ANRITSU

Electronic Measuring Instruments

2013

Anritsu

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Electronic Measuring Instruments

- Outline of Anritsu Corporation p.2
- Quality, Reliability Assurance System, and Effort for Environmental Considerations p.3
- How to Use This Catalog p.4
- Sales, Shipping, and Service Information p.5
- Sales Network p.6
- Index p.7
- Model Number Index p.9
- New Products Descriptions p.12

Optical Measuring Instruments

p.18

- Network Master Series
  - µOTDR Module
  - Drop Cable Fault Locator Module
  - Optical Channel Analyzer Module
- ACCESS Master
- Coherent OTDR
- Card OTDR
- OTDR Module
- Multi-Layer Network Test Platform
  - Optical Time Domain Reflectometer
  - OTDR/Chromatic Dispersion Application
  - Polarization Mode Dispersion Analyzer
  - Optical Spectrum Analyzer
- Light Source/Optical Power Meter
- Optical Spectrum Analyzer
- Optical Fiber Identifier
- Visual Fault Locator
- Bare Fiber Adapter

Bit Error Rate Tester (BERT)/Oscilloscope

p.81

- Signal Quality Analyzer
- 50G/56 Gbit/s MUX, 50G/56 Gbit/s DEMUX
- 4Tap Emphasis
- BERTWave

IP/Network Measuring Instruments

p.121

- Data Quality Analyzer
- 40/100G Ethernet Analyzer
- Network Performance Tester
- 40G SDH/SONET Analyzer
- Network Master Series
  - Gigabit Ethernet Module
- Multi-Layer Network Test Platform
  - 10 GigE/SDH/SONET/OTN Ethernet Test Set
- All-in-one Field Tester
- Ethernet Tester

Monitoring/Service Assurance

p.188

- MasterClaw

Mobile/Wireless Communications Measuring Instruments

p.196

- Signalling Testers
- Fading Simulator
- W-CDMA Signalling Tester
- Protocol Test System (PTS)/ Protocol Conformance Test Toolkit
- Rapid Test Designer (RTD)
- SUPL Simulation Server
- UTRAN/LTE Mobile Device Test Platform
- LTE RF Conformance Test System
- W-CDMA TRX/Performance Test System/ W-CDMA RRM Test System
- Radio Communication Analyzer
- Universal Wireless Test Set
- Shield Box
- Vector Signal Generator
- Digital Mobile Radio Transmitter Testers
- Digital Broadcast Signal Analyzer
- High Performance Handheld Spectrum Master
- High Performance Handheld Spectrum Analyzer
- Spectrum Master
- Cell Master
- BTS Master
- *Bluetooth* Test Set
- *Bluetooth* Audio Test Set
- WLAN Test Set
- Passive Intermodulation Analyzer
- High-Performance Passive Intermodulation Analyzer
- Air Interface Logging and Analysis Tools

Signal Analyzers/Spectrum Analyzers

p.463

- Signal Analyzers
- Spectrum Analyzer
- High Performance Handheld Spectrum Master
- Spectrum Master
- High Performance Handheld Spectrum Analyzer
- VNA Master
- Web-Based Line Sweep and Document Tracking Tools

Vector Network Analyzers

p.634

- Vector Network Analyzer
- Broadband Vector Network Analyzer
- VNA Master
- Site Master
- LMR Master
- Cable and Antenna Analyzer
- Web-Based Line Sweep and Document Tracking Tools
- VNA Calibration Kits
- VNA Verification Kits
- Network Analyzer
- Reflection Bridges/Transformers

Signal Generators

p.730

- RF/Microwave Signal Generators
- Fast Switching Microwave Signal Generator
- Analog Signal Generator

RF Microwave Measuring Instruments

p.763

- Microwave Frequency Counter
- Wideband Peak Power Meters
- Power Meter
- Inline Peak Power Sensor
- USB Power Sensor
- Resistance Attenuator
- Programmable Attenuator
- Pre-Amplifier
- EMI Probe
- Dipole Antenna
- Log-Periodic Antenna
- Biconical Antenna
- Rod Antenna
- Loop Antenna
- Standard Dipole Antenna
- Signal Generator

Components

p.802

- Fixed Attenuator
- Fixed Attenuator for High Power Measurement
- Termination
- 50Ω ↔ 75Ω Impedance Transformer
- Bias Tee
- Phase Shifter
- T-Pad
- Four-port Junction Pad
- CM Directional Coupler
- Directional Coupler
- 50Ω Coaxial Switch
- High-pass Filter
- Band Pass Filter
- RF Fuse Holder
- Fuse Element
- 32 Gbps LN Driver
- 9.5 - 11.5 GHz × 4 Frequency Multiplier
- 50 Gb/s EA Driver Module
- High Speed Digital ICs
- Precision RF & Microwave Components

Peripheral Equipment

p.820

- Coaxial Cords, Adapters
- Dimensions of Waveguide Flanges
- Portable Test Rack
- F-series Cabinets
- E-series Cabinets

Optical Devices

p.829

- 1.31/1.55 µm LD Module
- 1.48 µm LD Module
- 1.48 µm Cylindrical Module
- 1.55 µm SLD Module

Anritsu Corporation has always been at the forefront of technical innovation during its long 115-year history and continues this tradition with leading-edge developments in the information and communications business world.
The revolution in communications is spreading worldwide as countries rollout new technologies, including Next Generation Networks (NGNs) and Fixed Mobile Convergence (FMC). Anritsu measurement instruments and Service Assurance Solutions using advanced measurement platforms for next-generation Long Term Evolution (LTE) mobile communications and ultra-high-speed networks are based on the company's long experience in wireless, IP networks, optical, and digital technologies. In addition to its worldwide sales network, Anritsu's R&D laboratories and manufacturing bases in Japan, the USA, and Europe help guarantee fast and flexible responses meeting every customer's measurement needs.
Communication networks are a vital part of modern infrastructure supporting our daily and business lives. By strengthening and integrating its technologies, Anritsu will continue its mission to provide measurement solutions assuring safe, secure and comfortable society.

Corporate Information

- **Headquarters**
  Anritsu Corporation
  5-1-1 Onna, Atsugi-shi, Kanagawa 243-8555, Japan
- **First founded as Sekisan-sha in 1895.**
  Established as Anritsu Electric Corporation on March 17, 1931.
- **Paid-up capital: 17,105 million yen (as of March 31, 2012)**
- **Sales volume: 93,586 million yen (consolidated, year ended March 31, 2012)**
- **Employees: 3,681 (consolidated, as of March 31, 2012)**

Sales Network

Anritsu Company (United States)
Anritsu Electronics Ltd. (Canada)
Anritsu Eletrônica Ltda. (Brazil)
Anritsu Company S.A. de C.V. (Mexico)
Anritsu EMEA Ltd. (United Kingdom)
Anritsu S.A. (France)
Anritsu GmbH (Germany)
Anritsu S.r.l. (Italy)
Anritsu AB (Sweden/Finland)
Anritsu A/S (Denmark)
Anritsu EMEA Ltd. Representation Office in Russia (Russia)
Anritsu EMEA Ltd. Dubai Liaison Office (United Arab Emirates)
Anritsu (China) Co., Ltd. (P.R. China, Shanghai)
Anritsu Company Ltd. (P.R. China, Hong Kong)
Anritsu Corporation (Japan)
Anritsu Company Inc. (Taiwan)
Anritsu Corporation, Ltd. (Korea)
Anritsu Pte. Ltd. (Singapore)
Anritsu India Private Limited (India)
Anritsu Pty. Ltd. (Australia)

R&D and Manufactring

Anritsu Corporation (Japan)
Tohoku Anritsu Co. Ltd. (Japan)
Anritsu Company (United States)
Anritsu Instruments Company (United States)
Anritsu Ltd. (United Kingdom)
Anritsu A/S (Denmark)
Anritsu Solutions S.r.l. (Italy)
Anritsu Solutions S.R.L. (Romania)

Anritsu Homepage
http://www.anritsu.com

ISO9001/14000

Electronic Measurement Instruments products contained in this catalogue are manufactured under a quality system and environment management system in conformance to the ISO international standard.

Factory Location	Standards	Certificate Number	Registration Date	Certification Body
Atsugi, Japan	ISO9001	JQA-0316	Nov. 15, 1993	Japan Quality Assurance Organization (JQA)
	ISO14001	JQA-EM0210	Aug. 28, 1998	
Tohoku, Japan	ISO9001	JQA-0316	Nov. 15, 1993	
	ISO14001	JQA-EM0210	Aug. 28, 1998	
U.S.A	ISO9001	6495	Apr. 27, 1995	National Quality Assurance Limited
	ISO14001	EN12275	Mar. 29, 2007	

Quality and Reliability Assurance for Products

• Planning Stage

Management resources are focused on measuring instruments related to growing fields such as mobile Internet, WDM and digital broadcasting, system solutions, and device businesses. New products are planned to provide solutions whenever required by users.

• Design Stage

To realize a design with high-safety and high-reliability, several levels of design assessments are performed. Power consumption is reduced from the viewpoint of environment considerations, starting with evaluation of specifications, legal regulations and parts used. Evaluations are also implemented for improving the recycling ratio, and the design quality is improved.
Anritsu utilizes a design process that targets customer satisfaction.

• Evaluation Stage

In addition to safety, reliability and environment considerations of test models for new products, functions and performance are verified by an operating environmental conditions test and operability, uncertainty, maintainability and flexibility of design are evaluated fully. After passing these tests, the products can be commercialized.

• Manufacturing and Inspection Stages

Based on our policy, “post-processing is the customer,” the product is manufactured by experienced employees according to the workmanship standards. In the adjustment and inspection stage, automatic measurement is promoted. An expert will be in charge of the adjustment if high-skilled adjustment is required.

• After Sold

In each service department, traceability assurance by calibrations based on high-technical capabilities, as well as rapid repair and preventive maintenance are performed.

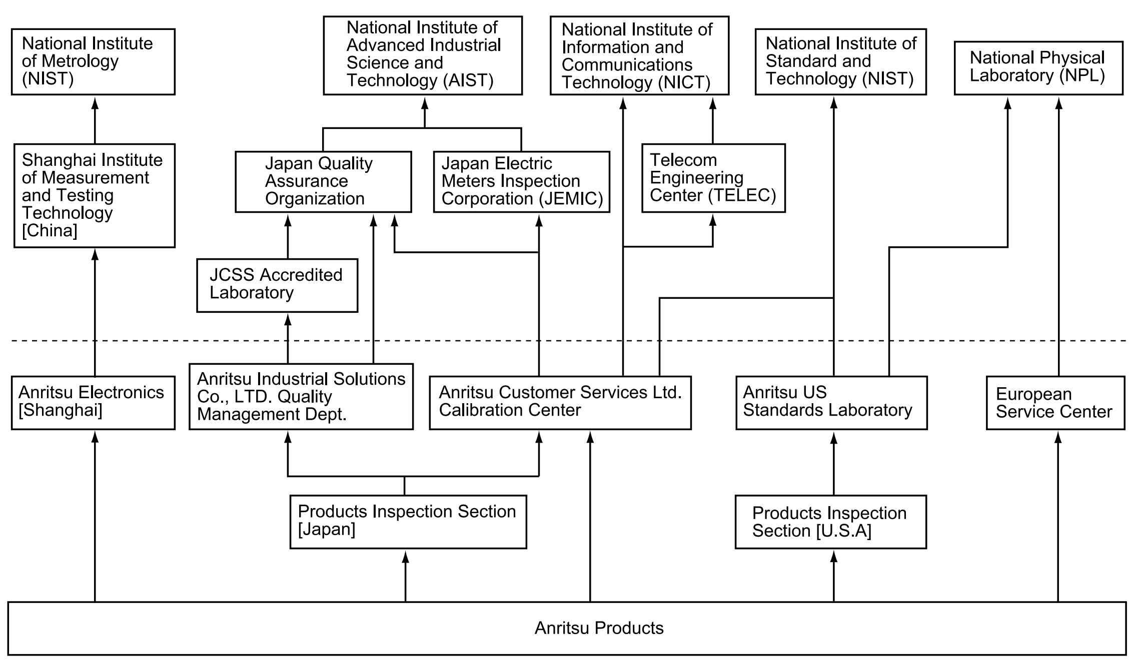
Parts Standardization and Improving Activities for Quality and Reliability

For parts generally used in each measuring instrument, quality improvement and standardization are actively promoted.
All field data is analyzed, arranged and completely made known to each department while required actions are taken for reliability improvement.
In addition, failure rate, MTBF observation and parts failure rate are calculated based on this information.

Traceability Assurance

As defined in the International vocabulary of metrology — Basic and general concepts and associated terms (VIM)-JCGM 200: 2008, property of a measurement result whereby the result can be related to a reference, usually national or international standards, through a documented unbroken chain of calibrations. Anritsu system to ensure traceability is shown below.

Traceability System



Standard Products
All measuring instruments appearing in this catalog are standard products. For information on non-standard instruments please contact us.

New Products
Identifies products developed and introduced in the period from November 2011 to October 2012.

CE
Measuring instruments whose outline views are marked with CE conform to EMC and LVD standards.

Products conformed to environment-friendly criteria uniquely set by ourselves is called "Excellent Eco Product."
For the details of the mark and environment-friendly criteria, please refer to Anritsu Corporation home page.

Specification Changes
We reserve the right to discontinue any item without notice and to change specifications at any time without incurring any obligation to incorporate new features in instruments or parts previously sold.

Accessories
Two types of accessories are available: Supplied and Optional.
All instruments include the cost of supplied accessories, including fuses and one operation (or instruction) manual in English. The cost of optional accessories, however, is not included and, therefore, the optional accessories will be supplied only on request.

• Measuring Cords
The measuring cord in the accessory column is indicated in the sequence of Connector · Cord · Connector.
A type S connector is compatible to a type N.

Numerical Values Used in This Catalog
All numerical values are expressed according to the following units:

• Output Voltage of Signal Generator
The output voltage expressed in a unit of dB or dBµ is calibrated in terms of e.m.f. (open circuit output voltage). 1 µV is equal to 0 dB or 0 dBµ.

• Input Power of Level Meter
The input power is expressed in a unit of dBm which is terminated by nominal impedance. 0 dBm is equal to 1 mW.
Even if the input power is applied to the "high" impedance input terminal, the indicated value is calibrated as mentioned above.

• Power Supply Voltage
Any rated voltage between 100 V and 240 V is available. Normal operation can be obtained within ±10% of each rated voltage (however, maximum permissible operating voltage is 250 V).

• Ambient Temperature, Rated Range of Use
"Ambient temperature, rated range of use" in the specifications represents the range of ambient temperature, which guarantees values given in specifications.

• External Dimensions
External dimensions are indicated in width, height, and depth in millimeters, and do not include controls, fittings, or stands.

Technical Publications
In this catalog you will notice that an outline of usage, noteworthy points, and standards have been prepared. If further information is required please contact us directly. We will be happy to send you the technical publications of your choice.

Order by Model Number

When ordering, please specify the model number and name of the instrument desired, for example, "MD8470A Signalling Tester." To prevent misunderstandings, include all necessary specifications and specific instructions in your order. That is to say, include all special options or features such as special color, nonstandard power line voltage, etc. To expedite your order we suggest that you contact us directly.

Shipment

Generally, instruments will be shipped within two months of receipt of your order. In the case of "Build-to order products" mentioned in the footnotes, shipment may take from 4 to 7 months. Every endeavor will be made to maintain delivery dates, but no liability is accepted for loss, damage, or delay of instruments, for reasons which are out of our control.

Terms

Unless previous terms have been arranged, we will use one of the following:

- Full payment in advance of shipment
- Sight draft against an irrevocable confirmed letter of credit

Quotations and Pro Forma Invoices

FOB, CIF, C&F, etc., quotations, and pro forma invoices are available on request. The instrument price includes a packing charge.

Inspection Surcharge

An inspection surcharge is applied to all orders requiring inspection by government agencies or individually appointed inspectors at our factory.

Special Products Made-to-order

Requests for remodeling standard products for special use will be accepted, but only after detailed discussions.

Returning Instrument for Repairs

When returning the instrument to Anritsu for repairs, the following suggestions will help us return it to you in the shortest possible time:

- Send complete instructions about what you would like done to the instrument.
- If possible, include the "symptoms" or "defects."
- Indicate the return address and, if different, the address to be used for billing purposes.

All repairs and recalibrations are carried out at our factory.

Extension Service

The normal warranty term is one year, but may be extended to three or five years as an option when purchasing equipment. For three or five years extension service, please ask your local Anritsu Field Office or Sales Representative for price and availability.

WARRANTY

All other expressed warranties are disclaimed and all implied warranties for this product, including the warranties of merchantability and fitness for a particular purpose, are limited in duration to a period of one year from the date of delivery. In no event shall all Anritsu group be liable to the customer for any damages, including lost profits, or other incidental or consequential damages arising out of the use or inability to use this product.

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Outline of Anritsu Corporation 2
Quality, Reliability Assurance System, and Effort for Environmental Considerations 3
How to Use This Catalog 4
Sales, Shipping, and Service Information 5
Sales Network 6
Index 7
Model Number Index 9
New Products 12

OPTICAL MEASURING INSTRUMENTS

Selection Guide 19
Network Master Series
- µOTDR Module 22
- Drop Cable Fault Locator Module 62
- Optical Channel Analyzer Module 66

ACCESS Master™ 31
Coherent OTDR 41
Card OTDR 45
OTDR Module 47
Multi-Layer Network Test Platform 50
- Optical Time Domain Reflectometer 52
- OTDR/Chromatic Dispersion Application 55
- Polarization Mode Dispersion Analyzer 57
- Optical Spectrum Analyzers 59

Light Source/Optical Power Meter 68
Optical Spectrum Analyzer 71
Optical Fiber Identifiers 78
Visual Fault Locator 79
Bare Fiber Adapter 80

BIT ERROR RATE TESTER (BERT)/OSCILLOSCOPE

Selection Guide 82
Signal Quality Analyzer 83
50G/56 Gbit/s MUX, 50G/56 Gbit/s DEMUX 94
4Tap Emphasis 99
BERTWave 104

IP/NETWORK MEASURING INSTRUMENTS

Selection Guide 122
Data Quality Analyzer 123
40/100G Ethernet Analyzer 131
Network Performance Tester 135
40G SDH/SONET Analyzer 145
Network Master Series
- Gigabit Ethernet Modules 152

Multi-Layer Network Test Platform
- 10 GigE/SDH/SONET/OTN 158
- Ethernet Test Set 165

All-In-One Field Tester 168
Ethernet Tester up to 10 Gbps 179

MONITORING/SERVICE ASSURANCE

MasterClaw 189

MOBILE/WIRELESS COMMUNICATIONS MEASURING INSTRUMENTS

Selection Guide 197
Signalling Testers 198, 244
Fading Simulator 206
W-CDMA Signalling Tester 212
Protocol Test System (PTS)/
Protocol Conformance Test Toolkit 220
Rapid Test Designer (RTD) 223
SUPL Simulation Server 228
UTRAN/LTE Mobile Device Test Platform 230
LTE RF Conformance Test System 234
W-CDMA TRX/Performance Test System/
W-CDMA RRM Test System 238
Radio Communication Analyzer 255
Universal Wireless Test Set 269
Shield Box 290
Vector Signal Generator 291, 313
Digital Mobile Radio Transmitter Testers 323, 334
Digital Broadcast Signal Analyzer 337
High Performance Handheld Spectrum Master 357, 379
High Performance Handheld Spectrum Analyzer 374
Spectrum Master 395
Cell Master 402
BTS Master 409
Bluetooth Test Set 418
Bluetooth Audio Test Set 426
WLAN Test Set 431
PIM Master™ Passive Intermodulation Analyzer 446
PIM Master™
High-Performance Passive Intermodulation Analyzer 451
Link Master™ Air Interface Logging and
Analysis Tools 457

SIGNAL ANALYZERS/SPECTRUM ANALYZERS

Selection Guide 464
Signal Analyzers 465, 496, 524
Spectrum Analyzer 551
High Performance Handheld Spectrum Master 558, 587
Spectrum Master 575
High Performance Handheld Spectrum Analyzer 582
VNA Master 603, 618
Sweep Master Web-Based Line Sweep and
Document Tracking Tools 631

VECTOR NETWORK ANALYZERS

Selection Guide 635
Vector Network Analyzers, Microwave 637
Vectorstar Broadband Vector Network Analyzers 648
VNA Master 655, 670
Site Master 683, 688
LMR Master 697
Cable and Antenna Analyzer 713
Sweep Master Web-Based Line Sweep and Document Tracking Tools 718
VNA Calibration Kits 721
VNA Verification Kits 723
Network Analyzer 724
Reflection Bridges/Transformers 729

SIGNAL GENERATORS

Selection Guide 731
RF/Microwave Signal Generator 733
Fast Switching Microwave Signal Generator 746
Analog Signal Generator 749

RF MICROWAVE MEASURING INSTRUMENTS

Microwave Frequency Counter 764
Wideband Peak Power Meters 768, 775
Power Meters 777
Inline Peak Power Sensor 780
USB Power Sensors 786
Resistance Attenuator 791
Programmable Attenuator 792
Pre-Amplifier 793
EMI Probe 794
Dipole Antennas 795, 796
Log-Periodic Antenna 797
Biconical Antenna 798
Rod Antenna 799
Loop Antenna 799
Standard Dipole Antenna 800
Signal Generator 801

COMPONENTS

Fixed Attenuator 803
Fixed Attenuator for High Power Measurement 803
Termination 804
50Ω ↔ 75Ω Impedance Transformer 804
Bias Tee 805
Phase Shifter 806
T-Pad 807
Four-port Junction Pad 807
CM Directional Coupler 808
Directional Coupler 808
50Ω Coaxial Switch 809
High-pass Filter 809
Band Pass Filter 810
RF Fuse Holder 810
Fuse Element 810
32 Gbps LN Driver 811
9.5 - 11.5 GHz × 4 Frequency Multiplier 814
50 Gb/s EA Driver Module 815
High Speed Digital ICs 817
Precision RF & Microwave Components 818

PERIPHERAL EQUIPMENT

Coaxial Cords, Adapters 821
Dimensions of Waveguide Flanges 823
Portable Test Rack 824
F-Series Cabinets 825
E-Series Cabinets 827

OPTICAL DEVICES

1.31/1.55 µm LD Module 830
1.48 µm LD Module 832
1.48 µm Cylindrical Module 836
1.55 µm SLD Module 838

2000-1694 Series Millimeter Wave Multiplier (→ MG3690C)...743
3650 Series Calibration Kits 721
3660 Series Verification Kits....723
3750R Series Calibration Kits 722

A

A3N1000 Series Bias Tee 805
A5N1102 Phase Shifter....806
AF3B/5B Series 1.31/1.55 µm LD Module....830
AF4B Series 1.48 µm LD Module....832
AF4Y108GA85J 1.48 µm Cylindrical Module....836
AH14144A 9.5 - 11.5 GHz × 4 Frequency Multiplier....814
AH34152A 32 Gbps LN Driver 811
AH54147A 50 Gb/s EA Driver Module 815
AS3B/5B/6B Series 1.55 µm SLD Module 838

B

B0472 Fixed Attenuator For High Power Measurement....803
BBA9106 Biconical Antenna 798

C

CMA 3000 All-In-One Field Tester 168
CMA 3000 Ethernet
Ethernet Tester....179
CMA5 Series Light Source/Optical Power Meter....68
CMA5000a Multi-Layer Network Test Platform 50
CMA5000a CD-OTDR
OTDR/Chromatic Dispersion Application 55
CMA5000a Gigabit Ethernet Module II
Ethernet Test Set....165
CMA5000a OSA 400
Optical Spectrum Analyzer 59
CMA5000a OSA 425
Optical Spectrum Analyzer 59
CMA5000a OTDR Module Series
Optical Time Domain Reflectometer 52
CMA5000a PMD
Polarization Mode Dispersion Analyzer....57
CMA5000a-UTA
10 GigE/SDH/SONET/OTN 158

F

FI700 Series Optical Fiber Identifier 78
FiberConnect Bare Fiber Adapter 80

J

J0063 Fixed Attenuator For High Power Measurement 803
J0078 Fixed Attenuator For High Power Measurement 803
J0395 Fixed Attenuator For High Power Measurement 803

M

MasterClaw Service Assurance Platform....189

MA

MA1612A Four-port Junction Pad 807
MA2201A Reflection Bridge....729
MA2301A Reflection Bridge....729
MA2302A Reflection Bridge....729
MA2303A Reflection Bridge....729
MA2401A Reflection Bridge....729
MA2402A Reflection Bridge....729
MA24105A Inline Peak Power Sensor 780
MA24106A USB Power Sensor....786
MA24108A USB Power Sensor....786
MA2411B Pulse Sensor
(for ML2480B series)....776
(for ML2490A series)....770
MA24118A USB Power Sensor....786
MA24126A USB Power Sensor....786
MA2490A Wideband Sensor
(for ML2480B series)....776
(for ML2490A series)....770
MA2491A Wideband Sensor
(for ML2480B series)....776
(for ML2490A series)....770
MA2512A Band Pass Filter....810
MA2601B/C EMI Probe....794
MA29A/J Transformer....729
MA313A/J Transformer....729
MA314A/J Transformer....729
MA315A/J Transformer....729
MA422A1 Transformer....729
MA5612 Series Dipole Antenna....796
MA8120E Shield Box....290

MB

MB-009 50Ω ↔ 75Ω Impedance Transformer 804
MB23B Portable Test Rack 824
MB24D Portable Test Rack 824

MD

MD1230B Data Quality Analyzer 123
MD1260A 40/100G Ethernet Analyzer....131
MD8430A Signalling Tester 198
MD8475A Signalling Tester 244
MD8480C W-CDMA Signalling Tester....212

ME

ME7834A UTRAN Mobile Device Test Platform 230
ME7834L LTE Mobile Device Test Platform 230
ME7838A Series Vector Network Analyzers
Broadband Vectorstar 648
ME7873F W-CDMA TRX/Performance Test System....238
ME7873L LTE RF Conformance Test System....234
ME7874F W-CDMA RRM Test System 238

MF

MF2400C Series Microwave Frequency Counter 764
MF6900A Fading Simulator 206

MG

MG3690C Series RF/Microwave Signal Generator 733
MG3700A Vector Signal Generator 313
MG3710A Vector Signal Generator 291
MG3740A Analog Signal Generator...749
MG37022A Fast Switching Microwave Signal Generator.....746
MG724E12/G12 Signal Generator 801

MH

MH648A Pre-amplifier...793

ML

ML2430A Series Power Meter 777
ML2480B Series Wideband Peak Power Meter 775
ML2490A Series Wideband Peak Power Meter 768
ML8725A Air Interface Logging and Analysis Tools 457
ML8726A Air Interface Logging and Analysis Tools 457

MN

MN510C Resistance Attenuator..791
MN63A Programmable Attenuator.......................................792
MN65A Programmable Attenuator.......................................792
MN72A Programmable Attenuator.......................................792

MP

MP1590B Network Performance Tester..................................135
MP1595A 40G SDH/SONET Analyzer 145
MP1800A Series Signal Quality Analyzer 83
MP1821A 50G/56 Gbit/s MUX..94
MP1822A 50G/56 Gbit/s DEMUX..94
MP1825B 4Tap Emphasis 99
MP2100A Series BERTWave...104
MP414B Loop Antenna...799
MP415B Rod Antenna 799
MP520 Series CM Directional Coupler 808
MP526 Series High-pass Filter 809
MP534A/B Dipole Antenna 795
MP59B 50Ω Coaxial Switch...809
MP612A RF Fuse Holder..810
MP613A Fuse Element..810
MP614B 50Ω ↔ 75Ω Impedance Transformer 804
MP635A Log-periodic Antenna..797
MP651A/B Dipole Antenna 795
MP652B Standard Dipole Antenna..800
MP654A Directional Coupler 808
MP659A Four-port Junction Pad 807
MP663A Dipole Antenna 795
MP666A Log-periodic Antenna..797
MP721 Series Fixed Attenuator 803
MP752A/B Termination 804
MP8931A Bit Error Rate Tester (→ MS8901A).......................355

MS

MS2024B VNA Master.. 618, 670
MS2025B VNA Master.. 618, 670
MS2026C VNA Master.. 603, 655
MS2028C VNA Master.. 603, 655
MS2034B VNA Master.. 618, 670
MS2035B VNA Master.. 618, 670
MS2036C VNA Master.. 603, 655
MS2038C VNA Master.. 603, 655
MS2687B Spectrum Analyzer..551
MS2690A Signal Analyzer 465
MS2691A Signal Analyzer 465
MS2692A Signal Analyzer 465
MS2711E Spectrum Master... 395, 575
MS2712E Spectrum Master... 395, 575
MS2713E Spectrum Master... 395, 575
MS2720T High Performance Handheld Spectrum Master 357, 558
MS2721B High Performance Handheld Spectrum Analyzer 374, 582
MS2722C High Performance Handheld Spectrum Master 379, 587
MS2723C High Performance Handheld Spectrum Master 379, 587
MS2724C High Performance Handheld Spectrum Master 379, 587
MS2725C High Performance Handheld Spectrum Master 379, 587
MS2726C High Performance Handheld Spectrum Master 379, 587
MS2830A Signal Analyzer 496
MS2830A Microwave Signal Analyzer 524
MS4630B Network Analyzer..724
MS4640A Series Vector Network Analyzers.........................637
MS8608A Digital Mobile Radio Transmitter Tester 334
MS8609A Digital Mobile Radio Transmitter Tester 323
MS8901A Digital Broadcast Signal Analyzer..........................337
MS9740A Optical Spectrum Analyzer 71

MT

MT1810A 4 Slot Chassis (for MP1800A Series) 83
MT8212E Cell Master...402
MT8213E Cell Master...402
MT8221B BTS Master 409
MT8222B BTS Master 409
MT8820C Radio Communication Analyzer..............................255
MT8852B *Bluetooth* Test Set 418
MT8855A *Bluetooth* Audio Test Set 426
MT8860C WLAN Test Set 431
MT8870A Universal Wireless Test Set...................................269
MT9083 Series ACCESS Master 31
MT9090A Network Master Series
(µOTDR Module) 22
(Drop Cable Fault Locator Module).....................62
(Optical Channel Analyzer Module).....................66
(Gigabit Ethernet Module) 152

MU

MU909011A Drop Cable Fault Locator Module (for MT9090A) 62
MU909014A1/B/B1/C/C6 µOTDR Module (for MT9090A) 22
MU909015A6/B/B1/C/C6 µOTDR Module (for MT9090A) 22
MU909020A Optical Channel Analyzer Module (for MT9090A) 66
MU909060A1/A2/A3 Gigabit Ethernet Modules (for MT9090A)....152

MW

MW8208A High-Performance Passive Intermodulation Analyzer 451
MW8209A High-Performance Passive Intermodulation Analyzer 451
MW82119A Passive Intermodulation Analyzer....446
MW8219A High-Performance Passive Intermodulation Analyzer 451
MW90010A Coherent OTDR 41
MW9077A/A1/A2/B OTDR Module 47
MW9087B/D Card OTDR....45

MX

MX785201A Protocol Test System (PTS)....220
MX785220A Protocol Conformance Test Toolkit....220
MX786201A Rapid Test Designer (RTD)....223
MX829000A Web-Based Line Sweep and Document Tracking Tools 631, 718
MX829001A Web-Based Line Sweep and Document Tracking Tools 631, 718
MX848600A SUPL Simulation Server....228

P

Precision RF & Microwave Components....818

S

S331E Site Master....688
S331L Site Master....683
S332E Site Master....688
S361E Site Master....688
S362E Site Master....688
S412E LMR Master 697
S810D Broadband SiteMaster 713
S820D Broadband SiteMaster 713
SG1G Series High Speed Digital ICs 817

V

VFL650 Visual Fault Locator 79

Z

Z-164A T-Pad 807

All-in-One FTTx Installation and Maintenance Functions

MT9090 Series µOTDR Module™

1.31/1.55/1.625/1.65 µm (SMF)

Single wavelength (1.625 µm or 1.65 µm) for the FTTx maintenance market including Metro networks, dual wavelength (1.31 µm/1.55 µm) for the installation market, and triple wavelength for both these markets.

- Tri-wavelength OTDR for both installation and maintenance (1.31 µm/1.55 µm plus filtered 1.65 µm or 1.625 µm)
- Built-in PON Power Meter, Loss Test Set and Light Source functions
- High-performance OTDR in a pocket-size package with unique battery operation
- Full AUTO mode simplies operation, no OTDR knowledge needed
- Complete PON testing through splitters up to 1 × 64

(For further information see page 22)

All-in-One Solution that Reduces Testing Times to Install and Maintain FTTx, CATV, LAN Access and Metro Networks

MT9083 Series ACCESS Master™

1.31/1.55/1.625/1.65 µm (SMF), 0.85/1.3 µm (MMF)

Anritsu is now pleased to announce the enhanced MT9083A2/B2/C2 models. The ACCESS Master MT9083x2 now features a 7-inch widescreen TFT-LCD display for use both indoors and outdoors, enhanced battery operation time (up to 12 hours), increased operating temperature range (–10° to +50°C) and new short-cut function keys.

Enhancements:

- Large (7-inch), higher resolution (800 × 400) display with LED backlight
- Longer battery operation time: Up to 12 hours
- Wider operating temperature range: –10° to +50°C
- Lightweight: Only 2.6 kg (5.7 lbs)

(For further information see page 31)

Up to 32.1 Gbit/s and 8ch. One Box Jitter BERT

MP1800A Signal Quality Analyzer <New Modules>

MU183020A 28G/32G bit/s PPG, MU183021A 28G/32G bit/s 4ch PPG
MU183040A 28G/32G bit/s ED, MU183041A 28G/32G bit/s 4ch ED

The MP1800A Signal Quality Analyzer is a modular BERT. Adding the 32 Gbit/s module to the MP1800A supports evaluation of the physical layer for optical modules and high-speed interconnects up to 32 Gbit/s. Combined installation with the synthesizer and Jitter modules supports a test environment without external signal generator. Moreover, powerful signal integrity tests at up to 28.1 Gbit/s are supported by linked operation with the MP1825B 4Tap Emphasis.

- **Various Signal Integrity Analysis Functions**
  TJ/DJ/RJ/Bathtub Jitter analysis, Jitter Tolerance (2-tone SJ/RJ/BUJ with MU181500B), 4Tap Emphasis (28.1 Gbit/s with MP1825B), Crosstalk testing with individual variable delay
- **Excellent Signal Quality and Rx Sensitivity**
  Low-jitter, high-quality waveform, 3.5 Vp-p output max., High-input-sensitivity error detector at 50 mVp-p
- **Supports Data Patterns for Various Applications**
  Pre-coding, De-coding, DQPSK, DP-QPSK, Burst signal test, 256 Mbit/ch max. programmable data pattern CJTPAT, CJPAT, K28.5

(For further information see page 83)

LTE/W-CDMA/CDMA2000/GSM Supports Global UE Networks with One Unit

MD8475A Signalling Tester <New Measurement Options>

350 MHz to 3600 MHz

SmartStudio

- Adds TD-LTE/TD-SCDMA Test Environment
- Complete VoLTE and Battery Life Test Environment
- Built-in IMS Server as standard

The MD8475A Signalling Tester is a desktop, base-station simulator, supporting installation of multiple mobile-terminal communications systems for testing 2G, 3G and 4G systems, including TD-LTE and TD-SCDMA as well as LTE FDD, W-CDMA, GSM, and CDMA2000.
The MD8475A SmartStudio user interface makes it easy to configure both a smartphone VoLTE test environment using IMS as well as a Battery Life test environment.

(For further information see page 244)

Suppoting Evaluation of Band 22, 42, 43 LTE Mobiles

MT8820C Radio Communication Analyzer <New Measurement Options>

MT8820C-017 Extended RF Hardware, MT8820C-018 Extended RF 3.4 GHz to 3.8 GHz
30 MHz to 2.7 GHz (3.4 GHz to 3.8 GHz)

The MT8820C Radio Communication Analyzer supports both previous mobile technologies plus the new LTE FDD Band 22 (3.4 GHz to 3.6 GHz) and LTE TDD Band 42, 43 (3.4 GHz to 3.8 GHz) frequencies used by LTE smartphones and mobiles (communicating with base station simulator at TRx call-processing evaluations) installing the new MT8820C-017, new MT8820C-018, and LTE Measurement Options on MT8820C.

The excellent expandability of the MT8820C with a full line of software and hardware options supports simultaneous measurement of LTE/3G/2G multi-systems for more efficient (infrastructure costs, power consumption, etc.) R&D and manufacturing inspection.

(For further information see page 255)

The Ideal Cost-effective Solution for Production Lines of Smartphone and Communication Modules

MT8870A Universal Wireless Test Set

MU887000A TRX Test Module

10 MHz to 3.8 GHz/6.0 GHz (Option)

The MT8870A Universal Wireless Test Set with the MU887000A TRX Test Module is the ideal cost-effective solution for high-efficiency inspection lines.

- Four High-performance Modules in One Chassis
  - Simultaneous control of four modules
  - Four simultaneous measurement
  - Smaller instrument footprint
  - Reduction in infrastructure costs with four installed modules
- High Performance Module with Flexibility and Expandability
  - Built-in Signal Generator and Signal Analyzer in each module
  - 160 MHz wide bandwidth
  - Wide frequency range from 10 MHz to 6 GHz
  - Each module supports multiple wireless standards
  - Non-signalling Measurement Support
  - Four test ports per module
- Cellular Technology Measurement Solution
  - Sequence measurement support
  - W-CDMA/HSPA, GSM/EDGE, LTE FDD, CDMA2000 1xEV-DO
- WLAN and *Bluetooth* Measurement Solution
  - WLAN 802.11b/g/a/n
  - WLAN 802.11ac
  - *Bluetooth* Basic Rate (BR), Enhanced Data Rate (EDR) low-energy
  - CombiTest automated manufacturing

(For further information see page 269)

"Multi-Band, Multi-System, Multi-Channel" Cut Costs for New Wireless Tests

MG3710A Vector Signal Generator

100 kHz to 2.7 GHz/4.0 GHz/6.0 GHz

The MG3710A is a Vector Signal Generator with 6-GHz upper frequency limit and 120-MHz wide RF modulation baseband generator. It outputs various radio systems signals.

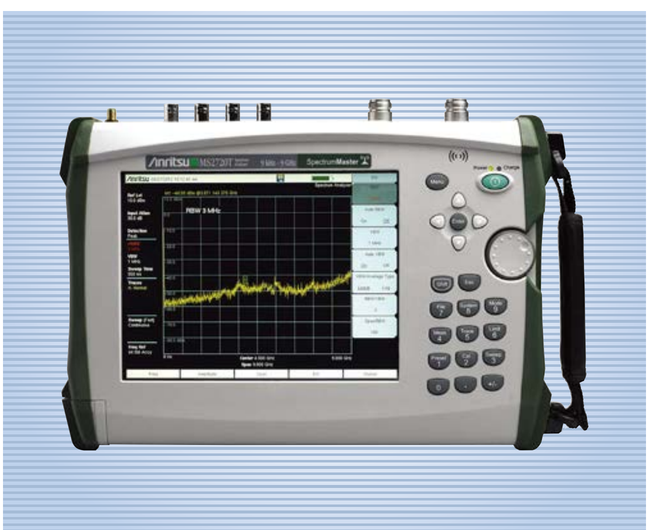
- Cuts Equipment Costs
  - Dual waveform memory; One RF output supports two waveform memories. Combine wanted and interference signals in baseband and output at one RF.
  - Dual RF; One unit supports two RF outputs. Ideal for Multi-band, MIMO and MSR evaluations.
- Improve Test Margins and Yields, Cuts Tact Time
  - ACLR: –71 dBc (W-CDMA Test-Model 1 64DPCH, 2 GHz)
  - SSB phase noise: <–140 dBc/Hz (nom.) (100 MHz, 20 kHz offset, CW)
  - Switching speed: ≤600 µs (List mode)
- Pre-installed Key Waveform Patterns
- Waveforms Generated by IQproducer Waveform Generation Software (Sold separately)

(For further information see page 291)

High-Performance Handheld Spectrum Analyzer

MS2720T Spectrum Master™

9 kHz to 9 GHz/13 GHz/20 GHz/32 GHz/43 GHz



From Anritsu, the inventor of the handheld spectrum analyzer first introduced in 1999, we are proud to introduce our 7th generation Spectrum Master MS2720T. The MS2720T represents the highest performance handheld spectrum analyzers available in the world as Anritsu pushes the envelope closer to benchtop quality.
This generation introduces a touch screen, full-band tracking generators to 20 GHz, and best-in-class performance for dynamic range, DANL, phase noise, and sweep speed.

The Spectrum Master MS2720T features over 30 analyzers in one to meet virtually every measurement need. In addition to spectrum analysis a user can select optional capabilities and analyzers including:

- High Accuracy Power Meter
- Interference Analyzer
- Channel Scanner
- 30 MHz Wide Zero-Span IF Output at 140 MHz
- GPS Receiver
- Increase frequency accuracy, geo-tag data collection
- Secure data operation
- 3GPP Signal Analyzers
- LTE TDD and FDD
- GSM, W-CDMA/HSPA+, TD-SCDMA/HSPA+
- 3GPP2 Signal Analyzers CDMA2000 1X and 1xEV-DO
- IEEE 802.16 Signal Analyzers
- Fixed WiMAX, Mobile WiMAX
- PIM Analyzer
- Coverage Mapping

(For further information see page 357,558)

40 Watts Battery-operated Passive Intermodulation Analyzer

MW82119A PIM Master™

LTE 700 MHz, Cellular 850 MHz, E-GSM 900 MHz, DCS 1800 MHz, PCS 1900 MHz, PCS/AWS 1900 MHz/2100 MHz

Anritsu Company introduces the first battery-operated high power Passive Intermodulation (PIM) testing solution for the major wireless standards in use around the world. PIM is a form of interference generated by passive components that are normally thought of as linear such as connectors, cable assemblies, filters and antennas. However, when subject to high RF power levels found in cellular systems, these devices can generate spurious signals that increase the receiver noise floor and reduce site performance.
The PIM Master accurately measures PIM performance by injecting two CW test tones into the antenna feed network and recording the magnitude of the 3rd, 5th, or 7th order intermodulation products falling in the receive band of the system. The MW82119A is able to perform the following measurements enabling test technicians to quickly find and eliminate PIM problems found at the cell site:

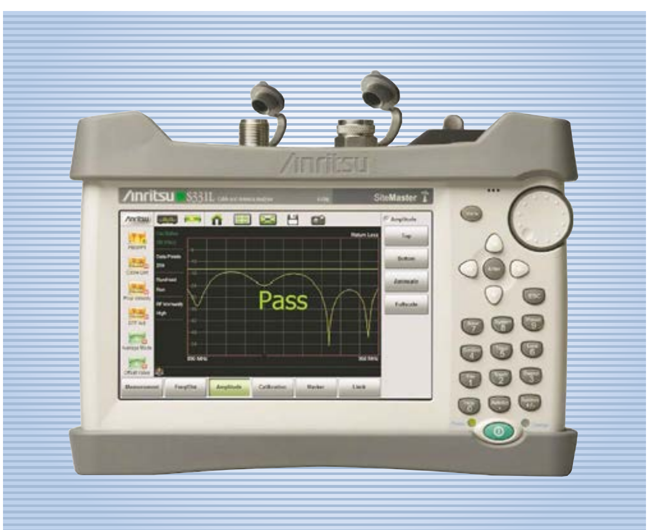
- PIM versus Time
- Swept PIM
- Distance-to-PIM™ (DTP)

(For further information see page 446)

Handheld Cable & Antenna Analyzer Featuring Classic and Advanced Modes

S331L Site Master™

Cable & Antenna Analyzer: 2.0 MHz to 4.0 GHz, Power Meter: 50 MHz to 4.0 GHz



Anritsu is proud to introduce the new Site Master™ S331L, our 9th generation compact handheld Cable and Antenna Analyzer.

The S331L is newly designed from the ground up. We took all of our experience, customer feedback, field trials, and the latest technology advancements, and developed the best value in a low cost, field optimized, trusted, reliable, rugged, easy to use, one port Cable and Antenna Analyzer.

With the battery fully charged, you're ready for a full workday of measurements. This is the longest lasting Site Master operation time we've ever offered in a handheld Cable and Antenna Analyzer. You won't need to look for outlets and drag power supplies with you from site to site anymore. Now you can focus on what matters, making measurements and getting the job completed.

(For further information see page 683)

Versatile Modulation Functions, Excellent Expandability

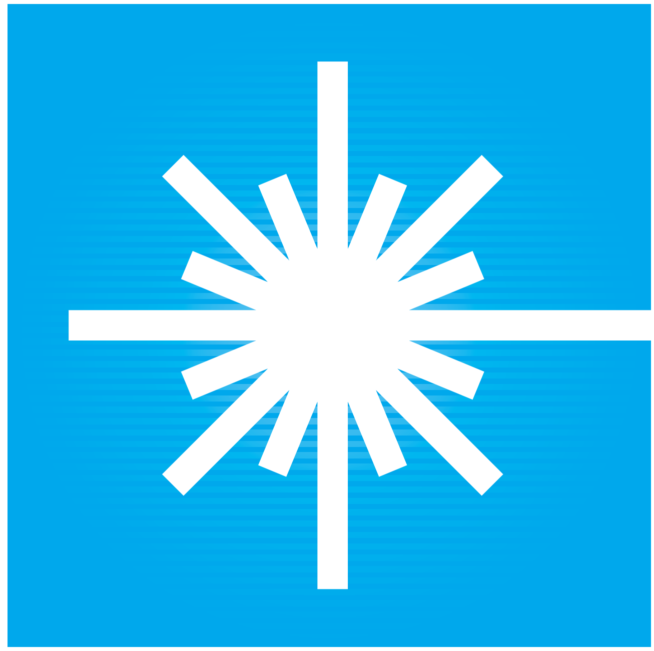
MG3740A Analog Signal Generator

100 kHz to 2.7 GHz/4 GHz/6 GHz

The MG3740A Analog Signal Generator has excellent RF specifications, including SSB phase noise, output level, etc., and versatile modulation functions (AM/FM/ΦM/Pulse). Moreover, the MG3740A supports additional analog modulation by external signal input, dual RF outputs, narrowband digital modulation function, BER test function and USB power sensors.

- Built-in AM/FM/ΦM/Pulse Modulation Function [Standard]
- Additional Analog Modulation Input [Option]
  AM + FM, AM + ΦM, Internal 1 + Internal 2, Internal + External
  (∗ FM + ΦM does not support.)
- Dual RF Outputs [Option]
  One unit supports two RF outputs (1st RF/2nd RF) max.
- Narrowband Digital Modulation Function [Option]
  RF modulation bandwidth: 2 MHz
- BER Test Function [Option]
  Input bit rate: 100 bps to 40 Mbps
- USB Power Sensors [Sold separately]

(For further information see page 749)



OPTICAL MEASURING INSTRUMENTS

Selection Guide 19
Network Master Series
  µOTDR Module 22
  Drop Cable Fault Locator Module 62
  Optical Channel Analyzer Module 66
ACCESS Master™ 31
Coherent OTDR 41
Card OTDR 45
OTDR Module 47
Multi-Layer Network Test Platform 50
  Optical Time Domain Reflectometer 52
  OTDR/Chromatic Dispersion Application 55
  Polarization Mode Dispersion Analyzer 57
  Optical Spectrum Analyzers 59
Light Source/Optical Power Meter 68
Optical Spectrum Analyzer 71
Optical Fiber Identifiers 78
Visual Fault Locator 79
Bare Fiber Adapter 80

Selection Guide

Application / Model/Name		Optical Power		Light Source Wavelength		Loss			Optical Identification		Optical Return Loss Measurement	Fiber Evaluation		Laser Diode Testing	Polarization Mode Dispersion Measurement	Chromatic Dispersion Measurement	Others	Remarks
		Low Level	Medium/High Level	Spectrum	Wavelength	High-loss	High Accuracy	Loss-wavelength	Identification	Loss		Fault Location	Splice Loss					
Light Source/ Handheld Power Meter	CMA5 Series	✓	✓			✓	✓	✓	✓	✓								0.85 µm to 1.625 µm
Optical Spectrum Analyzer	MS9740A	✓	✓	✓	✓	✓		✓						✓				0.6 µm to 1.75 µm
	CMA5000a OSA 400	✓	✓	✓	✓	✓		✓						✓				1.25 µm to 1.65 µm (Build-to order)
	CMA5000a OSA 425	✓	✓	✓	✓	✓		✓						✓				
OTDR	CMA5000a OTDR Series		✓				✓		✓	✓	✓	✓	✓					1.31/1.55/1.625 µm (SMF)
OTDR Module	MW9077A/A1/A2/B						✓		✓	✓	✓	✓	✓					1.31/1.55/1.625 µm (SM)
	MW9087B/D						✓		✓	✓	✓	✓	✓					1.55/1.65 µm
ACCESS Master	MT9083A2/B2/C2		✓				✓		✓	✓	✓	✓	✓					0.85/1.3 µm (MMF), 1.31/1.55/1.625/1.65 µm (SMF)
Coherent OTDR	MW90010A						✓		✓	✓	✓	✓	✓					1535.03 nm to 1565.08 nm
Network Master	MU909014x/15x		✓				✓		✓	✓	✓	✓	✓					1.31/1.55/1.625/1.65 µm
	MU909011A		✓				✓		✓	✓	✓	✓	✓					0.78/1.55 µm (SM)
	MU909020A		✓		✓												✓	CWDM network analyzer
PMD Analyzer	CMA5000a PMD														✓			1.25 µm to 1.65 µm
Chromatic Dispersion Analyzer	CMA5000a CD-OTDR		✓				✓		✓	✓	✓	✓	✓			✓		1.31 µm to 1.625 µm
Optical Fiber Identifier	FI700								✓									0.8 µm to 1.7 µm
Visual Fault Locator	VFL650								✓									635 nm

Optical Connector Options for Anritsu Optical Measuring Instruments

A variety of optical connectors are used with optical fibers worldwide. Specify the option number, model name, and number of the optical connector from the table below according to the type of optical connector you use. If no specification is made, an FC-type connector will be supplied.
For combinations marked with "✓" symbols in the table, the required instrument can be supplied according to the order. For connectors without "✓" symbols or which do not appear in the table, consult your sales representative. For measuring equipment with more than one control panel, specify only the connector connected to the measured fiber. Be sure to consult us before ordering, particularly for optical connectors for single-mode fibers, to avoid trouble with connectors not fitting.
Optical connectors may be designed for either flat-polished or PC-polished ends. Some measuring instruments use connectors only for PC-polished ends; consult the literature on the instrument before specifying the connector option.

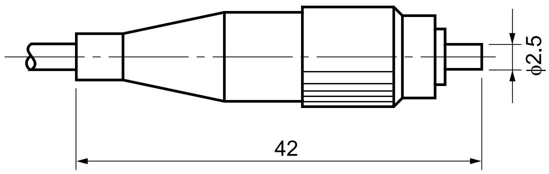
Model/Name		Connector option number						
		25	26	37	38	39	40	43
		FC-APC key width 2.0 mm*1	SC-APC*1	FC	ST	DIN 47256	SC	HMS-10/A (SM)*2
Connector Adapter	MA9005B			✓	✓	✓	✓	✓
Light Source/Optical Power Meter	CMA5 Series	For connector and product numbers, please refer to individual product page.						
Optical Spectrum Analyzer	MS9740A			✓*3	✓*3	✓*3	✓*3	
	CMA5000a OSA 400	For connector and product numbers, please refer to individual product page.						
	CMA5000a OSA 425	For connector and product numbers, please refer to individual product page.						
OTDR	CMA5000a OTDR Series	For connector and product numbers, please refer to individual product page.						
OTDR Module	MW9077A/A1/A2/B	✓	✓	✓*2	✓*2	✓*2	✓*2	✓*2
	MW9087B/D			✓*3	✓*3	✓*3	✓*3	✓*3
ACCESS Master	MT9083A2/B2/C2	✓	✓	✓*3	✓*3	✓*3	✓*3	
Network Master	MU909014x/15x			✓*3		✓*3	✓*3	
	MU909011A	✓	✓	✓*3	✓*3	✓*3	✓*3	
	MU909020A	✓	✓	✓*3			✓*3	
Coherent OTDR	MW90010A			✓*3	✓*3	✓*3	✓*3	✓*3
PMD Analyzer	CMA5000a PMD	For connector and product numbers, please refer to individual product page.						
Chromatic Dispersion Analyzer	CMA5000a CD-OTDR	For connector and product numbers, please refer to individual product page.						

*1: Ferrule type; APC (angled PC)
*2: Ferrule type; PC
*3: Ferrule type; PC (user replaceable and cleanable)
No marking: Ferrule type; Flat and PC.

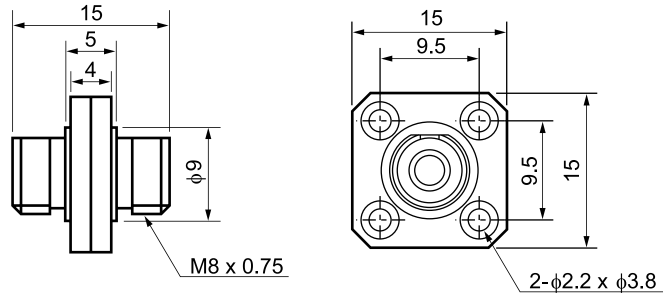
Unit in mm

Option 25: FC-APC key width 2.0 mm (angled convex)
Option 37: FC (flat, convex)

Plug

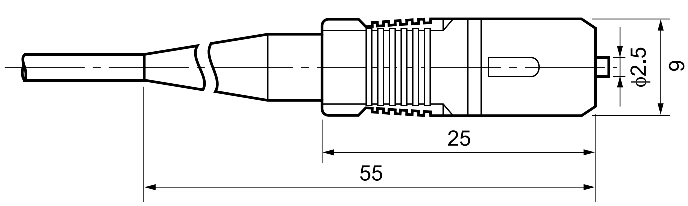


Adapter



Option 26: SC-APC (angled convex)
Option 40: SC (flat, convex: PC)

Plug



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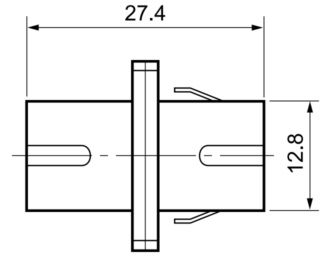
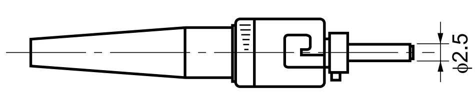
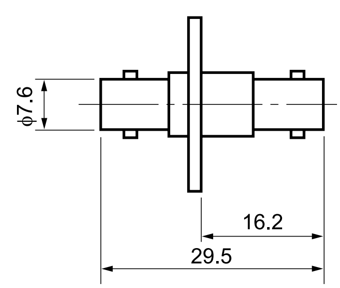


Option 38: ST (flat, convex: PC)

Plug

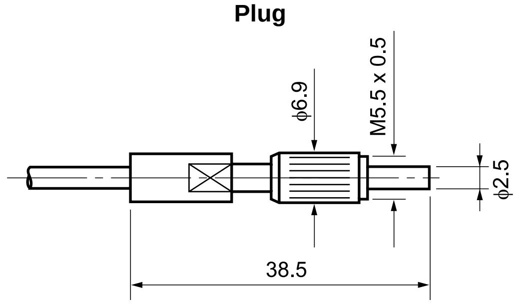


Adapter

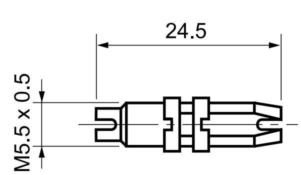


Option 39: DIN 47256 (flat, convex: PC)

Plug

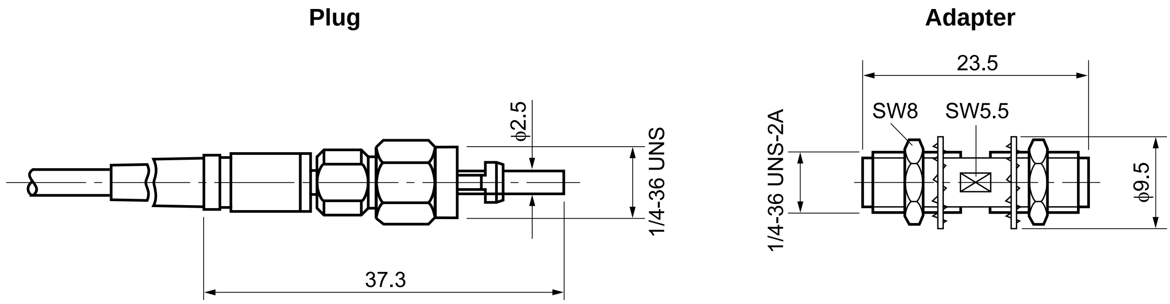


Adapter



Unit in mm

Option 43: HMS-10/A (SM, convex: PC)



Network Master Series

MT9090A MAINFRAME
MU909014A1/B/B1/C/C6, MU909015A6/B/B1/C/C6 µOTDR MODULE™

Field Optical Testing Redefined!

MT9090A with MU909014x/15x Overview

There are many handheld OTDRs on the market that appear to be a good value until they are put into action and the user quickly finds out that they lack the performance needed to install and maintain today's networks.

The new MU909014x/15x series µOTDR Module for the MT9090A Network Master platform from Anritsu finally addresses this need by providing all of the features and performance required for installation and maintenance of optical fibers in a compact, modular test set.

The MT9090A represents an unmatched level of value and ease of use, while not compromising performance. Data sampling of five centimeters, dead zones of less than one meter and dynamic range up to 37 dB ensure accurate and complete fiber evaluation of any network type – premise to access, metro to core…including PON-based FTTx networks featuring up to a 1 × 64 split.

The MT9090A with MU909014x/15x module represents a new era in optical fiber testing!

µOTDR Module™ is a trademark of Anritsu Corporation.

Key Features

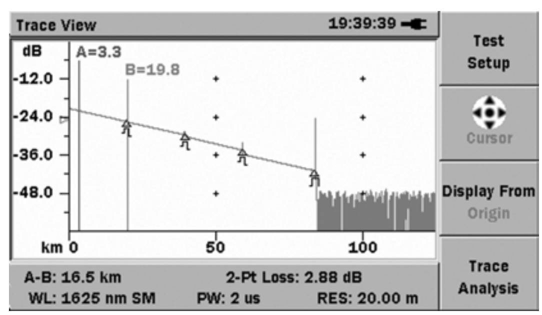
- **High-end OTDR performance in a pocket-size package with unique battery operation**
- **Tri-wavelength OTDR for both installation and maintenance (1310 nm/1550 nm plus filtered 1650 nm or 1625 nm)**
- **Built-in PON Power Meter, Loss Test Set and Light Source functions**
- **Full AUTO mode simple operation, no OTDR knowledge needed**
- **Complete PON testing through splitters up to 1 × 64**

A Truly Revolutionary OTDR!

Introducing the first handheld OTDR that does not compromise performance – the new µOTDR from Anritsu. With performance that rivals traditional OTDRs that are four times the size and more than double the price, the Network Master MT9090A µOTDR has created a new class of test instruments. It features 5 cm resolution for accurate mapping of events, dead zones of less than 1 meter (3 feet) and a dynamic range of up to 35 dB – enough to test over 150 km (90+ miles). The MT9090A µOTDR also takes portability to a new level by being the first handheld OTDR that truly fits in the palm of your hand.

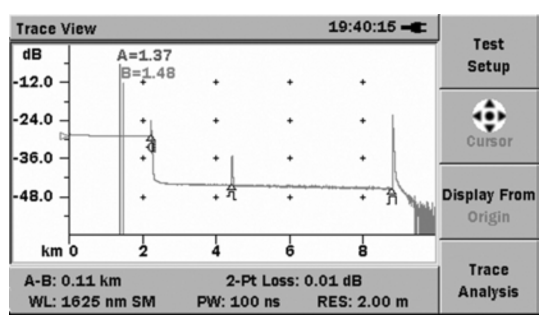
- **Complete Testing Tool - Premise to Core**

With a dynamic range of up to 37 dB, the µOTDR evolves far beyond the premise/access applications that other handheld OTDRs service. Metro links can be tested with lower pulsewidths which provides greater detail and better resolution while long haul fibers up to 175 km (108 miles) can also be completely evaluated.



- **FTTx and PON Ready**

With splitter-based fiber-to-the-x (FTTx) deployments becoming more popular, the need for test equipment to thoroughly test and maintain them has risen. The µOTDR series features the ability to test up to a 1 × 64 split completely from end-to-end and with high resolution.



- **Full Auto Operation**

To ensure easy operation and accurate results for all levels of users, the MT9090A µOTDR can be configured to automatically select all test parameters. The user simply presses the "Start" button and within a few seconds has a complete, easy to read summary of the fiber under test.

- **<1 m Dead Zone for Short Fiber Analysis**

With less than 1 meter dead zones, the MT9090A is perfect for evaluating central office, FTTx and intra building cables.

- **Fast Real Time Sweeping**

The MT9090A µOTDR features real-time updates as quickly as 0.25 seconds. This is useful for connector and splice optimizations as well as verifications of parameter selection.

- **Portable**

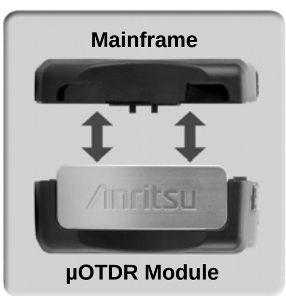
The MT9090A µOTDR takes portability to a whole new level. With dimensions of just 19 cm × 9.6 cm × 4.8 cm (7.5" × 3.8" × 1.9") and a weight of only 700 g (1.54 lbs.), the µOTDR is the smallest and lightest OTDR on the market. With its lightweight design and user friendly dimensions, the MT9090A is perfect for the outside plant environment and can easily be managed with one hand.
The standard soft case with shoulder strap further increases portability when traveling from the truck to the testing site.

- **Rugged**

With no fans or vents to allow dust and moisture to enter the unit, the MT9090A was designed for the challenging outside plant environment.

- **Modular Design**

The MT9090A features a modular design allowing modules to be easily changed in the field. Users can interchange different OTDR modules or perform other optical network testing such as optical channel analysis with the available CWDM channel analyzer module or 10/100/1000 MB Ethernet testing on optical or electrical links. Operation is quite similar between modules so the user is immediately familiar with operation.



- **4.3-inch Wide Screen Display for Easy Viewing**

The high resolution, full color, 4.3-inch wide screen display is the perfect format for viewing OTDR results. It also provides excellent readability both indoors and outdoors.

- **Integrated Launch Fiber**

To further simplify testing, the MU909014x/15x series is the only handheld OTDR that features an integrated launch cable. A ten meter (30 feet) fiber is built-in so initial fiber connections can be verified without the need for additional patchcords or launch fibers.

Reliable. Capable.

When buying products, you tend to choose ones that are innovative and from established companies.
When you need to install and maintain optical networks, this should also apply. With over 50 years of combined OTDR design, Anritsu, which now includes NetTest, delivers the features that matter.
Having been in the test and measurement business for a long time, we understand the importance of performance, portability, reliability, easy operation and of course price.

- **Event Table with User Defined Thresholds**

PASS/FAIL thresholds for key acceptance criteria such as splice loss, reflectance and total span loss can be set in the MT9090A allowing technicians to easily assess a fiber's condition. Failing values are clearly highlighted in the event table alerting technicians of potential problems.

- **Unique Battery Operation**

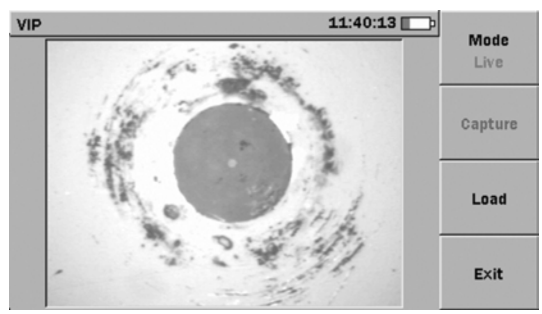
Since AC power is not always available where you need it, especially at fiber pedestals, the MT9090A typically provides 8 hours of testing on a single charge. This coupled with an optional car cigarette lighter cord guarantees the MT9090A is ready when you are. µOTDR supports widely available NiMH and Alkaline batteries for truly unique battery operation.

- **Quick Startup**

The MT9090A is ready for measurement in under 15 seconds so productive work can start immediately.

- **Video Inspection Probe Support**

When equipped with the optional connector video inspection probe (VIP), the µOTDR becomes a powerful tool for evaluating connector cleanliness and quality. Connector end faces can be safely viewed and images stored to document all aspects of your network.



- **Screen Capture Function**

Screen shots are sometimes useful for adding to reports so the MT9090A features the ability to save screen shots as Bitmap images.

Installation and Maintenance Simplified

Since the MT9090A is designed for technicians of any level, its hardware and user interface are optimized for simplicity.
A customizable testing sequence and "Full Auto" mode automates testing and guides novice users. Specialized maintenance wavelengths are also available to eliminate equipment damage and transmission interruptions.

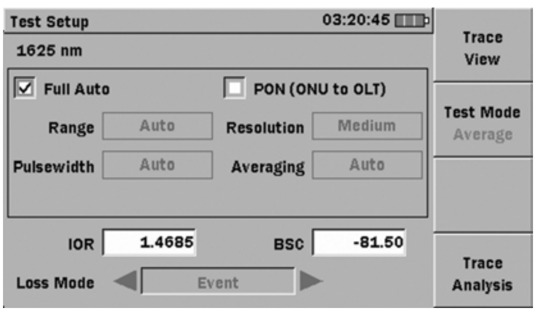
• Installation Simplified

The MU909014x/15x series µOTDR Module provides easy and accurate verification of fiber installations at 1310 nm & 1550 nm to ensure your network is ready for any transmission type. The user simply connects the fiber, selects "Full Auto" and presses "Start" - all settings are automatically selected to ensure accurate and constant results for any skill level. Upon completion, all key fiber characteristics are displayed within seconds. Experienced users can also "fine tune" all testing parameters and make manual measurements.

Step 1 – Connect fiber and Power on

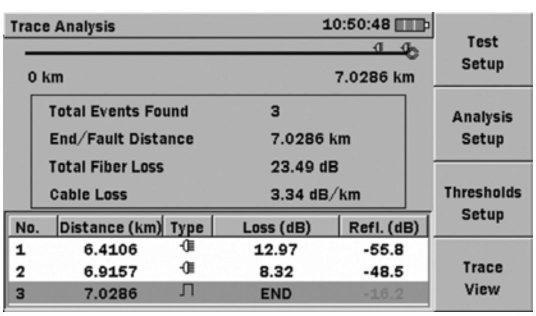
Step 2 – Select "Full Auto" and Press "Start"

All testing parameters are automatically selected.



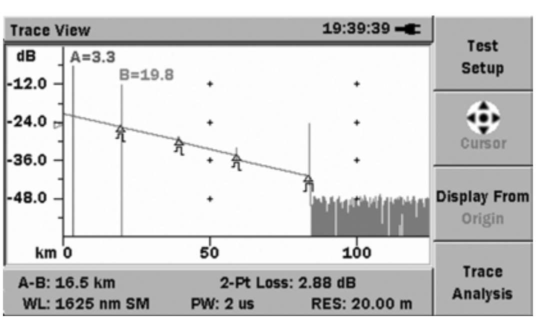
Step 3 – Read Results

Test results including all splices and connectors, as well as total fiber length and loss are shown in an easy to read table.



Step 4 – View Trace

View trace if desired to see the complete fiber trace and make any manual measurements.



• Maintenance Simplified

Being able to test active fibers is a key requirement for network maintenance since multiple users often share portions of the network and taking them all out of service is not an option.
To address this need, special modules are available in the MT9090A series µOTDR. 1650 nm is recommended by the ITU-T L.41 for active maintenance since it features 100 nm of isolation from the nearest 1550 nm transmission wavelength. The 1650 nm OTDR also features an integrated filter to block transmissions from damaging the OTDR. 1625 nm is also available and can be used for in-service testing or as an "extra" test to verify installation for stresses such as macrobends.

• Network Documentation Simplified

Simple Data Storage

With internal data storage plus support for external USB memory devices, the MT9090A is more than capable. Add to this auto file saving and naming for easy, error-free documenting of your network.

Common OTDR Data Format

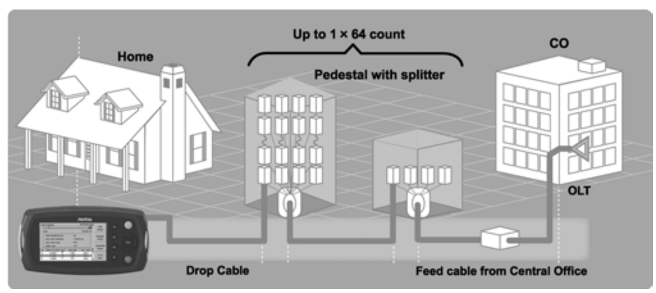
The MT9090A supports the universal Telcordia SR-4731 format making it compatible with not only legacy Anritsu and NetTest products, but with many other vendors data.

Easy "Drag and Drop" File Transfers

When the MT9090A is connected to a PC via a USB cable, the internal memory can be directly accessed. Data can be selected, dragged and dropped into the PC memory, greatly simplifying file transfers. The MT9090A also supports the use of USB memory sticks.

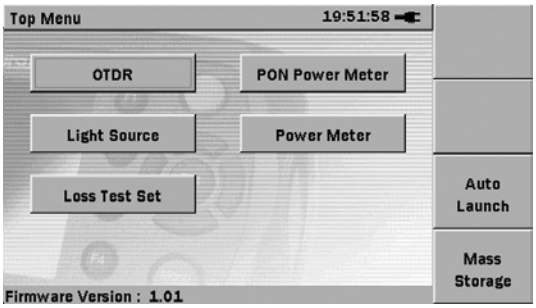
Free and Simple Software Upgrades

Firmware upgrades are easily performed via USB and available from the Anritsu website for registered users or through Anritsu customer support.



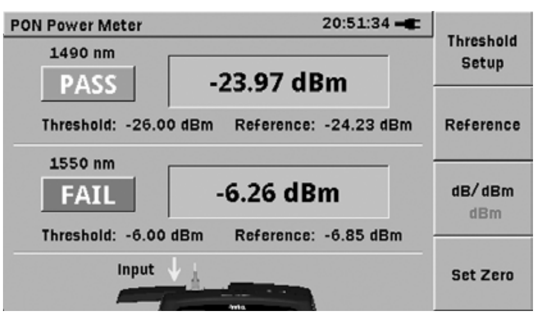
All-in-one FTTx Installation and Maintenance Functions

There are three types of µOTDR module: single wavelength (1625 nm or 1650 nm) for the FTTx maintenance market including Metro networks, dual wavelength (1310 nm/1550 nm) for the installation market, and triple wavelength for both these markets.
These all-in-one µOTDR modules support every function required at fiber installation and maintenance, as well as OTDR functions.
The PON Power Meter and Power Meter are ideal for loss measurements required for quality measurements and basic fault tests.



• PON Power Meter (1490 nm/1550 nm)

Generally, PON communications use three wavelengths: 1310 nm, 1490 nm, and 1550 nm. Data (1490 nm) and video (1550 nm) signals are sent to subscribers through one optical fiber but a general-purpose optical power meter cannot separate the two wavelengths, making it difficult to locate faults using optical level measurements.
The PON Power Meter can identify and measure the two 1490 nm and 1550 nm signals to support PASS/FAIL evaluations based on a set threshold and reference value. Additionally, power measurements and µOTDR tests are quick and easy without changing the optical fiber because the PON Power Meter port is shared with the µOTDR function.

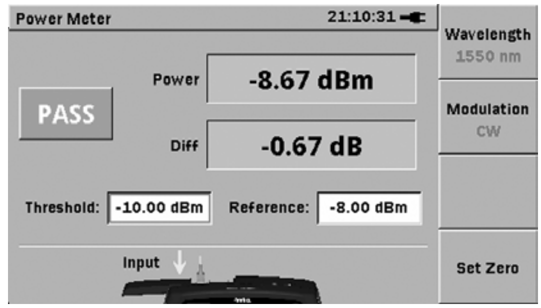


• Light Source

The µOTDR module can be used as a light source to identify an optical fiber and measure the loss by connecting an optical fiber identifier and optical power meter at the other end of the fiber. Since all wavelengths are shared by one µOTDR port, the fiber identification, loss, and µOTDR measurements can all be performed as a single task without changing the fiber connection. Both modulation (270 Hz, 1 kHz, 2 kHz) and CW signals are supported.

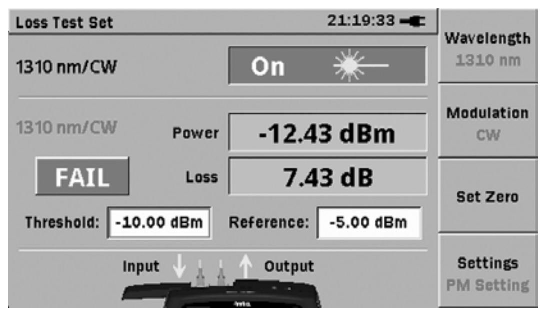
• Power Meter

The simple power meter function is ideal for checking optical levels to confirm a fault occurrence using total received power. Setting a threshold and reference value makes PASS/FAIL evaluation easy too. In addition, power measurements and µOTDR tests are quick and easy without changing the optical fiber, because the Power Meter port is shared with the µOTDR.



• Loss Test Set

Combining the µOTDR module light source with the Power Meter supports use as a Loss Test Set.
The loss at both 1310 nm and 1550 nm can be measured with one µOTDR by looping-back the optical fiber. And both modulation (270 Hz, 1 kHz, 2 kHz) and CW signals are supported. Just setting the threshold and reference value makes PASS/FAIL evaluation easy.



• Visible Laser Diode

The optional visible red LD light source makes it easy to spot faults in splices and connectors and well as to manage fibers.

∗: The PON Power Meter, Light Source, Power Meter, Loss Test Set, and Visible Laser Diode functions have different menus, depending on the selected module. See the Ordering Information for details.
∗: The Visible Laser Diode is operated from the µOTDR and Power Meter menus.
∗: The screen items depend on the selected module.

Specifications

• MT9090A Mainframe

Dimensions and Mass	190 (W) × 96 (H) × 48 (D) mm (7.5" × 3.8" × 1.9") (including Mainframe and Module) <700 g (1.54 lbs.) (including Mainframe, Module and Standard battery)
Display	4.3-inch TFT Color LCD (480 × 272 pixels, Transmissive)
Interface	USB 1.1, Type A × 1 (memory), Type B × 1 (USB mass storage)

• µOTDR Module Common (MU909014C/C6, MU909015C/C6, MU909014A1/B/B1 and MU909015B/B1, MU909015A6)

Fiber Type	10 µm/125 µm SMF (ITU-T G.652)
Optical Connector	FC/SC/DIN adapter are changeable
Distance Range	0.5, 1, 2.5, 5, 10, 25, 50, 75, 125, 250 km (IOR=1.500000)
Pulse Width	5, 10, 20, 50, 100, 200, 500 ns, 1, 2, 5, 10, 20 µs
Linearity	Which ever is greater ±0.05 dB/dB or ±0.1 dB
Return Loss Measurement Accuracy*1	±2 dB
Distance Measurement Accuracy	±1 m ±3 × Measurement distance × 10^{-5} ±Marker resolution (excluding IOR uncertainty)
Data Storage	Internal memory: 40 MB (<1,000 traces) External (USB Memory): 1 GB (<30,000 traces)
IOR Setting	1.3000 to 1.7000 (0.0001 steps)
Units	km, m, kft, ft, mi
Other Functions	Integrated launch fiber: 10 m (30 ft) Connection check: Automatic check of OTDR to FUT connection quality Live fiber detect: Verifies presence of communication light in fiber Real time sweep: <1 sec (typ.)
Language	User selectable (English, Simplified Chinese, Traditional Chinese, Korean, Japanese, French, German, Italian, Spanish, Polish, Portuguese, Finnish, Danish, Swedish, Spanish (Latin America), Russian and Dutch)
Power Supply	9 V (dc), 100 V (ac) to 240 V (ac), Allowable Input voltage range: 90 V (ac) to 264 V (ac), 50 Hz/60 Hz
Fiber Event Analysis	Automatic, Displayed in table format based on user defined PASS/FAIL thresholds
Loss Measurement Modes	2-point loss, Splice loss, dB/km Loss LSA, ORL, Event
OTDR Trace Format	Telcordia universal (.SOR) issue 2 (SR-4731)
Battery	NiMH (Standard battery), NiMH (AA Type), Alkaline Dry Battery (AA Type)*2 Operating time (Standard battery): 8 hours (typ.)*3, Telcordia GR-196-CORE Issue2, September 2010 Recharging time: <4 hours (typ.)*4
EMC	EN61326-1, EN61000-3-2

• MU909014C/C6 and MU909015C/C6 µOTDR Module

Model Name		MU909015C/C6-057 MU909015C/C6-067	MU909015C/C6-058 MU909015C/C6-068	MU909014C/C6-057 MU909014C/C6-067	MU909014C/C6-058 MU909014C/C6-068
Center Wavelength*5		1310/1550±20 nm*6 1625±15 nm	1310/1550±20 nm*6 1650±15 nm	1310/1550±20 nm*6 1625±15 nm	1310/1550±20 nm*6 1650±15 nm
Dynamic Range*7, *8	PW=20 µs	38 dB/37 dB/35 dB*9, *10	38 dB/37 dB/35 dB*9, *10	32.5 dB/31 dB/32.5 dB*9, *11	32.5 dB/31 dB/32.5 dB*9, *11
	PW=500 ns	27 dB/26 dB/25 dB*9, *10	27 dB/26 dB/24 dB*9, *10	24.5 dB/23 dB/24 dB*9, *11	24.5 dB/23 dB/24 dB*9, *11
Dead Zone*12 (IOR=1.500000)		Fresnel: ≤0.8 m (Typical) Backscatter: ≤4.0 m (1310 nm, Typical), ≤4.5 m (1550/1625/1650 nm, Typical)			
Number of Sampling Points*13		<250,001 pts (Course: <7,501 pts, Medium: <20,001 pts, Fine: <250,001 pts)			
Sampling Resolution		2 cm (min.)			
Testing Modes		OTDR (Full automatic, Manual, Real time), Power Meter, [Video Inspection Probe (Option)] [PON Power Meter, Loss Test Set, Light Source (MU909015C6, MU909014C6)]			
Power Meter		Please refer to the spec "Power Meter"			
PON Power Meter (only for MU909015C6/14C6)		Please refer to the spec "PON Power Meter"			
Light Source (only for MU909015C6/14C6)		Please refer to the spec "Light Source"			
Loss Test Set (only for MU909015C6/14C6)		Please refer to the spec "Loss Test Set"			
Environment		Operating temperature and humidity: –10° to +50°C, <95% (no condensation) Storage temperature and humidity: –30° to +70°C, <95% (no condensation) Vibration: MIL-T-28800E Class 3, Dust and Drip proof: IP51			
Laser Safety*14		IEC Pub 60825-1: 2007 Class 1M, 21CFR1040.10			

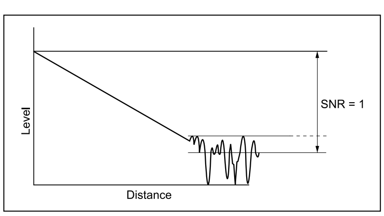
• MU909014A1/B/B1 and MU909015B/B1 µOTDR Module

Model name		MU909015B/B1-056 MU909015B/B1-066	MU909014B/B1-056 MU909014B/B1-066	MU909014A1-053 MU909014A1-063	MU909014A1-054 MU909014A1-064
Center Wavelength*5		1310/1550 ±20 nm*6		1625 ±15 nm	
Dynamic Range*7, *8	PW=20 µs	37 dB/36 dB	32.5 dB/31 dB	32.5 dB*9, *11	
	PW=500 ns	28 dB/26 dB	24.5 dB/23 dB	24.5 dB*9, *11	24 dB*9, *11
Dead Zone*12 (IOR=1.500000)		Fresnel: ≤1 m Backscatter: ≤5 m			
Number of Sampling Points*13		<125,001 pts (Course: <6,251 pts, Medium: <25,001 pts, Fine: <125,001 pts)			
Sampling Resolution		5 cm (min.)			
Testing Modes		OTDR (Full automatic, Manual, Real time), Power Meter, [Visible Fault Locator (Option)], [Video Inspection Prove (Option)]			
Power Meter (only for MU909014B/B1/15B/15B1)		Please refer to the spec “Power Meter”		Not applicable	
Visible Fault Locator (only for MU909014A1/B1/15B1)		Connector: 2.5 mm universal Wavelength: 650 ±15 nm (CW, +25°C) Output power: 0 ±3 dBm (CW, +25°C) Modulation: CW, 1 Hz			
Environment		Operating temperature and humidity: –5° to +40°C, <80% (no condensation) Storage temperature and humidity: –20° to +60°C, <80% (no condensation) Vibration: MIL-T-28800E Class 3, Dust and Drip proof: IP51			
Laser Safety*14		IEC Pub 60825-1: 2007 Class 1, IEC Pub 60825-1: 2007 Class 1M, IEC Pub 60825-1: 2007 Class 3R (VLD Option), 21CFR1040.10			

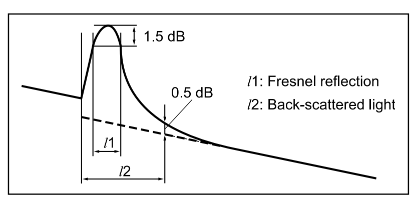
• MU909015A6 µOTDR Module

Model Name		MU909015A6-053 MU909015A6-063	MU909015A6-054 MU909015A6-064
Center Wavelength*5		1625 ±15 nm	1650 ±15 nm
Dynamic Range*7, *8	PW=20 µs	35 dB*9, *10	
	PW=500 ns	25 dB*9, *10	24 dB*9, *10
Dead Zone*12 (IOR=1.500000)		Fresnel: ≤0.8 m (Typical) Backscatter: ≤4.5 m (Typical)	
Number of Sampling Points*13		<250,001 pts (Course: <7,501 pts, Medium: <20,001 pts, Fine: <250,001 pts)	
Sampling Resolution		2 cm (min.)	
Testing Modes		OTDR (Full automatic, Manual, Real time), Power Meter, [Video Inspection Probe (Option)] [PON Power Meter, Light Source]	
Power Meter		Please refer to the spec “Power Meter”	
PON Power Meter		Please refer to the spec “PON Power Meter”	
Light Source		Please refer to the spec “Light Source”	
Environment		Operating temperature and humidity: –10° to +50°C, <95% (no condensation) Storage temperature and humidity: –30° to +70°C, <95% (no condensation) Vibration: MIL-T-28800E Class 3, Dust and Drip proof: IP51	
Laser Safety*14		IEC Pub 60825-1: 2007 Class 1, 21CFR1040.10	

∗1: Design assurance. Distance range: 25 km, Pulse width: 2 µs, 20 km open the fiber-end. BSC: –78.5 (1310 nm), –81.5 (1550 nm), –82.5 (1625 nm/1650 nm)
∗2: All specifications are guaranteed by standard battery.
∗3: Back light low, Sweeping halted, +25°C
∗4: +10° to +30°C, Power off
∗5: At +25°C, 1 µs, except charging battery
∗6: Typical value, ±25 nm is Guaranteed
∗7: Typical value, Distance range: 125 km, Averaging: 180 sec, SNR=1, +25°C, Except while charging battery, Subtract 1 dB for guarantee
∗8: Dynamic range (one-way back-scattered light)
SNR=1: The level difference between the RMS nose level and the level where near end back-scattering occurs.



∗9: 1490 nm/1550 nm cut filter included (1625 nm or 1650 nm port)
∗10: Specified without background light (1625 nm, 1650 nm)
∗11: In service Signal is –20 dBm (CW) at 1310 nm/1550 nm
∗12: Return Loss 45 dB, +25°C
Fresnel: PW=5 ns, 1.5 dB down from the peak of Fresnel
Backscatter: PW=5 ns, Deviation ±0.5 dB



∗13: Either medium and fine density value is selected depends on distance range
∗14: Safety measures for laser products
This option complies with optical safety standards, in Class1, 1M, 3R of IEC 60825-1; the following descriptive labels are affixed to the product.

• Other Functions

Light Source

Models	MU909015C6/14C6, MU909015A6
Wavelength*15	1310/1550 ±25 nm (MU909015C6/14C6) 1625 ±25 nm (MU909015C6/14C6-057, MU909015A6-053, MU909015C6/14C6-067, MU909015A6-063) 1650 ±25 nm (MU909015C6/14C6-058, MU909015A6-054, MU909015C6/14C6-068, MU909015A6-064)
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)
Output port	Shared with OTDR port
Output power*15, *16	–5 ±1.5 dBm
Output stability*17	≤0.2 dB
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz
Laser Safety	Same as OTDR

Power Meter

Models	MU909015C6/14C6, MU909015A6	MU909015C/14C	MU909015B/B1, MU909014B/B1
Wavelength	1310/1490/1550/1625/1650 nm	1310/1490/1550 nm	1310/1490/1550/1625/1650 nm
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)		
Measurement range*18	–50 to +26 dBm (CW) –40 to +13 dBm (270 Hz, 1 kHz, 2 kHz)	–50 to –5 dBm (CW)	
Measurement port	Shared with OTDR port (1625 nm or 1650 nm OTDR port)	Shared with OTDR port (1310 nm/1550 nm OTDR port)	
Measurement Accuracy*19	±0.5 dB		
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz	CW	

PON Power Meter (1490 nm/1550 nm)

Models	MU909015C6/14C6, MU909015A6
Wavelength	1490 nm/1550 nm
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)
Measurement range	–50 to +13 dBm (1490 nm, CW) –50 to +26 dBm (1550 nm, CW)
Measurement port	Shared with OTDR port (1625 nm or 1650 nm)
Measurement Accuracy*20	±0.5 dB
Isolation*21	1490 nm: >35 dB, 1550 nm: >50 dB

Loss Test Set

Models	MU909015C6/14C6
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)
Measurement port	Light Source: Shared with OTDR port (1310 nm/1550 nm OTDR port) Power Meter: Shared with OTDR port (1625 nm or 1650 nm OTDR port)
Light Source	
Wavelength	1310 ±25 nm, 1550 ±25 nm
Output Power*15, *16	–5 ±1.5 dBm (CW, 25°C)
Output stability*17	≤0.2 dB
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz
Laser Safety	Same as OTDR
Power Meter	
Wavelength	1310/1490/1550/1625/1650 nm
Measurement range*18	–50 to +26 dBm (CW) –40 to +13 dBm (270 Hz, 1 kHz, 2 kHz)
Measurement Accuracy*19	±0.5 dB
Modes of Operation	CW, 270 Hz, 1 kHz, 2 kHz

*15: At +25°C, CW
*16: Fiber length 2 m, after the warm-up.
*17: Wavelength 1310 nm/1550 nm, CW, ±1°C at one point within –10 to +50°C, deference between the largest value and shortest value for one minute, single mode fiber 2 m, when the optical power meter with return loss of 40 dB or more is used. After the warm-up time (10 minutes) passed.
*18: At 1550 nm
*19: 1310 nm/1490 nm/1550 nm, CW, –20 dBm, 25°C, on master connector fiber (FC) use, after zero offset execution.
*20: 1490 nm/1550 nm, CW, –20 dBm, +25°C, on master connector fiber (FC) use, after zero offset execution.
*21: Design assurance.

Ordering information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• Select Mainframe

Model/Order No.	Description
MT9090A	Mainframe (with color LCD)

• Select Base Module

Model/Order No.	Description
MU909014A1[*1]	µOTDR (Single wavelength, 30 dB class OTDR with VLD)
MU909015A6[*2]	µOTDR (Single wavelength, 35 dB class OTDR with PM, PON-PM and LS)
MU909014B[*1]	µOTDR (2-wavelength, 30 dB class OTDR)
MU909014B1[*1]	µOTDR (2-wavelength, 30 dB class OTDR with VLD)
MU909015B[*1]	µOTDR (2-wavelength, 35 dB class OTDR)
MU909015B1[*1]	µOTDR (2-wavelength, 35 dB class OTDR with VLD)
MU909014C[*3]	µOTDR (3-wavelength, 30 dB class OTDR)
MU909014C6[*3]	µOTDR (3-wavelength, 30 dB class OTDR with PM, PON-PM, LTS and LS)
MU909015C[*3]	µOTDR (3-wavelength, 35 dB class OTDR)
MU909015C6[*3]	µOTDR (3-wavelength, 35 dB class OTDR with PM, PON-PM, LTS and LS)

∗1: One µOTDR port (any of 1310 nm/1550 nm, 1625 nm, 1650 nm) and visible light source (option) (Fig. 1)
∗2: One µOTDR port (1625 nm or 1650 nm) (Fig. 2)
∗3: Two µOTDR ports (1310 nm/1550 nm, and 1625 nm or 1650 nm) (Fig. 3)

Fig. 1

Fig. 2

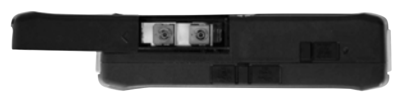


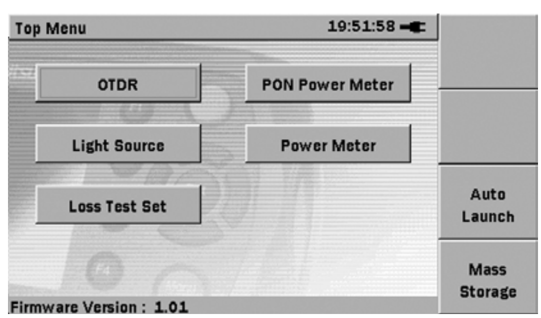
Fig. 3

• Select Module, Connector Interface and Testing Options

Includes operation manual, quick reference guide, battery pack, AC charger/adapter, standard soft case and strap.

Model/Order No.		Description	PM[*1]	PON-PM[*2]	LTS[*3]	LS[*4]	VLD[*5]
UPC type	APC type	Installation and Maintenance Models					
MU909014C-057	MU909014C-067	µOTDR (1310/1550/1625 nm, 32.5/31/32.5 dB)	✓				
MU909014C-058	MU909014C-068	µOTDR (1310/1550/1650 nm, 32.5/31/32.5 dB)	✓				
MU909015C-057	MU909015C-067	µOTDR (1310/1550/1625 nm, 38/37/35 dB)	✓				
MU909015C-058	MU909015C-068	µOTDR (1310/1550/1650 nm, 38/37/35 dB)	✓				
MU909014C6-057	MU909014C6-067	µOTDR (1310/1550/1625 nm, 32.5/31/32.5 dB)	✓	✓	✓	✓	
MU909014C6-058	MU909014C6-068	µOTDR (1310/1550/1650 nm, 32.5/31/32.5 dB)	✓	✓	✓	✓	
MU909015C6-057	MU909015C6-067	µOTDR (1310/1550/1625 nm, 38/37/35 dB)	✓	✓	✓	✓	
MU909015C6-058	MU909015C6-068	µOTDR (1310/1550/1650 nm, 38/37/35 dB)	✓	✓	✓	✓	
UPC type	APC type	General Purpose Models					
MU909014B-056	MU909014B-066	µOTDR (1310/1550 nm, 32.5/31 dB)	✓				
MU909014B1-056	MU909014B1-066	µOTDR (1310/1550 nm, 32.5/31 dB)	✓				✓
MU909015B-056	MU909015B-066	µOTDR (1310/1550 nm, 37/36 dB)	✓				
MU909015B1-056	MU909015B1-066	µOTDR (1310/1550 nm, 37/36 dB)	✓				✓
UPC type	APC type	Maintenance Models					
MU909014A-053	MU909014A-063	µOTDR (1625 nm, 32.5 dB)					
MU909014A1-053	MU909014A1-063	µOTDR (1625 nm, 32.5 dB)					✓
MU909014A-054	MU909014A-064	µOTDR (1650 nm, 32.5 dB)					
MU909014A1-054	MU909014A1-064	µOTDR (1650 nm, 32.5 dB)					✓
MU909015A6-053	MU909015A6-063	µOTDR (1625 nm, 35 dB)	✓	✓		✓	
MU909015A6-054	MU909015A6-064	µOTDR (1650 nm, 35 dB)	✓	✓		✓	

∗1: PM (Power Meter) function shared with µOTDR port.
∗2: PON-PM (PON Power Meter) shared with 1625 or 1650-nm µOTDR port. Identifies and measures 1490 and 1550-nm wavelengths.
∗3: LTS (Loss Test Set) function for measuring 1310/1550-nm wavelengths. Light source shared with 1310/1550-nm µOTDR port. Power meter shared with 1625 or 1650-nm µOTDR port.
∗4: LS (Stabilized Light Source) shared with OTDR for each wavelength.
∗5: VLD (Visible Laser Diode) function with visible light source port operated from OTDR or Power Meter.



Top Menu differs with selected module

• Select Connector Adapter

Adapter included at no charge – must be added as a separate line item.

Model/Order No.	Description
MU909014A/B/C-025 MU909015A/B/C-025	FC-APC Connector key width 2.0 mm (APC: Models -063, 064, 066, 067 and -068)
MU909014A/B/C-026 MU909015A/B/C-026	SC-APC Connector (APC: Models -063, 064, 066, 067 and -068)
MU909014A/B/C-037 MU909015A/B/C-037	FC Connector (UPC: Models -053, 054, 056, 057 and -058)
MU909014A/B/C-039 MU909015A/B/C-039	DIN 47256 Connector (UPC: Models -053, 054, 056, 057 and -058)
MU909014A/B/C-040 MU909015A/B/C-040	SC Connector (UPC: Models -053, 054, 056, 057 and -058)

• Select Accessories

Must be added as separate line items.

Model/Order No.	Description
Z1580A*1	Protector & Soft Case
B0663A*2	Protector
G0203A	AC Adapter (for Replacement)
G0202A	NiMH battery pack (for Replacement)
B0602A	Deluxe Soft Case (for MT9090A)
B0601B	Standard Soft Case
B0600B	Hard Case (for MT9090A)
Z1023A	Strap
J1402A	Car Plug Cord
J1530A	SC Plug-in Converter (UPC(P)-APC(J))
J1531A	SC Plug-in Converter (APC(P)-UPC(J))
J1532A	FC Plug-in Converter (UPC(P)-APC(J))
J1533A	FC Plug-in Converter (APC(P)-UPC(J))
J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))
J1535A	LC-SC Plug-in Converter (for MM, SC(P)-LC(J))
W3585AE	MU909014C/C6, MU909015A6/C/C6 Quick Reference Guide (English, Printed)
W3415AE	MT9090A/MU909014x/15x Quick Reference Guide (English, Printed)
W3586AE	MU909014C/C6, MU909015A6/C/C6 Operation Manual (English, Printed)
W3416AE	MT9090A/MU909014x/15x Operation Manual (English, Printed)
Z1579A	MU909014C/C6, MU909015A6/C/C6 Operation Manual (English and Japanese, Electronic (CD-R))
Z1547A	MU909014x/15x Operation Manual (English and Japanese, Electronic (CD-R))
G0293A	Video Inspection Probe Lite
OPTION-545VIP	Connector Inspection Microscope
Networks	PC Emulation Software for Data Analysis and Reporting

*1: The protector (B0663A) and standard soft case (B0601B) from a set. The protector includes a shoulder strap.
*2: The shoulder strap can be used to hang the instrument around the neck while working.

• Replacement Adaptors

Must be added as separate line items.

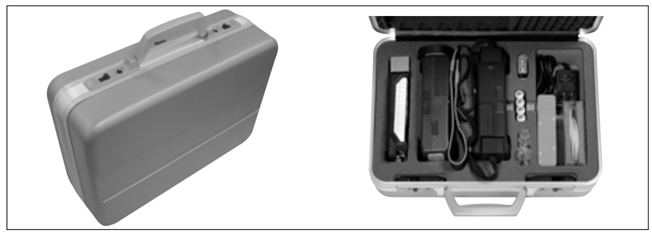
Model/Order No.	Description
J0617B	FC (UPC: Models -053, -054, -056, -057, -058)
J0618E	DIN (UPC: Models -053, -054, -056, -057, -058)
J0619B	Replaceable Optical Connector SC (UPC: Models -053, -054, -056, -057, -058) (APC: Models -063, -064, -066, -067, -068)
J0739A	FC (APC: Models -063, -064, -066, -067, -068)

B0601B Standard Soft Case

This standard accessory accommodates the mainframe with fitted protector.

B0602A Deluxe Soft Case

Full Network Master operation without removal from the case.
Provides excellent protection for use in hash conditions.
This does not accommodate the mainframe if the protector is fitted.



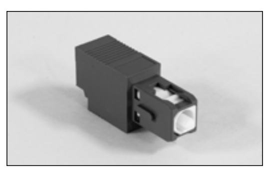
B0600B Hard Case

This accommodates two mainframes (with or without fitted protector), accessories (light source or power meter, backup battery, fiber cleaner, etc.).

Mainframe with Protector

B0663A Protector

The mainframe with fitted protector.



J1530A to J1535A

Plug-in Converter
(The photo shows the J1534A)

ACCESS MASTER™

MT9083 Series

0.85/1.3 µm (MMF), 1.31/1.55/1.625/1.65 µm (SMF)

Remote Control
Ethernet

All-in-One Solution that Reduces Testing Times to Install and Maintain FTTx, CATV, LAN, Access and Metro Networks

NEW

CE

Optical fibers are a key technology in today's modern communications systems, including access networks such as FTTx, CATV, and optical LANs. Moreover, optical-fiber technologies are playing increasingly important roles in mobile communications and digital broadcasting systems. Technicians maintaining these diverse systems are forced to carry a large variety of test equipment on-site, including OTDRs, Light Sources, Optical Power Meters, Visible Light Sources, etc. On the other hand, fiber construction requires measuring instruments with different functions and performance. As an example, FTTx access networks use single mode (SM) fiber whereas optical LANs use multimode (MM) fiber. In addition, core and backbone networks utilize long fibers while optical access networks use short fibers, both requiring different types of measuring instruments with different performance. But now Anritsu's new line of MT9083 ACCESS Master OTDRs solves all these problems by providing all the measurement functions and performance required for optical fiber construction and maintenance in a compact, lightweight, all-in-one unit that eliminates the burden of carrying many different test sets and instruments on-site. Whatever your work, construction or maintenance, long haul or intra-building, Anritsu has an MT9083 model for your needs.

Key Features

- Ready to test in about 15 seconds … and all day without recharging
- Specialized testing modes simplify operation
- High resolution and high dynamic range ensure quick and through fiber evaluation
- Intelligent analysis software identifies problem splices, connectors and even macrobends
- Rugged, sealed design provides years of service in the most challenging environments
- Large 7-inch enhanced display for easy viewing of results indoors or outdoors
- Test multiple wavelengths with a single unit - single mode, multimode or both
- Unique in-service testing without the need for external filters
- Verify connector quality with optional connector inspection microscope

Full SCPI Command Support for Remote Operation or Automated Testing

Multiple Models to Meet Any Testing Requirement

- MT9083A2: General purpose, good range, up to 39 dB.
- MT9083B2: High performance, enhanced range with full 1 × 64 PON support, up to 42 dB.
- MT9083C2: Ultra-high performance, enhanced range with full 1 × 128 PON support, up to 46 dB.

New Feature Highlight

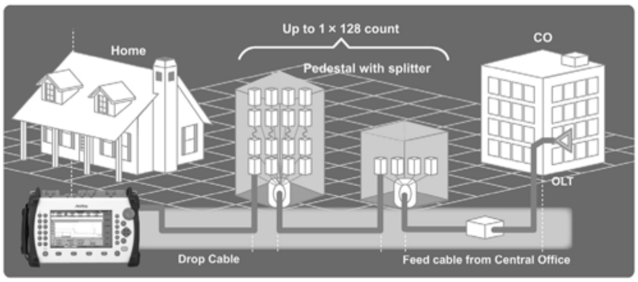
Anritsu is now pleased to announce the enhanced MT9083A2/B2/C2 models. The ACCESS Master MT9083x2 now features a 7-inch widescreen TFT-LCD display for use both indoors and outdoors, enhanced battery operation time (up to 12 hours), increased operating temperature range (–10° to +50°C) and new short-cut function keys.

Enhancements:

- Larger (7 inch), higher resolution (800 × 480) display with LED backlight
- Longer battery operation time: Up to 12 hours
- Wider operating temperature range: –10° to +50°C
- New shortcut keys to simplify operation: quickly change between trace and event table or access set-ups and mass storage
- Lighter – now only 2.6 kg (5.7 lbs)!

Optimized for Verifying PON Splitters Up to 1 × 128 Count

Many OTDRs claim to be able to test splitter-based, passive optical networks (PON) but the MT9083 delivers in a way others wish they could. With its high dynamic range and quick data acquisition, the MT9083 provides unparalleled resolution of single or closely spaced, cascaded splitters up to an industry-leading 1 × 128 count.



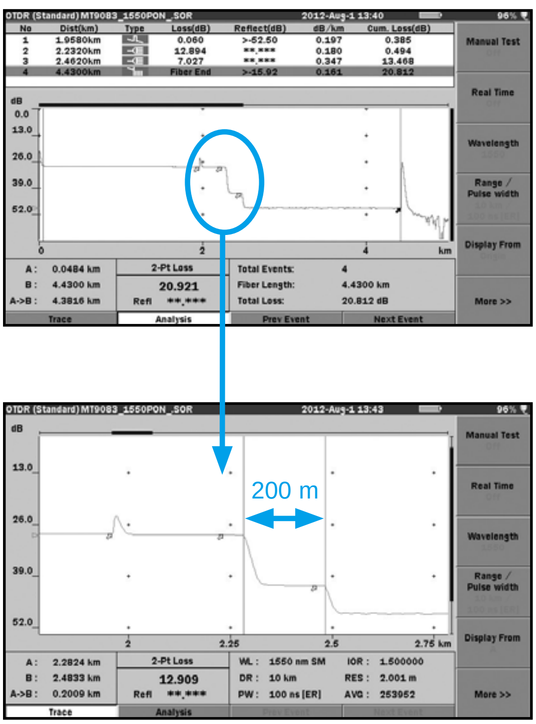


Fig 1: Typical PON 1 × 64 count System Measurement from the customer premise.

The MT9083 Series Enhanced Range Mode and a Pulse width of 100 ns provides excellent dynamic range while not compromising deadzone resolution to clearly display multiple, high loss splitters.

Exceptional OTDR Performance from the World's First OTDR Manufacturer

Evaluation of access networks ranging from a few kilometers to metro networks reaching up to 100 km in length is becoming commonplace, requiring OTDRs to have the performance and functions for evaluating both short and long fibers. Designed with this in mind, the ACCESS Master delivers on both fronts.

• Improved Short Fiber Analysis

An event dead zone of less than 1 m (80 cm typical) and a sampling resolution of 5 centimeters allow the MT9083 to evaluate connections and troubleshoot central office, FTTx and intra-building faults with ease – providing a level of detail never before seen.

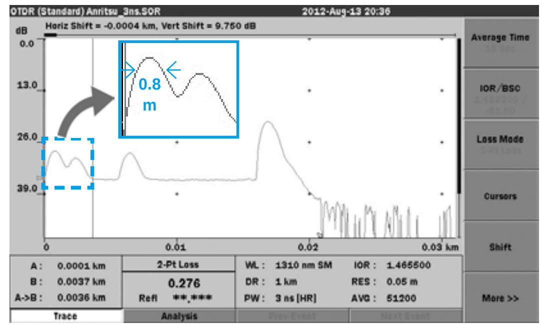


Fig. 2: With its high resolution optics, the MT9083 provides exceptional detail allowing users to quickly determine where the problem is – even when events are closely spaced.

• Extended Range Testing of 200 + km Fibers

In addition to its superb high-resolution performance, the MT9083 also features up to 46 dB of dynamic range allowing it to easily test 200 + km spans making it a very useful tool for any network type.

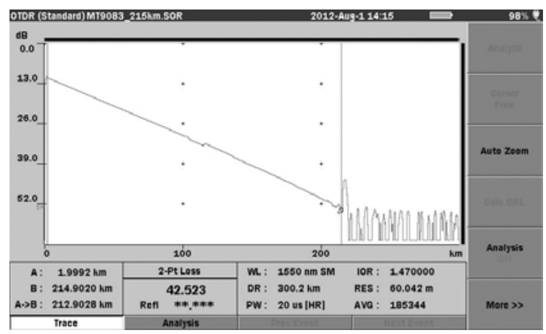


Fig. 3: Spans of over 200 km are also easily tested making the MT9083 the only tool you will need - for any network type.

Convenient Features

• Full PON Testing

Many OTDRs claim to be able to test PONs but being able to do it with both high resolution and high range is what sets the MT9083 series apart. Splitters up to a single 1 × 128 or closely spaced, cascaded splitters are completely and accurately measured with industry leading resolution.

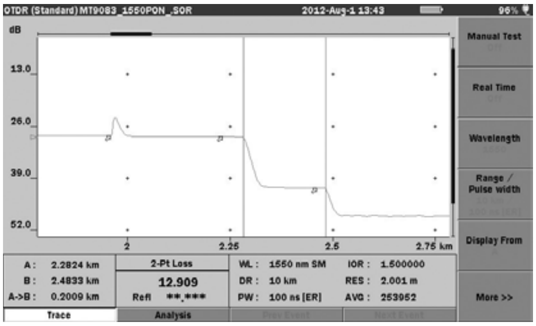


Fig. 4: The MT9083 series provides high range and excellent resolution of PON systems

• Waveform Comparison Function

Compare current and stored trace data to easily assess changes over time and to locate problems before they affect service or compare traces at different wavelengths to identify installation issues such as macrobending.

• Standard High Resolution Display

The MT9083 series now features a standard 7" high resolution display with excellent readability both indoors and outdoors – even in direct sunlight.

• Dual-mode High Resolution/Enhanced Range Operation

While many OTDRs provide good deadzone resolution or high dynamic range, the MT9083 series features a dual-mode design that allows a single unit to excel in both categories. The user can simply select HIGH RESOLUTION (HR) mode or ENHANCED RANGE (ER) based on the current task at hand. When HR mode is selected, this mode provides good measurement range with an industry leading deadzone (<1 m). When ER mode is selected, it provides unparalleled performance for measurement distance, measurement speed and deadzone - allowing a 100 km fiber to be tested in less than 10 seconds. ER mode is also used for testing PON networks with up to 128 branches.

• Up to 150,001 Data Points for Increased Accuracy

The MT9083 series also collects up to 150,001 with a resolution of just 2 m. This provides the necessary detail when installing and maintaining fiber spans.

• Event Table with User Defined Thresholds

PASS/FAIL thresholds for key acceptance criteria such as splice loss, connector loss and reflectance can be set in the MT9083 allowing technicians to easily assess a fiber's condition. Failing values are clearly highlighted in the event table alerting technicians of potential problems.

Solutions for Various Measurement Needs

• Simple Operation

To simplify testing, the MT9083 features dedicated measurement modes via the top menu to automate and simplify the task at hand.

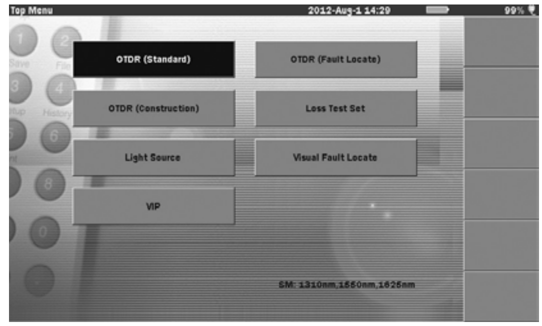


Fig. 5: Dedicated measurement modes simplify testing for any skill level.

• Fault Location

FAULT LOCATE mode is designed for the novice or someone who only uses an OTDR occasionally. Simply connect the fiber and press START. The unit will verify the fiber is connected correctly, select testing parameters and provide a text response indicating fault/break location - easy to read results for any skill level.

• General OTDR Testing

For those who have more experience or would like to perform more advanced testing, STANDARD OTDR mode allows the user to set all parameters and compare traces manually, automatically or somewhere in between.

• Optical Fiber Construction and Certification

When final cable acceptance is the task at hand, CONSTRUCTION mode greatly simplifies operation through its innovative wizard. Select the required testing wavelengths, number of fibers and file naming scheme and construction mode acts as the project manager guiding the user through the testing, while ensuring consistency with testing parameters and filenames - virtually eliminating user induced errors and missing files.

• Value

Whatever your construction or maintenance needs, the new ACCESS Master MT9083 is designed to reduce the time to install, commission and maintain your optical networks – without breaking your budget.

• NETWORKS PC Software for Analysis and Reporting

Once the data is collected, NetWorks PC emulation software makes analysis and report generation a breeze. Professional reports including splice loss, fiber acceptance and exceptions as well as various printing options are possible with only a few mouse clicks.

Fig. 6: Comprehensive, professional reports are easily generated

• Template Feature

To simplify fiber acceptance, the Access Master incorporates an on-the-fly template feature to quickly locate and measure all splices in a fiber cable. In addition, an on-screen highlight blocks out the expected splice locations during trace acquisition.

• Remote Command Support

To simplify and automate testing in manufacturing and lab environments, the MT9083 supports SCPI commands.
Through the use of a USB converter and a common scripting program such as LabView™, the MT9083 can be quickly integrated and immediately reduce testing times. Remote control can also be used for remote, unmanned monitoring applications.

A True All-in-One Tester

An OTDR, Optical Power Meter, and Visible Light Source are built into Anritsu's compact, light-weight MT9083 supporting tasks ranging from searching for faults in optical fibers to QoS evaluation to FTTx troubleshooting with just one unit.

• Complete Loss Test Set Features

· Standard Stabilized Light Source

The OTDR port also functions as a stabilized light source providing continuous wave, 270 Hz, 1 kHz and 2 kHz modulations for easy fiber identification. This is standard equipment on all single mode models - a chargeable option on most other OTDRs.

· Standard or Optional Integrated Power Meter

In the base unit, the OTDR port also functions as an integrated power meter for verification of optical power levels. Additional power meter options are available for higher power transmissions and loop-back testing.

· Visual Laser Source for Easy Fault Location and Fiber Identification

A Visible Light Source is useful for tracking down bad connections, splices and fiber management issues such as macrobends.
The optional Visible Light Source is factory installed in the MT9083 and features up to 5 km (3 miles) of operation.

• Video Inspection Probe (VIP) Application – Complete Connector Inspection

· Data Table for Saved Results

Loss test set measurements for multiple wavelengths can be saved into a results table for easy comparison and archiving. The table can also be saved as a text file and exported to a PC spread-sheet program for further manipulation or integration into a standard company template.

· Video Inspection Probe Support

When equipped with the optional connector video inspection probe (VIP), the MT9083 becomes a powerful tool for evaluating connector cleanliness and quality. Connector end faces can be safely viewed and images stored to document all aspects of your network.

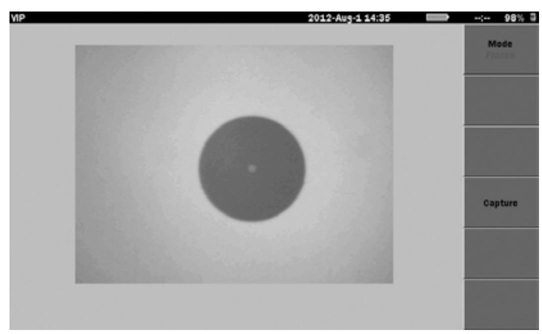


Fig. 7: VIP Mode

Specifications

● MT9083A2/B2/C2 ACCESS Master Common Specifications

<table>
<tr><td rowspan="4">Dimensions and Mass</td><td rowspan="2">Without Protector (option 010)</td><td>Dimensions: 270 (W) × 165 (H) × 61 (D) mm, 10.6 × 6.5 × 2.4 inches</td></tr>
<tr><td>Mass: 1.6 kg, 1.9 kg including battery</td></tr>
<tr><td rowspan="2">With Protector (option 010)</td><td>Dimensions: 284 (W) × 200 (H) × 77 (D) mm, 11.2 × 7.9 × 3 inches</td></tr>
<tr><td>Mass: 2.6 kg including battery</td></tr>
<tr><td>Display</td><td colspan="2">7 inch TFT-LCD (800 × 480, with LED backlight), indoor/outdoor type</td></tr>
<tr><td>Interface</td><td colspan="2">USB 1.1, Type A × 1 (memory), Type B × 1 (USB mass storage)</td></tr>
<tr><td>Data Storage</td><td colspan="2">Internal memory: 440 MB (up to 1000 traces),
External memory (USB): up to 30,000 traces with 512 MB</td></tr>
<tr><td>Power Supply</td><td colspan="2">12 V(dc), 100 V(ac) to 240 V(ac), Allowable input voltage range: 90 V to 264 V, 50 Hz/60 Hz</td></tr>
<tr><td>Battery</td><td colspan="2">Type: Lithium ion
Operating Time*1: 12 hours, Telcordia GR-196-CORE Issue 2, September 2010
Recharge Time: <5 hours (power off)</td></tr>
<tr><td>Power Saving Functions</td><td colspan="2">Backlight off: Disable/1 to 99 minutes
Auto shutdown: Disable/1 to 99 minutes</td></tr>
<tr><td>Vertical Scale</td><td colspan="2">0.13, 0.33, 0.65, 1.3, 3.25, 6.5, 13 dB/div</td></tr>
<tr><td>IOR Setting</td><td colspan="2">1.400000 to 1.699999 (0.000001 steps)</td></tr>
<tr><td>Units</td><td colspan="2">km, m, kft, ft, mi</td></tr>
<tr><td>Languages</td><td colspan="2">User selectable (English, Simplified Chinese, Traditional Chinese, French, German, Italian, Korean, Portuguese, Russian, Spanish and Swedish - contact Anritsu for availability of others)</td></tr>
<tr><td>Sampling Points*2</td><td colspan="2">Normal: 5001, High density: 20001 or 25001, Very high density: 100,001 or 150,001</td></tr>
<tr><td>Sampling Resolution</td><td colspan="2">5 cm (min.)</td></tr>
<tr><td>Reflectance Accuracy</td><td colspan="2">Single mode: ±2 dB, multimode: ±4 dB</td></tr>
<tr><td>Distance Accuracy</td><td colspan="2">±1 m ±3 × measurement distance × 10^{-5} ± marker resolution (excluding IOR uncertainty)</td></tr>
<tr><td>Distance Range</td><td colspan="2">Single mode: 0.5, 1, 2.5, 5, 10, 25, 50, 100, 200, 300 km
Multimode: 0.5, 1, 2.5, 5, 10, 25, 50, 100 km</td></tr>
<tr><td>Testing Modes</td><td colspan="2">Fault locate: Provides end/break location, end to end loss, fiber length
Standard OTDR: User selectable automatic or manual set-up
Construction OTDR: Automated, multi-wavelength testing
Light source: Stabilized Light source (CW, 270 Hz, 1 kHz, 2 kHz output)
Loss test set (optional): Power meter and Light source
Connector Video Inspection Probe
Visual fault locator (optional): Visible red light for fiber identification and troubleshooting</td></tr>
<tr><td>Fiber Event Analysis</td><td colspan="2">Auto or manual operation, displayed in table format
User defined PASS/FAIL thresholds:
- Reflective and non-reflective events: 0.01 to 9.99 dB (0.01 dB steps)
- Reflectance: –70.0 to –20.0 dB (0.1 dB steps)
- Fiber end/break: 1 to 99 dB (1 dB steps)
Number of detected events: up to 99
Macrobend detection</td></tr>
<tr><td>OTDR Trace Format</td><td colspan="2">Telcordia universal. SOR, issue 2 (SR-4731)</td></tr>
<tr><td>Other Functions</td><td colspan="2">Real time sweep*3: 0.15 sec.
Loss modes: 2 point loss, dB/km, 2 point LSA, splice loss, ORL
Averaging modes: Timed (1 to 3600 sec.)
Live Fiber detect : Verifies presence of communication light in optical fiber
Connection check: Automatic check of OTDR to FUT connection quality
Trace overlay and comparison, Template function, USB keyboard support, Remote control, Video output to PC</td></tr>
<tr><td>Environmental Conditions</td><td colspan="2">Operating temperature and humidity: –10° to +50°C, <80% (non-condensing)
Storage temperature and humidity: –20° to +60°C, <80% (non-condensing)
Vibration: Conforming to MIL-T-28800E Class 3
Dust proof: MIL-T-28800E (Dust Exposure) Class 2
Drip proof: IP51 (IEC 60529), JIS C 0920 TYPE I</td></tr>
<tr><td>EMC</td><td colspan="2">EN61326-1, EN61000-3-2</td></tr>
<tr><td>LVD</td><td colspan="2">EN61010-1</td></tr>
</table>

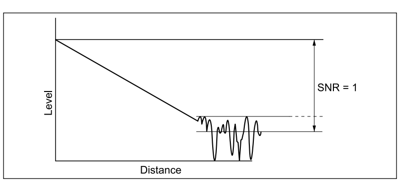
*1: Typical, backlight off, sweeping halted at 25°C, 6 hours typical continuous testing
*2: Either high density value is selected depending on distance range
*3: Resolution: Low Density

• OTDR Specifications

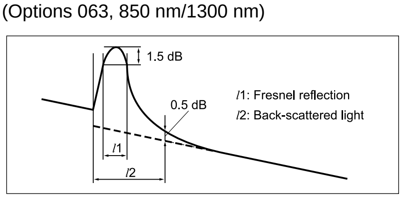
MT9083C2							
Options	HR/ER Mode*4	Wavelength*5	Fiber Type	Pulse Width	Dynamic Range*6,*7	Deadzone (Fresnel)*8 (IOR = 1.500000)	Deadzone (Backscatter)*9 (IOR = 1.500000)
MT9083C2-053	✓	1310/1550 nm ±25 nm	Single Mode (SMF) 10/125 µm ITU-T G.652	3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	46/46 dB*11 25/25 dB*10 (Pulse width: 100 ns)	≤1 m, ≤80 cm (typ.)	≤3.8/4.3 m
MT9083C2-057	✓	1310/1550/1625 nm ±25 nm			46/46/44 dB*11 25/25/23 dB*10 (Pulse width: 100 ns)		≤3.8/4.3/4.8 m
MT9083B2							
Options	HR/ER Mode*4	Wavelength*5	Fiber Type	Pulse Width	Dynamic Range*6,*7,*13	Deadzone (Fresnel)*8 (IOR = 1.500000)	Deadzone (Backscatter)*9
MT9083B2-053	✓	1310/1550 nm ±25 nm	Single Mode (SMF) 10/125 µm ITU-T G.652	3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	42/41 dB*11	≤1 m ≤80 cm (typ.)	≤5/5.5 m
MT9083B2-055	✓	1310/1550 nm ±25 nm, 1650 nm ±5 nm			42/41/35 dB*11		≤5/5.5/6.5 m
MT9083B2-057	✓	1310/1550/1625 nm ±25 nm			40/39/38 dB*11		≤6/6.5/7.5 m
MT9083B2-063	✓	1310/1550 nm ±25 nm, 850/1300 nm ±30 nm	HYBRID (SMF/MMF)*12	SMF: above MMF: 3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000 ns 850 nm: Not support 1000, 2000, 4000 ns	42/41 dB*11 29/28 dB*11		≤5/5.5 m, ≤4/5 m (3/4 m typ.)
MT9083A2							
Options	HR/ER Mode*4	Wavelength*5	Fiber Type	Pulse Width	Dynamic Range*6,*7,*13	Deadzone (Fresnel)*8 (IOR = 1.500000)	Deadzone (Backscatter)*9
MT9083A2-073	✓	1310/1550 nm ±25 nm	Single Mode (SMF) 10/125 µm ITU-T G.652	3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	39/37.5 dB*11	≤1 m ≤80 cm (typ.)	≤5/5.5 m
MT9083A2-055	✓	1310/1550 nm ±25 nm, 1645 nm to 1655 nm			38.5/37/34.5 dB*11		≤5/5.5/6.5 m
MT9083A2-057	✓	1310/1550/1625 nm ±25 nm			37/35.5/32.5 dB*11		≤6/6.5/7.5 m
MT9083A2-063	✓	1310/1550 nm ±25 nm, 850/1300 nm ±30 nm	HYBRID (SMF/MMF)*12	SMF: above MMF: 3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000 ns 850 nm: Not support 1000, 2000, 4000 ns	39/37.5 dB*11 29/28 dB*11		≤5/5.5 m, ≤4/5 m (3/4 m typ.)

Laser Safety*14	IEC 60825-1: 2007 CLASS 1M: option 053, 055, 057, 063, 073 21 CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

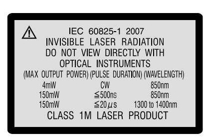
*4: HR: High Resolution mode for Short dead zone.
ER: Enhanced Range mode for PON measurement.
*5: 25°C, Pulse width: 1 µs (all except 850 nm, 1300 nm), 850 nm/1300 nm: 100 ns
*6: Pulse widths: 20 µs (Options 053, 055, 057, 063, 073, 1310 nm/1550 nm) at Distance range: 100 km
Pulse width: 4 µs (Options 063, 1300 nm) at Distance range: 25 km
Pulse width: 500 ns (Options 063, 850 nm) at Distance range: 25 km
Averaging: 180 sec., SNR = 1, 25°C
*7: Dynamic range (one-way back-scattered light), SNR = 1: The level difference between the RMS noise level and the level where near end back-scattering occurs.



*8: Pulse width: 3 ns (Options 053, 055, 057, 063, 073.)
Return loss: 40 dB, 25°C (Refer to the figure below)
*9: Pulse width 10 ns, return loss 55 dB, Deviation ±0.5 dB, 25°C
(Options 053, 055, 057, 063, 073. All except 850 nm/1300 nm)
Pulse width 3 ns, return loss 40 dB, Deviation ±0.5 dB, 25°C
(Options 063, 850 nm/1300 nm)



*10: Pulse width: 100 ns (ER Mode), Distance range: 100 km
Averaging: 180 sec., SNR = 1, 25°C
*11: Typical. Subtract 1 dB for guarantee
*12: At measurement of 50 µm/125 µm MM Fiber, the dynamic range drops by about 3.0 dB
*13: At 1.65 µm: With background light, 1.31 µm/1.55 µm, –19 dBm CW light
*14: Safety measures for laser products
This product complies with optical safety standards in IEC 60825-1, 21CFR1040.10 and 1040.11; the following descriptive labels are affixed to the product.



THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

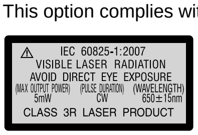
Light Source Specifications – Standard on all models[*15]	
Stabilized Light Source (through OTDR port)	
Wavelength[*17]	Same as OTDR
Spectral Width[*17]	≤5 nm (1310 nm) ≤10 nm (850/1300/1550/1625 nm) ≤3 nm (1650 nm)
Wavelength Accuracy	850/1300/1310/1550/1625 nm: ±30 nm 1650 nm: ±5 nm
Fiber Type	Same as OTDR
Optical Connector	Same as OTDR
Output Power[*17]	–5 ±1.5 dBm
Output Stability[*18]	±0.1 dB
Modes of Operation[*19]	CW, 270 Hz, 1 kHz, 2 kHz
Laser Safety	Same as OTDR

Power Meter Specifications – Standard on all models[*15]	
Standard Integrated Power Meter[*16] (through OTDR port)	
Maximum Input	+10 dBm
Measurement Range	–50 to –5 dBm
Fiber Type	Same as OTDR
Optical Connector	Same as OTDR
Accuracy[*20]	±6.5%
Supported Wavelengths	1310, 1550, 1625, 1650 nm
Features	Store reference, loss table

Loss Test Set Specifications – Optional on all Models[*17, *18] Power meters (004, 005 and 007)			
Option Number	MT9083A2/B2/C2-007	MT9083A2/B2/C2-004	MT9083A2/B2/C2-005
Fiber Type	Single Mode: 10 µm/125 µm (G.652), Multimode: 62.5 µm/125 µm	Single Mode: 10 µm/125 µm (G.652) ∗PC only for UPC connector	Single Mode: 10 µm/125 µm (G.652)
Measurement Range[*21]	–67 to +6 dBm[*22]	–50 to +23 dBm	–43 to +30 dBm
Wavelength Range	750 nm to 1700 nm	1200 nm to 1700 nm	
Calibrated Wavelengths	850, 1300, 1310, 1383, 1490, 1550, 1625, 1650 nm	1310, 1383, 1490, 1550, 1625, 1650 nm	
Optical Connector	Universal – uses LP-XX adapters	Universal – uses JXXXX adapters (same as OTDR)	Universal – uses MA9005B adapters
Accuracy[*23]	±5%		
Modulation	CW, 270 Hz, 1 kHz, 2 kHz		
Features	Store reference, loss table		
Environmental	Operating temperature and humidity: 0° to +50°C, <80% (non-condensing)		

Visible Light Source (Option 002)	
Central Wavelength	650 nm ±15 nm (at 25°C)
Optical Output	0 ±3 dBm (CW)
Output Optical Fiber	10 µm/125 µm, SMF (ITU-T G.652)
Optical Connector	2.5 mm universal
Laser Safety[*24]	IEC 60825-1: 2007 CLASS 3R 21CFR1040.10 and 1040.11 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007
Environmental	Operating temperature and humidity: 0° to +50°C, <80% (non-condensing)

∗15: Some models do not support power meter (See next page)
∗16: If option 004, 005 or 007 is ordered, the standard integrated power meter is not available
∗17: CW, 25°C
∗18: CW, –10° to +50°C (±1°C) difference between max/min. values over 1 minute, SM fiber 2 m
∗19: Modulation +1.5% with 10 minute warm up
∗20: CW input, –20 dBm at 1550 nm, 23°C ±2 Using Master FC connector
∗21: Peak power, subtract 3 dB for modulated tones
∗22: –60 to +3 dBm (Option 007 @850 nm)
∗23: CW, model 007: At –10 dBm, 1310 nm/1550 nm, At –10 dBm, 850 nm, 25°C
model 004/005: At 0 dBm, 1310 nm and 1550 nm, Using Master FC connector, After zero offset
∗24: Safety measures for laser products
This option complies with optical safety standards in IEC 60825-1, 21CFR1040.10 and 1040.11; the following descriptive labels are affixed to the product.



THIS PRODUCT COMPLIES WITH 21 CFR 1040.10
AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT
TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

● **Standard Light Source and Power Meter Built-in**

LS: MT9083A2/B2/C2 standard built-in stabilized Light Source, OPM: MT9083A2/B2/C2 standard built-in Optical Power Meter

Options	Optical Port	LS	OPM
MT9083B2/C2-053	1310/1550 nm SM	✓	✓
MT9083A2-073	1310/1550 nm SM	✓	✓
MT9083A2/B2-055	1310/1550 nm SM	✓	✓
	1650 nm SM	✓	✓
MT9083A2/B2/C2-057	1310/1550/1625 nm SM	✓	✓
MT9083A2/B2-063	850/1300 nm MM	✓	—
	1310/1550 nm SM	✓	✓

Battery Pack: Z0921A

Battery	Lithium Ion secondary battery
Voltage, Capacity	11.1 V, 4200 mAh
Dimensions and Mass	53 (W) × 19 (H) × 215 (D) mm, 330 g (typ.)
Environmental Conditions	Charging: +5° to +30°C, ≤80%RH
	Discharging: –20° to +60°C, ≤80%RH
	Storage: –20° to +50°C, ≤80%RH

AC Adapter: Z1467A

Rated AC Input	100 V(ac) to 240 V(ac), 50 Hz/60 Hz
Rated DC Output	12 V(dc), 5 A
Dimensions and Mass	47 (W) × 33 (H) × 112 (D) mm, ≤240 g
Environmental Conditions	Operating: 0° to +45°C, 20 to 80% R.H.
	Storage: –20° to +70°C, 10 to 90% R.H.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

1) Specify Base Unit

Includes ACCESS Master OTDR, AC charger/adapter, line cord, battery pack (1), printed quick user's guide and user's manual (CD).

Model/Order No.	Description
MT9083A2/B2/C2	ACCESS Master base unit, Enhanced display for indoor/outdoor use

2) Select Optical Configuration

Includes choice of OTDR connector adapters – select in step 5 below.

MT9083C2 Series (OTDR Ultra-high Performance Model)

Model/Order No.	Wavelength	Application
MT9083C2-053	1310/1550 nm, SM	General-purpose model for construction, maintenance and fault location
MT9083C2-057	1310/1550/1625 nm, SM	General-purpose plus enhanced macrobend detection at 1625 nm

MT9083B2 Series (OTDR High Performance Model)

Model/Order No.	Wavelength	Application
MT9083B2-053	1310/1550 nm, SM	General-purpose model for construction, maintenance and fault location
MT9083B2-055	1310/1550 nm & 1650 nm, SM	General-purpose models for construction, maintenance and fault location plus In-service measurement – integrated filter to block transmissions
MT9083B2-057	1310/1550/1625 nm, SM	General-purpose plus enhanced macrobend detection at 1625 nm
MT9083B2-063	850/1300 nm MM, 1310/1550 nm SM	Best unit for contractors or anyone who installs or maintains hybrid networks

MT9083A2 Series (OTDR Base Model)

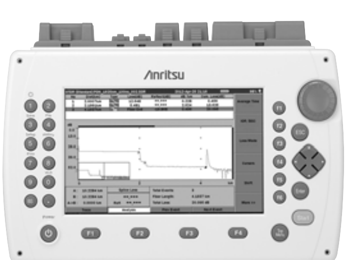
Model/Order No.	Wavelength	Application
MT9083A2-073	1310/1550 nm, SM	General-purpose model for construction, maintenance and fault location
MT9083A2-055	1310/1550 nm & 1650 nm, SM	
MT9083A2-057	1310/1550/1625 nm, SM	General-purpose plus enhanced macrobend detection at 1625 nm
MT9083A2-063	850/1300 nm MM, 1310/1550 nm SM	Best unit for contractors or anyone who installs or maintains hybrid networks

Note: Models noted feature user-selectable enhanced range (ER) for measuring PON systems/detecting faults in short time and high resolution (HR) for the shortest dead zone.

3) Select Factory Installed Options

Must be added as separate, chargeable line items.

Model/Order No.	Description
MT9083A2/B2/C2-010	Protector option (includes rubber bumpers, display cover and shoulder strap)



Without Protector option-010

With Protector option-010

4) Select Loss Test Set Options

Optical Power Meter Must be added as separate, chargeable line items.	
Model/Order No.	Description
MT9083A2/B2/C2-004	SMF Optical Power Meter (UPC only)
MT9083A2/B2/C2-005	SMF High Power Optical Power Meter (UPC/APC)
MT9083A2/B2/C2-007	SMF/MMF Optical Power Meter (UPC/APC)
Visible Light Source	
Model/Order No.	Description
MT9083A2/B2/C2-002	Visible Laser Diode

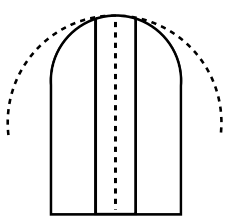
5) Select Connector Types

The ACCESS Master MT9083 can be optioned to feature up to three optical ports – single mode OTDR, multimode OTDR and an Optical Power Meter (options -004, -005, and -007). Selecting a single connector code below will populate all optical ports with that connector type or customer can select different adapters by specifying the adapter for each of the three optical ports – see examples below.

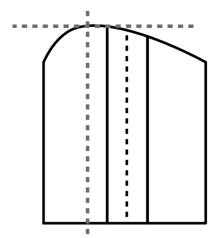
Optical Connectors One adapter type is provided for each port at no charge - must be added as separate line items. NOTE: FC-APC and SC-APC are not available for MM OTDR or Optical Power Meter.			
Model/Order No.	Description	Model/Order No.	Description
MT9083A2/B2/C2-025	FC-APC Connector - single mode OTDR only (additional charge applies)	MT9083A2/B2/C2-038	ST Connector
MT9083A2/B2/C2-026	SC-APC Connector - single mode OTDR only (additional charge applies)	MT9083A2/B2/C2-039	DIN Connector
MT9083A2/B2/C2-037	FC Connector	MT9083A2/B2/C2-040	SC Connector

Note: UPC and APC connectors are not compatible – the internal optics are different and must be specified at time or order.

UPC Ultra Physical Contact



APC Angled Physical Contact



Examples:

1) MT9083B2-053 with MT9083B2-004 Power Meter option
Customer can specify "MT9083B2-040 for the SM OTDR" port and "MT9083B2-037 for the OPM" port at no charge.

2) MT9083A2-063 with MT9083A2-007 Power Meter option
Customer can specify "MT9083A2-040 for the SM OTDR" port, "MT9083A2-037 for the MM OTDR" port and "MT9083A-037 for the OPM" port at no charge.

3) MT9083C2-053 with no options
Customer can specify "MT9083C2-026 for the SM OTDR" port however an additional charge applies.

6) Select Accessories & Replacement Items

Accessories Must be added as separate, chargeable line items.			
Model/Order No.	Description	Model/Order No.	Description
	MT9083 Series ACCESS Master Operation Manual (CD)	J1028	D1 Power Cord
W3634AE	MT9083 Operation Manual (Hard copy)	Z0942A	Battery Charger
W3637AE	MT9083 Quick User's Guide (Hard copy)	J1530A	SC Plug-in Converter (UPC(P)-APC(J))
B0582A	Soft Carrying Case	J1531A	SC Plug-in Converter (APC(P)-UPC(J))
B0583A	Hard Transit Case (for MT9083 - attache style)	J1532A	FC Plug-in Converter (UPC(P)-APC(J))
B0549	Hard Carry Case (for MT9083 with handle and wheels)	J1533A	FC Plug-in Converter (APC(P)-UPC(J))
Z0921A	Battery Pack (for MT9083)	J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))
Z1467A	AC Adapter	J1535A	LC-SC Plug-in Converter (for MM, SC(P)-LC(J))
J0979	A-2 (Japan) Power Cord	J1295	Car Plug Cord
J0980	A-2 Power Cord (for USA, Canada, Taiwan)	J1480A	USB-Ethernet Converter
J0981	B4 Power Cord	OPTION-545VIP	Connector Video Inspection Probe (VIP) Option (X200, X400)
J0982	C7 Power Cord	G0293A	Connector Video Inspection Probe Lite (VIP-LITE) Option (X400)
J0983	S3 Power Cord	NETWORKS	PC Emulation Software for Data Analysis and Reporting
J1027	P4 Power Cord		

Retrofit Options for existing units – unit must be returned to authorized service center			
MT9083A2/B2/C2-110	Protector Option (Retrofit)		
MT9083A2/B2/C2-107	SMF/MMF Optical Power Meter (Retrofit)		
MT9083A2/B2/C2-104	SMF Optical Power Meter (Retrofit)		
MT9083A2/B2/C2-105	SMF High Power Optical Power Meter (Retrofit)		
Replacement Adapters			
Type	OTDR and Power Meters (MT9083A2/B2/C2-004)	Power Meter (MT9083A2/B2/C2-005 only)	Power Meter (MT9083A2/B2/C2-007 only)
FC	J0617B	MA9005B-37	LP-FC
Angled FC (AFC)	J0739A	MA9005B-37	LP-FC
ST	J0618D	MA9005B-38	LP-ST
DIN	J0618E	MA9005B-39	LP-DIN
HMS-10A	J0618F	MA9005B-43	N/A
SC (UPC or APC)	J0619B	MA9005B-40	LP-SC


Soft Carrying Case (B0582A)



Hard Carrying Case (B0583A)-Attache style

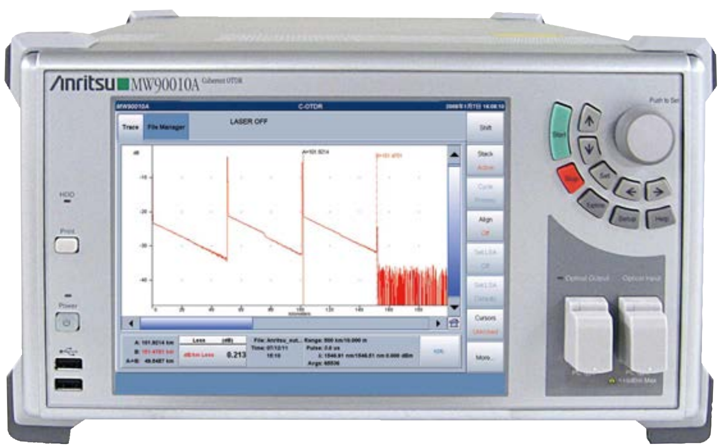

Hard Carrying Case (B0549)

Video Inspection Probe (OPTION-545VIP)

COHERENT OTDR
MW90010A

Remote Control
Ethernet

Measure Submarine Cables up to 12,000 km Long with 10 m Resolution



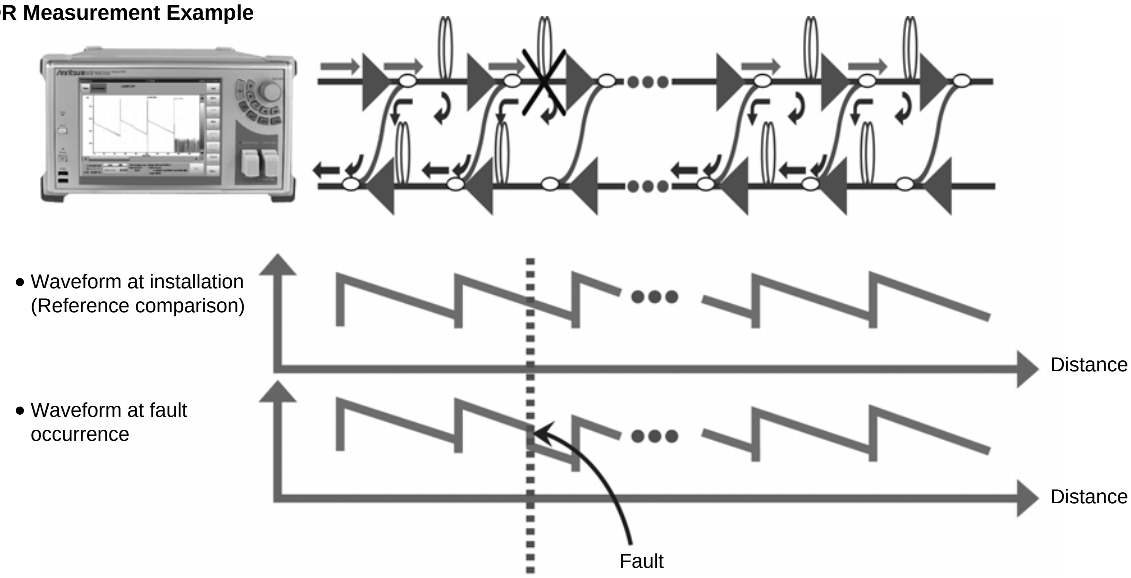
The MW90010A Coherent OTDR (C-OTDR) is a measuring instrument for detecting faults in ultra-long optical submarine cables of up to 12,000 km including multiple repeaters (EDFAs). It is the ideal solution for evaluating new cables at service deployment as well as for troubleshooting in-service faults.
Ultra-long optical submarine cables use optical amplifiers to boost signals. Successful OTDR measurement through the repeaters requires configuring a backscatter detection system using up and down links. The MW90010A can measure the backscatter light through all repeaters by using coherent detection. As a result, it can display every fault condition, such as optical loss between repeaters, bending loss, distances, breaks, etc., on-screen for waveform data analysis.

Features

- Fault detection with 10 m distance resolution
- Compact and lightweight all-in-one design for on-site portability [320 (W) × 177 (H) × 451 (D) mm, 17 kg Max.]
- Simple and easy touch-panel operation for easy first-time use by any operator
- Wide dynamic range supporting fault detection and troubleshooting of submarine cables with repeaters at 80 km or wider intervals
- Built-in tunable light source with high wavelength accuracy of ±0.2 nm for wavelength setting range of 1535.03 nm to 1565.08 nm
- Adjustable output power from 0 to +13 dBm

Application

C-OTDR Measurement Example



• Measure Submarine Cables up to 12,000 km Long with 10 m Resolution

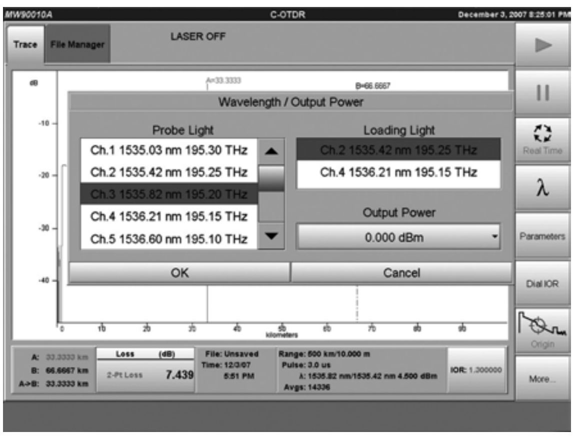
The MW90010A can capture data from up to 1.2 million points on the horizontal axis at a fixed resolution of 10 m with no dependency on measured distance. As a result, faults can be located with very high resolution even in fibers longer than 10,000 km.

• Lightweight and Compact

In comparison to previous optical submarine cable measuring equipment, the MW90010A is less than half the weight (17 kg max.) and size. The all-in-one design incorporates a tunable light source for easy on-site portability and troubleshooting.

• Excellent GUI

Every stage from setting parameters to starting measurement is made easy using the touch-screen. The rotary knob and keypad can be used for operation too. The easy-to-use design coupled with standard interfaces for USB memory, USB mouse, keyboard, and VGA OUT, makes measurement simple even for novice OTDR operators.



• Remote Operation Function

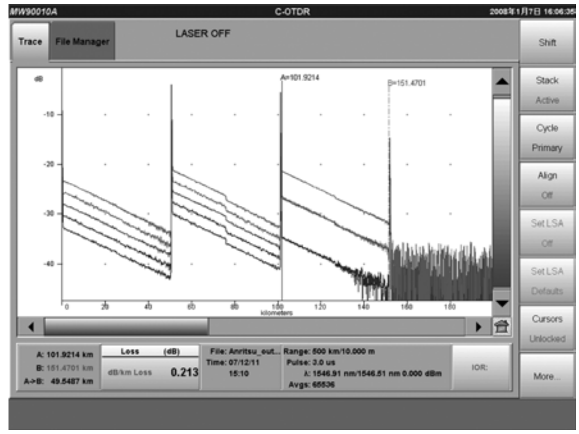
The MW90010A has a built-in VNC server. When the MW90010A (server) is connected over Ethernet to a PC (client) running either a Windows or Linux OS, the MW90010A GUI can be remotely controlled from the PC to transfer files between the server and client.

• Wide Dynamic Range

Typical optical submarine cables are designed with repeaters every 50 km to 60 km but the high resolution of the MW90010A easily supports fiber loss measurement of these systems as well as fault location of cables with repeaters spaced at more than 80 km.

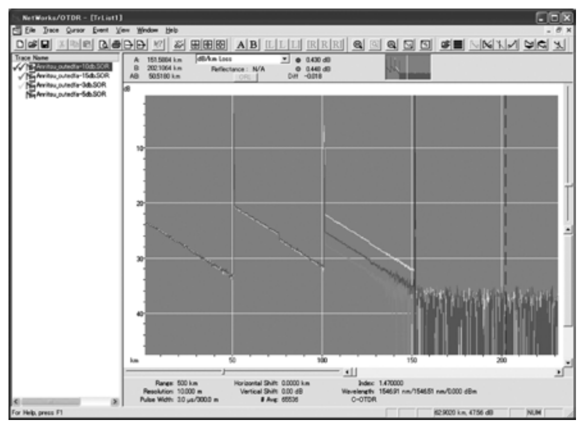
• Simultaneous Display of 8 Waveforms (max.)

Installation and maintenance of optical submarine cables requires comparison of current waveform data with data at cable installation to monitor aging changes. The MW90010A makes this comparison easy because it can display up to 8 waveforms simultaneously, allowing faults to be seen at glance by comparing the install waveform with the fault waveform on one screen.

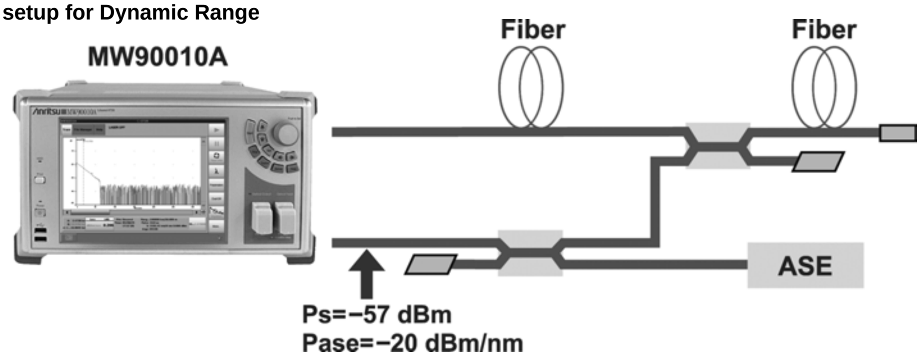


• Waveform Analysis using Emulation Software

Waveform data measured and saved by the MW90010A can be analyzed on a PC running a Windows OS using the optional NETWORKS (version 4.1 or newer) emulation software (sold separately).



Measurement setup for Dynamic Range



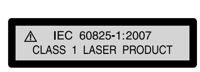
Specifications

MW90010A Coherent OTDR

Fiber Under Test	ITU-T G.653 (DSF)
Optical Connector	FC, SC, DIN, HSM-10/A, ST (Replaceable, PC type)
Wavelength (Probe Light)	1535.03 nm to 1565.08 nm (ITU-T Grid, Wavelength in vacuum setting with 50 GHz steps)
Wavelength Accuracy	±0.2 nm (20° to 30°C)
Warm-up Time	30 minutes (20° to 30°C)
Loading Light Source (Dummy)	" wavelength of probe light " +50 GHz or –50 GHz The loading wavelength can be selectable at +50 GHz or –50 GHz of the probe (OTDR) wavelength.
Pulse Width	3, 10, 30, 60, 100 µs
Optical Output Power	0 to +13 dBm, 0.5 dB Steps
Dynamic Range (S/N = 1) (See the block diagram on previous page)	>17 dB (one way, S/N = 1) Measurement Conditions: Pulse width: 10 µs, Average times: 2^{16}, Distance range: 1000 km, Smoothing: On, Ps: –57 dBm @ Pin*1, Pase: –20 dBm/nm @ Pin*1
Dead Zone	0.5 km (Pulse width: 3 µs)
Distance Measurement Accuracy	±10 m ±0.5 × 10^{-6} × measurement value (m) This does not include optical fiber refraction index (IOR) based uncertainty.
Vertical Scale	0.02, 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div
Distance Range	100 km, 500 km to 12,000 km (in 500 km steps)
Sampling Resolution (IOR = 1.500000)	10 m
Measurement Time	15 minutes (Distance Range: 1000 km, Average times: $2^{16)}$
Average Times	2^8 to 2^{24}
Ior Settings	1.300000 to 1.700000 (0.000001 steps)
Monitor Output	–25 to –15 dBm (for OTDR Wavelength Monitor)
Other Functions	• Real Time Measurement • Multiple Trace Display (8 Waveforms maximum) • Zoom & Shift • Loss Calculation Splice Loss, 2Pt Loss, 2Pt LSA, dB/ km Loss, dB/km LSA, 2Pt & dB/km, 2Pt & dB/km LSA • File Save formats GR-196, SR4731 • USB Memory support • Internal Memory (2.8 GB) • Print External printer, Hard Copy (file: PDF) • Distance Unit miles, feet, kilofeet, meters, kilometers • File Utility File: Copy, Paste, Delete Folder: Create New • Help function • Remote Control Function (Option)
Display	8.4 inch, XGA (1024 × 768) color LCD with touch panel
Interface	USB (2 ports, REV1.1), Mouse (USB), Keyboard (PS/2), VGA
Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac), 50 Hz to 60 Hz, ≤300 VA
Dimensions and Mass	320 (W) × 177 (H) × 451 (D) mm, <17 kg
Environmental Conditions	Temperature: +10° to +35°C (operating), –10° to +50°C (storage) Humidity: <85% RH Vibration: Conforms to MIL-STD-810D
EMC/LVD	EN61326-1, EN61000-3-2 EN61010-1
Laser Safety Level*2	IEC 60825-1: 2007 CLASS 1M: Optical Output Port CLASS 1: Monitor Port 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*1: Ps: Maximum backscatter level at the input [dBm]
Pase: ASE level at the input [dBm]

*2: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.



Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MW90010A	Coherent OTDR	
	Standard accessories	
	Power Cord:	1 pc
W3030AE	MW90010A Operation Manual (CD-ROM version):	1 copy
	Options	
MW90010A-001	Remote Control Function	
MW90010A-101	Remote Control Function Retrofit	
	Options (Optical Connector)	
MW90010A-037*1	FC Connector	
MW90010A-038*1	ST Connector	
MW90010A-039*1	DIN 47256 Connector	
MW90010A-040*1	SC Connector	
MW90010A-043*1	HMS-10/A Diamond Connector	
	Application parts	
NETWORKS	Emulation Software (Version 4.1 or newer)	
B0335C	Carrying Case	
B0604A	Rack Mount Kit	
J0617B	Replaceable Optical Connector (FC-PC)	
J1409A	Replaceable Optical Connector (ST)	
J1410A	Replaceable Optical Connector (DIN)	
J1411A	Replaceable Optical Connector (SC)	
J1412A	Replaceable Optical Connector (HMS-10/A)	
J0057	Optical Adapter FC type	
J0635*2	Optical Fiber Cord with FC-PC at both ends (SM, with FC-PC at both ends)	
J0952A	FC · PC-FC · APC(SG)-1M-SM	
Z0914A	Ferrule Cleaner	
Z0915A	Replacement Reel for Ferrule Cleaner (6 pcs/set)	
Z0284	Adapter Cleaner (Stick type, 200 pcs/set)	
W3024AE	MW90010A Operation Manual (Printed version)	
Z0397A*3	FC Adapter Cap	
Z0411A*3	ST Adapter Cap	
Z0412A*3	DIN Adapter Cap	
Z0413A*3	SC Adapter Cap	
Z0414A*3	HMS-10 Adapter Cap	

∗1: Required option
Specify the optical connector type. The same type of connector will be supplied for the optical output port, optical input port, and optical monitor port.

∗2: Specify the optical fiber length as A, B or C (A: 1 m, B: 2 m, C: 3 m)

∗3: Monitor Output Port optical connector cap. Specify exchangeable optical connectors (J1409A, J1410A, J1411A, J1412A, J0617B) as a pair.

CARD OTDR

MW9087B/D

Remote Control
Ethernet

Suitable Solution for all Optical Fiber Networks (PON Network, Core Network and so on…)

MW9087 series Card OTDR is a suitable solution for monitoring the optical fiber networks. Recently, the optical fiber monitoring business is expanding from Long distance fiber (Core network) to PON network (Access network). MW9087 series Card OTDR is supplied a solution for all kinds optical networks with "Small", "High performance".

Features

- Suitable size to install to RFTS system (B5 size)
- High performance to test the PON Network
  (possible to test up to 1 × 128, High resolution, Short Dead zone)
- High performance to test the long fiber
  (High Dynamic Range up to 50 dB)
- High speed data transfer (100BASE-T Ethernet I/F)
- Environment-Conscious Product (RoHS Compliance)

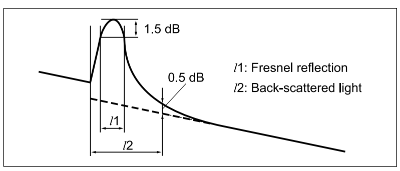
Specifications

Model No.	MW9087B	MW9087D
Wavelength*1	1645 nm to 1655 nm*7	1550 ±25 nm
Pulse Peak Power	≤+15 dBm	–
Measurement Fiber	10/125 µm SM fiber (ITU-T G.652)	
Optical Connector	SC/PC replaceable	
Dynamic Range*2, *3	41 dB	50 dB
Dead Zone (Fresnel)*4	≤0.5 m	≤1.0 m
Dead Zone (Back Scatter)*5	≤6.5 m	≤4.3 m
LD Type	DFB-LD	FP-LD
In-service Cut Filter	Mounted	Not mounted
Pulse Width	3, 10, 20, 50, 100, 200, 500 ns 1, 2, 4, 10, 20 µs	
Distance Range	1, 2.5, 5, 10, 25, 50, 100, 200, 300 km (IOR = 1.500000)	
Sampling Resolution	0.05-60 m (IOR = 1.500000)	
Distance Measurement Accuracy	±1 m ±3 × Meas. distance × 10^{-5} ±Sampling Resolution (Uncertainty with fiber's index of refraction is excluded.)	
Loss Minimum Unit	0.001 dB	
Linearity (Loss Measurement Accuracy)	±0.05 dB/dB or ±0.1 dB (Whichever is greater)	
Sampling Points	Coarse: 5,001 Medium: 20,001 or 25,001 Fine: 100,001, 125,001 or 150,001	
IOR Setting	1.000000 to 1.999999 (0.000001 step)	
Averaging Time (Averaging Count)	1 to 9999 times or 1 to 9999 seconds (settable range)	
Auto Measurement*6	Measurement item: Total loss, Distance of each event, Splice loss, Return loss, or Reflectance Threshold Splice loss: 0.01 to 9.99 dB (0.01 dB step) Reflectance: –60 to –20 dB (0.1 dB step) Far end: 1 to 99 dB (1 dB step) Number of detected events: Up to 99 events Automatic setting: Distance range, pulse width, and averaging count (period)	

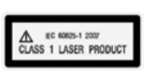
Continued on next page

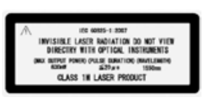
Manual Measurement	Measurement item: 2-point loss, 2-point LSA, dB/km loss, splice loss, return loss or level difference
Other Function	Partial sampling function Remote control function High dynamic range mode added (pulse width 50 ns to 2 µs)
Interface	Ethernet: RJ45 Ethernet 10BASE-T/100BASE-Tx Auto negotiation supported Ethernet Full Duplex/Half Duplex supported USB 1.1: Type B × 1[*8]
LED I/F	Option
Power	12 Vdc ±10%
Power Consumption	≤20 W
Dimensions	165 (H) × 50 (W) × 270 (D) mm (not including projection portion)
Mass	≤1.5 kg
Temperature/Humidity	Operating temperature and humidity: 0 to +50°C, ≤95% (no condensation) Storage temperature and humidity: –20 to +60°C, ≤95%
Laser Safety[*9]	IEC 60825-1: 2007 Class 1 (MW9087B) IEC 60825-1: 2007 Class 1M (MW9087D)

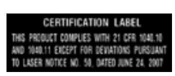
∗1: Pulse width: 1 µs at +25°C
∗2: SNR = 1, +25°C, Pulse width 20 µs.
Distance range: 100 km, Average: 180 seconds, +25ºC.
With background light, 1310/1550 nm –19 dBm Continuous light (MW9087B)
Standard/High dynamic range mode added (pulse width 50 ns to 20 µs)
∗3: Typical. Subtract 1 dB for guarantee.
∗4: *l*1 in the below figure.
Return loss: 40 dB, +25°C, IOR = 1.500000, Pulse width 3 ns.
∗5: *l*2 in the below figure.
Return loss: 55 dB, +25°C, IOR = 1.500000, Pulse width 10 ns.



∗6: Automatic measurement is an auxiliary function to facilitate measurement operations, and does not assure any detected results. As there may be a case of miss detection, be sure to check waveform data as well for final judgment of measured results.
∗7: Wavelength range at peak value [Spectrum peak value] –20 dB
∗8: Interface for IP address setup.
The specified driver installation is required for connection.
∗9: Safety measures for laser products
This option complies with optical safety standards in Class 1, 1M of IEC 60825-1; the following descriptive labels are affixed to the product.







Front View (When installed LED Interface Option)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Mainframe
MW9087B	Card OTDR (1650 nm, 40 dB class DR)
MW9087D	Card OTDR (1550 nm, 50 dB class DR)
	Standard accessories
W3543AE	MW9087 Series Operation Manual
	Option
MW9087B/D-001	LED Interface
	Options (Optical Connector)
MW9087B/D-037	FC Connector
MW9087B/D-038	ST Connector
MW9087B/D-039	DIN47256 Connector
MW9087B/D-040	SC Connector
MW9087B/D-043	HMS-10/A DIAMOND Connector

OTDR MODULE

MW9077A/A1/A2/B

1.31 µm (SM)/1.55 µm (SM)/1.625 µm (SM)

Remote Control
Ethernet

Compact and High-performance OTDR Module for Optical Fiber Monitoring Systems

The MW9077A/A1/A2/B OTDR Module is ideal for monitoring optical fiber systems. In recent years, optical-fiber monitoring is being used in many fields including maintenance of optical-communications networks as well as security sensors, flood sensors and disaster-prevention systems, etc. The MW9077A/A1/A2/B offers a compact and high-performance solution for optical fiber applications.

Features

- Compact A5-size for monitoring optical fiber systems
- Wide operating temperature range (–5° to +55°C)
- Fast data transmission by Ethernet interface

• Compact A5-size for Monitoring Optical Fiber Systems

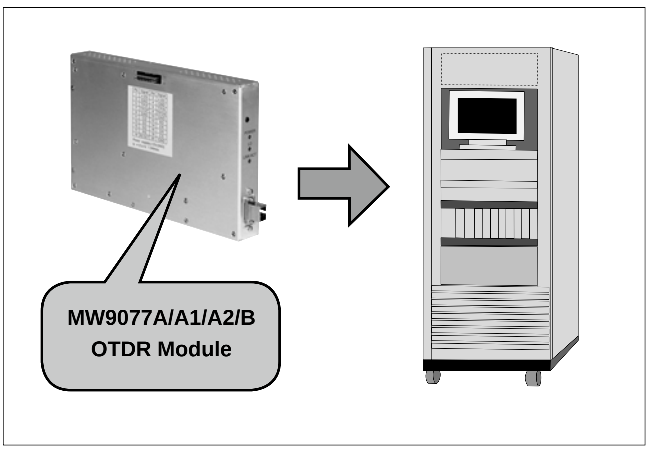
Space is an important factor in designing a monitoring systems. Factors such as functions, performance, and module size favor use of compact modules.
Furthermore, using a compact module helps reduce the size of the whole system, reading to system-wide cost reductions. The compact MW9077A/A1/A2/B is less than A5 size (200 × 130 × 25 mm). Even systems with severe space limitations can use this module.

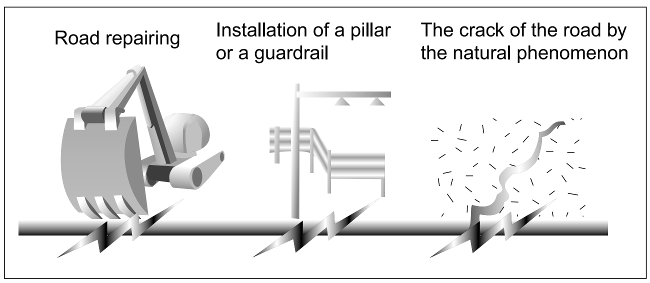
• Wide Operating Temperature Range

The system operating temperature is affected by various environmental factors, such as installation location, and monitored objects.
In addition, the heat that the system generates itself influences the operation temperature. As a result, temperature of the monitoring system must also be monitored to assure reliability.
The MW9077A/A1 dynamic range is stable from –5° to +55°C, supporting its use in a wide range of temperature environments (MW9077A2/B is stable to +25°C).

• Fast Data Transmission over Ethernet Interface

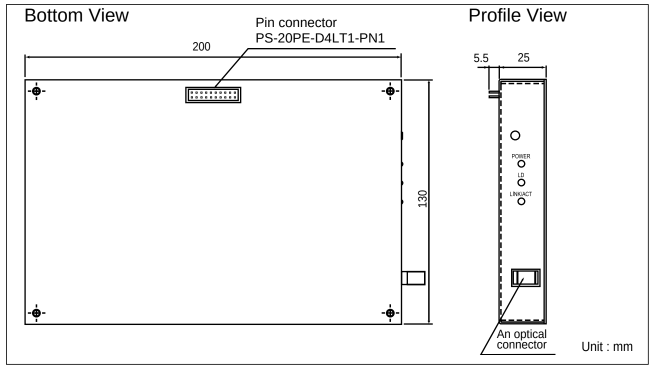
Optical fibers are monitored for various reasons. For example, to assess long-term changes in optical fiber, the system checks the fiber every several hours using an OTDR. In other cases, such as when there is a network fault, the system checks the fiber immediately using an OTDR to find the fiber break. On the other hand, monitoring is always performed to detect changes in the loss of an optical fiber. The MW9077A/A1/A2/B can perform trace sweep at intervals of about 1 second with smoothing by averaging. The Ethernet interface transmits waveform data to a controller at high speeds, making fiber monitoring much easier.



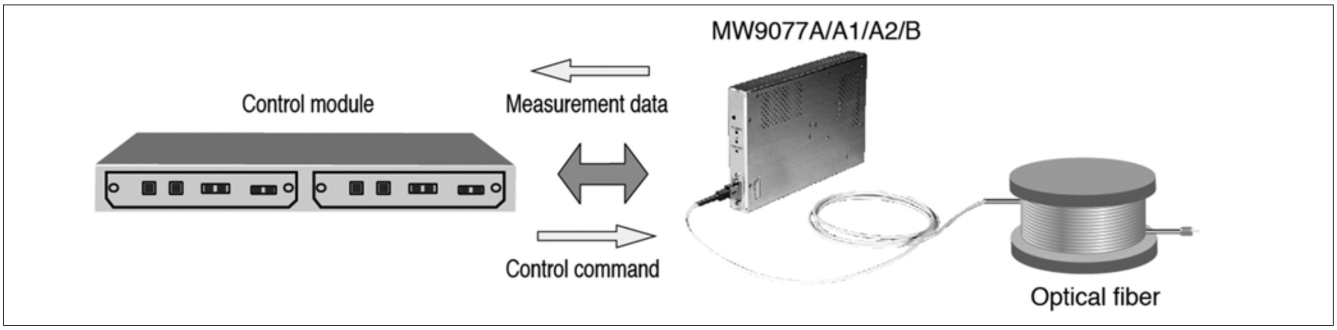


● Fast and Precision Operation from Controller

The MW9077A/A1/A2/B has a 10BASE-T compatible Ethernet interface for control over an Ethernet network. (The IP address is set using RS-232C.)
A comprehensive set of commands is built-in, including commands for setting measurement conditions, transferring measured data to the controller, along with a full range of file formats, making it easy to match settings with the monitored fiber.



Appearance of MW9077A/A1/A2/B



Specifications

Model	MW9077A	MW9077A1	MW9077A2[*1]	MW9077B
Wavelength[*2]	1310 nm ±25 nm	1550 nm ±25 nm	1625 nm ±25 nm	1310 nm/1550 nm ±25 nm
Fiber Under Test	10 µm/125 µm single-mode optical fiber (ITU-T G.652)			
Distance Range	1, 2.5, 5, 10, 25, 50, 100, 200, 250, 400 km			
Pulse Width	10 ns ±30%, 30 ns ±25%, 100 ns ±10%, 300 ns ±10%, 1 µs ±10%, 3 µs ±10%, 10 µs ±10%, 20 µs ±10%			
Dynamic Range	41 dB (+25°C, Pulse width 20 µs) 39 dB at –5° to +55°C (S/N = 1)	40 dB (+25°C, Pulse width 20 µs) 38 dB at –5° to +55°C (S/N = 1)	37 dB (+25°C, Pulse width 20 µs) (S/N = 1)	39 dB (1.31 µm, +25°C, Pulse width 20 µs)[*3] 38 dB (1.55 µm, +25°C, Pulse width 20 µs)[*3] (S/N = 1)
Dead Zone (Back Scattered Light)[*4]	≤20 m			
Dead Zone (Fresnel Reflection)[*5]	≤5 m (typ. 2 m)			
Sampling Resolution[*6]	0.05 m to 80 m			
Number of Sampling Points	Normal: 5001 or 6251, Fine: 20001 or 25001			
IOR	1.400000 to 1.699999 (in 0.000001 steps)			
Distance Measurement Accuracy	±1 m ±3 × Measurement distance × 10^{-5} ± Sampling resolution			
Loss Measurement Accuracy (Linearity)	±0.05 dB/dB or ±0.1 dB (whichever is greater)			
Return Loss Measurement Accuracy	±2 dB			
Automatic Measurement[*7]	Measurement items: Total loss, Each event distance, Connection loss, Return loss or Reflectance Threshold values: Connection loss : 0.01 to 9.99 dB (in 0.01 dB steps) Reflectance: –14 to –70 dB (in 0.1 dB steps), Fiber end : 1 to 99 dB (in 1 dB steps) Number of detected events: Up to 99 Automatic setting: Distance range, Pulse width, Averaging count (time)			
Manual Measurement	Measurement items: Transmission loss and distance between 2 points, Connection loss, Reflectance			
Other Functions	Relative distance setting (zero offset cursor), Calendar clock (without backup), Distance unit: m (Fixed)			
Laser Safety	IEC 60825-1: 2007: CLASS 1 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007			
Power Supply	+12 V(dc) ±1 V, 1.5 A Max.			
Interface	Ethernet interface[*8]: 10Base with 20 pin connector Serial interface: RS-232C : 115.2 kbps (The IP address is set using RS-232C)			
Dimensions and Mass	200 (W) × 130 (H) × 25 (D) mm, ≤0.6 kg			
Environmental Conditions	Operating temperature and humidity: –5° to +55°C, ≤95% (no condensation) (MW9077A/A1/B) –5° to +50°C, ≤85% (no condensation) (MW9077A2) Storage temperature: –40° to +70°C			
EMC	EN61326-11, EN61000-3-2			

∗1: When an optical pulse from the MW9077A2 (1.625 µm) is input (in-service monitoring) into an optical fiber used for communications at 1.55 µm, the optical communications signal is affected by Ramman amplification. Take care when using this setup.
∗2: At 25°C, Pulse width : 1 µs
∗3: The dynamic range specification at a pulse width of 3 µs is shown below 26.5 dB (1.31 µm, +25°C), 25.5 dB (1.55 µm, +25°C), (S/N = 1)
∗4: At pulse width 10 ns
∗5: At pulse width 10 ns, Return loss: 35 dB (MW9077A/A1/A2), 40 dB (MW9077B)
∗6: IOR = 1.500000
∗7: Automatic measurement function : Automatic measurement results are not guaranteed. There is a possibility to miss detection of event. Please check each result at on your own.
∗8: Signal exchange with 10BASE-T

Note: This product outputs the pulse light of a high peak power. When this product is used in the state where it connected with transmission equipment, attaching a wavelength filter etc. should take care about the input of too much OTDR pulse light to Receiver. There is a possibility of damaging Receiver of transmission equipment.

Safety Measures for Laser Products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

⚠ IEC 60825-1:2007
CLASS 1 LASER PRODUCT

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MW9077A[*1]	OTDR Module (Wavelength 1.31 µm)
MW9077A1[*1]	OTDR Module (Wavelength 1.55 µm)
MW9077A2[*1]	OTDR Module (Wavelength 1.625 µm)
MW9077B[*1]	OTDR Module (Wavelength 1.31 µm/1.55 µm)
	Standard accessory
W2254AE[*2]	MW9077A/A1 Operation Manual: 1 copy
	Options
MW9077A-01	1550 nm Filter (Factory option, 1550 nm cut filter inside)
MW9077A/A1/A2/B-25[*3]	FC-APC Connector (Factory option, Fixed)
MW9077A/A1/A2/B-26[*3]	SC-APC Connector (Factory option, Fixed)
MW9077A/A1/A2/B-37[*3]	FC Connector (Factory option, Fixed)
MW9077A/A1/A2/B-38[*3]	ST Connector (Factory option, Fixed)
MW9077A/A1/A2/B-39[*3]	DIN Connector (Factory option, Fixed)
MW9077A/A1/A2/B-43[*3]	HMS-10/A Connector (Factory option, Fixed)

∗1: In the case of purchase, Please concluded a sales contract.
∗2: A new table is attached at purchase of the MW9077A2/B.
∗3: Standard connector for specified option. If not specified, SC connector (Fixed) supplied as standard.

MULTI-LAYER NETWORK TEST PLATFORM

CMA5000a

Remote Control
Ethernet

All-in-one Platform for SONET/SDH, OTN, Gigabit Ethernet, DWDM, OTDR, PMD, CD

Improved customer service, easy maintenance and lower costs are key issues for operators of high-speed data services.
The CMA5000a Multi-Layer Network Test Platform has a full range of versatile modules and easy to use touch panel, supporting fast network rollout and maintenance at lower total cost.

● Multi-measurement Functions

The CMA5000a measurement modules support SONET/SDH, OTN, 10 Gigabit Ethernet, Gigabit Ethernet, DWDM, OTDR, PMD, and CD measurements.
For field-testing, one unit supports all required physical layer, data link layer, network layer, and transport layer measurement items.

● Lower Total Cost of Ownership

One CMA5000a supports all measurements required for rolling out an optical network and maintenance follow-up. Multiple measurement modules can be set and operated simultaneously in one mainframe, eliminating the need for other single-function specialist measuring instruments and cutting total cost of ownership.
The easy to use touch panel and GUI shorten operator training too.

● Fast Service Roll-out

The consistent GUI between measurement modules simplifies work, allowing the operator to focus on evaluating each network layer efficiently and contributing to the fastest service rollout and maintenance.
A touch of a button can generate PDF-formatted report of measurement conditions and results.
Engineer can operate CMA5000a over Ethernet to support measurements at local site.

Module Specifications

Module	Measurement	Platform	Bay
UTA	Network performance measurement 10G Ethernet LAN-PHY, WAN-PHY SONET (optical) OC3/12/48/192 SDH (optical) STM1/4/16/64 OTU1/2	SBA, MBA	2
GIGE II	Gigabit Ethernet performance measurement 10M/100M/1000M Ethernet	SBA, MBA	1
OSA	Optical spectrum analysis DWDM channel selection	MBA	4
OTDR	Optical Time Domain Reflectometer	SBA, MBA	1
PMD	Polarization mode dispersion measurement	MBA	4
CD-OTDR	Wavelength dispersion measurement Optical pulse test	SBA, MBA	1

See each module data sheet for detailed configurations.

Small Bay Adapter (SBA)
2 Bays

Medium Bay Adapter (MBA)
4 Bays

CMA5000a Specifications

Platform	SBA: 5000A-150-DC MBA: 5000A-250-DC
Operating System	Windows® XP
Display	10.4" color XGA (1024 × 768) LCD (touch panel)
Hard Disk	40 GB
Media Drive	DVD/CD-R/W
Interface	Audio in/out, VGA Output, USB 2.0 (4 Ports), 10/100 Ethernet
Power Supply	100 V(ac) to 240 V(ac) (Auto-switching), 50 Hz/60 Hz, 150 W
Dimensions and Mass	SBA: 371 (W) × 246 (H) × 140 (D) mm, 5.9 kg 14.6 (W) × 9.7 (H) × 5.5 (D) in, 13 lbs MBA: 371 (W) × 246 (H) × 180 (D) mm, 6.81 kg 14.6 (W) × 9.7 (H) × 7.1 (D) in, 15 lbs
Battery No.	SBA: 2 (one battery as standard accessory)[*1] MBA: 2 (two batteries as standard accessory)
Battery Type	Li-Ion
Environmental Conditions	Temperature: +5° to +45°C (operating), –20° to +60°C (storage) Humidity: 10 to 80% (operating), 5 to 95% (storage), non-condensing
Laser Safety[*2]	IEC 60825-1:2007 CLASS 1 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*1: Additional 5000A-BATT Battery may be required depending on module configurations.
*2: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

CERTIFICATION LABEL
THIS PRODUCT CONFORMS TO
ALL APPLICABLE STANDARDS
UNDER 21 CFR 1040.10

⚠ IEC 60825-1:2007
CLASS 1 LASER PRODUCT

Windows® is a registered trademark of Microsoft Corporation in the USA and other countries.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Description
	Main frame
5000A-150-DC-xx	SBA main frame featuring two bays
5000A-250-DC-xx	MBA main frame featuring four bays xx: Choose the accessory power cable from following: IT Italy; SW: Switzerland; AU: Australia; EU: Europe; UK: Great Britain, US: USA, Japan
	Accessories
5000A-AC	Replacement AC Adapter
CORD-C5-xx	Replacement Power cable (xx: cable connector type)
STYLUS-3PK	Replacement Touch panel stylus
5000A-OPMAN	Replacement Quick Start Guide
	Application parts
USB-KEYBD-US	USB English keyboard with trackball
5000A-HCASE-SBA	Hard case for SBA main frame
5000A-HCASE-DLX	Hard case for SBA/MBA main frame with extra module capacity
5000A-SCASE	Soft case for SBA/MBA main frame
5000A-SBATOTE	Soft case for SBA main frame

OPTICAL TIME DOMAIN REFLECTOMETER
CMA5000a OTDR Module Series

Remote Control
Ethernet

Expansive Series of High Performance OTDR Modules for the CMA5000a

The CMA5000a Optical Time Domain Reflectometer (OTDR) application is based on over 30 years of development and experience in characterizing optical fibers. Our world – class OTDR modules continue this tradition with the latest in high performance hardware and dedicated, easy to use software.

The compact size of the OTDR Application module allows another module (OTDR or test fiber box) to be inserted into a small bay adapter and up to three more into a medium or large bay adapter.

Benefits

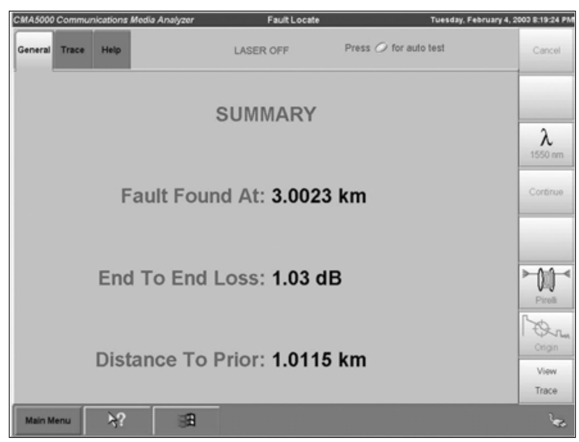
- Sophisticated analysis software provides consistent and accurate fiber characterization
- Dedicated testing modes simplify commonly performed tasks
- Easy to use for any skill level – from fault location to advanced fiber analysis
- Touch screen and hard key user interfaces ensure smooth and efficient operation
- Solutions for all network types: Metro, CWDM, ultra-long haul and FTTP deployments
- Complete fiber characterization from 10 available wavelengths
- Automated, on-the-box reporting

High Performance Hardware

To satisfy even the most demanding testing requirements, the CMA5000a series OTDR modules, feature a multitude of available wavelengths including 1310 nm, 1550 nm, and 1625 nm. Up to three of these wavelengths can be combined into a single optical port providing full spectrum fiber characterization at the press of a button and are ideal for testing backbone or metro networks that deploy CWDM. For ultra-long haul systems, the CMA5000a OTDR modules feature up to 50 dB of dynamic range (enough to see approximately 250 km of fiber) – with an impressive 1 meter resolution.

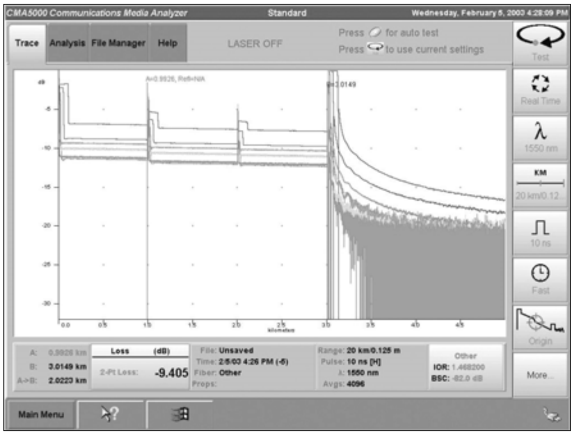
Dedicated, Ease to Use Software

To simplify testing, the CMA5000a features dedicated testing modes to automate and simplify the task at hand.
Fault Locate mode is designed for someone just starting out or the novice who only uses an OTDR occasionally. Simply connect the fiber and press test. The unit will verify the fiber is connected correctly, select testing parameters, execute the test and provide a text response indicating fault/break location and end to end loss.



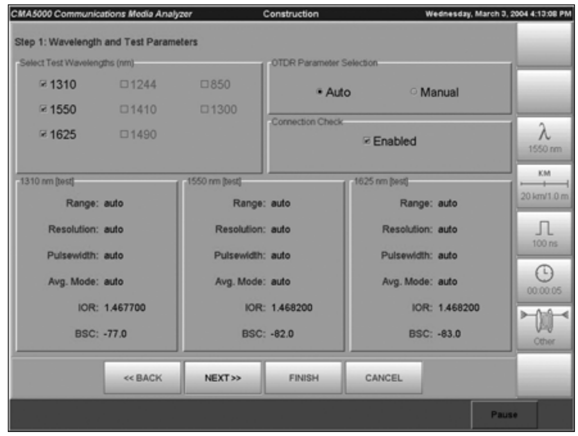
Fault Locate Mode – ease to read results

For those who have more experience or would like to perform more advanced testing, Classic OTDR mode allows the user to select all parameters, compare up to eight traces and even generate splice loss reports.



Classic OTDR – advanced testing

Cable commissioning is also automated through the use of Construction OTDR mode where a wizard allows the user to select the required testing wavelengths, number of fibers and file naming scheme. The wizard then becomes the project manager guiding the user through the testing and ensuring consistency with testing parameters and file naming – virtually eliminating user induced errors.



Construction OTDR – automated multi-fiber testing

• Added Value

To further increase the value of your CMA5000a OTDR, it can be equipped with an integrated power meter, a high output stabilized light source and integrated Visual Fault Locator (VFL). These options are integrated into the single slot OTDR module and do not require an additional module slot like some other solutions. In addition, all OTDR wavelengths are available as stabilized light sources reducing the equipment cost and providing a complete end-to-end loss testing solution.

Whatever your testing needs, our world-class OTDR products are designed to reduce the time to install, commission and maintain fiber spans.

Specifications

Model	Wavelength*1	Optical Fiber Type	Pulse Width*2	Dynamic Range (typical) (SNR = 1)*3	Deadzone (typical) (back-scattered)*4	Deadzone (typical) (Fresnel)*5
5225	1310 nm ±20 nm 1550 nm ±25 nm	Single Mode (8 µm to 10 µm)	5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 ns	37 dB 36 dB	9 m 9 m	4 m 3.5 m
5245	1310 nm ±20 nm 1550 nm ±25 nm		5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 30000 ns	43 dB 45 dB	10 m 10 m	5 m 5 m
5246	1310 nm ±20 nm 1550 nm ±25 nm 1625 nm ±15 nm			43 dB 45 dB 43 dB	10 m 10 m 10 m	6 m 5 m 5 m
5254	1550 nm ±25 nm			50 dB	10 m	5 m

∗1: At 23°C, 10 µs pulse width
∗2: Range dependent
∗3: SNR = 1 with up to 256k averages (typical)
∗4: Deadzones measured on –45 dB reflections
∗5: Using Bellcore TR-TSY-000196 Issue 2

• Common Specifications

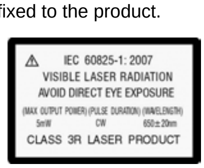
Distance Range*1	5, 20, 50, 75, 125, 250, 300 km
Sampling Resolution*1	0.125, 0.5, 1, 2, 4, 8, 16 m
Sampling Points	Up to 256,000
IOR Settings	1.300000 to 1.700000
Distance Measurement Accuracy	0.0025% of distance measurement ± distance resolution ± index uncertainty
Loss Measurement Accuracy (Linearity)	±0.04 dB/dB
Loss Resolution	0.001 dB
Laser Safety*2	IEC 60825-1: 2007: CLASS 1 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007
Optical Connector	Universal with UFC, USC, UST, AFC, ASC
Operating Modes	Fault Locate, Classic OTDR, Construction (Automated Multi-wavelength, Multi-fiber testing), Networks (data processing and report generation) Optional: Power Meter, Stabilized Light Source, Visual Fault Locator (VFL), Video Inspection Probe (VIP)
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*1: Wavelength and range dependent
*2: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

• Loss Test Set Option

Stabilized Light Source	Type	Single mode (8 µm to 10 µm)
		Laser (same wavelength and specs as OTDR)
	Output	–8 dBm (min)
	Stability (at 23°C)	±0.2 dB (8 hours)
	Modes of Operation	CW, 1 kHz, 2 kHz
	Connector Type	Same as OTDR
Power Meter	Detector Type	InGaAs
	Wavelength Range	780 nm to 1800 nm
	Calibrated Wavelengths	850, 1300, 1310, 1490, 1550, 1625 nm
	Power Range	Standard: –55 to +10 dBm CATV: –45 to +20 dBm
	Resolution	0.01 dB, 0.01 watts
	Accuracy	±4% (–50 to +5 dBm) ±8% (+5 to +10 dBm, –55 to –50 dBm)
	Linearity	±0.10 dB (–50 to +5 dBm)
	Connector Type	Universal (uses LP-XX adapters)
Visual Fault Locator	Wavelength	650 nm ±20 nm
	Output	0 dBm into 9 µm/125 µm fiber (max.)
	Transmission Modes	CW, 2 Hz
	Connector Type	2.5 mm universal
	Laser Safety*	IEC 60825-1: 2007: CLASS 3R 21CFR1040.10: CLASS II

*: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.



Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

The CMA5200 OTDR's are Single Bay modules that include one OTDR/Source Universal Adapter (UC-130-XX) at no charge.
For units with a Power Meter option, a Meter Connector Adapter (LP-XX) is also included at no charge.

Additional OTDR modules are available in various combinations of wave lengths and dynamic ranges.
Please contact Anritsu for a comprehensive list.

• Module Number:

52 __ __ - __ __ __ - OTDR - __ __ __
A B C

A = Select an OTDR Module

25 = Singlemode, 37/36 dB dynamic range, dual-wavelength 1310 nm/1550 nm
45 = Singlemode, 43/45 dB dynamic range, dual-wavelength 1310 nm/1550 nm
46 = Singlemode, 43/45/43 dB dynamic range, tri-wavelength 1310 nm/1550 nm/1625 nm
54 = Singlemode, 50 dB dynamic range, single-wavelength 1550 nm

B = Select Meter, Light Source and VFL Options
000 = No Meter, Light Source or VFL
001 = VFL Only
210 = +20 dBm Meter and Light Source
211 = +20 dBm Meter, Light Source and VFL

C = Select Connector
UFC = FC/UPC
USC = SC/UPC
UST = ST/UPC
AFC = FC/APC
ASC = SC/APC
AST = ST/APC

OTDR/CHROMATIC DISPERSION APPLICATION
CMA5000a CD-OTDR

Remote Control
Ethernet

Measure Chromatic Dispersion and Loss in One Step

The field portable CMA5000a OTDR/Chromatic Dispersion (OTDR/CD) measurement system is a dedicated module that combines the advanced capabilities of Anritsu's OTDR technology with Anritsu's experience in Chromatic Dispersion. The CMA5000a OTDR/CD measurement system gives installers and network providers a combined module that can be used as an OTDR and a chromatic dispersion measurement system, reducing testing times while increasing network performance. The CMA5000a OTDR/CD measurement system is based upon the industry accepted time-of-flight measurement method (FOTP-168) that can evaluate chromatic dispersion of individual fiber links. Utilizing a single fiber for the test and multiple wavelengths results in an increase in the accuracy of the measurement, as well as a reduction in the testing time. This translates into improved network performance and efficiency, resulting in increased revenue for the network provider.

Anritsu understands how valuable your time is, so we've provided intuitive, easy-to-use setup menus and single-button operation. The CMA5000a OTDR/CD measurement system has been designed to provide optimal test efficiency to facilitate quicker turn-up of services and reduce the cost of testing. The combined unit has an auto-test feature that will determine the optimum settings. In addition, intuitive setup menus guide the user through a few minor settings that minimize the testing and setup times.
The field portable CMA5000a OTDR/CD is an accurate system available for measuring both Chromatic Dispersion, loss and attenuation on all single-mode fiber types providing installers, carriers and system providers increased revenue through optimized network bandwidth, while improving efficiency and reducing operational expenses through proper CD mitigation and compensation techniques.

Chromatic Dispersion Specifications

Wavelength Range	1310 nm to 1625 nm
Dynamic Range	37 dB (100 km is the typical range when using all 6 wavelengths)
Dispersion Range	There is no physical limitation on either the negative or positive dispersion that can be measured.
Dispersion Accuracy*	±0.7 ps/nm/km or ±4% (greater number)
λ_0 Accuracy	±10 nm (typ.)
Number of Testing Wavelengths	6
Test Time	<4 minutes for 50 km
Number of Fibers Required	1
Minimum Measurable Length	10 km

*: C- and L- bands

OTDR Module Specifications

Fiber Type	Single-mode (Tri-wavelegth)
Center Wavelength	1310 nm ±20 nm 1550 nm ±20 nm 1625 nm ±15 nm
Spectral Width (RMS)	1310 nm: <15 nm 1550 nm: <15 nm 1625 nm: <15 nm
Dynamic Range (typical)*1	1310 nm: 38 dB 1550 nm: 38 dB 1625 nm: 38 dB
Initial Reflective Deadzone (typical)*2	1310 nm: 4 m 1550 nm: 4 m 1625 nm: 4 m
Initial Non-reflective Deadzone (typical)*3	1310 nm: 9 m 1550 nm: 8 m 1625 nm: 9 m
Linearity	0.04 dB/dB
Pulsewidth*4	5 ns to 20 µs
Distance Resolution	0.0001 km, 0.1 m, 1 ft, 0.0001 mi
Distance Range Setting	5, 20, 50, 125, 250, 300 km
Loss Resolution	0.001 dB
Distance Sampling (Range Dependent)	0.125, 0.25, 0.5, 1, 2, 4, 8, 16 m
Data Points	Up to 256,000
Distance Accuracy	0.0025% of distance measurement ± distance resolution ± index uncertainty
Laser Safety*5	IEC 60825-1: 2007 CLASS 1 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*1: SNR = 1 with up to 256k averages (subtract approximately 2 dB of range to 98% peak noise. Bellcore TR-TSY-000196 Issue 2)
*2: Using Bellcore TR-TSY- 000196 Issue
*3: Deadzones measured on –45 dB reflections
*4: Wavelength dependent
*5: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

The CMA5302 OTDR based Chromatic Dispersion unit is a single bay module that can be used in either an SBA and MBA. It features time of flight CD measurements as well as traditional tri-wavelength OTDR testing.

Module Number:

5302 - 21 -CDOTDR- __ __ __
A

A = Connector
UFC = FC/UPC
USC = SC/UPC
UST = ST/UPC

POLARIZATION MODE DISPERSION ANALYZER
CMA5000a PMD

Remote Control
Ethernet

Fast, High Dynamic and Reliable PMD Measurement at the Press of One Button

The CMA5000a PMD application increases revenue through complete PMD characterization, to optimize high data rate networks. By utilizing the CMA5000a's PMD application to characterize the data rate capability of each fiber and transmitting at each fiber's maximum data rate, the negative effects of PMD may be minimized. As a result, installers, carriers and system providers can release the full potential of high data rate optical networks.

Increase Revenue through Accurate PMD Characterization:

- Patented interferometric technique based on a pi-shifted Michelson interferometer
- Comply to EIA/TIA FOTP-124 and IEC-60793-1-48
- No auto-correlation peak for accurate characterization of all necessary PMD parameters: PMD, length PMD coefficient and second order PMD value

Added Value through Performance:

- Multiple test modes simplify and automate tests for several applications including multiple scans and long term PMD monitoring
- All band testing through a large choice of light sources
- Highest dynamic range on the market: 55 dB with standard light source and more than 64 dB with the high power source

Reduced Cost of Measurement:

- Fast measurement time: less than 8 seconds.
- Test through multiple EDFAs
- Easy to use touch screen interface combined with an innovative parameter set-up scheme
- Professional, comprehensive reporting of all settings and test results in a standard .pdf format at the press of a button

PMD Module/Optical Sources/PMD Artifact

- **PMD Module**

It is a double deep module which operates in a CMA5000a MBA or LBA. The PMD module provides up to 160 ps for a birefringent fibre and 80 ps for telecom fibre. Reference: 5400-001-PMD

- **Optical Sources**

All sources come with a soft bag, a universal fibre optic PC connector and operate on battery.

- **Standard 1550 nm Wavelength Source**

This is the standard source offering 1550 nm operation. It will provide very high dynamic range and is suitable for most optical fiber and optical cable PMD characterization tests. It provides more than +2 dBm output power at 1550 nm, giving more than 55 dB dynamic range at 1550 nm for 1 ps PMD and more than 47 dB at 1550 nm for 10 ps PMD when used with the CMA5000a PMD module.
Reference: 5403-003-PMD

- **Dual 1310 nm & 1550 nm Wavelength Source**

This is the dual wavelength source offering 1310 nm & 1550 nm operation. It provides more than –1 dBm output power at 1550 nm, giving more than 52 dB dynamic range at 1550 nm for 1 ps PMD and more than 44 dB at 1550 nm for 10 ps PMD when used with the CMA5000a PMD module. Reference: 5403-004-PMD

- **Dual 1550 nm & 1625 nm Wavelength Source**

This is the dual wavelength source offering 1550 nm & 1625 nm operation. It provides more than –2 dBm output power at 1550 nm, giving more than 51 dB dynamic range at 1550 nm for 1 ps PMD and more than 43 dB at 1550 nm for 10 ps PMD when used with the CMA5000a PMD module. Reference: 5403-006-PMD

- **1550 nm C+L Wavelength Source**

This is the ultra-broadband wavelength source offering 1550 nm operation and a minimum PMD measurable of 0,035 ps. It is targeted for very low PMD measurement. It provides more than –10 dBm output power at 1550 nm, giving more than 43 dB dynamic range at 1550 nm for 1 ps PMD and more than 35 dB at 1550 nm for 10 ps PMD when used with the CMA5000a PMD module.
Reference: 5403-005-PMD

- **1550 nm High Power Source**

This is the ultra high power source offering 1550 nm operation and highest dynamic range. It is designed for very long fiber PMD measurements that can test lengths over 300 km. It provides more than +11 dBm output power at 1550 nm, giving more than 64 dB dynamic range at 1550 nm for 1 ps PMD and more than 56 dB at 1550 nm for 10 ps PMD when used with the CMA5000a PMD module.
Reference: 5403-010-PMD

- **PMD Artefact**

This is a piece of birefringent fiber with 1 ps PMD.
Reference: 5402-000-PMD

Specifications

• Polarization Mode Dispersion Module

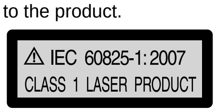
Operating Wavelengths	1250 nm to 1650 nm
Random PMD Measurement Range*1	80 ps
Deterministic Measurement Range*2	160 ps
Dynamic Range*3	See below
Accuracy	1% ±0.06 ps (for weakly coupled fiber)
Repeatability	1% ±0.06 ps (for strongly coupled fiber)
Measurement Time for 45 ps Scanning Range	8 seconds
Measurement Time for 160 ps Scanning Range	20 seconds
Test Through EDFA	Yes
Battery Operation*4	Yes
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

• Polarization Mode Dispersion Source

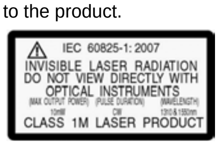
Product Number	5403-003-PMD-X	5403-004-PMD-X	5403-005-PMD-X	5403-006-PMD-X	5403-010-PMD-X
Wavelength	1550 nm	1310 & 1550 nm	1550 nm C+L	1550 & 1625 nm	1550 nm HP
Output Power	+2 dbm	–1 dBm	–10 dBm	–2 dBm	+11 dBm
Related Dynamic Range*5	55 dB	52 dB	43 dB	51 dB	64 dB
Minimum Measurable PMD	0.06 ps	0.06 ps	0.035 ps	0.065 ps	0.08 ps
Battery Operation	Yes, 9 h autonomy (30 h typ.)				
Laser Safety*6	IEC 60825-1: 2007 CLASS 1 21CFR1040.10 and 1040.11 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007				IEC 60825-1: 2007 CLASS 1M 21CFR1040.10 and 1040.11 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

∗1: Typical Telecommunication fibers
∗2: Polarization maintaining fiber or artifact measurement
∗3: Dynamic range depends of the output power of associated light source.
∗4: Inside CMA5000a MBA platform
∗5: For 1 ps PMD, subtract 8 dB to this value for 10 ps PMD
∗6: Safety measures for laser products

<5403-003-PMD-X, 5403-004-PMD-X, 5403-005-PMD-X, 5403-006-PMD-X>
This product complies with optical safety standards in IEC 60825-1, 21CFR1040.10 and 1040.11; the following descriptive labels are affixed to the product.



<5403-010-PMD-X>
This product complies with optical safety standards in IEC 60825-1, 21CFR1040.10 and 1040.11; the following descriptive labels are affixed to the product.



Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

• PMD Module and Light Source Order Guide

Order Number	Description
5400-001-PMD-YY	Base PMD Double Deep Module, 160 ps
5402-000-PMD-YY	PMD Artifact
5403-003-PMD-X	Polarized Broadband 1550 nm Battery Powered Light Source
5403-004-PMD-X	Polarized Broadband dual 1310 nm & 1550 nm Battery Powered Light Source
5403-005-PMD-X	Polarized Ultra-broadband 1550 nm C+L-band Battery Powered Light Source
5403-006-PMD-X	Polarized Broadband dual 1550 nm & 1625 nm Battery Powered Light Source
5403-010-PMD-X	Polarized Broadband 1550 nm High Power Battery Powered Light Source

X = Power Cord Option:
U = US
E = Europe
G = Great Britain
A = Australia

YY = Connector Option:
FU = FC/UPC
SU = SC/UPC
FA = FC/APC
SA = SC/APC

Note: All light sources come with a universal connector compatible with all PC connectors with 2.5 mm diameter (FU, SU, TU)

OPTICAL SPECTRUM ANALYZERS
CMA5000a OSA 425/OSA 400
1250 nm to 1650 nm

Remote Control
Ethernet

Field Portable DWDM/CWDM Testers

Build-to order product

Today's competitive environment demands that networks offer exceptional performance and reliability with minimal down time. When characterizing and documenting such stringent performance levels, the CMA5000a Optical Spectrum Analysis (OSA) applications are the ideal single solution for facilitating accurate and efficient channel management, power balancing and tuning throughout the network. The OSA applications lower CWDM and DWDM installation and maintenance costs by providing industry leading spectral analysis of system critical parameters.

Operating from 1250 nm to 1650 nm, these OSA modules for the CMA5000a are the perfect tools for testing large wavelength range CWDM system.

Two different modules are available to meet all test requirements: the OSA 425 and the OSA 400.

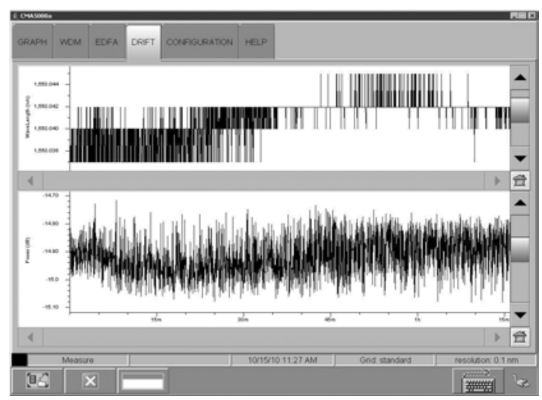
- OSA 425: the optimized cost OSA.
This OSA is ready for field operation and harsh environment.
Its internal calibration valid over all temperature range gives you accurate power and wavelength measurement in all conditions without any user calibration

- OSA 400
The OSA 400 extends the performances of the OSA 425 and provides lab specifications in a rugged field module. With best in class ORR, this OSA can compute OSNR measurements with very high accuracy. The unique flat top filter can drop signals up to 40 Gb/s to perform transport analysis.

The compact size of the OSA module conveniently fits into the CMA5000a Multi-Layer Network Test Platform using a medium bay adapter.

• Best in Class Optical Rejection for Accurate OSNR Measurements
Optical REJECTION Ratio (ORR) is a very important parameter for an Optical Spectrum Analyzer. This parameter gives the noise floor at a specified distance away from the center wavelength of the channel under test (see fig.1). ORR values are generally specified either at 50, 25 or 12.5 GHz away from the center of the channel. High ORR values guarantee high OSNR measurement accuracy. With its high Optical Rejection Ratio, more than 65 dBc at 50 GHz from peak, the OSA400 is the perfect tool for measuring accurate OSNR on DWDM channels.

• WDM Channel Drift Monitoring Function
One user specific channel in WDM signals can be selected, and its wavelength and power is monitored. Channel stability can be seen very easily.



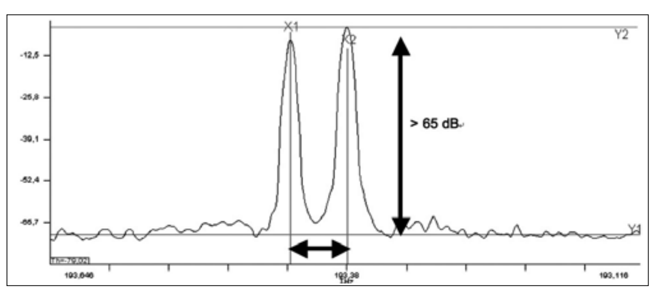


**Fig 1: Two peaks at 50 GHz spacing with OSA 400.
OSNR measurements are no longer limited by the OSA optical response.**

• Automatic EDFA tests

Erbium-Doped Fiber Amplifiers (EDFAs) are commonly used in today's WDM networks. Optical amplification is the main function of an EDFA and consequently, the gain is one of the most important parameter to measure. Nevertheless, the gain is depending on many other parameters: wavelengths, polarization, power… In theory, the EDFA gain is supposed to be flat in its operating window, but in practical it can vary from one wavelength to another. The noise figure of an EDFA must also be checked as this value will determine how many amplifiers can be cascaded on a link. That's why it is important to be able to measure the dependence of the EDFA gain to these parameters with an OSA. The CMA5000a OSA's provide automatic test for fast and easy EDFA characterization.

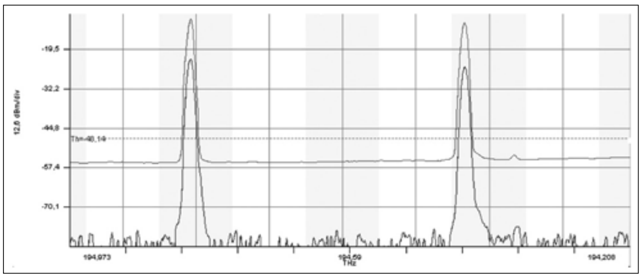


Fig 2: Input and Output EDFA curves display on the same graph for immediate analysis.

• Unique Channel Drop Filter (OSA 400)

The deployment of DWDM systems presents system engineers and maintenance personnel with the added challenge of how to selectively choose one channel among many and analyze its performance.
For example, WDM networks are commonly used to transport SDH/SONET signal. Each data channel is carried on its own unique wavelength. Several channels are transmitted on the fiber at the same time. To analyze the SDH/SONET signal, it is necessary to select and drop the corresponding wavelength. The main challenge is to ensure that the bandwidth of the filter does not degrade the integrity of the channel under test. In the case of a 10 Gbit/s modulated signal, depending on the modulation technique, the bandwidth of the filter within the spectrum analyzer may need to be in excess of 20 GHz. For practical use, it is desirable that the bandwidth of the filter be large enough to accommodate center wavelength drift of both the channel under test and the measuring device, as well as the sidebands of the modulated signal.
For a 40 Gbit/s system the bandwidth of the device may need to exceed 80 GHz. The OSA 400 has unique embedded channel drop filter. Any wavelength can be selected via the tunable flat top sharp-edge filter. The bandwidth of the filter is also adjustable depending on the modulation rate of the signal. The OSA 400 filter can support modulation rate up to 40 Gbps. The combination of the OSA module and the SONET/SDH module (XTA or UTA module) in the same CMA5000a platform is particularly useful to completely test WDM links carrying SONET/SDH signals.

Specifications

Osa Specifications	OSA 400	OSA 425
Spectral Range	1250 nm to 1650 nm	
Wavelength Accuracy[*1, *2]	±40 pm, ±15 pm[*3]	
Wavelength Repeatability[*4]	±5 pm	
Wavelength Stability[*5]	±10 pm	
Wavelength Linearity[*2]	±15 pm	
Maximum Total Safe Power	+25 dBm	
Power Range per Channel[*2, *6]	–70 to +20 dBm	
Noise Floor[*6, *7]	–75 dBm	
Power Accuracy[*8]	±0.4 dB	
Power Repeatability[*4]	±0.04 dB	
Power Linearity[*1]	±0.1 dB	
Power Flatness[*2]	±0.3 dB	
Power Stability[*5]	±0.1 dB	
Polarization Dependent Loss[*9, *10]	±0.1 dB	
Pdl + Repeatability[*9]	±0.15 dB	
Optical Resolution Bandwidth (FWHM)[*2]	<60, 100, 200 & 500 pm[*12]	60 pm (typ.)[*2]
Setting Resolution Bandwidth	Full, 0.1, 0.2, 0.5, 1 nm	
Optical Rejection Ratio[*2, *11]	65 dBc at ±50 GHz from peak 55 dBc at ±25 GHz from peak 35 dBc at ±12.5 GHz from peak	40 dBc at ±50 GHz from peak 35 dBc at ±25 GHz from peak 25 dBc at ±12.5 GHz from peak
Optical Return Loss	>45 dB	>40 dB
Maximum Measurement Time	8 s (for 400 nm and 80,000 sampling points)	
Scanning Time[*13]	<2 s	
Channel Number	1024	
Wavelength Readout Resolution	1 pm	
Power Readout Resolution	0.01 dB	
Internal Temperature Sensor	Yes	
Internal Wavelength Calibration	Yes (Automatic)	

Channel Drop Features

Channel Drop Features	OSA 400	OSA 425
Spectral Range	1250 nm to 1650 nm	NA
Modulation Rate	Up to 40 Gbps	NA
Filter Bandwidth*9	User selectable from 60 to 800 pm	NA
Insertion Loss*9	<10 dB	NA
Autopositioning Accuracy*10	±40 pm	NA
Wavelength Resolution	5 pm	NA
Polarization Dependent Loss*9, *10	±0.1 dB	NA
Optical Bandwidth Resolution	20 pm	NA
Flatness*14	Width at 0.2 dB >FWHM/2	NA
Crosstalk*2	Up to 65 dB	NA

General Specifications

Temperature	Operating: 0° to +40°C Storage: –20° to +70°C
Humidity	95% RH non-condensing
Battery Operation	Yes
Calibration Cycle	1 year recommended
Warranty	1 year standard
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*1: Signal from –30 to +5 dBm from 15° to 30°C
*2: In C&L band (1530 nm to 1610 nm)
*3: User offset with external calibration
*4: in 5 consecutive scans
*5: in 1 hour
*6: with averaging
*7: in C band (1530 nm to 1570 nm)
*8: at –15 dBm in C band (1530 nm to 1570 nm)
*9: at 1550 nm; at 23°C ±2°C
*10: Typical
*11: with the finest resolution
*12: ±10%
*13: 45 nm scan
*14: For FWM >150 pm

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

The CMA 5500 OSA modules cover the 1250 nm to 1650 nm spectral range.
Two modules are available: the OSA 425 (standard OSA) and the OSA 400 (includes channel isolation feature).
The CMA 5500 OSA's are double-deep (4-Bay) modules that must be used with an MBA or LBA. Each module includes a large choice of connector styles with channel isolation feature that allows the user to select a channel to be isolated to an output port for input to additional test equipment (such as BERT) for optical signals up to 40 Gb/s.

References	Description
5510-100-OSA-XXX	OSA 400 with filter: High resolution Optical Spectrum Analyzer covering 1250 nm to 1650 nm with channel selector for signals up to 40 Gbps
5525-000-OSA-XXX	OSA 425: Optical Spectrum Analyzer covering 1250 nm to 1650 nm
XXX = connector option	UFC = FC/UPC USC = SC/UPC AFC = FC/APC ASC = SC/APC

Network Master Series

MT9090A MAINFRAME
MU909011A DROP CABLE FAULT LOCATOR MODULE

780 nm/1550 nm (SMF)

Last Mile Testing Redefined!

Excellent Eco Product

MT9090A/MU909011A Overview

Until now, the right tool just didn't exist for cost effectively testing short fibers. Handheld OTDRs and Fault Locators lacked the resolution and in such short spans while mini-OTDRs were too large, too expensive and too complicated.

The MT9090A from Anritsu finally addresses this need by providing all of the features and performance required for installation and maintenance of short fibers in a compact, modular test set.

The MT9090A represents an unmatched level of value and ease of use, while not compromising performance. Data sampling of five centimeters and deadzones of less than one meter, ensure accurate and complete fiber evaluation while a simple testing sequence requires only one key press to initiate – allowing anyone to make error-free measurements.

The MT9090A represents a new era in drop cable and premise testing. Its ease of use, low price, high-resolution and size make this the perfect product for "last mile" and intra-building testing.

Key Features

- Unique, purpose-built solution for short fiber applications such as FTTx drop cables, MDU riser cables and CO cabling
- Exclusive, integrated launch fiber provides accurate initial connector measurement without external devices
- High resolution, wide screen color display that is easy to read indoors or out
- Fixed parameters simplify operation and ensure proper set-up – just press "Start"
- High resolution and extremely short deadzones ensure thorough short fiber evaluation
- Rugged, sealed design provides years of service in the most challenging environments
- Modular platform ensures maximum return on investment
- Compact and lightweight design for maximum portability in the field
- Complete FTTx maintenance tool including optical power meter and visible source "red light"
- Unique 780 nm wavelength for in-service maintenance of PONs without filters
- High performance without a high price
- Verify connector quality with optional connector inspection microscope
- Basic multimode fiber testing with 1550 nm single mode module

Purpose - Built for Short Fiber Applications

Realizing that short fiber premise applications such as FTTx drop cables, intra-building riser cables and cell towers have different testing requirements, Anritsu designed the MT9090A from the ground up. It features 5 cm resolution for accurate mapping of events, deadzones of less than 1 meter (3 feet) and a built-in 10 m (30 ft) launch fiber to ensure everything is evaluated.

• Quick Startup

The MT9090A is ready for measurement in about 15 seconds so productive work can start immediately.

• Long Battery Life

Since AC power is not always available where you need it, especially at fiber pedestals, the MT9090A typically provides 3.5 hours of testing on a single charge. This coupled with an optional car cigarette lighter cord guarantees the MT9090A is ready when you are.

• Portable

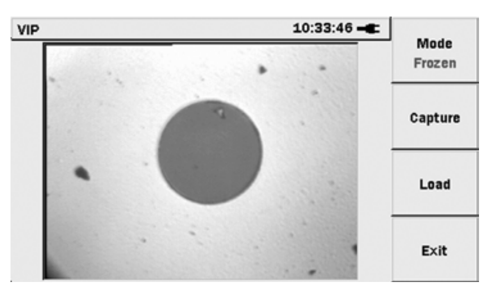
With its lightweight design and user friendly dimensions, the MT9090A is perfect for the outside plant environment and can easily be managed with one hand. The standard softcase with shoulder strap further increases portability when traveling from the truck to the testing site.

• Rugged

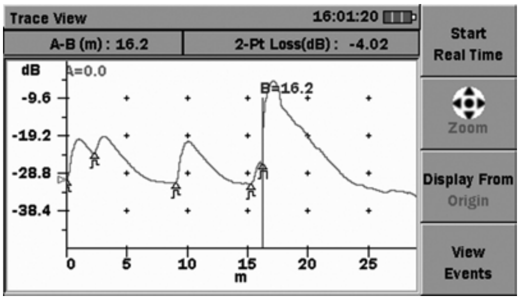
With no fans or vents to allow dust and moisture to enter the unit, the MT9090A was designed for the challenging outside plant environment.

• Video Inspection Probe Support

When equipped with the optional connector video inspection probe (VIP), the MU909011A becomes a powerful tool for evaluating connector cleanliness and quality. Connector end faces can be safely viewed and images stored to document all aspects of your network.



• 4.3-inch Wide Screen Display for Easy Viewing
The high resolution, full color, 4.3-inch wide screen display is the perfect format for viewing OTDR results. It also provides excellent readability both indoors and outdoors.



• <1 m Dead Zone for Short Fiber Analysis
With less than 1 m dead zones, the MT9090A is perfect for evaluating central office, FTTX and intra building cables.

• No Experience Required
With the MT9090A, the expertise is built in. With an automated testing sequence, fixed parameters and PASS/FAIL classification, anyone can certify and troubleshoot drop cables or premise networks.

Despite its size…it is not a toy!

When buying products, you tend to choose ones that are innovative and from established companies. When you need to install and maintain optical networks, this should also apply.
Having been in the test and measurement business for a long time, we understand the importance of performance, portability, reliability, easy operation and of course price.

• Real Time Sweeping
In the field, real-time sweeping is often very useful to confirm correct fiber splicing and placement.

• Integrated Launch Fiber
To further simplify testing, the MU909011A has 10 m (30 ft) of fiber built-in so initial fiber connections can be verified without the need for additional patchcords or launch fibers.

• Full Trace View
The user can also select to view the full trace for additional information or to initiate real time testing.

• Event Table with User Defined Thresholds
PASS/FAIL thresholds for key acceptance criteria such as splice loss, reflectance and total span loss can be set in the MT9090A allowing technicians to easily assess a fiber's condition. Failing values are clearly highlighted in the event table alerting technicians of potential problems.

• Visible Light Source
A visible laser diode "red light" to visually troubleshoot splices, connectors and the fiber management is also available.

• Integrated Power Meter (through OTDR port)
The power meter allows users to verify the presence of signals and then fault locate with one instrument – and without having to disconnect and move the fiber to another port.

• Screen Capture Function
Screen shots are sometimes useful for adding to reports so the MT9090A features the ability to save screen shots as Bitmap images.

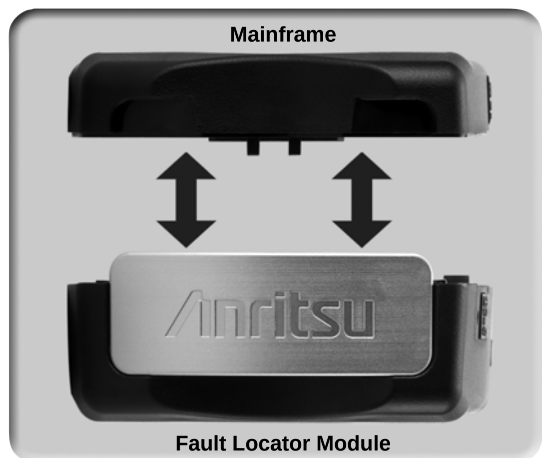
• Free and Simple Software Upgrades
Firmware upgrades are easily performed via USB and available from the Anritsu website for registered users or through Anritsu customer support.

• Simple Data Storage
With internal data storage plus support for external USB memory devices, the MT9090A is more than capable. Add to this auto file saving and naming for easy, error-free documenting of your network.

• Common OTDR Data Format
The MT9090A supports the universal Telcordia SR-4731 format making it compatible with not only legacy Anritsu and NetTest products, but with many other vendors data.

• Easy "Drag and Drop" File Transfers
When the MT9090A is connected to a PC via a USB cable, the internal memory can be directly accessed. Data can be selected, dragged and dropped into the PC memory, greatly simplifying file transfers. The MT9090A also supports the use of USB memory sticks.

• Modular Design
The MT9090A features a modular design allowing modules to be easily changed in the field. Users can interchange different wavelength fault locator modules or perform other optical network testing such as optical channel analysis with the available CWDM channel analyzer module. Operation is quite similar between modules so the user is immediately familiar with operation.



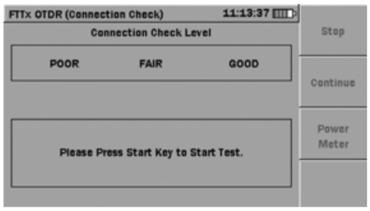
Installation and Maintenance Simplified

Since the MT9090A is purpose built for testing short fiber spans, its hardware and user interface are optimized for simplicity. A customizable testing sequence automates testing and guides novice users.

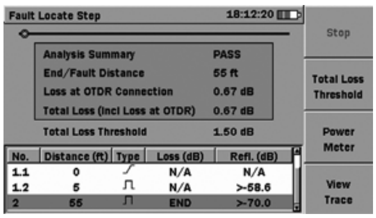
• Installation Simplified
The MU909011A fault locator module provides easy and accurate verification of drop cable installation. The user simply connects the fiber and presses "Start" for true one-button testing - all settings are fixed to ensure accurate and consistent results for any skill level. Upon completion, the length, total loss and PASS/FAIL status are displayed within seconds. A full event table of all characteristics is also shown providing additional information on the fiber under test.

Step 1 – Connect fiber and power on

Step 2 – Press "Start"
The connection check feature ensures that the fiber to be tested is properly cleaned and connected correctly.



Step 3 – Read Results
Test results including all splices and connectors, as well as total fiber length, loss and PASS/FAIL status are shown in an easy to read table.



• A Unique Approach to In-service Maintenance
Since multiple users share the common feed fiber, FTTx maintenance becomes difficult when only one or two users are down. Traditionally, 1625 nm or 1650 nm wavelengths were used to test active fibers however these wavelengths typically need costly WDM couplers and filters in the network. As a unique approach to this, Anritsu also offers a 780 nm Fault Locator module that can be used to troubleshoot in-service FTTx networks without costly filters and without disruption to other customers. This offers a clear advantage over PON specific power meters that only verify signal presence but still rely on an additional OTDR or fault locator to locate the cause. With the MT9090A, one box does it all !

Step 1 – Verify ONT Fault

Step 2 – Disconnect fiber from ONT and connect to MT9090A

Step 3 – Verify signal presence and level

Good signal – replace ONT

No signal – press "Continue" to launch fault locate test

Low signal - press "Continue" to launch fault locate test

(780 nm will not interfere with 1490 nm or 1550 nm transmissions)[*1, *2]

Step 4 – Review Results

*1: At actual work, Only use the 780 nm OTDR after confirming that there is no effect on the customer's communications system. Anritsu cannot guarantee in advance that there will be no impact on communications.
*2: Fiber bending loss (attenuation) cannot be detected at the 780 nm wavelength.

Specifications

• MT9090A Mainframe

Dimensions and Mass	190 (W) × 96 (H) × 48 (D) mm (7.5" × 3.8" × 1.9") (Including mainframe and module) <800 g (<2 lbs.) (Including mainframe, module and battery)
Display	4.3-inch TFT-LCD (480 × 272, with backlight, transparent type)
Interface	USB 1.1, Type A × 1 (memory), Type B × 1 (USB mass storage)

• MU909011A Drop Cable Fault Locator Module

Model	MU909011A3-052/062	MU909011A3-050/060	
		Singlemode Fiber Test	Multimode Fiber Test[*12]
Wavelength[*1]	780 ±20 nm	1550 ±30 nm	Undefined
Fiber Type	10 µm/125 µm SMF (ITU-T G.652)		62.5 µm/125 µm MMF
Distance Range	1.0 km (3,000 ft) or 2.5 km (8,000 ft) set automatically	1.0 km (3,000 ft), 2.5 km (8,000 ft) or 10 km (32,000 ft) set automaticallly	
Pulse width	<10 ns		
Dynamic Range[*2]	>7.0 dB		Undefined
Deadzone	Fresnel: <1 m[*3], Backscatter: <5 m[*4]		Undefined
Sampling Resolution	5 cm (Distance range 1.0 km), 10 cm (Distance range 2.5 km) (IOR = 1.50000), 50 cm (Distance range 10 km)		
Sampling Points	20001 (Distance range 1.0 km), 25001 (Distance range 2.5 km), 20001 (Distance range 10 km)		
Data Storage	Internal memory: 40 MB (up to 800 traces), External (USB): up to 20,000 traces with 1 GB		
IOR Setting	1.3000 to 1.7000 (0.0001 steps)		
Units	ft, m		
Fiber Event Analysis	Automatic, displayed in table format based on user defined PASS/FAIL thresholds		Undefined
Loss Modes	2 point loss, dB/km		
OTDR Trace Format	Telcordia universal (.SOR), issue 2 (SR-4731)		
Other Functions	Integrated launch fiber: 10 m (30 ft)		
	Connector Inspection Microscope (Optional); verifies connector condition and clealiness		
	Connection check: Automatic check of OTDR to FUT connection quality		
	Live Fiber detect: verifies presence of communication light in optical fiber		
	Real time sweep: <1 sec (typical)		
Languages	Spanish, French, German, Italian, Simplified Chinese, Traditional Chinese and English		
Integrated Optical Power Meter (Optional)	Wavelength 1550 nm, same port as OTDR		
	Power range: –5 to –45 dBm, Accuracy: ±0.5 dB[*5], Maximum input: +10 dBm		
Visible Laser Diode (Optional)	Connector: 2.5 mm universal, Wavelength: 650 ±15 nm, Output: 0 ±3 dBm Laser safety: IEC 60825-1: 2007 CLASS 3R: MU909011A3-050/060/052/062[*9] (CW) 21CFR1040.10[*11]		
Power Supply	9 VDC, 100 V(ac) to 240 V(ac), Allowable input voltage range: 90 V to 264 V, 50 Hz/60 Hz		
Battery	NiMH, Operating time: 3.5 hours (typical)[*6], Recharge time:<3 h[*7]		
Environmental Conditions	Operation: 0˚ to +50˚C, <80% (non-condensing)[*8], Storage: –20˚ to +60˚C		
	Vibration: MIL-T-28800E Class 3, Dust and Drip proof: IP 51		
EMC	EN61326-1, EN61000-3-2		
LVD	EN61010-1		
Laser Safety	IEC 60825-1: 2007 CLASS 1: MU909011A3-050/060/052/062[*10] 21CFR1040.10[*11]		

∗1: @25˚C
∗2: Averaging: 10 seconds, SNR = 1, 25˚C
∗3: Return loss 45 dB, Deviation ±0.5 dB, 25˚C
∗4: Return loss: 45 dB, 25˚C (1.5 dB down from the peak of Fresnel)
∗5: CW input, –20 dBm @ 1550 nm, 25˚C
∗6: back light low, sweeping halted at 25˚C
∗7: 10˚ to 30˚C, Power OFF
∗8: 10˚ to 30˚C (During Recharging battery, Power OFF)
∗9: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10, 1040.11 and IEC 60825-1; the following descriptive labels are affixed to the product.

THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

∗10: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10, 1040.11 and IEC 60825-1; the following descriptive labels are affixed to the product.

THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

∗11: Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007.
∗12: MU909011A3-002 Multimode Test Function installed and selected.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• Select Mainframe

Includes battery pack, AC charger/adapter, standard soft case and strap

Model/Order No.	Description
MT9090A	Mainframe (with color LCD)

• Select Module

Includes printed operation manual

Model/Order No.	Description
MU909011A3	Drop Cable Fault Locator Module (with visible laser diode and Power Meter)

• Select Module Option

Model/Order No.	Description
MU909011A3-050	1550 nm, single mode, UPC, visible laser diode, power meter
MU909011A3-060	1550 nm, single mode, APC, visible laser diode, power meter
MU909011A3-052	780 nm, single mode, UPC, visible laser diode, power meter
MU909011A3-062	780 nm, single mode, APC, visible laser diode, power meter

• Select Connector Adapter

One adapter included at no charge – must be added as a separate line item.

Model/Order No.	Connector Type
MU909011A-037	FC Connector (UPC: Models -050 and -052 only)
MU909011A-038	ST Connector (UPC: Models -050 and -052 only)
MU909011A-039	DIN 47256 Connector (UPC: Models -050 and -052 only)
MU909011A-040	SC Connector (UPC: Models -050 and -052 only)
MU909011A-025	FC-APC Connector key width 2.0 mm (APC: Models -060 and -062 only)
MU909011A-026	SC-APC Connector (APC: Models -060 and -062 only)

• Select Software Option

Must be added as a separate line item.
Available for models -050, -060 only

Model/Order No.	Description
MU909011A3-002	Multimode Test Function

• Select Accessories

Must be added as separate line items.

Model/Order No.	Description
G0203A	AC adapter (Replacement)
G0202A	NiMH Battery Pack (Replacement)
Z1580A∗1	Protector & Soft Case
B0663A∗2	Protector
B0600B	Hard Case
B0601B	Standard Soft Case
Z1023A	Strap
B0602A∗3	Deluxe Soft Case (for MT9090A)
J1402A	Car plug cord
J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))
J1535A	LC-SC Plug-in Converter (for MM, SC(P)-LC(J))
W2988AE	MU909011A Operation Manual (Hardcopy)
W2989AE	MU909011A Operation Manual (CD)
OPTION-545VIP	Connector Inspection Microscope Kit
MU909011A3-ES210	12 month extended warranty (total 2 years warranty)
MU909011A3-ES310	24 month extended warranty (total 3 years warranty)

∗1: The protector (B0663A) and standard soft case (B0601B) from a set. The protector includes a shoulder strap.
∗2: The shoulder strap can be used to hang the instrument around the neck while working.
∗3: This does not accommodate the mainframe if the protector is fitted.

• Replacement Adaptors

Must be added as separate line items.

Model/Order No.	Description
J0617B	FC (UPC: Models -050 and -052 only)
J0618D	ST (UPC: Models -050 and -052 only)
J0618E	DIN (UPC: Models -050 and -052 only)
J0619B	SC (UPC or APC: all models)
J0739A	FC (APC: Models -060 and -062 only)

Network Master Series

MT9090A MAINFRAME
MU909020A OPTICAL CHANNEL ANALYZER MODULE

All 18 CWDM channels

Optical CWDM Channel Monitoring

The Network Master Optical Channel Analyzer (OCA) is a low price CWDM analyzer designed to measure and monitor power and wavelength over the 18 CWDM channels. This small, rugged and easy to use instrument is the ideal and essential mate of each technician for installation, maintenance and troubleshooting of CWDM access networks. Providing fast and reliable measurements in every environment, this modular device is a low cost alternative to more complex OSA for the emerging CWDM market.

Reliable Measurements at a Glance

Starting in less than 30 seconds and reaching stability after a warm-up time inferior to 5 minutes, the OCA is instantaneously operational to monitor CWDM networks.
Light, compact, with no moving part and battery operation, it is ideal for field applications.
Its friendly software interface, with comprehensive graph and table displays of wavelength and power levels and drifts, with pass and fail indicators, makes it easy to use for any skill level, reducing the need for training.
The OCA module is fully compliant with ITU-T G.695 and G.694.2 standards, comes with a universal optical connector, easy to clean by the operator, and is interchangeable with other Network Master modules, without the use of special tools and without requiring calibration.

Specifications

• MT9090A Mainframe

Dimensions and Mass	190 (W) × 96 (H) × 48 (D) mm (7.5” × 3.8” × 1.9”) (Including mainframe and module) <800 g (<2 lbs.) (including mainframe, module and battery)
Display	4.3-inch TFT-LCD (480 × 272, with backlight, transparent type)
Interface	USB 1.1, Type A × 1 (memory), Type B × 1 (USB mass storage)

• MU909020A Optical Channel Analyzer Module

Number of Channels	All 18 CWDM channels, compliant to ITU-T G.694.2
Channel Pass Band	±6.5 nm, compliant to ITU-T G.695
Channel Wavelength Accuracy	±1 nm*2
Power Range per Channel	–40 to +10 dBm
Channel Power Accuracy	±0.5 dB*1
Channel Power Linearity	±0.3 dB*2
Total Power Accuracy	±0.5 dB*1
Total Power Linearity	±0.3 dB*2
Maximum Total Safe Power	+17 dBm
Maximum Channel Safe Power	+13 dBm
Instrument Repeatability	±0.2 dB*1
Channel Imbalance (Adjacent Channels)	≥12 dB*2, *3

Continued on next page

Polarization Dependant Loss	±0.3 dB
Power Supply	9 V(dc), 100 V(ac) to 240 V(ac)
Battery	NiMH, Operating time: 4 hours (typ.)*4, Recharge time: <3 hours (typ.)*5, Operation possible with 4 × AA alkaline: operating time depends on batteries type
Environmental Conditions	Operating: 0° to +50°C*6, <80% (non-condensing)*7, Storage: –20° to +60°C
	Vibration: MIL-T-28800E Class 3, Dust and Drip proof: IP 51
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*1: Measured at –10 dBm
*2: Signal from –35 to +10 dBm
*3: for wavelengths spacing >15 nm. Channel imbalance >15 dB for wavelengths spacing >20 nm
*4: Backlight low
*5: 10° to 30°C, Power OFF
*6: Specifications are guaranteed from 10° to 40°C. Operation possible from 0° to 50°C.
*7: 10° to 30°C (During Recharging battery, Power OFF)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• Select Mainframe

Model/Order No.	Description
MT9090A	Mainframe (with color LCD)

• Select Base Module

Includes battery pack, AC charger/adapter, standard soft case, and strap, operation manual on CD

Model/Order No.	Description
MU909020A	Optical Channel Analyzer Module

• Select Connector Interface

Model/Order No.	Description
MU909020A-050	OCA with UPC Optical Connector
MU909020A-060	OCA with APC Optical Connector

• Select Connector Adapter

One adapter included at no charge – must be added as a separate line item.

Model/Order No.	Connector Type
MU909020A-037	FC Connector (UPC: Model -050 only)
MU909020A-040	SC Connector (UPC: Model -050 only)
MU909020A-025	FC-APC Connector key width 2.0 mm (APC: Model -060 only)
MU909020A-026	SC-APC Connector (APC: Model -060 only)

• Select Accessories

Must be added as separate line items.

Model/Order No.	Description
G0203A	AC adaptor (Replacement)
G0202A	NiMH Battery Pack (Replacement)
Z1580A*1	Protector & Soft Case
B0663A*2	Protector
B0600B	Hard Case
B0601B	Standard Soft Case
Z1023A	Strap
B0602A*3	Deluxe Soft Case (for MT9090A)
CD005568	Hardcopy MT9090A/MU909020A Operation manual
CD005780	Hardcopy MT9090A/MU909020A Quick Reference Guide
MU909020A-ES210	2 years Extended Warranty Service (total 2 years warranty)
MU909020A-ES310	3 years Extended Warranty Service (total 3 years warranty)

*1: The protector (B0663A) and standard soft case (B0601B) from a set. The protector includes a shoulder strap.
*2: The shoulder strap can be used to hang the instrument around the neck while working.
*3: This does not accommodate the mainframe if the protector is fitted.

• Replacement Adaptors

Must be added as separate line items.

Model/Order No.	Description
J0617B	Replaceable Optical Connector (FC-PC) (UPC: Models -050)
J0619B	Replaceable Optical Connector (SC) (UPC or APC: all models)
J0739A	Replaceable Optical Connector (FC · APC) (APC: Model -060 only)

LIGHT SOURCE/OPTICAL POWER METER

CMA5 Series

Optical Loss Tester/Light Source 850, 1300, 1310, 1550 nm/Optical Power Meter 850, 1300, 1310, 1490, 1550, 1625 nm

Compact and Lightweight for Optical Fiber Installation and Maintenance

The CMA5 series (Optical Loss Tester/Light Source/Optical Power Meter) measures optical loss and power for optical fiber I&M. The CMA5 series are compact and lightweight, its excellent cost performance and simple operation with the required minimum number of functions make it ideal for onsite I&M. Service engineers can choose from three models — optical loss tester, optical source, and optical power meter — to match the onsite application.

Features

Optical Loss Tester

- All-in-one light source and optical power meter supporting SM (1310 nm/1550 nm) and MM (850 nm/1300 nm) fiber
- Compact and lightweight (300 g)
- Measures +23 dBm max. optical power*1
- 20 hours of battery (dry cell) operation*2
- Useful fiber identification modulation function (270 Hz, 1 kHz, 2 kHz and CW)

*1: SM type (CATV model) only
*2: With 9-V alkaline batteries using optical source and optical power meter

Light Source

- Supports MM model (850 nm/1300 nm), SM model (1310 nm/1550 nm)
- Lightweight at only 250 g
- 16 hours of continuous running with 9 V alkaline battery
- Light source for fiber identification (270 Hz, 1 kHz, 2 kHz and CW)

Optical Power Meter

- Lightweight at only 250 g
- 40 hours of continuous running with 9 V alkaline battery
- Measures up to +23 dBm optical power*3

*3: CATV model

Specifications

- **Optical Loss Tester**

Optical Loss Tester*	
SM Model	1310 nm/1550 nm (Power Meter: Standard)
	1310 nm/1550 nm (Power Meter: CATV)
MM Model	850 nm/1300 nm

*:One 9 V alkaline battery as standard. No AC adapter.

Model	5LT35	5LT35C	5LT83
Light Source Port			
Supported Optical Fiber	10 µm/125 µm SM fiber, PC-polished		62.5 µm/125 µm MM fiber, PC-polished
Emitter Type	LD		
Wavelength	1310 nm/1550 nm ±20 nm		850 nm/1300 nm ±20 nm
Output Power	≥–7 dBm		≥–7 dBm*1
Source Line Width (FWHNM)	≤5 nm		
Modulation Output	CW, 270 Hz, 1 kHz, 2 kHz (±2%)		
Stability	±0.05 dB/15 minutes		
	±0.10 dB/8 hours (1310 nm/1550 nm) ±0.15 dB/8 hours (850 nm/1300 nm)		
Connector Type	FC/PC, SC/PC, ST/PC (user replaceable)		
Optical Power Meter Port			
Supported Optical Fiber	SM (10 µm/125 µm) MM (50 µm/125 µm, 62.5 µm/125 µm)		
Detector Type	InGaAs		
Calibrated Wavelength	850, 1300, 1310, 1490, 1550, 1625 nm		
Measurement Range*2	–60 to +5 dBm –50 to +10 dBm (850 nm)	–40 to +23 dBm	–60 to +5 dBm –5 to +10 dBm (850 nm)
Accuracy*2	±0.2 dB @ –10 dBm (±0.5 dB @ 850 nm)		
Linearity*2	±0.2 dB		±0.5 dB
Display Resolution	0.01 dB		
Auto-Zero Setting	Supported		
Warm-up Time	60 s		
Connector Type	FC, SC, ST (user replaceable)		
General Specifications			
Input Power	9 V Alkaline battery, or optional AC adapter (input:100 V to 240 V, 50 Hz to 60 Hz, output:7.5 V)		
Battery Operation	40 hours min. (Optical Power Meter) 20 hours min. (Optical Power Meter & Light Source)		
Auto Off Function	5 minutes		
Others	Reference setting function, Loop loss testing function		

Continued on next page

Model	5LT35	5LT35C	5LT83
Operating Temperature Range	–10° to +50°C		
Storage Temperature Range	–25° to +60°C		
Relative Humidity	0 to 95% (no condensation)		
Dimensions	75 (W) × 145 (H) × 25 (D) mm (2.9 × 5.7 × 1 inch) (Excluding Rubber Protective Cover)		
Mass	300 g (0.66 lbs) or less (Excluding Rubber Protective Cover and 9 V Alkaline Battery)		
Warranty	3 years		
Laser Safety*3	IEC 60825-1:2007 CLASS1, 21CFR 1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007		
EMC	EN61326-1, EN61000-3-2		

Specifications assured at 25°C (±3°C)

∗1: If a 50 µm/125 µm MM fiber is connected to the optical output port, the rated output power (≥–7 dBm) can not be obtained due to differences in core diameter, NA, and fiber excitation condition. The optical output power can drop by about 2 to 10 dB from the rated output power.

∗2: When GI fiber (62.5 µm/125 µm) is connected to optical power meter port.

∗3: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC60825-1; the following descriptive labels are affixed to the product.

IEC 60825-1: 2007
CLASS 1 LASER PRODUCT

THIS PRODUCT COMPLIES WITH 21 CFR 1040. 10 AND 1040. 11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

• Light Source

Light Source*	
SM Model	1310 nm/1550 nm
MM Model	850 nm/1300 nm

∗:One 9 V alkaline battery as standard. No AC adapter.

Model/Order No.	5L83	5L35
Emitter Type	LD	
Wavelength	850/1300 ±20 nm	1310/1550 ±20 nm
Output Power*1	–7 dBm*2(62.5 µm/125 µm MM fiber)	–7 dBm (SM fiber)
Source Line Width (FWHM)	<5 nm	
Modulation Output	CW, 270 Hz, 1 kHz, 2 kHz	
Stability (8 hours)	±0.1 dB (25°C)	
Connector Type	FC, ST, SC (User replaceable)	
Battery Operation Time	16 h (9 V alkaline battery)	
Input Power	9 V (9 V alkaline battery)	
AC Adapter (Option)	Input: 100 V to 240 V, 50 Hz to 60 Hz, Output: 7.5 V	
Operating Temperature Range	–10° to +50°C	
Storage Temperature Range	–25° to +60°C	
Relative Humidity	0 to 95% (no condensation)	
Dimensions	75 (W) × 145 (H) × 25 (D) mm (excl. rubber cover)	
Mass	250 g	
Warranty	3 years	
Laser Safety*3	IEC 60825-1:2007 CLASS 1 21CFR 1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007	
EMC	EN61326-1, EN61000-3-2	

∗1: Typical (25°C)

∗2: If a 50 µm/125 µm MM fiber is connected to the optical output port, the rated output power (≥–7 dBm) can not be obtained due to differences in core diameter, NA, and fiber excitation condition. The optical output power can drop by about 2 to 10 dB from the rated output power.

∗3: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

IEC 60825-1: 2007
CLASS 1 LASER PRODUCT

THIS PRODUCT COMPLIES WITH 21 CFR 1040. 10 AND 1040. 11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

• Optical Power Meter

Optical Power Meter* (Calibrated for 850, 1300, 1310, 1490, 1550, and 1625 nm)	
Standard Model	–60 to +10 dBm
CATV Model	–50 to +23 dBm

∗: One 9 V alkaline battery as standard. No AC adapter.

Model/Order No.	5P100	5P100C
Connector Type	FC, SC, ST (User replaceable)	
Fiber Type	MM, SM	
Detector Type	InGaAs-PD	
Calibrated Wavelength	850/1300/1310/1490/1550/1625 nm	
Measurement Range	–60 to +10 dBm –50 to +10 dBm (850 nm)	–50 to +23 dBm
Accuracy*1	±0.2 dB, ±0.5 dB (850 nm)	
Linearity*2	±0.2 dB @ 1310/1550 nm (–60 to +5 dBm) ±0.5 dB @ 850 nm (–50 to +5 dBm)	±0.2 dB @ 1310/1550 nm (–40 to +23 dBm) ±0.5 dB @ 850 nm (–40 to +23 dBm)
Display Resolution	0.01 dB	
Modulation Detection	2 kHz modulation	
Display	4-digit, 7-segment display LCD	
Others	Reference setting function, battery level display, automatic power OFF	
Battery Operation Time	40 hours min. (9 V alkaline battery)	
Input Power	9 V (one alkaline battery)	
AC Adapter (Option)	Input: 100 V to 240 V, 50 Hz to 60 Hz, Output: 7.5 V	
Operating Temperature Range	–10° to +50°C	
Storage Temperature Range	–25° to +60°C	
Relative Humidity	0 to 95% (no condensation)	
Dimensions	75 (W) × 145 (H) × 25 (D) mm (excl. rubber cover)	
Mass	250 g	
Warranty	3 years	
EMC	EN61326-1, EN61000-3-2	

∗1: –10 dBm, 25°C (typ.)

∗2: 25°C

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• Optical Loss Tester

Model/Order No.	Description
	Main frame
5LT35-YY*	Optical Loss Tester 1310 nm/1550 nm (Standard Power Meter)
5LT35C-YY*	Optical Loss Tester 1310 nm/1550 nm (CATV Power Meter)
5LT83-YY*	Optical Loss Tester 850 nm/1300 nm (Standard Power Meter)
	Standard accessories
	CMA5 Optical Loss Tester Operation Manual: 1 pc
	Rubber Protective Cover: 1 pc
	9 V Alkaline Battery: 1 pc
	Accessories
GN-3HH-CASE	Hard Case (for two CMA5 series)
CMA5-POUCH-A	Carrying Pouch/Shoulder Strap
CMA5-BAT	9 V Alkaline Battery
Z1525A	AC Adapter (CMA5)
CMA5-AD-LS-FC	FC Connector Adapter (Light Source Port)
CMA5-AD-LS-SC	SC Connector Adapter (Light Source Port)
CMA5-AD-LS-ST	ST Connector Adapter (Light Source Port)
CMA5-AD-LS-ALL3	Connector Adapter (FC, SC and ST)
CMA5-AD-PM-FC	FC Connector Adapter (Power Meter Port)
CMA5-AD-PM-SC	SC Connector Adapter (Power Meter Port)
CMA5-AD-PM-ST	ST Connector Adapter (Power Meter Port)
CMA5-AD-PM-ALL3	Connector Adapter (FC, SC and ST)
J1530A	SC Plug-in Converter (UPC(P)-APC(J))
J1532A	FC Plug-in Converter (UPC(P)-APC(J))
J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))
J1535A	LC-SC Plug-in Converter (for MM, SC(P)-LC(J)) ∗62.5 µm/125 µm type

∗: Specify one connector adapter at YY (FU = FC/PC, SU = SC/PC, TU = ST/PC).

The specified connector adapter is fitted at each optical source and power meter connector.

• Light Source

Model/Order No.	Description
	Main frame
5L35-YY*	Light Source:1310 nm/1550 nm (Dual wavelength for SM fiber)
5L83-YY*	Light Source:850 nm/1300 nm (Four wavelength for MM fiber)
	Standard accessories
	CMA5 Operation Manual: 1 pc
	Rubber Protective Cover: 1 pc
	9 V Alkaline Battery: 1 pc
	Accessories
GN-3HH-CASE	Hard Case (for two CMA5 series)
CMA5-POUCH-A	Carrying Pouch/Shoulder Strap
CMA5-BAT	9 V Alkaline Battery
Z1525A	AC Adapter (CMA5)
CMA5-AD-LS-FC	FC Connector Adapter
CMA5-AD-LS-SC	SC Connector Adapter
CMA5-AD-LS-ST	ST Connector Adapter
CMA5-AD-LS-ALL3	Connector Adapter (FC, SC and ST)

∗: Specify one connector adapter for YY.
FU=FC/PC, SU=SC/PC, TU=ST/PC, FA=FC/APC, SA=SC/APC
(FA=FC/APC and SA=SC/APC cannot be selected for 5L83-YY.)

• Optical Power Meter

Model/Order No.	Description
	Main frame
5P100-YY*	Optical Power Meter (Standard): –60 to +10 dBm
5P100C-YY*	Optical Power Meter (CATV): –50 to +23 dBm
	Standard accessories
	CMA5 Operation Manual: 1 pc
	Rubber Protective Cover: 1 pc
	9 V Alkaline Battery: 1 pc
	Accessories
GN-3HH-CASE	Hard Case (for two CMA5 series)
CMA5-POUCH-A	Carrying Pouch/Shoulder Strap
CMA5-BAT	9 V Alkaline Battery
Z1525A	AC Adapter (CMA5)
CMA5-AD-PM-FC	FC Connector Adapter
CMA5-AD-PM-SC	SC Connector Adapter
CMA5-AD-PM-ST	ST Connector Adapter
CMA5-AD-PM-ALL3	Connector Adapter (FC, SC and ST)

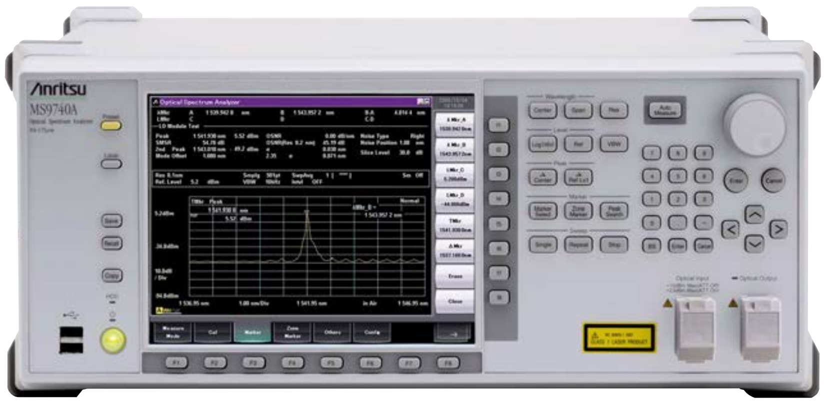
∗: Specify one of FC, SC or ST connector adaptor for YY.

OPTICAL SPECTRUM ANALYZER
MS9740A
600 nm to 1750 nm

Remote Control
GPIB OPTION | Ethernet

Improved Production Efficiency, Reduces Measurement and Inspection Times

Excellent Eco Product

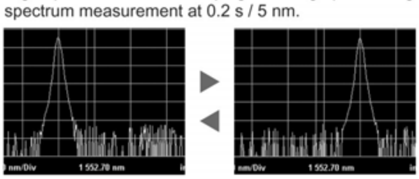


Reduce the manufacturing costs is a key issue for vendors of active optical devices. Measuring instruments for device evaluation are expected to increase productivity by shortening inspection times.
The MS9740A Optical Spectrum Analyzer reduces the total time from waveform sweeping to data transfer to external control equipment and supports simple analysis procedures, offering excellent cost performance and better productivity.

Reduces the Time from Waveform Sweeping to Data Transfer by 80% Compared to Previous Models

Waveform Sweeping — **Spectrum Measurement at 0.2 s / 5 nm Sweeping**

High-speed waveform sweeping and range processing support spectrum measurement at 0.2 s / 5 nm.



The spectrum change and variation in noise level can be monitored and the waveform light source can be switched.

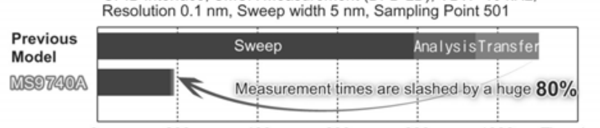
Analysis — **Eight Analysis Menus**

- LD-Module
- DFB-LD
- FP-LD
- LED
- PMD
- WDM
- Opt. Amp
- Opt. Amp (Multi-channel)

Data Transfer — **Instant Data Transfer**

Data is transferred at high speed from waveform sweeping to external controller equipment.

GPIB Interface, SMSR Measurement (DFB-LD), VBW=10 kHz, Resolution 0.1 nm, Sweep width 5 nm, Sampling Point 501



Ideal Solution for Active Optical Device Evaluation

This all-in-one unit has the performance and functions for evaluating all active optical devices, including SFP, XFP, and SFP+ modules, as well as optical transceivers and VCSEL and DFB optical sources. Evaluation results, such as center wavelength, level, spectrum, SMSR, OSNR, etc., are displayed on one screen. Combination with a Bit Error Rate Tester (BERT) supports spectrum analysis of optical transceiver outputs and WDM signals.

- **Wavelength sweep time <0.2 s**
- **Built-in application for optical active device evaluation (LD module test)**
- **Option for multimode measurements (MS9740A-009 Multimode Fiber Interface (50/62.5 µm) option)**
- **Supports LC connector using conversion adapter**
- **All-in-one function (MM mode) supporting SM and MM fiber***

*: This function is installed in the standard MS9740A model. Connection loss when connecting 50 µm/125 µm multimode optical fiber to the standard MS9740A model degrades the minimum light reception sensitivity.
The optical loss level is corrected when the MM mode is On. Since connection loss differs according to the excitation state, it causes some error in the level display.
The MS9740A-009 Multimode Fiber Interface option is designed for multimode connections to the optical input section; it supports measurements with high optical sensitivity and high sweep speeds when using a MM fiber with a core diameter of 62.5 µm and a NA of ≤0.275.
Although the MS9740A-009 option can also be used to measure SM fiber, some features are different from the standard MS9740A model. For details refer to the MS9740A and MS9740A-009 specifications.

Supports High Resolution and Wide Dynamic Range Required for WDM Signal Evaluation

The wide dynamic range and high resolution support OSNR analysis of WDM signals, etc.

- **Dynamic range >58 dB (at 0.4 nm from peak wavelength)**
- **– 90 dBm lowest optical sensitivity**
- **30 pm minimum resolution**
- **±20 pm wavelength accuracy (C/L band, at wavelength calibration using wavelength calibration light source)**
- **Supports signal level integration function supporting modulation signals**
- **Accurate noise position estimation using noise fitting function**
- **Supports optical axis alignment, wavelength calibration, effective resolution calibration functions**

Easy to View and Easy to Use with Large 8.4" Display, Full Interface Line-up, and Storage Functions

Increasing the screen to 8.4 inches makes operation much easier than previous generations, while dedicated front-panel function keys simplify procedures like setting wavelength sweep width, resolution, measurement sensitivity, markers, etc., supporting intuitive operation. Built-in Ethernet (TCP/IP) and GPIB (option) interfaces support transfer of measurement screen capture files to an external PC at remote operation. In addition, the large internal memory can save up to 1000 measurement files. Files can also be exchanged between the main unit and PC via the USB port.
The embedded Windows OS simplifies measurement menu selection and parameter setting with familiar PC-like mouse operations.

- **8.4-inch large LCD**
- **Ethernet, GPIB (option) external interface**
- **USB storage function**

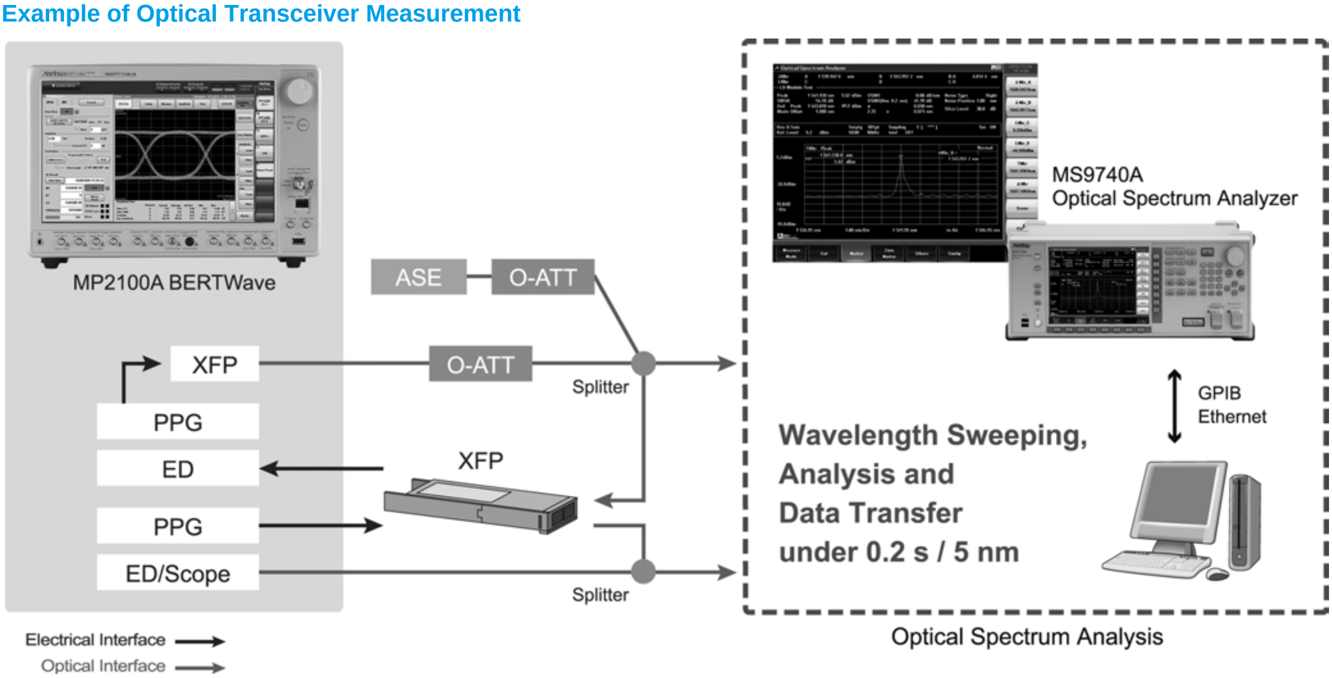
Windows® is a registered trademark of Microsoft Corporation in the USA and other countries.

Lightweight, 50% Less Power Consumption

The MS9740A is 10% lighter than the MS9710C, offering easy portability, and power consumption is halved using a resource-friendly design.

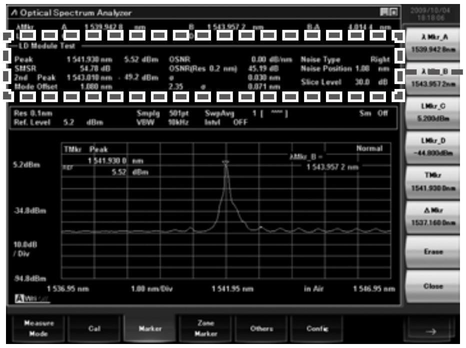
- **Low power consumption at <75 VA**
- **Compact and quiet bench-top analyzer weighing <15 kg**

Example of Optical Transceiver Measurement



• LD Module Test Analysis

This application measures test items such as center wavelength, optical level, OSNR, etc., required for LD module tests, and displays the results on one screen. The center wavelength, optical level, OSNR (per nm), side mode suppression ratio (SMSR) and 20 dB down spectrum width of LD modules can be measured. The center wavelength and spectrum half-width (FWHM) of FP-LDs are measured using the RMS method. Both SM and MM fibers are supported by one unit, helping cut equipment costs.



LD Module Test Items
- Center wavelength, Level
- OSNR (actual measured value)
- OSNR (noise level per nm)
  - ∗ OSNR noise level specified from Higher, Left, Right, (L+R)/2 or distance from peak wavelength
- SMSR
- Side mode peak wavelength, Level
- Spectrum width (n dB, RMS method, Standard deviation)

LD Module Test

The wavelength sweep time changes according to the VBW and measurement wavelength range; the relationship is shown in the following table.

Relationship between VBW, Sweep Speed, and Minimum Optical Reception Sensitivity∗1

VBW	10 Hz	100 Hz	200 Hz	1 kHz	2 kHz	10 kHz	100 kHz	1 MHz
Sweep Speed (typ.)∗2	32 s	3.5 s	2 s	0.5 s	0.3 s	0.2 s	0.2 s	0.2 s
Min. Optical Reception Sensitivity∗3	–90 dBm	–80 dBm	–76 dBm	–70 dBm	–66 dBm	–60 dBm	–50 dBm	–40 dBm

∗1: Reference value and not guaranteed.
∗2: Center wavelength: 1200 nm, Span: 200 nm, No. of samples: 501, Normal dynamic range, Point Avg. 1, No optical input, Sweep start to end
∗3: Wavelength range: 1250 nm to 1600 nm, Resolution: >0.07 nm, Optical attenuator OFF, Sweep Avg. 10, SM fiber is used, 5° to 30°C

Various Functions, Easy Operability

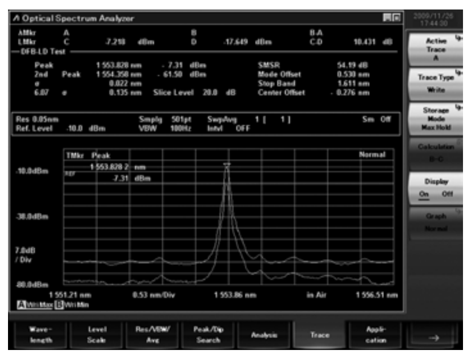
• Supports Eight Application Modes

The MS9740A supports eight application measurement modes (DFB-LD, FP-LD, LED, PMD, Opt. Amp, Opt. Amp (Multi-channel), WDM, LD Module) for measurement targets.
For example, at evaluation of LD characteristics, analysis items and methods can be tailored to the spectrum, such as a Single longitudinal mode laser (DFB-LD) spectrum, Multiple longitudinal mode laser (FP-LD), wideband LED, etc. Furthermore, analysis of each wavelength channel required by WDM signals is supported too. Combining test items into a menu supports easy batch measurement.

Application Name	Test Items
DFB-LD	Spectrum analysis of single longitudinal mode laser
FP-LD	Spectrum analysis of multiple longitudinal mode laser
LED	Spectrum analysis of wideband light source
PMD	PMD characteristics evaluation of optical fiber
Opt. Amp/Opt. Amp (Multi-channel)	Evaluation of fiber amp (EDFA) gain and NF characteristics
WDM	Spectrum evaluation of WDM for up to 300 wavelengths (channels)
LD Module	Evaluation of optical transceiver characteristics

• Various Trace Displays

In addition to the normal waveform displays, the MS9740A has a full range of flexible display modes including Max Hold for displaying peak levels at continuous sweeping, Min Hold for displaying dip level at continuous sweeping, Calculate for computing differences between traces, etc.
The Overlap function superimposes all swept waveforms on one screen. It is ideal for checking the wavelengths of optical sources and long-term level drift.



Max Hold, Min Hold Display Function

These display functions are convenient for confirming maximum and minimum levels at continuous sweeping.

• Modulated and Pulse Light Measurements

Measurement of modulated and pulsed optical signals requires synchronization with modulation. The trigger input connector on the rear panel of the MS9740A supports input of an external trigger synchronized to the internally modulated light, supporting measurement without data loss.

- **Wavelength Calibration Function for Accurate Measurements and Analysis**

Assuring reliable measurement and analysis requires measurement with the best accuracy and resolution, which in turn requires automatic alignment of the internal optical axis, wavelength calibration with an external light source, and resolution calibration.
A wavelength accuracy of ±20 pm is assured by calibrating the wavelength using the Light Source for Wavelength Calibration (Option 002) after automatic optical axis alignment. In addition, the MS9740A has a function for automatically calibrating wavelength if the ambient temperature and pressure change, based on the first calibration data. Calibration of effective resolution is important when measuring the noise level of a continuous spectrum, such as EDFA ASE, LDs, etc.

Item	Calibration
Automatic Optical Axis Alignment	Satisfy wavelength accuracy, level accuracy and dynamic range specifications
Wavelength Calibration	Calibrate wavelength using external light source and light source for wavelength calibration
Effective Resolution Calibration	Calibrate effective resolution for accurate noise level measurement

- **Remote Control via Ethernet and GPIB Interfaces**

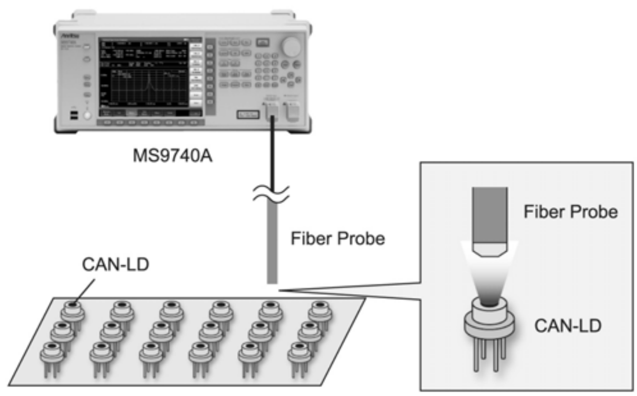
Remote control is supported over either the Ethernet or GPIB (option) interfaces, slashing the time from measurement start at the MS9740A to data capture at an external PC via the GPIB interface by 80% compared to previous measurement systems.

- **Backward Compatibility with MS9710/MS9780 Series Remote Commands**

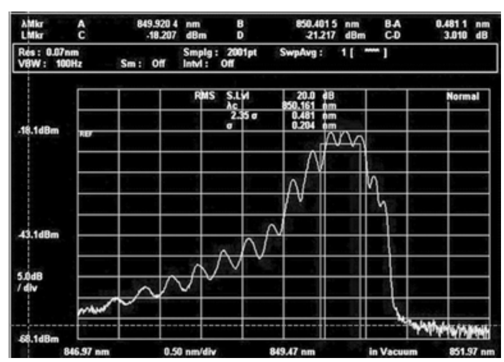
Support for almost all remote commands used by the previous MS9710 and MS9780 series of instruments assures smooth backwards compatibility and easy future-proof migration to newer instruments.

Optical Chip/CAN Device Evaluation

Evaluation systems for optical Chip/CAN devices must support efficient measurements of multiple devices and two key factors are short evaluation time as well as fast optical axis alignment time for each device. For example, irrespective of the LD type, optical axis alignment using MM fiber for receiving radiated light in a short time with good efficiency requires a lot of time consuming work. In this case, the optical spectrum analyzer finally receiving this light must also have the lowest possible connection loss and excellent high-speed sweep performance for waveform analysis.
The MS9740A-009 Multimode Fiber Interface (50/62.5 µm) option is ideal for evaluating optical devices mainly using this type of MM fiber.
The MS9740A-009 optical receiver section is optimized for MM fiber connections. Since extremely accurate sensitivity settings (VBW) are supported, MM fiber connection loss is kept to a minimum and the characteristics of multiple devices can be evaluated efficiently because the optimum sensitivity for level and SMSR measurements as well as high-speed sweeping conditions are both assured.
In addition, the MS9740A has high resolution even in the short wavelength band, and offers optimized applications for VCSEL, etc., evaluations.



Example of Device Characteristics Evaluation



850 nm VCSEL Spectrum Measurement Example

Specification

● MS9740A Optical Spectrum Analyzer

Supported Optical Fiber	SM fiber (ITU-T G.652), 50 µm/125 µm GI fiber[*1]
Optical Connector	User replaceable: FC, SC, ST, DIN
Wavelength Measurement Range	600 nm to 1750 nm
Wavelength Accuracy[*2]	±20 pm (1520 nm to 1620 nm, Resolution: 0.03 nm to 0.2 nm), ±100 pm (1520 nm to 1620 nm, Resolution: 0.5 nm, 1.0 nm)[*3] ±300 pm (600 nm to 1520 nm), ±200 pm (1520 nm to 1570 nm), ±300 pm (1570 nm to 1750 nm)[*4]
Wavelength Stability[*2]	≤±5 pm
Wavelength Linearity[*2]	±20 pm (1520 nm to 1620 nm)
Setting Resolution	0.03, 0.05, 0.07, 0.1, 0.2, 0.5, 1.0 nm (RBW: 3 dB optical filter: transmission bandwidth)
Resolution Accuracy[*2, *5]	±7% (Resolution: 0.1 nm), ±3% (Resolution: 0.2 nm), ±2.2% (Resolution: 0.5 nm) [1520 nm to 1620 nm] ±30% (Resolution: 0.1 nm), ±15% (Resolution: 0.2 nm), ±7% (Resolution: 0.5 nm) [600 nm to 1520 nm, 1620 nm to 1750 nm]
Measurement Range[*2]	–65 to +10 dBm (600 nm to 1000 nm), –85 to +10 dBm (1000 nm to 1250 nm), –90 to +10 dBm (1250 nm to 1600 nm), –85 to +10 dBm (1600 nm to 1650 nm), –65 to +10 dBm (1650 nm to 1700 nm), –55 to +10 dBm (1700 nm to 1750 nm) [5° to 30°C, VBW: 10 Hz, Sweep average: 10, Resolution: 0.07 nm to 1.0 nm, using SM fiber, Optical Att: Off] –60 to +10 dBm (600 nm to 1000 nm), –80 to +10 dBm (1000 nm to 1250 nm), –85 to +10 dBm (1250 nm to 1600 nm), –80 to +10 dBm (1600 nm to 1650 nm), –60 to +10 dBm (1650 nm to 1700 nm), –50 to +10 dBm (1700 nm to 1750 nm) [30° to 45°C, VBW: 10 Hz, Sweep average: 10, Resolution: 0.07 nm to 1.0 nm, using SM fiber, Optical Att: Off] –70 to +23 dBm (1100 nm to 1600 nm), [5° to 30°C, VBW: 10 Hz, Sweep average: 10, Resolution: 0.07 nm to 1.0 nm, using SM fiber, Optical Att: On] –65 to +23 dBm (1100 nm to 1600 nm), [30° to 45°C, VBW: 10 Hz, Sweep average: 10, Resolution: 0.07 nm to 1.0 nm, using SM fiber, Optical Att: On]
Level Accuracy[*2, *6]	±0.4 dB (Wavelength: 1310 nm, 1550 nm, Input: –10 dBm, Resolution: 0.1 nm to 1.0 nm)
Level Stability[*2]	±0.02 dB (1 min, Wavelength: 1550 nm, Input: –23 dBm, Resolution: 0.1 nm to 1.0 nm, no polarization fluctuation)
Level Linearity[*2]	±0.05 dB (Wavelength: 1550 nm, Input: –50 to 0 dBm, Optical Att: Off) ±0.05 dB (Wavelength: 1550 nm, Input: –30 to +20 dBm, Optical Att: On)
Level Flatness[*2, *7]	±0.1 dB (Wavelength: 1520 nm to 1620 nm, Resolution: 0.5 nm, Optical Att: Off)
Polarization Dependency[*2]	±0.05 dB (Wavelength: 1550 nm/1600 nm), ±0.1 dB (Wavelength: 1300 nm), [Resolution: 0.5 nm, 1.0 nm]
Dynamic Range[*2]	High dynamic range: 70 dB (1 nm from peak wavelength), 60 dB (0.4 nm from peak wavelength), 42 dB (0.2 nm from peak wavelength) Normal dynamic range: 62 dB (1 nm from peak wavelength), 58 dB (0.4 nm from peak wavelength), 42 dB (0.2 nm from peak wavelength) [Wavelength: 1550 nm, Resolution: 0.05 nm, Optical Att: Off, 20° to 30°C]
Optical Return Loss[*2]	≥35 dB (1310 nm, 1550 nm)
Sweep	Sweep width: 0.2 nm to 1200 nm, 0 nm Sweep speed: ≤0.2 s (span: 5 nm, Resolution: 0.1 nm), ≤0.3 s (span: 500 nm) [VBW: 10 kHz, Normal dynamic range, center 1550 nm (span: 5 nm), 1200 nm (span: 500 nm), sweep start to stop, no optical input, sampling point: ≤501]
Sampling Point	51, 101, 251, 501, 1001, 2001, 5001, 10001, 20001, 50001
Display	800 × 600 dots, 8.4 inch SVGA color LCD
Function	Measurement functions: Auto Measure, Optical pulse measurement (External trigger), Power monitor Display functions: Normal, Normalize, Max hold, Min hold, Value in Air/Vacuum, Effective resolution, Multimode fiber, Overlap Analysis functions: Waveform difference function, Marker function, Waveform analysis (Threshold, n dB-Loss, Envelope, RMS, SMSR, Spectrum Power), Light source (FP-LD, DFB-LD, LED, LD-Module), Opt. Amp, PMD, WDM Calibration functions: Auto Align, Wavelength cal., Level offset, Wavelength offset Memory function: Display measurement data to memory A to J (10 waveforms) Interfaces: Ethernet, GPIB (Option) I/O: I/O: Save and read files to USB memory Input: External trigger terminal (0 to 0.8 V/2 V to 5 V, high impedance) Output: Measurement data text file, measurement screen file (BMP, PNG), VGA output terminal, keyboard, mouse
Operating Conditions	Operating temperature: +5° to +45°C, Storage temperature: –20° to +60°C, Relative humidity: 0 to 90% (no condensation)
Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac), 50 Hz to 60 Hz, ≤75 VA
Dimensions and Mass	426 (W) × 177 (H) × 350 (D) mm (excluding projections), ≤15.0 kg (without options)
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*1: The connection loss when connecting 50 µm/125 µm multimode optical fiber degrades the minimum light reception sensitivity.
The MS9740A has an MM mode function to correct correction loss when connecting 50 µm/125 µm multimode optical fiber and to display the level.
The optical loss level is corrected when the MM mode is On. It corrects the level by 14 dB (sum).
Level display errors occur if light is input under other excitation conditions.

*2: Using SM fiber (ITU-T G.652), after 2 hours of warm-up (The Repeat sweeping performed at span 100 nm or more and VBW 10 kHz or more during the warm-up operation), after Auto Align, at stable room temperature

*3: Built-in MS9740A-002, after Wl cal (ref) wavelength calibration execution, at stable room temperature

*4: After Wl cal (Ext) wavelength calibration execution by external light source, such as Single Longitudinal mode laser (DFB-LD)

*5: Effective resolution, after Res-cal, using SM fiber

*6: Using master FC connector, 23° ±5°C

*7: 10° to 30°C

• MS9740A-009 Multimode Fiber Interface (50/62.5 µm)

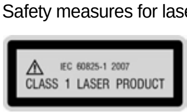
Supported Optical Fiber	SM fiber (ITU-T G.652), 50 µm/125 µm GI fiber[*1], 62.5 µm/125 µm GI fiber[*1]
Optical Connector	User replaceable: FC, SC, ST, DIN
Wavelength Measurement Range	600 nm to 1750 nm
Wavelength Accuracy[*2]	±50 pm (1530 nm to 1570 nm)[*3], ±100 pm (1530 nm to 1570 nm)[*4]
	±300 pm (600 nm to 1750 nm)[*5]
Wavelength Stability[*2]	±5 pm (1 min, smoothing: 11 pt, at center wavelength of half maximum, Using SM fiber)
Setting Resolution	0.07, 0.1, 0.2, 0.5, 1.0 nm (RBW: 3 dB optical filter: transmission bandwidth)
Resolution Accuracy[*2]	±30% (Resolution: 0.1 nm), ±15% (Resolution: 0.2 nm), ±7% (Resolution: 0.5 nm) After Res-cal, using SM fiber, 633/1310/1550 nm
Measurement Range[*2]	–65 to +10 dBm (600 nm to 1000 nm), –85 to +10 dBm (1000 nm to 1250 nm), –90 to +10 dBm (1250 nm to 1600 nm), –75 to +10 dBm (1600 nm to 1700 nm), –55 to +10 dBm (1700 nm to 1750 nm) [5° to 30°C, VBW: 10 Hz, Sweep average: 10, Resolution: 0.07 nm to 1.0 nm, using SM fiber, Optical Att: Off]
	–60 to +10 dBm (600 nm to 1000 nm), –80 to +10 dBm (1000 nm to 1250 nm), –85 to +10 dBm (1250 nm to 1600 nm), –70 to +10 dBm (1600 nm to 1700 nm), –50 to +10 dBm (1700 nm to 1750 nm) [30° to 45°C, VBW: 10 Hz, Sweep average: 10, Resolution: 0.07 nm to 1.0 nm, using SM fiber, Optical Att: Off]
	–70 to +23 dBm (1100 nm to 1600 nm), [5° to 30°C, VBW: 10 Hz, Sweep average: 10, Resolution: 0.07 nm to 1.0 nm, using SM fiber, Optical Att: On]
	–65 to +23 dBm (1100 nm to 1600 nm), [30° to 45°C, VBW: 10 Hz, Sweep average: 10, Resolution: 0.07 nm to 1.0 nm, using SM fiber, Optical Att: On]
Level Accuracy[*2]	±0.6 dB (Wavelength: 1310 nm, 1550 nm, Input: –10 dBm, Resolution: 0.2 nm to 1.0 nm, using SM fiber, using master FC connector, 23 ±5°C)
Level Stability[*2]	±0.1 dB (1 min, Wavelength: 1550 nm, Input: –23 dBm, Resolution: 0.2 nm to 1.0 nm, no polarization fluctuation, using SM fiber, at stable room temperature)
Level Linearity[*2]	±0.1 dB (Wavelength: 1550 nm, Input: –50 to 0 dBm, using SM fiber, Optical Att: Off) ±0.1 dB (Wavelength: 1550 nm, Input: –30 to +20 dBm, using SM fiber, Optical Att: On)
Dynamic Range[*2]	High dynamic range: 70 dB (1 nm from peak wavelength, 20° to 30°C), 60 dB (0.5 nm from peak wavelength, 20° to 30°C) 65 dB (1 nm from peak wavelength, 5° to 45°C), 55 dB (0.5 nm from peak wavelength, 5° to 45°C) Normal dynamic range: 62 dB (1 nm from peak wavelength, 20° to 30°C), 58 dB (0.5 nm from peak wavelength, 20° to 30°C) 57 dB (1 nm from peak wavelength, 5° to 45°C), 53 dB (0.5 nm from peak wavelength, 5° to 45°C) [Wavelength: 1550 nm, Resolution: 0.07 nm, using SM fiber, Optical Att: Off]
Optical Return Loss[*2]	32 dB (Wavelength: 1310 nm, 1550 nm, using SM fiber, Optical Att: Off)
Sweep[*2]	Sweep width: 0.2 nm to 1200 nm, 0 nm
	Sweep speed: ≤0.2 s (span: 5 nm, Resolution: 0.1 nm), ≤0.3 s (span: 500 nm) [VBW: 10 kHz, Normal dynamic range, center 1550 nm (span: 5 nm), 1200 nm (span: 500 nm), sweep start to stop, no optical input, sampling point: ≤501]
Sampling Point	51, 101, 251, 501, 1001, 2001, 5001, 10001, 20001, 50001
Display	800 × 600 dots, 8.4 inch SVGA color LCD
Function	Measurement functions: Auto Measure, Optical pulse measurement (External trigger), Power monitor Display functions: Normal, Normalize, Max hold, Min hold, Value in Air/Vacuum, Effective resolution, Multimode fiber, Overlap Analysis functions: Waveform difference function, Marker function, Waveform analysis (Threshold, n dB-Loss, Envelope, RMS, SMSR, Spectrum Power), Light source (FP-LD, DFB-LD, LED, LD-Module), Opt. Amp, PMD, WDM Calibration functions: Auto Align, Wavelength cal., Level offset, Wavelength offset Memory function: Display measurement data to memory A to J (10 waveforms) Interfaces: Ethernet, GPIB (Option) I/O: I/O: Save and read files to USB memory Input: External trigger terminal (0 to 0.8 V/2 V to 5 V, high impedance) Output: Measurement data text file, measurement screen file (BMP, PNG), VGA output terminal, keyboard, mouse
Operating Conditions	Operating temperature: +5° to +45°C, Storage temperature: –20° to +60°C, Relative humidity: 0 to 90% (no condensation)
Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac), 50 Hz to 60 Hz, ≤75 VA
Dimensions and Mass	426 (W) × 177 (H) × 350 (D) mm (excluding projections), ≤15.0 kg (without options)
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*1: The NA is 0.2 for 50 µm/125 µm GI fiber and 0.275 for 62.5 µm/125 µm GI fiber.
*2: Warm-up the instrument for at least 2 hours before measurement by performing repeated sweeping at span ≥100 nm, VBW = 10 kHz. Perform waveform calibration after auto-optical alignment (WI Cal) and keep the instrument at the same temperature unless stated otherwise. Use either SM fiber (ITU-T G.652) or GI fiber (50 µm/125 µm) with a return loss of >40 dB, or GI fiber (62.5 µm/125 µm) with a return loss of >38 dB.
*3: Built-in MS9740A-002, after Wl Cal (Ref), with SM fiber and resolution at 0.07 nm to 0.2 nm
*4: Built-in MS9740A-002, after Wl Cal (Ref), with SM fiber and resolution at 0.5 nm/1.0 nm
*5: After Wl cal (Ext) wavelength calibration execution by external light source, such as DFB-LD, using SM fiber or GI fiber (50 µm/125 µm or 62.5 µm/125 µm)

• MS9740A-002 Light Source for Wavelength Calibration

Supported Optical Fiber	10 µm/125 µm SM fiber (ITU-T G.652)
Output Level	–40 dBm/nm (Reference wavelength, 10° to 30°C, Wavelength: 1550 nm ±20 nm, Resolution: 1 nm)
Output Level Stability	±0.04 dB (10 minutes after power-on, Wavelength: 1550 nm, Resolution: 1 nm, VBW: 100 Hz, Point Avg.: 20, Measurement time: 1 minute)
Laser Safety[*]	Class 1 (IEC 60825-1: 2007)

*: Safety measures for laser products. This option complies with optical safety standards in Class 1 of IEC 60825-1; The following descriptive labels are affixed to the product.



Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

(1) Specify the mainframe

Model/Order No.	Name
MS9740A	**Main Frame** Optical Spectrum Analyzer
Z1353A*1	**Standard Accessories** MS9740A Operation Manual (CD): 1 pc Power Cord: 1 pc

(2) Specify one optical connector

Model/Order No.	Name
	Options (Optical Connector)*2
MS9740A-037	FC Connector
MS9740A-038	ST Connector
MS9740A-039	DIN 47256 Connector
MS9740A-040	SC Connector

(3) Select an option from the list

Model/Order No.	Name
	Options (Interface)
MS9740A-001	GPIB Interface
MS9740A-101	GPIB Interface Retrofit
	Options (Light Source for Wavelength Calibration)*3, *4
MS9740A-002	Light Source for Wavelength Calibration
MS9740A-102	Light Source for Wavelength Calibration Retrofit
	Option (Multimode Fiber Interface)*5, *6
MS9740A-009	Multimode Fiber Interface (50/62.5 µm)

(4) Select the application parts, peripherals and consumables from the list

Model/Order No.	Name
	Application Parts
W3328AE	MS9740A Optical Spectrum Analyzer Operation Manual (Printed)
W3329AE	MS9740A Optical Spectrum Analyzer Remote Control Operation Manual (Printed)
J0617B	Replaceable Optical Connector (FC-PC)*7
J0618D	Replaceable Optical Connector (ST)*7
J0618E	Replaceable Optical Connector (DIN)*7
J0619B	Replaceable Optical Connector (SC)*7
J0635A	FC · PC-FC · PC-1M-SM (Optical Fiber Cord, 1.0 m)
J0635B	FC · PC-FC · PC-2M-SM (Optical Fiber Cord, 2.0 m)
J0635C	FC · PC-FC · PC-3M-SM (Optical Fiber Cord, 3.0 m)
J0660A	SC · PC-SC · PC-1M-SM (Optical Fiber Cord, 1.0 m)
J0660B	SC · PC-SC · PC-2M-SM (Optical Fiber Cord, 2.0 m)
J0660C	SC · PC-SC · PC-3M-SM (Optical Fiber Cord, 3.0 m)
J0893A	FC · PC-FC · PC-1M-GI (Optical Fiber Cord, 1.0 m)
J0893B	FC · PC-FC · PC-2M-GI (Optical Fiber Cord, 2.0 m)
J0839A	SC · PC-SC · PC-1M-GI (Optical Fiber Cord, 1.0 m)
J0839B	SC · PC-SC · PC-2M-GI (Optical Fiber Cord, 2.0 m)
J1534A	LC-SC Plug-in Converter (for SM, SC(P)-LC(J))
Z0914A	Ferrule Cleaner
Z0915A	Replacement Reel for Ferrule Cleaner
Z0284	Adapter Cleaner (Stick Type)
B0640B*8	Carrying Case
B0641A	Rack Mount Kit
J0008	GPIB Cable, 2.0 m
Z0541A	USB Mouse
Z0975A	Keyboard (USB)

*1: CD contains Operation Manual for Main Frame and Remote Control.
*2: One free specified optical connector for optical input port.
*3: When Light Source For Wavelength Calibration option selected, one more connector specified in (2) supplied free.
*4: Executing wavelength calibration with this option secures ±20 pm (1520 nm to 1620 nm, without MS9740A-009) accuracy. The MS9740A supports wavelength calibration with the external light source, such as DFB-LD, but this option assures higher accuracy. Refer to the specifications for details.
*5: Factory option and Retrofit not supported.
*6: MS9740A Optical Spectrum Analyzer standard not guaranteed. Refer to MS9740A-009 Multimode Fiber Interface Option Standard.
*7: Exchangeable-type optical connectors for optical input port and wavelength calibration light source output port.
*8: The Carrying Case includes a Front Panel Protective Cover (B0658A).

Ordering Configuration 1

(1) MS9740A Optical Spectrum Analyzer
(2) MS9740A-040 SC Connector
(3) MS9740A-001 GPIB Interface
(3) MS9740A-002 Light Source for Wavelength Calibration
(4) J0617B Optical Connector Adapter (FC) × 2 pcs

- When ordering the main frame, specify model name (1) and one connector from (2).
- Two SC connectors specified in (2) supplied free when light source for wavelength calibration option selected in (3).

Ordering Configuration 2

(1) MS9740A Optical Spectrum Analyzer
(2) MS9740A-037 FC Connector
(3) MS9740A-002 Light Source for Wavelength Calibration
(3) MS9740A-009 Multimode Fiber Interface (50/62.5 µm)

- When ordering the main frame, specify model name (1) and one connector from (2).
- Two FC connectors specified in (2) supplied free when light source for wavelength calibration option selected in (3).
- When MS9740A-009 specified with (3): specifications based on MS9740A-009 Multimode Fiber Interface (50/62.5 µm) Option.

OPTICAL FIBER IDENTIFIERS
FI700 Series

Single-hand Operation and Wide Detection Range

The FI700 Series of Optical Fiber Identifiers is the safe, economical and non-destructive way to identify active lit optical fibers. These rugged units use local detection technology, which employs a macro-bend method, eliminating the need to open the fiber at the splice point for identification.
All models detect continuous wave, live optical transmission and low frequency modulated tones at 270 Hz, 1 kHz, and 2 kHz. The presence of traffic, the direction of the transmission and modulated tones on the fiber are indicated by LEDs.

In addition, the FI720 models measure the fiber's relative power and displays the reading on a two-digit, seven-segment LED. This allows for measurement of power loss through a splice or connector.

Features and Benefits

- Detection of modulated tones; 270 Hz, 1 kHz, 2 kHz
- Single-hand operation
- Light weight (≤0.2 kg/7.5 oz.)
- Interchangeable head for ribbon, jacketed and coated fiber allows virtually any fiber to be identified
- Detects all light source and loss test set modulation frequencies

Optical Specifications

Model	FI710	FI720	FI720C
Insertion Loss	<0.5 dB*		
Spectral Response	800 nm to 1700 nm		
Optical Tone Receiver	270 Hz, 1 kHz and 2 kHz		
Maximum Range	–40 to 0 dBm	–40 to 0 dBm; ±2.0 dBm	–20 to +20 dBm; ±2.0 dBm
Relative Power	No	Yes	
Fiber Stress	None; Macro-bending		

∗: Mean Detectable Signal Power for single-mode fiber at 1310 nm.

Fiber Compatibility	Dual Window Single-mode	8 nm to 10 mm diameter
	Coating Diameter	250 mm diameter
	Coating	High refractive index acrylate
Optical Characteristics		(Using Corning 1528)
Minimum Fiber Slack		0.75 µm required for detection

General Specifications

Power Supply	One 9 volt Alkaline battery
Operation	Approximately 10,000 readings
Temperature Range	Operating: –20° to +50°C (–4° to 122° F) Storage: –40° to +60°C (–40° to 140° F)
Humidity	≤90%, non-condensing
Dimensions (W × H × D)	4.2 × 19.1 × 2.5 cm (1.3 × 7.5 × 1.0 inches)
Mass	≤0.2 kg (7.5 oz)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

A Fiber Identifier is a non-intrusive tool used to determine if a fiber has traffic on it prior to breaking the connection and interrupting service. All Fiber Identifiers operate on a 9-volt battery and include a 3 mm, 900 µm, ribbon adapter, manual, and carry case.

• Model Numbers:

FI710: Basic Optical Fiber Identifier
FI720: Optical Fiber Identifier with relative power reading
FI720C: High Power (CATV) Optical Fiber Identifier

• Fiber Identifier Accessories:

TD-30418	250 µm buffered fiber adapter
TD-30419	900 µm buffered fiber adapter
TD-30420	3 mm fiber adapter
TD-34788	2 mm adapter
TD-30421	Replacement leather pouch for Fiber Identifier

VISUAL FAULT LOCATOR
VFL650

Compact and Cost-effective Design

Now you can easily isolate high losses and faults in optical fiber cable with the VFL650 Visual Fault Locator. This handheld, visible laser source emits a bright beam of red light into a fiber, allowing you to see a break as a glowing or blinking red light. Two versions are available: one with a universal port for 2.5 mm ferrule connectors (FC, SC, ST, E2000, DIN), and one which includes an adapter that allows use with 1.25 mm ferrule connectors as well (LC, MU).

Key Features and Benefits

- Both CW and pulsed mode are available
- Lightweight (≤60 g)
- 40 hours continuous operation
- Cost effective solution

Optical Specifications

Emitter Type	Laser Diode
Wavelength (nm)	635 nm
CW Output Power	>–3 dBm (500 µW) into a single mode or multi mode fiber
Modulation Modes	CW or Pulsed (2 Hz to 3 Hz)
Range	>5 km
Power Supply	Two AAA alkaline batteries
Fiber Type	Multimode or Single-mode
Temperature Range	–10° to +50°C
Dimensions	Length: 168 mm, Diameter: 12 mm, Weight: ≤60 g
Laser Safety*	IEC 60825-1: 2007 Class 2 21CFR1040.10, 1040.11 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10, 1040.11 and IEC 60825-1; the following descriptive labels are affixed to the product.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

A Visual Fault Locator is a "red" light that allows users visually see the light in the fiber. This is a useful tool to aid in fiber identification and troubleshooting for macro bends and near end fiber breaks.

- **Model Number:**

VFL-650-250: VFL compatible with all 2.5 mm connectors
VFL-650-UNI: VFL adaptable to all 2.5 mm and 1.25 mm connectors
VFL-650-ADPT: VFL 2.5 mm to 1.25 mm adapter (only)

BARE FIBER ADAPTER
FiberConnect

Coupling Unterminated Fiber or Optical Components to Test Equipment

The FiberConnect is the ultimate time saving solution for coupling unterminated fiber or optical components to test equipment. By allowing the user to perform optical measurements without terminating, which requires additional equipment and procedures, test time can be significantly reduced over 50% compared to other methods. The low loss and highly repeatable connection made using the FiberConnect is similar to that of connectorized fiber.

Optical Specifications

Fiber Type Single-mode	9 µm/125 µm
Multimode	62.5 µm/125 µm or 50 µm/125 µm
Pigtail Length	1 m
Insertion Loss	<0.6 dB (typ.)
Number of Insertions	2000 (min.)
Back Reflectance	<–50 dB

General Specifications

Temperature Range	Operating: –10° to +50°C (14° to 122°F) Storage: –40° to +60°C (–40° to 140°F)
Connector Types	FC, ST, SC, D4, E2000, LC, DIN
Weight (With Cable)	≤90 g (3.2 oz)
Unit Size (W × H × D) (with suction cup)	35 × 32 × 35 mm (1.375 × 1.25 × 1.375 inches)
Case Size (W × H × D)	240 × 80 × 200 mm (9.5 × 3.5 × 8 inches)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

FiberConnect-X-XXX
X = 1: Single-mode 9 µm/125 µm
X = 2: Multimode 62.5 µm/125 µm
X = 3: Multimode 50 µm/125 µm
XXX=Connector and polish
UFC = Ultra FC
USC = Ultra SC
UST = Ultra ST
AFC = Angled FC (single mode only)
ASC = Angled SC (single mode only)

Package Includes
- FiberConnect
- Maintenance kit
- Magnetic stand
- Manual
- Cleaning brush
- Carrying case
- Index matching oil
- Spare pigtail
- 90 days warranty

BIT ERROR RATE TESTER (BERT)/ OSCILLOSCOPE

Selection Guide 82
Signal Quality Analyzer 83
50G/56 Gbit/s MUX, 50G/56 Gbit/s DEMUX.............. 94
4Tap Emphasis 99
BERTWave... 104

Selection Guide

Application \ Model	MP1800A Series Signal Quality Analyzer	MP1825B 4Tap Emphasis	MP1821A 50G/56 Gbit/s MUX	MP1822A 50G/56 Gbit/s DEMUX	MP2100A BERTWave	MP2101A BERTWave PE	MP2102A BERTWave SS
10 Gbit/s Optical Module Test	✓				✓	✓	✓
Active Optical Cable (AOC) Test	✓				✓	✓	✓
10 GE-PON Optical Module Test	✓				✓	✓	✓
16G FC/InfiniBand FDR (14G)	✓	✓					✓*
28 Gbit/s Interconnect Test	✓	✓					
40 Gbit/s DQPSK Optical Module Test	✓						
100 GbE Optical Module Test	✓						
40 Gbit/s Optical Module Test	✓		✓	✓			

*: Electrical Interface

SIGNAL QUALITY ANALYZER
MP1800A Series

Remote Control
GPIB OPTION | Ethernet OPTION
MP1800A

Small and Flexible Cost-efficient BER Test Solution

NEW

Excellent Eco Product

MP1800A

MT1810A

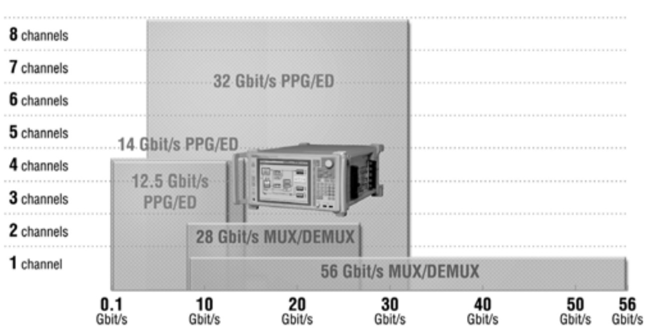
The MP1800A series Signal Quality Analyzer (SQA) is ideal for evaluation of physical layers for optical modules and high-speed devices ranging from 0.1 Gbit/s to 32.1 Gbit/s. The plug-in modular platform design makes it easy to customize a tailored system configuration. Combined use with the MP1821A 50G/56 Gbit/s MUX and MP1822A 50G/56 Gbit/s DEMUX supports BER tests up to 56 Gbit/s.

Features

• Wide Bandwidth 0.1 Gbit/s to 32.1 Gbit/s

Supports 0.1 Gbit/s to 32.1 Gbit/s bit rate thru module selection

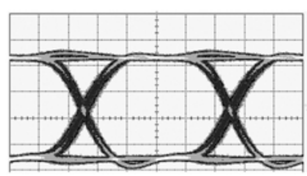
- 2.4 Gbit/s to 32.1 Gbit/s:
  MU183020A/21A, MU183040A/41A (Option-001)
- 2.4 Gbit/s to 28.1 Gbit/s: MU183020A/21A, MU183040A/41A
- 8 Gbit/s to 28.1 Gbit/s:
  MU182020A/21A, MU182040A/41A (Option-001/003)
- 8 Gbit/s to 28 Gbit/s:
  MU182020A/21A, MU182040A/41A (Option-001)
- 8 Gbit/s to 25 Gbit/s: MU182020A/21A, MU182040A/41A
- 0.1 Gbit/s to 14 Gbit/s: MU181020B, MU181040B (Option-002)
- 0.1 Gbit/s to 14.05 Gbit/s: MU181020B, MU181040B (Option-002/003)
- 0.1 Gbit/s to 12.5 Gbit/s: MU181020A, MU181040A (Option-002)
- 9.8 Gbit/s to 12.5 Gbit/s: MU181020A, MU181040A (Option-001)



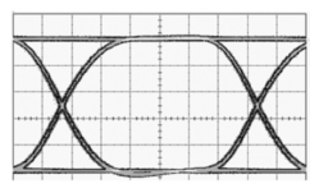
• Low-jitter High-quality Waveforms

The combination of low-jitter, high-quality output waveform, and high-amplitude output PPG and MUX modules can be tailored to the application.

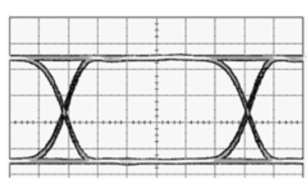
- Low Jitter: 8 ps p-p (MU181020A/B-012)
- High Amplitude: 0.5 Vp-p to 3.5 Vp-p
  (MU181020A/B-013, MU182020A/21A-013)



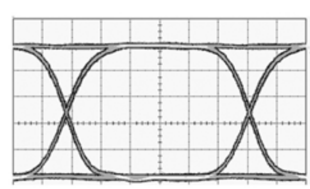
MU181020A-010



MU181020A-011



MU181020A-012

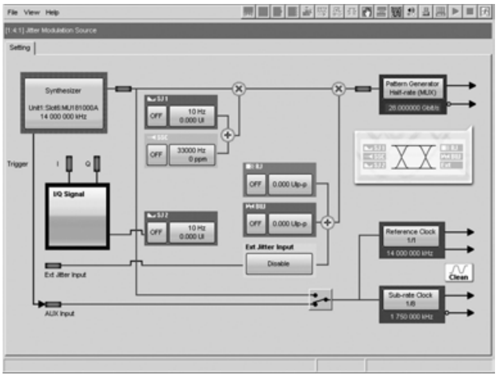


MU181020A-013

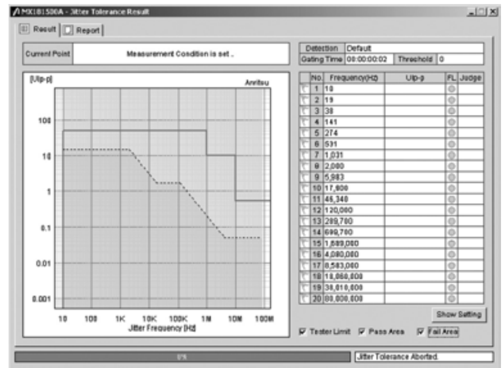
10 Gbit/s, PRBS31, Maximum amplitude

• SJ, RJ, BUJ and SSC Modulation Source Supporting Interconnect Standards up to 32.1 Gbit/s

The intrinsic jitter of the clock output from the MU181500B Jitter Modulation Source is less than 350 fs rms, supporting low-jitter clocks. The combination of low-jitter waveform with excellent jitter transparency supports high-accuracy jitter tolerance tests.
Moreover, simultaneous injection of RJ, BUJ and SSC as well as two SJ for two-tone support required by PCIe enables a variety of jitter tolerance tests. In addition, the MX181500A Jitter/Noise Tolerance Test Softwave supports multi-mask tables as standard as well as easy mask editing to support future next-generation standards.

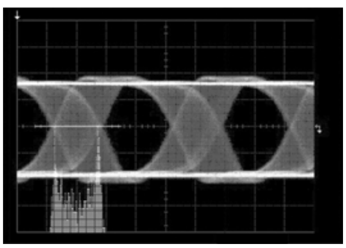


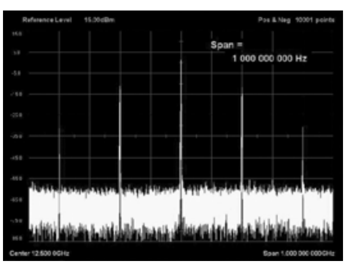
MU181500B Jitter Modulation Source setting screen



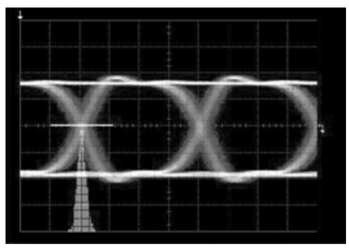
MX181500A Jitter/Noise Tolerance Test Software setting screen

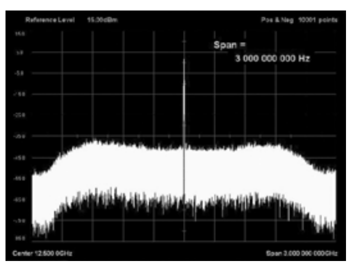
Sine-wave jitter (SJ)



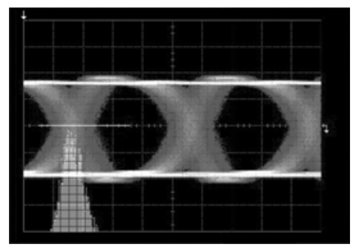


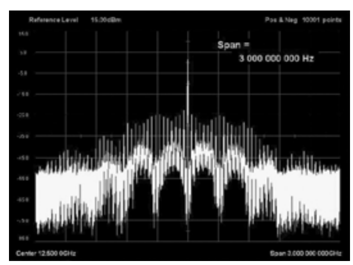
Random jitter (RJ)





Bounded uncorrelated jitter (BUJ)





• Versatile Pattern Generation

• Pseudorandom patterns (PRBS)
Because all PRBS rates required by the standards are supported up to PRBS2^{31} – 1, all BER are supported.
2^n – 1 (n = 7, 9, 10, 11, 15, 20, 23, 31)

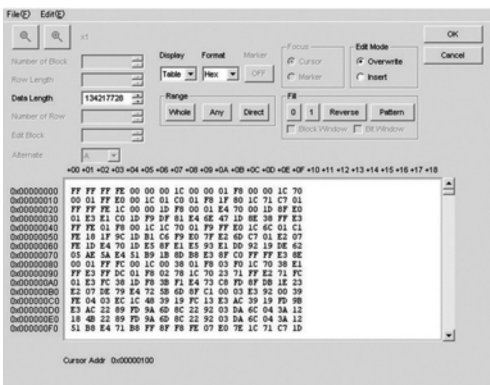
• Zero Substitution Pattern
All 0 s and All 1 s patterns can be added to PRBS patterns for performing CDR tolerance tests.
2^n, 2^n – 1 (n = 7, 9, 10, 11, 15, 20, 23)

• Data Pattern
Patterns required by each application can be created with flexibility.
128 Mbits max. (Steps: 1-bit)

• Alternate Pattern
Two patterns (A and B) can be set and the A/B pattern can be output at any timing.

• Mixed Pattern
A mixed data and PRBS pattern can be output. At creation of SONET/SDH frames, adding a PRBS2^{31} – 1, etc., pattern to the payload allows setting of a continuous pattern across frames.

• Sequence Pattern
A variety of programmable patterns can be output in any sequence and combining various patterns offers effective support for applications requiring sequence processing.



Data Pattern Setting Screen

• High Input Sensitivity & Wide Phase Margin

Using the high-input sensitivity ED Rx function supports direct input and evaluation of low-amplitude data.

• Input Sensitivity
MU181040A-001: <50 mVp-p
MU181040A/B-002: 10 mVp-p (typ.)

• Phase Margin
MU181040A/B-002: 60 ps (typ.) (12.5 Gbit/s)

• Burst Measurement

The following application evaluations using burst signals are supported.

• E-PON, G-PON, 10GE-PON Upstream Test
• Optical Loop Test
• Transmission Test using Quantum Noise Technology

• Optical Interface

Supports Two Optical Interface Types

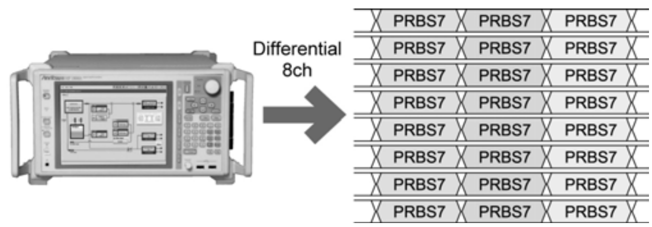
• MU181600A/01A
Supported wavelengths and bit rates for SFP and XFP modules can be customized freely by changing modules.

• MU181620A/40A
These options are used for the 10GbE stressed eye test; the output power and extinction ratio can be changed as necessary using the 0.1 Gbit/s to 12.5 Gbit/s wideband E/O, O/E converter.

• Multi-channel Configuration

Due to the modular platform design, the PPG/ED modules can be configured with various other modules to build a custom system. Additionally, crosstalk and skew tolerance are easily evaluated by synchronizing several PPG patterns and shifting phases.

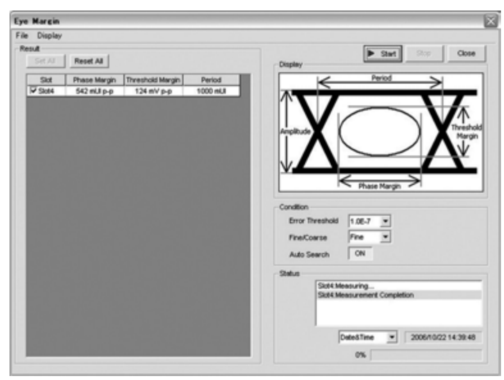
*: For details about possible module combinations, see the Option Selection Guide for the MP1800A series.



MP1800A Pattern Timing when Sending PRBS7 on All Channels (Pattern Sync)

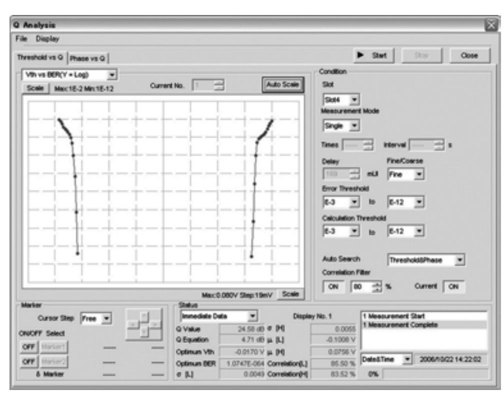
• Eye Margin

For confirming DATA threshold and phase margins.



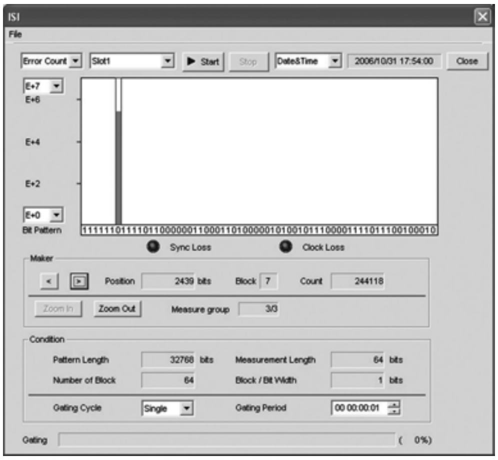
• Q Measurement

Calculates Q value from bit error rate using change in threshold value. Can be used to check change in Q value for clock phase.



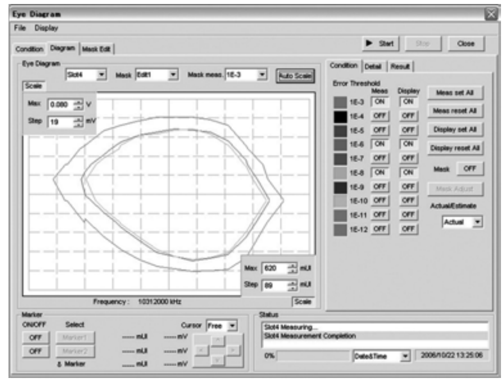
*: Functions and specifications are different according to the module. Refer to the Specification and Brochure for each module.

• Bit Error Analysis using ISI
Used to confirm bit error rate in each specified block or bit position and for bit error rate correlation with inter-symbol interference.

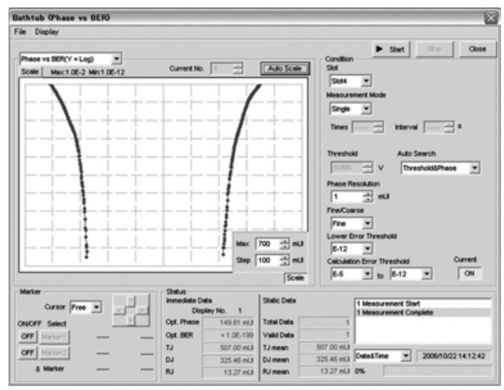


*: Functions and specifications are different according to the module.
Refer to the Specification and Brochure for each module.

• Eye Diagram
Used to obtain bit error rate contours linking specified bit error rate points.

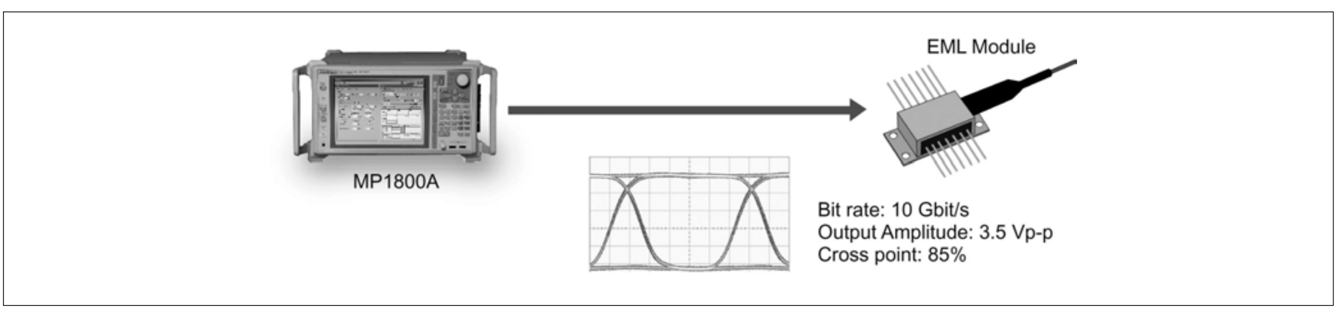


• Bathtub
Performs optimum bit error rate based on changes in bit error rate relative to phase. And performs jitter analysis (TJ, DJ, RJ).



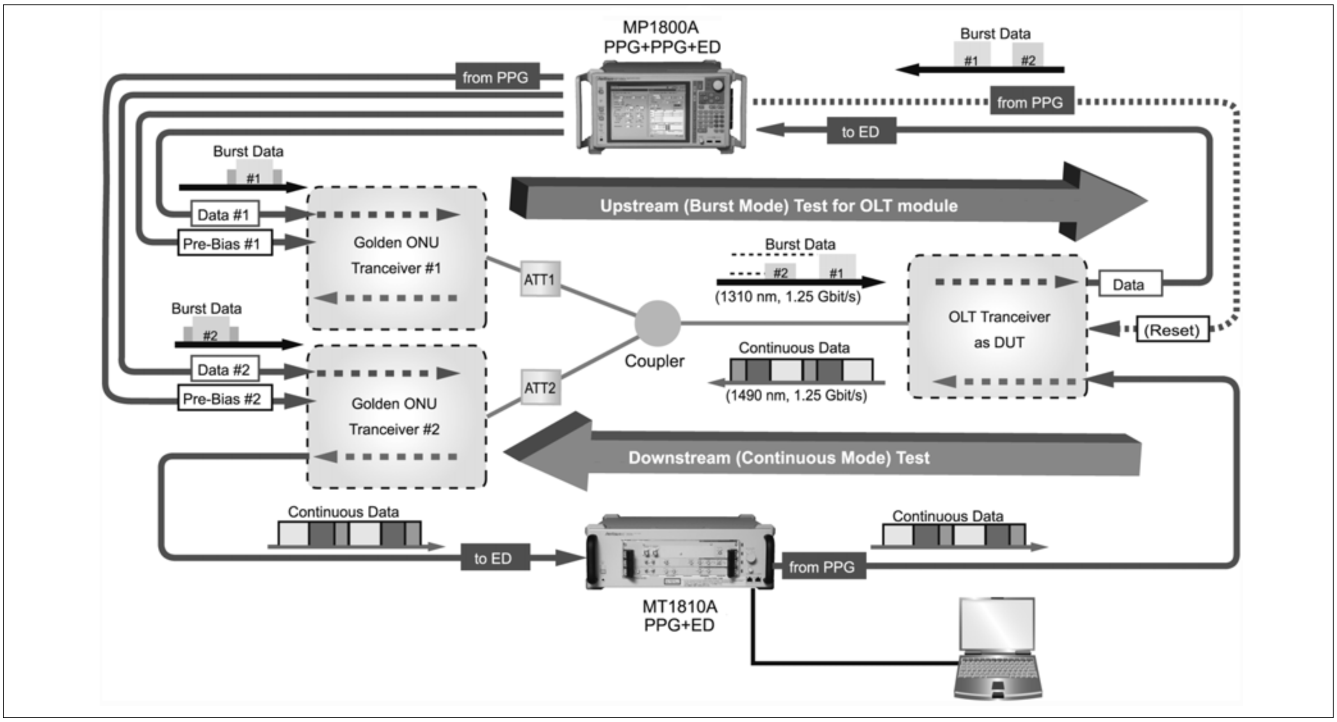
Applications

• Application 1: EA/EML Module Evaluation



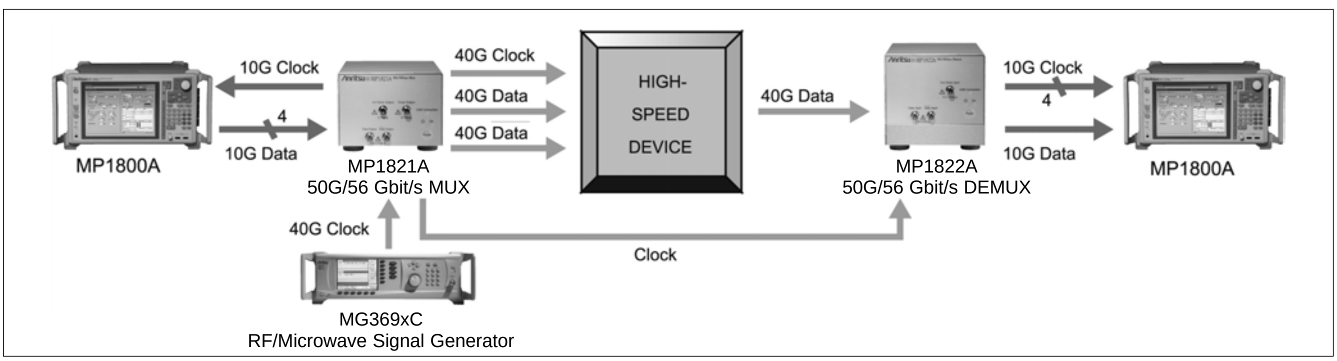
Direct driving of EML and EA module using 3.5 Vp-p high-amplitude waveform
Wide cross point adjustment function: 20 to 90% [MU181020A/B-013]

- **Application 2: 10 Gbit/s PON OLT Module Inspection**



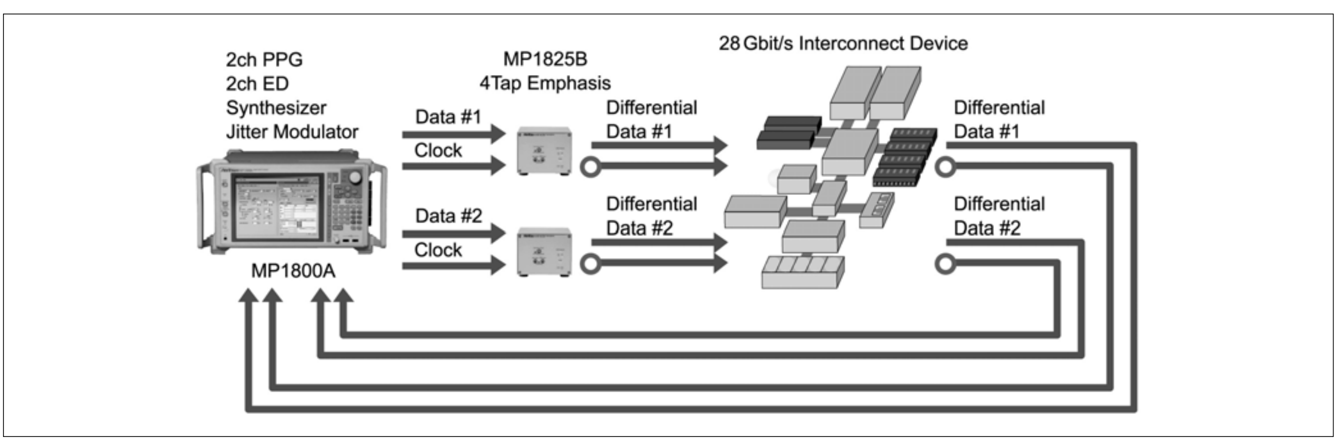
Each PPG slot can output pre-bias and reset signals for the PON BER test. (Level: H: 0 V; L: –1 V)
The PON OLT Upstream test can be performed at up to 12.5 Gbit/s using one MP1800A.

- **Application 3: Evaluation of 56 Gbit/s High-speed Devices**

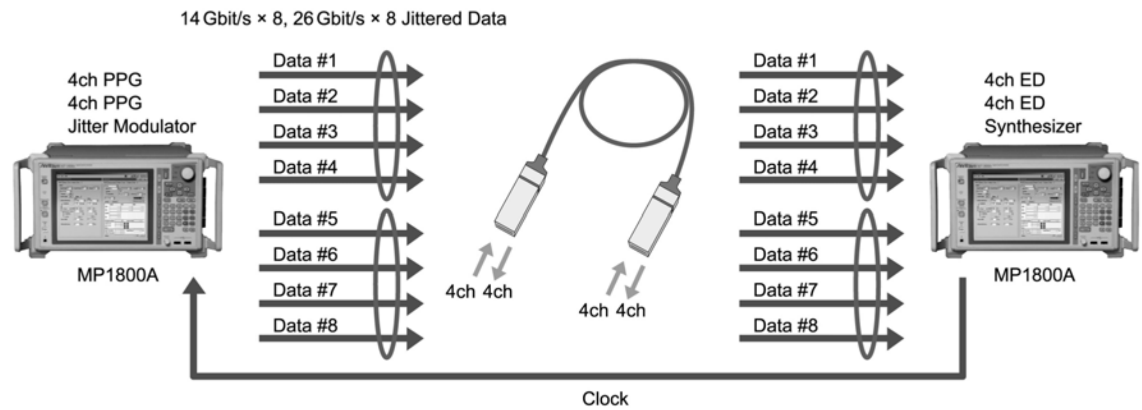


A 4-channel PPG and 4-channel ED are used in combination with the MP1821A 50G/56 Gbit/s MUX and MP1822A 50G/56 Gbit/s DEMUX to function as a 56 Gbit/s BERTS.

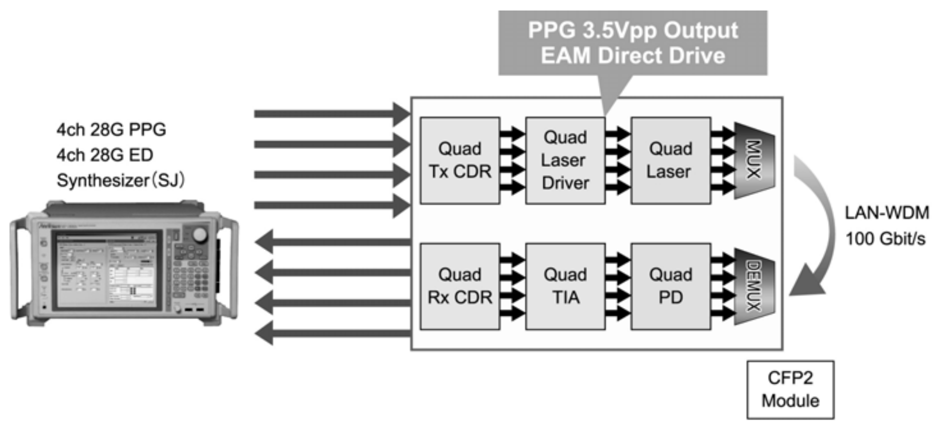
- **Application 4: 28 Gbit/s Band Ultrafast Interconnect Evaluation**



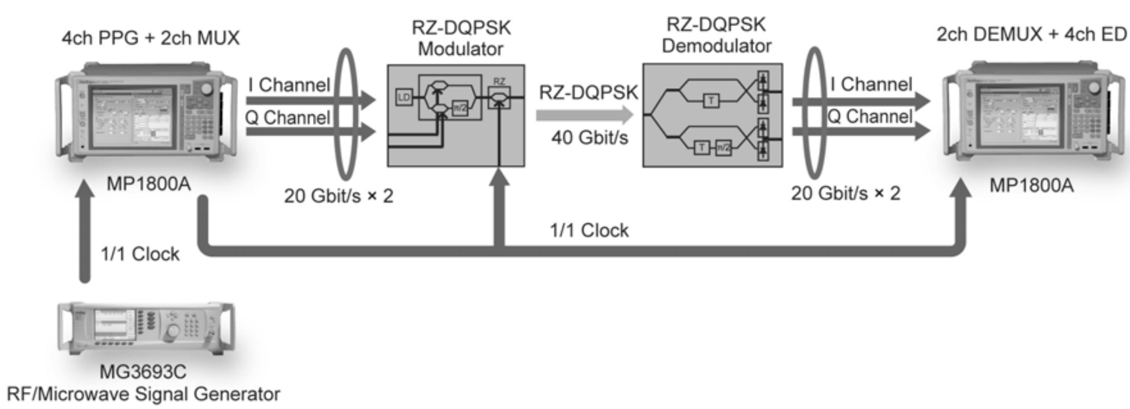
- **Application 5: AOC (Active Optical Cable) Evaluation**



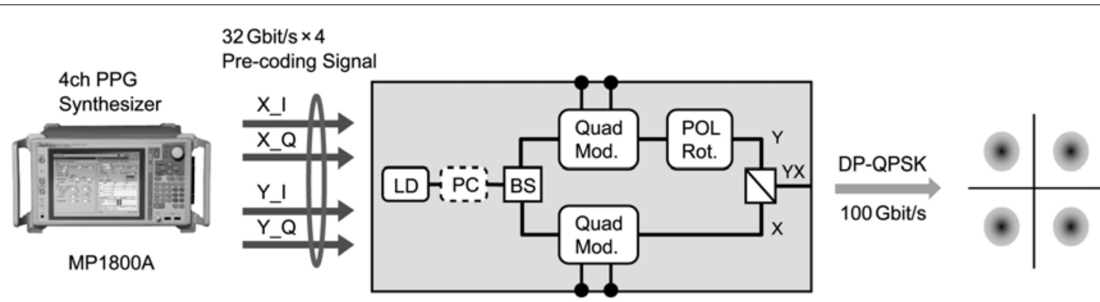
- **Application 6: CFP2/CFP4, EML Device Evaluation**



- **Application 7: 40 Gbit/s Band DQPSK Optical Module/Device Evaluation**



- **Application 8: 100 Gbit/s DP-QPSK Evaluation**



Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• MP1800A Signal Quality Analyzer

Model/Order No.	Name	
	Main frame	
MP1800A	Signal Quality Analyzer	
	Standard accessories	
J0491	Shield Power Cord (13 A):	1 pc
Z0306A	Wrist Strap:	1 pc
Z0541A	USB Mouse:	1 pc
B0329G	Front Cover for 3/4MW 4U:	1 pc
B0574A	MP1800A Protect Cover:	1 pc
MX180000A	Signal Quality Analyzer Control Software:	1 pc
Z0897A	MP1800A Manual CD:	1 pc
	Options	
MP1800A-001	GPIB	
MP1800A-002	LAN	
MP1800A-014	2-Slot for PPG and/or ED	
MP1800A-015	4-Slot for PPG and/or ED	
MP1800A-016	6-Slot for PPG and/or ED	
	Retrofit options	
MP1800A-101	GPIB Retrofit	
MP1800A-102	LAN Retrofit	
	Calibration service	
MP1800A-190	25G Calibration of PPG and MUX Retrofit	
	Maintenance service	
MP1800A-ES310	Three Years Extended Warranty Service	
MP1800A-ES510	Five Years Extended Warranty Service	

• MT1810A 4 Slot Chassis

Model/Order No.	Name	
	Main frame	
MT1810A	4 Slot Chassis	
	Standard accessories	
J0491	Shield Power Cord (13 A):	1 pc
Z0306A	Wrist Strap:	1 pc
J1109B	LAN Cable (CAT5, Cross), 5 m:	1 pc
B0575A	MT1810A Protect Cover:	1 pc
MX180000A	Signal Quality Analyzer Control Software:	1 pc
Z0897A	MP1800A Manual CD:	1 pc
	Options	
MT1810A-014	2-Slot for PPG and/or ED	
MT1810A-015	4-Slot for PPG and/or ED	
	Calibration service	
MT1810A-190	25G PPG/MUX Calibration Retrofit	
	Maintenance service	
MT1810A-ES310	Three Years Extended Warranty Service	
MT1810A-ES510	Five Years Extended Warranty Service	

• MU181000A 12.5 GHz Synthesizer

Model/Order No.	Name	
	Unit/Module	
MU181000A	12.5 GHz Synthesizer	
	Standard accessories	
J1349A	Coaxial Cable 0.3 m (SMA, DC to 18 GHz):	1 pc
	Options	
MU181000A-001	Jitter Modulation	
	Retrofit options	
MU181000A-101	Jitter Modulation Retrofit	
	Maintenance service	
MU181000A-ES310	Three Years Extended Warranty Service	
MU181000A-ES510	Five Years Extended Warranty Service	

• MU181000B 12.5 GHz 4port Synthesizer

Model/Order No.	Name	
	Unit/Module	
MU181000B	12.5 GHz 4port Synthesizer	
	Standard accessories	
J1349A	Coaxial Cable 0.3 m (SMA, DC to 18 GHz):	4 pcs
	Options	
MU181000B-001	Jitter Modulation	
	Retrofit options	
MU181000B-101	Jitter Modulation Retrofit	
	Maintenance service	
MU181000B-ES310	Three Years Extended Warranty Service	
MU181000B-ES510	Five Years Extended Warranty Service	

• MU181500B Jitter Modulation Source

Model/Order No.	Name	
	Unit/Module	
MU181500B	Jitter Modulation Source	
	Standard accessories	
J1349A	Coaxial Cable 0.3 m (SMA, DC to 18 GHz):	1 pc
J1508A	BNC-SMA Connector Cable (30 cm):	2 pcs
	Maintenance service	
MU181500B-ES310	Three Years Extended Warranty Service	
MU181500B-ES510	Five Years Extended Warranty Service	

• MU181800A 12.5 GHz Clock Distributor

Model/Order No.	Name
	Unit/Module
MU181800A	12.5 GHz Clock Distributor
	Maintenance service
MU181800A-ES310	Three Years Extended Warranty Service
MU181800A-ES510	Five Years Extended Warranty Service

• MU181800B 14 GHz Clock Distributor

Model/Order No.	Name
	Unit/Module
MU181800B	14 GHz Clock Distributor
	Maintenance service
MU181800B-ES310	Three Years Extended Warranty Service
MU181800B-ES510	Five Years Extended Warranty Service

• MU181020A 12.5 Gbit/s PPG

Model/Order No.	Name	
	Unit/Module	
MU181020A	12.5 Gbit/s PPG	
	Standard accessories	
J1137	Terminator (50Ω):	3 pcs
J1341A	Open:	1 pc
	Options	
MU181020A-001	9.8 to 12.5 Gbit/s	
MU181020A-002	0.1 to 12.5 Gbit/s	
MU181020A-010	Variable Data Output (0.05 to 0.8 Vp-p)	
MU181020A-011	Variable Data Output (0.25 to 2.5 Vp-p)	
MU181020A-012	High Performance Data Output (0.05 to 2.0 Vp-p)	
MU181020A-013	Variable Data Output (0.5 to 3.5 Vp-p)	
MU181020A-021	Differential Clock Output (0.1 to 2.0 Vp-p)	
MU181020A-030	Variable Data Delay	
	Retrofit options	
MU181020A-110	Variable Data Output (0.05 to 0.8 Vp-p) Retrofit	
MU181020A-111	Variable Data Output (0.25 to 2.5 Vp-p) Retrofit	
MU181020A-112	High Performance Data Output (0.05 to 2.0 Vp-p) Retrofit	
MU181020A-113	Variable Data Output (0.5 to 3.5 Vp-p) Retrofit	
MU181020A-121	Differential Clock Output (0.1 to 2.0 Vp-p) Retrofit	
MU181020A-130	Variable Data Delay Retrofit	
	Standard accessories for MU181020A-011/111	
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
	Standard accessories for MU181020A-012/112	
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
	Standard accessories for MU181020A-013/113	
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
	Standard accessories for MU181020A-021/121	
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
J1137	Terminator (50Ω):	1 pc
	Maintenance service	
MU181020A-ES310	Three Years Extended Warranty Service	
MU181020A-ES510	Five Years Extended Warranty Service	

• MU181020B 14 Gbit/s PPG

Model/Order No.	Name	
	Unit/Module	
MU181020B	14 Gbit/s PPG	
	Standard accessories	
J1137	Terminator (50Ω):	3 pcs
J1341A	Open:	1 pc
	Options	
MU181020B-002	0.1 to 14 Gbit/s	
MU181020B-003	14.05 Gbit/s Extension	
MU181020B-011	Variable Data Output (0.25 to 2.5 Vp-p)	
MU181020B-012	High Performance Data Output (0.05 to 2.0 Vp-p)	
MU181020B-013	Variable Data Output (0.5 to 3.5 Vp-p)	
MU181020B-021	Differential Clock Output (0.1 to 2.0 Vp-p)	
MU181020B-030	Variable Data Delay	
	Retrofit options	
MU181020B-111	Variable Data Output (0.25 to 2.5 Vp-p) Retrofit	
MU181020B-112	High Performance Data Output (0.05 to 2.0 Vp-p) Retrofit	
MU181020B-113	Variable Data Output (0.5 to 3.5 Vp-p) Retrofit	
MU181020B-121	Differential Clock Output (0.1 to 2.0 Vp-p) Retrofit	
MU181020B-130	Variable Data Delay Retrofit	
	Standard accessories for MU181020B-011/111	
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
	Standard accessories for MU181020B-012/112	
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
	Standard accessories for MU181020B-013/113	
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
	Standard accessories for MU181020B-021/121	
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
J1137	Terminator (50Ω):	1 pc
	Maintenance service	
MU181020B-ES310	Three Years Extended Warranty Service	
MU181020B-ES510	Five Years Extended Warranty Service	

• MU181040A 12.5 Gbit/s ED

Model/Order No.	Name	
	Unit/Module	
MU181040A	12.5 Gbit/s ED	
	Options	
MU181040A-001	9.8 to 12.5 Gbit/s	
MU181040A-002	0.1 to 12.5 Gbit/s	
MU181040A-020	Clock Recovery	
MU181040A-030	Variable Clock Delay	
	Retrofit options	
MU181040A-120	Clock Recovery Retrofit	
MU181040A-130	Variable Clock Delay Retrofit	
	Standard accessories for MU181040A-001	
J1341A	Open:	2 pcs
	Standard accessories for MU181040A-002	
J1341A	Open:	3 pcs
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
J1137	Terminator (50Ω):	2 pcs
	Standard accessories for MU181040A-020/120	
J1137	Terminator (50Ω):	1 pc
	Maintenance service	
MU181040A-ES310	Three Years Extended Warranty Service	
MU181040A-ES510	Five Years Extended Warranty Service	

• MU181040B 14 Gbit/s ED

Model/Order No.	Name	
	Unit/Module	
MU181040B	14 Gbit/s ED	
	Options	
MU181040B-002	0.1 to 14 Gbit/s	
MU181040B-003	14.05 Gbit/s Extension	
MU181040B-020	Clock Recovery	
MU181040B-030	Variable Clock Delay	
	Retrofit options	
MU181040B-120	Clock Recovery Retrofit	
MU181040B-130	Variable Clock Delay Retrofit	
	Standard accessories for MU181040B-002	
J1341A	Open:	3 pcs
J1359A	Coaxial Adapter (K-P, K-J, SMA):	2 pcs
J1137	Terminator (50Ω):	2 pcs
	Standard accessories for MU181040B-020/120	
J1137	Terminator (50Ω):	1 pc
	Maintenance service	
MU181040B-ES310	Three Years Extended Warranty Service	
MU181040B-ES510	Five Years Extended Warranty Service	

• MU182020A 25 Gbit/s 1ch MUX

Model/Order No.	Name
	Unit/Module
MU182020A	25 Gbit/s 1ch MUX
	Standard accessories
J1137	Terminator (50Ω): 5 pcs
J1341A	Open: 4 pcs
J1359A	Coaxial Adapter (K-P, K-J, SMA): 2 pcs
	MU182020A Semi-Rigid Cable Set (MUX-PPG): 1 pc
	Options
MU182020A-001	28 Gbit/s Extension
MU182020A-002	Clock Input Band Switch
MU182020A-003	28.1 Gbit/s Extension
MU182020A-010	Variable Data Output (0.25 to 1.75 Vp-p)
MU182020A-011	Variable Data Output (0.5 to 2.5 Vp-p)
MU182020A-013	Variable Data Output (0.5 to 3.5 Vp-p)
MU182020A-021	Variable Clock Output (0.5 to 2.0 Vp-p)
MU182020A-030	25 Gbit/s Variable Data Delay
MU182020A-031	28 Gbit/s Variable Data Delay
	Retrofit options
MU182020A-101	28 Gbit/s Extension Retrofit
MU182020A-102	Clock Input Band Switch Retrofit
MU182020A-110	Variable Data Output (0.25 to 1.75 Vp-p) Retrofit
MU182020A-111	Variable Data Output (0.5 to 2.5 Vp-p) Retrofit
MU182020A-113	Variable Data Output (0.5 to 3.5 Vp-p) Retrofit
MU182020A-121	Variable Clock Output (0.5 to 2.0 Vp-p) Retrofit
MU182020A-130	25 Gbit/s Variable Data Delay Retrofit
MU182020A-131	28 Gbit/s Variable Data Delay Retrofit
	Standard accessories for MU182020A-002/102
J1359A	Coaxial Adapter (K-P, K-J, SMA): 2 pcs
	Standard accessories for MU182020A-020/120
J1359A	Coaxial Adapter (K-P, K-J, SMA): 1 pc
	Maintenance service
MU182020A-ES310	Three Years Extended Warranty Service
MU182020A-ES510	Five Years Extended Warranty Service

• MU182040A 25 Gbit/s 1ch DEMUX

Model/Order No.	Name
	Unit/Module
MU182040A	25 Gbit/s 1ch DEMUX
	Standard accessories
J1137	Terminator (50Ω): 4 pcs
J1341A	Open: 3 pcs
J1359A	Coaxial Adapter (K-P, K-J, SMA): 2 pcs
	MU182040A Semi-Rigid Cable Set (DEMUX-ED): 1 pc
	Options
MU182040A-001	28 Gbit/s Extension
MU182040A-002	Clock Input Band Switch
MU182040A-003	28.1 Gbit/s Extension
MU182040A-030	25 GHz Variable Clock Delay
MU182040A-031	28 GHz Variable Clock Delay
	Retrofit options
MU182040A-101	28 Gbit/s Extension Retrofit
MU182040A-102	Clock Input Band Switch Retrofit
MU182040A-130	25 GHz Variable Clock Delay Retrofit
MU182040A-131	28 GHz Variable Clock Delay Retrofit
	Standard accessories for MU182040A-002/102
J1359A	Coaxial Adapter (K-P, K-J, SMA): 1 pc
	Maintenance service
MU182040A-ES310	Three Years Extended Warranty Service
MU182040A-ES510	Five Years Extended Warranty Service

• MU182021A 25 Gbit/s 2ch MUX

Model/Order No.	Name
	Unit/Module
MU182021A	25 Gbit/s 2ch MUX
	Standard accessories
J1137	Terminator (50Ω): 9 pcs
J1341A	Open: 6 pcs
J1359A	Coaxial Adapter (K-P, K-J, SMA): 4 pcs
	MU182021A Semi-Rigid Cable Set (MUX-PPG): 1 pc
	Options
MU182021A-001	28 Gbit/s Extension
MU182021A-002	Clock Input Band Switch
MU182021A-003	28.1 Gbit/s Extension
MU182021A-010	Variable Data Output (0.25 to 1.75 Vp-p)
MU182021A-011	Variable Data Output (0.5 to 2.5 Vp-p)
MU182021A-013	Variable Data Output (0.5 to 3.5 Vp-p)
MU182021A-021	Differential Clock Output (0.5 to 2.0 Vp-p)
MU182021A-030	25 Gbit/s Variable Data Delay
MU182021A-031	28 Gbit/s Variable Data Delay
MU182021A-040	Emphasis Control
	Retrofit options
MU182021A-101	28 Gbit/s Extension Retrofit
MU182021A-102	Clock Input Band Switch Retrofit
MU182021A-110	Variable Data Output (0.25 to 1.75 Vp-p) Retrofit
MU182021A-111	Variable Data Output (0.5 to 2.5 Vp-p) Retrofit
MU182021A-113	Variable Data Output (0.5 to 3.5 Vp-p) Retrofit
MU182021A-121	Differential Clock Output (0.5 to 2.0 Vp-p) Retrofit
MU182021A-130	25 Gbit/s Variable Data Delay Retrofit
MU182021A-131	28 Gbit/s Variable Data Delay Retrofit
MU182021A-140	Emphasis Control Retrofit
	Standard accessories for MU182021A-002/102
J1359A	Coaxial Adapter (K-P, K-J, SMA): 2 pcs
	Standard accessories for MU182021A-021/121
J1359A	Coaxial Adapter (K-P, K-J, SMA): 1 pc
	Maintenance service
MU182021A-ES310	Three Years Extended Warranty Service
MU182021A-ES510	Five Years Extended Warranty Service

• MU182041A 25 Gbit/s 2ch DEMUX

Model/Order No.	Name
	Unit/Module
MU182041A	25 Gbit/s 2ch DEMUX
	Standard accessories
J1137	Terminator (50Ω): 8 pcs
J1341A	Open: 5 pcs
J1359A	Coaxial Adapter (K-P, K-J, SMA): 4 pcs
	MU182041A Semi-Rigid Cable Set (DEMUX-ED): 1 pc
	Options
MU182041A-001	28 Gbit/s Extension
MU182041A-002	Clock Input Band Switch
MU182041A-003	28.1 Gbit/s Extension
MU182041A-030	25 GHz Variable Clock Delay
MU182041A-031	28 GHz Variable Clock Delay
	Retrofit options
MU182041A-101	28 Gbit/s Extension Retrofit
MU182041A-102	Clock Input Band Switch Retrofit
MU182041A-130	25 GHz Variable Clock Delay Retrofit
MU182041A-131	28 GHz Variable Clock Delay Retrofit
	Standard accessories for MU182041A-002/102
J1359A	Coaxial Adapter (K-P, K-J, SMA) 1 pc
	Maintenance service
MU182041A-ES310	Three Years Extended Warranty Service
MU182041A-ES510	Five Years Extended Warranty Service

• **MU183020A 28G/32G bit/s PPG**

Model/Order No.	Name	
MU183020A	**Unit/Module** 28G/32G bit/s PPG	
J1137 J1359A J1341A J1451A Z0897A Z0918A	**Standard accessories** Terminator: Coaxial Adaptor (K-P, K-J, SMA): Open: Coaxial Attenuator (6 dB): MP1800A Manual CD: MX180000A Software CD:	 3 pcs 1 pc 1 pc 1 pc 1 pc 1 pc
MU183020A-001 MU183020A-012 MU183020A-013 MU183020A-022 MU183020A-023 MU183020A-030 MU183020A-031	**Options** 32G bit/s Extension 1ch 2 V Data Output 1ch 3.5 V Data Output 2ch 2 V Data Output 2ch 3.5 V Data Output 1ch Data Delay 2ch Data Delay	
MU183020A-101 MU183020A-112 MU183020A-113 MU183020A-122 MU183020A-123 MU183020A-130 MU183020A-131	**Retrofit options** 32G bit/s Extension Retrofit 1ch 2 V Data Output Retrofit 1ch 3.5 V Data Output Retrofit 2ch 2 V Data Output Retrofit 2ch 3.5 V Data Output Retrofit 1ch Data Delay Retrofit 2ch Data Delay Retrofit	
J1137 J1359A	**Standard accessories for MU183020A-x12, x13** Terminator: Coaxial Adaptor (K-P, K-J, SMA):	 2 pcs 2 pcs
J1137 J1359A	**Standard accessories for MU183020A-x22, x23** Terminator: Coaxial Adaptor (K-P, K-J, SMA):	 4 pcs 4 pcs
MU183020A-ES310 MU183020A-ES510	**Maintenance service** Three Years Extended Warranty Service Five Years Extended Warranty Service	

• **MU183040A 28G/32G bit/s ED**

Model/Order No.	Name	
MU183040A	**Unit/Module** 28G/32G bit/s ED	
J1137 J1341A Z0897A Z0918A	**Standard accessories** Terminator: Open: MP1800A Manual CD: MX180000A Software CD:	 2 pcs 1 pc 1 pc 1 pc
MU183040A-001 MU183040A-010 MU183040A-020	**Options** 32G bit/s Extension 1ch ED 2ch ED	
MU183040A-101 MU183040A-120	**Retrofit options** 32G bit/s Extension Retrofit 2ch ED Retrofit	
J1341A J1359A	**Standard accessories for MU183021A-x10** Open: Coaxial Adaptor (K-P, K-J, SMA):	 2 pcs 2 pcs
J1341A J1359A	**Standard accessories for MU183040A-x20** Open: Coaxial Adaptor (K-P, K-J, SMA):	 4 pcs 4 pcs
MU183040A-ES310 MU183040A-ES510	**Maintenance service** Three Years Extended Warranty Service Five Years Extended Warranty Service	

• **MU183021A 28G/32G bit/s 4ch PPG**

Model/Order No.	Name	
MU183021A	**Unit/Module** 28G/32G bit/s 4ch PPG	
J1137 J1359A J1341A J1451A Z0897A Z0918A	**Standard accessories** Terminator: Coaxial Adaptor (K-P, K-J, SMA): Open: Coaxial Attenuator (6 dB): MP1800A Manual CD: MX180000A Software CD:	 3 pcs 1 pc 1 pc 1 pc 1 pc 1 pc
MU183021A-001 MU183021A-012 MU183021A-013 MU183021A-030	**Options** 32G bit/s Extension 4ch 2.0 V Data Output 4ch 3.5 V Data Output 4ch Data Delay	
MU183021A-101 MU183021A-112 MU183021A-113 MU183021A-130	**Retrofit options** 32G bit/s Extension Retrofit 4ch 2.0 V Data Output Retrofit 4ch 3.5 V Data Output Retrofit 4ch Data Delay Retrofit	
J1137 J1359A	**Standard accessories for MU183021A-x12, x13** Terminator: Coaxial Adaptor (K-P, K-J, SMA):	 8 pcs 8 pcs
MU183021A-ES310 MU183021A-ES510	**Maintenance service** Three Years Extended Warranty Service Five Years Extended Warranty Service	

• **MU183041A 28G/32G bit/s 4ch ED**

Model/Order No.	Name	
MU183041A	**Unit/Module** 28G/32G bit/s 4ch ED	
J1137 J1359A J1341A Z0897A Z0918A	**Standard accessories** Terminator: Coaxial Adaptor (K-P, K-J, SMA): Open: MP1800A Manual CD: MX180000A Software CD:	 3 pcs 1 pcs 1 pc 1 pc 1 pc
MU183041A-001	**Options** 32G bit/s Extension	
MU183041A-101	**Retrofit options** 32G bit/s Extension Retrofit	
MU183041A-ES310 MU183041A-ES510	**Maintenance service** Three Years Extended Warranty Service Five Years Extended Warranty Service	

• **MU181600A Optical Transceiver (XFP)**

Model/Order No.	Name	
MU181600A*1	**Unit/Module** Optical Transceiver (XFP)	
J1355A J0541E J0541A	**Standard accessories** Semirigid Cable: 6 dB Fixed Attenuator: 10 dB Fixed Attenuator:	 1 pc 2 pcs 2 pcs
MU181600A-ES310 MU181600A-ES510	**Maintenance service** Three Years Extended Warranty Service Five Years Extended Warranty Service	

*1: The XFP module is sold separately.
Note that Anritsu supports only XFP modules purchased from Anritsu.

• **MU181601A Optical Transceiver (SFP)**

Model/Order No.	Name	
MU181601A*2	**Unit/Module** Optical Transceiver (SFP)	
J0541E	**Standard accessories** 6 dB Fixed Attenuator:	 1 pc
MU181601A-ES310 MU181601A-ES510	**Maintenance service** Three Years Extended Warranty Service Five Years Extended Warranty Service	

*2: The SFP module is sold separately.
Note that Anritsu supports only SFP modules purchased from Anritsu.

• MU181620A Stressed Eye Transmitter

Model/Order No.	Name
	Unit/Module
MU181620A	Stressed Eye Transmitter
	Options
MU181620A-001	1310 nm Reference
MU181620A-002	1550 nm Reference
MU181620A-003	1310 nm/1550 nm Reference
MU181620A-011	1310 nm Stressed Eye
MU181620A-012	1550 nm Stressed Eye
MU181620A-013	1310 nm/1550 nm Stressed Eye
MU181620A-037	FC Connector
MU181620A-040	SC Connector
	Standard accessories for MU181620A-011/012/013
J1137	Terminator (50Ω): 1 pc
	Standard accessories for MU181620A-011/013
J1404A	Semirigid Cable: 1 pc
	Standard accessories for MU181620A-012/013
J1405A	Semirigid Cable: 1 pc
	Maintenance service
MU181620A-ES310	Three Years Extended Warranty Service
MU181620A-ES510	Five Years Extended Warranty Service

• MU181640A Optical Receiver

Model/Order No.	Name
	Unit/Module
MU181640A	Optical Receiver
	Options
MU181640A-004	Band Width 8.5 GHz
MU181640A-037	FC Connector
MU181640A-040	SC Connector
	Standard accessories
J1359A	Coaxial Adapter (K-P, K-J, SMA): 1 pc
	Maintenance service
MU181640A-ES310	Three Years Extended Warranty Service
MU181640A-ES510	Five Years Extended Warranty Service

• Software

Model/Order No.	Name
MX180000A	Signal Quality Analyzer Control Software
MX180000A-001	Pre-Code
MX180000A-002	De-Code
MX180001A	SDH/SONET Pattern Editor
MX180002A	Stressed Eye Measurement Control Software
MX180003A	GbE/10 GbE Pattern Editor
MX180004A	PON Application Software
MX180005A	Jitter Application Software
MX181500A	Jitter/Noise Tolerance Test Software

• Optional Accessories

Model/Order No.	Name
J0008	GPIB Cable 2 m
J1137	Terminator (50Ω)
J1341A	Open
J1342A	Coaxial Cable 0.8 m (APC-3.5, DC to 27.5 GHz)
J1343A	Coaxial Cable 1.0 m (SMA, DC to 18 GHz)
J1349A	Coaxial Cable 0.3 m (SMA, DC to 18 GHz)
J1439A	Coaxial Cable 0.8 m (K connector) (DC to 40 GHz)
G0174A	850 nm XFP Module (9.95 to 11.10 Gbit/s)
G0175A	1310 nm XFP Module (9.95 to 11.30 Gbit/s)
G0176A	1550 nm XFP Module (9.95 to 10.75 Gbit/s)
G0177A	850 nm SFP Module (1.062 to 4.25 Gbit/s)
G0178A	1310 nm SFP Module (0.155 to 2.67 Gbit/s)
G0179A	1550 nm SFP Module (0.155 to 2.67 Gbit/s)
J0617B	Replaceable Optical Connector (FC-PC)
J0619B	Replaceable Optical Connector (SC)
J0635A	FC · PC-FC · PC-1M-SM
J0660A	SC · PC-SC · PC-1M-SM
J1344A	LC · PC-LC · PC-1M-SM
J1139A	FC · PC-LC · PC-1M-SM
J1345A	SC · PC-LC · PC-1M-SM
J0893B	FC · PC-FC · PC-2M-GI (50/125)
J0894B	FC · PC-FC · PC-2M-GI (62.5/125)
J1346A	LC · PC-LC · PC-1M-GI (62.5/125)
J1347A	FC · PC-LC · PC-1M-GI (62.5/125)
J1348A	SC · PC-LC · PC-1M-GI (62.5/125)
J1359A	Coaxial Adapter (K-P, K-J, SMA)
J1360A	Measurement Kit <J1342A × 2, J1343A × 1>
J1449A	Measurement Kit (K connector) <J1439A × 2, J1342A × 2, J1343A × 1>
Z0282	Ferrule Cleaner
Z0283	Ferrule Cleaning Replacement Tape (6 pcs/set)
Z0284	Adapter Cleaner (Stick type, 200 pcs/set)
Z0897A	MP1800A Manual CD
Z0916A	Ferrule Side Face Cleaner
Z0917A	Shielded LAN Cable, 5 m (CAT5, Straight)
Z0918A	MX180000A Software CD
Z0922A	English USB Keyboard (104 key)
B0588A	Rack Mount Kit (MP1800A)
B0587A	Rack Mount Kit (MT1810A)
B0576A	Blank Panel
B0566A	MP1800A Hard Carrying Case (MP1800A)
B0591A	MT1810A Hard Carrying Case (MT1810A)
W2745AE	MP1800A Operation Manual
W2747AE	MP1800A Installation Guide
W2746AE	MT1810A Operation Manual
W2748AE	MT1810A Installation Guide
W2750AE	MU181000A/B Operation Manual
W2752AE	MU181020A/B Operation Manual
W2753AE	MU181040A/B Operation Manual
W3481AE	MU181500B Operation Manual
W2754AE	MU181600A/MU181601A Operation Manual
W2998AE	MU181620A Operation Manual
W2999AE	MU181640A Operation Manual
W2751AE	MU181800A/B Operation Manual
W3128AE	MU182020A/MU182021A Operation Manual
W3129AE	MU182040A/MU182041A Operation Manual
W2749AE	MX180000A Operation Manual
W2799AE	MX180000A Remote Control Operation Manual
W2884AE	MX180001A Operation Manual
W2885AE	MX180002A Operation Manual
W2886AE	MX180003A Operation Manual
W2887AE	MX180004A Operation Manual
W2926AE	MX180005A Operation Manual
W3480AE	MX181500A Operation Manual
W3594AE	MU183020A/MU183021A Operation Manual
W3595AE	MU183040A/MU183041A Operation Manual

50G/56 Gbit/s MUX, 50G/56 Gbit/s DEMUX

MP1821A/MP1822A

8 Gbit/s to 56 Gbit/s

R&D into Fast 40G and Ultra-fast 50G Devices for Next-Generation Communications

MP1821A

MP1822A

Build-to order product

Internet Exchanges (IX) and ISPs require larger network capacities as more Internet users access more rich-content services over faster access networks such as DSL, LTE, WiMAX, FTTx, etc.
To meet these needs, IEEE, ITU-T, and OIF are working to define issues and new standards for next-generation 40 Gbit/s and 100 Gbit/s networks. These new standards use WDM transmission equipment and phase-modulation technologies to curb symbol rate but further expansion of transmission capacity requires higher symbol rates.
The MP1821A 50G/56 Gbit/s MUX and MP1822A 50G/56 Gbit/s DEMUX supports operation frequencies up to 56 Gbit/s to meet these needs. Moreover, a full line of versatile functions and excellent performance for R&D into 40 Gbit/s fast next-generation devices, and ultra-fast 50 Gbit/s optical modules, supports customers with the perfect solution for bringing new products to market as early as possible.

Key Features

- **Supports 56 Gbit/s Max. Operation Frequency**

Anritsu provides the best measurement solutions for fundamental R&D in the 40 Gbit/s market and ultra-fast next-generation communications at more than 50 Gbit/s.

- **Compact Remote Head**

Shorter cables to the DUT keep signal quality high.
It supports direct evaluation of wafer on the probe station.
Troubleshooting at the early R&D phase cuts repeat work and time to product rollout.

- **Sophisticated Waveform**

High-speed Tr/Tf and low-jitter waveforms are ideal for evaluating electronic devices. In addition, direct driving of modulators without an external amplifier supports high-quality measurement results.

  - 8 ps (20 to 80%) high-speed Tr/Tf time
  - 4 psp-p low-jitter waveform
  - 3.5 Vp-p max. high amplitude waveform
  - 30 to 70% wide crosspoint adjustment function

- **Automatic Measurement Function**

Eye Margin, Eye Diagram, Bathtub, Q, ISI Analysis and Capture functions are supported. A full range of versatile analysis functions help cut design verification times.

- **Pre-Code/De-code Functions**

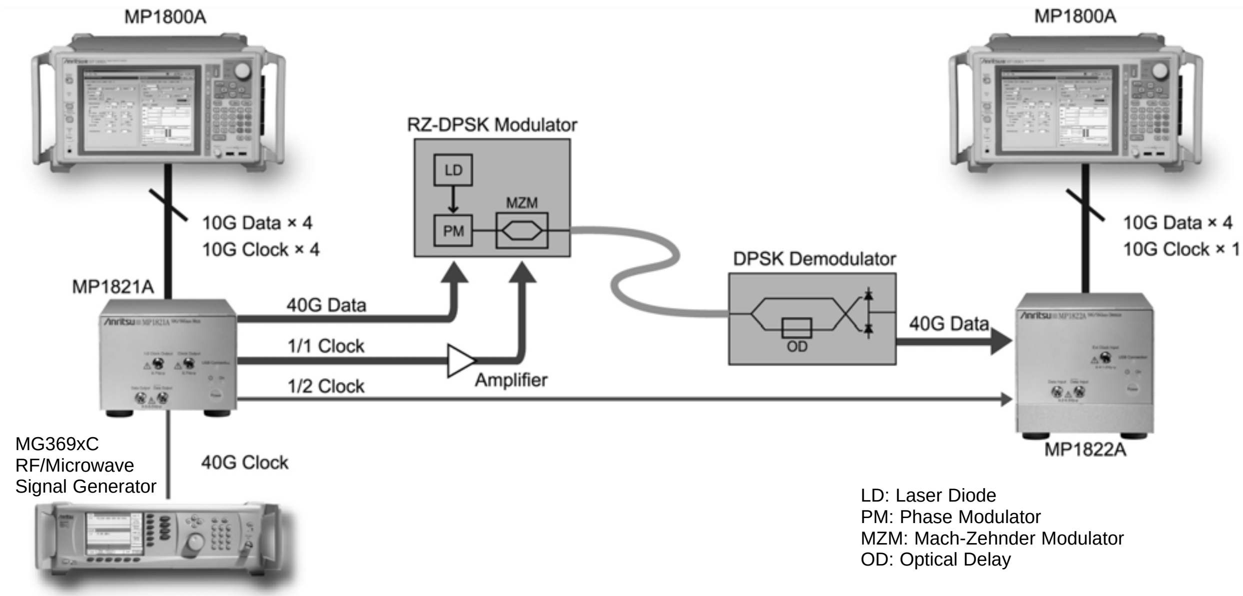
40G DPSK/ODB modulation signals are generated to evaluate optical modulators using the pre-code function. Moreover, the de-code function performs logic evaluation of pre-code blocks.

- **Flexible Expandability**

The MP1800A Signal Quality Analyzer supports operating frequencies from 0.1 Gbit/s to 28 Gbit/s. Moreover, combination with the MP1821A/1822A expands supported speeds to 56 Gbit/s and minimizes R&D investment for next-generation technologies.

Application Example

• Ultra-fast Optical Module Evaluation



Anritsu Solution

- **Compact Remote Head: Minimizes cable effects for assured high signal quality**
- **Sophisticated Waveform: Direct driving of modulators without external amplifier supports high-quality measurements**
- **Pre-Code/De-code Functions: Generates 40G DPSK/ODB supported modulation signals for evaluation**

• Ultra-fast Device–On-wafer Evaluation

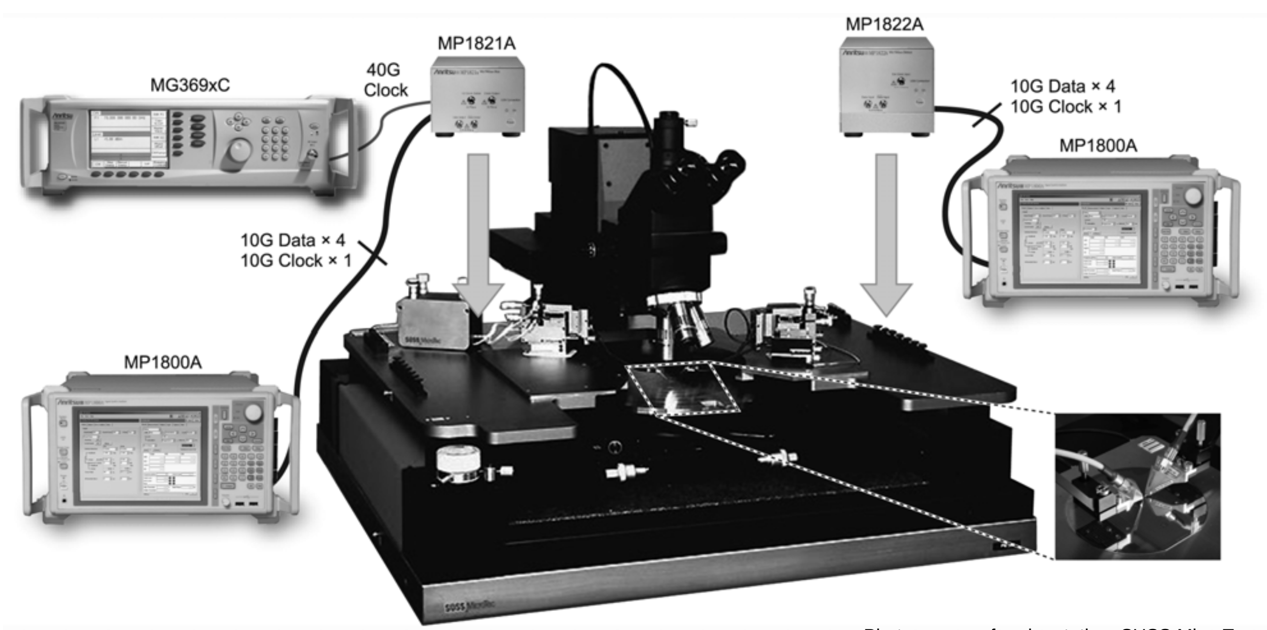


Photo source of probe station: SUSS MicroTec

Anritsu Solution

- **Compact Remote Head: Direct on-wafer device evaluation**
- **Sophisticated Waveform: High-speed Tr/Tf & low-jitter waveforms for electronic device evaluation**
- **Automatic Measurement Function: Full line of versatile analysis functions, such as Bathtub, cut design verification times**

Specifications

• MP1821A 50G/56 Gbit/s MUX

Item	Specification		
Operation Frequency	8 Gbit/s to 50 Gbit/s 8 Gbit/s to 56 Gbit/s (option-001 installed)		
External Clock Input			
Number of Input	1		
Input Frequency	4 GHz to 25 GHz 4 GHz to 28 GHz (option-001 installed) 4 GHz to 25 GHz, 8 GHz to 50 GHz (option-002 installed) 4 GHz to 28 GHz, 8 GHz to 56 GHz (option-001, 002 installed)		
Input Amplitude	0.4 to 1.0 Vp-p		
Termination	50Ω/AC Coupling		
Connector	K (f.) V (f.) (option-002 installed)		
Data Output	MP1821A-010	MP1821A-011	MP1821A-013
Number of Output	2 (Data/xData)		
Amplitude*1	H: 0 V, L: –0.4 V	0.5 to 2.5 Vp-p, step: 2 mV	0.5 to 3.5 Vp-p, step: 2 mV
Offset*1	–	–2 to +3.3 Voh, step: 1 mV	
Current Limiting	–	Source 50 mA, Sink 80 mA	
Fixed Interface	–	NECL, SCFL, NCML, PCML, LVPECL	
Crosspoint*1	50% ±15%	30 to 70% (±5% @50 Gbit/s, 2.0 Vp-p or more), step: 0.1%	
Tf/Tf*1, *2	10 ps (typ.), ≤12 ps, (20 to 80%)	8 ps (typ.), ≤10 ps, (20 to 80%)	
Total Jitter*1, *2	4 psp-p (typ.), ≤5 psp-p	4 psp-p (typ.), ≤5 psp-p	
Waveform Distortion (0 peak)*1	±25 mV ±15% (typ.)	±25 mV ±10% (typ.)	
Termination	50Ω/GND	AC, DC switching DC: 50Ω/GND, –2 V, +1.3 V	
Output ON/OFF Function	No	Yes	
Connector	V (f.)		
Clock Output			
Number of Output	1		
Frequency	Output clock frequency is same of input clock frequency		
Amplitude	0.4 Vp-p min., 1.0 Vp-p max. (Fixed)		
Termination	50Ω/AC Coupling		
Connector	K (f.) V (f.) (option-002 installed)		
1/2 Clock Output			
Number of Output	1		
Frequency	4 GHz to 25 GHz 4 GHz to 28 GHz (option-001 installed)		
Amplitude	0.4 Vp-p min., 1.0 Vp-p max. (Fixed)		
Termination	50Ω/AC Coupling		
Connector	K (f.)		
1/4 Clock Output			
Number of Output	1		
Frequency	2 GHz to 12.5 GHz 2 GHz to 14 GHz (option-001 installed)		
Amplitude	0.4 Vp-p min., 1.2 Vp-p max. (Fixed)		
Termination	50Ω/AC Coupling		
Connector	SMA (f.)		
1/4 Data Input			
Number of Input	4 (Data1, Data2, Data3, Data4)		
Input level	0/–1 V		
Termination	50Ω/GND		
Connector	SMA (f.)		
Variable Data Delay (option-030 installed)			
Phase Shift Range	–1000 to +1000 mUI, step: 4 mUI		
Setting Error	±50 mUIp-p (typ.)		
General Specifications			
USB Interface	USB 2.0 or 1.1 Type B × 1		
Power Supply	AC Adapter, DC 19 V, 4 A		
Dimension	100 (W) × 70 (H) × 140 (D) mm 100 (W) × 90.9 (H) × 140 (D) mm (option-030 installed)		
Mass	<5 kg		
Operation Temperature	15° to 35°C		
EMC	EN61326-1, EN61000-3-2		
LVD	EN61010-1		

*1: Values when using oscilloscope with residual jitter <200 fs (RMS) and sampling bandwidth >70 GHz
*2: Bit rate: 50 Gbit/s, Maximum amplitude: 2.5 Vp-p (MP1821A-011), 3.5 Vp-p (MP1821A-013)

- **MP1822A 50G/56 Gbit/s DEMUX**

Item	Specification
Operation Frequency	8 Gbit/s to 50 Gbit/s 8 Gbit/s to 56 Gbit/s (option-001 installed)
External Clock Input	
Number of Input	1
Input Frequency	4 GHz to 25 GHz 4 GHz to 28 GHz (option-001 installed) 4 GHz to 25 GHz, 8 GHz to 50 GHz (option-002 installed) 4 GHz to 28 GHz, 8 GHz to 56 GHz (option-001, 002 installed)
Input Amplitude	0.4 to 1.0 Vp-p
Termination	50Ω/AC Coupling
Connector	K (f.) V (f.) (option-002 installed)
Data Input	
Number of Input	2 (Data, xData)
Input Format	NRZ
Input Amplitude	0.2 to 0.5 Vp-p (single-ended)
Threshold Voltage	–0.5 to +0.5 V (single-ended)
Input Sensitivity	50 mVp-p (typ., 40 Gbit/s), 70 mVp-p (typ., 50 Gbit/s)
Phase Margin	200 deg. (typ., 50 Gbit/s, 56 Gbit/s)
Termination	50Ω/GND
Connector	V (f.)
1/4 Clock Output	
Number of Output	1
Frequency	2 GHz to 12.5 GHz 2 GHz to 14 GHz (option-001 installed)
Amplitude	0.4 Vp-p min., 1.2 Vp-p max. (Fixed)
Termination	50Ω/AC Coupling
Connector	SMA (f.)
1/4 Data Input	
Number of Input	4 (Data1, Data2, Data3, Data4)
Output Level	0/–0.4 V
Termination	50Ω/GND
Connector	SMA (f.)
Variable Clock Delay (option-030 installed)	
Phase Shift Range	–1000 to +1000 mUI, step: 4 mUI
Setting Error	±50 mUIp-p (typ.)
General Specifications	
USB Interface	USB 2.0 or 1.1 Type B × 1
Power Supply	AC Adapter, DC 19 V, 4 A
Dimension	100 (W) × 70 (H) × 140 (D) mm 100 (W) × 90.9 (H) × 140 (D) mm (option-030 installed)
Mass	<5 kg
Operation Temperature	15° to 35°C
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• MP1821A 50G/56 Gbit/s MUX

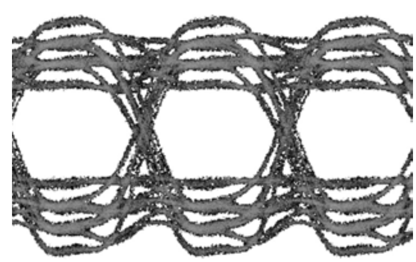
Model/Order No.	Name	
	Main frame	
MP1821A	50G/56 Gbit/s MUX	
	Standard accessories	
	Power Cord:	1 pc
J1343A	Coaxial Cable 1.0 m:	5 pcs
J1145	Terminator <V Connector>:	2 pcs
J1137	Terminator <SMA Connector>:	1 pc
J1341A	Open <SMA Connector>:	7 pcs
J1475A	USB Cable:	1 pc
Z1312A	AC Adaptor:	1 pc
Z1307A	MP1821A/1822A Manual CD:	1 pc
Z0918A	MX180000A Software CD:	1 pc
	Options	
MP1821A-001	56 Gbit/s Extension	
MP1821A-002	Clock Input Band Switch	
MP1821A-010	Data Output (0.4 Vp-p Fixed)	
MP1821A-011	Variable Data Output (0.5 to 2.5 Vp-p)	
MP1821A-013	Variable Data Output (0.5 to 3.5 Vp-p)	
MP1821A-030	Variable Data Delay	
MP1821A-101	56 Gbit/s Extension Retrofit	
MP1821A-102	Clock Input Band Switch Retrofit	
MP1821A-110	Data Output (0.4 Vp-p Fixed) Retrofit	
MP1821A-111	Variable Data Output (0.5 to 2.5 Vp-p) Retrofit	
MP1821A-113	Variable Data Output (0.5 to 3.5 Vp-p) Retrofit	
MP1821A-130	Variable Data Delay Retrofit	
	MP1821A-002/102 standard accessories	
J1363A	Protection Cap <V Connector>:	2 pcs
	Optional accessories	
J1090	Coaxial Cable <V120MM-30CM>	
J1108	Coaxial Cable <V120MM-50CM>	
J1379A	Coaxial Attenuator <41V-3>	
J1144	Coaxial Attenuator <41V-6>	
J1380A	Coaxial Attenuator <41V-10>	
J1381A	Coaxial Attenuator <41V-20>	
J1477A	Coaxial Adaptor <V (m.) -V (f.)>	
J1359A	Coaxial Adaptor (K-P.K-J, SMA)	
J1486A	V (m.) -K (f.) Adaptor	
J1439A	Coaxial Cable (0.8 m, K Connector)	
J1474A	Cable Kit for 4ch PPG	
J1476A	Cable Kit for 4ch ED	
W3207AE	MP1821A/1822A Operation Manual (Booklet)	

• MP1822A 50G/56 Gbit/s DEMUX

Model/Order No.	Name	
	Main frame	
MP1822A	50G/56 Gbit/s DEMUX	
	Standard accessories	
	Power Cord:	1 pc
J1343A	Coaxial Cable 1.0 m:	5 pcs
J1363A	Protection Cap <V Connector>:	2 pcs
J1137	Terminator <SMA Connector>:	4 pcs
J1341A	Open <SMA Connector>:	2 pcs
J1475A	USB Cable:	1 pc
Z1312A	AC Adaptor:	1 pc
Z1307A	MP1821A/1822A Manual CD:	1 pc
Z0918A	MX180000A Software CD:	1 pc
	Options	
MP1822A-001	56 Gbit/s Extension	
MP1822A-002	Clock Input Band Switch	
MP1822A-030	Variable Clock Delay	
MP1822A-101	56 Gbit/s Extension Retrofit	
MP1822A-102	Clock Input Band Switch Retrofit	
MP1822A-130	Variable Clock Delay Retrofit	
	MP1822A-002/102 standard accessories	
J1486A	V (m.) -K (f.) Adaptor:	1 pc
	Optional accessories	
J1090	Coaxial Cable <V120MM-30CM>	
J1108	Coaxial Cable <V120MM-50CM>	
J1379A	Coaxial Attenuator <41V-3>	
J1144	Coaxial Attenuator <41V-6>	
J1380A	Coaxial Attenuator <41V-10>	
J1381A	Coaxial Attenuator <41V-20>	
J1477A	Coaxial Adaptor <V (m.) -V (f.)>	
J1359A	Coaxial Adaptor (K-P.K-J, SMA)	
J1486A	V (m.) -K (f.) Adaptor	
J1439A	Coaxial Cable (0.8 m, K Connector)	
J1474A	Cable Kit for 4ch PPG	
J1476A	Cable Kit for 4ch ED	
W3207AE	MP1821A/1822A Operation Manual (Booklet)	

4TAP EMPHASIS
MP1825B

Characteristics Evaluation for Interconnect Serial Interface with 28.1 Gbit/s 4 Taps Pre-emphasis Signals



The passage of signals through printed-circuit board (PCB) wiring causes signal level attenuation and quality degradation, resulting in a closed Eye diagram. Since it is impossible to transfer high-speed signals through PCBs without attenuation, many interconnect interfaces use pre-emphasis technology to maintain the Eye opening by correcting the level attenuation.
The MP1825B 4Tap Emphasis is a 4 taps pre-emphasis converter for bit rates up to 28.1 Gbit/s; it supports easy changes to the pre-emphasis waveform amplitude, offset, amplitude of each tap, etc., for effective evaluation of the characteristics of high-speed interfaces below 10 Gbit/s, such as PCIe, USB, and Backplane Ethernet requiring pre-emphasis signals, as well as Infiniband 26G-IB-EDR, CEI-28G-VSR, etc., in the 25/28 Gbit/s band.

Target Applications
CEI-28G-SR/VSR, Infiniband 26G-IB-EDR, PCI express, USB 3.0, Backplane Ethernet, FB-DIMM

Features

- **Pre-emphasis up to 4 Taps**

Generates 2 and 3 taps pre-emphasis signals required for various standards and supports up to 4 taps. Since each tap can be changed independently, the effect of adding pre-emphasis can be confirmed accurately.

- **Jitter Transparent**

Supports accurate jitter tolerance tests due to transparent input data and clock jitter.

- **Compact Remote Head**

Shorter cable to DUT minimizes cable effects and assures high signal quality.

- **Supports Two Ranges of Bit Rates**

Choice of two configurations tailored to application, supporting 1 Gbit/s to 14.05 Gbit/s (MP1825B-001) and 1 Gbit/s to 28.1 Gbit/s (MP1825B-002).

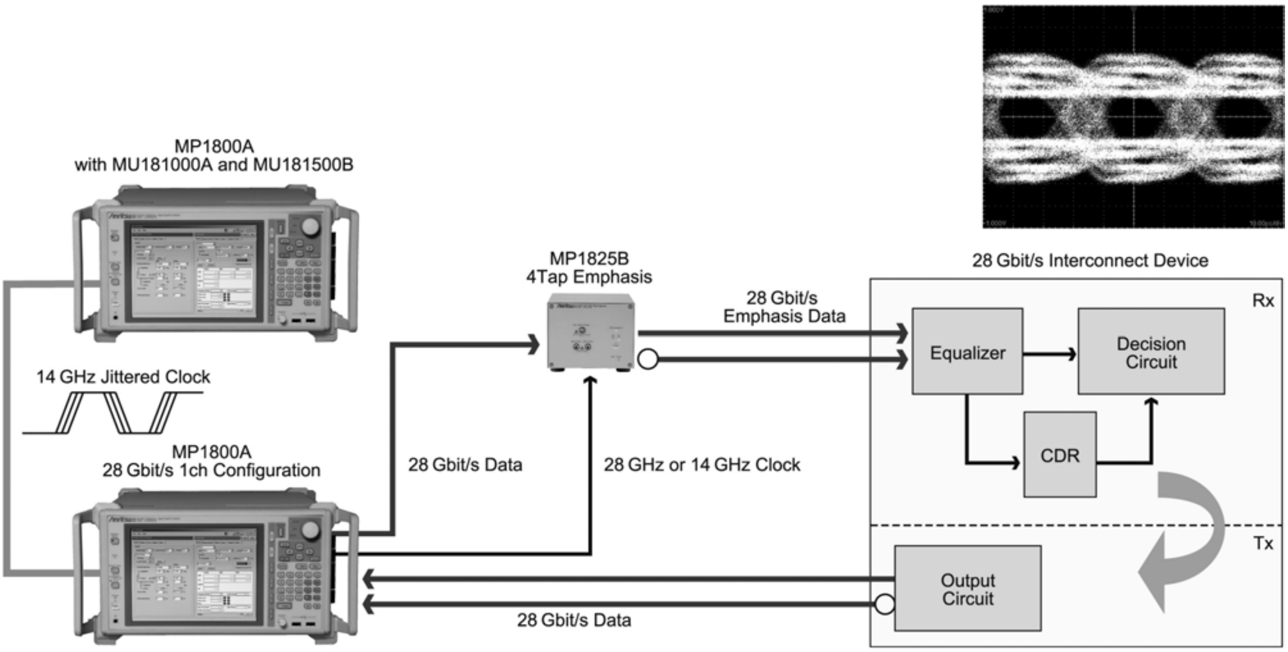
- **Use as Front End for Other Makers' BERTs and Customers' Devices**

Independent operation via USB control can generate pre-emphasis signals using other makers' devices as signal source to maximize efficiency of customers' investment in signal sources.

Applications

• BER Measurements and Jitter Tolerance Tests of Receivers using Pre-emphasis Signals

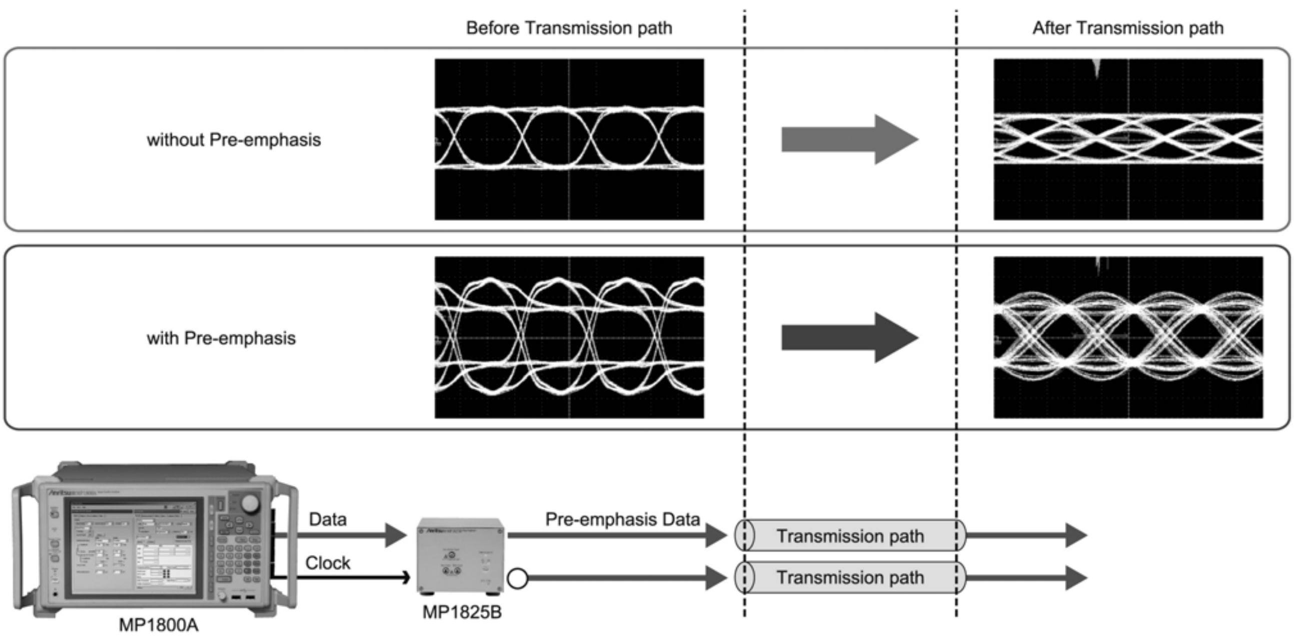
The MP1825B supports up to 4 taps at pre-emphasis ratio required by the various standards. Using pre-emphasis signals creates an interconnect standards-compliant measurement system supporting reliable BER measurements and jitter tolerance tests.



Jitter Tolerance Test Configuration using 28 Gbit/s Pre-emphasis Signals

• Optimized Pre-emphasis

The pre-emphasis signal minimizes signal attenuation in the transmission path. Because the MP1825B can change the emphasis ratio for each tap individually, the optimum pre-emphasis for the transmission path is confirmed easily.

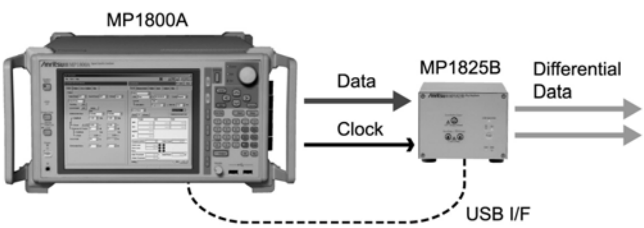


Optimized Pre-emphasis Effect

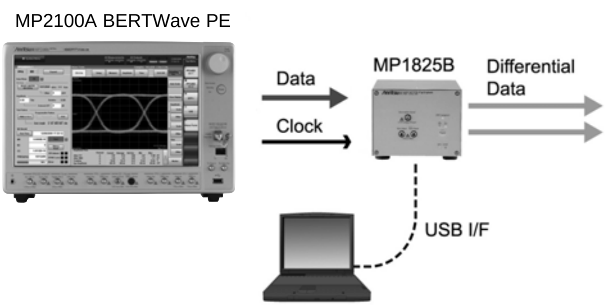
Setup

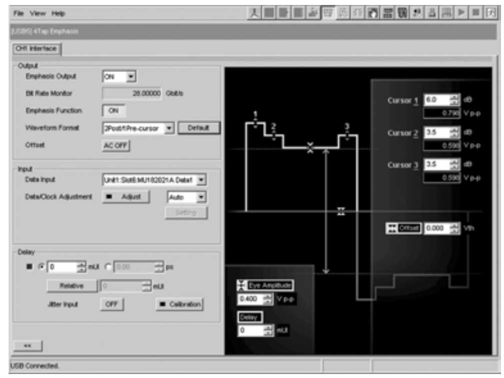
Using the MP1800A Signal Quality Analyzer as a signal source enables the MX180000A Signal Quality Analyzer Control Software installed in the MP1800A to control both MP1825B and MP1800A. When using signal sources other than the MP1800A, the MP1825B can be controlled independently via the USB interface from a PC with MX180000A installed.

Using MP1800A as signal source



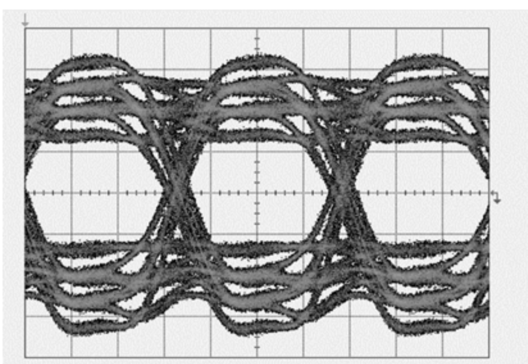
Using other product as signal source



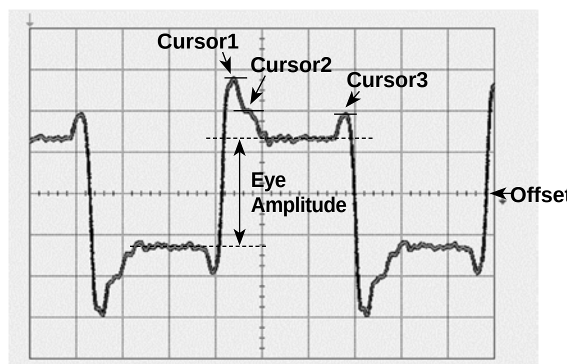


MP1825B 4Tap Emphasis Setting Screen

Waveform



Test Pattern: PRBS31



Test Pattern: FF00

Setting: 28.1 Gbit/s, Eye Amplitude: 0.5 Vp-p, Offset: 0 Vth, Cursor1: 6 dB, Cursor2: 3.5 dB, Cursor3: 3.5 dB

Selection Guide

No.	Main Frame	Bit Rate	Data Delay
1	MP1825B 4Tap Emphasis	MP1825B-001 14 Gbit/s Operation	
2			MP1825B-003 14 Gbit/s Variable Data Delay
3		MP1825B-002 28 Gbit/s Operation	
4			MP1825B-004 28 Gbit/s Variable Data Delay

- **MP1825B 4Tap Emphasis**

Converts input signals to pre-emphasis signals and outputs signals

- **MP1825B-001 14 Gbit/s Operation**

Extends bit rate from 1 Gbit/s to 14.05 Gbit/s. Select either Opt-001 or Opt-002.

- **MP1825B-002 28 Gbit/s Operation**

Extends bit rate from 1 Gbit/s to 28.1 Gbit/s. Select either Opt-001 or Opt-002.

- **MP1825B-003 14 Gbit/s Variable Data Delay**

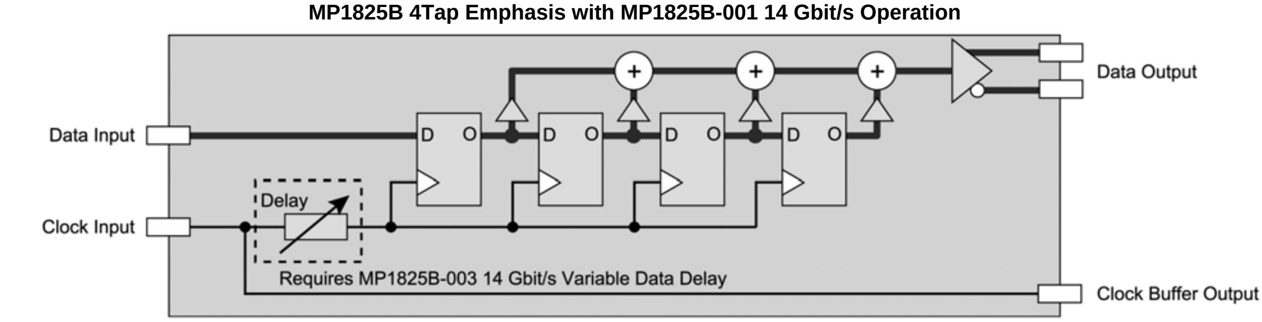
Phase shifts input data and input clock. Select this option to input ideal phase when data and clock phase shift function not available at signal source. Requires MP1825B-001.

- **MP1825B-004 28 Gbit/s Variable Data Delay**

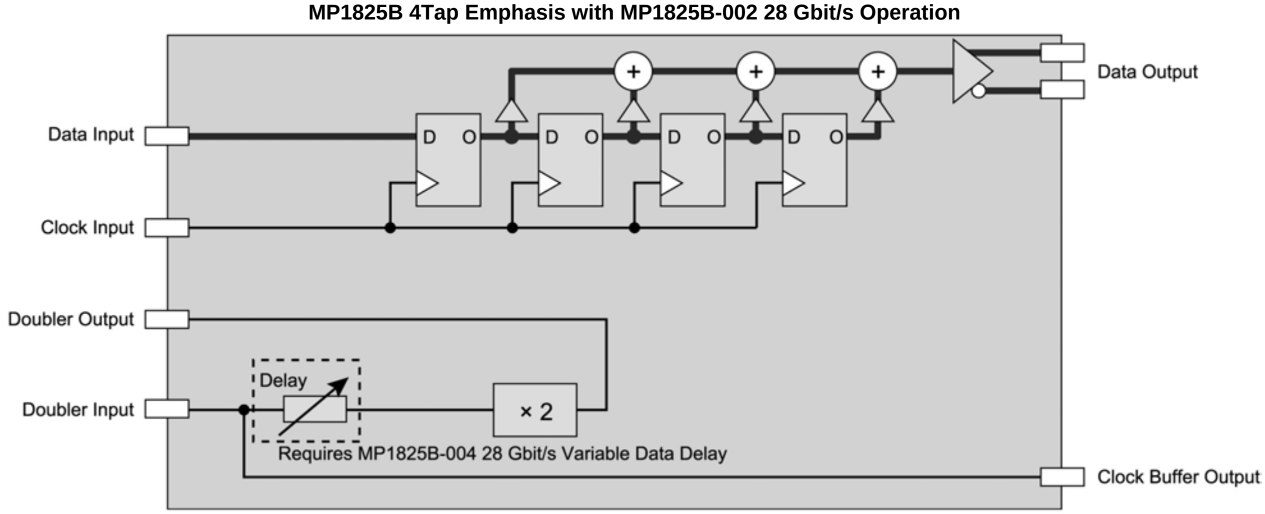
Phase shift input data and input clock. Select this option to input ideal phase when data and clock phase shift function not available at signal source. Requires MP1825B-002.

Block Diagrams

MP1825B 4Tap Emphasis with MP1825B-001 14 Gbit/s Operation



MP1825B 4Tap Emphasis with MP1825B-002 28 Gbit/s Operation



Specifications

Bit Rate	1 Gbit/s to 14.05 Gbit/s [MP1825B-001] 1 Gbit/s to 28.1 Gbit/s [MP1825B-002, when not using Doubler Input/Output] 8 Gbit/s to 28.1 Gbit/s [MP1825B-002, when using Doubler Input/Output]
Data Output*1	Number of Output: 2 (Data/xData) Emphasis Setting: a) 2post-cursor, 1pre-cursor b) 3post-cursor c) 1post-cursor, 1pre-cursor d) 2post-cursor e) 1post-cursor f) Rev. 3post-cursor Peak Voltage: 100 mVp-p to 1.5 Vp-p (Single-ended) Eye Amplitude: 100 mVp-p to 1.0 Vp-p (Single-ended), Steps: 2 mVp-p Offset: –1.0 Vth to +1.0 Vth, Steps: 1 mV Total Jitter*2: 8 ps p-p (typ.) Tr/Tf*3: 20 ps (typ.), ≤25 ps (20 to 80%) [MP1825B-001] 12 ps (typ.), ≤16 ps (20 to 80%) [MP1825B-002] Cursor1 Emphasis: –20 to +20 dB, 20log (Eye Amplitude/Cursor1), Steps: 0.1 dB Cursor2 Emphasis: –20 to +20 dB, 20log (Eye Amplitude/Cursor2), Steps: 0.1 dB Cursor3 Emphasis: –20 to +20 dB, 20log (Eye Amplitude/Cursor3), Steps: 0.1 dB On/Off Function: Supported Connector: K (f.), Termination: 50Ω/AC Coupling
Data Input	Amplitude: 0.4 Vp-p to 1.2 Vp-p Connector: SMA (f.) [MP1825B-001], K (f.) [MP1825B-002], Termination: 50Ω/GND
Clock Input	Frequency Range: 1 GHz to 14.05 GHz [MP1825B-001] 1 GHz to 28.1 GHz [MP1825B-002] Amplitude: 0.25 Vp-p to 1.0 Vp-p Connector: SMA (f.) [MP1825B-001], K (f.) [MP1825B-002], Termination: 50Ω/AC Coupling
Clock Buffer Output	Frequency Range: 1 GHz to 14.05 GHz [MP1825B-001] 4 GHz to 14.05 GHz [MP1825B-002] Amplitude: 0.4 Vp-p (Min.), 1.0 Vp-p (Max.) (Fixed) Connector: SMA (f.), Termination: 50Ω/AC Coupling
Doubler Input [MP1825B-002]	Frequency Range: 4 GHz to 14.05 GHz Amplitude: 0.25 Vp-p to 1.2 Vp-p Connector: SMA (f.), Termination: 50Ω/AC Coupling
Doubler Output [MP1825B-002]	Amplitude: 0.4 Vp-p (Min.), 1.0 Vp-p (Max.) (Fixed) Connector: K (f.), Termination: 50Ω/AC Coupling
Variable Data Delay [MP1825B-003 or MP1825B-004]	Phase Variable Range: –1000 mUI to +1000 mUI Accuracy: 50 mUIp-p (typ.)
General Specification	Channel Switch: CH1/CH2 (Rear panel switch) Operation Interface: USB 2.0 or 1.1 Type B Power Supply: 100 V(ac) to 240 V(ac), 50 Hz/60 Hz Power Consumption: <100 W Dimensions: 120 (W) × 90.9 (H) × 140 (D) mm Mass: <5 kg Operating Temperature: 15° to 35°C EMC: EN61326-1, EN61000-3-2 LVD: EN61010-1

*1: Measured at PRBS 2^{31} – 1, Mark Ratio 1/2 with 50 GHz sampling oscilloscope
*2: Measured at 14.05 Gbit/s or 28.1 Gbit/s (with MP1825B-002) with the sampling oscilloscope, intrinsic jitter should be less than 200 fs (rms)
*3: Emphasis Function: Off

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No	Name	
	Main frame	
MP1825B	4Tap Emphasis	
	Standard accessories	
J1137	Terminator:	3 pcs
J1341A	Open:	2 pcs
J1359A*	Coaxial Adaptor (K-P, K-J, SMA compatible):	2 pcs/3 pcs
J1507A**	Semirigid Cable:	1 pc
J1475A	USB Cable:	1 pc
Z1312A	AC Adaptor:	1 pc
	Power Cord:	1 pc
Z0897A	MP1800A Manual CD:	1 pc
Z0918A	MX180000A Software CD:	1 pc
	Options	
MP1825B-001	14 Gbit/s Operation	
MP1825B-002	28 Gbit/s Operation	
MP1825B-003	14 Gbit/s Variable Data Delay	
MP1825B-004	28 Gbit/s Variable Data Delay	
MP1825B-103	14 Gbit/s Variable Data Delay Retrofit	
MP1825B-104	28 Gbit/s Variable Data Delay Retrofit	

Model/Order No	Name
	Optional accessories
J1342A	Coaxial Cable 0.8 m (APC-3.5, DC to 27.5 GHz)
J1439A	Coaxial Cable (0.8 m, K Connector) (DC to 40 GHz)
W3482AE	MP1825B Operation Manual
	Maintenance service
MP1825B-ES310	Extended Three Year Warranty Service
MP1825B-ES510	Extended Five Year Warranty Service

*: MP1825B-001: 2 pcs, MP1825B-002: 3 pcs
**: Select MP1825B-002

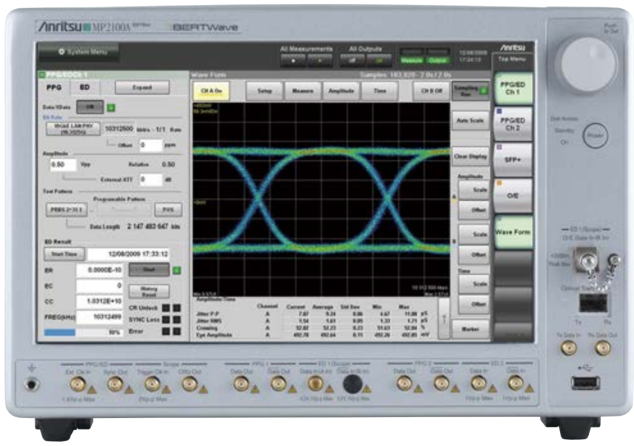
BERTWave

MP2100A Series

Remote Control
GPIB OPTION | Ethernet

Slim All-in-One Instrument for BER and Eye-pattern Analysis

Excellent Eco Product



Cuts Measurement Times and Raises Productivity

The rapid spread of the Internet and increases in network transmission capacity are driving development and manufacturing of FTTx and 10-Gbit Ethernet devices. As a result, R&D into high-speed transmission technologies and manufacturing of high-speed devices are both progressing at a fast pace. To assure the integrity of signals passing via these high-speed devices, the Bit Error Rate (BER) and Eye-pattern are measured using a BERT and sampling scope. The all-in-one MP2100A series BERTWave supporting simultaneous BER and Eye-pattern measurements is ideal for both R&D and manufacturing tests because it increases efficiency and cuts measurement costs by eliminating time-consuming setup.

- **Cuts Measurement Times**
  All-in-one BER and Eye-pattern Measurements
  High-speed Mask Tests
  High-speed Remote Tests
- **Various Analysis Functions**
  Wide Operation Frequency Range
  Simultaneous 2-channel BER Measurements
  Signal Integrity Analysis
  Supports Electrical and Optical Interfaces
  Clock Recovery
- **Low Equipment and Running Costs**
  Flexible Measurement
  Easy Operability, Flash Disk Drive, and Eco-friendly

MP2100A Series BERTWave

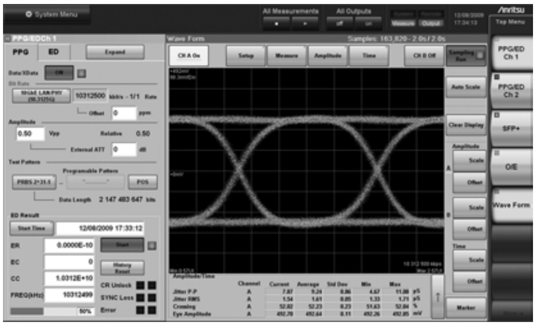
The MP2100A series BERTWave cuts measurement times and assures signal integrity. Customers can tailor the configuration according to usage.

- **MP2100A BERTWave**
  All-in-one instrument supporting simultaneous BER measurements and Eye-pattern analysis
- **MP2101A BERTWave PE**
  BER tester supporting 125 Mbit/s to 12.5 Gbit/s
- **MP2102A BERTWave SS**
  Eye/Pulse pattern tester supporting high-speed mask tests

MP2100A BERTWave	BERT	Eye/Pulse Scope
MP2101A BERTWave PE	BERT	
MP2102A BERTWave SS		Eye/Pulse Scope

Cuts Measurement Times

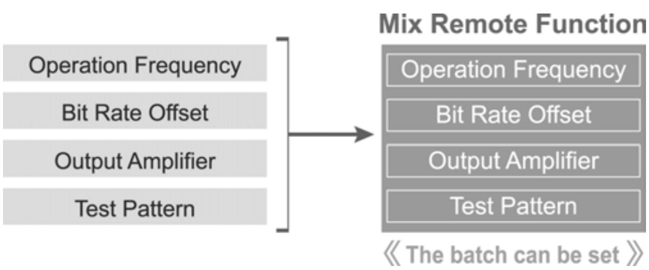
• All-in-one BER and Eye-pattern Measurements
Simultaneous BER and Eye/Pulse Scope measurements using an all-in-one tester halve investment costs and cut measurement times. The tracking function supports easy BERT and Eye/Pulse Scope settings.



• High-speed Remote Tests
The built-in remote high-speed mode supports mix remote functions for batch processing multiple commands and cuts BER measurement times by 30%* to 10 ms.

*: Compared to MP1761C/1762C

Mix Remote Function:
The mix remote function supports batch sending of the four commands required to set the operation frequency, bit rate, output amplifier, and test pattern, cutting setting times by 75%.



• High-speed Mask Tests
High-speed sampling enabled the acquisition of 100,000 samples in about 1 s. And, it support Automatic Mask Margin test within 1 s. As a result, cutting measurement times.

Various Analysis Functions

• Supports Electrical and Optical Interfaces
One MP2100A supports both electrical and optical interfaces for performing simultaneous TRx evaluations of optical modules, cutting measurement times.

• Wide Operation Frequency Range
The BERT function supports bit rate from 125 Mbit/s to 12.5 Gbit/s (with Option-090) for evaluating devices and application supporting STM-1, 10 GFC and etc…

Support Bit Rate and Application samples (With Option 090)

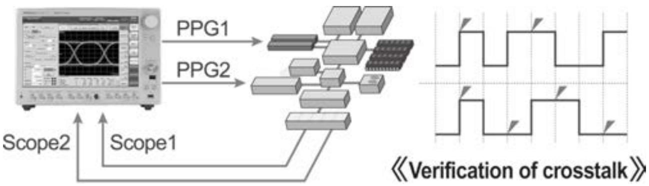
PPG/ED Operation Bit Rate	Application samples
8 Gbit/s to 12.5 Gbit/s	• 8GFC • 10GFC • 10GFC FEC • OTU-2 • OTU-2e • 10GbE • 10GbE FEC • OC-192/STM-64 • OC-192/STM-64 FEC • OTU-1e
4 Gbit/s to 6.25 Gbit/s	• CPRI/OBSAI • 4GFC
2 Gbit/s to 3.125 Gbit/s	• CPRI/OBSAI • 2GFC • Infiniband • 2GbE • OC-48/STM-16 • OTU-1
1 Gbit/s to 1.5625 Gbit/s	• 1GbE • 1GFC
0.5 Gbit/s to 0.78125 Gbit/s	• OC-12/STM-4
0.25 Gbit/s to 0.39625 Gbit/s	
0.125 Gbit/s to 0.195312 Gbit/s	• OC-3/STM-1

Support Bit Rate and Application samples (Without Option 090)

PPG Operation Bit Rate	Application samples
8.5 Gbit/s to 11.32 Gbit/s	• 8GFC • 10GFC • 10GFC FEC • OTU-2 • OTU-2e • 10GbE • 10GbE FEC • OC-192/STM-64 • OC-192/STM-64 FEC • OTU-1e
4.25 Gbit/s to 5.66 Gbit/s	• 4GFC
2.125 Gbit/s to 2.83 Gbit/s	• 2GFC • Infiniband • 2GbE • OC-48/STM-16 • OTU-1
1.0625 Gbit/s to 1.415 Gbit/s	• 1GbE • 1GFC
0.53125 Gbit/s to 0.7075 Gbit/s	• OC-12/STM-4
0.265625 Gbit/s to 0.35375 Gbit/s	
0.132812 Gbit/s to 0.176875 Gbit/s	• OC-3/STM-1

ED Operation Bit Rate	Application samples
8.5 Gbit/s to 11.32 Gbit/s	• 8GFC • 10GFC • 10GFC FEC • 10GbE • OC-192/STM-64 • OC-192/STM-64 FEC
4.25 Gbit/s to 5.66 Gbit/s	• 4GFC

• Simultaneous 2-channel BER Measurements
Expansion of the BERT to 2 channels supports easy simultaneous TRx measurements, crosstalk tests and confirmation of adjacent lane interference.



• Insertion/Omission
This can check how signal is involved.
Insertion: Change of 0 → 1
Omission: Change of 1 → 0

• Clock Recovery

ED Clock Recovery Function (Standard):
This is for inputting data signals and performing BER analysis without an external clock.

4 Gbit/s to 6.25 Gbit/s, 8 Gbit/s to 12.5 Gbit/s
This have been using the trigger of Scope.

Eye/Pulse Pattern Clock Recovery Function (Option-055):

8.5 GHz to 12.5 GHz, 0.1 GHz to 2.7 GHz
This supports evaluation of characteristics of long-distance transmissions and equipment without clock output.

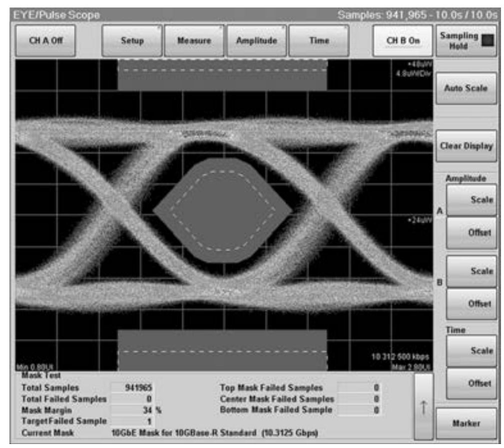
• Signal Integrity Analysis
The Eye/Pulse Scope supporting DC to 25 GHz offers signal integrity analysis using a variety of applications.

Time and Amplifier Tests
These tests supports measurement of 0 and 1 levels, SNR, Eye crosspoint ratio, Eye amplification, Eye height, Eye width, Jitter p-p values, Jitter RMS, Extinction ratio, Rise and Fall times, Duty cycle distortion, and Average power and OMA.
In addition, the high-accuracy extinction ratio measurements close to ideal values are perfect for confirming the characteristics of optical modules.

Amplitude/Time

	Channel	Current	Average	Std Dev	Min	Max	
Jitter P-P	A	44.94	44.52	0.48	43.87	45.29	pS
Jitter RMS	A	5.97	5.98	0.01	5.97	6.01	pS
Crossing	A	53.42	53.20	0.19	53.03	53.42	%
Eye Amplitude	A	101.51	101.44	0.04	101.38	101.51	mV

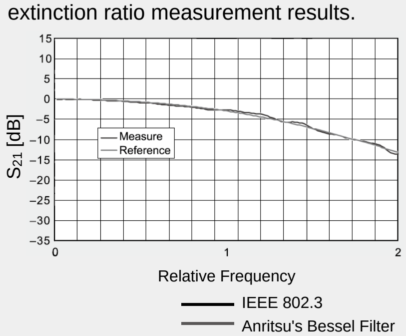
Eye Mask/Mask Margin Tests
Eye Mask and Mask Margin tests confirm product margin against standards to improve yield.
- Automatic measurement within 1 s
- Supporting real time Mask Margin test



Ideal Extinction Ratio Measurements

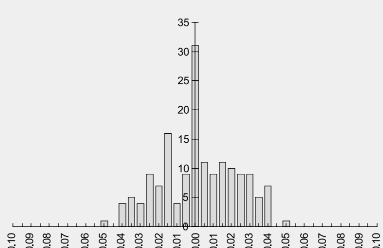
High-accuracy Extinction Ratio Measurements Close to Ideal Values

1. Ideal Bessel filters
Bessel filters with the ideal frequency characteristics support high-accuracy extinction ratio measurement results.

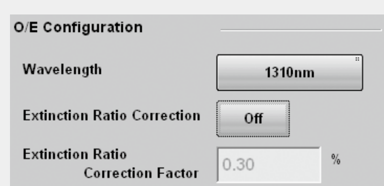


Frequency Characteristics (typical)

2. High-accuracy results close to true value
Calibration using the reference light source holds error to less than ±0.05 dB (typ.).



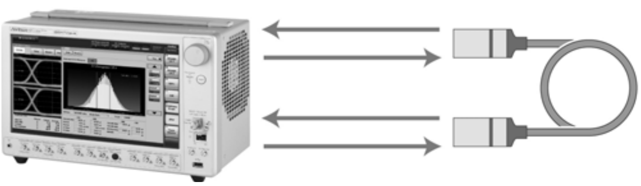
3. Correction function
Correction of the measured extinction ratio assures correlation with other instruments.

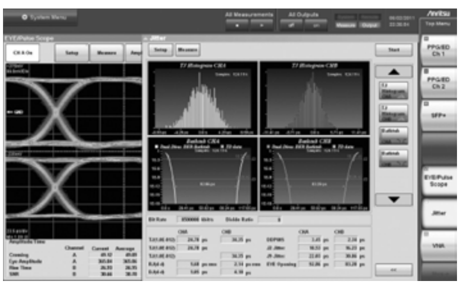


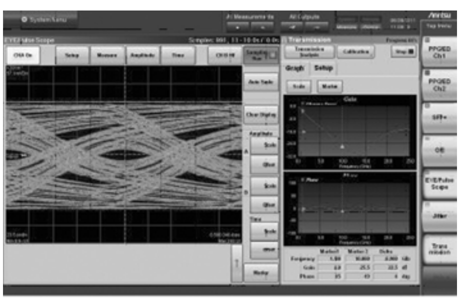
Correction Value Input Display

All-in-One Simultaneous Waveform Simulation, Jitter Analysis, Eye Pattern Measurement and Eye Mask Test

To meet rapid increases in data volumes, data centers are introducing high-speed interconnects, such as Active Optical Cable (AOC) and Direct Attach Cable (DAC), with transmission speeds faster than 10 Gbit/s between servers.
The MX210001A Jitter Analysis Software has a new, high-speed, jitter-analysis function supporting all-in-one measurements, such as simultaneous jitter analysis, and eye pattern measurement and eye mask test.
Moreover, the high-speed sampling increases measurement efficiency by cutting measurement time.
Adding the MX210002A Transmission Analysis Software to the BERTWave supports Tx analyses (S_{21} Gain, Phase), and waveform simulation (de-embedded) using linear equalizer, filter, and emphasis operations; simultaneous waveform sampling and simulation support simultaneous eye pattern measurement and eye mask test.
Furthermore, combined tracking with the MX210001A software permits simultaneous post-simulation waveform jitter analysis.
These versatile functions provide the perfect environment for applications ranging from R&D to manufacturing of AOC and DAC.







- **Target Applications**
  - Fibre Channel, InfiniBand, USB, SAS/SATA, 10GbE, 40GbE, 100GbE
  - Active Optical Cable (AOC), Direct Attach Cable (DAC), SFP+, QSFP+, CFP/2, CXP
  - Design Validation Test (DVT)

- **Jitter Analysis**
  - Bathtub Jitter Analysis
  - Classify TJ into DJ, RJ, J2, J9, DDJ, DDPWS, DCD, ISI, and PJ
  - Measure any signal, including PRBS31*1

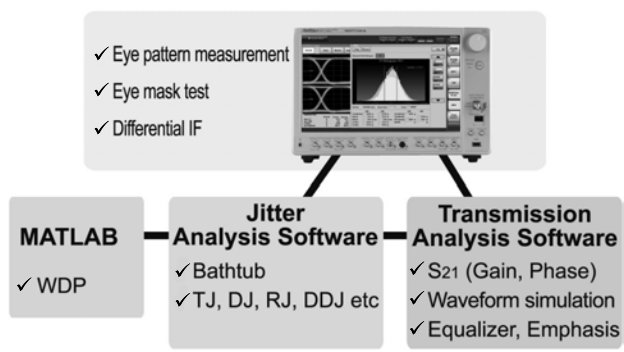
- **WDP Measurements**
  - WDP, TWDP, dWDP

- **Transmission Analysis**
  - Measures transmission path and device S_{21} (Gain, Phase) characteristics*2
  - Single-end and differential IF measurements*3

- **Waveform Simulation**
  - Linear equalizer and filter
  - Emphasis (4 taps max.)

- **High-speed Measurements**
  - High-speed bathtub BER value (1.0e-18)
  - High-speed sampling
  - High-speed DDJ using high-speed triggering

- **Simultaneous Measurements**
  - Simultaneous two-channel jitter analysis*4
  - Simultaneous measurements of BER, Eye pattern, Eye mask, and Jitter with simulation waveforms
  - Jitter Analysis and Transmission Analysis software tracking

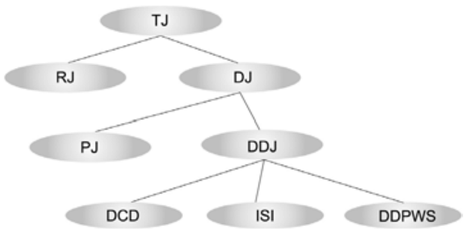


*1: Histogram mode only
*2: MP2100A with PPG and sampling scope options
*3: MP2100A-001 with dual electrical interface option
*4: Supports jitter analysis only

- MATLAB® is a trademark of The MathWorks Inc.
- To compute the WDP, MATLAB R2010b by MathWorks purchase is required separately.

MX210001A Jitter Analysis Software

The ideal jitter analysis solution matching the application can be selected from either the histogram mode for measuring basic jitter analysis or the pattern search mode for detailed jitter analysis.



• Histogram Mode

This mode supports basic jitter analysis for any signal (including PRBS31). Results are displayed as either bathtub jitter or a histogram calculated by the Dual Dirac model from the eye pattern. In addition, tact times are cut by simultaneous 2-channel jitter analysis, eye pattern, and eye mask test measurements.

• Pattern Search Mode

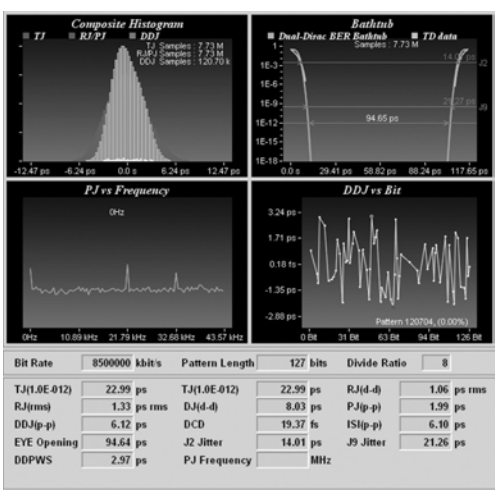
In addition to basic jitter components, this mode isolates more detailed jitter components for specific signals (up to PRBS15). Anritsu's unique triggering method supports faster DDJ measurements than conventional analyzers.

Analyses at both of Histogram and Pattern Search Mode

• TJ BER	: Total Jitter at 1.0e-12
• DJdd	: Deterministic Jitter (Dual Dirac model)
• RJdd	: Random Jitter (Dual Dirac model)
• TJ at sBER	: Total Jitter at specified BER
• Eye Opening	: Horizontal Eye opening at specified BER
• J2 BER	: Total Jitter at 2.5e-3
• J9 BER	: Total Jitter at 2.5e-10

Analyses at Pattern Search Mode

• DDJ	: Data Dependent Jitter vs. Bit
• DDPWS	: Data Dependent Pulse Width Shrinking
• PJ	: Periodic Jitter (support PJ frequency estimation)
• DCD	: Duty Cycle Distortion
• ISI	: Inter Symbol Interference



• WDP Measurements

Combining the MX210001A with MATLAB supports WDP, TWDP and dWDP measurements for evaluating the waveform dispersion of specific signals.

Note: To compute the WDP, MATLAB R2010b by MathWorks purchase is required separately.

MX210002A Transmission Analysis Software

Waveform simulation with transmission analysis (S_{21} Gain, Phase) functions as well as linearity, filtering and emphasis calculation supports simultaneous waveform sampling and simulation. The eye pattern measurement and eye mask test functions can also be used simultaneously.

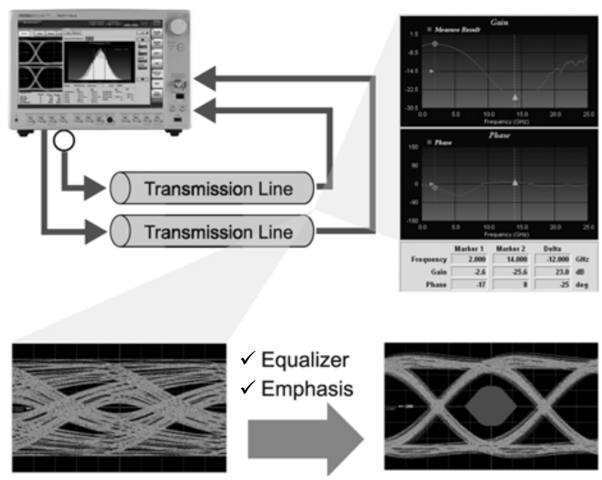
• Transmission Analysis S_{21} (Gain, Phase)

BERTWave PPG and Eye/Pulse scope tracking supports measurement of transmission path and device S_{21} characteristics (Gain, Phase). S_{21} differentials are supported by the built-in differential interface.

• Waveform Simulation

Waveform data can be sampled, linear-equalized, filtered, emphasized and displayed simultaneously. Various eye analyses, including eye pattern measurement (Tr/Tf, etc.), eye mask test, jitter analysis separation, etc., can be applied to the displayed eye waveform.

∗: Data length equivalent to PRBS15

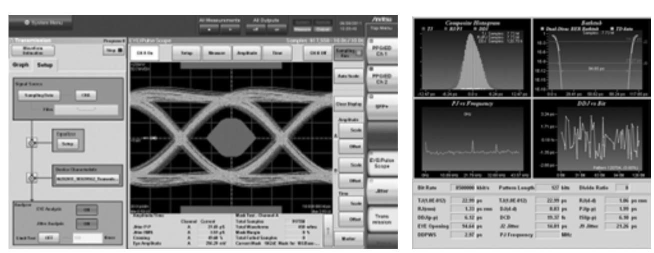


File Compatibility

Support for the S2P data file format makes it easy to use data captured by the Vector Network Analyzer as well as simulated characteristics data.

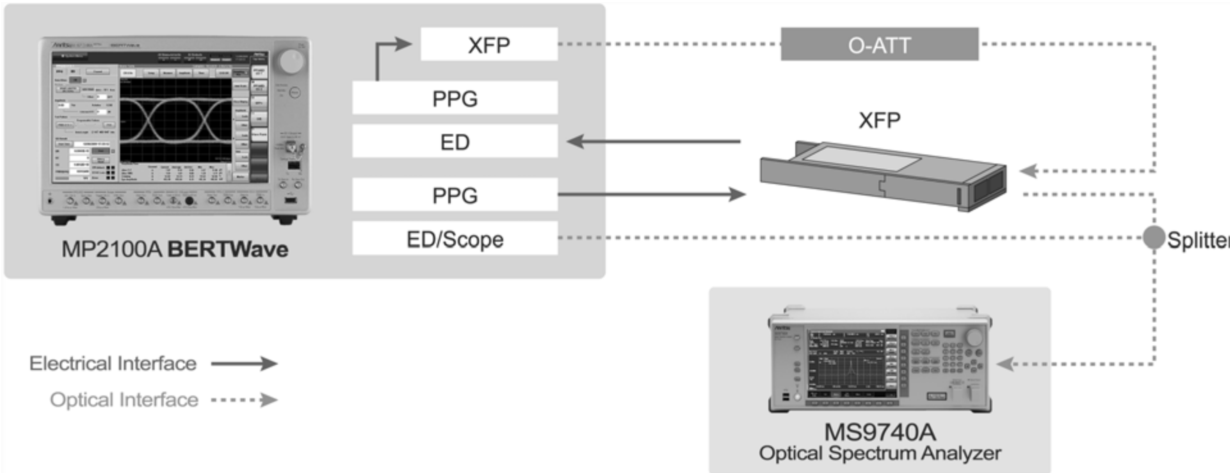
• Tracking with Jitter Analysis Software

Tracking between the MX210001A and the MX210002A supports simulation of actual connection conditions, permitting simultaneous eye pattern measurement, eye mask test, jitter analysis, etc., measurements.



Applications

• Optical Module Evaluations



• Cuts Measurement Times

Simultaneous BER and Eye/Pulse Scope measurements using the all-in-one tester halve investment costs and cut measurement times. Use with the MP2100A BERTWave and MS9740A Optical Spectrum Analyzer cuts optical module measurement times.

- **Simultaneous TRx Measurements**
  One MP2100A supports both electrical and optical interfaces for performing simultaneous TRx evaluations of optical modules, cutting measurement times.
- **High-speed Remote Tests**
  The built-in remote high-speed mode supports mixed remote functions for batch processing multiple commands and cuts BER measurement times by 30% to 10 ms.
- **High-speed Mask Tests**
  High-speed sampling supports fast mask tests in about 12 s*, cutting measurement times.

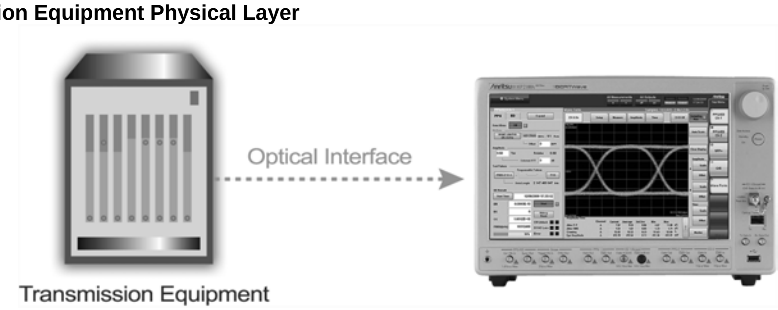
*: Typical value when capturing 1 × 10^6 samples at bit rate of 10.3125 Gbit/s with PRBS31 test pattern, back-to-back

Optical Transceiver Measurement Items

Measurement Items		MP2100A BERTWave	MS9740A Optical Spectrum Analyzer
Tx	Data Rate Tolerance	✓	
	Center Wavelength		✓
	Side Mode Suppression Ratio		✓
	Average Optical Output Power (Min./Max.)	✓	✓
	Extinction Ratio	✓	
	Mask Test	✓	
Rx	Input Sensitivity (10^{-12})	✓*	

*: Programmable optical attenuator is needed.

• Evaluation of Transmission Equipment Physical Layer



• Physical Layer Evaluation

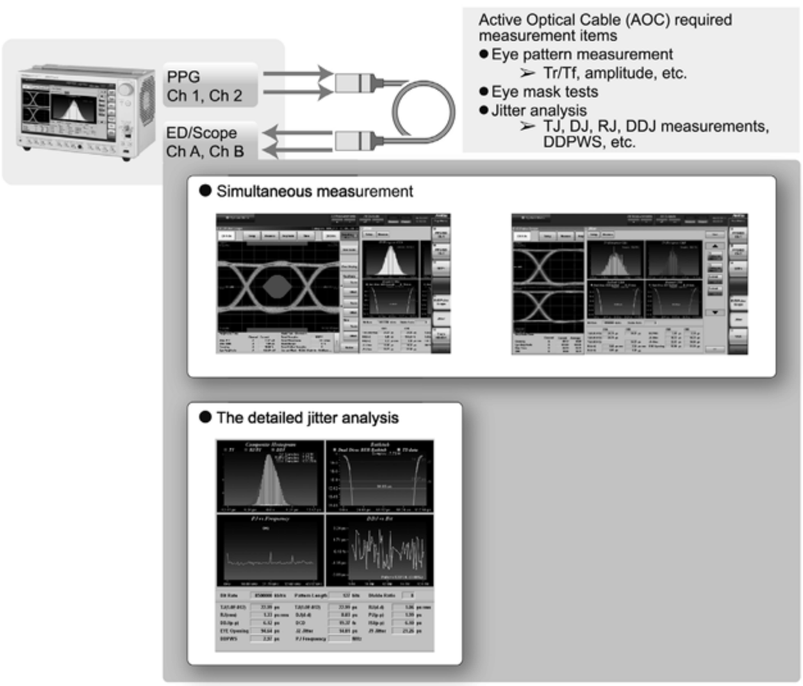
The MP2102A BERTWave SS clock recovery function eliminates the need for a trigger source when evaluating optical output characteristics, and the full range of mask patterns makes the MP2102A ideal for both evaluating the physical layer of equipment supporting various 2G, 4G, and 8GFC applications, and for testing optical transceivers at acceptance inspection.

- **Clock Recovery**
  The Eye/Pulse pattern Clock recovery (Option-055) function supports rates of 8.5 GHz to 12.5 GHz and 0.1 GHz to 2.7 GHz to perform mask tests for most applications.
- **High-speed Mask Tests**
  High-speed sampling supports fast mask tests in about 12 s*, cutting measurement times.

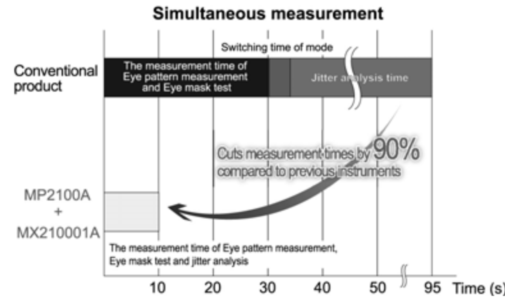
*: Typical value when capturing 1 × 10^6 samples at bit rate of 10.3125 Gbit/s with PRBS31 test pattern, back-to-back

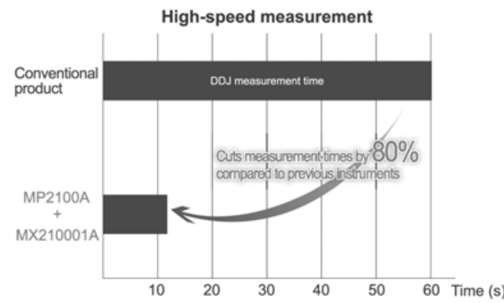
● **Active Optical Cable (AOC) Measurements**

The MX210001A supports simultaneous jitter analysis, eye pattern measurement, and eye mask tests required by high-speed and multi-lane Active Optical Cables (AOC). Moreover, high-speed triggering supports fast DDJ measurements, reducing measurement times by 80%.



Simultaneous Eye pattern measurement, Eye mask test and jitter analysis

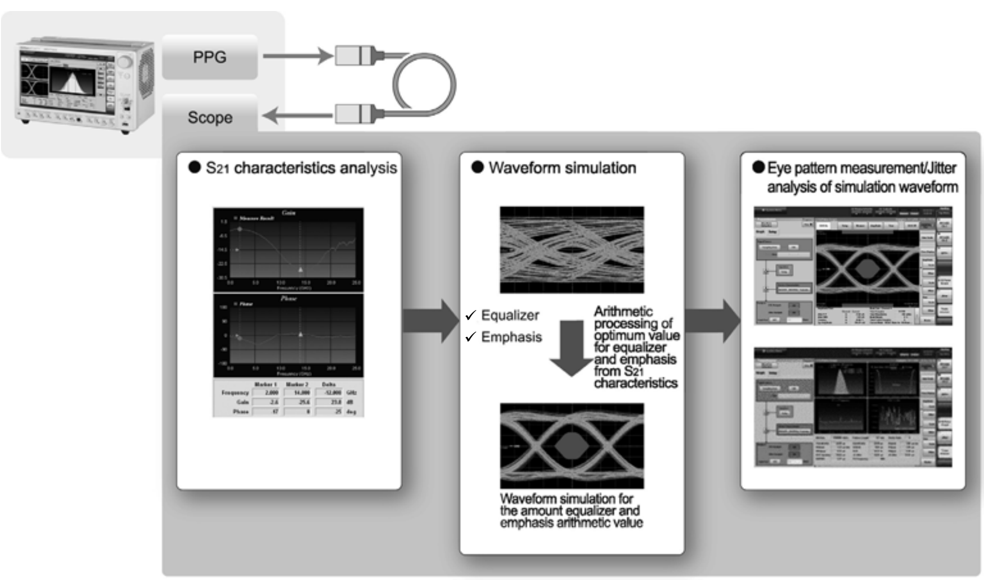




Typical values when capturing 10^6 samples at 10.3125 Gbit/s bit rate with PRBS15 test pattern at back-to-back measurements

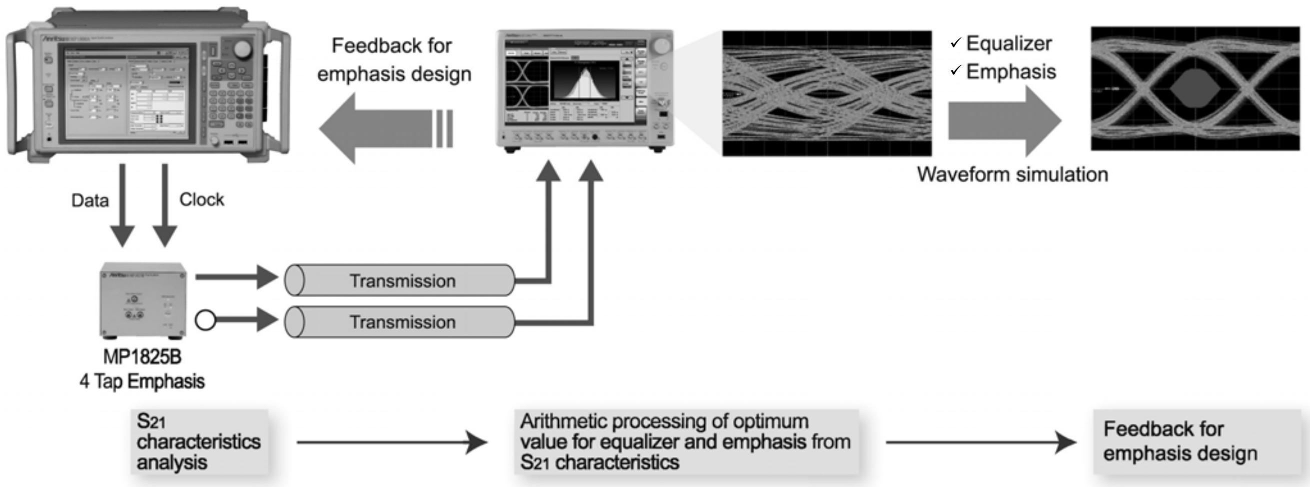
● **Direct Attach Cable (DAC) Measurements**

The eye opening of passive cables like Direct Attach Cables (DAC) used for short connections between server racks, etc., can be assured using the equalizer built into the equipment Rx section. The MX210002A can be used to measure S_{21} (Gain, Phase) characteristics of these devices. Moreover, since waveforms with optimized equalizer, filter, and emphasis values can be predicted from these transmission characteristics, eye pattern measurement and eye mask test of simulated waveforms can be performed. In addition, combination with the MX210001A supports tests required for DAC manufacturing, such as eye pattern measurement and jitter analysis, in one unit.



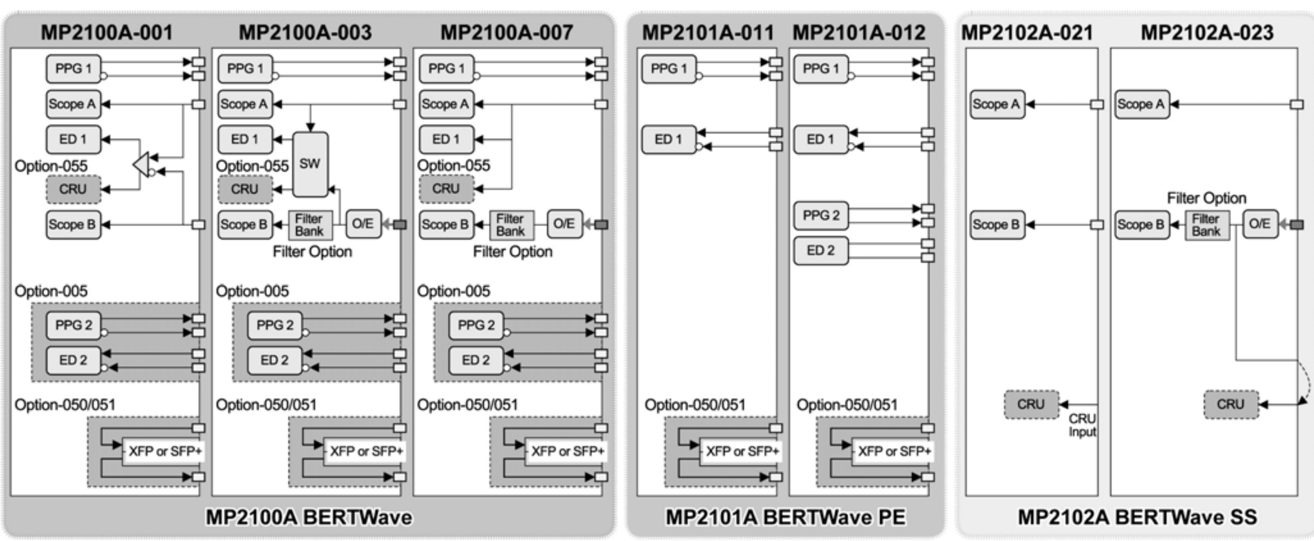
• **Emphasis Effect Simulation**

The same 4-tap emphasis as the MP1825B 4Tap Emphasis can be set. The type of eye pattern resulting from equalization and emphasis correction of a waveform with an eye pattern degraded by transmission path loss, or analysis using on-the-spot waveform simulation to determine the required equalization or emphasis can be fed back into the emphasis design.



MP2100A Series BERTWave Composition

• **Block Diagram**



• **Interface List**

Interface		MP2100A BERTWave		MP2101A BERTWave PE		MP2102A BERTWave SS	
		MP2100A-001	MP2100A-003/007	MP2101A-011	MP2101A-012	MP2102A-021	MP2102A-023
2 Output (Electrical Data1, xData1)		✓	✓	✓	✓		
2 Input (Electrical Data1/Scope1, Electrical xData1/Scope2)		✓				✓	
2 Input (Electrical Data1/Scope1, Optical Data2/Scope2)			✓				
2 Input (Electrical Data1, xData1)				✓	✓		
2 Input (Electrical Scope1, Scope2)						✓	
2 Input (Electrical Scope1, Optical Scope2)							✓
Additional Interface	2 Output (Electrical Data1, xData1)	✓*1	✓*1		✓		
	2 Input (Electrical Data1, xData1)	✓*1	✓*1		✓		
	XFP Slot	✓*2	✓*2	✓*2	✓*2		
	SFP+ Slot	✓*3	✓*3	✓*3	✓*3		

- **Function List**

Interface	MP2100A BERTWave		MP2101A BERTWave PE		MP2102A BERTWave SS	
	MP2100A-001	MP2100A-003/007	MP2101A-011	MP2101A-012	MP2102A-021	MP2102A-023
Crosstalk tests	✓*1	✓*1		✓		
Optical Module Simultaneous TRx measurements (XFP)		✓*1, *4				
1ch BER measurement	✓	✓	✓	✓		
2ch BER measurement	✓*1	✓*1		✓		
Electrical integrity of signals tests - Time and Amplitude Tests - Histogram Test - Eye Mask/Mask Margin Tests	✓	✓			✓	✓
Optical integrity of signals tests - Time and Amplitude Tests - Histogram Test - Eye Mask/Mask Margin Tests		✓				✓

*1: Option-005 Selected
*2: Option-050 Selected
*3: Option-051 Selected
*4: Option-050 or Option-051 Selected

Selection Guide

- **Composition List**

BERTWave

Model Number	Model Name	Note
MP2100A	BERTWave	BERT + Eye/Pulse Scope
MP2100A -001	Dual Electrical Receiver	Must select one of those
MP2100A -003	Optical/Single-ended Electrical Receiver	
MP2100A -007	1ch Electrical BERT and Optical/Single-ended Electrical Scope	
MP2100A -005	Extended PPG/ED Channel	
MP2100A -030	GPIB	
MP2100A -037	FC Connector	Option-003/007 is required Must select one of those
MP2100A -038	ST Connector	
MP2100A -039	DIN 47256 Connector	
MP2100A -040	SC Connector	
MP2100A -050	XFP Slot	Select no option or one of these
MP2100A -051	SFP+ Slot	
MP2100A -052	Full Rate Clock Output	
MP2100A -055	Clock Recovery for Eye/Pulse Scope	
MP2100A -061	1 High Bit Rate Filter	Option-003/007 is required About of Filter Bank and Filter, refer to “Filter Bank Configuration”
MP2100A -062	2 High Bit Rate Filter Bank	
MP2100A -063	3 to 4 High Bit Rate Filter Bank	
MP2100A -064	1 to 2 Low Bit Rate Filter Bank	
MP2100A -065	3 to 4 Low Bit Rate Filter Bank	
MP2100A -066	1 High Bit Rate/1 to 2 Low Bit Rate Filter Bank	
MP2100A -067	1 to 2 High Bit Rate/3 to 4 Low Bit Rate Filter Bank	
MP2100A -068	2 to 3 High Bit Rate/1 to 2 Low Bit Rate Filter Bank	
MP2100A -069	3 High Bit Rate/3 Low Bit Rate Filter Bank	
MP2100A -070	LPF for 156M (L)	
MP2100A -071	LPF for 622M (L)	
MP2100A -072	LPF for 1.0G (L)	
MP2100A -073	LPF for 1.2G (L)	
MP2100A -076	LPF for 2.1G (H)	
MP2100A -077	LPF for 2.5G (H)	
MP2100A -078	LPF for 2.6G (H)	
MP2100A -079	LPF for 3.1G (H)	
MP2100A -080	LPF for 4.2G (H)	
MP2100A -081	LPF for 5.0G (H)	
MP2100A -082	LPF for 6.2G (H)	
MP2100A -083	LPF for 8.5G (H)	
MP2100A -084	LPF for 9.9G to 10.3G (H)	
MP2100A -085	LPF for 10.5G to 11.3G (H)	
MP2100A -086	LPF for Multi 10G (H)	
MP2100A -090	Bit rate Extension for PPG/ED	
MP2100A -091	ED High Sensitivity	
MP2100A -130	GPIB Retrofit	
MP2100A -152	Full Rate Clock Output Retrofit	
MP2100A -191	ED High Sensitivity Retrofit	

BERTWave PE

Model Number	Model Name	Note
MP2101A	BERTWave PE	BERT
MP2101A -011	1CH PGG/ED	Must select one of those
MP2101A -012	2CH PGG/ED	
MP2101A -030	GPIB	Select one of these
MP2101A -050	XFP Slot	Select no option or one of these
MP2101A -051	SFP+ Slot	
MP2101A -052	Full Rate Clock Output	Select one of these
MP2101A -090	Bit rate Extension for PPG/ED	
MP2101A -091	ED High Sensitivity	
MP2101A -130	GPIB Retrofit	
MP2101A -152	Full Rate Clock Output Retrofit	
MP2101A -191	ED High Sensitivity Retrofit	

BERTWave SS

Model Number	Model Name	Note
MP2102A	BERTWave SS	Eye/Pulse Scope
MP2102A -021	Dual Electrical Receiver	Must select one of those
MP2102A -023	Optical/Single-ended Electrical Receiver	
MP2102A -030	GPIB	
MP2102A -037	FC Connector	Option-023 is required Must select one of those
MP2102A -038	ST Connector	
MP2102A -039	DIN 47256 Connector	
MP2102A -040	SC Connector	
MP2102A -055	Clock Recovery	
MP2102A -061	1 High Bit Rate Filter	Option-023 is required About of Filter Bank and Filter, refer to "Filter Bank Configuration"
MP2102A -062	2 High Bit Rate Filter Bank	
MP2102A -063	3 to 4 High Bit Rate Filter Bank	
MP2102A -064	1 to 2 Low Bit Rate Filter Bank	
MP2102A -065	3 to 4 Low Bit Rate Filter Bank	
MP2102A -066	1 High Bit Rate/1 to 2 Low Bit Rate Filter Bank	
MP2102A -067	1 to 2 High Bit Rate/3 to 4 Low Bit Rate Filter Bank	
MP2102A -068	2 to 3 High Bit Rate/1 to 2 Low Bit Rate Filter Bank	
MP2102A -069	3 High Bit Rate/3 Low Bit Rate Filter Bank	
MP2102A -070	LPF for 156M (L)	
MP2102A -071	LPF for 622M (L)	
MP2102A -072	LPF for 1.0G (L)	
MP2102A -073	LPF for 1.2G (L)	
MP2102A -076	LPF for 2.1G (H)	
MP2102A -077	LPF for 2.5G (H)	
MP2102A -078	LPF for 2.6G (H)	
MP2102A -079	LPF for 3.1G (H)	
MP2102A -080	LPF for 4.2G (H)	
MP2102A -081	LPF for 5.0G (H)	
MP2102A -082	LPF for 6.2G (H)	
MP2102A -083	LPF for 8.5G (H)	
MP2102A -084	LPF for 9.9G to 10.3G (H)	
MP2102A -085	LPF for 10.5G to 11.3G (H)	
MP2102A -086	LPF for Multi 10G (H)	
MP2102A -130	GPIB Retrofit	

• BERTWave Selection Guide

Measurement Item	MP2100A BERTWave		MP2102A BERTWave SS		MX210001A*1 Jitter Analysis Software	MX210002A*1 Transmission Analysis Software
	MP2100A-001	MP2100A-003	MP2102A-021	MP2102A-023		
Electrical Differential Measurement	✓		✓			
Single-ended Electrical Measurement	✓	✓	✓	✓		
Optical Signal Measurement		✓		✓		
Integrity of Signals Tests - Time and Amplitude Tests - Histogram Test - Eye Mask Test/Mask Margin Test	✓	✓	✓	✓		
Jitter Analysis					✓	
WDP Measurement					✓	
Transmission Analysis (S_{21} Gain, Phase)*2						✓
Waveform Simulation - Linear Equalizer/Filter, Emphasis Arithmetic						✓
Waveform Simulation + Jitter Analysis					✓	✓

*1: MX210001A and MX210002A operates on MP2100A BERTWave and MP2102A BERTWave SS
*2: Transmission analysis (S_{21} Gain, Phase) operates on MP2100A BERTWave.

• **Filter Bank Configuration**

Filter Bank		Low Bit Rate LPF				High Bit Rate LPF										
		Option-070	Option-071	Option-072	Option-073	Option-076	Option-077	Option-078	Option-079	Option-080	Option-081	Option-082	Option-083	Option-084	Option-085	Option-086
		156M (L)	622M (L)	1.0G (L)	1.2G (L)	2.1G (H)	2.5G (H)	2.6G (H)	3.1G (H)	4.2G (H)	5.0G (H)	6.2G (H)	8.5G (H)	9.9G to 10.3G (H)	10.5G to 11.3G (H)	9.9G to 10.7G (H)
Option-061	1 High Bit Rate Filter	—	—	—	—	Select 1 LPF										
Option-062	2 High Bit Rate Filter Bank	—	—	—	—	Select 2 LPFs										
Option-063	3 to 4 High Bit Rate Filter Bank	—	—	—	—	Select 3 to 4 LPFs										
Option-064	1 to 2 Low Bit Rate Filter Bank	Select 1 to 2 LPFs				—	—	—	—	—	—	—	—	—	—	—
Option-065	3 to 4 Low Bit Rate Filter Bank	Select 3 to 4 LPFs				—	—	—	—	—	—	—	—	—	—	—
Option-066	1 High Bit Rate/1 to 2 Low Bit Rate Filter Bank	Select 1 to 2 LPFs				Select 1 LPF										
Option-067	1 to 2 High Bit Rate/3 to 4 Low Bit Rate Filter Bank	Select 3 to 4 LPFs				Select 1 to 2 LPFs										
Option-068	2 to 3 High Bit Rate/1 to 2 Low Bit Rate Filter Bank	Select 1 to 2 LPFs				Select 2 to 3 LPFs										
Option-069	3 High Bit Rate/3 Low Bit Rate Filter Bank	Select 3 LPFs				Select 3 LPFs										

Specifications

MP2100A, MP2101A, MP2102A Common

Input Device	Rotary Encoder, Touch Panel, Power Switch
Liquid-crystal Display	12.1 inch WXGA (1280 × 800)
Remote Interface	Ethernet, GPIB (Option-030)
Circumjacent Connection	VGA Output (SVGA), USB (5ports, Revision 2.0), Ethernet (2ports, 10/100/1000 BASE-T)
OS	Windows embedded standard 2009 (based on Windows XP SP3)
Internal Memory	Flash memory 8 GB (min.)
Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) (100 V/200 V is unnecessary change.), 50 Hz/60 Hz
Power Consumption	300 VA (max.)
Temperature Range	Operating: +5˚ to +40˚C Storage: –20˚ to +60˚C
Dimensions	341 (W) × 221.5 (H) × 180 (D) mm (Exclusive of surface projection)
Mass	7 kg (max.) (With MP2100A-003 installing, Not contain other options)
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

BERT

• **Common**

External 10 MHz Input Connector	Amplitude: 0.7 Vp-p to 2 Vp-p, AC coupled Connector: BNC connector, 50Ω
External Ref Clock Input	External 1/16 Clock Input Amplitude: 0.2 Vp-p to 1.5 Vp-p, AC coupled Connector: SMA connector, 50Ω
Sync. Output	Output Level: V_{OL}: –0.5 V to –0.3 V, V_{OH}: –0.1 V to 0 V, 0.4 Vp-p (typ.) Connector: SMA connector, 50Ω

Bit Rate	Frequency Dividing Rate
8.5G to 11.32G	1/8 PPG Clock, 1/16 PPG Clock, 1/64 PPG Clock, PPG Pattern Sync., 1/16 ED Clock
1/2 Rate	1/4 PPG Clock, 1/16 PPG Clock, 1/64 PPG Clock, PPG Pattern Sync., 1/4 ED Clock, 1/16 ED Clock
1/4 Rate	1/2 PPG Clock, 1/16 PPG Clock, PPG Pattern Sync.
1/8 Rate	1/1 PPG Clock, PPG Pattern Sync.
1/16 Rate	1/1 PPG Clock, PPG Pattern Sync.
1/64 Rate	1/1 PPG Clock, PPG Pattern Sync.

• PPG

<table>
<tr><td rowspan="2">Operation Bit Rate</td><td>With MP2100A/MP2101A-090</td><td>Without MP2100A/MP2101A-090</td></tr>
<tr><td>Variable bit-rate range (1 kbit/s step)
8 Gbit/s to 12.5 Gbit/s
1/N bit-rate operation range
N=2: 4 Gbit/s to 6.25 Gbit/s
N=4: 2 Gbit/s to 3.125 Gbit/s
N=8: 1 Gbit/s to 1.5625 Gbit/s
N=16: 500 Mbit/s to 781.25 Mbit/s
N=32: 250 Mbit/s to 390.625 Mbit/s
N=64: 125 Mbit/s to 195.312 Mbit/s</td><td>Variable bit-rate range (1 kbit/s step)
8.5 Gbit/s to 11.32 Gbit/s
1/N bit-rate operation range
N=2: 4.25 Gbit/s to 5.66 Gbit/s
N=4: 2.125 Gbit/s to 2.83 Gbit/s
N=8: 1.0625 Gbit/s to 1.415 Gbit/s
N=16: 531.25 Mbit/s to 707.5 Mbit/s
N=32: 265.625 Mbit/s to 353.75 Mbit/s
N=64: 132.813 Mbit/s to 176.875 Mbit/s</td></tr>
<tr><td>Internal Reference Clock Accuracy</td><td colspan="2">±10 ppm
Offset Variability: ±100 ppm, 1 ppm step</td></tr>
<tr><td>Data Output</td><td colspan="2">Data, xData
Amplitude: Variable 0.1 Vp-p to 0.8 Vp-p, 10 mV step, AC coupled
Tr/Tf: 25 ps (20 to 80%, typ.)
Output Jitter: 3 ps rms (typ.)
Connector: SMA connector, 50Ω</td></tr>
<tr><td>Test Pattern</td><td colspan="2">PRBS: $2^7 - 1$, $2^9 - 1$, $2^{15} - 1$, $2^{23} - 1$, $2^{31} - 1$ (Invert ON/OFF)
User Data: 1.3 Mbit/s (Editable Text File, Presence Sample File)</td></tr>
<tr><td>Error Addition</td><td colspan="2">Repeat, Single</td></tr>
</table>

• ED

<table>
<tr><td rowspan="2">Operation Bit Rate</td><td>With MP2100A/MP2101A-090</td><td>Without MP2100A/MP2101A-090</td></tr>
<tr><td>Variable bit-rate range (1 kbit/s step)
8 Gbit/s to 12.5 Gbit/s
1/N bit-rate operation range*
N=2: 4 Gbit/s to 6.25 Gbit/s
N=4: 2 Gbit/s to 3.125 Gbit/s
N=8: 1 Gbit/s to 1.5625 Gbit/s
N=16: 500 Mbit/s to 781.25 Mbit/s
N=32: 250 Mbit/s to 390.625 Mbit/s
N=64: 125 Mbit/s to 195.312 Mbit/s</td><td>Variable bit-rate range (1 kbit/s step)
8.5 Gbit/s to 11.32 Gbit/s
4.25 Gbit/s to 5.66 Gbit/s</td></tr>
<tr><td>Offset Capacity</td><td colspan="2">±100 ppm</td></tr>
<tr><td rowspan="3">Electrical Data Input</td><td colspan="2">Input Number: Data, xData, Single-ended or Differential (With MP2100A-001, MP2101A-011, MP2101A-012)
Data, Single (With MP2100A-003)
Input Format: NRZ, Mark Ratio 50%
Threshold: –0.085 V to +0.085 V, 1 mV step
Consecutive Identical Digit Tolerance: 72 bits (min.)
Connector
MP2100A: K connector
MP2101A: SMA connector</td></tr>
<tr><td>With MP2100A/MP2101A-090</td><td>Without MP2100A/MP2101A-090</td></tr>
<tr><td>0.1 Vp-p to 0.8 Vp-p, AC coupled :
8.0 Gbit/s to 11.32 Gbit/s and 1/N bit rate above
(10.3125 Gbit/s, single-ended 0.1 Vp-p,
loopback, PRBS31, mark ratio 1/2, 20° to 30°C,
BER <1E–12)
0.25 Vp-p to 0.8 Vp-p, AC coupled:
11.320001 Gbit/s to 12.5 Gbit/s and 1/N bit rate above
(12.288 Gbit/s, single-ended 0.25 Vp-p,
loopback, PRBS31, mark ratio 1/2, 20° to 30°C,
BER <1E–12)</td><td>0.1 Vp-p to 0.8 Vp-p, AC coupled:
8.5 Gbit/s to 11.32 Gbit/s and 1/N bit rate above
(10.3125 Gbit/s, single-ended 0.1 Vp-p,
loopback, PRBS31, mark ratio 1/2, 20° to 30°C,
BER <1E–12)</td></tr>
<tr><td>Optical Data Input (O/E Input)</td><td colspan="2">Input Number: 1 (With MP2100A-003)
Input Format: NRZ, Mark Ratio 50%
Optical Sensitivity: –9 dBm (typ.)
Another Specification is same Optical Data Input of Eye/Pulse Scope (O/E Input) specification.</td></tr>
<tr><td>Test Pattern</td><td colspan="2">PRBS: $2^7 - 1$, $2^9 - 1$, $2^{15} - 1$, $2^{23} - 1$, $2^{31} - 1$ (Invert ON/OFF)
USER Data: 1.3 Mbit/s (Editable Text File, Presence Sample File)</td></tr>
<tr><td>Measurement</td><td colspan="2">Error Rate: 0.0001E-18 to 1.0000E-00
Error Count: 1.0000E07 to 9.9999E17</td></tr>
</table>

*: When N is 4 or higher, asynchronous data recovery is used for the ED.
In this case, the ED sync. clock cannot be used.

Eye/Pulse Scope

<table>
<tr><td colspan="2">Function</td><td>Wave Display: Eye Pattern, Pulse Pattern
Measurement Function: Time and Amplitude tests, Histogram, Eye Mask/Mask Margin Tests</td></tr>
<tr><td colspan="2">Sampling Speed</td><td>100 k sample/s (typ.)</td></tr>
<tr><td colspan="2">Trigger Clock Input</td><td>Frequency: 0.1 GHz to 12.5 GHz
Sensitivity: 100 mVp-p (typ.)
Maximum Amplitude: 2 Vp-p
Jitter
5 GHz to 12.5 GHz: 0.85 ps rms (typ.)
1 GHz to 5 GHz: 1 ps rms (typ.)
0.1 GHz to 1 GHz: 2 ps rms (typ.)
Connector: SMA connector, 50Ω</td></tr>
<tr><td colspan="2">Electrical Data Input</td><td>Input Number: A in, B in (A in is Data of BERT and B in is xData of BERT is use the common port)
(With MP2100A-001, MP2102A-021)
Input Number: A in (A in is Data of BERT is use the common port)
(With MP2100A-003, MP2102A-023)
Bandwidth (–3 dB): DC to 20 GHz (min.), DC to 25 GHz (typ.)
Maximum Input: ±2 V
Input Range: ±500 mV offset (min.)
±400 mV dynamic range (min.)</td></tr>
<tr><td colspan="2">Optical Data Input (O/E Input)</td><td>Input Number: 1 (B in)
Fiber: 62.5 µm, Multimode, accepts single mode
Wavelength: 750 nm to 1650 nm
Bandwidth: DC to 9 GHz (typ., Unfiltered, –3 dB electrical)
Responsively: 0.25 A/W (850 nm, typ.), 0.475 A/W (1310 nm, typ.), 0.45 A/W (1550 nm, typ.)
Conversion Gain: 112.5 V/W (850 nm, typ.), 210 V/W (1310 nm, typ.), 200 V/W (1550 nm, typ.)
Optical Noise: 15 µW (typ.)
Optical Sensitivity
<table>
<tr><td colspan="2">MP2100A:</td><td>Option-003</td><td>Option-007</td></tr>
<tr><td rowspan="3">Filter Option</td><td>Without Filter</td><td>–12 dBm</td><td>–15 dBm</td></tr>
<tr><td>With Option-086</td><td>–11 dBm</td><td>–14 dBm</td></tr>
<tr><td>With Filter (except Option-086)</td><td>–9 dBm</td><td>–12 dBm</td></tr>
</table>
<table>
<tr><td colspan="2">MP2102A:</td><td>—</td><td>Option-055</td></tr>
<tr><td rowspan="3">Filter Option</td><td>Without Filter</td><td>–15 dBm</td><td>–12 dBm</td></tr>
<tr><td>With Option-086</td><td>–14 dBm</td><td>–11 dBm</td></tr>
<tr><td>With Filter (except Option-086)</td><td>–12 dBm</td><td>–9 dBm</td></tr>
</table>
Maximum Input Power: –1 dBm or 794 µW (average)
+2 dBm or 1.58 mW (peak)
Absolute Maximum Ratings: +5 dBm or 3.16 mW (peak)
Optical Return Loss: –30 dB (typ.)
Connector: Select one of these Options
Option-037 FC connector
Option-038 ST connector
Option-039 DIN 47256 connector
Option-040 SC connector</td></tr>
<tr><td rowspan="5">Clock Recovery
(Option-055)</td><td>CRU Input</td><td>Connector: SMA connector (Jack), 50Ω (AC coupled)
Amplitude: 100 mVp-p (typ.)
Maximum Amplitude: 2 Vp-p: input before damage</td></tr>
<tr><td>CRU Output</td><td>Connector: SMA connector (Jack), 50Ω (AC coupled)
Amplitude: 0.5 Vp-p to 1.5 Vp-p</td></tr>
<tr><td>Clock Rates</td><td>8.5 GHz to 12.5 GHz, 0.1 GHz to 2.7 GHz</td></tr>
<tr><td>Jitter, RMS
(additive)</td><td>8.5 GHz to 12.5 GHz band: 10 mUI (typ.), 20 mUI (4 MHz loop BW, max.)
0.1 GHz to 2.7 GHz band: 5 mUI (typ.)</td></tr>
<tr><td>Loop Bandwidth
(typ.)</td><td>8.5 GHz to 12.5 GHz band: 1, 2, 4, or 8 MHz (Possible to change, typ.)
0.1 GHz to 2.7 GHz band
2488.32 GHz: 200 kHz (typ.)
622 MHz: 50 kHz (typ.)
156 MHz: 20 kHz (typ.)</td></tr>
<tr><td colspan="2">Low Pass Filter (156M) (Option-070)</td><td>0.116 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (622M) (Option-071)</td><td>0.47 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (1.0G) (Option-072)</td><td>0.80 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (1.2G) (Option-073)</td><td>0.94 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (2.1G) (Option-076)</td><td>1.6 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (2.5G) (Option-077)</td><td>1.87 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (2.6G) (Option-078)</td><td>2.0 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (3.1G) (Option-079)</td><td>2.37 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (4.2G) (Option-080)</td><td>3.2 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (5.0G) (Option-081)</td><td>3.75 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (6.2G) (Option-082)</td><td>4.61 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (8.5G) (Option-083)</td><td>6.3 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (9.9G to 10.3G)
(Option-084)</td><td>7.6 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (10.5G to 11.3G)
(Option-085)</td><td>8.2 GHz (–3 dB cut off typical) LPF</td></tr>
<tr><td colspan="2">Low Pass Filter (9.9G to 10.7G)
(Option-086)</td><td>7.5 GHz (–3 dB cut off typical) LPF</td></tr>
</table>

MX210001A Jitter Analysis Software

Operating Conditions	Operates only when installed in MP2100A/MP2102A with correct license information The installer runs with V3.00.00 or later Other use conditions comply with MP2100A series The WDP runs under MATLAB R2010b SP1
Measurement Algorithm	Histogram mode, Pattern Search mode
Histogram Mode	
Measurement Targets	Channel A, Channel B, Channel A&B, Differential signals (MP2100A-001 or MP2102A-021)
Measurement Items	TJ (1.0E-12), TJ (user defined)*, RJ (d-d), DJ (d-d), J2 jitter, J9 jitter, Eye opening*
Measurement Graphs	TJ Histogram CHA, TJ Histogram CHB, Bathtub CHA, Bathtub CHB
Pattern Search Mode	
Pattern Length	2 to 32768
Measurement Targets	Channel A, Channel B, Differential signal (MP2100A-001 or MP2102A-021)
Measurement Items	TJ (1.0e-12), TJ (user defined)*, RJ (d-d), RJ (rms), DJ (d-d), PJ (p-p), DDJ (p-p), DCD, ISI (p-p), Eye opening*, J2 jitter, J9 jitter, DDPWS, PJ Frequency
Measurement Graphs	TJ Histogram, RJ/PJ Histogram, DDJ Histogram, Composite histogram, DDJ vs. Bit, Bathtub, PJ vs. Frequency
PDJ Standard PDJ Filter	(Hz) — see table below
Measurement Edge Type	ALL, Rising, Falling
Jitter Unit	UI, Time (Result of unit)
WDP Measurement	Requires installation of MATLAB R2010b SP1 by MathWorks
Measurement Targets	Channel A, Channel B
Measurement Items	WDP, dWDP, TWDP, dTWDP, WDPc, dWDPc, TWDPc, dWDPc
Signal Bit Rate	0.1 Gbit/s to 12.5 Gbit/s, 1-kbit/s steps
Input Pattern	PRBS9, Variable
Input Pattern Length	64 to 2048, 1 steps (input pattern variable)

PDJ Standard / PDJ Filter (Hz)

Standard	HP0	HP1	HP1'	HP2	HP'	HP	LP	LP'
STM-0	10	100	—	20 k	—	12 k	400 k	—
STM-1	10	500	—	65 k	—	12 k	1.3 M	500
STM-4	10	1 k	—	250 k	—	12 k	5 M	1 k
STM-16	10	5 k	—	1 M	—	12 k	20 M	5 k
STM-64	10	20 k	10 k	4 M	50 k	12 k	80 M	20 k
STM-256	—	80 k	20 k	16 M	—	—	320 M	—

*: BER specified as TJ Measurement BER in setting items

MX210002A Transmission Analysis Software

Operating Conditions	Operates only when installed in MP2100A/MP2102A with correct license information The installer runs with V3.00.00 or later Other use conditions comply with MP2100A series
Measurement Mode	Transmission analysis, Waveform estimation
Transmission Analysis*	
Measurement Items	Gain graph, Phase graph, Group delay graph (Phase graph and Group delay graph switching display)
Gain Graph	Displays amplitude characteristics of transmission frequency characteristics
Frequency Range	0.0 Hz to 25 GHz, 0.025-GHz steps
Frequency Scale	0.5 GHz to 5.0 GHz/division, 0.1-GHz steps (max. frequency <25 GHz)
Frequency Offset	0.0 Hz to 20.0 GHz, 0.5-GHz steps (max. frequency <25 GHz)
Gain Scale	0.5 to 20.0 dB/division, 0.5-dB steps
Gain Offset	–80.0 to +80.0 dB, 0.5-dB steps
Phase Graph	Displays phase characteristics of transmission frequency characteristics
Phase Scale	Degree: –180 to +180° Radian: –3.14 to +3.14
Group Delay Graph	Displays group delay characteristic of transmission frequency characteristics. Group delay characteristic is set by relative delay.
Group Delay Scale	1 to 1000 ps/division, 1-ps steps
Group Delay Offset	–500 to +500 ps/division, 1-ps steps
Phase Graph Unit	Degree, Radian
Read Out Marker	Read Out Marker function
Average	Displays average result/measurement (1 to 99 times, 1-time steps)
Smoothing	Calculates moving average of measurement value (Enable, Disable switching display)
Smoothing Factor	0.0 to 10.0%, 0.1% steps
Calibration	Sets calibration information for basic transmission characteristics
Waveform Estimation	
Equalizer Setting	Selects reflector, non-reflector at calculation
Equalizer Type	Analog, Digital
Emphasis Format	2Post/1Pre, 3Post, 1Post/1Pre, 2Post, 1Post
Emphasis Tap	–10.0 to +10.0 dB, 0.1-dB steps
Device Character	Reads S2P File
Jitter Analysis	Displays estimated waveform calculation results at MX210001A (when MX210001A installed in MP2100A)

*: Operates on MP2100A BERTWave

XFP Slot (Option-050)

Tx Data Input	Single-ended data input: 0.2 Vp-p to 0.4 Vp-p Input waveform: NRZ Connector: SMA connector, 50Ω/GND
Rx Data Output	Single-end output level: 0.1 Vp-p (min.), 1.0 Vp-p (max.) Output waveform: NRZ Connector: SMA connector, 50Ω/GND
Laser Safety	IEC60825-1: 2007: CLASS 1 21CFR1040.10*

SFP+ Slot (Option-051)

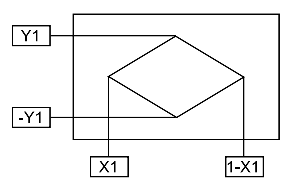
Tx Data Input	Single-end input level: 0.6 Vp-p to 0.8 Vp-p (G0238A) 0.25 Vp-p to 0.35 Vp-p (G0239A) Input waveform: NRZ Connector: SMA connector, 50Ω/GND
Rx Data Output	Single-end output level: 0.10 Vp-p (min.), 1.0 Vp-p (max.) Output waveform: NRZ Connector: SMA connector, 50Ω/GND
Laser Safety	IEC60825-1: 2007: CLASS 1 21CFR1040.10*

*: All laser sources of this plug-in unit are classified as Class 1 according to IEC 60825-1 (2007). All laser sources comply with 21CFR 1040.10 except for deviations pursuant to Laser Notice No.50, dated 2007-June-24.
The following descriptive labels are affixed to the product.

Full Rate Clock Output (Option-052)

Operation Frequency	The MP2100A/01A-052 supports output at the following bit rates. With MP2100A/MP2101A-090 8.0 GHz to 12.5 GHz (1/1 rate) 4.0 GHz to 6.25 GHz (1/2 rate) 2.0 GHz to 3.125 GHz (1/4 rate) 1.0 GHz to 1.5625 GHz (1/8 rate) Without MP2100A/MP2101A-090 8.5 GHz to 11.32 GHz (1/1 rate) 4.25 GHz to 5.66 GHz (1/2 rate) 2.125 GHz to 2.83 GHz (1/4 rate) 1.0625 GHz to 1.415 GHz (1/8 rate) No clock is output when operating at the 1/16, 1/32, and 1/64 rates.
No. of Output Ports	1 (Single end)
Amplitude	300 mVp-p to 750 mVp-p
Duty	50±15%
Tr/Tf	30 ps (20 to 80%) (typ.)
Jitter (RMS)	2 ps rms (typ.) (10 GHz, Sync. Clock 1/8) 2 ps rms (typ.) (12.5 GHz, Sync. Clock 1/8, With MP2100A/MP2101A-090)
Connector	SMA connector
Termination	50Ω/AC coupled
Reference Channel	Clock output synchronization target Ch1 PPG, ED: 1/1 rate, 1/2 rate operation selectable Ch2 PPG: With MP2100A-005 or MP2101A-012 ED: With MP2100A-005 or MP2101A-012 and 1/1 rate or 1/2 rate
Alarm	PLL Unlock Detect Function

ED High-sensitivity Output (Option-091)

Jitter Standard	Standardized jitter tolerance value per bit rate
Total Jitter: TJ [UI]	10.3125 Gbps: 0.65 4.25 Gbps: 0.325 2.125 Gbps: 0.325
Deterministic Jitter	10.3125 Gbps: 0.45 4.25 Gbps: 0.225 2.125 Gbps: 0.225
SJ (d-d) [UI] (4 MHz)	10.3125 Gbps: 0.22 4.25 Gbps: 0.11 2.125 Gbps: 0.11
Eye Mask Standard	Standardized input Eye mask per bit rate 
Y1: [mV]	MP2100A: Ch1 ED 10.3125 Gbps: 50 4.25 Gbps: 50 2.125 Gbps: 50 MP2100A: Ch2 ED 10.3125 Gbps: 25 4.25 Gbps: 25 2.125 Gbps: 25 MP2101A: Ch1 ED, Ch2 ED 10.3125 Gbps: 25 4.25 Gbps: 25 2.125 Gbps: 25
X1: [UI]	10.3125 Gbps: 0.325 4.25 Gbps: 0.1625 2.125 Gbps: 0.1625

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

MP2100A BERTWave

Model/Order No.	Name	
	Main frame	
MP2100A	BERTWave	
	Standard accessories	
	Power Cord:	1
MX210000A	BERTWave Control Software	
	(CD-ROM, Operation manual):	1
	Option	
MP2100A-001	Dual Electrical Receiver	
MP2100A-003	Optical/Single-ended Electrical Receiver*1	
MP2100A-005	Extended PPG/ED Channel	
MP2100A-007	1ch Electrical BERT and Optical/Single-ended Electrical Scope*2	
MP2100A-030	GPIB	
MP2100A-037	FC Connector	
MP2100A-038	ST Connector	
MP2100A-039	DIN47256 Connector	
MP2100A-040	SC Connector	
MP2100A-050	XFP Slot	
MP2100A-051	SFP+ Slot	
MP2100A-052	Full Rate Clock Output	
MP2100A-055	Clock Recovery for Eye/Pulse Scope	
MP2100A-056	Low Pass Filter Bank (8.5G/10G/10.7G)	
MP2100A-057	Low Pass Filter Bank (2G/4G/8.5G/10G)	
MP2100A-061	1 High Bit Rate Filter	
MP2100A-062	2 High Bit Rate Filter Bank	
MP2100A-063	3 to 4 High Bit Rate Filter Bank	
MP2100A-064	1 to 2 Low Bit Rate Filter Bank	
MP2100A-065	3 to 4 Low Bit Rate Filter Bank	
MP2100A-066	1 High Bit Rate/1 to 2 Low Bit Rate Filter Bank	
MP2100A-067	1 to 2 High Bit Rate/3 to 4 Low Bit Rate Filter Bank	
MP2100A-068	2 to 3 High Bit Rate/1 to 2 Low Bit Rate Filter Bank	
MP2100A-069	3 High Bit Rate/3 Low Bit Rate Filter Bank	
MP2100A-070	LPF for 156M (L)	
MP2100A-071	LPF for 622M (L)	
MP2100A-072	LPF for 1.0G (L)	
MP2100A-073	LPF for 1.2G (L)	
MP2100A-076	LPF for 2.1G (H)	
MP2100A-077	LPF for 2.5G (H)	
MP2100A-078	LPF for 2.6G (H)	
MP2100A-079	LPF for 3.1G (H)	
MP2100A-080	LPF for 4.2G (H)	
MP2100A-081	LPF for 5.0G (H)	
MP2100A-082	LPF for 6.2G (H)	
MP2100A-083	LPF for 8.5G (H)	
MP2100A-084	LPF for 9.9G to 10.3G (H)*1	
MP2100A-085	LPF for 10.5G to 11.3G (H)	
MP2100A-086	LPF for Multi 10G (H)*3	
MP2100A-090	Bit Rate Extension for PPG/ED	
MP2100A-091	ED High Sensitivity	
MP2100A-107	1ch Electrical BERT and Optical/Single-ended Scope Retrofit*4, *5	
MP2100A-130	GPIB Retrofit (Upgrade option to original order)	
MP2100A-152	Full Rate Clock Output Retrofit	
MP2100A-176	LPF for 2.1G (H) Retrofit	
MP2100A-177	LPF for 2.5G (H) Retrofit	
MP2100A-178	LPF for 2.6G (H) Retrofit	
MP2100A-179	LPF for 3.1G (H) Retrofit	
MP2100A-180	LPF for 4.2G (H) Retrofit	
MP2100A-181	LPF for 5.0G (H) Retrofit	
MP2100A-182	LPF for 6.2G (H) Retrofit	
MP2100A-183	LPF for 8.5G (H) Retrofit	
MP2100A-184	LPF for 9.9G to 10.3G (H) Retrofit	
MP2100A-185	LPF for 10.5G to 11.3G (H) Retrofit	
MP2100A-186	LPF for Multi 10G (H) Retrofit*6	
MP2100A-191	ED High Sensitivity Retrofit	

Model/Order No.	Name	
	Standard accessories (MP2100A-001)	
J1137	Terminator:	2
J1341A	Open (Coaxial connector cover):	5
J1359A	Coaxial Adaptor (K-P · K-J, SMA compatible):	2
	Standard accessories (MP2100A-003)	
J1137	Terminator:	2
J1341A	Open (Coaxial connector cover):	4
J1359A	Coaxial Adaptor (K-P · K-J, SMA compatible):	1
	Standard accessories (MP2100A-005)	
J1137	Terminator:	2
J1341A	Open (Coaxial connector cover):	2
	Standard accessories (MP2100A-050)	
J1341A	Open (Coaxial connector cover):	2
	Standard accessories (MP2100A-051)	
J1341A	Open (Coaxial connector cover):	2
	Standard accessories (MP2100A-055)	
J1341A	Open (Coaxial connector cover):	1
	Maintenance service	
MP2100A-ES310	Three Years Extended Warranty Service	
MP2100A-ES510	Five Years Extended Warranty Service	

MP2101A BERTWave PE

Model/Order No.	Name	
	Main frame	
MP2101A	BERTWave PE	
	Standard accessories	
	Power Cord:	1
MX210000A	BERTWave Control Software	
	(CD-ROM, Operation manual):	1
	Option	
MP2101A-011	1CH PPG/ED	
MP2101A-012	2CH PPG/ED	
MP2101A-030	GPIB	
MP2101A-050	XFP Slot	
MP2101A-051	SFP+ Slot	
MP2101A-052	Full Rate Clock Output	
MP2101A-090	Bit Rate Extension for PPG/ED	
MP2101A-091	ED High Sensitivity	
MP2101A-130	GPIB Retrofit (Upgrade option to original order)	
MP2101A-152	Full Rate Clock Output Retrofit	
MP2101A-191	ED High Sensitivity Retrofit	
	Standard accessories (MP2101A-011)	
J1137	Terminator:	2
J1341A	Open (Coaxial connector cover):	4
	Standard accessories (MP2101A-012)	
J1137	Terminator:	4
J1341A	Open (Coaxial connector cover):	6
	Standard accessories (MP2101A-050)	
J1341A	Open (Coaxial connector cover):	2
	Standard accessories (MP2101A-051)	
J1341A	Open (Coaxial connector cover):	2
	Maintenance service	
MP2101A-ES310	Three Years Extended Warranty Service	
MP2101A-ES510	Five Years Extended Warranty Service	

MP2102A BERTWave SS

Model/Order No.	Name
	Main frame
MP2102A	BERTWave SS
	Standard accessories
	Power Cord: 1
MX210000A	BERTWave Control Software
	(CD-ROM, Operation manual): 1
	Option
MP2102A-021	Dual Electrical Receiver
MP2102A-023	Optical/Single-ended Electrical Receiver
MP2102A-030	GPIB
MP2102A-037	FC Connector
MP2102A-038	ST Connector
MP2102A-039	DIN 47256 Connector
MP2102A-040	SC Connector
MP2102A-055	Clock Recovery
MP2102A-061	1 High Bit Rate Filter
MP2102A-062	2 High Bit Rate Filter Bank
MP2102A-063	3 to 4 High Bit Rate Filter Bank
MP2102A-064	1 to 2 Low Bit Rate Filter Bank
MP2102A-065	3 to 4 Low Bit Rate Filter Bank
MP2102A-066	1 High Bit Rate/1 to 2 Low Bit Rate Filter Bank
MP2102A-067	1 to 2 High Bit Rate/3 to 4 Low Bit Rate Filter Bank
MP2102A-068	2 to 3 High Bit Rate/1 to 2 Low Bit Rate Filter Bank
MP2102A-069	3 High Bit Rate/3 Low Bit Rate Filter Bank
MP2102A-070	LPF for 156M (L)
MP2102A-071	LPF for 622M (L)
MP2102A-072	LPF for 1.0G (L)
MP2102A-073	LPF for 1.2G (L)
MP2102A-076	LPF for 2.1G (H)
MP2102A-077	LPF for 2.5G (H)
MP2102A-078	LPF for 2.6G (H)
MP2102A-079	LPF for 3.1G (H)
MP2102A-080	LPF for 4.2G (H)
MP2102A-081	LPF for 5.0G (H)
MP2102A-082	LPF for 6.2G (H)
MP2102A-083	LPF for 8.5G (H)
MP2102A-084	LPF for 9.9G to 10.3G (H)*1
MP2102A-085	LPF for 10.5G to 11.3G (H)
MP2102A-086	LPF for Multi 10G (H)*3
MP2102A-130	GPIB Retrofit (Upgrade option to original order)
MP2102A-176	LPF for 2.1G (H) Retrofit
MP2102A-177	LPF for 2.5G (H) Retrofit
MP2102A-178	LPF for 2.6G (H) Retrofit
MP2102A-179	LPF for 3.1G (H) Retrofit
MP2102A-180	LPF for 4.2G (H) Retrofit
MP2102A-181	LPF for 5.0G (H) Retrofit
MP2102A-182	LPF for 6.2G (H) Retrofit
MP2102A-183	LPF for 8.5G (H) Retrofit
MP2102A-184	LPF for 9.9G to 10.3G (H) Retrofit
MP2102A-185	LPF for 10.5G to 11.3G (H) Retrofit
MP2102A-186	LPF for Multi 10G (H) Retrofit*6
	Standard accessories (MP2102A-021)
J1341A	Open (Coaxial connector cover): 3
J1359A	Coaxial Adaptor (K-P · K-J, SMA compatible): 2
	Standard accessories (MP2102A-023)
J1341A	Open (Coaxial connector cover): 2
J1359A	Coaxial Adaptor (K-P · K-J, SMA compatible): 1
	Standard accessories (MP2102A-055)
J1341A	Open (Coaxial connector cover): 2
	Maintenance service
MP2102A-ES310	Three Years Extended Warranty Service
MP2102A-ES510	Five Years Extended Warranty Service

Optional Accessories

Model/Order No.	Name
J1137	Terminator
J1341A	Open (Coaxial connector cover)
J1359A	Coaxial Adaptor (K-P · K-J, SMA compatible)
J1349A	Coaxial Cable 0.3 m
J1342A	Coaxial Cable 0.8 m
J1343A	Coaxial Cable 1 m
G0238A	SFP+ SR 850 nm
G0239A	SFP+ LR 1310 nm
G0174A	850 nm XFP Module (9.95 to 11.10 Gbit/s)
G0194A	1310 nm XFP Module
G0195A	1550 nm XFP Module
G0177A	850 nm SFP Module (1.062 to 4.25 Gbit/s)
G0178A	1310 nm SFP Module (0.155 to 2.67 Gbit/s)
G0179A	1550 nm SFP Module (0.155 to 2.67 Gbit/s)
J1344A	LC/PC-LC/PC-1M-SM
J1139A	FC · PC-LC · PC-1M-SM
J1345A	SC/PC-LC/PC-1M-SM
J1346A	LC/PC-LC/PC-1M-GI (62.5/125)
J1347A	FC/PC-LC/PC-1M-GI (62.5/125)
J1348A	SC/PC-LC/PC-1M-GI (62.5/125)
J1510A	Pick OFF Tee
B0639A	Carrying Case
W3349AE	MP2100A/MP2101A/MP2102A Operation Manual (Operation)
W3350AE	MP2100A/MP2101A/MP2102A Operation Manual (Remote Control, SCPI)
W3354AE	MP2100A/MP2101A/MP2102A Operation Manual (Remote Control, Native)
G0301A	External CDR Board (<2.667G)
J1512A	7.5G Passive Probe Set
B0650A	Rack Mount Kit

Software

Model/Order No.	Name
MX210001A	Jitter Analysis Software
MX210002A	Transmission Analysis Software

*1: Build to Order.
*2: Does not support optical BER measurements. Does not support Clock Recovery function of optical signal.
*3: Cannot be used with Option-084.
*4: Retrofitting is not supported the optical signal clock recovery function when the MP2100A-055 is installed.
*5: Retrofitting is possible only for the MP2100A-003 configuration. It is not supported for the MP2100A-001 configuration.
*6: When retrofitting to configurations including the Option-084, the Option-084 must be removed and replaced by either the Option-086.

IP/NETWORK MEASURING INSTRUMENTS

Selection Guide 122
Data Quality Analyzer.. 123
40/100G Ethernet Analyzer...................................... 131
Network Performance Tester 135
40G SDH/SONET Analyzer...................................... 145
Network Master Series
  Gigabit Ethernet Modules....................................... 152
Multi-Layer Network Test Platform
  10 GigE/SDH/SONET/OTN.................................... 158
  Ethernet Test Set 165
All-In-One Field Tester 168
Ethernet Tester up to 10 Gbps 179

Selection Guide

• Bit Rate/Interface

Bit Rate/Interface	MP1590B	MP1595A	MD1230B	CMA 3000	CMA 3000 Ethernet	CMA5000a GigE II	CMA5000a -UTA	MT9090A/ MU909060Ax	MD1260A
1.544 Mbit/s: DS1	✓	✓							
2.048 Mbit/s: E1	✓	✓		✓					
8.448 Mbit/s: E2	✓	✓							
34.368 Mbit/s: E3	✓	✓		✓					
44.736 Mbit/s: DS3	✓	✓							
139.264 Mbit/s: E4	✓	✓		✓					
51.84 Mbit/s: STM-0/OC-1	✓	✓							
155.52 Mbit/s: STM-1	✓	✓		✓			✓		
155.52 Mbit/s: OC-3	✓	✓					✓		
622.08 Mbit/s: STM-4	✓	✓		✓			✓		
622.08 Mbit/s: OC-12	✓	✓					✓		
2488.32 Mbit/s: STM-16	✓	✓		✓			✓		
2488.32 Mbit/s: OC-48	✓	✓					✓		
9953.28 Mbit/s: STM-64	✓	✓		✓			✓		
9953.28 Mbit/s: OC-192	✓	✓					✓		
39813.12 Mbit/s: STM-256/OC-768		✓							
2666.057 Mbit/s: OTU-1	✓	✓					✓		
10709.225 Mbit/s: OTU-2	✓	✓					✓		
11.049 Gbit/s/11.096 Gbit/s: FEC	✓						✓		
43.018 Gbit/s: OTU-3		✓							✓*
111.809 Gbit/s: OTU-4									✓*
10M/100M Ethernet	✓		✓	✓	✓	✓		✓	
Gigabit Ethernet	✓		✓	✓	✓	✓		✓	
10 Gigabit Ethernet	✓		✓	✓	✓		✓		
40 Gigabit Ethernet									✓
100 Gigabit Ethernet									✓

*: ITU-T G.709 Annex C

• Measurement Functions

Measurement Functions		MP1590B	MP1595A	MD1230B	CMA 3000	CMA 3000 Ethernet	CMA5000a GigE II	CMA5000a -UTA	MT9090A/ MU909060Ax	MD1260A
ISDN, PDH/DSn	Frequency Measurements	✓	✓		✓			✓		
	Error Measurement (G.821, etc.)	✓	✓		✓					
OTN/ SDH/ SONET/ EOS	OTN Frame	✓	✓					✓		✓
	SDH Frame	✓	✓		✓			✓		
	SONET Frame	✓	✓					✓		
	GFP Frame	✓								
	O.191 Test Cells				✓					
	1-Point CDV, 2-Point CDV				✓					
	ATM over SDH/SONET				✓			✓		
	CID Pattern G.958									
	Tandem Connection Pattern G.707	✓	✓		✓			✓		
	Automatic Protection Switch	✓	✓		✓			✓		✓
	Frame Memory/Capture		✓					✓		✓
	PDH Mapping	✓	✓		✓			✓		
	DSn Mapping	✓	✓					✓		
	GMP Mapping									✓
	POS	✓								
	Through Mode	✓	✓		✓			✓		✓
	Optical Power Measurements	✓	✓		✓			✓		✓
	Jitter/Wander Measurements	✓	✓							
	Frequency Offset	✓	✓		✓			✓		✓
Ethernet	Packet Capture	✓		✓				✓		✓
	Protocol Decoding	✓		✓				✓		✓
	Protocol Emulation	✓		✓						
	XENPAK Measurements	✓		✓						
	RFC2544 Automatic Test	✓		✓	✓	✓	✓	✓	✓	✓
	Y.1564 Automatic Test				✓	✓			✓	
	RFC2889 Automatic Test	✓		✓						
	Through Mode	✓		✓	✓	✓	✓		✓	
	Traffic Map							✓		
	Traffic Monitor	✓		✓	✓	✓	✓	✓	✓	✓
	Full Wire Rate Transmission	✓		✓	✓	✓	✓	✓	✓	✓
	Packet BER Measurement	✓		✓	✓	✓	✓	✓	✓	✓
	Latency	✓		✓	✓	✓	✓	✓	✓	✓
Remote Control		✓	✓	✓	✓	✓	✓	✓	✓	✓

DATA QUALITY ANALYZER
MD1230B

Remote Control
GPIB OPTION | Ethernet OPTION

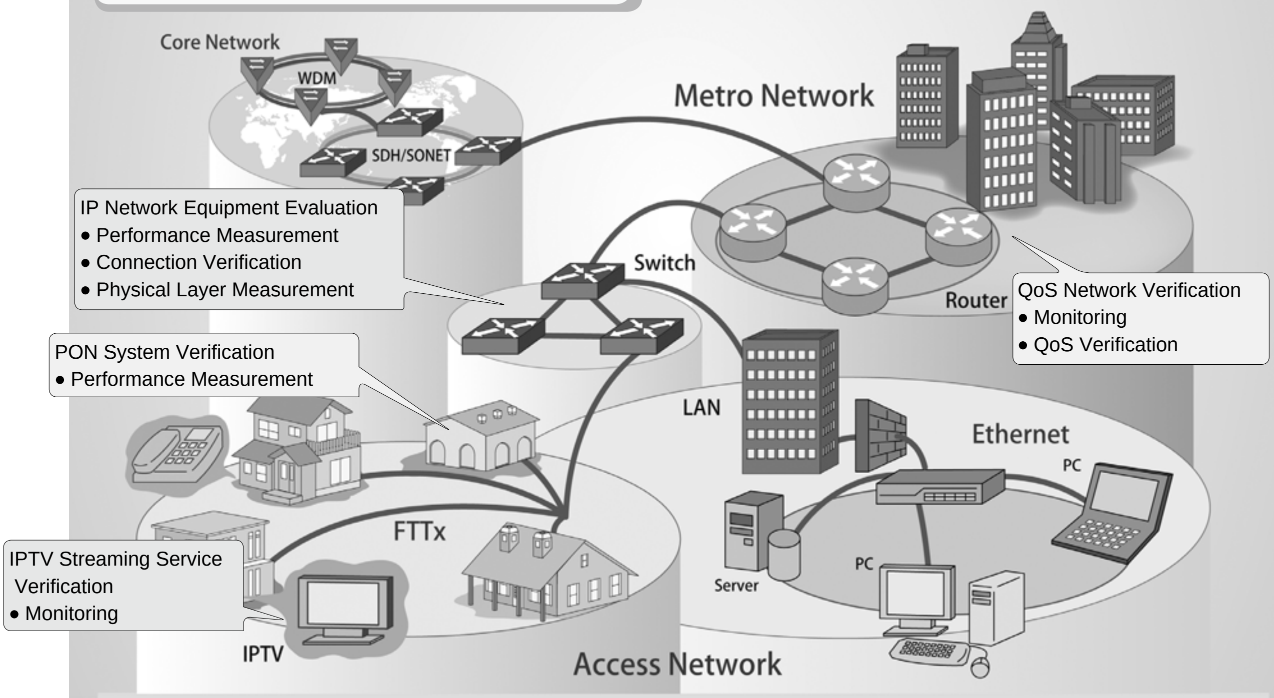
IP Testing Instruments Changing in Response to Applications for Metropolitan-area and Access Networks

The MD1230B Data Quality Analyzer is a group of IP/Ethernet measuring instruments covering the increasingly active field of next-generation networks. The family supports the full range of access and metro network applications, including PON system verification, IP network equipment evaluation, network QoS verification, and IPTV streaming service verification. In addition, the products combine all the functions required for performance evaluation of IP network equipment and network systems in all-in-one platform, offering a high-efficiency measurement environment with integrated operations. The MD1230B is the Anritsu solution of choice for all your next-generation network measurement needs.

Versatile Applications

1. IP Network Equipment Evaluation
(1) High-density Switch Performance Evaluation
(2) Automated Switch Performance Measurement
(3) Interoperability Verification
(4) Physical Layer Measurement

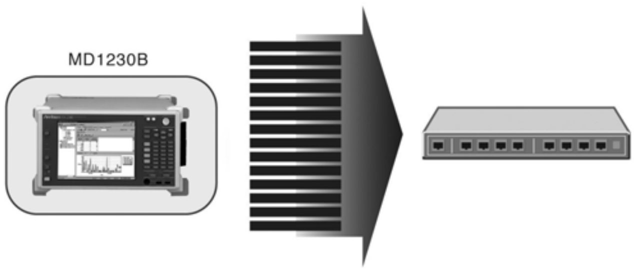
2. Network System Verification
(1) PON System Verification
(2) IPTV Streaming Service Verification
(3) Carrier Class Network Service Verification



IP Network Equipment Evaluation

• High-Density Switch Performance Measurements

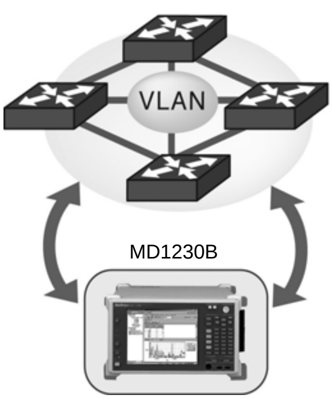
One MD1230B unit supports control and measurement of up to 60 ports, respectively. Therefore, all 48 ports of the highest-density 1U switch can be load-tested simultaneously, providing a small footprint, cost savings, and effective return on investment.

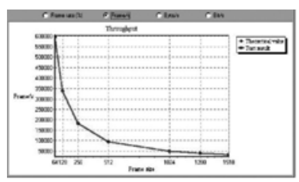


• Automatic Switch Performance Measurement

One-button, IETF RFC2544 and RFC2889-compliant automatic performance testing [Option-10] supports automatic display of measurement results, shortening evaluation times and improving work efficiency.

VLAN networks are supported as well.





RFC2544 Throughput Result

RFC2889 Result

• Connection Verification

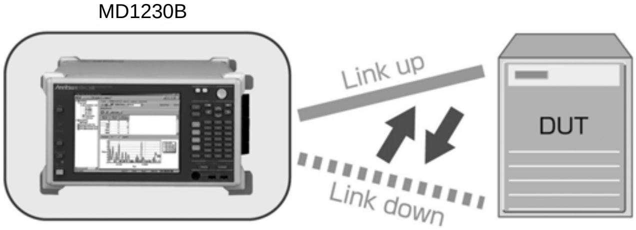
The following functions make network configuration pre-verification interoperability checks and fault troubleshooting easier, while elimination of link faults improves network connection reliability.

<Link Test>

Repeatedly forcing the link on and off permits verification of equipment operation during a Link Flap situation.

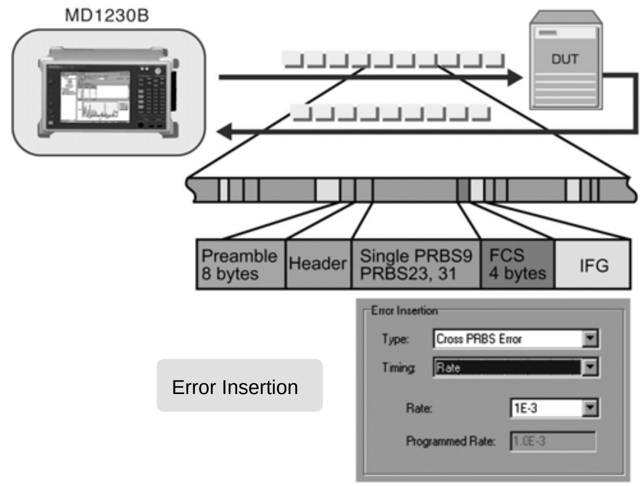
<Auto Negotiation Analysis> [Option-15]

The auto negotiation connection status is easily analyzed using the Sequence Capture and Decode functions to improve the validity of interoperability test verification.



• Physical Layer Measurements

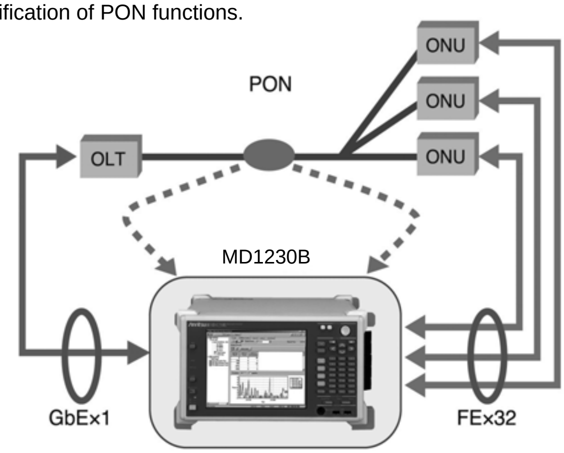
Verification of signal transmission quality is key to improving network reliability. The variable measurement clock (±100 ppm) and clock monitoring functions of the Clock Measurement Option [MU120131A/132A/138A-01], as well as the error insertion and error measurement functions of the BER Measurement Option [Option-11], support this verification to assure high-reliability operation at the equipment physical layer.



Network System Verification

PON System Verification

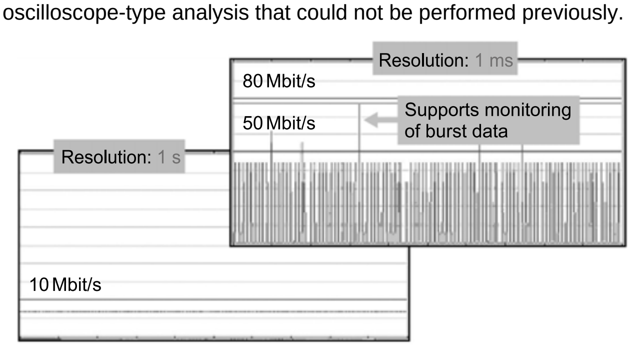
A single MD1230B unit can control a simultaneous end-to-end evaluation of a 32-branch PON system. Each unit also supports OAM analysis by capturing and decoding E-PON system frames for verification of PON functions.



IPTV Streaming Service Verification

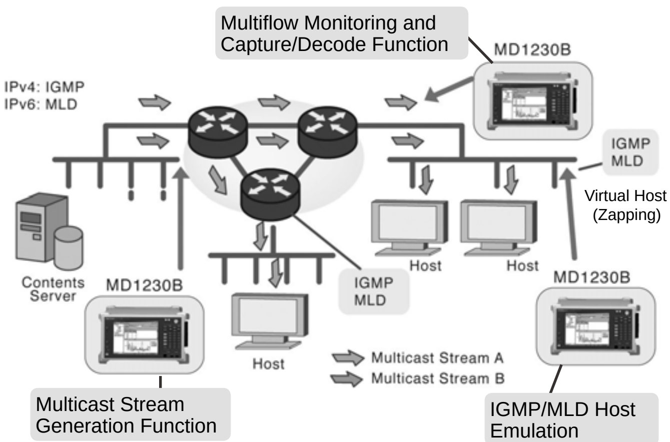
• High-Resolution Traffic Monitor

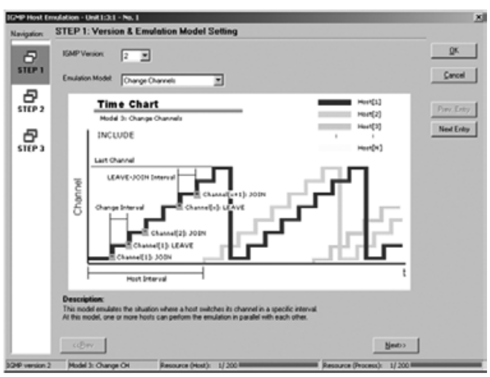
Previous measuring instruments (with 1-s resolution) are inadequate for analyzing burst data that can impact the quality of streaming services. However, the Application Traffic Monitor [Option-20] provides monitoring of burst data with 1 ms resolution for realtime oscilloscope-type analysis that could not be performed previously.



Same Traffic Monitored at Different Resolution

• IP Multicasts (Channel Zapping)
Surfing quickly through IPTV channels (called zapping) puts extremely high loads on the network and its routers. The multicast host emulation feature automatically increases and decreases the number of virtual hosts and channel zapping levels to verify and evaluate IP multicast QoS under high load conditions, which is difficult to achieve intentionally in a real network.

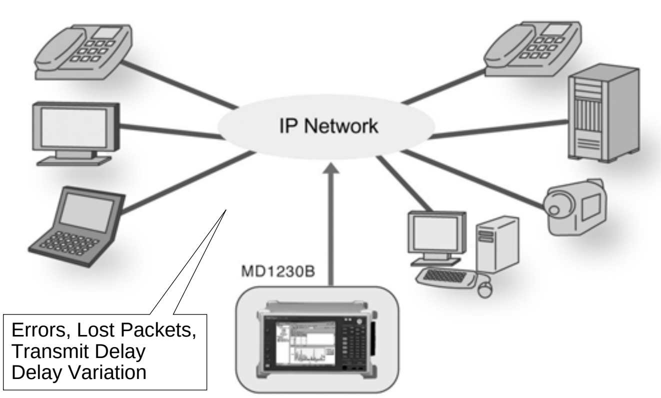




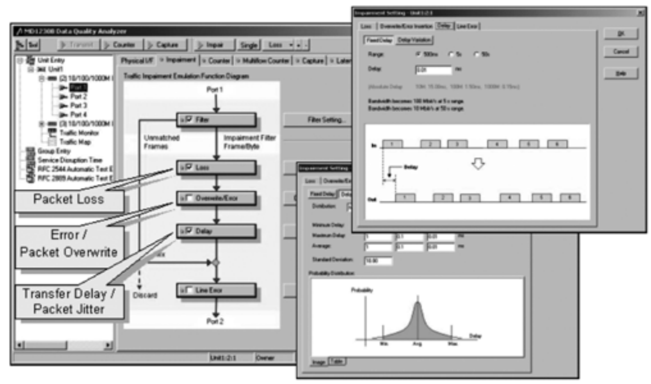
Multicast Host Emulation

<Multicast Host Emulation>
Multicast protocols that can be analyzed and emulated:
• IGMPv2/IGMPv3
• MLDv1/MLDv2 [Option-12]

• Traffic Impairment Emulator



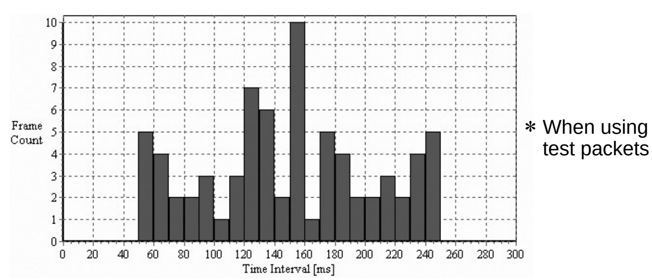
The Traffic Impairment Emulator [Option-17] emulates network faults to evaluate and verify service quality under hypothetical fault conditions.
Service quality can be checked by emulating packet loss, errors, and delays occurring in actual networks, such as IPTV and VoIP streams. In addition, because the effect of network faults can be varied in real time, different networks conditions can be emulated effectively.



<Traffic Impairment Emulator>*1
The following effects can be inserted:
• Packet Loss
• Error/Packet Overwrite
• Delay (Transmission Delay 51.2 s*2 max.) /Packet Jitter

∗1: The Traffic Impairment Emulator uses Ports 1 and 2 of the MU120121A 10/100/1000M Ethernet Module or the MU120122A Gigabit Ethernet Module.
∗2: When using 50-s range (guaranteed bandwidth: 10 Mbit/s)

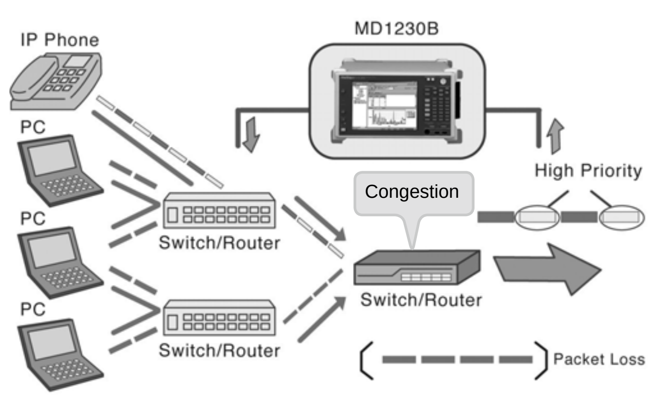
• Delay Time Distribution (Packet Jitter)
Packet jitter impacting the quality of real-time services can be monitored.



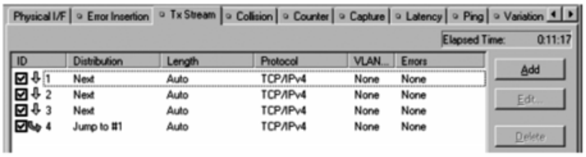
Latency Distribution

Carrier Class Network Service Verification

• Multiflow Counter QoS Priority Control Verification
Emulating high-load conditions and monitoring individual traffic flows under these conditions enables pre-commissioning QoS evaluation and verification.



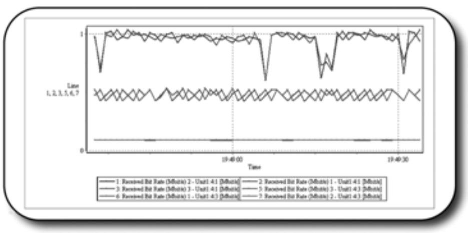
<Stream Generation>
Full-wire-rate, high-load traffic can be generated easily, something that is difficult to do intentionally on a real network. Using the stream editing functions supports flexible setting of QoS-related parameters.

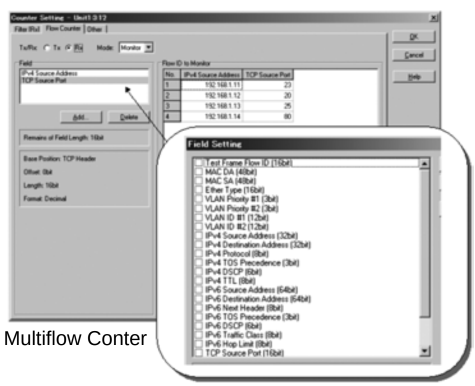


Stream Generation

<Multiflow Counter>*1
Simultaneous monitoring of every traffic condition (throughout/delay/frame loss) enables verification of QoS controls and measurement of QoS efficiency. Templates with various priority parameters, including MAC, VLAN, IP, and TCP/UDP port number, are provided.

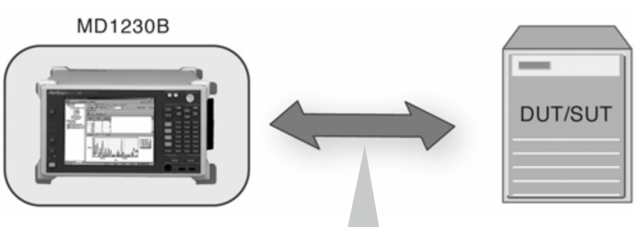
*1: Using MU120131A 10/100/1000M Ethernet Module, MU120132A Gigabit Ethernet Module, and MU120138A 10 Gigabit Ethernet Module Multiflow Counter





Flow Definitions (Priority Parameters)

• Ethernet OAM Function Verification
The Ethernet OAM Protocol Emulation Function [Option-28] imitates equipment supporting Ethernet OAM (MEP) for evaluation and verification of networks and network equipment.



<Ethernet OAM Protocol Emulation>
Supports ITU-T Y.1731 and IEEE 802.1ag
CCM periodic send*1; LBM/LTM response*1;
RDI addition*1; LOC/AIS/RDI detection*1; and OAM frame send and protocol analysis of captured frame

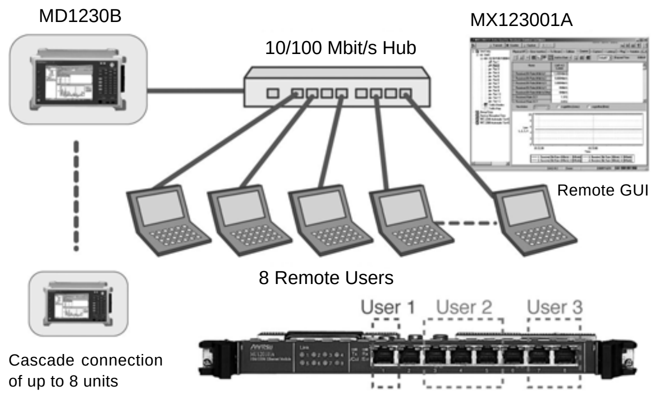
*1: Enabled with MU120131A 10/100/1000M Ethernet Module, MU120132A Gigabit Ethernet Module, MU120121A 10/100/1000M Ethernet Module, MU120122A Gigabit Ethernet Module, and MU120138A 10 Gigabit Ethernet Module

• Protocol Analysis
In addition to the standard protocol decoding functions, installing the Ethereal®/Wireshark® and Sniffer® Technologies option [Option-04, MX123002A], supports more detailed analysis of captured data.

- Ethereal® is registered trademarks of Ethereal, Inc.
- Wireshark® is registered trademarks of Gerald Combs.
- Sniffer® is registered trademarks or trademarks of Network General Corporation and/or its affiliates in the US and/or other countries.

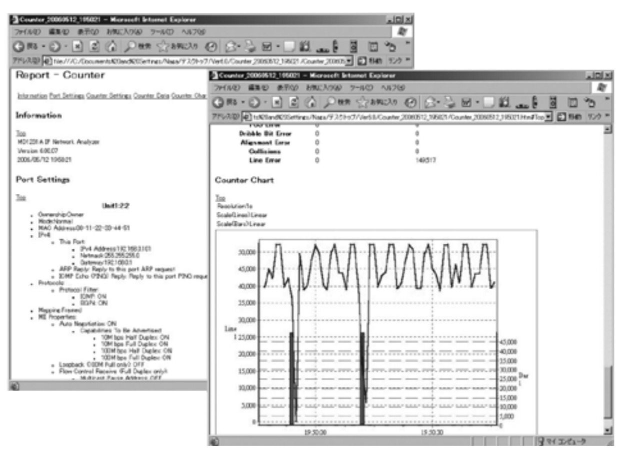
Useful Functions

• PC Remote Control
Installing the MX123001A Control Software options in an external PC supports remote control of the MD1230B using an identical built-in GUI. Multiple users are supported, allowing up to 8 operators to share a single mainframe by sharing ports. Connecting up to eight MD1230B units in cascade provides expansion to 40 slots.



• Remote Control Command Interfaces
Using the remote command interface allows automatic control of measuring instruments by sending text-based commands, making it easy to create applications for automatic testing. The RS-232C, GPIB, and Ethernet interfaces [Option-01, -02, and -03] all support remote commands. Additionally, the MD1230B supports the Tcl Interface [Option-06].

• Report Function
Reports are output in HTML format. Counter, Multiflow Counter, Latency, RFC2544, and RFC2889 measurement results can be saved with attached graphs and measurement conditions. The Pause function can be used to save results to reports during measurement.



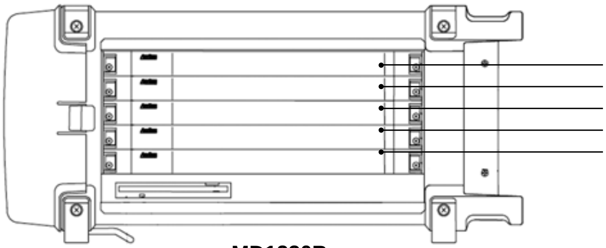
Functions

Model	MU120111A	MU120121A	MU120131A	MU120112A	MU120122A	MU120132A	MU120118B/C	MU120138A
Interface	10/100BASE-T	10/100/1000BASE-T		1000BASE-X, T	10/100/1000BASE-T 1000BASE-X	1000BASE-X	10GBASE-R	
Ports (Connector)	8 (RJ-45)	4 (RJ-45)	12 (RJ-45)	2 (GBIC)	2 (RJ-45) 2 (SFP)	8 (SFP)	2 (XENPAK)/ 1 (XENPAK)	4 (SFP+)
Clock Variation		✓	✓*1		✓	✓*1	✓*2	✓*1
Link Flap			✓			✓		✓*3
Auto MDI/MDI-X		✓	✓		✓			
Frame Generation								
Stream Generation (Tx Stream)	✓	✓	✓	✓	✓	✓	✓	✓
Multi-Layer VLAN		✓	✓		✓	✓		✓
MAC Address Increment	✓	✓	✓	✓	✓	✓	✓	✓
IP Address Increment	✓	✓	✓	✓	✓	✓	✓	✓
TCP/UDP Port Number Increment	✓	✓	✓	✓	✓	✓	✓	✓
Spanning Tree/Link Aggregation Frame (Option-23)	✓	✓	✓	✓	✓	✓	✓	✓
Test Frame Addition	✓	✓	✓	✓	✓	✓	✓	✓
Hardware Random Pattern		✓	✓		✓	✓	✓	✓
Measurement								
Counter	✓	✓	✓	✓	✓	✓	✓	✓
Multi-Flow Counter		✓*4	✓		✓*4	✓		✓
Capture	✓	✓	✓	✓	✓	✓	✓	✓
Decode	✓	✓	✓	✓	✓	✓	✓	✓
Latency	✓	✓	✓	✓	✓	✓	✓	✓
Ping	✓	✓	✓	✓	✓	✓	✓	✓
Ping6 (Option-12)	✓	✓	✓	✓	✓	✓	✓	✓
Arrival Time Variation/Latency Variation	✓*5	✓	✓	✓*5	✓	✓	✓*5	✓
Through Mode	✓	✓	✓	✓	✓	✓	✓	✓
Monitor Mode	✓	✓	✓	✓	✓	✓	✓	✓
Address Swap Mode	✓	✓	✓	✓	✓	✓		✓
Unframe BER Test	✓	✓	✓	✓	✓	✓	✓*6	✓
Packet BER Test (Option-11)	✓	✓	✓	✓	✓	✓	✓	✓
Auto Negotiation Analysis (Option-15)*7				✓	✓	✓		
Application Traffic Monitor (Option-20)		✓	✓	✓	✓	✓		
Link Fault Signaling (Option-16)							✓	
Link Fault Signaling (Module Option-03)								✓*8
XENPAK Test (Option-13)							✓	
Clock Measurement		✓	✓*1		✓	✓*1		✓*1
PoE (Module Option-02)			✓					
PPPoE (Option-26)		✓			✓			
Ethernet OAM (Option-28)	✓*9	✓	✓	✓*9	✓	✓	✓*9	✓
Automatic Test								
RFC2544 with VLAN	✓	✓	✓	✓	✓	✓	✓	✓
RFC2889 with VLAN (Option-10)	✓	✓	✓	✓	✓	✓	✓	✓
Protocol Emulation								
ARP	✓	✓	✓	✓	✓	✓	✓	✓
ICMP	✓	✓	✓	✓	✓	✓	✓	✓
OSPF (Option-07)	✓	✓		✓	✓		✓	
BGP-4	✓	✓		✓	✓		✓	
ICMPv6 (Option-12)	✓	✓	✓	✓	✓	✓	✓	✓
OSPFv3 (Option-18)*10	✓	✓		✓	✓		✓	
BGP4+ (Option-19)*10	✓	✓		✓	✓		✓	
IGMPv2/IGMPv3	✓	✓	✓	✓	✓	✓	✓	✓
IGAP (Option-14)	✓	✓	✓	✓	✓	✓	✓	✓
MLD/MLDv2 (Option-12)	✓	✓	✓	✓	✓	✓	✓	✓
MLDA (Option-22)*10	✓	✓	✓	✓	✓	✓	✓	✓
PIM-SMv2 (Option-21)*11	✓	✓		✓	✓		✓	
MPLS (LDP/CR-LDP) (Option-08)	✓	✓		✓	✓		✓	
MPLS (RSVP-TE) (Option-09)	✓	✓		✓	✓		✓	
Other								
Traffic Impairment Emulator (Option-17)*4		✓			✓			

*1: Requires MU120131A/32A-01 Clock Measurement option
*2: Requires XENPAK Test (Option-13). However, the variable clock of this module supports only the XAUI interface.
*3: Excludes No/Go Check
*4: Supported by ports 1 and 2. Electrical ports (10/100/1000BASE-T) for MU120121A and Optical ports (1000BASE-X) for MU120122A.
*5: Supports only Arrival Time Variation Measurement
*6: Requires XENPAK Test (Option-13)
*7: Supports SX/LX/LH/ZX for GPIC or SX/LX/LE/LR for SFP
*8: Requires MU120138A-03 Link Fault Signaling option
*9: Supports OAM frame send and protocol analysis of captured frame only
*10: Requires IPv6 Expansion (Option-12)
*11: Requires IPv6 Expansion (Option-12) when using IPv6 addresses.

Selection Guide

● Module Slots



MD1230B

∗ The MD1230B is a 5-slot model accepting up to five measurement modules.

● Installed Module Combinations

Model/Order No.	Module Name	No. of Slots Required	No. of Ports	Max. No. Modules	Supported Slots
MU120111A	10/100M Ethernet Module	1	8	5	1 to 5
MU120112A	Gigabit Ethernet Module	1	2	5	1 to 5
MU120121A	10/100/1000M Ethernet Module	1	4	5	1 to 5
MU120122A	Gigabit Ethernet Module	1	4	5	1 to 5
MU120131A	10/100/1000M Ethernet Module	1	12	5	1 to 5
MU120132A	Gigabit Ethernet Module	1	8	5	1 to 5
MU120138A	10 Gigabit Ethernet Module	1	4	5	1 to 5
MU120118B	10 Gigabit Ethernet Module	2	2	2	1 to 5
MU120118C	10 Gigabit Ethernet Module	2	1	2	1 to 5

● Mainframe Options

Name	Model/Order No.
RS-232C Control	MD1230B-01
GPIB Control	MD1230B-02
Ethernet Control	MD1230B-03
MD1230B Decode Module	MD1230B-04
Tcl Interface	MD1230B-06
OSPF Protocol	MD1230B-07
MPLS (LDP/CR-LDP) Protocol	MD1230B-08
MPLS (RSVP) Protocol	MD1230B-09
RFC2889 Benchmarking Test	MD1230B-10
Packet BER Test	MD1230B-11
IPv6 Expansion	MD1230B-12
XENPAK Test	MD1230B-13
IGAP Protocol	MD1230B-14
Auto Negotiation Analysis	MD1230B-15
Link Fault Signaling∗1	MD1230B-16
Traffic Impairment Emulator	MD1230B-17
OSPFv3 Protocol∗2	MD1230B-18
BGP4+ Protocol∗2	MD1230B-19
Application Traffic Monitor	MD1230B-20
PIM-SMv2 Protocol∗3	MD1230B-21
MLDA Protocol∗2	MD1230B-22
Spanning Tree/Link Aggregation	MD1230B-23
PPPoE	MD1230B-26
Ethernet OAM	MD1230B-28
MD1230B Expert Analysis Module∗4	MX123002A

∗1: This option is for the MU120118B/C 10 Gigabit Ethernet Module.
Choose the MU120138A-03 when using the Link Fault Signaling option for the MU120138A 10 Gigabit Ethernet Module.
∗2: Requires Option-12 IPv6 Expansion
∗3: Requires Option-12 IPv6 Expansion when using IPv6 addresses
∗4: Requires Option-04 Decode Module

● Module Options

Name	Model/Order No.
Clock Measurement	MU120131A-01, MU120132A-01, MU120138A-01
PoE	MU120131A-02
Link Fault Signaling∗1	MU120138A-03

∗1: This option is for the MU120138A 10 Gigabit Ethernet Module.
Choose the MD1230B-16 when using the Link Fault Signaling option for the MU120118B/C 10 Gigabit Ethernet Module.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MD1230B	Data Quality Analyzer	
	Standard accessories	
	Power Cord[*1]:	1 pc
F0113	Fuse, 15 A[*1]:	1 pc
B0329G	Front Cover for 3/4MW4U[*1]:	1 pc
B0500A	Side Cover[*1]:	1 pc
Z0847A	MD1230/MP1590 Family Software (CD)[*1, *2]:	1 pc
	Plug-in modules	
MU120111A	10/100M Ethernet Module	
MU120112A	Gigabit Ethernet Module[*3]	
MU120118B	10 Gigabit Ethernet Module[*4]	
MU120118C	10 Gigabit Ethernet Module[*4]	
MU120121A	10/100/1000M Ethernet Module	
MU120122A	Gigabit Ethernet Module[*5]	
MU120131A	10/100/1000M Ethernet Module	
MU120132A	Gigabit Ethernet Module[*5]	
MU120138A	10 Gigabit Ethernet Module[*6]	
	Options	
MD1230B-01	RS-232C Control	
MD1230B-02	GPIB Control	
MD1230B-03	Ethernet Control	
MD1230B-04	MD1230B Decode Module	
MD1230B-06	Tcl Interface[*7]	
MD1230B-07	OSPF Protocol	
MD1230B-08	MPLS (LDP/CR-LDP) Protocol	
MD1230B-09	MPLS (RSVP) Protocol	
MD1230B-10	RFC2889 Benchmarking Test	
MD1230B-11	Packet BER Test	
MD1230B-12	IPv6 Expansion	
MD1230B-13	XENPAK Test	
MD1230B-14	IGAP Protocol	
MD1230B-15	Auto Negotiation Analysis	
MD1230B-16	Link Fault Signaling[*8]	
MD1230B-17	Traffic Impairment Emulator[*9]	
MD1230B-18	OSPFv3 Protocol[*10]	
MD1230B-19	BGP4+ Protocol[*10]	
MD1230B-20	Application Traffic Monitor	
MD1230B-21	PIM-SMv2 Protocol	
MD1230B-22	MLDA Protocol[*10]	
MD1230B-23	Spanning Tree/Link Aggregation	
MD1230B-26	PPPoE	
MD1230B-28	Ethernet OAM	
MU120131A-01	Clock Measurement	
MU120131A-02	PoE	
MU120132A-01	Clock Measurement	
MU120138A-01	Clock Measurement	
MU120138A-03	Link Fault Signaling[*8]	
	Software	
MX123001A	Data Quality Analyzer Control Software[*7, *22]	
MX123001A-05	Data Quality Analyzer Control Software 5 licenses[*7, *22]	
MX123001A-08	Data Quality Analyzer Control Software 8 licenses[*7, *22]	
MX123001A-01	Remote Control Software for MD1230A-04[*11, *21]	
MX123001A-15	Remote Control Software for MD1230A-04 5 licenses[*11, *21]	
MX123001A-18	Remote Control Software for MD1230A-04 8 licenses[*11, *21]	
MX123002A	MD1230A Expert Analysis Module[*12]	
MX123003A	Remote Control Software for MX123002A[*13, *21]	
MX123003A-05	Remote Control Software for MX123002A 5 licenses[*13, *21]	
MX123003A-08	Remote Control Software for MX123002A 8 licenses[*13, *21]	
	Software options	
MX123001A-06	Tcl Interface[*7, *21]	
MX123001A-07	RS-232C Control[*21]	
MX123001A-09	GPIB Control[*21]	
MX123001A-10	Ethernet Control	
	Optional accessories	
G0105A	GBIC SX 850 nm[*14]	
G0106A	GBIC LX 1310 nm[*14]	
G0107A	GBIC LH 1310 nm[*14]	
G0108A	GBIC ZX 1550 nm[*14]	
G0124A	GBIC T(1000 BASE-T)[*14]	
G0181A	SFP SX 850 nm[*15]	
G0182A	SFP LX 1310 nm[*15]	
G0183A	SFP LE 1310 nm[*15]	
G0184A	SFP LR 1550 nm[*15]	
G0277A	XENPAK (10GBASE-SR)[*16]	
G0192A	XENPAK (10GBASE-LR)[*16]	
G0193A	XENPAK (10GBASE-ER)[*16]	
G0238A	SFP+ SR 850 nm[*17]	
G0239A	SFP+ LR 1310 nm[*17]	
G0271A	SFP+ ER 1550 nm[*17]	

Model/Order No.	Name
J1049A	Fixed Optical ATT: SC (5 dB)
J1049B	Fixed Optical ATT: SC (10 dB)
J1049C	Fixed Optical ATT: SC (15 dB)
MZ1221A	XAUI Extender[*18]
MZ1222A	XENPAK Interface[*19]
J1163A	XAUI Cable, 0.5 m
J1164A	MDIO Cable, 0.5 m
J0660B	SC · PC-SC · PC-2M-SM (Optical Fiber Cord, SM, SC-SC connector, 2 m)
J0773B	Optical Fiber Cable (GI, SC-SC connector, 2 m)
J1119B	Optical Fiber Cable (Duplex, MM, 2 m)
J1271	Optical Fiber Cord (Duplex, SM, LC-LC connector), 2 m
J1272	Optical Fiber Cord (Duplex, SM, LC-SC connector), 2 m
J1273	Optical Fiber Cord (Duplex, GI, LC-LC connector), 2 m
J1274	Optical Fiber Cord (Duplex, GI, LC-SC connector), 2 m
J0775B	Coaxial Cord, 0.5 m (BNC-P620 · 3C-2WS · BNC-P620, 75Ω)[*20]
J0775D	Coaxial Cord, 2 m (BNC-P620 · 3C-2WS · BNC-P620, 75Ω)[*20]
J0008	GPIB Cable, 2 m
J1109B	LAN Cable (CAT5, cross), 5 m
J1110B	LAN Cable (CAT5, straight), 5 m
J1275	LAN Cable (CAT5E, straight), 1 m
J1275B	LAN Cable (CAT5E, straight), 5 m
J1275C	LAN Cable (CAT5E, cross), 1 m
J1275D	LAN Cable (CAT5E, cross), 5 m
Z0321A	Keyboard (PS/2)
Z0541A	USB Mouse
B0336C	Carrying Case 3/4MW 4U 350D
B0530	420K-R-65 Carrying Case Caster (for B0336C)
B0533	Carrying Case for MD1230A
B0448	Soft Case
B0593A	Blank Panel
Z0849A	MD1230/MP1590 Family Manual CD
W1927AE	MD1230A/B Operation Manual
W1928AE	MX123001A Software Operation Manual
W1929AE	MD1230A Remote Control Operation Manual
W2107AE	MD1230A-04/MX123001A-01 Operation Manual
W2122AE	MD1230A-06 Tcl Interface Operation Manual
W2134AE	Application Traffic Monitor Operation Manual
W2906AE	PPPoE Operation Manual
W2108AE	MX123002A/MX123003A Operation Manual
W1931AE	MD1230 Family Ethernet Module Operation Manual

*1: Supplied with main frame
*2: CD includes installer, release notes and operation manual and cannot be purchased separately
*3: Requires GBIC module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
*4: Requires XENPAK module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
*5: Requires SFP modules (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
*6: Requires SFP+ module (sold separately). In addition, operation with non-Anritsu modules not guaranteed
*7: MD1230B-03 not required
*8: The MD1230B-16 is supported by the MU120118B/C. The MD120138A-03 is supported by the MU120138A.
*9: Only ports 1 and 2 of the MU120121A/122A support the MD1230B-17 Traffic Impairment Emulator option. Moreover, only MU120121A/122A models shipped after March 7, 2008 with the "Supports Opt.17" sticker support the option.
*10: Requires separate MD1230B-12
*11: Requires MD1230B-04 for main frame control. In addition, requires MX123001A for installing this software in PC.
*12: Requires separate MD1230B-04
*13: Requires MD1230B-04 and MX123002A for main frame control. In addition, requires MX123001A and MX123001A-01 for installing this software in PC.
*14: GBIC modules sold as single units. Two can be mounted in MU120112A.
*15: SFP modules sold as single units. Two can be mounted in MU120122A and eight in MU120132A.
*16: XENPAK modules sold as single units. Two can be mounted in MU120118B and one in MU120118C. G0277A, G0192A and G0193A only supported by MU120118A/B/C units with "With APS" sticker. DO NOT install in MU120118A/B/C units without “With APS” sticker. G0277A, G0192A and G0193A have “Only for APS” stickers attached.
*17: SFP+ modules sold as single units. Four can be mounted in MU120138A.
*18: When using XAUI extender, MZ1222A XENPAK interface, J1163A XAUI cable, and J1164A MDIO cable required along with separate external power supply (5 V, 4 A)
*19: MZ1222A supplied by a 1.8-V APS.
*20: Required for synchronizing time between several units. MD1230B use BNC connectors; J0775B/D is required for connecting BNC connectors.
*21: Windows 2000, XP are supported.
*22: Windows 2000, XP, 7 are supported.

Other

• Software Upgrade Service

Model/Order No.	Name
	Software upgrade service
MD1230B-40	Annual Software Upgrade Service

*: Option for latest version of the MD1230B modules' software.
MD1230B-40 is bundled with MD1230B purchase and effective by September 30th 2013.
From October 1st 2013, MD1230B's owners can download MD1230B modules' software from Anritsu Website.

• Maintenance Service

Model/Order No.	Name
	Maintenance service
***-ES210	2 Years Extended Warranty Service
***-ES310	3 Years Extended Warranty Service
***-ES510	5 Years Extended Warranty Service

*: Extends standard 1-year warranty at purchase to 2, 3, or 5 years. Must be purchased separately when purchasing new Anritsu product.
(Cannot be purchased midway through standard 1-year warranty, at standard warranty expiry, or as combination of several multi-year contracts.)

***-ES210: MD1230B-ES210, MU120111A-ES210, MU120112A-ES210, MU120118B-ES210, MU120118C-ES210, MU120121A-ES210, MU120122A-ES210, MU120131A-ES210, MU120132A-ES210, MU120138A-ES210
***-ES310: MD1230B-ES310, MU120111A-ES310, MU120112A-ES310, MU120118B-ES310, MU120118C-ES310, MU120121A-ES310, MU120122A-ES310, MU120131A-ES310, MU120132A-ES310, MU120138A-ES310
***-ES510: MD1230B-ES510, MU120111A-ES510, MU120112A-ES510, MU120118B-ES510, MU120118C-ES510, MU120121A-ES510, MU120122A-ES510, MU120131A-ES510, MU120132A-ES510, MU120138A-ES510

40/100G ETHERNET ANALYZER
MD1260A

Remote Control
GPIB OPTION | Ethernet

For Manufacturing and Installing 40/100 GbE Equipment and Networks

All-in-one Compact 40/100G Ethernet Analyzer

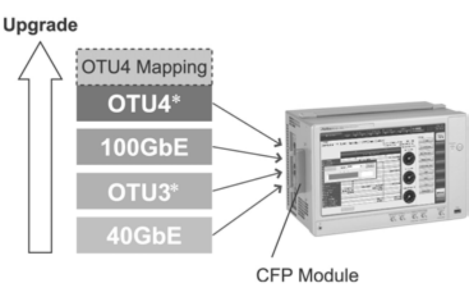
The all-in-one portable MD1260A 40/100G Ethernet Analyzer supports the latest high-speed transmission technologies, such as 40/100 GbE, OTU3, and OTU4.
It has all the functions needed for manufacturing and installing equipment and networks. Moreover, it can be used for R&D final evaluation of 40/100G equipment and devices. It is a measuring instrument for assuring the quality of high-speed networks forming the foundation of next-generation applications for cloud computing.

Key Features

- I/F Upgrade matching budget and schedule
- Excellent operability with rugged, compact, lightweight construction
- Expandable multi-unit platform
- Evaluation function supporting 40/100 GbE unique latest technology

I/F Upgrade Matching Budget and Schedule

One MD1260A supports 40 GbE, 100 GbE, OTU3, and OTU4 interface options that can be added according to budget and schedule.



*: OTU3/4: ITU-T G.709 Annex C

Excellent Operability with Rugged, Compact, Lightweight Construction, and Silent Design

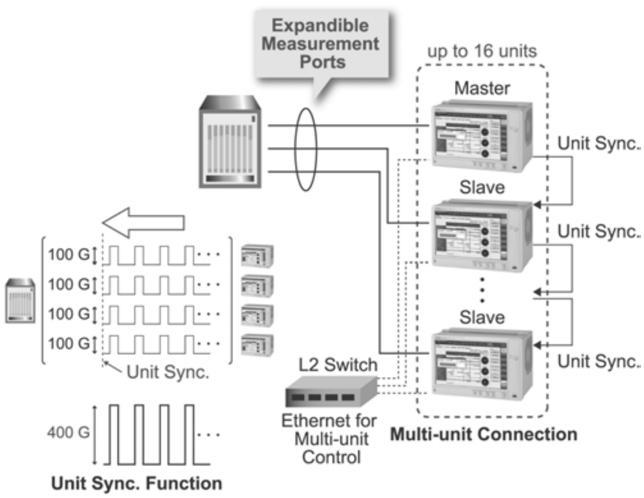
Operation is easy with a large 12.1-inch touch panel and intuitive GUI, and drive crashes are a thing of the past due to the rugged solid-state Flash drive. The small footprint and light weight offer easy portability to even the most difficult test sites. The silent design provides a quiet, comfortable working environment.

- 12.1-inch touch panel
- Easy-to-use GUI
- Flash disk
- Compact and Lightweight
  Dimensions: 340 (W) × 221.5 (H) × 200 (D) mm
  Weight: ≤8 kg
- Silent design

B0647A Carrying Case

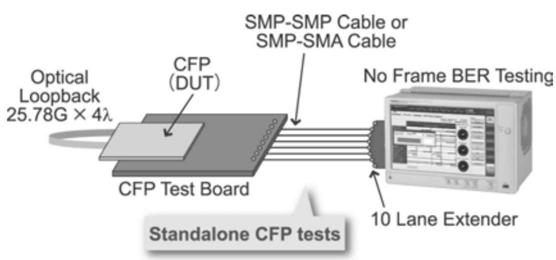
Expandable Multi-unit Platform

Up to sixteen MD1260A units can be connected in a master/slave multi-unit configuration for evaluating multiport switches and routers and batch testing multiple pieces of transmission equipment.
In addition, the Unit Sync function can be used to synchronize the test frame time stamp issued from each MD1260A and the timing for use as a high background load generator when measuring delay in a multi-unit environment.



Evaluation Function Supporting 40/100 GbE Unique Latest Technology

40/100G tolerance tests exceeding IEEE/ITU-T standards, such as skew margin tests for transmission equipment, are supported using skew generation and monitoring for all lanes or per lane.
In addition, external output from the electrical interface (CAUI/XLAUI) supports standalone CFP tests and fault isolation between the CFP and transmission equipment. No-frame BER tests support physical layer evaluation without frames.



40/100G tolerance tests exceeding IEEE/ITU-T standards

Skew margin tests (819.2 ns max.)
Generates load exceeding full wire rate
Frame length (60 to 32700 bytes)
Clock tolerance tests (±120 ppm)*

*: Excludes CFP

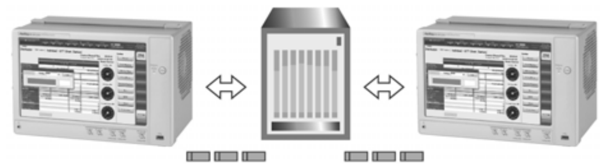
Evaluation using MZ1223C 10 Lane Extender

The external electrical I/F output (CAUI/XLAUI) supports standalone CFP tests and fault isolation between the CFP and transmission equipment.

Manufacturing Inspection of 40/100G Transmission Equipment

The all-in-one MD1260A has every test function for manufacturing inspection of transmission equipment.

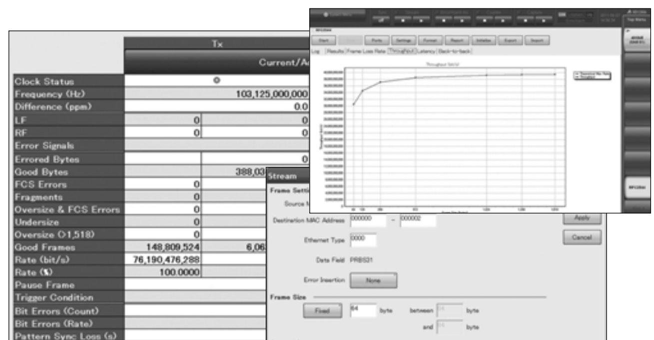
- **Ethernet/IP Tests**



40/100GbE Frame

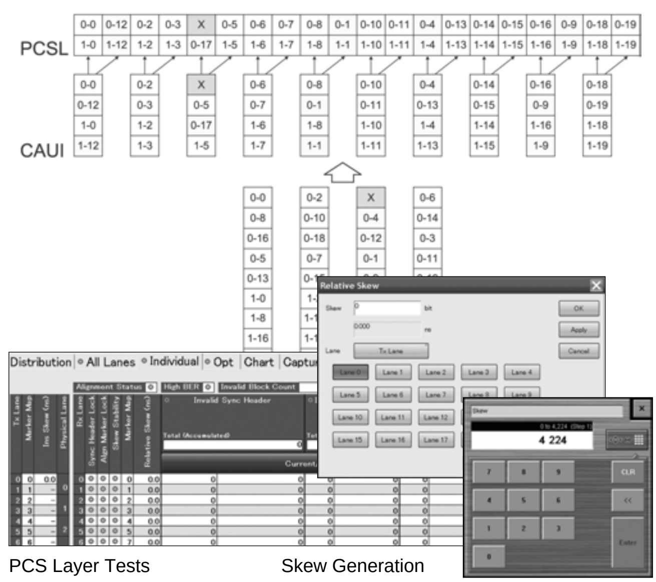
General Ethernet/IP frame tests are supported. Basic Ethernet measurements, such as Throughput, Frame loss, BER, Statistics and RFC2544 Tests, are provided. In addition, a unique function for evaluating 40/100 GbE skew adjustment between Lanes is supported.

RFC2544 Tests



Throughput, Frame Loss, BER and Statistics

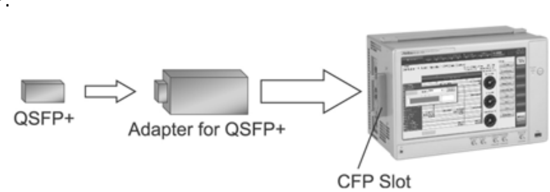
Ethernet/IP Frame Generation



PCS Layer Tests

Skew Generation

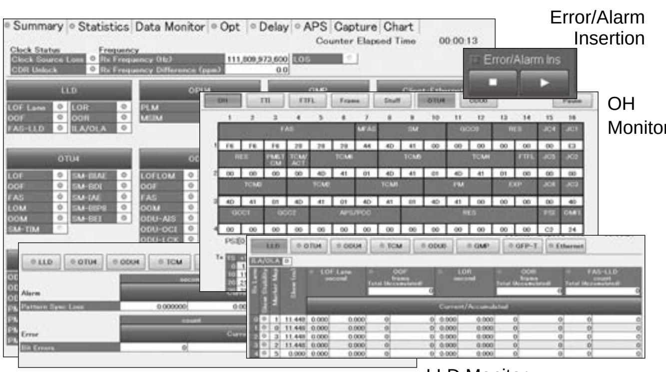
Using an adapter supports both QSFP+ optical modules as well as CFP.



- **OTN Tests**

OTU3/OTU4 Signal

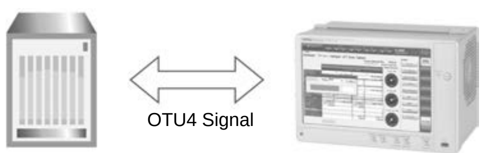
General testing using OTU3 and OTU4 signals is supported along with basic OTN measurements, such as errors/alarms, BER, APS measurements and Delay measurements. LLD monitoring for all lanes or per lane as well as an OH edit/monitor function and OTU4 mapping analysis function are supported too.

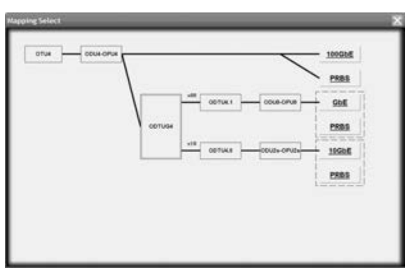


Error/Alarm, BER Counter

LLD Monitor

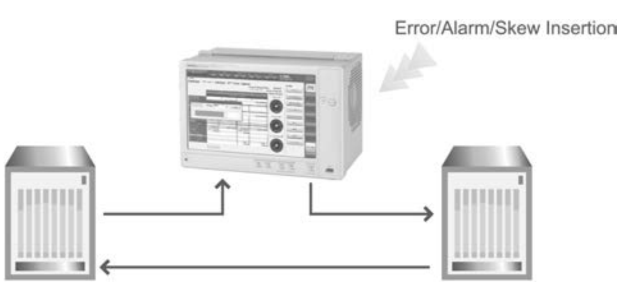
Mapping Ethernet client signals to OTU4 signals using GMP (Generic Mapping Procedure) supports verification closer to real operation.





OTU4 Mapping

The Through mode monitors the system status and checks operation when errors occur.

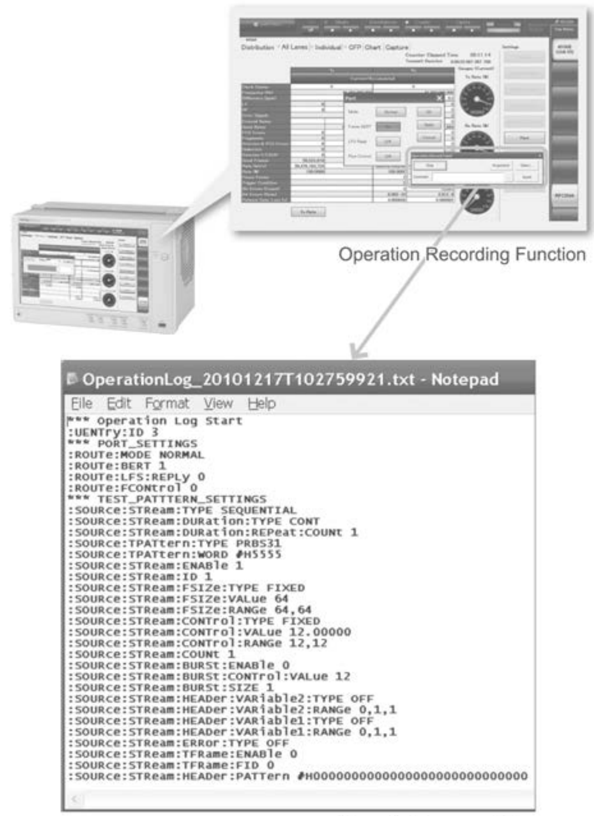


Through Mode:
Transparent, Analyzed (Error/Alarm/Skew Insertion)
OH Overwrite (OH Overwrite and Error/Alarm/Skew Insertion)

- **Auto Measurements**

Automatic remote control of measuring instruments over Ethernet or GPIB using control commands cuts manufacturing inspection costs.

Operation logs are output as a remote command file, cutting the workload for creating automatic control scripts (Operation Recording Function).



Remote Command File

Commissioning 40/100G Networks

Portable Analyzer

- **Connection Tests**

Easy 40 GbE, 100 GbE, OTU3, and OTU4 network verification tests are supported.

40/100G Network

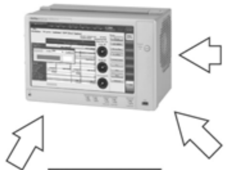
Ethernet/IP tests
Throughput, Frame loss, Statistics, BER

OTN tests
Errors/Alarms, BER

• Troubleshooting

Faults are quickly located using the powerful built-in troubleshooting functions.

Capture and Analysis

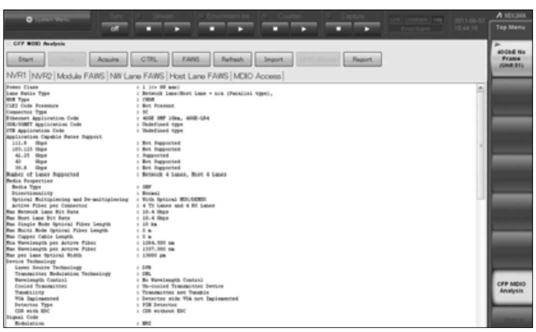


Error/Alarm Insertion and Monitor

OH Edit/Monitor

Final Evaluation for 40/100G Equipment and Device R&D

40/100G tolerance tests (equipment R&D final evaluation) exceeding IEEE/ITU-T standards and evaluation (device R&D final evaluation) using the 10 Lane Extender are supported.
Using the CFP MDIO analysis function supports simple CFP MDIO register setting and reading. In addition, better device stability is assured because MDIO data can be read regularly.



CFP MDIO Analysis Function

Ordering Information

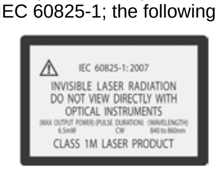
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

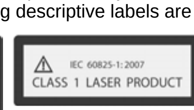
Model/Order No.	Name	
	Main frame	
MD1260A	40/100G Ethernet Analyzer	
	Standard accessories	
J0491	Shield Power Cord (13 A):	1 pc
Z1442A	MD1260A Software/Manual CD-ROM:	1 pc
B0642A	Blank Panel:	1 pc
J1137	SMA 50Ω Terminator:	4 pcs
J1341A	SMA Connector Cover:	1 pc
	Option	
MD1260A-001	100G Ethernet*1	
MD1260A-002	OTU4*1	
MD1260A-003	40G Ethernet*1	
MD1260A-004	OTU3*1	
MD1260A-005	ODU4-100GbE Mapping*2	
MD1260A-006	ODTU4.1-ODU0-GbE Mapping*2	
MD1260A-007	ODTU4.8-ODU2e-10GbE Mapping*2	
MD1260A-030	GPIB*3	
MD1260A-031	CFP MDIO Analysis	
	Warranty	
MD1260A-ES310	3 Years Extended Warranty Service	
MD1260A-ES510	5 Years Extended Warranty Service	
	Application parts	
G0259A	CFP 100GBASE-LR4*4	
G0281A	CFP 100GBASE-SR10*4, *5	
G0279A	CFP 40GBASE-LR4*6	
G0280A	CFP 40GBASE-SR4*5, *6	
G0296A	QSFP+ 40GBASE-SR4*6, *7	
MZ1225A	Adapter for QSFP+*6, *8	
MZ1223C	10 Lane Extender*9, *10	
J1502A	SMP-SMA Cable, 40cm*11	
J1503A	SMP-SMP Cable, 40cm*11	
J1540A	SMP-GPPO Cable, 40cm*11	
Z0975A	Keyboard (USB)	
Z0541A	USB Mouse	
J0660B	Optical Fiber Cord (SM, SC-SC connectors), 2 m	
J1519A	Optical Fiber Cord (MM, MPO-MPO connector), 3 m	
J0775B	Coaxial Cord (BNC, 75Ω), 0.5 m	
J0775D	Coaxial Cord (BNC, 75Ω), 2 m	
J0776D	Coaxial Cord (BNC, 50Ω), 2 m	
J0008	GPIB Cable, 2m	
J1343A	Coaxial Cord (SMA), 1 m	
J1049A	Fixed Optical Attenuator (SC, 5 dB)	
Z0306A	Wrist Strap	
B0648A	Front Cover	
B0647A	Carrying Case*12	
Z1578A	MZ1223C Operation Manual (CD-ROM)	
W3395AE	MD1260A Operation Manual	
W3406AE	MD1260A Remote Control Operation Manual	
W3483AE	MD1260A Add-on Function Operation Manual	
W3485AE	MZ1225A Operation Manual	
W3492AE	MZ1223C Operation Manual	

∗1: Requires at least one of MD1260A-001, MD1260A-002, MD1260A-003 or MD1260A-004.
∗2: Requires MD1260A-002
∗3: Order the MD1260A-030 GPIB option with the main frame.
∗4: for 100GbE
∗5: To be released
∗6: for 40GbE
∗7: Application parts for MZ1225A
∗8: Supplied with Z1442A
∗9: Supplied with Z1578A
∗10: Use J1502A, J1503A or J1540A when connecting to the DUT. If the cables other than J1502A, J1503A or J1540A are used, the required performance may not be obtained.
∗11: Application parts for MZ1223C. Cables sold as single units.
J1502A: SMP (Jack) - SMA (Plug)
J1503A: SMP (Jack) - SMP (Jack)
J1540A: SMP (Jack) - GPPO (Jack)
∗12: Always fit the Front Cover when using the Carrying Case.

Safety measures for laser products

This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.





NETWORK PERFORMANCE TESTER
MP1590B

Remote Control
GPIB OPTION | Ethernet OPTION

All-In-One Next-Generation Network Testing

SDH/SONET/OTN/PDH/DSn/Jitter/EoS/Ethernet/IP Analyzer

The dawn of the NGN era and the spread of high value-added and seamless networks are driving the need for high-level testing and evaluation of these networks and their network devices.
Using modular plug-in units, the MP1590B Network Performance Tester supports performance, jitter, and EOS measurements of networks, equipment and devices with SDH/SONET/OTN/PDH/DSn interfaces. The MP1590B also supports both Ethernet and IP technologies with a variety of applications such as QoS and IPTV streaming service tests.
This tester family is the perfect tool for performing the wide range of measurements covering the physical to application layers needed for constructing next-generation networks.

- Simultaneous Multichannel Measurement
- All-in-one Support for Performance Measurements of SDH/SONET/OTN/PDH/DSn/Jitter
- Supports EoS (GFP, VCAT, LCAS, Differential Delay) Measurements
- Supports 10/100/1000M, Gigabit, and 10 Gigabit Ethernet Measurements

MP1590B Main Frame

Front View

Side View

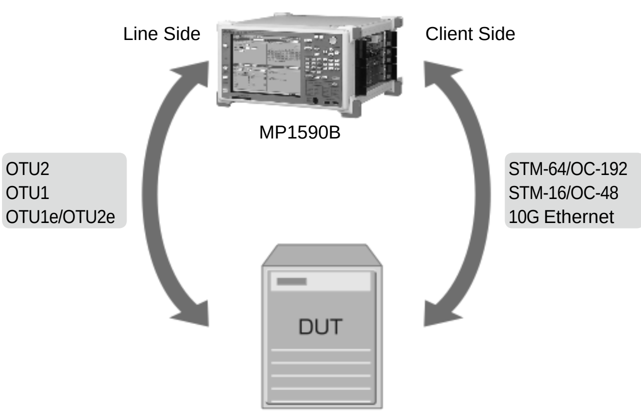
6-slot Integrated screen model
Built-in Windows® XP operating system
Dimensions: 320 (W) × 177 (H) × 350 (D) mm
Mass: 13 kg max. (excl. options and units)

SDH/SONET/OTN/PDH/DSn/10G Ethernet Performance Measurements

The MP1590B supports ITU-T, Telcordia and IEEE compliance tests of 1.5 Mbit/s to 11.1 Gbit/s SDH/SONET/OTN/PDH/DSn/10G Ethernet equipment. The following functions can be used to evaluate the performance of networks, equipment, and devices supporting these standards:

- Multichannel Measurement
- Error/Alarm Measurements
- Alarm Detection and Removal Conditions Setting Function
- Delay Time Measurement
- APS (Automatic Protection Switching) Measurement
- Through Mode Function
- Overhead Editing Function
- Monitor Functions
- Unframe BER Measurement
- Variable Frequency Offset Function
- FEC Performance Measurement
- 10G Ethernet Measurement

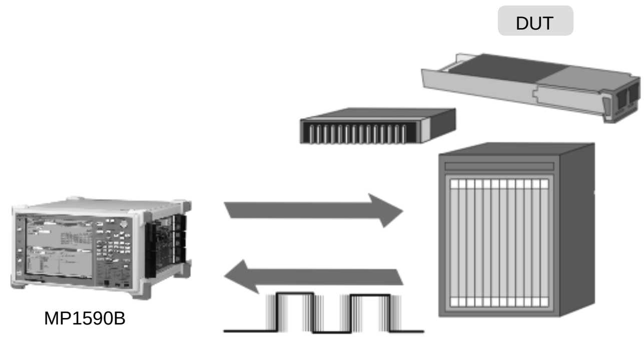
Sending remote control commands via the Ethernet, RS-232C, GPIB interfaces makes it easy to configure a customized measurement environment for maintenance, installation, R&D, and manufacturing. Different bit rates can be specified for MP1590B Tx and Rx signals. This means that line- and client-side equipment and networks can be tested simultaneously, supporting configuration of an efficient measurement environment.



SDH/SONET/OTN Jitter Measurements

Jitter is a key index expressing the performance and quality of SDH/ SONET and OTN transmission equipment and devices.
Jitter evaluation is also an important part of assuring interoperability and network stability.
The MP1590B supports the following ITU-T and Telcordia-compliant SDH/SONET/OTN measurements from 52 Mbit/s to 10.7 Gbit/s:

- Jitter Generation Measurement
- Jitter Tolerance Measurement
- Jitter Transfer Measurement



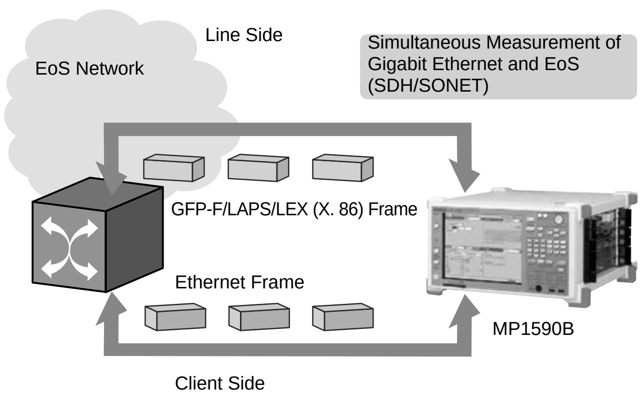
The user can set any mask standard values for these measurements. Because the MP1590B supports optical, electrical and electrical differential (10 Gbit/s band only) interfaces, network equipment jitter as well as device and optical module jitter can be measured. In the 10 Gbit/s band, jitter measurement of 10.3 Gbit/s transfers used by 10G Ethernet can be measured.
When required, a high-accuracy jitter measurement option can be installed in the MP1590B to perform high-accuracy and high-repeatability measurements with calibration based on Appendix VIII of the April 2005 ITU-T O.172 standard. But even without this option, jitter measurement is still in full compliance with the April 2005 ITU-T O.172 standards.

Anritsu is a proactive member of the ITU-T standardization working groups and has extensive knowledge and practical experience of jitter measurement that is incorporated in the MP1590B.

EoS (Ethernet over SDH/SONET) Measurements

The MP1590B supports the following measurements for next-generation SDH/SONET:

- GFP-F, LEX, LAPS (X.86), PPP Encapsulation
- Virtual Concatenation Member Editing Function
- Virtual Concatenation Group (VCG) Auto-detect Function
- Differential Delay Add/Monitor Function
- LCAS Autonegotiation Function
- LCAS Sequence Generation/Capture Function
- Path Monitor Function



The following measurements are supported because the MP1590B can generate GFP-F, LEX, and LAPS (X.86) encapsulated EoS frames, even when VLAN tags and IP and TCP/UDP headers are attached. Adding an Ethernet unit to the configuration enables a seamless client- and line-side measurement environment using only one main frame.

- **Load Tests**

Stream Generation
Variable Tx Clock Offset

- **Traffic Measurement**

Various Counters
Packet Jitter/Latency
Through Mode
Frequency Measurement

- **Packet Analysis**

Packet Capture/Protocol Decode

In addition to EoS measurements, the MU150101A 2.5/2.6G EoS Unit used here also supports POS measurements and performance measurements of 1.5 Mbit/s to 2.6 Gbit/s SDH/SONET/OTN/PDH/DSn, facilitating a wide range of applications.

Ethernet Performance Measurement

The MP1590B supports all the key tests of devices and networks, such as load tests, performance tests, traffic measurements, and packet analysis. They can also be used for IPv6 measurements, RFC2544/RFC2889 auto-measurements, auto-negotiation analysis, Ethernet OAM emulation, and more.

- **Load Tests**

Stream Generation
Variable Tx Clock Offset
Traffic Impairment Emulation

- **Traffic Measurement**

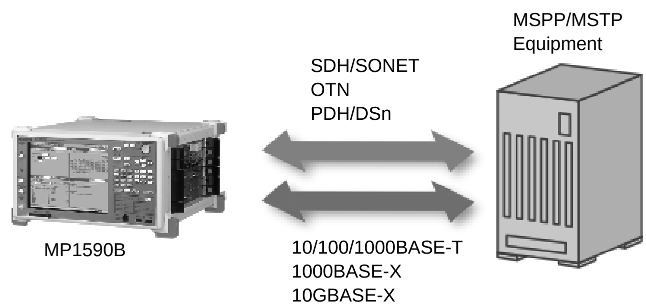
Various Counters/Multiflow Counters
High-resolution Traffic Monitor
Packet Jitter/Latency
Through Mode
Frequency Measurement

- **Packet Analysis**

Packet Capture/Protocol Decode

- **Auto-measurement**

RFC2544/RFC2889 Auto-measurement



The MP1590B supports 10/100/1000BASE-T, 1000BASE-X, and 10GBASE-X Ethernet measurements using plug-in Ethernet modules. As a result, a single unit can measure the performance MSPP/MSTP equipment used in combination with SDH/SONET/OTN/PDH/DSn plug-in modules.
By taking advantage of the Ethernet module functions listed on the next page, they can also be used as genuine IP testers for Ethernet interfaces. See the MD1230B Data Quality Analyzer catalog for the individual Ethernet module specifications.

Ethernet Unit Functions

Model	MU120111A	MU120121A	MU120131A	MU120112A	MU120122A	MU120132A	MU120118B/C	MU120138A
Interface	10/100BASE-T	10/100/1000BASE-T		1000BASE-X, T	10/100/ 1000BASE-T 1000BASE-X	1000BASE-X	10GBASE-R	
Ports (Connector)	8 (RJ-45)	4 (RJ-45)	12 (RJ-45)	2 (GBIC)	2 (RJ-45) 2 (SFP)	8 (SFP)	2 (XENPAK)/ 1 (XENPAK)	4 (SFP+)
Clock Variation		✓	✓*1		✓	✓*1	✓*2	✓*1
Link Flap			✓			✓		✓*3
Auto MDI/MDI-X		✓	✓		✓			
Frame Generation								
Stream Generation (Tx Stream)	✓	✓	✓	✓	✓	✓	✓	✓
Multi-Layer VLAN		✓	✓		✓	✓		✓
MAC Address Increment	✓	✓	✓	✓	✓	✓	✓	✓
IP Address Increment	✓	✓	✓	✓	✓	✓	✓	✓
TCP/UDP Port Number Increment	✓	✓	✓	✓	✓	✓	✓	✓
Test Frame Addition	✓	✓	✓	✓	✓	✓	✓	✓
Hardware Random Pattern		✓	✓		✓	✓	✓	✓
Measurement								
Counter	✓	✓	✓	✓	✓	✓	✓	✓
Multi-Flow Counter		✓*4	✓		✓*4	✓		✓
Capture	✓	✓	✓	✓	✓	✓	✓	✓
Decode	✓	✓	✓	✓	✓	✓	✓	✓
Latency	✓	✓	✓	✓	✓	✓	✓	✓
Ping	✓	✓	✓	✓	✓	✓	✓	✓
Ping6 (Option-12)	✓	✓	✓	✓	✓	✓	✓	✓
Arrival Time Variation/Latency Variation	✓*5	✓	✓	✓*5	✓	✓	✓*5	✓
Through Mode	✓	✓	✓	✓	✓	✓	✓	✓
Monitor Mode	✓	✓	✓	✓	✓	✓	✓	✓
Address Swap Mode	✓	✓	✓	✓	✓	✓		✓
Unframe BER Test	✓	✓	✓	✓	✓	✓	✓*6	✓
Packet BER Test (Option-11)	✓	✓	✓	✓	✓	✓	✓	✓
Auto Negotiation Analysis (Option-15)*7				✓	✓	✓		
Application Traffic Monitor (Option-20)		✓	✓	✓	✓	✓		
Link Fault Signaling (Option-16)							✓	
Link Fault Signaling (Module Option-03)								✓*8
XENPAK Test (Option-13)							✓	
Clock Measurement		✓	✓*1		✓	✓*1		✓*1
PoE (Module Option-02)			✓					
Ethernet OAM (Option-28)	✓*9	✓	✓	✓*9	✓	✓	✓*9	✓
Automatic Test								
RFC2544 with VLAN	✓	✓	✓	✓	✓	✓	✓	✓
RFC2889 with VLAN (Option-10)	✓	✓	✓	✓	✓	✓	✓	✓
Protocol Emulation								
ARP	✓	✓	✓	✓	✓	✓	✓	✓
ICMP	✓	✓	✓	✓	✓	✓	✓	✓
OSPF (Option-07)	✓	✓		✓	✓		✓	
BGP-4	✓	✓		✓	✓		✓	
ICMPv6 (Option-12)	✓	✓	✓	✓	✓	✓	✓	✓
IGMPv2/IGMPv3	✓	✓	✓	✓	✓	✓	✓	✓
IGAP (Option-14)	✓	✓	✓	✓	✓	✓	✓	✓
MLD/MLDv2 (Option-12)	✓	✓	✓	✓	✓	✓	✓	✓
MPLS (LDP/CR-LDP) (Option-08)	✓	✓		✓	✓		✓	
MPLS (RSVP-TE) (Option-09)	✓	✓		✓	✓		✓	
Other								
Traffic Impairment Emulator (Option-17)*4		✓			✓			

∗1: Requires MU120131A/32A/38A-01 Clock Measurement option
∗2: Requires XENPAK Test (Option-13). However, the variable clock of this unit supports only the XAUI interface.
∗3: Excludes No/Go Check
∗4: Supported by ports 1 and 2. Electrical ports (10/100/1000BASE-T) for MU120121A and optical ports (1000BASE-X) for MU120122A.
∗5: Supports only Arrival Time Variation Measurement
∗6: Requires XENPAK Test (Option-13)
∗7: Supports SX/LX/LH/ZX for GBIC or SX/LX/LE/LR for SFP
∗8: Requires MU120138A-03 Link Fault Signaling option
∗9: Supports OAM frame send and protocol analysis of captured frame only

SDH/SONET/OTN/PDH/DSn/10G Ethernet/Jitter/EoS Interface List

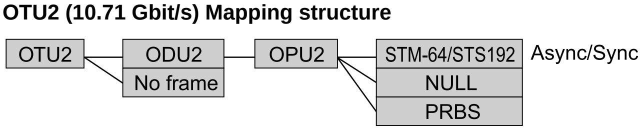
Typical Configuration				For SDH/SONET/OTN/PDH/DSn/10G Ethernet/Performance Measurement	For SDH/SONET/OTN/Jitter Measurement				For EoS Measurement	For Ethernet Measurement
Model/Slot Position		MP1590B	Slot 1	MU150110A	MU150110A	MU150110A	MU150110A	MU150101A	MU150101A	Blank
			Slot 2							Blank
			Slot 3	Blank	MU150121A	MU150121B	MU150121B	Blank	Blank	Blank
			Slot 4	Blank	MU150123A	MU150123B	MU150124B	Blank	Blank	Blank
			Slot 5	Blank	MU150125A	MU150125A	MU150125A	MU150125A	Blank	Blank
			Slot 6	Blank					Blank	Blank
Item	Bit Rate		Interface							
Performance Measurement	PDH/DSn	1.5 Mbit/s to 139 Mbit/s	Electrical	✓	✓	✓	✓	✓	✓	
	SDH/SONET	52 Mbit/s to 156 Mbit/s	Electrical • Optical	✓	✓	✓	✓	✓	✓	
		622 Mbit/s to 2488 Mbit/s	Optical	✓	✓	✓	✓	✓	✓	
		9953 Mbit/s	Electrical • Optical	✓	✓	✓	✓			
			Electrical differential			✓	✓			
	OTN	2666 Mbit/s	Optical	✓*1	✓*1	✓*1	✓*1	✓*1	✓*1	
		10.7 Gbit/s	Electrical • Optical	✓*1	✓*1	✓*1	✓*1			
		11.04 Gbit/s to 11.09 Gbit/s	Optical	✓*1	✓*1	✓*1	✓*1			
	10G Ethernet	10.3 Gbit/s	Electrical • Optical	✓*1	✓*1	✓*1	✓*1			
			Electrical differential			✓*1	✓*1			
	Ethernet	10 Mbit/s to 10 Gbit/s	Electrical • Optical	✓*2				✓*2	✓*2	✓*2
	EoS	156 Mbit/s to 2488 Mbit/s	Optical					✓*1	✓*1	
Jitter Measurement	PDH/DSn	1.5 Mbit/s to 139 Mbit/s	Electrical							
	SDH/SONET	52 Mbit/s to 156 Mbit/s	Electrical • Optical		✓	✓	✓	✓		
		622 Mbit/s to 2488 Mbit/s	Optical		✓	✓	✓	✓		
		9953 Mbit/s	Electrical • Optical		✓	✓				
			Electrical differential			✓				
	OTN	2666 Mbit/s	Optical		✓*1	✓*1	✓*1	✓*1		
		10.7 Gbit/s	Electrical • Optical		✓*1	✓*1				
		11.04 Gbit/s to 11.09 Gbit/s	Optical							
	10G Ethernet	10.3 Gbit/s*3	Electrical • Optical				✓*1			
			Electrical differential				✓*1			

*1: Requires addition of separate option.
*2: Supports installation of Ethernet units in blank slots but with restrictions on position and number. See page of the Selection Guide for more details.
*3: 10.3 Gbit/s jitter measurement supports only No Frame.

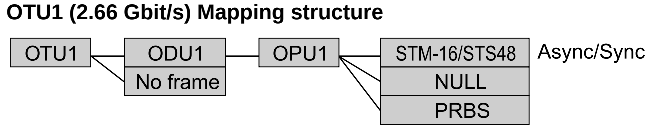
Supported Mappings

• OTN Mappings

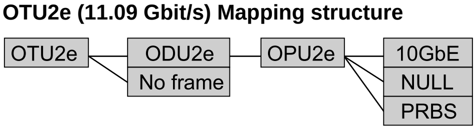
OTU2 (10.71 Gbit/s) Mapping structure



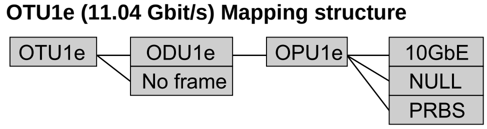
OTU1 (2.66 Gbit/s) Mapping structure



OTU2e (11.09 Gbit/s) Mapping structure

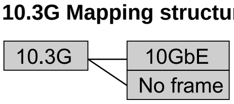


OTU1e (11.04 Gbit/s) Mapping structure



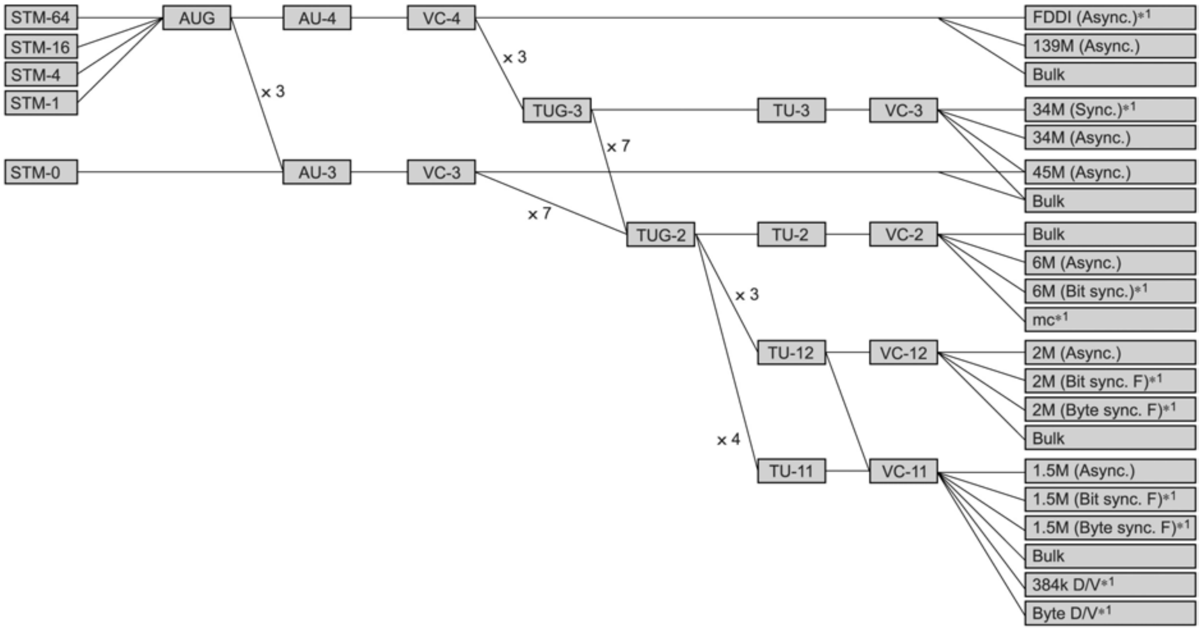
• 10G Ethernet Mapping

10.3G Mapping structure

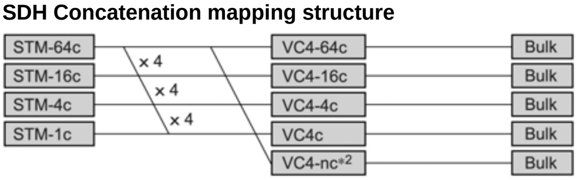


- **SDH Mappings**

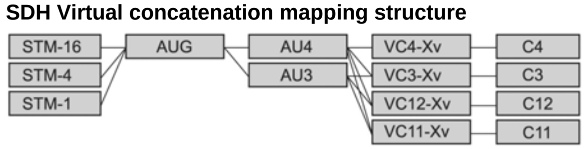
SDH Mapping structure



SDH Concatenation mapping structure

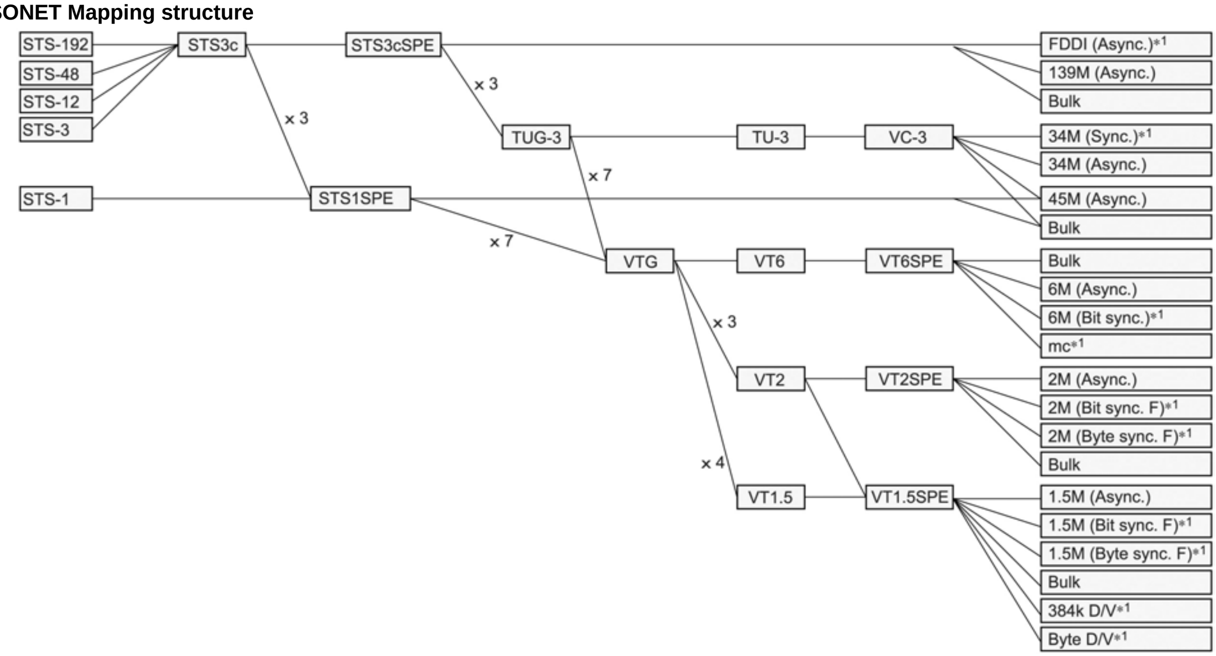


SDH Virtual concatenation mapping structure

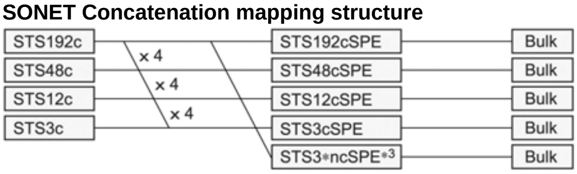


- **SONET Mappings**

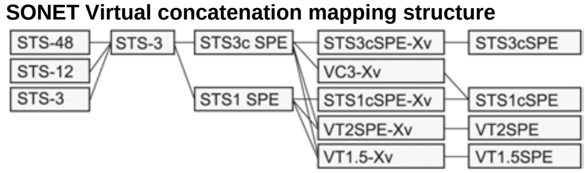
SONET Mapping structure



SONET Concatenation mapping structure



SONET Virtual concatenation mapping structure



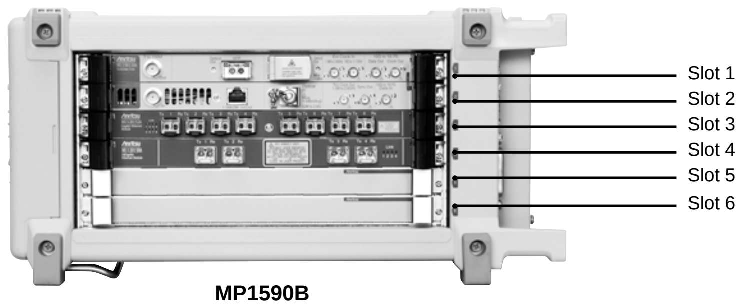
*1: Not supported in multichannel mode

*2: The maximum value of n is 16. However, this value is 8 in the multichannel mode. Links cannot be made across the following groups.
AUG#1 to AUG#8, AUG#9 to AUG#16, AUG#17 to AUG#24, AUG#25 to AUG#32, AUG#33 to AUG#40, AUG#41 to AUG#48, AUG#49 to AUG#56, AUG#57 to AUG#64

*3: The maximum value of n is 16. However, this value is 8 in the multichannel mode. Links cannot be made across the following groups.
STS3c#1 to STS3c#8, STS3c#9 to STS3c#16, STS3c#17 to STS3c#24, STS3c#25 to STS3c#32, STS3c#33 to STS3c#40, STS3c#41 to STS3c#48, STS3c#49 to STS3c#56, STS3c#57 to STS3c#64

Selection Guide

• Unit Insertion Positions



MP1590B

• Plug-in Unit Insertion Table

Model/Order No.	Module Name	No. of Slots Required	No. of Ports	Max. No. Modules	Supported Slots	Current Consumption (A)*
MU120111A	10/100M Ethernet Module	1	8	4	3 to 6	5.5
MU120112A	Gigabit Ethernet Module	1	2	4	3 to 6	5.5
MU120121A	10/100/1000M Ethernet Module	1	4	2	3 to 6	19
MU120122A	Gigabit Ethernet Module	1	4	2	3 to 6	19
MU120131A	10/100/1000M Ethernet Module	1	12	2	3 to 6	15
MU120132A	Gigabit Ethernet Module	1	8	2	3 to 6	13
MU120118B	10 Gigabit Ethernet Module	2	2	1	4 to 6	19
MU120118C	10 Gigabit Ethernet Module	2	1	1	4 to 6	10
MU120138A	10 Gigabit Ethernet Module	1	4	3	3 to 6	11
MU150110A	Multirate Unit	2		1	1 to 2	10
MU150101A	2.5/2.6G EoS Unit	2		1	1 to 2	7
MU150121A	10/10.7G Optical Unit (Tx)	1		1	3	0.5
MU150121B	10/10.7G Optical/Electrical Unit (Tx)	1	–	1	3	0.5
MU150123A	10/10.7G Optical Unit (Rx Wide)	1		1	4	0.5
MU150123B	10/10.7G Optical/Electrical Unit (Rx Wide)	1		1	4	0.5
MU150124B	10.3G Optical/Electrical Unit (Rx Wide)	1		1	4	0.5
MU150125A	10/10.7G Jitter Unit	2		1	5 to 6	2

*: Ensure that the total current consumption for all plug-in units inserted in the MP1590B does not exceed 38 A.

• MP1590B Main Frame Options

Model/Order No.	Name
MP1590B-01	RS-232C
MP1590B-02	GPIB
MP1590B-03	LAN
MP1590B-07	OSPF Protocol
MP1590B-08	MPLS (LDP/CR-LDP) Protocol
MP1590B-09	MPLS (RSVP) Protocol
MP1590B-10	RFC2889 Benchmarking Test
MP1590B-11	Packet BER Test
MP1590B-12	IPv6 Expansion
MP1590B-13	XENPAK Test
MP1590B-14	IGAP Protocol
MP1590B-15	Auto Negotiation Analysis
MP1590B-16	Link Fault Signaling*
MP1590B-17	Traffic Impairment Emulator
MP1590B-20	Application Traffic Monitor
MP1590B-28	Ethernet OAM
MP1590B-30	High Precision Jitter Analysis

*: This option is for the MU120118B/C 10 Gigabit Ethernet Module.
Choose the MU120138A-03 when using the Link Fault Signaling option for the MU120138A 10 Gigabit Ethernet Module.

● **Plug-in Unit Options**

	Model/Order No.	Name	MU120131A	MU120132A	MU120138A	MU150110A	MU150101A	MU150121A/21B	MU150123A/23B	MU150124B	MU150125A
Ethernet Unit	MU120131A/32A/38A-01	Clock Measurement	✓	✓	✓						
	MU120131A-02	PoE	✓								
	MU120138A-03	Link Fault Signaling[*1]			✓						
SDH/SONET/ OTN/PDH/DSn/ Jitter/EoS Unit	MU150101A/21A/21B-01	Wavelength 1.31 μm					✓	✓			
	MU150101A/21A/21B-02	Wavelength 1.55 μm					✓	✓			
	MU150101A/21A/21B-03	Wavelength 1.31/1.55 μm					✓	✓			
	MU150110A-004, MU150101A/21A/21B-04	Optical Output Power Adjustable				✓	✓	✓			
	MU150110A-005, MU150125A-05	OTU1/OTU2				✓					✓
	MU150101A-05	OTU1					✓				
	MU150123A/23B-05	OTU2							✓		
	MU150110A-006	11.1G				✓					
	MU150101A-06	GFP-F/LEX/LAPS					✓				
	MU150101A-07	POS					✓				
	MU150101A-11	HO Virtual Concatenation					✓				
	MU150101A-12	LO Virtual Concatenation					✓				
	MU150101A-13	LCAS					✓				
	MU150101A-14	Differential Delay					✓				
	MU150125A-01	Wander Measurement									✓
	MU150110A-008, MU150125A-06	10.3G				✓					✓
	MU150110A-009	Insert/Extract				✓					
	MU150110A-010	Multichannel Measurement				✓					
	MU150110A/01A/21A/21B/23A/23B/24B-38	ST Connector				✓	✓	✓	✓	✓	
	MU150110A/01A/21A/21B/23A/23B/24B-39	DIN Connector				✓	✓	✓	✓	✓	
	MU150110A/01A/21A/21B/23A/23B/24B-40	SC Connector				✓	✓	✓	✓	✓	
	MU150110A/01A/21A/21B/23A/23B/24B-43	HMS-10/A Connector				✓	✓	✓	✓	✓	

∗ Order additional J1349A when Ethernet unit installed simultaneously in SDH/SONET/OTN/PDH/DSn unit and jitter unit configurations.

∗1: This option is for the MU120138A 10 Gigabit Ethernet Module.
Choose the MP1590B-16 when using the Link Fault Signaling option for the MU120118B/C 10 Gigabit Ethernet Module.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MP1590B	Network Performance Tester	
	Standard accessories	
J0491	Shield Power Cord (13 A)[*1]:	1 pc
F0105	Fuse, 10 A[*1]:	2 pcs
E0010	Side Cover[*1]:	1 pc
B0329G	Front Cover for 3/4MW 4U[*1]:	1 pc
Z0847A	MD1230/MP1590 Family Software (CD)[*1, *2]:	1 pc
J0617B	Replaceable Optical Connector (FC-PC)[*3, *4]:	1 pc/2 pcs
J0747B	Fixed Optical Attenuator (10 dB, FC connector)[*5]:	1 pc
J0747C	Fixed Optical Attenuator (15 dB, FC connector)[*6]:	1 pc
J1003N	Semirigid Cable (136.6 mm)[*7]:	2 pcs
J1003P	Semirigid Cable (96 mm)[*7]:	1 pc
J1003Q	Semirigid Cable (75.6 mm)[*8, *9]:	1 pc/2 pcs
J1003R	Semirigid Cable (55.3 mm)[*7]:	1 pc
J1003S	Semirigid Cable (56.5 mm)[*10]:	1 pc
J1003T	Semirigid Cable (67 mm)[*11]:	2 pcs
J0500A	Semi-rigid Cable 0.5 m[*11]:	1 pc
	Plug-in units	
MU150110A	Multirate Unit[*12, *13]	
MU150101A	2.5/2.6G Eos Unit[*14]	
MU150121A	10/10.7G Optical Unit (Tx)[*14]	
MU150121B	10/10.7G Optical/Electrical Unit (Tx)[*14]	
MU150123A	10/10.7G Optical Unit (Rx Wide)	
MU150123B	10/10.7G Optical/Electrical Unit (Rx Wide)	
MU150124B	10.3G Optical/Electrical Unit (Rx Wide)	
MU150125A	10/10.7G Jitter Unit	

Model/Order No.	Name
MU120111A	10/100M Ethernet Module[*15]
MU120112A	Gigabit Ethernet Module[*15, *16]
MU120118B	10 Gigabit Ethernet Module[*15, *17]
MU120118C	10 Gigabit Ethernet Module[*15, *17]
MU120121A	10/100/1000M Ethernet Module[*15]
MU120122A	Gigabit Ethernet Module[*15, *18]
MU120131A	10/100/1000M Ethernet Module[*15]
MU120132A	Gigabit Ethernet Module[*15, *18]
MU120138A	10 Gigabit Ethernet Module[*15, *19]
	Options
MP1590B-01	RS-232C
MP1590B-02	GPIB
MP1590B-03	LAN
MP1590B-07	OSPF Protocol
MP1590B-08	MPLS (LDP/CR-LDP) Protocol
MP1590B-09	MPLS (RSVP) Protocol
MP1590B-10	RFC2899 Benchmarking Test
MP1590B-11	Packet BER Test
MP1590B-12	IPv6 Expansion
MP1590B-13	XENPAK Test
MP1590B-14	IGAP Protocol
MP1590B-15	Auto Negotiation Analysis
MP1590B-16	Link Fault Signaling[*20]
MP1590B-17	Traffic Impairment Emulator[*21]
MP1590B-20	Application Traffic Monitor
MP1590B-28	Ethernet OAM
MP1590B-30	High Precision Jitter Analysis[*22]

Continued on next page

Model/Order No.	Name
MU150110A-004	Optical Output Power Adjustable*23
MU150110A-005	OTU1/OTU2
MU150110A-006	11.1G
MU150110A-008	10.3G
MU150110A-009	Insert/Extract
MU150110A-010	Multichannel Measurement
MU150110A-038	ST Connector*24
MU150110A-039	DIN Connector*24
MU150110A-040	SC Connector*24
MU150110A-043	HMS-10/A Connector*24
MU150101A-01	Wavelength 1.31 µm
MU150101A-02	Wavelength 1.55 µm
MU150101A-03	Wavelength 1.31/1.55 µm
MU150101A-04	Optical Output Power Adjustable
MU150101A-05	OTU1
MU150101A-06	GFP-F/LEX/LAPS
MU150101A-07	POS
MU150101A-11	HO Virtual Concatenation
MU150101A-12	LO Virtual Concatenation
MU150101A-13	LCAS
MU150101A-14	Differential Delay*25
MU150101A-38	ST Connector*24
MU150101A-39	DIN Connector*24
MU150101A-40	SC Connector*24
MU150101A-43	HMS-10/A Connector*24
MU150121A-01	Wavelength 1.31 µm
MU150121A-02	Wavelength 1.55 µm
MU150121A-03	Wavelength 1.31/1.55 µm
MU150121A-04	Optical Output Power Adjustable
MU150121A-38	ST Connector*24
MU150121A-39	DIN Connector*24
MU150121A-40	SC Connector*24
MU150121A-43	HMS-10/A Connector*24
MU150121B-01	Wavelength 1.31 µm
MU150121B-02	Wavelength 1.55 µm
MU150121B-03	Wavelength 1.31/1.55 µm
MU150121B-04	Optical Output Power Adjustable
MU150121B-38	ST Connector*24
MU150121B-39	DIN Connector*24
MU150121B-40	SC Connector*24
MU150121B-43	HMS-10/A Connector*24
MU150123A-05	OTU2
MU150123A-38	ST Connector*24
MU150123A-39	DIN Connector*24
MU150123A-40	SC Connector*24
MU150123A-43	HMS-10/A Connector*24
MU150123B-05	OTU2
MU150123B-38	ST Connector*24
MU150123B-39	DIN Connector*24
MU150123B-40	SC Connector*24
MU150123B-43	HMS-10/A Connector*24
MU150124B-38	ST Connector*24
MU150124B-39	DIN Connector*24
MU150124B-40	SC Connector*24
MU150124B-43	HMS-10/A Connector*24
MU150125A-01	Wander Measurement
MU150125A-05	OTU1/OTU2
MU150125A-06	10.3G
MU120131A-01	Clock Measurement
MU120131A-02	PoE
MU120131A-12	PoE Retrofit
MU120132A-01	Clock Measurement
MU120138A-01	Clock Measurement
MU120138A-03	Link Fault Signaling*20
	Software
MX159001B	Network Performance Tester Control Software*26, *38
MX159001B-05	5 licenses*38
MX159001B-08	8 licenses*38
	Software Options
MX159001B-01	RS-232C Control*37
MX159001B-02	GPIB Control*37
MX159001B-03	Ethernet Control*38

Model/Order No.	Name
	Optional accessories
G0105A	GBIC SX 850 nm*27
G0106A	GBIC LX 1310 nm*27
G0107A	GBIC LH 1310 nm*27
G0108A	GBIC ZX 1550 nm*27
G0124A	GBIC T (1000 BASE-T)*27
G0181A	SFP SX 850 nm*28
G0182A	SFP LX 1310 nm*28
G0183A	SFP LE 1310 nm*28
G0184A	SFP LR 1550 nm*28
G0277A	XENPAK (10 GBASE-SR)*29
G0192A	XENPAK (10 GBASE-LR)*29
G0193A	XENPAK (10 GBASE-ER)*29
G0238A	SFP+ SR 850 nm*30
G0239A	SFP+ LR 1310 nm*30
G0271A	SFP+ ER 1550 nm*30
G0194A	1310 nm XFP Module*31
G0195A	1550 nm XFP Module*31
J0796A	Replaceable ST Connector (with protective caps, 1 set)
J0796B	Replaceable DIN Connector (with protective caps, 1 set)
J0796C	Replaceable SC Connector (with protective caps, 1 set)
J0796D	Replaceable HMS-10/A Connector (with protective caps, 1 set)
J0796E	Replaceable FC Connector (with protective caps, 1 set)
J0617B	Replaceable Optical Connector (FC-PC)
J0747B	Fixed Optical Attenuator (10 dB, FC Connector)
J0747C	Fixed Optical Attenuator (15 dB, FC Connector)
J0747D	Fixed Optical Attenuator (20 dB, FC Connector)
J1049A	Fixed Optical ATT: SC (5 dB)
J1049B	Fixed Optical ATT: SC (10 dB)
J1049C	Fixed Optical ATT: SC (15 dB)
J1376A	AFA-0466-050-35-S-B-O (5 dB, LC connector)
MZ1221A	XAUI Extender*32
MZ1222A	XENPAK Interface*33
J1163A	XAUI Cable, 0.5 m
J1164A	MDIO Cable, 0.5 m
J0635A	FC · PC-FC · PC-1M-SM (SM, FC-SPC connector both ends, 1 m)
J0635B	FC · PC-FC · PC-2M-SM (SM, FC-SPC connector both ends, 2 m)
J0635C	FC · PC-FC · PC-3M-SM (SM, FC-SPC connector both ends, 3 m)
J0660B	SC · PC-SC · PC-2M-SM (SM, SC-SC connector, 2 m)
J0773B	Optical Fiber Cable (GI, SC-SC connector, 2 m)
J1344A	LC/PC-LC/PC-1M-SM (Simplex, SM, LC-LC connector, 1 m)
J1327B	LC/PC-LC/PC-2M-SM (Simplex, SM, LC-LC connector, 2 m)
J1119B	Optical Fiber Cable (Duplex, MM, 2 m)
J1271	Optical Fiber Cord (Duplex, SM, LC-LC connector), 2 m
J1272	Optical Fiber Cord (Duplex, SM, LC-SC connector), 2 m
J1273	Optical Fiber Cord (Duplex, GI, LC-LC connector), 2 m
J1274	Optical Fiber Cord (Duplex, GI, LC-SC connector), 2 m
J1139A	FC · PC-LC · PC-1M-SM (Simplex, SM, LC-FC connector, 1 m)
J1003N	Semirigid Cable (136.6 mm)
J1003P	Semirigid Cable (96 mm)
J1003Q	Semirigid Cable (75.6 mm)
J1003R	Semirigid Cable (55.3 mm)
J1003S	Semirigid Cable (56.5 mm)
J0776D	BNC Cable, 2 m (BNC-P-3W · 3D-2W · BNC-P-3W, 50Ω) (Double Shield)
J0322B	Coaxial Cord, 1 m (11SMA · SUCOFLEX104 · 11SMA)
J0696A	SMA Cable (AA-165-500, 0.5 m)
J1268	Semiflexible Coaxial Cable
J1349A	Coaxial Cable, 0.3 m
J1173	6020180 Power Divider
J1059B	Measurement Cable (RJ-45, M-3912) (Siemens 3P, 2 m)
J1060B	Measurement Cable (RJ-45, MIN BANTUM), 2 m
J0008	GPIB Cable, 2 m
J1109B	LAN Cable (CAT5, cross), 5 m
J1110B	LAN Cable (CAT5, straight), 5 m
J1275	LAN Cable (CAT5E, straight), 1 m
J1275B	LAN Cable (CAT5E, straight), 5 m
J1275C	LAN Cable (CAT5E, cross), 1 m
J1275D	LAN Cable (CAT5E, cross), 5 m
Z0989A	1310 nm XFP Kit*34
Z0990A	1550 nm XFP Kit*35
Z0321A	Keyboard (PS/2)
Z0541A	USB Mouse
Z0282	Ferrule Cleaner
Z0283	Ferrule Cleaner Replacement Tape
Z0284	Adapter Cleaner
Z0838A	Stick Cleaner 1.25 mm (250 pcs/set)

Continued on next page

Model/Order No.	Name
B0336C	Carrying Case 3/4MW 4U 350D
B0530	420K-R-65 Carrying Case Caster (for B0336C)
B0448	Soft Case
B0593A	Blank Panel
B0588A	Rack Mount Kit[*36]
Z0849A	MD1230/MP1590 Family Manual CD
W2420AE	MP1590B Operation Manual
W2421AE	MX159001B Operation SDH Edition Manual
W2422AE	MX159001B Operation SONET Edition Manual
W2423AE	MP1590B/MP1591A Remote Control Operation Manual
W2134AE	Application Traffic Monitor Operation Manual
W1931AE	MD1230 Family Ethernet Module Operation Manual
W3218AE	MU150110A Operation Manual
W2425AE	MU150101A Specifications Operation Manual
W2426AE	MU150125A Specifications Operation Manual
W2427AE	MU150121/2/3/34A Specifications Operation Manual
W2589AE	MU150121B/123B Operation Manual
W2590AE	MU150124B Operation Manual

*1: Supplied with main frame.
*2: CD includes installer, release notes and operation manual.
*3: Supplied with MU150110A, MU150101A, MU150121A/B, MU150123A/B, and MU150124B.
*4: Two pieces of MU150110A, and MU150101A.
*5: Supplied with MU150123A/B, and MU150124A.
*6: Supplied with MU150101A.
*7: Supplied with MU150125A.
*8: Supplied with MU150121A/B, MU150123A/B, and MU150124B.
*9: One piece of MU150123A/B, and MU150124B, and two pieces of MU150121A/B.
*10: Supplied with MU150110A, and MU150101A.
*11: Supplied with MU150121B.
*12: Requires XFP module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
*13: An XFP module (G0194A/G0195A) and fixed optical attenuator (J0747C, J1376A) are required when performing the self-test.
*14: One of Option-01, 02, 03 required.
*15: Order additional J1349A when Ethernet unit is installed simultaneously in SDH/SONET/OTN/PDH/DSn unit and jitter unit configurations.
*16: Requires GBIC module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
*17: Requires XENPAK module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
*18: Requires SFP module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
*19: Requires SFP+ module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
*20: The MP1590B-16 is supported by the MU120118B/C.
The MU120138A-03 is supported by the MU120138A.
*21: Only ports 1 and 2 of the the MU120121A/122A support the MP1590B-17 Traffic Impairment Emulator option. Moreover, only MU120121A/122A models shipped after March 7, 2008 with the "Supports Opt.17" sticker support the option.
*22: MP1590B-30 option can be added to the main frame before delivery.
But it cannot be added after.
*23: Only enabled for optical output signals up to 2.6G.
*24: Exchangeable.
*25: Requires one of MU150101A-11 or MU150101A-12.
*26: MP1590B-03 not required. However, the maximum number of MP1590B units that can be controlled simultaneously with one licence is limited o 8.
*27: GBIC modules sold as single units. Two can be mounted in MU120112A.
*28: SFP modules sold as single units. Two can be mounted in MU120122A and eight in MU120132A.
*29: XENPAK modules sold as single units. Two can be mounted in MU120118B and one in MU120118C. G0277A, G0192A and G0193A only supported by MU120118A/B/C units with "With APS" sticker. DO NOT install in MU120118A/B/C units without “With APS” sticker. G0277A, G0192A and G0193A have “Only for APS” stickers attached.
*30: SFP+ modules sold as single units. Four can be mounted in MU120138A.
*31: XFP modules sold as single units. One can be mounted in MU150110A.
*32: When using XAUI extender, MZ1222A XENPAK interface, J1163A XAUI cable, and J1164A MDIO cable required along with separate external power supply (5 V, 4 A)
*33: MZ1222A supplied by 1.8-V APS.
*34: G0194A and J1344A included in Z0989A.
*35: G0195A, J1344A, and J1376A included in Z0990A.
*36: Rack mount Kit for MP1590B.
*37: Windows 2000, XP are supported.
*38: Windows 2000, XP, 7 (32 bit) are supported.

Other

• Software Upgrade Service

Model/Order No.	Name
	Software upgrade service
MP1590B-40	Annual Software Upgrade Service

*: Option for latest versions of modules' software.
MP1590B-40 is bundled with MP1590B purchase and effective by September 30th 2013.
From October 1st 2013, MP1590B's owners can download MP1590B modules' software from Anritsu Website.

• Maintenance Service

Model/Order No.	Name
	Maintenance service
***-ES210	2 Years Extended Warranty Service
***-ES310	3 Years Extended Warranty Service
***-ES510	5 Years Extended Warranty Service

*: Extends standard 1-year warranty service period on new main frame and plug-in units to 2, 3, or 5 years.
Purchased separately at new purchase. (Cannot be purchased mid-contract, at contract renewal or in multi-year combinations.)

***-ES210: MP1590B-ES210, MU150110A-ES210, MU150101A-ES210, MU150121A-ES210, MU150121B-ES210, MU150123A-ES210, MU150123B-ES210, MU150124B-ES210, MU150125A-ES210, MU120111A-ES210, MU120112A-ES210, MU120118B-ES210, MU120118C-ES210, MU120121A-ES210, MU120122A-ES210, MU120131A-ES210, MU120132A-ES210, MU120138A-ES210
***-ES310: MP1590B-ES310, MU150110A-ES310, MU150101A-ES310, MU150121A-ES310, MU150121B-ES310, MU150123A-ES310, MU150123B-ES310, MU150124B-ES310, MU150125A-ES310, MU120111A-ES310, MU120112A-ES310, MU120118B-ES310, MU120118C-ES310, MU120121A-ES310, MU120122A-ES310, MU120131A-ES310, MU120132A-ES310, MU120138A-ES310
***-ES510: MP1590B-ES510, MU150110A-ES510, MU150101A-ES510, MU150121A-ES510, MU150121B-ES510, MU150123A-ES510, MU150123B-ES510, MU150124B-ES510, MU150125A-ES510, MU120111A-ES510, MU120112A-ES510, MU120118B-ES510, MU120118C-ES510, MU120121A-ES510, MU120122A-ES510, MU120131A-ES510, MU120132A-ES510, MU120138A-ES510

40G SDH/SONET ANALYZER

MP1595A

1.5 Mbit/s to 43 Gbit/s

Remote Control
GPIB OPTION | Ethernet OPTION

All-in-one Model Supporting 40/43G Jitter & Wander Measurements
All-in-one Multibit Rate Analyzer

Core networks are adopting 40G speeds to support cloud computing applications and faster mobile phone applications. In addition, plans are advancing for upgrading submarine fiber cables from 10 to 40G. The spread of 40G networks across many business sectors is driving the need for reliable jitter measurements to assure the interoperability of the various types of network equipment. The MP1595A 40G SDH/SONET Analyzer is the ideal solution for network quality measurements.

STM-256/OC-768, OTU3 Support

Just one MP1595A 40G SDH/SONET Analyzer provides full 40G/43G support for all network quality measurements.

All-in-one 1.5M to 43G Multibit Rate Support

This all-in-one flagship model for SDH/SONET and OTN measurements supports the following Multibit rate.

Electrical interface	PDH	2.048, 8.448, 34.368, 139.264 Mbit/s
	DSn	1.544, 44.736 Mbit/s
	SDH/SONET	51.84, 155.52, 9,953.28, 39,813.12 Mbit/s
	OTN	10,709.22, 43,018.41 Mbit/s
	Non frame	10,312.5 Mbit/s
Optical interface	SDH/SONET	51.84, 155.52, 622.08, 2,488.32, 9,953.28, 39,813.12 Mbit/s
	OTN	2,666.05, 10,709.22, 43,018.41 Mbit/s
	Non frame	10,312.5 Mbit/s

Full SDH/SONET, OTN Measurement Functions

Stress testing for SDH/SONET and OTN Equipments is supported using the full line of versatile functions, including overhead setting, monitoring, error/alarm generation and detection functions. The random error insertion using a Poisson distribution is especially useful for evaluating FEC performance of OTN as recommended by ITU-T.

40/43G Jitter and Wander Generation and Measurement

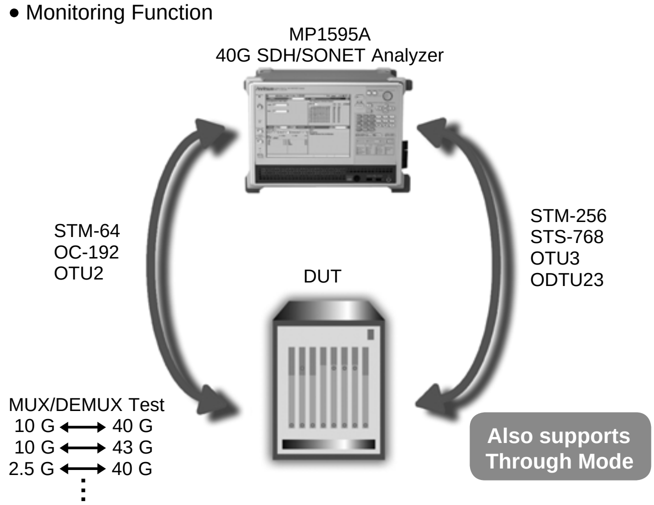
Installing the jitter module supports high-performance jitter generation and measurement, as well as SDH/SONET frame measurement, including STM-256/OC-768 (39.813 Gbit/s) and OTU3 (43.018 Gbit/s). It also supports jitter tolerance and jitter transfer measurements.
The patented MP1595A circuit design slashes measurement times while wander generation and measurement is added by versatile software options.

Key Measurement Applications

• SDH/SONET/OTN Measurement Solutions

The following measurement solutions required by 40G/43G transmission equipment and networks are supported:

- Error/Alarm Insertion and Detection
- Pointer Increment/Decrement Test
- APS (Automatic Protection Switching) Measurement
- Frame Memory/Capture
- Through Mode Measurement
- Delay Time Measurement
- Monitoring Function

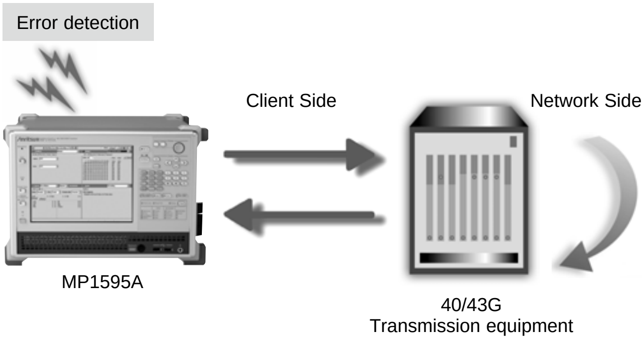


A single MP1595A unit supports a wide range of bit rates from 1.5M to 43G, offering an efficient measurement test platform for MUX/DEMUX equipment with 2.5G and 10G interfaces as well as 40G/43G transmission equipment and networks.

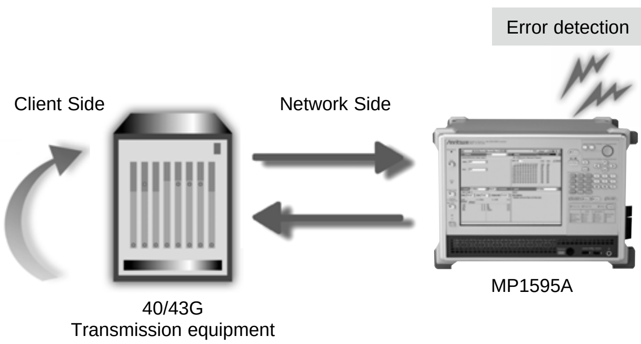
- **40/43G Jitter Measurement**

Installing the jitter module supports the following 40/43G jitter measurements to verify transmission system quality.

- Jitter Generation Measurement
- Jitter Tolerance Measurement
- Jitter Transfer Measurement



Client-side Jitter Tests

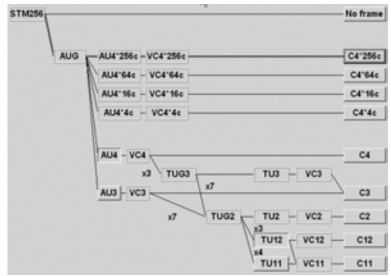


Network-side Jitter Tests

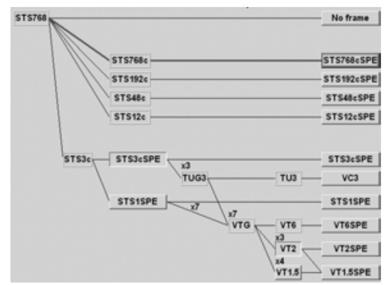
Mapping Support

- **Mapping Support (SDH/SONET)**

Concatenation mappings from STM-1c/ STS-3c to STM-256c/STS-768c can be set. In addition, using the MP1595A with either the 10G Measurement Unit (MU150100A) or the 10G E/O, O/E Unit (MU150135A) offers support for SDH/SONET, Japanese, European PDH, and North American DSn mapping routes for bit rates from 1.5M to 10G.



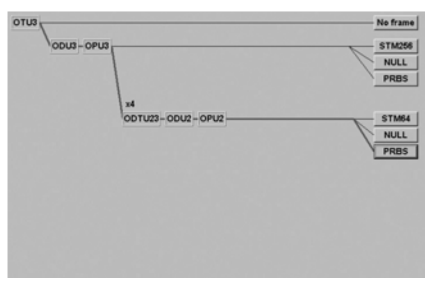
SDH Mapping



SONET Mapping

- **Mapping Support (OTN)
  (MU150140A-05 OTU3, MU150140A-06 ODTU23)**

The following ITU-T G.709 mappings are supported for OTN (43G). and the ODTU23 mapping can be supported as an option. Moreover, STM-64/STS-192 signals can be mapped to OTU3 signals as client signals.



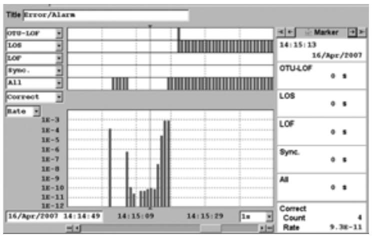
OTN Mapping

∗: Client-side SDH/SONET supports following OT3 mappings:
- OPU3: STM-256c/STS-768c
- OPU3-ODTU23-OPU2: STM-64c/STS-192c

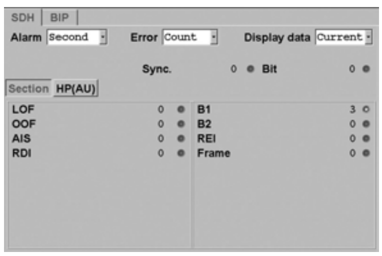
SDH/SONET, OTN Measurement Functions

• Error/Alarm Measurement Function

For stress testing SDH/SONET and OTN devices, errors such as FAS, BIP-8, B1/B2/B3, etc., and alarms such as LOF, LOM, AIS, etc., can be generated at any timing and counted (monitored) by the MP1595A.



Error/Alarm Measurement Example (monitoring)

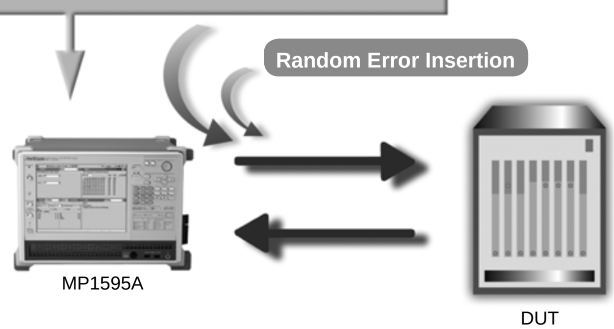


Error/Alarm Measurement Example (result)

• FEC Measurement Function using ITU-T O.182 Random Error

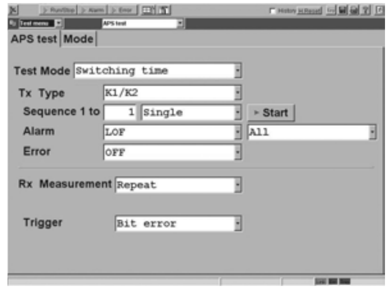
The error signal (generated by Poisson distribution) specified by ITU-T O.182 is used to evaluate and verify the FEC performance in accordance with the ITU-T-recommended procedure. In addition, generation of burst bit errors of more than 1024 bits is useful for confirming the FEC burst error correction performance.

Random error insertion using O.182 method
This function is required for FEC evaluation. Accurate measurement was impossible using previous error insertion methods.

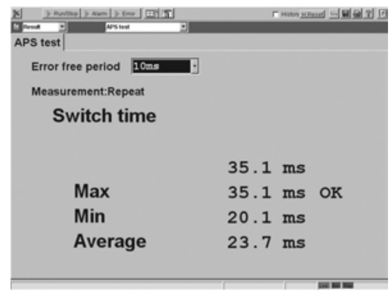


• APS Measurement Function

The Automatic Protection Switch (APS) test verifies the switching time with 0.1 ms resolution by measuring the time. until the abnormal status is released when an alarm or error is triggered. This function checks that the switching time meets the specifications.



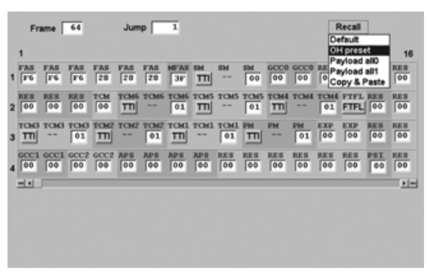
APS Measurement (setting)



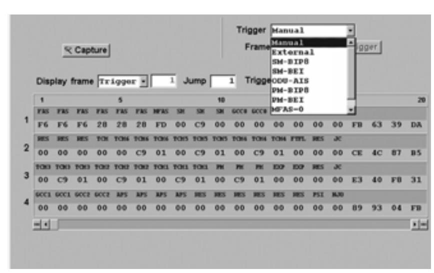
APS Measurement Example

• Frame Memory/Capture Function
MU150140A-10 Frame Memory/Capture (40G/43G)

All data (OH, Payload) for a maximum of up to 16 frames can be captured using the frame capture function. Since frames can be captured using various errors and alarms as a trigger, this function can be very useful for analyzing data at abnormalities.



Frame Memory



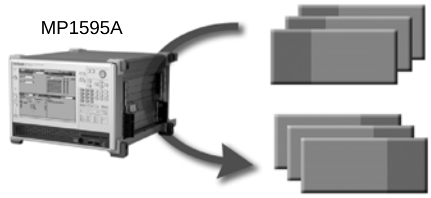
Frame Capture

- **Through Mode Function**

The Through mode is convenient for SDH/SONET and OTN tests because it supports monitoring of signal quality on an in-service network as well as insertion of various errors and alarms.

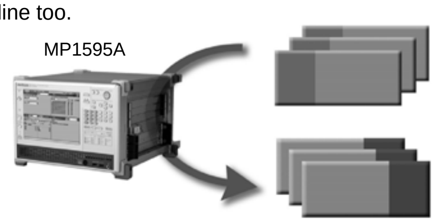
Transparent Mode

This mode loops-back and outputs the received signal as is. And random error insertion is useful for emulating transmission paths.



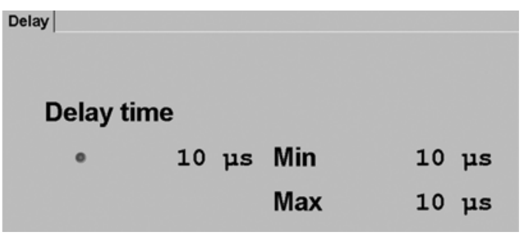
Overhead Overwrite

This mode loops-back and outputs the received signal after overwriting the OH part of the received signal with the OH specified by the MP1595A. Various errors and alarms can be inserted into an in-service line too.



- **Delay Measurement Function**

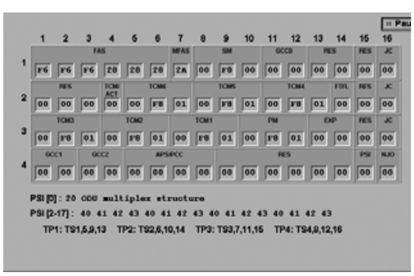
Network delay times are directly related to network quality and this function can measure payload data transmission delays with µs accuracy.



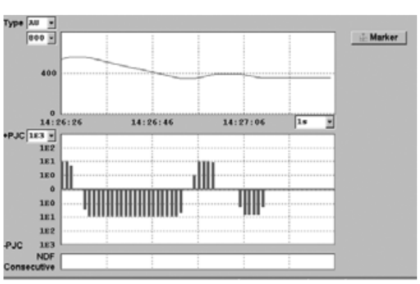
Delay Measurement Function Example

- **Monitoring Function**

A versatile line of monitoring functions, including errors/alarms, pointers, OH, etc., supports comprehensive network monitoring.



OH Monitoring



Pointers Monitoring

40/43G Jitter and Wander Measurements

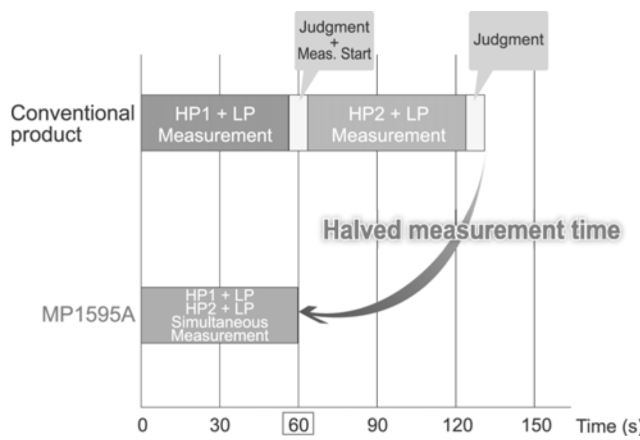
- **Parallel Jitter Measurement with Parallel Filters**

The MP1595A jitter modules with digital jitter analysis circuit support simultaneous jitter measurements using various bandwidth filters, cutting measurement times by 70%. Simultaneous display of measurement results for each filter is ideal for jitter generation analysis. Moreover, measurement in combination with the G.873- and G.8251-defined filters supports monitoring of the effect of jitter components between client and a line.

Parallel Jitter Measurement

- **High-speed Jitter Generation Measurement**

Measurement times halved by ITU-T-defined parallel filter.



- **Automatic Measurement**

The MP1595A automatically measures ITU-T O.172-defined jitter generation, jitter tolerance, and jitter transfer. Moreover, reduced jitter measurement times compared to conventional instruments help cut inspection workloads.

- Jitter generation measurement

Simultaneous measurements with multiple parallel filters

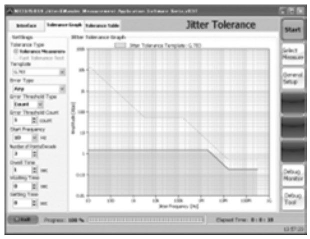
- Jitter Tolerance measurement

Fast tests with jitter tolerance mask OK/NG evaluation

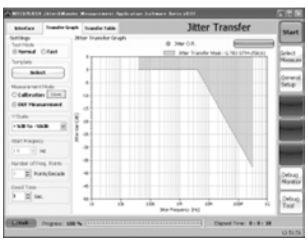
- Jitter Transfer measurement

Fast transfer test function (MU150147A-007) using unique Anritsu synthesized waveform

Jitter Generation Measurement



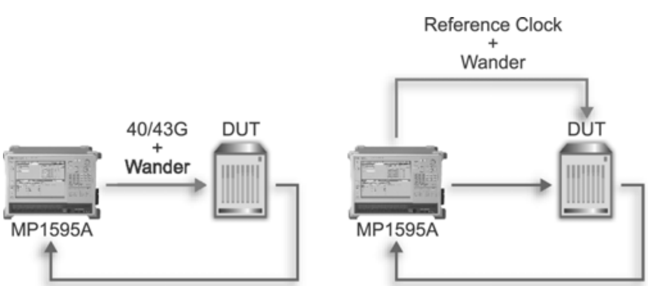
Jitter Tolerance Measurement



Jitter Transfer Measurement

- **Wander Measurement**

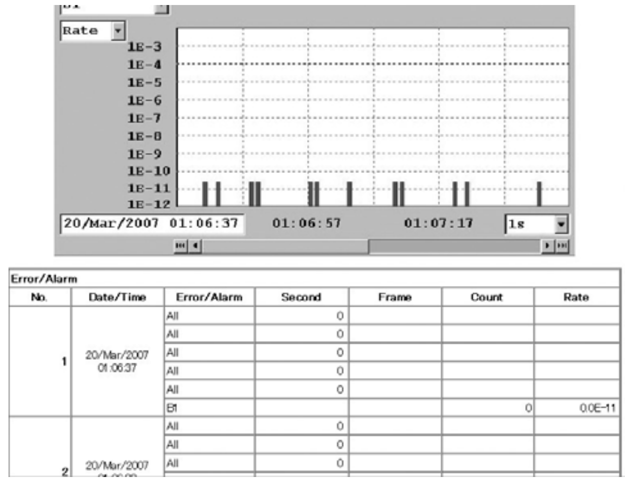
MP1595A wander generation supports both Sin modulation and TDEV. The results of TIE, MTIE and TDEV automatic measurement are displayed as graphs.
Moreover, since tests of TDEV tolerance and wander transfer characteristics can add wander to client-side signals or the reference clock, both the recommended ITU-T O.172 wander measurements are supported.



Useful Functions

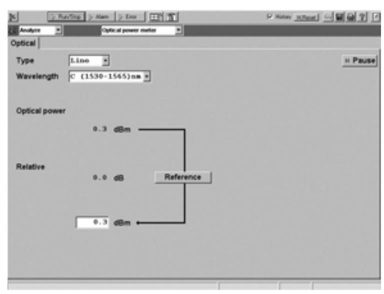
- **Reporting Function**

Measurement results can be saved in various formats. Outputting results including graphs, measurements, etc., in HTML is convenient for creating reports.

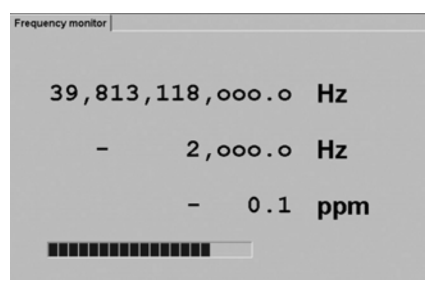


- **Optical Level/Frequency Monitoring**

Optical level and frequency monitoring functions are standard, making it easy to verify the input signal.



Optical Level Monitoring



Frequency Monitoring

• Jitter Troubleshooting

The MP1595A new jitter modules support new troubleshooting functions and extra inputs/outputs for new purposes.

• Demod. Output (Option) and Spectrum Analysis Function (Option)
Outputs demodulated jitter analog waveform.
In addition, it displays spectrum analysis results on the MP1595A screen without a spectrum analyzer.

• 1/4, 1/16 Clock Output
Outputs 1/4 or 1/16 clock synchronized with Tx clock.
This can be used with a sampling scope as a Tx waveform confirmation trigger because this clock is free of jitter modulation.

• 1/64 Clock Output1, 1/64 Clock Output2
Outputs 1/64 clock synchronized with Tx clock.
This can be used as a clock source for a DUT requiring a reference clock because this clock is free of jitter modulation.

• Wideband clock offset
±100 ppm Tx clock offset. In addition, the Rx side supports jitter analysis up to ±100 ppm supporting DUT frequency tolerance tests.

• Remote Control

The optional MX159501A 40G SDH/SONET Analyzer Control Software supports remote control of the MP1595A from a PC using the same GUI as the instrument .

• Pointing Device/USB Interface

The compact main frame includes a display, keyboard and pointing device for all-in-one operation but two USB ports are also included for connecting a mouse and USB storage device to save measurement results when necessary.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MP1595A	40G SDH/SONET Analyzer	
	Standard accessories	
J0491	Shield Power Cord 2.6 m (13 A)*1:	1 pc
J0670A	Power Cord L Type (C7), 2.5 m*1:	1 pc
F0105	Fuse 10 A*1:	2 pcs
B0482	Front Cover (3/4MW5U)*1:	1 pc
J1003S	Semirigid Cable, 56.5 mm*2, *3:	1 pc
J1003N	Semirigid Cable, 136.6 mm*2:	1 pc
J0635A	Optical Fiber Cable (SM, FC-SPC connector both ends), 1 m*4:	1 pc
J0617B	Replaceable Optical Connector (FC-PC)*3, *4:	2 pcs
J1383A	Semirigid Cable, 105.7 mm*5:	1 pc
J1384A	Semirigid Cable, 90.0 mm*5:	1 pc
J0747C	Fixed Optical Attenuator (15 dB, FC connector)*3:	1 pc
	Units/Modules	
MU150100A	10/10.7G Unit*6	
MU150135A	10/10.7G Optical Unit (XFP)*7	
MU150140A	40/43G Unit	
MU150141A	40G Optical Unit	
MU150141B	40/43G Optical Unit	
MU150147A	40/43G Jitter Unit*8	
MU150149A	40/43G Optical Unit (TX)*8	
	Software	
MX159501A	40G SDH/SONET Analyzer Control Software	
MX159508A	Jitter/Wander Measurement Software*9	
	Option	
MP1595A-01	RS-232C	
MP1595A-02	GPIB	
MP1595A-03	LAN	
MP1595A-004	Clock Source Output for Jitter/Wander*10	
MP1595A-104	Clock Source Output for Jitter/Wander Retrofit*10	
MU150140A-05	OTU3	
MU150140A-06	ODTU23*11	
MU150140A-10	Frame Memory/Capture (40/43G)	
MU150141A-40	SC Connector	
MU150141B-40	SC Connector	
MU150147A-001	39.813 Gbit/s*12	
MU150147A-002	43.018 Gbit/s*12	
MU150147A-007	Fast Jitter Transfer Measurement	
MU150147A-008	Demod Signal Analysis	
MU150147A-009	Demod Output	
MU150147A-010	Wander Measurement	
MU150147A-011	Wander Generation	
MU150147A-040	SC Connector	
MX159508A	Jitter/Wander Measurement Software	
MU150100A-01	Wavelength 1.31 µm	
MU150100A-02	Wavelength 1.55 µm	
MU150100A-03	Wavelength 1.31/1.55 µm	
MU150100A-04	Optical Output Power Adjustable	
MU150100A-05	OTU1/OTU2	
MU150100A-07	10/10.7G Minus Option*13	
MU150100A-08	10.3G*14	
MU150100A-09	Insert/Extract*13	
MU150100A-38	ST Connector*15	
MU150100A-39	DIN Connector*15	
MU150100A-40	SC Connector*15	
MU150100A-43	HMS-10/A Connector*15	

Model/Order No.	Name
	Optional accessories
B0483	Carrying Case
B0593A	Blank Panel
G0194A	1310 nm XFP Module*16
G0195A	1550 nm XFP Module*16
J0008	GPIB cable, 2 m
J0845	Balanced Cable (BANTAM 3P-BANTAM 3P), 6 ft
J0162A	Balanced Cable (Siemens 3P-Siemens 3P), 1 m
J0162B	Balanced Cable (Siemens 3P-Siemens 3P), 2 m
J0322B	Coaxial Cable (11SMA SUCOFLEX104 11SMA), 1 m
J0617B	Replaceable Optical Connector (FC-PC)
J0635B	Optical Fiber Cable (SM, FC-SPC connector both ends), 2 m
J0635C	Optical Fiber Cable (SM, FC-SPC connector both ends), 3 m
J0660B	Optical Fiber Cable (SM, SC-SC connector both ends), 2 m
J0747A	Fixed Optical Attenuator (5 dB, FC connector)
J0747B	Fixed Optical Attenuator (10 dB, FC connector)
J0747C	Fixed Optical Attenuator (15 dB, FC connector)
J0747D	Fixed Optical Attenuator (20 dB, FC connector)
J0775D	Coaxial cable (BNC-P620 3C-2WS BNC-P620 75 Ω), 2 m
J0776D	Coaxial cable (BNC-P-3W/3D-2W/BNC-P-3W, 50 Ω), 2 m
J0796A	ST Connector (replaceable, with protective caps, 1 set)
J0796B	DIN Connector (replaceable, with protective caps, 1 set)
J0796C	SC Connector (replaceable, with protective caps, 1 set)
J0796D	HMS-10/A Connector (replaceable, with protective caps, 1 set)
J0796E	FC Connector (replaceable, with protective caps, 1 set)
J1003S	Semirigid Cable, 56.5 mm
J1003N	Semirigid Cable, 136.6 mm
J1049A	Fixed Optical Attenuator (5 dB, SC connector)
J1139A	Optical Fiber Cable (SM, FC-LC connector both ends), 1 m
J1271	Optical Fiber Cable (Duplex, SM, LC-LC connector), 2 m
J1272	Optical Fiber Cable (Duplex, SM, LC-SC connector), 2 m
J1327B	Optical Fiber Cable (SM, LC-LC connector both ends), 2 m
J1344A	Optical Fiber Cable (SM, LC-LC connector both ends), 1 m
J1139A	Optical Fiber Cable (SM, LC-FC connector both ends), 1 m
J1376A	Fixed Optical Attenuator (5 dB, LC connector)
J1383A	Semirigid Cable, 105.7 mm
J1384A	Semirigid Cable, 90.0 mm
Z0282	Ferrule Cleaner 1 CLETOP type
Z0283	Replacement Reels for Ferrule Cleaner 1 6/pack
Z0284	Adapter Cleaner 1 Stick type (200/set)
Z0321A	Keyboard (PS/2)
Z0541A	USB Mouse
Z0849A	MD1230/MP1590 Family Manual CD
Z0989A	1310 nm XFP Kit*17
Z0990A	1550 nm XFP Kit*18
W2869AE	MP1595A Operation Manual
W2937AE	MX159501A Operation SDH Edition Manual
W2938AE	MX159501A Operation SONET Edition Manual
W2939AE	MP1595A Remote Control Operation Manual
W2424AE	MU150100A Specifications Operation Manual
W2870AE	MU150135A Specifications Operation Manual
W2871AE	MU150140A Specifications Operation Manual
W2872AE	MU150141A/B Specifications Operation Manual

• Maintenance Service

Name	Model/Order No.
2 Years Extended Warranty Service	Option-ES210
3 Years Extended Warranty Service	Option-ES310
5 Years Extended Warranty Service	Option-ES510

∗: These options extend the 1-year guarantee at purchase.

∗1: Supplied with main frame
∗2: Supplied with MU150140A
∗3: Supplied with MU150100A
∗4: Supplied with MU150141A or MU150141B
∗5: Supplied with MU150135A
∗6: One of MU150100A-01, 02, 03 required.
∗7: Requires XFP module (sold separately).
In addition, operation with non-Anritsu modules not guaranteed.
∗8: The MU150147A and MU150149A are not compliant with the CE marking EMC (electromagnetic compatibility) regulations.
∗9: Jitter and wander measurement requires MX159508A.
∗10: The Jitter and wander measurement must need MP1595A-004/104.
∗11: Requires separate MU150140-05 OTU3 option.
∗12: MU150147A must need MU150147A-001 and MU150147A-002.
It does not operate at either one.
∗13: MU150100A-07 factory installed only. MU150100A-07 and MU150100A-09 cannot both be installed simultaneously.
∗14: External clock source is required.
∗15: Exchangeable.
∗16: XFP modules sold as single units. One can be mounted in MU150135A.
∗17: Z0989A includes G0194A and J1344A.
∗18: Z0990A includes G0195A, J1344A, and J1376A.

Network Master Series

MT9090A MAINFRAME
MU909060A1/A2/A3 GIGABIT ETHERNET MODULES

Remote Control
Ethernet
OPTION

Gigabit Ethernet Testing Redefined!

MT9090A with MU909060A1/A2/A3 Overview

The Ethernet technology is widely deployed, and used for carrier class Ethernet and Mobile backhaul. Therefore easy testing of Ethernet links is very important. When outfitted with the Gigabit Ethernet Module, the very compact battery-powered, easy-to-use Anritsu Network Master is a comprehensive solution for Gigabit Ethernet testing and for installation and troubleshooting Ethernet communication lines. The instrument gives the user facilities for easy bandwidth verification, connectivity testing and service availability verification. The small size and low weight of the instrument makes it very easy to carry around for the field technician working with the Ethernet lines and despite the small size the instrument is equipped with a large display. The user can easily read and interpret information from the tested lines off the large color display with easy-to-understand colors and graphical symbols. And the graphical user interface makes it a simple task to configure and operate the instrument.

Key Features

- **RJ45 and SFP optical interface are selectable for two ports**
- **Newly released ITU-T standard for End-to-End Ethernet testing**
  ITU-T Y.1564 testing, simultaneously testing of multiple traffic streams emulating real world networks
- **Stacked VLAN (Q-in-Q), MPLS, IPv4, IPv6 supported**
- **Test Automator simplify operation and ensure proper set-up**
- **Ping, Traceroute, Ramp data generation, RFC 2544 testing**
- **Upstream/Downstream individual and simultaneous testing with end-to-end RFC 2544**
- **Service Disruption Time measurement for VoIP and IPTV**
- **Shorter testing time of multiple port networks by utilizing MT9090 ports**
- **Optical power level check and electrical cable test for physical layer testing**
- **In-band pass through and bidirectional monitoring using two ports**
- **Channel Stats for identifying error streams, top talkers, network attacks**
- **PDF and CSV report generation for documentation of test results**
- **Modular platform ensures maximum return on investment**
- **Compact and lightweight design for maximum portability in the field**

Designed for Field Operations

The Network Master Gigabit Ethernet tester (MT9090A with MU909060A) is purpose built for testing Ethernet links in the field. Its hardware and user interface are optimized for simplicity, making it easy to use for any skill level, and it is rugged enough to function in harsh environments.

- **Quick Startup**

The Network Master Gigabit Ethernet tester is ready for measurement in about 15 seconds so productive work can start immediately.

- **Long Battery Life**

Since AC power is not always available where you need it, the Network Master Gigabit Ethernet tester provides up to 3 hours of testing on a single charge, depending on configuration and setup. This coupled with an optional car cigarette lighter cord guarantees the instrument is ready when you are.

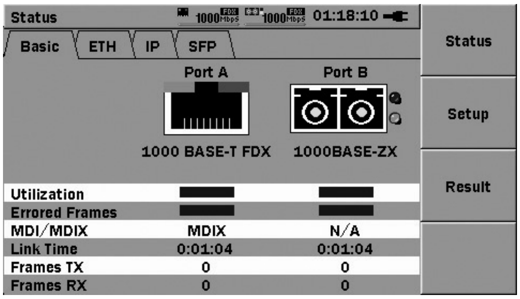
- **Portable**

With its lightweight design and user friendly dimensions, the Network Master Gigabit Ethernet tester is perfect for the outside plant environment and can easily be managed with one hand. The standard softcase with shoulder strap further increases portability when traveling from the truck to the testing site.

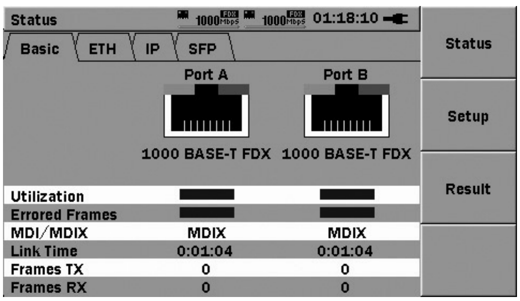
- **Rugged**

With no fans or vents to allow dust and moisture to enter the unit, the Network Master Gigabit Ethernet tester was designed for the challenging outside plant environment.

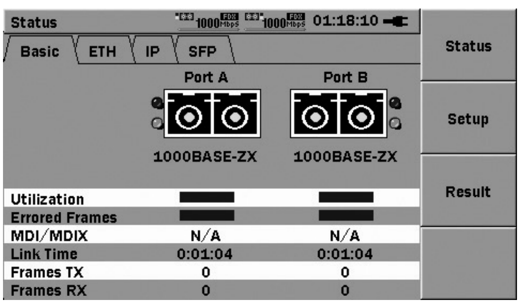
• 4.3-inch Wide Screen Display for Easy Viewing
The high resolution, full color, 4.3-inch wide screen display is the perfect format for viewing Ethernet measurement results. It also provides excellent readability both indoors and outdoors.



MU909060A1



MU909060A2



MU909060A3

• No Experience Required
The expertise is built into the Network Master Gigabit Ethernet tester. With its Test Automator and PASS/FAIL indicators the instrument makes it easy to test and troubleshoot Ethernet connections.

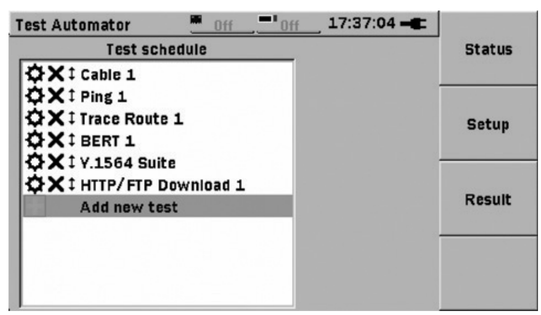
Designed for Network Activation

For installation, commissioning and QoS verification the Network Master Gigabit Ethernet tester provides powerful and flexible traffic generation capabilities, allowing you to easily test the network under various conditions, including generation of VLAN tagged traffic. The instrument also provides facilities for BER testing of the lines, performance statistics and QoS statistics.

Single end test with Loopback or Using a Ethernet Reflector, Two ports simultaneous testing for multiple ports installation.

Bidirectional performance test with End-to-End RFC 2544, Two ports simultaneous testing for multiple ports installation.

• Installation and Maintenance Simplified
Since the Network Master Gigabit Ethernet tester is purposely built for easy testing of Ethernet links in the field, its hardware and user interface are optimized for simplicity. The instrument is easy to setup using its keys and screen. The user can also store setups relevant for a given application and via a USB port distribute the setup to other instruments with the Gigabit Ethernet tester. A Test Automator is provided making it easy to set up a sequence of tests.

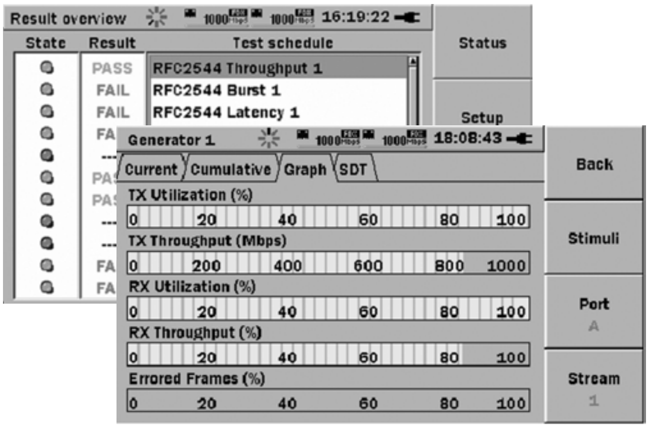


The Test Automator makes it easy to set up a sequence of tests

• Report Generation
With the powerful and flexible report generator you can create .pdf or .csv files for selected measurement results. With these files you can provide professional documentation of test results to your customers.

• Pass/Fail Indication, Graphical Display

The result can be checked not only value but also PASS/FAIL indicator and graphical display.

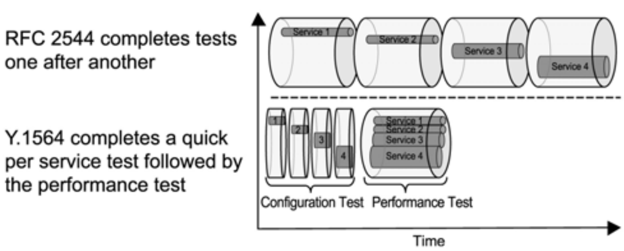


• Y.1564 Test Option

ITU-T Y.1564 is a new test methodology for bring Ethernet networks into service, simultaneously completing multiple traffic streams. RFC 2544 commonly use today completes tests in a serial manner never running all traffic streams at the same time. ITU-T Y.1564 completes this testing in two phases:

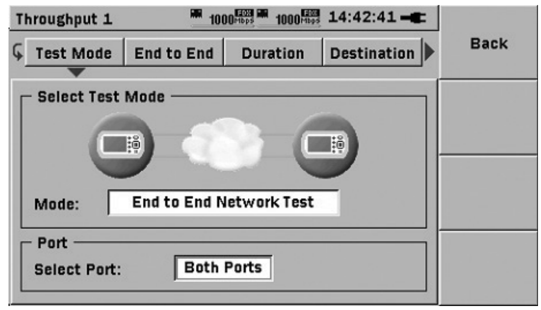
- Service Configuration Test, confirms the end to end configuration while quickly checking the Information Rate (IR), Frame Delay Variation (FDV), Frame Loss Ratio (FLR), Frame Loss Ration at the Service Acceptance Criteria (FLRSAC), Committed Burst Size (CBS) and Excess Burst Size (EBS) sequentially for all configured traffic streams.
- Service Performance Test transmits all configured traffic streams simultaneously at the CIR confirming all traffic is able to transverse the network under full load while checking the following IR, FDV, FLR and Availability (AVAIL).

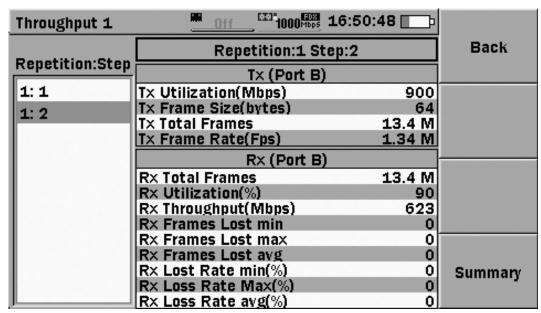
This two phase approach reduces total testing time.



• RFC 2544 Test Option

With the RFC 2544 test option, testing of throughput and frame loss, latency, packet jitter and burstability is straightforward. The Network Master Gigabit Ethernet tester automates the testing procedure while still allowing you to configure the test to be as thorough as needed. To get full information on the performance of both sides of a line, the end-to-end test mode allows two Network Master Gigabit Ethernet tester to work together in a master-slave setup whereby the user can control both units and inspect the results of the test from both units on the master instrument.





• Multistream Option

The Ethernet Multistream option for the Network Master Gigabit Ethernet tester allows testing a congested networks ability to transport high priority traffic rather than lower priority traffic. The user can activate up to 8 streams with different priority settings on the Ethernet line and detect how they are affected by frame loss through the network.

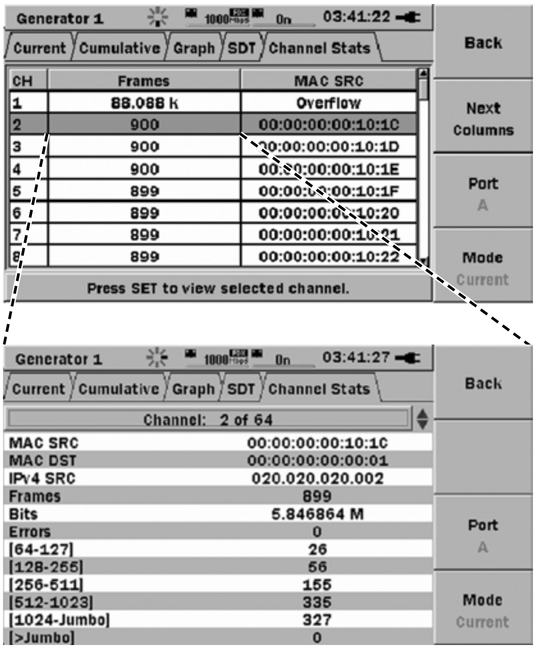
Simplifying Maintenance and Troubleshooting

The Network Master Gigabit Ethernet tester has maintenance and troubleshooting application in 800 g pocketable package.

Pass through monitoring by inserting the tester in a network. Tx and Rx of two ports are used for this application.

Bidirectional monitoring by dividing both signals and put them into the tester. Two Rxs are used for this application.

• Channel Stats (Option)
Up to 63 streams can be selected by the filter of Source/Destination addresses, VLAN, MPLS. Those streams can be monitored and displayed in detailed information. It's useful to identify the error streams, top talkers and network attack.



• Simultaneous Two Ports Monitoring
Network Master Gigabit Ethernet tester has two ports and they can be used simultaneously. It saves the test time for multiple ports deployment. It is possible to support identification of issues in the network by pass through monitoring and bidirectional monitoring.

• Remote GUI Option
Network Master Gigabit Ethernet tester can be operated remotely from the far end operation center using a Web browser. USB-Ethernet Converter (option) connects the Network Master Gigabit Ethernet tester with Ethernet for remote control.

Specifications

The specification table below applies to the Network Master Mainframe equipped with the Gigabit Ethernet Module.

Ethernet Interfaces	Interfaces	• Electrical interfaces: 10/100/1000 Mbps RJ 45 (10BASE-T, 100BASE-TX, 1000BASE-T) • Optical interfaces: 100 or 1000 Mbps LC connector (100BASE-FX, 100BASE-LX, 1000BASE-SX, 1000BASE-LX or 1000BASE-ZX)			
	Interface Configurations	• MU909060A1: Gigabit Ethernet Module with one SFP port and 1 electrical RJ-45 port. One optical module can be installed • MU909060A2: Gigabit Ethernet Module with 2 electrical RJ-45 ports. • MU909060A3: Gigabit Ethernet Module with two SFP ports. Two electrical or optical modules can be installed			
	Duplex Modes	Full duplex. Electrical 10/100 Mbps also half duplex			
	Test Configurations	Monitor/Generate, Pass through, Reflector			
Optical Modules*1	Description	Min. input sensitivity and wavelength		Output power and wavelength	
	1000BASE-SX 850 nm Multimode	–17 dBm	770 nm to 860 nm	–9.5 to –1.5 dBm	830 nm to 860 nm
	1000BASE-LX 1310 nm Singlemode	–20 dBm	1260 nm to 1580 nm	–10 to –3 dBm	1285 nm to 1343 nm
	1000BASE-ZX 1550 nm Singlemode	–22 dBm	1260 nm to 1580 nm	–3 to +5 dBm	1480 nm to 1580 nm
	100BASE-FX 1310 nm Multimode	–31 dBm	1260 nm to 1570 nm	–20 to –14 dBm	1270 nm to 1335 nm
	100BASE-LX 1310 nm Singlemode	–28 dBm	1260 nm to 1570 nm	–15 to –8 dBm	1261 nm to 1360 nm
Generate	Supported Encapsulations	EtherType II (DIX v.2), IEEE 802.3 with 802.2 (LLC1), IEEE 802.3 with SNAP			
	Traffic Generation/Monitor	• Variable line rate traffic generation, up to full line rate • Traffic shaping: Constant, Burst, Ramped • Frame sizes can be set to Constant, Stepped or Random length • Configurable MAC/IP source and destination addresses (supports IPv4 and IPv6), UDP/TCP address and DSCP/TOS byte • Request IP source address from a DHCP server (On/Off) • Adjustable frame size from 46 to 10,000 bytes • User defined up to 3 level VLAN ID and VLAN priority (Option) • User defined up to 3 level MPLS label (Option) • User defined traffic mix of unicast and broadcast frames • Generate and respond to pause frames • Answer incoming ARP request (On/Off) • MAC /IP address swapping (reflector configuration) Test Result Current/Cumulative: Total frame, Total bit, Utilization, Throughput, Broadcast frame, Error frame, Frame loss, Frame loss rate Graph: Tx utilization, Tx throughput, Rx utilization, Rx throughput, Error frame Service Disruption Time: Min, Max, Average, Count, Total time, Total SDT (%), Last frame received (interval) timestamp Channel Stats: Total frame, Total bit, Error, Frame size distribution of up to 63 filtered streams			

Continued on next page

Measurements	Status	Link status, Signal and Frames present (utilization), Errored frames, Rx/Tx frame count, Link time, Remote fault, Speed, Full/Half duplex, MDI/MDIX, Interface type, Link partner abilities (Pause capable and Asymmetric pause capable), Local clock (1000 Mbps), DHCP lease time, Optical level for optical interfaces
	Frame Statistics	Link status, Signal and Frames present (utilization), Error frames, Rx/Tx frame count, Link time, Remote fault, Speed, Full/Half duplex, MDI/MDIX, Interface type, Link partner abilities (Pause capable and Asymmetric pause capable), Local clock (1000 Mbps), DHCP lease time, Optical level for optical interfaces
	Event Log	The instrument logs major events during a test with a 1 sec. resolution time stamp. Logged events include: Link/No link and Test Start/Stop
	Report Generation	Generation of test result reports as pdf-files. The report may be customized with a user logo and comments.
Dedicated Tests	Electrical Cable Test (MU909060A1/A2)	NB: The electrical cable test is not available when using electrical SFP modules. • Detection of MDI/MDIX mode, Link speed and status, Cable status and distance to fault (if any), Polarity. For 1000 Mbps also skew • Pin mapping: Tx/Rx for 10/100 Mbps, DA, DB, DC, DD for 1000 Mbps
	BER Test	Generation and detection of test patterns. Count of errors in received test pattern. Pattern generation: Unframed, Framed with IP header or Framed with IP and TCP/UDP header Test patterns supported: FOX, all 0, all 1, 0101, PING, PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CRPAT, JTPAT, SPAT Detection of sequence errors and loss of sequence synchronization.
	Ping Test	For connectivity and configuration check • Round Trip Time (RTT) • Supports IPv4 and IPv6 addressing • Answer incoming Ping requests (On/Off)
	Traceroute Test	Setup: Number of Attempts, Max number of hops, Number of ping each host, Timeout Result: Number of hop, Host IP address, Number of Received/Lost replies, Min/Max/Average time
	ITU-T Y.1564 Test (Option)	Test mode: Single Ended test, Switch/Router test, End-to-End test Configuration Test: Up to 32 services, Up to 6 steps with CBS, EBS Test result: Pass/Fail, IR (Information Rate), FL (Frame Loss), FTD (Frame Transfer Delay), FDV (Frame Delay Variation) Service Performance Test: Up to 32 services Test result: Pass/Fail, IR (Information Rate), FL (Frame Loss), FTD (Frame Transfer Delay), FDV (Frame Delay Variation), AVAIL (Availability), UN-AVAIL (Unavailable seconds), SEQ ERR (Sequence Errors) Test report: Y.1564 Appendix II compliant (CSV or PDF) Parameters: Configurable with MT9090A's Test Automator or the standalone PC application (MX909060A)
	RFC 2544 Installation and Commissioning Tests (Option)	Single ended network test and Switch/Router test modes: Throughput and utilization, Frame loss, Latency, Packet jitter, Back-to-back frames (burstability) End-to-End network test mode (two Network Master Gigabit Ethernet testers in a master-slave setup): Throughput and utilization, Frame loss, Back-to-back frames (burstability) Router latency test mode: IP ping based latency, IP ping based packet jitter
	Multistream Test (Option)	Number of streams: Up to 8 streams can be activated on the Ethernet line available information per stream: Frame loss count/rate, Frames and bytes received, Frames and bytes transmitted
	HTTP/FTP Test	Test mode: HTTP, FTP Setup: Target directory, Download file name, Authentication Result: Received/Total file size, Min/Max/Average throughput
	Reflector Delay	Maximum internal delay when instrument is in reflector configuration: 2.44 µs @1000 Mbps, 5.16 µs @100 Mbps, 31.93 µs @10 Mbps
Miscellaneous	Internal Memory	Internal memory for storage of results, setups and screen shots: 40 MB
	Stored Configurations	The user can save a number of configuration files for later recall. The configuration files can be transferred to other instruments via the instruments USB port.
	Test Automator	The user can create a macro to run several tests in sequence. The user can also load, save, import and export test macros
	Service Interface	Two USB 1.1 (One type A for USB memory stick, One type B for USB mass storage)
	Display	4.3-inch color LCD (480 × 272 pixels), with LED back light, transmissive
	Language	English, Japanese, Chinese (Simplified, Traditional), Spanish, German, Korean, French, Italian, Portuguese
	Battery	• Dedicated battery pack or 4 AA Ni-MH • Operating time: Up to 3 hours, depending on configuration and test setup • Charging time: 4 hours while power off (typ.), Temperature: +10° to +30°C • Indicator for battery level in display when the unit is turned on
	Power Supply	AC adapter: 9 V(dc), 100 V(ac) to 240 V(ac), Frequency: 50 Hz/60 Hz
	Dimensions and Mass	MT9090A: 190 (W) × 96 (H) × 18 (D) mm, <200 g MU909060A1/A2/A3: 190 (W) × 96 (H) × 30 (D) mm, <600 g
	Environmental	• Operational Temperature Range: 0° to +40°C, humidity ≤85%, No condensation • Storage Temperature Range: –25° to +60°C, humidity ≤80%, No condensation • Vibration: IEC 60 068-2-6 Fc and IEC 60 068-2-64 Fh, Dust and Drip proof: IP 51
	EMC	EN61326-1, EN61000-3-2
	Laser Safety*3	IEC 60825-1: 2007 CLASS 1 21CFR1040.10*2: MU909060A1/A3 with optical modules Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*1: Correct functioning can only be guaranteed with optical modules from Anritsu for the Network Master Gigabit Ethernet tester.
Modules with extended temperature range (up to +85°C) must be used.

*2: Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*3: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

⚠ IEC 60825-1:2007
CLASS 1 LASER PRODUCT

THIS PRODUCT COMPLIES WITH 21 CFR 1040.10
AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT
TO LASER NOTICE NO. 50, DATED JUNE 24, 2007

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

• Select Mainframe

Model/Order No.	Description
MT9090A	Mainframe (with color LCD)
	Standard accessories
G0203A	AC Adapter
G0202A	NiMH Battery Pack
Z1023A	Strap
B0601B	Standard Soft Case

• Select Base Model

Model/Order No.	Description
MU909060A1	Gigabit Ethernet Module (with one SFP slot and one RJ-45 port)
MU909060A2	Gigabit Ethernet Module (with two RJ-45 ports)
MU909060A3	Gigabit Ethernet Module (with two SFP slots)
	Standard accessories
W3173AE	Gigabit Ethernet Tester Quick Start Guide
Z1234A	Network Master Gigabit Ethernet Tester CD

• Select Module Option

One module can be installed in MU909060A1.
Two modules can be installed in MU909060A3

Model/Order No.	Description
G0240A	1000 Mbps SX SFP [850 nm multimode, LC connector (optical)]
G0241A	1000 Mbps LX SFP [1310 nm single mode, LC connector (optical)]
G0242A	1000 Mbps ZX SFP [1550 nm single mode, LC connector (optical)]
G0243A	100 Mbps FX SFP [1310 nm multimode, LC connector (optical)]
G0244A	100 Mbps LX SFP [1310 nm single mode, LC connector (optical)]
G0246A	10/100/1000 Mbps RJ-45 SFP (electrical)

• Select Software Option

Model/Order No.	Description
MU909060A1-001	RFC 2544 Test (for MU909060A1)
MU909060A2-001	RFC 2544 Test (for MU909060A2)
MU909060A3-001	RFC 2544 Test (for MU909060A3)
MU909060A1-002	Multistream (for MU909060A1)
MU909060A2-002	Multistream (for MU909060A2)
MU909060A3-002	Multistream (for MU909060A3)
MU909060A1-003	Stacked VLAN (for MU909060A1)
MU909060A2-003	Stacked VLAN (for MU909060A2)
MU909060A3-003	Stacked VLAN (for MU909060A3)
MU909060A1-004	MPLS (for MU909060A1)
MU909060A2-004	MPLS (for MU909060A2)
MU909060A3-004	MPLS (for MU909060A3)
MU909060A1-005[*1]	Remote GUI (for MU909060A1)
MU909060A2-005[*1]	Remote GUI (for MU909060A2)
MU909060A3-005[*1]	Remote GUI (for MU909060A3)
MU909060A1-006	Channel Stats (for MU909060A1)
MU909060A2-006	Channel Stats (for MU909060A2)
MU909060A3-006	Channel Stats (for MU909060A3)
MU909060A1-007	Y.1564 Test (for MU909060A1)
MU909060A2-007	Y.1564 Test (for MU909060A2)
MU909060A3-007	Y.1564 Test (for MU909060A3)

• Select Accessories

Must be added as separate line items

Model/Order No.	Description
Z1580A[*2]	Protector & Soft Case
B0663A[*3]	Protector
B0600B	Hard Case
B0602A	Deluxe Soft Case (for MT9090A)
J1402A	Car Plug Cord
W3166AE	MU909060A1/A2/A3 Operation Manual (Hardcopy – English version)
J1480A[*4]	USB-Ethernet Converter

*1: Requires J1480A USB-Ethernet Converter (sold separately)
*2: The protector (B0663A) and standard soft case (B0601B) from a set. The protector includes a shoulder strap.
*3: The shoulder strap can be used to hang the instrument around the neck while working.
*4: Requires MU909060Ax-y05 Remote GUI (sold separately)

• Warranty Service

Model/Order No.	Description
MT9090A-ES210	2 Years Extended Warranty Service (for MT9090A)
MT9090A-ES310	3 Years Extended Warranty Service (for MT9090A)
MU909060A1-ES210	2 Years Extended Warranty Service (for MU909060A1)
MU909060A2-ES210	2 Years Extended Warranty Service (for MU909060A2)
MU909060A3-ES210	2 Years Extended Warranty Service (for MU909060A3)
MU909060A1-ES310	3 Years Extended Warranty Service (for MU909060A1)
MU909060A2-ES310	3 Years Extended Warranty Service (for MU909060A2)
MU909060A3-ES310	3 Years Extended Warranty Service (for MU909060A3)

• Installed Software Option (Retrofit)

The following software options can be field installed by the customer in already purchased Network Master Gigabit Ethernet testers.

Model/Order No.	Description
MU909060A1-301	RFC 2544 Test Retrofit (for MU909060A1)
MU909060A2-301	RFC 2544 Test Retrofit (for MU909060A2)
MU909060A3-301	RFC 2544 Test Retrofit (for MU909060A3)
MU909060A1-302	Multistream Retrofit (for MU909060A1)
MU909060A2-302	Multistream Retrofit (for MU909060A2)
MU909060A3-302	Multistream Retrofit (for MU909060A3)
MU909060A1-303	Stacked VLAN Retrofit (for MU909060A1)
MU909060A2-303	Stacked VLAN Retrofit (for MU909060A2)
MU909060A3-303	Stacked VLAN Retrofit (for MU909060A3)
MU909060A1-304	MPLS Retrofit (for MU909060A1)
MU909060A2-304	MPLS Retrofit (for MU909060A2)
MU909060A3-304	MPLS Retrofit (for MU909060A3)
MU909060A1-305[*1]	Remote GUI Retrofit (for MU909060A1)
MU909060A2-305[*1]	Remote GUI Retrofit (for MU909060A2)
MU909060A3-305[*1]	Remote GUI Retrofit (for MU909060A3)
MU909060A1-306	Channel Stats Retrofit (for MU909060A1)
MU909060A2-306	Channel Stats Retrofit (for MU909060A2)
MU909060A3-306	Channel Stats Retrofit (for MU909060A3)
MU909060A1-307	Y.1564 Test Retrofit (for MU909060A1)
MU909060A2-307	Y.1564 Test Retrofit (for MU909060A2)
MU909060A3-307	Y.1564 Test Retrofit (for MU909060A3)

B0601B Standard Soft Case

This standard accessory accommodates the mainframe with fitted protector.

B0602A Deluxe Soft Case

Full Network Master operation without removal from the case.
Provides excellent protection for use in hash conditions.
This does not accommodate the mainframe if the protector is fitted.

B0600B Hard Case

This accommodates two mainframes (with or without fitted protector), accessories (light source or power meter, backup battery, fiber cleaner, etc.).

Mainframe with Protector

B0663A Protector

The mainframe with fitted protector.

10 GigE/SDH/SONET/OTN
CMA5000a-UTA

Remote Control
Ethernet

Testing 10 GigE, SDH/SONET and OTN Networks with One Single Module

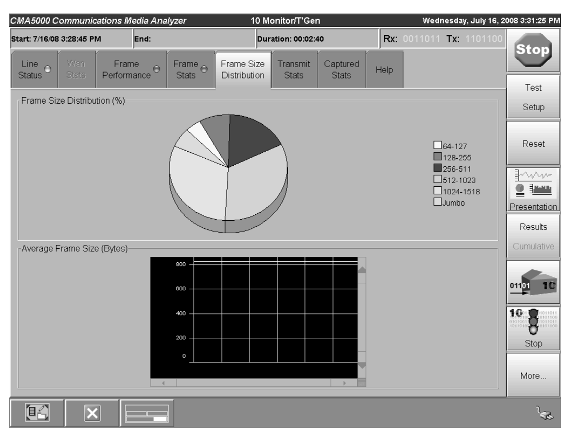
In recent years have witnessed a tremendous evolution of the transport networks with the emergence of new technologies. Engineers and technicians tasked with the installation, turn-up and maintenance of today's networks have to deal with this increasing complexity in their daily job. In this context, a test instrument like the CMA5000a-UTA capable to manage all the main technologies in one single module is a great help.

• Universal
The Universal Transport Analysis -UTA- module represents a new generation of tester with this ability to support almost all the existing transport standards: Ethernet, SONET/SDH, ... With its small size, the UTA module fits in the CMA5000a platform and provides a very portable solution for field engineer.

• Flexible
The UTA module also supports hot pluggable XFP and SFP transceivers. This feature brings a lot of configurability to the module. Whatever the network or equipment to test, the field engineer has the insurance to be able to equip his UTA module with the right optical/ electrical interface.

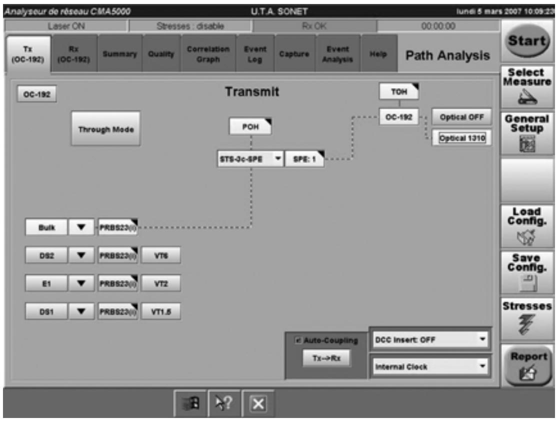
• Easy to use
All the UTA applications are based on the same graphical user interface. The users will greatly benefit from this feature as it significantly reduces the time of training with a new application.
The UTA application is available with 10 GigE, SDH/SONET and OTN applications.
To ensure proper and efficient deployment of services, the UTA 10 GigE application measures critical parameters during network installation, including throughput, latency, burstability and frame loss (as detailed in RFC 2544). Full line rate traffic generation and shaping up to 10 Gbps, combined with comprehensive professional reporting, ensures the easy installation, maintenance, troubleshooting and documentation of 10 GigE LAN-PHY and WAN-PHY networks.

10 Gigabit Ethernet Application
The CMA5000a-UTA module provides efficient construction and maintenance of 10 Gigabit Ethernet (LAN-PHY, WAN-PHY) network. The UTA's Master/Slave function at End-to-End RFC2544 test can evaluate upstream/downstream of 10GigE network simultaneously and individually. It can ease to find the bottleneck of the network. The UTA can generate and evaluate stackable VLAN and multi stream. The UTA has ping, frame generation and analysis, BER test, RFC2544 (Throughput, Latency, Burst, Frame Loss) Channel Stats and Sequence test. More than them, UTA has a function of Reflector mode to swap the the IP address and MAC address of the received frame at the end of the network it helps to measure latency over network.



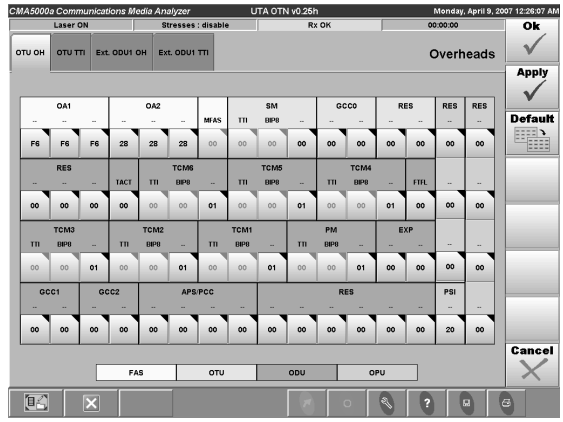
SDH/SONET Application

For characterizing and documenting network performance levels, the UTA SDH/SONET application provides efficient, reliable testing of a multitude of parameters, including Alarm and Error analysis, APS with 125 µs resolution, Round Trip Delay measurement with 100 ns resolution, network availability and performance evaluation. The UTA application characterizes 10 Gbit/s SONET/SDH networks down to the tributary level (DS1/E1).



OTN Application

The CMA5000a-UTA module provides efficient construction and maintenance of ITU-T G.709 OTN network. It supports the format of OTU-1 (2.66 Gbit/s), OTU-2 (10.709 Git/s). Other than them, the UTA supports 11.049 Gbit/s FEC and 11.095 Gbit/s FEC to map 10 GigE traffic in them.
The UTA can generate O.182 poisson error which is required to test FEC encoder of the transmission equipments.



Specifications

• 10GigE Application

Interfaces and Signal Specifications		
Signal	Port/Connector	Format
10 Gig Ethernet	One XFP port*1	As per IEEE 802.3ae: • 10GigE LAN-PHY • 10GigE WAN-PHY*2
Clock Input	Bantam 100Ω	E1 (2.048 Mbit/s)/DS1 (1.544 Mbit/s)
	BNC 75Ω	2.048 MHz/1.544 MHz/10 MHz
Clock Output	BNC 75Ω	10 MHz
	SMA 50Ω	Line rate divided by 16: • 644.53 MHz (for LAN-PHY) • 622.06 MHz (for WAN-PHY)

Optical Interfaces*3, *4					
Interfaces	Wavelength	Output Power	Reach	Overload	Sensitivity
10GBASE-SR/SW	840 nm to 860 nm	–7.3 to –1.0 dBm	300 m	–1.0 dBm	–11.0 dBm
10GBASE-LR/LW	1290 nm to 1330 nm	–8.2 to +0.5 dBm	10 km	+0.5 dBm	–12.6 dBm
10GBASE-ER/EW	1530 nm to 1565 nm	–4.7 to +4.0 dBm	40 km	–1.0 dBm	–14.1 dBm

*1: The XFP interface of the UTA module meets the requirements stated in the MSA standard
*2: 10GigE WAN-PHY is an option
*3: Requires XFP that must be ordered separately
*4: As defined in IEEE 802.3ae. Real specifications may be different depending on the XFP used

Traffic Generation	
Frame Edition	• Encapsulation Type (Ethertype/SNAP/LLC1). • Source and Destination MAC addresses. • Source and Destination IP V4 addresses. • ARP function (enable/disable) for destination MAC address discovery. • Gateway function (enable/disable) with configurable gateway IPV4 address and network mask. • VLAN Tag (1 - 3) with configurable PRIORITY (0 - 7)/CFI (enable/disable)/ID (0 - 4095) fields. • Payload content: PRBS or User Defined pattern. • Multi stream (1 - 8)
Traffic Profile Edition	Uniform and Burst profiles
Frame Size Distribution	Constant and Random frame size
Flow Control	Response to Pause frames (enable/disable)
Error Insertion	FCS errors: User programmable number of frames
Pause Frames Insertion	User programmable number of Pause frame

Traffic Monitoring	
Thresholds	User programmable thresholds (to trigger LED error indicators):
Frame Performance	Utilization (%), Throughput (Mbps), Frame Rate (Fps)
Frame Statistics	• Number of Frames: (Total, Good, Unicast, Multicast, Broadcast, Pause) • Errored Frames (Total, Fragmented, Undersized, Oversized, FCS Errored) • Miscellaneous: Frames lost due to Internal MAC Errors Symbol errors In Range Length error Jabbers
Frame Size Distribution (available for both Tx and Rx)	• Frames with size between 64 bytes and 127 bytes • Frames with size between 128 bytes and 255 bytes • Frames with size between 256 bytes and 511 bytes • Frames with size between 512 bytes and 1023 bytes • Frames with size between 1024 bytes and 1518 bytes • Jumbo frames • Average frame size (bytes)
Channel Stats (option)	Number of Ethernet frames, MPLS frames, Error Frames, IP frames, IPv4 frames, TCP frames, UDP frames, TCP/UDP error packets, Frame size distribution

RFC 2544 Tests	
Test Modes	• Switch/Router Test: Only one unit is required. Used to test the data link layer of a switch or a router somewhere in the network. • End-to-End Network Test: Two units are required, one at each end of the network connection.
General Configuration Parameters	• Destination MAC and IPV4 addresses • Source MAC and IPV4 addresses. • ARP function (enable/disable) for destination MAC address discovery. • Gateway function (enable/disable) with configurable gateway IPV4 address and network mask.
RFC 2544 Tests	Throughput, Frame Loss, Latency, Burstability

Miscellaneous	
Reflector Mode	When in Reflector mode, the UTA application filters selected Ethernet frames and swaps MAC/IP Source and Destination addresses before resending them into the network. The Reflector mode is used for end-to-end or loopback tests in switched networks.
Ping Tests	• Generation of Ping frames (with user-programmable Quanta field) • Response to received Ping frames
Capture & Decode (option)	The UTA This feature will allow users of the CMA5000a 10GigE module to capture Ethernet frames from the network and decode and view them in a traditional “3-pane type” display. The user is then able to see the hexadecimal representation of each frame captured. In addition the user is able to filter the traffic so that only certain frames are captured and triggers are definable so that the capture can be started at the correct time. This feature provides ultimate detail for advanced troubleshooting.
Sequence Tests (option)	Sequence testing involves the insertion of ascending sequence numbers inside each frame that is transmitted, thereby allowing the counting of out of sequence frames and duplicated frames when transmitting in more than a simple point to point network.
BERT Tests (option)	Performs a BERT test on a PRBS pattern inserted in the Ethernet frame payload.
WAN-PHY (option)	• WAN-PHY frames generation and analysis • Overhead Edition (SOH/TOH and POH) • Alarms/errors generation and analysis
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

Interfaces and Signal Specifications		
Signal	Port/Connector	Format
STM-64/OC-192 (9953.280 Mbit/s)	One XFP port*1	• STM-64: as per ITU-T G.707 • OC-192: as per Telcordia GR-253-Core
Clock Input	Bantam 100Ω	E1 (2,048 Mbit/s)/DS1 (1,544 Mbit/s)
	BNC 75Ω	2.048 MHz/1.544 MHz/10 MHz
Clock Output	BNC 75Ω	2.048 MHz/1.544 MHz
	SMA 50Ω	622.08 MHz (with STM-4/16/64), 155.52 MHz (with STM-1)
Data Communication Channel	DB-15 connector	D1-D3: 192 kbit/s channel D4-D12: 576 kbit/s channel

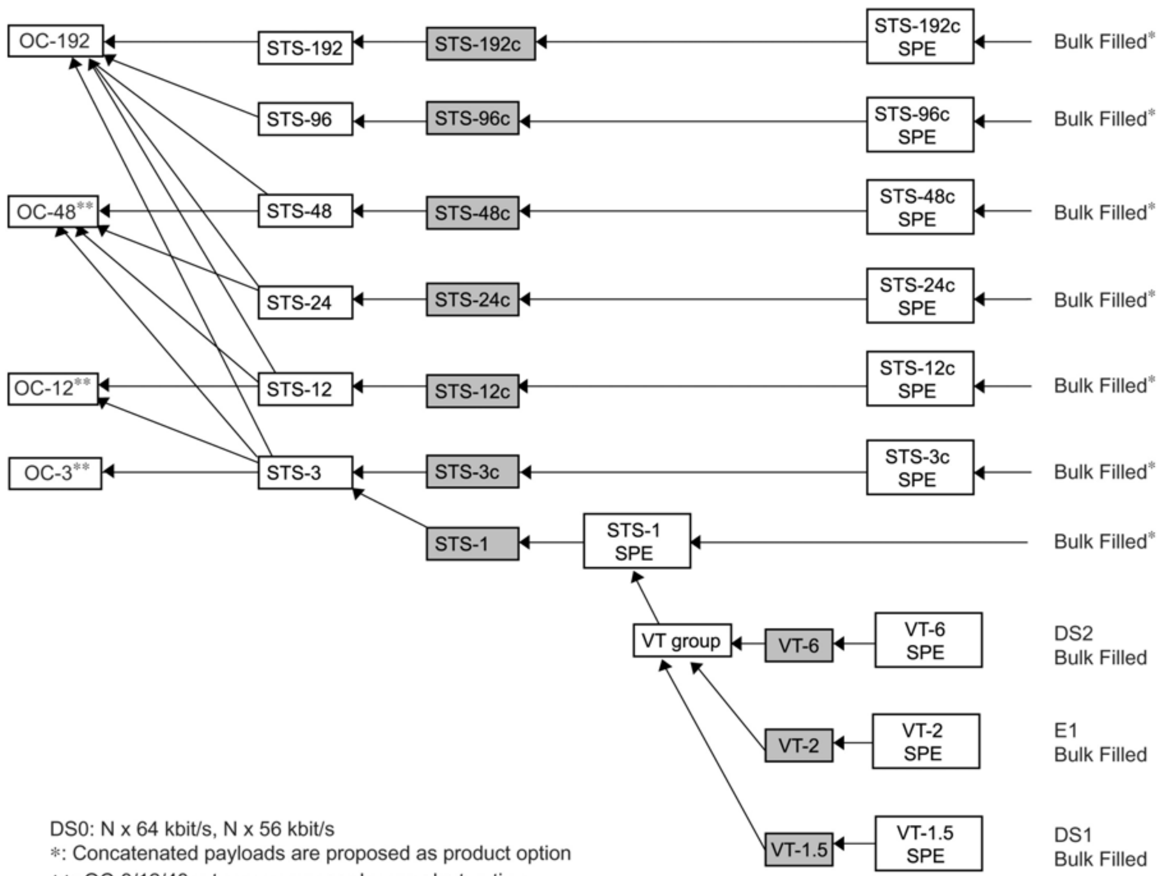
Optical Interfaces*2, *3					
Interfaces	Wavelength	Output Power	Reach	Overload	Sensitivity
SR1/I64.1	1290 nm to 1330 nm	–6 dBm/–1 dBm	10 km (SMF)	–1 dBm	–11 dBm
IR2/S64.2	1530 nm to 1565 nm	–1 dBm/+2 dBm	40 km (SMF)	–1 dBm	–14 dBm
LR2/P1L1-2D2	1530 nm to 1565 nm	0 dBm/+4 dBm	80 km (SMF)	–9 dBm	–24 dBm

*1: The XFP interface of the UTA module meets the requirements stated in the MSA standard
*2: Requires XFP that must be ordered separately
*3: As defined in G.691 and G.959.1. Real specifications may be different depending on the XFP used.

Clock Synchronization	
Clock Reference	• Internal stratum 3 clock generation • External 2.048 MHz reference clock • Timed from 2.048 Mbit/s received signal • External 1.544 MHz reference clock • Timed from 1.544 Mbit/s received signal • External 10 MHz reference clock • Timed from STM-64/OC-192 received signal

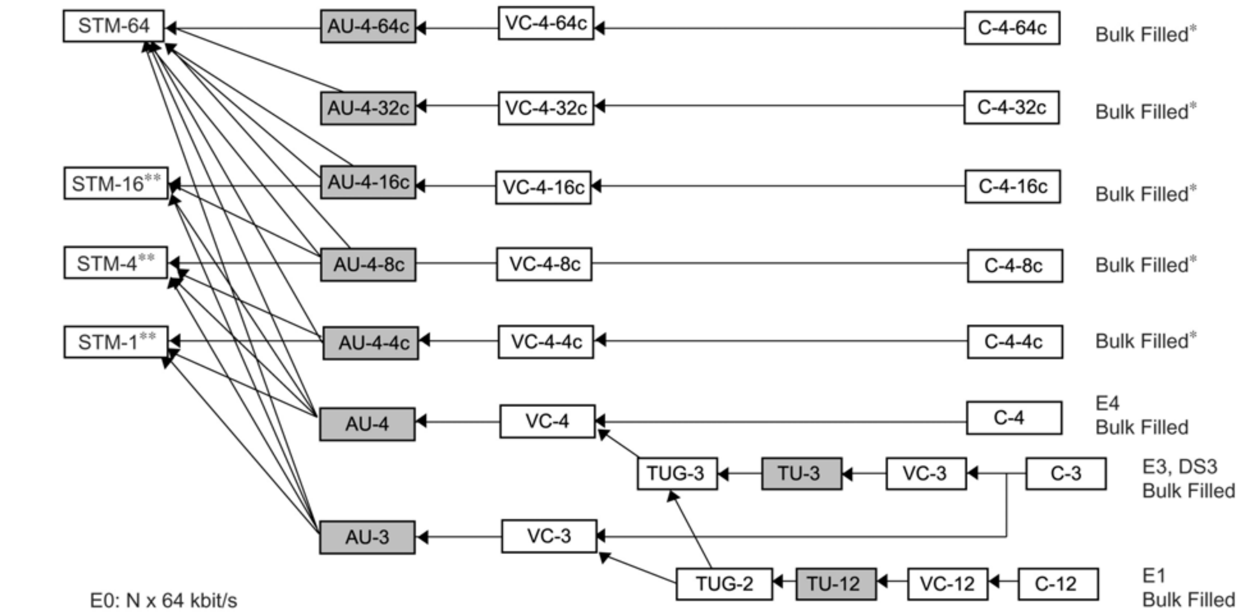
• SDH/SONET Application

SONET Mappings



DS0: N x 64 kbit/s, N x 56 kbit/s
*: Concatenated payloads are proposed as product option
**: OC-3/12/48 rates are proposed as product option

SDH Mappings



*: Concatenated payloads are proposed as product option

**: STM1/4/16 rates are proposed as product option

SONET/SDH Overhead Editors	
SONET	
TOH Editor	• All bytes of TOH (STS-1/STS-3) are programmable except B1/B2 and Z0 • J0 (Trace Identifier)
POH Editor (STS)	• C2, G1, F2, H4, Z3, Z4, N1 • J1 (Trace Identifier)
POH Editor (VT)	• V5, Z6, Z7 • J2 (Trace Identifier)
SDH	
SOH Editor	• All bytes of SOH (STM-1) are programmable except B1/B2 • J0 (Trace Identifier)
POH Editor (VC-4 and VC-3)	• C2, G1, F2, H4, F3, K3, N1 • J1 (Trace Identifier)
POH Editor (VC-12)	• V5, N2, K4 • J2 (Trace Identifier)

Path Analysis	
Signal Qualification	Power meter • Frequency meter
Errors Analysis	• SONET A1/A2, B1, B2, REI-L, B3, REI-P, V5, REI-V, PRBS, Word, FAW, SFAW, FPS, CRC-6, MAW, Parity P, Parity CP, F-bit, M-bit, FEBE • SDH A1/A2, B1, B2, MS-REI, B3, HP-REI, LP-B3, LP-REI, V5, PRBS, Word, FAW, CRC4
Alarms Analysis	• SONET LOS, LOF, SEF, OOF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, PLM-P, TIM-P, UNEQ-P, RDI-P, LOM-V, AIS-V, LOP-V, PLM-V, UNEQ-V, RDI-V, TIM-V,RFI-V, LSS, LPS, AIS, RAI, LOMF, IDLE • SDH LOS, LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-PLM, LP-UNEQ, LP-TIM, LP-RDI, LP-RFI, LSS, LPS, AIS, LOMF
Pointer Movement Analysis	• Pointer value • Number of positive and negative pointer movements • Number of pointer movement with NDF
Quality Analysis	• SONET Transmission quality is calculated each second as per GR-253 • SDH/PDH Transmission quality is calculated each second in accordance with recommendations G.826, G.828, M.2100, M2.101.1, M.2101, M.2110 for performance
Overhead Analysis	• J0, J1 and J2 Path Trace messages (ASCII sequence) • S1 (synchronization status) • C2/V5 (signal label) • Complete display of SOH/TOH and POH of the analyzed path channel • Capture capacity: 64 consecutive frames
Event Analysis	Alarms and errors event analysis in temporal graphical display with 125 μs resolution

Round Trip Delay
• Measurement possible at each path level • Resolution: 100 ns • Range: 0 to 2 s (depending on path level) • Result: Maximum RTD, minimum RTD, Average RTD and errors/alarms detection

Automatic Protection Switching Measurement
• Number of switches • Switch duration (with 125 µs resolution) • K1/K2 capture and interpretation

Performance Analysis
• Direct graphical presentation of performance and availability conformance test result • Automatic calculation of acceptance thresholds according to ITU-T recommendations, such as M.2100, M.2101.1 and M.2101 • Automatic calculation of Performance Objectives according to ITU-T recommendations such as G.826, G.828

Structure Scan
Complete signal mapping auto discovery (including Mix Payload)

Trouble Scan
Continuous VC-4/SPEs scanning for alarms and errors detection

• OTN Application

Frame Formats	
OTN format	OTU-2 and OTU-1 as per ITU-T G.709
SDH format	STM-64 and STM-16 as per ITU-T G.707
SONET format	OC-192 and OC-48 as per Telcordia GR-253

Unframed Signals	
Rates	• 10.709 Gbps • 11.04911 Gbps • 11.09573 Gbps • 2.66 Gbps

OTN Overhead Editors	
OTU Editor	• FAS: OA1, OA2 • SM: SAPI, DAPI, Operator bytes • GCC 0
ODU Editor	• RES: 3 bytes • TCM/ACT: 1 byte • TCM-i (i = 1 to 6): SAPI, DAPI, Operator bytes • FTFL: 1 byte • GCC 1: 2 bytes • GCC 2: 2 bytes • APS/PCC: 4 bytes
OPU Editor	PSI: PT

Errors Addition	
SDH over OTN	A1/A2, B1, B2, B3, MS-REI, AU-REI, ERR
SONET over OTN	A1/A2, B1, B2, B3, REI-L, REI-P, ERR
OTN	• FEC: Correctable FEC bit, Correctable FEC block, Uncorrectable FEC block Error generation according to O.182 (Poisson error generation) • OTU: FAS, MFAS, SM-BIP 8, SM-BEI • ODU: PM-BIP 8, PM-BEI
Error Control	• Programmable number or Rate • FEC error control: User-programmable 8-bit mask

Test Functions	
OTU Frequency Shift	• Programmable frequency offset: –100 to +100 ppm
OPU Justifications	• Generation of payload frequency offset: –65 to +65 ppm
FEC	• FEC encoder can be deactivated
SDH/SONET Pointer Movements	• Pointer movement generation: - Pointer set to any value with or without NDF - Positive and Negative movements - G.783 sequences

Alarms Addition	
SDH over OTN	LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-TIM, HP-UNEQ, HP-RDI, LSS
SONET over OTN	LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, LSS
OTN	• OTU: LOF, OOF, LOM, OOM, OTU-AIS, SM-TIM, SM-IAE, SM-BDI, SM-BIAE, SM-SAPI, SM-DAPI • ODU: ODU-AIS, ODU-LCK, ODU-OCI, PM-BDI, PM-SAPI, PM-DAPI • OPU: PLM
Alarm Control	On steady-state or programmable number of frames

OTN Analysis	
Signal Qualification	• Power meter (dB) • Frequency meter (ppm)
Error Analysis	• FEC: FEC bit, FEC block, FUEB • OTU: FAS, MFAS, SM-BIP 8, SM-BEI • ODU: PM-BIP 8, PM-BEI • Payload: ERR
Alarm Analysis	• OTU: LOF, OOF, LOM, OOM, OTU-AIS, SM-TIM, SM-IAE, SM-BDI, SM-BIAE • ODU: ODU-AIS, ODU-LCK, ODU-OCI, PM-BDI, PM-TIM • OPU: PLM
Justifications	• Positive and Negative OPU justifications count • OPU frequency shift (ppm)

Laser Safety*	IEC 60825-1: 2007: CLASS 1 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

CERTIFICATION LABEL
THIS PRODUCT CONFORMS TO
ALL APPLICABLE STANDARDS
UNDER 21 CFR 1040.10

⚠ IEC 60825-1:2007
CLASS 1 LASER PRODUCT

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

The CMA5610 UTA (Universal Transport Analysis) Module is a Double wide module and can be used in a CMA 5000a platform SBA and MBA.

Ordering Information	
5610-000-UTA	UTA Base Module *Applications must be ordered separately
	10 GigE application
5610-101-UTA	10 GigE LAN-PHY application (XFP not included)
5610-102-UTA	10 GigE WAN-PHY application (XFP not included)
	Options
5610-111-UTA	"Capture & Decode" option for LAN-PHY/WAN-PHY applications
5610-112-UTA	"BERT" option for LAN-PHY/WAN-PHY applications
5610-113-UTA	"Sequence Test" option for LAN-PHY/WAN-PHY applications
5610-114-UTA	"Sequence Test" option for LAN-PHY/WAN-PHY applications
5610-115-UTA	"Stacked VLAN" option for LAN-PHY/WAN-PHY applications
5610-116-UTA	"Multi Stream" option for LAN-PHY/WAN-PHY applications
5610-117-UTA	"Channel Stats" option for LAN-PHY/WAN-PHY applications
	Accessories
5610-140-UTA	850 nm XFP transceiver (LC connector)
5610-141-UTA	1310 nm XFP transceiver (LC connector)
5610-142-UTA	1550 nm XFP transceiver (LC connector)

	OC-192/STM-64 Application
5610-201-UTA	10 Gig SONET/SDH application (XFP not included)
	Options
5610-211-UTA	Concatenation option for 10 Gig SONET/SDH application
5610-212-UTA	Voice add/drop option for 10 Gig SONET/SDH application (only available for SONET)
5610-213-UTA	Tandem Connection Monitoring option for 10 Gig SONET/SDH application
5610-214-UTA	ATM option 10 Gig SONET/SDH application
5610-215-UTA	Virtual Concatenation Monitoring option (VCAT, LCAS, Diff.Delay) for High Order for 10 Gig SONET/SDH application
5610-216-UTA	"STM-1/4/16 and OC-3/12/48" option for 10 Gig SDH/SONET application (SFP not included)
5610-239-UTA	Remote Command for SDH/SONET application (via Ethernet) Remark: Voice Add/Drop/ATM/VCAT Monitoring options are not supported by remote commands

	OTN Application
5610-301-UTA	"OTN" application for UTA module supporting OTU-2 interface (XFP not included)
5610-311-UTA	"OTU-1" option for OTN application (SFP not included)

ETHERNET TEST SET

CMA5000a Gigabit Ethernet Module II

Accelerating the Deployment of Ethernet Services

The Gigabit Ethernet application is a single slot module that can be used in any CMA5000a. The Gigabit Ethernet test module enables testing of 10M/100M/1000 Mbps optical and electrical Ethernet networks. The module provides 2 optical (SFP) and 2 electrical (RJ45) ports. The module is specifically designed to facilitate installation and maintenance of Ethernet networks. For installation, the module provides RFC2544 test functions including: Throughput, Latency and Frame Loss tests. For maintenance and troubleshooting the module provides complete, non-intrusive monitoring capabilities and presents comprehensive statistics to give insight into the network's health and status.

Network Monitoring and Troubleshooting

The CMA5000a targeted application modes allow for quick and easy set up to ensure decreased downtime of the network under test. The auto-detect and auto negotiation capabilities takes the guess work out of connectivity and link status. User defined thresholds provide instant Pass/Fail notification of the network impairment. In addition the pass through capabilities of the CMA5000a allow for non-intrusive network monitoring.

Features

- Small light weight single slot module
- Industry standard SFP optics
- Extended Battery operation
- Easy to use graphical user interface
- RFC 2544 Master/slave functionality to ensure ease of use
- Professional and comprehensive report generation

Installation and Commissioning

In today's triple play networks proper installation testing and verification is essential to providing QoE to your customer. The industry standard RFC2544 is this method of ensuring proper network turn up and is required for deploying and commissioning high data rate networks. The CMA5000a not only performs these tests but automates the process through an Auto search function which decreases test time but still provides the accuracy that is needed.

Fig. 1: Intuitive graphical user interface provides unsurpassed ease of use

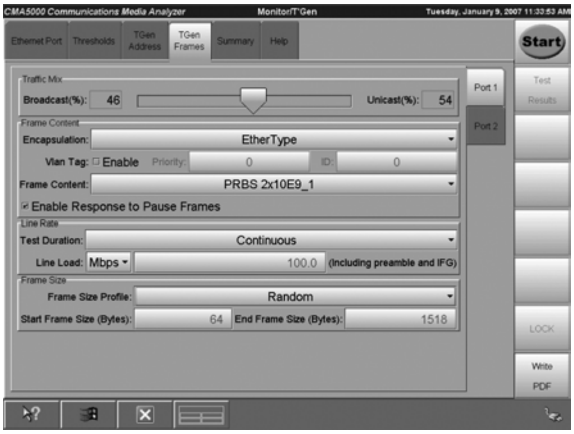


Fig. 2: User defined traffic mix provides emulation of real world traffic

Fig. 3: Quick and automated RFC 2544 testing.

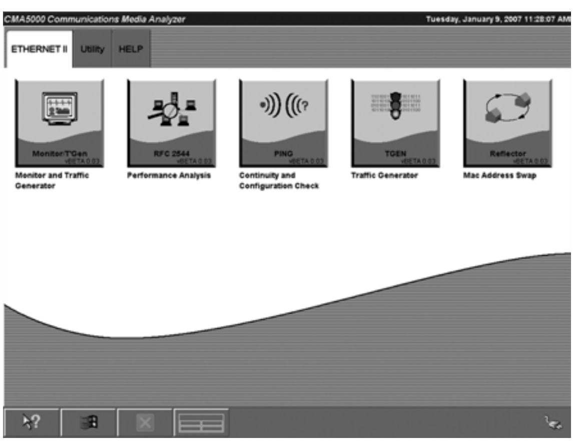


Fig. 4: Targeted application modes provide the required tests for each test application

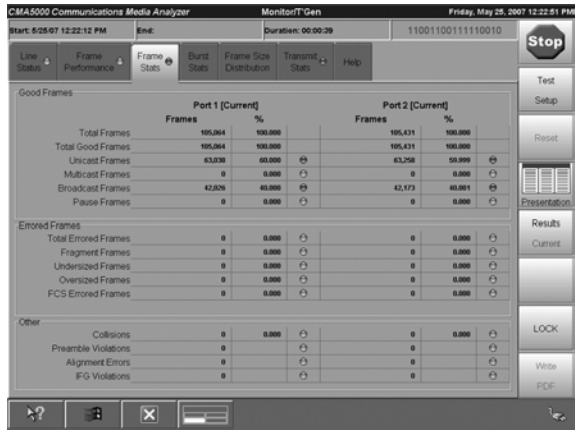


Fig. 5: Intuitive test results in both a tabular and graphical display.

Specifications

General	
Ports	2 electrical 10M/100M/1000 Mbps 2 optical (SFP) 1000 Mbps (sold as separate line item)
Connectivity	Auto negotiation User defined On or selective service Auto detection User defined On or Off Pass through mode in Monitor/Tgen application
Additional Support	ARP Response PING Response Trace Route

Traffic Generation Application
• Variable line rate traffic generation, up to full line rate • Configurable IP and Ethernet source and destination addresses (Support of IPv4 and IPv6 addressing) • Configurable TCP and UDP source and destination ports • Unicast and broadcast frames • EtherType II (DIX V.2), IEEE 802.3 with 802.2 (LLC1) and IEEE 802.3 with SNAP encapsulation • Adjustable frame size from 38 bytes to 10,000 bytes • User definable VLAN ID and VLAN priority • Configurable data field (payload) supporting PRBS or user defined payload • User definable traffic mix (Broadcast and Unicast) • Frame sizes may be set to constant, stepped, or random length to emulate real world traffic profiles. • Transmit Statistics

Monitor Application	
General Health/ Line Statistics	• Link status • Signal present • Frames present • Speed • Full or half duplex • Interface type • Local clock • Pause capable • Asymmetric pause capable • Link partner capabilities
Performance Statistics	• Max., min., average utilization • Max., min., average throughput • Max., min., average frame rate
Frame Statistics	• Total frames • Unicast frames • Multicast frames • Broadcast frames • Number of pause frames • Number of VLAN tagged frames • Total errored frames • Number of fragment frames • Number of oversize frames • Number of undersized frames • Number of FCS errored frames • Number of collisions (10M/100 Mbps half duplex only) • Preamble violations • Alignment errors • IFG violations
Frame Distribution Statistics	• Total valid/good frames • 64 byte to 127 byte frames • 128 byte to 255 byte frames • 256 byte to 511 byte frames • 512 byte to 1023 byte frames • 1024 byte to 1518 byte frames • Total number of jumbo frames • Max., min., average frame size
Burst Statistics	• Total frames in bursts • Max., min., average burst size
Transmit Statistics	• Compare transmitted and received Statistics • Current and cumulative
Thresholds	To facilitate simplified Pass/Fail evaluation of the tested results Adjustable Thresholds for the following: • Utilization • Throughput • Collision rate • Unicast, Multicast, Broadcast frames • Pause frames • Errored frames • Fragment frames • Undersized, oversized frames • FCS errored frames • IFG violations • Preamble violations • Alignment errors

RFC-2544 Application	
General	• Graphical display of "use cases" to choose from for ease of use • Support for Half duplex • Auto Search • User selectable "stop on No frame loss" • VLAN tag selectable • Predefined test configurations
Throughput and Frame Loss	• Frame profile: constant, stepped and user defined frames sizes including Jumbo frames. • User selectable step duration • User selectable frame content • Sequence Errors and Sequence Lost
Back to back frames (Burst)	• Frame profile: constant, stepped and user defined frames sizes including Jumbo frames. • Burst profile: constant, stepped • Step duration • User selectable number of repeats • Sequence Errors and Sequence Lost
Latency	• Frame profile: constant, stepped and user defined frames sizes including Jumbo frames. • User selectable step duration • User selectable number of repeats • Selectable "measure latency only at throughputs"
Report	• Printable PDF report • Results and settings • Tabular and graphical results • Custom logos can be generated on the PDF report. • A text version of the report may be generated, with CSV utilized for tabular results.

Channel Statistics (Option)	
Statistics Displayed	• Frame count/Rate • Throughput • Errored frames • Frame/Packet size distribution • IP packet rate/Throughput/Errors • TCP/UDP packet rate/Throughput/Errors
Filter	• Different filters are available to be used in conjunction with the Channel Statistics Option to show only the required type of traffic of interest

BERT Application	
BERT Statistics	• Bert, Errored Second, Error Free Second
Sequence Status	• Sequence Errors, Frame Loss, Sequence Sync Loss

Laser Safety*	IEC 60825-1: 2007: CLASS 1 21CFR1040.10 Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

*: Safety measures for laser products
This product complies with optical safety standards in 21CFR1040.10 and IEC 60825-1; the following descriptive labels are affixed to the product.

CERTIFICATION LABEL
THIS PRODUCT CONFORMS TO ALL APPLICABLE STANDARDS UNDER 21 CFR 1040.10

⚠ IEC 60825-1:2007
CLASS 1 LASER PRODUCT

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

• Base Model

5710-000-GIGE Base GigE II module

• Software Option

5710-CS-OPT Channel Statistics

• SFP Options

5710 - __ __ __ - GIGE

085 = 850 nm GigE SFP Transceiver
013 = 1300 nm GigE SFP Transceiver
015 = 1550 nm GigE SFP Transceiver
100 = 850 nm 100ME SFP Transceiver

ALL-IN-ONE FIELD TESTER

CMA 3000

Remote Control
Ethernet
OPTION

Installation and Maintenance of Mobile-Access and Fixed-Access Networks, Transmission Networks and Switching.

Field Testing Has Never Been Easier

CMA 3000 All-in-one Field Tester is Anritsu's next-generation portable, compact and user-friendly field tester. It's designed specifically for field technicians who install and maintain mobile-access and fixed-access networks, transmission networks and switching.
The CMA 3000 is a powerful tool for a wide range of applications, including fast first-aid troubleshooting to comprehensive, in-depth and all-layer analysis of transmission problems.
The basic CMA 3000 configuration, with its two 2 Mbps receivers and transmitters, supports framed and unframed testing and monitoring of 2 Mbps systems. This makes CMA 3000 the ideal instrument for measuring in- and out-of-service transmission quality.

Key Features

- Simultaneous bi-directional monitoring of 2 Mbps lines
- Powerful testing of framed N × 64 kbps and unframed 2 Mbps systems
- Simultaneous testing of two 2 Mbps lines
- Great flexibility through easy-to-install options
- LEDs for immediate line state indications
- Large color touch-display
- Battery-powered, with more than 10 hours operation between recharges

Key Applications

- Comprehensive out-of-service testing for:
  - Installation
  - Provisioning
  - Propagation time analysis
- Performance analysis
- Physical line monitoring
- In-service monitoring for:
  - Fast troubleshooting
  - Traffic monitoring
  - Identification of synchronization problems
  - In-service error performance measurement

Futureproof Design

The modular design provides you with a clear and cost-effective upgrade path. By adding options the CMA 3000 becomes a highly flexible field tester with the ability to test a large number of interfaces and technologies, including SDH, E4, E3 and Ethernet interfaces, ATM connections, frame relay lines and the Abis interface of GSM and GPRS networks. Other options turn the CMA 3000 into a very powerful signaling analyzer for GSM, GPRS/EDGE, SS7, and ISDN protocols.
Finally options allow the instrument to emulate VoIP or ISDN PRI calls.

Easy-to-Use Interface

The intuitive user interface, with a large color LCD display and easy-to-understand graphical symbols allows you to easily read and interpret results of measurements.
Using the high-contrast touch-screen display you can easily customize and store both setup and result screens to fit your personal needs and work routines. You may also configure the CMA 3000 to the received signal, eliminating time-consuming instrument setup.
With the powerful and flexible report generator you can create .pdf files for selected measurement results. Thus you can document test results to customers. Remote operation is facilitated through an optional MS Windows® program simulating the instrument's front panel.
In addition, the CMA 3000 has a full selection of interfaces for data transfer and external communication including LAN interface and USB ports to give you full flexibility whether in the field or in the workshop.
The instrument is powered by rechargeable and replaceable intelligent high-capacity LiIon batteries, providing more than 10 hours of operation between recharges. The CMA 3000 can also be powered via an external mains adapter for long-term measurements.

Speeds Troubleshooting

To speed troubleshooting the CMA 3000 displays alarms and transmission link status on LED indicators.

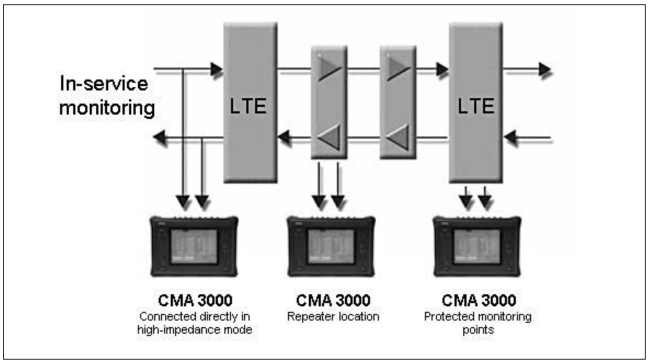


Figure 1: The CMA 3000 allows you to perform in-service monitoring of 2 Mbps lines.

The instrument's two inputs allow instant monitoring of both sides of a line and comparison of simultaneously recorded results.

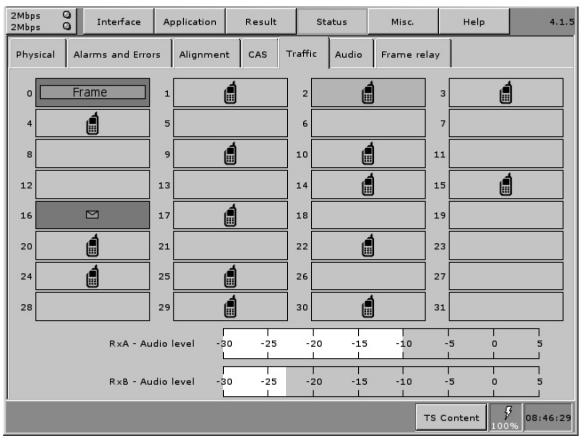


Figure 2: Fast overview of traffic channel time slots.

Fault location is greatly facilitated by the high degree of portability of the robust CMA 3000. This allows you take measurements at any suitable measuring point.

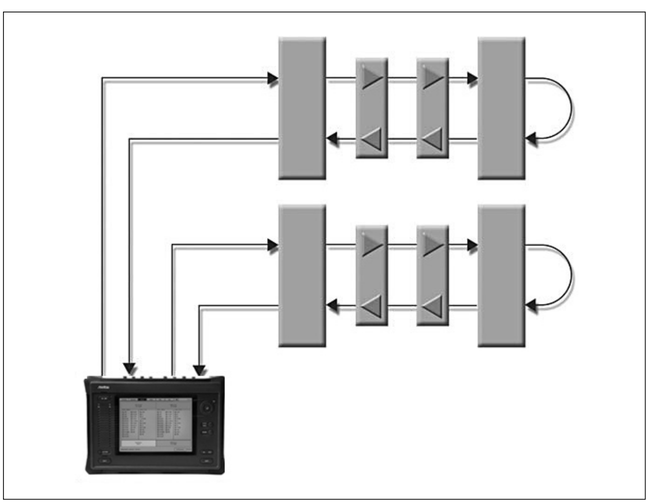


Figure 3: Simultaneous out-of-service testing of up to two 2 Mbps lines with CMA 3000.

The CMA 3000 status monitor is always active, providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current input frequency and deviation
- Indication of input level
- Traffic channel usage
- Audio level in a traffic channel
- Propagation time monitor
- Listen-in on a traffic channel

Out-of-Service or In-Service Statistics

For installation/commissioning and troubleshooting of out-of-service lines the CMA 3000 provides powerful statistical measurements for Bit Error Rate (BER) testing.
Statistics are also available for in-service analysis of the transmission-error performance of a line. Information on errors and alarms is collected in time-intervals as defined by you, and error-performance parameters (G.821/G.826/M.2100) are calculated.
The Measurement Summary function gives you a rapid overview of a measurement via an 'OK/Questionable/not-OK' indication. You may also define thresholds for the 'OK/not-OK' levels. Histogram presentations facilitate the tracing of errors over time.

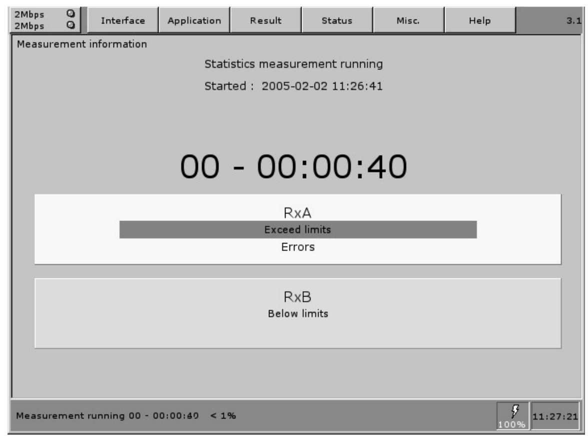


Figure 4: The Measurement Summary function gives you an OK/Questionable/not-OK indication.

Advanced In-Service Troubleshooting

Troubleshooting transmission errors may require analysis of timing between events that occur within a few milliseconds.
The CMA 3000's high-resolution log makes it easier to analyze timing between errors or alarms.

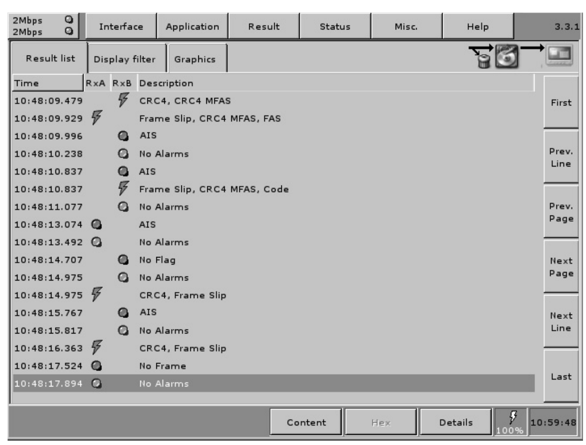


Figure 5: CMA 3000 gives you a log of errors and alarms with high-resolution time stamps.

Other events logged are CAS bit changes, Sa bit changes and, depending on the options added, a number of other events types, such as GSM, GPRS/EDGE, SS7, and ISDN signaling.
This allows you to correlate and observe the different event types. Using filters you may disable the logging and display of individual events, allowing you to view only the most essential information. You can check the event log during or after a measurement.

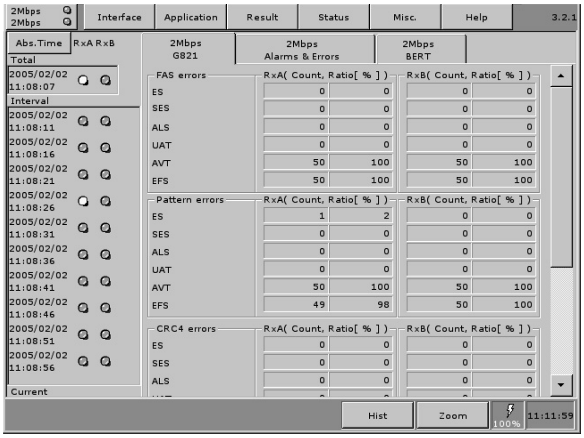


Figure 6: With the CMA 3000 you have comprehensive error performance statistics.

Out-of-Service Tests

During installation/commissioning and stress testing of network elements it's possible to control the signal transmitted by the CMA 3000. When generating a 2 Mbps signal, the instrument allows you to inject errors and alarms into the transmitted signal.
In addition, you may diverge the frequency of the transmitted signal from nominal to test a receiver's ability to handle signals that are out of specifications.

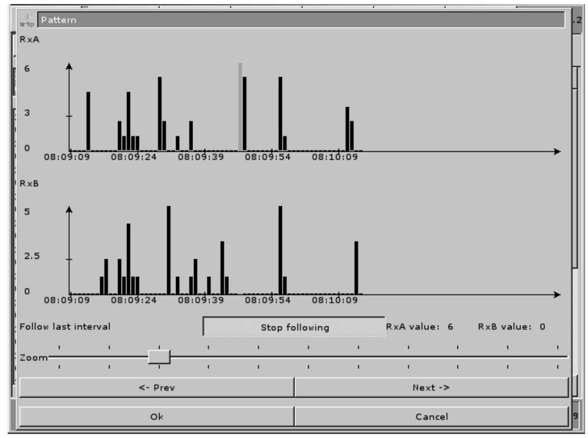


Figure 7: The CMA 3000 histograms facilitate the overview of a statistical measurement.

Specifications

The specifications table on the following pages covers the functionality of the CMA 3000 basic instrument.

2 Mbps Interfaces	General	The interfaces comply with ITU-T recommendation G.703 for 2 Mbps
	Connectors	Unbalanced connector: • BNC or Siemens 1.6/5.6 (as specified by the user) Balanced connector: • BNO
	Port Number	Number of transmitters: 2 Number of receivers: 2
Transmitter	Impedance	Output impedances supported: • 75Ω (unbalanced), 120Ω (balanced)
	Clocks	• Internal 2.048 Mbps clock, Accuracy: 4.6 ppm • Clock may be deviated +/– 125 ppm in 1 ppm steps • Recovered from a receiver • TTL level external 2.048 MHz clock in a D-Sub 15 male connector
	Line Code	HDB3 or AMI (user-selectable)
	Framing	• Unframed or framed (FAS/nFAS) • Sa-bits (non-FAS) are user-programmable
	Drop and Insert	Supports drop & insert of one or multiple 64 kbps timeslots (TS) within E1
	Alarms	Alarm may be generated: • No Signal, AIS, No Frame, CRC4 MF loss, Distant Alarm, CAS MF Loss, Distant MF Alarm
	Errors	Errors may be generated in: • Error insertion: (Bit, code, FAS bit, FAS word, CRC-4, E-bit) • Manual: 1-255 consecutive errors (1-16 consecutive FAS word errors) • Continuous 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} • Provoking of G.821, G.826 or M.2100 events (ES, SES etc.) (Bit, FAS, CRC-4, E-bit) • Manual slip insertion: frame slip, pattern slip
	CAS	CAS signalling bits may be generated
	BER Test Patterns	Pattern generation: • Unframed of framed n × 64 kbps in contiguous or non-contiguous channel access Test patterns supported: • PRBS 6, PRBS 7, PRBS 9, PRBS 11, PRBS 12, PRBS 15, PRBS 20, PRBS 23, QRSS 11, QRSS 20 • All 0s, All 1 s, Alternating (1:1), (1:3), (1:7), (3:1), (7:1), (3:24), Quick brown fox. User-defined up to 16 bits. Length in steps of 1 bit • User-defined up to 2048 bits. Length in steps of 8 bits • All patterns, except 'All 0', 'All 1' and 'Fox', can be inverted
	Tone and Speech Signal Insertion	Tone in one speech channel on one of the transmitters: • Frequency: 1 Hz to 4 kHz in 1 Hz steps • Level: –70 to +3 dBm in 1 dBm steps Artificial speech signal in one speech channel on one of the transmitters

Continued on next page

Receivers	Impedance	Input impedances supported: • 75Ω (unbalanced), 120Ω (balanced), High (>10 *, nominal)
	Jitter Tolerance	In accordance with ITU-T G.823 section 3.1.1
	Return Loss	Complies with the ITU-T Rec. G.703
	Receiver Attenuation and Impedance Modes	MONITOR: Up to 6 dB cable attenuation (20 to 30 dB linear attenuation), nominal impedance BRIDGED: Up to 40 dB cable attenuation, High impedance TERMINATE: Up to 40 dB cable attenuation, Nominal impedance
	Receiver Sensitivity	As stated above. Inputs will tolerate input levels up to 3 dB above nominal value
	Input Level Indication	Range: +3 to –42 dB (normal) or –20 to –32 dB (monitor)
	Receive Signal Rate	• 2048 kbps ±100 ppm • Frequency deviation indication accuracy: ±1 ppm
	Line Code	HDB3 or AMI (user-selectable)
	Framing	Unframed or framed (FAS/nFAS)
	Detectors	• Each input has a no signal detector with levels –20 dB, –33 dB, and full sensitivity • Each input has a signal level detector • Each input has signal frequency detector
	Auto Configuration	Framing and pattern are automatically determined. Signaling channels are identified if signaling options are installed
	Alarms	Alarm detected: • No Signal, AIS, No Frame, CRC4 MF loss, Distant Alarm, CAS MF loss, BERT Pattern Sync Loss, Distant MF Alarm
	Errors	Errors detected: • FAS/nFAS errors, Pattern Errors, CRC4 errors, E-bit (FEBE) errors, Code errors, Pattern Slips, Frame Slips
	CAS	CAS channel contents (TS16) can be supervised. Whenever a CAS channel contents change, an event is logged and time-stamped
	BER Test Patterns	Same as transmitter. Test patterns are detected in n × 64 kbps contiguous or non-contiguous channels (framed) or as an unframed signal
	Error Performance	• G.821, G.826 or M.2100 analysis of a PRBS in the received signal, or based on CRC-4, E-bit or FAS. ES, SES, DM (G.821), BBE (G.826), UAT, EFS, AT % or count Error performance evaluation for the total measurement: • HR% for a user- defined error performance parameter or programmable OK and not-OK limits for Bit, FAS, CRC-4 or E-bit count or ratio
	Round Trip Delay (propagation time) measurement	• Resolution: 1 µsec (unframed), 0.1 msec (framed) • Range: 0 to 4 sec
	Time-slot Monitoring	FAS, NONFAS, CAS signaling, Contents of single time slot incl. positive/negative peak values and coder offset. Level and frequency for encoded tone: • Frequency: 1 Hz to 4 kHz with 1 Hz resolution • Level: –66 to +3 dBm with 1 dBm resolution
	Speech Decode	In one 64 kbps time slot (ITU-T Rec. G.703): A-law according to ITU-T Rec. G.711
Results	Status	Current information on: • Alarms and errors on the monitored line • Input level indication • Frequency deviation • Round trip delay • Contents of one time slot • FAS/non-FAS and CAS bits • Traffic overview: Busy/idle indication from all 31 channels
	Statistics	User-defined resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 15, 30 min, 1, 2, 4, 6, 12 hours Information logged: • Alarms • Code error count/ratio • Pattern bit, FAS, CRC-4 and E-bit error count/ratio and G.821, G.826 or M.2100 parameters • Frequency deviation information
	Event Log	• Events are logged with 1 msec resolution time stamps • Logged events: Detected alarms and errors. Changes in CAS and Sa bits • Filters enable/disable the logging of individual events
Memory Capacity	Internal Memory Capacity	32 Mbytes are available for measurement results
Service Interfaces	USB Data Interface	2 USB 1.1 ports, Connector type A, CMA 3000 will operate as host
	Ethernet Interface	Ethernet 10 M/100 Mbps, One RJ45 connector
	V.24 Data Interface	DTE, Connector: 9 pin, D-sub, Male
Other Interfaces	Phone Interface	• For connection of an optional telephone set; to insert human voice into a traffic channel and to listen-in using the loud speaker in the telephone set Connector: • RJ11 (1 × 6) Female
	Built-in Loudspeaker	• The built-in loudspeaker monitors speech in both directions of a voice channel • Output level: user-controlled from front panel • A jack provides ear phone access to the audio signal. The built-in loudspeaker is disconnected when a headset is plugged in
	CompactFlash	The instrument is equipped with one CompactFlash socket

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Miscellaneous	Display	8 1/4" active TFT display with VGA resolution (640 × 480 pixels) and touch- screen
	LEDs	34 bi-color LEDs (with text on display)
	Battery	10.8 V rechargeable and replaceable intelligent LiIon battery Operating time (basic instrument): • With PowerSave; more than 10 hours • Without PowerSave; more than 6 hours Charging time: Typically 3 to 6 hours Indicator for remaining capacity: % and hours/minutes
	Mains Adapter	Input: 100 V(ac) to 240 V(ac), 50 Hz to 60 Hz Output: 18 V(dc), max. 3.4 A
	Mechanical	Basic instrument: • Dimensions: Approx. 330 (W) × 230 (H) × 75 (D) mm • Weight: Approx. 3.3 kg
	Environmental	Operating temperature: 0° to +40°C Storage temperature: –25° to +60°C The CMA 3000 is CE-marked and complies with EN 300 386, EN 61326-1 and EN 61010-1
	Standard Accessories	• User's Guide • Li-ion battery • Mains adapter with mains cable • Stylus
	Options	• SDH STM-1/-4/-16 test options • Frame relay test option • Abis protocols – ETSI and vendor specific* • Vendor specific GPRS Abis PCU protocols* • GPRS Gb interface protocol decode (requires Frame relay test option) • SS7 protocols* • ISDN protocols* • ISDN PRI call emulation protocols* • V-series interface measurement option • Ethernet 10 M/100 Mbps interface measurement option • Ethernet 10 M/100 M/1000 Mbps interface measurement option • Ethernet 10 M/100 M/1 G/10 Gbps interface measurement option - Two versions: Single or Dual port at 10 Gbps level - 10G LAN PHY, 10G WAN PHY and STM-64 options • IP over Ethernet channel statistics option (requires Ethernet interface measurement option) • Ethernet Service Activation Test option (requires an Ethernet interface measurement option) • Ethernet multistream option (requires Ethernet interface measurement option) • Ethernet stacked VLAN option (requires Ethernet interface measurement option) • Ethernet MPLS option (requires Ethernet interface measurement option) • Basic VoIP test option (requires Ethernet interface measurement option) • VoIP SIP Call emulator option (requires Basic VoIP test option) • VoIP H.323 Call emulator option (requires Basic VoIP test option) • VoIP Voice quality measurement (requires a VoIP call emulator) • E3 interface testing • E4 interface testing (requires SDH STM-1/-4/-16 test option) • Unframed T1 testing • ATM-over-SDH measurement option (requires SDH STM-1/-4/-16 test option) • ATM over E1/E3 test option (ATM over E3 requires E3 test option) • FrontSim (remote operation) option
	Additional Accessories	• Carrying case • Carrying soft bag • Instrument carrying strap • Extra Li-ion battery • Ear phones • Telephone set • Measurement cables
	Service Products	• Factory calibration

*: Please contact your local Anritsu representative for details on available protocols

Safety measures for laser products

When equipped with optical modules this product complies with optical safety standards in IEC 60825-1; the following descriptive label is affixed to the product.

⚠ IEC 60825-1:2007
CLASS 1 LASER PRODUCT

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

General guideline for ordering CMA 3000

● Minimum Order

As a minimum the following shall be specified:
- CMA 3000 basic instrument (0053100X)
- Accessories Supplied CMA 3000 (075310YY)

● Protocols and Software Options

When ordering protocols (083###xx), please also order the related Basic protocol functionality option:
- 083026xx Basic Abis Interface and Protocol Functionality
- 083027xx Basic SS7 Protocol Functionality
- 083028xx Basic ISDN Protocol Functionality
- Basic protocol functionalities should never be ordered without protocols

When ordering post-installed protocols and software options (083###90) please also specify delivery information:
- 08399990 On CD-ROM (Default, if nothing is specified)
- 08399995 On CD-ROM and USB memory stick (at extra cost)
- 08399950 By E-mail

● SDH

There is one basic SDH option for the CMA 3000:
- 015897ZZ Enhanced SDH Test Option Incl. STM-1 Electrical Interface
  - Supports optional optical modules for STM-1, STM-4 and STM-16

ZZ = 08: Factory installed at initial delivery of instrument
ZZ = 80: Post installed at factory after initial delivery of instrument
ZZ = 90: Field installed by customer

When ordering SDH options you must always order the above basic option. It includes the hardware needed to carry the optical modules.

Please also order as relevant:
- Software driver and optical modules (one or two) 015xxxYY
  - YY = 00 For port A, Factory installed
  - YY = 01 For port B, Factory installed, NB: requires that a SW driver for port A is already installed
  - YY = 90 For port A, Field installed
  - YY = 91 For port B, Field installed, NB: requires that a SW driver for port A is already installed
- Cables for optical modules (minimum two)

● Ethernet and STM-64 Options

3 basic Ethernet options are available:
- 015861XX Ethernet 10 M/100 Mbps Electrical – Internal module
- 015870XX Ethernet 10 M/100 M/1000 Mbps – Plug-on ("GigE") module (attached to the rear of the CMA 3000 Basic instrument)
- 012003XX/012017XX High speed single or dual port Interface incl. Ethernet 10 M/100 M/1000 Mbps Interface Testing with 2 RJ-45 Electrical Ports

The modules offer the same Ethernet testing functions.
012003XX/012017XX will require the 083385XX 10 GigE LAN option to do Ethernet testing at 10 Gbps.
012003XX/012017XX can be equipped with the 083386XX 10 GigE WAN option when 083385XX is installed.
012003XX/012017XX will require the 083396XX STM-64 option to do STM-64 testing.
The 015870XX, 012003XX and 012017XX plug-on modules offers the same 10 M/100 Mbps electrical interface as the internal module 015861XX.
In addition they have 1000 Mbps electrical interface and optional optical interfaces.

● V-Series Interface Option

If the 015835xx V-Series Interface measurement option is ordered either connection cables or 01558600 Data Interface Connection Box should also be ordered

Order Checklist

1. Select CMA 3000 Basic Instrument version BNC or 1.6/5.6 connectors
2. Include the regional accessory kit with the CMA 3000 Basic Instrument
3. Include interface specific options
4. Check for applicable optical interfaces
5. Check that applicable protocol functionality is included when ordering protocols
6. Check software delivery option for field installation of software options
7. Check for correct ordering codes for field installation of V-series interface or 10 M/100 Mbps Ethernet options
8. Include Serial Number when ordering options for field installation

Ordering Information

Model/Order No.	Name	Required Basic Software	Required Order No.
0053100X	**CMA 3000 Basic Instrument** NB: These items are **NOT** for sale in China X = 0: BNC connectors for unbalanced and BNO connector for balanced interfaces X = 1: 1.6/5.6 connectors for unbalanced and BNO connector for balanced interfaces Includes one 84501600 Li-Ion Battery Includes one 97600800 Stylus Touch Pen Includes one 075310YY "Accessories for CMA 3000", please specify.		
00531040	**CMA 3000 Basic Instrument with labels required in the Chinese market** NB: This item is **ONLY** for sale in China BNC connectors for unbalanced and BNO connector for balanced interfaces Includes one 84501600 Li-Ion Battery Includes one 97600800 Stylus Touch Pen Includes one 075310YY "Accessories for CMA 3000", please specify.		
075310YY	**Accessories for CMA 3000** NB: The following versions are **NOT** for sale in China YY = 00: Europe - includes power cable 01453098 YY = 01: Australia - includes power cable 01453198 YY = 03: UK - includes power cable 01453298 YY = 04: USA - includes power cable 01453398 YY = 09: Japan - without power cable and mains adapter NB: The following versions are **ONLY** for sale in China YY = 11: China - includes power cable 01453098 YY = 12: China - includes power cable 01453398 YY = 13: China - includes power cable 01453198		
	Calibration and Test Certificates		
00880947	Factory calibration for CMA 3000, including factory-installed options Including detailed result form		
00880945	Test Certificate for Function Test Including detailed result form Only available if ordered at the same time as the instrument		
	HW Options for CMA 3000		
01586100	Ethernet 10 M/100 Mbps Electrical Interface Test Option, Factory installed at initial delivery of instrument		
01586180	Ethernet 10 M/100 Mbps Electrical Interface Test Option, Post installed at factory after initial delivery of instrument	V2.10 or higher	
01586191	Ethernet 10 M/100 Mbps Electrical Interface Test Option, Field installed by customer	V2.10 or higher	
01587000	Ethernet 10 M/100 Mbps/1000 Mbps Interface Testing incl 2 RJ-45 Electrical Ports, Factory installed at initial delivery of instrument		
01587080	Ethernet 10 M/100 M/1000 Mbps Interface Testing incl 2 RJ-45 Electrical Ports, Post installed at factory after initial delivery of instrument	V2.34 or higher	
01587090	Ethernet 10 M/100 M/1000 Mbps Interface Testing incl 2 RJ-45 Electrical Ports, Field installed by customer	V2.34 or higher	
01200300	High speed single port Interface incl. Ethernet 10 M/100 M/1000 Mbps Interface Testing with 2 RJ-45 Electrical Ports, Factory installed at initial delivery of instrument	V4.00 or higher	
01200380	High speed single port Interface incl. Ethernet 10 M/100 M/1000 Mbps Interface Testing with 2 RJ-45 Electrical Ports, Post installed at factory after initial delivery of instrument	V4.00 or higher	
01200390	High speed single port Interface incl. Ethernet 10 M/100 M/1000 Mbps Interface Testing with 2 RJ-45 Electrical Ports, Post installed at authorized Anritsu Service center after initial delivery of instrument	V4.00 or higher	
01201700	High speed dual port Interface incl. Ethernet 10 M/100 M/1000 Mbps Interface Testing with 2 RJ-45 Electrical Ports, Factory installed at initial delivery of instrument	V4.00 or higher	
01201780	High speed dual port Interface incl. Ethernet 10 M/100 M/1000 Mbps Interface Testing with 2 RJ-45 Electrical Ports, Post installed at factory after initial delivery of instrument	V4.00 or higher	
01201790	High speed dual port Interface incl. Ethernet 10 M/100 M/1000 Mbps Interface Testing with 2 RJ-45 Electrical Ports, Post installed at authorized Anritsu Service center after initial delivery of instrument	V4.00 or higher	
	015870XX, 012003XX and 012017XX can be equipped with two optical modules: **Optical modules for 015870XX, 012003XX and 012017XX:**		
015941XX	1 Gbps 850 nm (SX) (one module), LC connector		015870XX or 012003XX or 012017XX
015942XX	1 Gbps 1310 nm (LX) (one module), LC connector		015870XX or 012003XX or 012017XX
015943XX	1 Gbps 1550 nm (ZX) (one module), LC connector		015870XX or 012003XX or 012017XX
	Optical modules for 015870XX only:		
015980XX	Gigabit Ethernet port converter module to 100BASE-FX (1310 nm multimode), LC connector	V3.20 or higher	015870XX
015982XX	Gigabit Ethernet port converter module to 100BASE-LX (1310 nm single mode), LC connector	V3.31 or higher	015870XX
	Optical modules for 012003XX and 012017XX only:		
012006XX	10 Gbps optical module SR/SW (850 nm), LC connector	V4.00 or higher	012003XX or 012017XX
012007XX	10 Gbps optical module LR/LW (1310 nm), LC connector	V4.00 or higher	012003XX or 012017XX
012008XX	10 Gbps optical module ER/EW (1550 nm , 40 km), LC connector	V4.00 or higher	012003XX or 012017XX
012010XX	10 Gbps optical module ER/EW (1550 nm , 80 km), LC connector	V4.00 or higher	012003XX or 012017XX
012004XX	100 Mbps optical module FX (1310 nm MM), LC connector	V4.00 or higher	012003XX or 012017XX
012005XX	100 Mbps optical module LX (1310 nm SM), LC connector	V4.00 or higher	012003XX or 012017XX
	Note: XX = 00 Factory installed XX = 90 Field installed. Please specify serial No of the target instrument		

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Model/Order No.	Name	Required Basic Software	Required Order No.
01583308	E3 Interface, Factory installed at initial delivery of instrument		
01583380	E3 Interface, Post installed at factory after initial delivery of instrument	V2.40 or higher	
01583390	E3 Interface, Field installed by customer	V2.40 or higher	
01589708	Enhanced SDH Test Option Incl. STM-1 Electrical Interface, Factory installed at initial delivery of instrument	V3.50 or higher	
01589780	Enhanced SDH Test Option Incl. STM-1 Electrical Interface, Post installed at factory after initial delivery of instrument	V3.50 or higher	
01589790	Enhanced SDH Test Option Incl. STM-1 Electrical Interface, Field installed by customer	V3.50 or higher	
	Up to two of the following modules can be installed in the SDH Test Option		
015845YY	Software driver and optics for STM-1 1310 nm, short haul, LC connector		015897XX
015846YY	Software driver and optics for STM-1/4 1310 nm, short haul, LC connector		015897XX
015990YY	Software driver and optics for STM-1/-4/-16 1310 nm, short haul, LC connector	V3.50 or higher	015897XX
015847YY	Software driver and optics for STM-1 1310 nm, long haul, LC connector		015897XX
015848YY	Software driver and optics for STM-1 1550 nm, long haul, LC connector		015897XX
015849YY	Software driver and optics for STM-1/4 1310 nm, long haul, LC connector		015897XX
015850YY	Software driver and optics for STM-1/4 1550 nm, long haul, LC connector		015897XX
015991YY	Software driver and optics for STM-1/-4/-16 1310 nm, long haul, LC connector	V3.50 or higher	015897XX
015993YY	Software driver and optics for STM-1/-4/-16 1550 nm, long haul, LC connector	V3.50 or higher	015897XX
	YY = 00 For port A, Factory installed YY = 01 For port B, Factory installed, NB: requires that a SW driver for port A is already installed YY = 90 For port A, Field installed by customer YY = 91 For port B, Field installed by customer, NB: requires that a SW driver for port A is already installed		
	Single Fiber Cables for Optical Modules		
	The optical cables in this section are single fiber cables		
01460198	Cable, optical, singlemode LC/PC to SC/PC, 3 m		
01463190	Cable, optical, singlemode LC/PC to Radiall VFO/straight, 3 m		
01463298	Cable, optical, singlemode LC/PC to FC/APC, 3 m		
01463390	Cable, optical, singlemode LC/PC to DIN47256, 3 m		
01463498	Cable, optical, singlemode LC/PC to FC/PC, 3 m		
01463598	Cable, optical, singlemode LC/PC to E-2000/PC, 3 m		
01463698	Cable, optical, singlemode LC/PC to E-2000/APC, 3 m		
01463798	Cable, optical, singlemode LC/PC to ST/PC, 3 m		
01463898	Cable, optical, singlemode LC/PC to LC/PC, 3 m		
01468990	Cable, optical, multimode SC/PC to LC/PC, 3 m		
01468890	Cable, optical, multimode LC/PC to LC/PC, 3 m		
	Dual Fiber (Duplex) Cable for Optical Modules		
	The optical cable in this section is a dual fiber cable		
01474398	Cable, Optical singlemode LC/PC to LC/APC, Duplex, 3 m		
	Optical Attenuator		
01463990	Optical Attenuator 10 dB LC/PC to LC/PC		
	V-Series Interface		
01583508	V-Series Interface Option, Factory installed at initial delivery of instrument		
	Please see below for available connection and extender cables		
01583580	V-Series Interface Option, Post installed at factory after initial delivery of instrument	V2.10 or higher	
01583591	V-Series Interface Option, Field installed by customer	V2.10 or higher	015861xx
	• For instruments delivered after September 2005 and after • For instruments with 015861xx 10 M/100 Mbps Ethernet Board Option installed regardless of age Serial number information required		
	Connection Cables for V-Series Interface Option		
01442290	RS-530 DCE/DTE		015835xx
01442398	RS-449, V.36 DCE/DTE		015835xx
01442498	RS 232C, V.24 DCE/DTE (25 pin)		015835xx
01442598	V.11, X.21 DCE/DTE		015835xx
01442698	V.35 DCE/DTE		015835xx
01442790	V.35 DTE		015835xx
01443098	RS 232C, V.24 DCE/DTE (9 pin)		015835xx
01442898	Codir. (G.703)		015835XX
01558600	Data Interface Connector Box		015835xx
01448208	Replacement for cable between instrument and Data Interface Connector Box.		015835xx and 01558600
	Extender Cables for V-Series Interface Option		
01445790	RS 530, RS 232C, V.24 Extender Cable (25 pin)		
01445898	V.35 Extender Cable		
01445990	RS-449, V.36 Extender Cable		
01446090	V.11, X.21 Extender Cable		
01446190	RS 232C, V.24 Extender Cable (9 pin)		
	Option: FrontSim for CMA 3000 (Note: for one license)		
083101xx	FrontSim for CMA 3000		
	XX=00: Instrument part factory installed; PC-part delivered on CD-ROM XX=90: Field installed; Instrument part delivered on CD-ROM; PC-part delivered on CD-ROM XX=50: Field installed; Instrument part delivered by E-mail; PC-part can be downloaded from ftp-site		
08310195	FrontSim for CMA 3000		
	Field installed; Instrument part delivered on both CD-ROM and USB memory stick; PC-part delivered on CD-ROM		

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Model/Order No.	Name	Required Basic Software	Required Order No.
	Option: Remote Control – Scripting for CMA 3000 (Note: for one license for one instrument)		
083384XX	Remote Control – Scripting for CMA 3000 XX=00: Instrument part factory installed; documentation delivered on CD-ROM XX=90: Field installed by customer; Instrument part delivered on CD-ROM; documentation delivered on CD-ROM XX=50: Field installed by customer; Instrument part delivered by E-mail; documentation can be downloaded from ftp-site	V3.80 or higher	
08338495	Remote Control – Scripting for CMA 3000 Field installed by customer; Instrument part delivered on both CD-ROM and USB memory stick; documentation delivered on CD-ROM	V3.80 or higher	
	Software Delivery Options When ordering field-installed software options and protocols, one of the delivery options below must also be ordered. If nothing is specified, option 08399990 - Delivery on CD will be assumed. Only one delivery option is required per instrument.		
08399990	Software is delivered on CD-ROM		
08399995	Software is delivered on a CD-ROM and on a USB memory stick		
08399950	The software is delivered via E-mail. Please specify recipients E-mail address.		
	Software Options for CMA 3000 (Note: for one license)		
083026xx	Basic Abis Interface and Protocol Functionality		
083027xx	Basic SS7 Protocol Functionality		
083028xx	Basic ISDN Protocol Functionality		
083341xx	Basic Abis and SS7 Protocol Functionality i.e. 083026xx and 083027xx together		
083342xx	Basic Abis and ISDN Protocol Functionality i.e. 083026xx and 083028xx together		
083343xx	Basic SS7 and ISDN Protocol Functionality i.e. 083027xx and 083028xx together		
083344xx	Basic Abis, SS7, and ISDN Protocol Functionality i.e. 083026xx, 083027xx and 083028xx together		
083354XX	Basic VoIP Functionality option Requires P/N 015861XX, 015870XX, 012003XX or 012017XX.	V3.40 or higher	015861XX or 015870XX or 012003XX or 012017XX
083029xx	GPRS Gb interface protocol decode for CMA 3000 Requires that Order No. 083084xx - Frame Relay test option is installed.		083084XX
083084xx	Frame Relay Test		
083030xx	Frame Relay Decode Requires that Order No. 083084xx - Frame Relay test option is installed.		083084xx
083086xx	Tandem Connection Monitoring	V4.10 or higher	015897xx or 083396xx
083376xx	E4 Interface	V3.60 or higher	015897xx
083398XX	Unframed T1	V4.20 or higher	
083087xx	ATM layer measurement - over E1/E3 ATM over E3 requires that Order No. 015833xx - E3 Interface option is installed.	V3.10 or higher	015833xx
083088xx	ATM layer measurement - over SDH Requires that Order No. 015897xx - SDH test option incl STM-1e is installed.	V3.00 or higher	015897xx
083089XX	IP over Ethernet channel statistics Requires P/N 015861XX, 015870XX, 012003XX or 012017XX.	V4.01 or higher	015861XX or 015870XX or 012003XX or 012017XX
083399XX	Ethernet Service Activation Test (Y.1564) option Requires P/N 015861XX, 015870XX, 012003XX or 012017XX. Requires SW version 4.20 or higher	V4.20 or higher	015861XX or 015870XX or 012003XX or 012017XX
083401XX	Synchronous Ethernet Test option Requires P/N 015870XX, 012003XX or 012017XX. Requires SW version 4.30 or higher	V4.30 or higher	015870XX or 012003XX or 012017XX
083333XX	Ethernet Multistream option Requires P/N 015861XX, 015870XX, 012003XX or 012017XX.	V4.00 or higher	015861XX or 015870XX or 012003XX or 012017XX
083377XX	Ethernet Stacked VLAN option Requires P/N 015861XX, 015870XX, 012003XX or 012017XX.	V4.00 or higher	015861XX or 015870XX or 012003XX or 012017XX
083378XX	Ethernet MPLS option Requires P/N 015861XX, 015870XX, 012003XX or 012017XX.	V4.00 or higher	015861XX or 015870XX or 012003XX or 012017XX
083385XX	10 GigE LAN Requires that P/N 012003XX or 012017XX option is installed.	V4.00 or higher	012003XX or 012017XX
083386XX	10 GigE WAN Requires that P/N 083385XX option is installed	V4.00 or higher	083385XX
083396XX	STM-64 Requires that P/N 012003XX or 012017XX option is installed.	V4.10 or higher	012003XX or 012017XX
	CMA 3000 Software Kits for Updating to Latest Release		
08309190	WLD Please specify serial number of target instrument The software is delivered on a CD-ROM		
08309195	WLD Please specify serial number of target instrument The software is delivered on a CD-ROM and on a USB memory stick		

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Model/Order No.	Name	Required Basic Software	Required Order No.
	Miscellaneous		
07030599	Carrying Case - Full Size		
070306WW	Softbag WW = 90: When ordered separately. WW = 99: When ordered together with an instrument.		
09108200	CMA 3000 User's Guide (Latest Release)		
84704100	USB Memory stick (2 Gbytes)		
01200100	Li-Ion Battery		
97600800	Stylus for Touch Screen		
01582600	Mains Adapter without Mains Cable		
01453098	Power Cable for AC Mains - Europe		
01453198	Power Cable for AC Mains - Australia		
01453298	Power Cable for AC Mains - UK		
01453398	Power Cable for AC Mains - US		
07030000	Instrument Carrying Strap		
0753102Y	Stand-Alone Charger for Battery including Mains Adapter Y = 0: Europe - includes power cable 01453090 Y = 1: Australia - includes power cable 01453190 Y = 3: UK - includes power cable 01453290 Y = 4: USA - includes power cable 01453390		
01592500	Car 12 Vdc adapter for CMA 3000		
07530010	Telephone Set		
80701200	Earphone		
01475990	Cable, GPS adaptor for CMA 3000	V4.20 or higher	083399XX
01467898	Clock in/clock out cable		
	Software Delivery Options When ordering field-installed software options and protocols, one of the delivery options below must also be ordered. If nothing is specified, option 08399990 - Delivery on CD will be assumed. Only one delivery option is required per instrument.		
08399990	Software is delivered on CD-ROM		
08399995	Software is delivered on a CD-ROM and on a USB memory stick		
08399950	The software is delivered via E-mail. Please specify recipients E-mail address.		
	VoIP Call Emulation Software Options for CMA 3000 Requires basic VoIP Functionality option 083354xx. Note: for one license		
083355xx	SIP call emulator option	V3.40 or higher	083354xx
083357xx	H.323 call emulator option	V3.60 or higher	083354xx
083356xx	Voice quality measurement option	V3.40 or higher	083354xx and 083355xx or 083357xx
	ISDN Call Emulation Software Options for CMA 3000 Requires basic ISDN protocol functionality option 083028xx. Note: for one license		
083308xx	WLD - ISDN DSS1 (Q.931) Call Emulation	V3.10 or higher	083028xx
083309xx	WLD - ETSI Euro ISDN Call Emulation	V3.10 or higher	083028xx
083310xx	WLD - QSIG Call Emulation	V3.10 or higher	083028xx
083311xx	France - VN6 Call Emulation	V3.10 or higher	083028xx
083312xx	Germany - 1TR6 Call Emulation	V3.10 or higher	083028xx
083313xx	UK - DPNSS Call Emulation	V3.10 or higher	083028xx
083314xx	UK - DASS-2 Call Emulation	V3.10 or higher	083028xx
	SS7 Protocols Requires basic SS7 protocol functionality 083027xx. Note: for one license		
083031xx	WLD - ETSI Core INAP CS1		083027xx
083032xx	WLD - ETSI Core INAP CS1 and CAMEL (CAP) ph2		083027xx
083033xx	WLD - CAP (CAMEL) v3		083027xx
083034xx	WLD - GSM Phase 2+ A interface		083027xx
083035xx	WLD - GSM Phase 2+ MAP		083027xx
083036xx	WLD - GSM Phase 2+ GPRS Gs interface		083027xx
083037xx	WLD - ITU-T White Book ISUP (R99) and ANS.1 Decoding of TCAP - OPC: 3-8-3		083027xx
083038xx	WLD - ITU-T White Book ISUP (R99) and ANS.1 Decoding of TCAP - OPC: in decimal		083027xx
083039xx	WLD - ITU-T Q.767		083027xx
083126xx	WLD - ITU-T Blue Book SS7		083027xx
083040xx	WLD - ETSI ISUP v3		083027xx
083041xx	WLD - ETSI ISUP v4		083027xx
083042xx	WLD-IS 41C with 24 bit OPC/DPC		083027xx
083043xx	WLD-IS 41C with 14 bit OPC/DPC		083027xx
083044xx	Brazil - Brazilian TUP and ISUP		083027xx
083045xx	China - White 24 bit SNM, SNT, SCCP, TCAP, TUP and ISUP		083027xx
083046xx	Czech - ISUP 2		083027xx
083047xx	France -TUP SSUTR2 VN7		083027xx
083048xx	France - SPIROU		083027xx
083049xx	France - SSURN		083027xx
083050xx	Germany - ETSI ISUP v.3 with AOC99		083027xx
083051xx	Greece - ISUP		083027xx
083052xx	Italy - ISUP and CS2		083027xx
083053xx	Mexico - Mexican ISUP		083027xx
083054xx	Poland - Polish ISUP v2		083027xx
083055xx	Russia - ISUP EOCC 12.3		083027xx
083056xx	UK - IUP and Enveloped ISUP (1999)		083027xx

Continued on next page

Model/Order No.	Name	Required Basic Software	Required Order No.
	Abis Protocols		
	Requires basic Abis interface and protocol functionality option 083026xx. Note: for one license		
083057xx	WLD - GSM900/DCS1800 Phase 2+ Abis		083026xx
083058xx	WLD - Ericsson GSM RBS 200		083026xx
083059xx	WLD - Ericsson GSM RBS 2000		083026xx
083061xx	WLD - Lucent LM 6.0 incl. Abis Phase 2+		083026xx
083062xx	WLD - Motorola GSM Mobis		083026xx
083063xx	WLD - Motorola GSM Mobis Only when customer is Motorola.		083026xx
083064xx	WLD - Nokia Abis O&M		083026xx
083065xx	WLD - Siemens Abis O&M and GSM Phase 2+		083026xx
	GPRS Abis Protocols		
	Requires basic Abis interface and protocol functionality option 083026xx. Note: for one license		
083066xx	WLD - GPRS Abis with Ericsson PCU Frames		083026xx
083067xx	WLD - GPRS Abis with Lucent PCU Frames		083026xx
083068xx	WLD - GPRS Abis with Motorola PCU Frames		083026xx
083069xx	WLD - GPRS Abis with Motorola PCU Frames Only when customer is Motorola.		083026xx
083070xx	WLD - GPRS Abis with Nokia PCU Frames		083026xx
083071xx	WLD - GPRS Abis with Nortel PCU Frames		083026xx
083072xx	WLD - GPRS Abis with Siemens PCU Frames		083026xx
	ISDN Protocols		
	Requires basic ISDN protocol functionality option 083028xx. Note: for one license		
083073xx	WLD - EURO-ISDN (ETSI) including Supplementary Services and X.25 This protocol also supports ITU-T Q.931		083028xx
083074xx	WLD - QSIG		083028xx
083075xx	Australia - ISDN		083028xx
083076xx	France VN6 ISDN		083028xx
083077xx	Germany - 1TR6 ISDN		083028xx
	Other Protocols		
	Requires basic ISDN protocol functionality option 083028xx. Note: for one license		
083078xx	WLD - X.25 Modules 8		083028xx
083079xx	WLD - X.25 Modules 128		083028xx
083080xx	UK - DPNSS		083028xx
083081xx	UK - DASS-2		083028xx
	Remote Subscriber		
	Requires basic ISDN protocol functionality option 083028xx. Note: for one license		
083082xx	WLD - ETSI V5.1/5.2 Note: XX = 00: Factory-installed. XX = 90: Field-installed. Please specify serial number of the target instrument.		083028xx

ETHERNET TESTER up to 10 Gbps

CMA 3000 Ethernet

Remote Control
Ethernet
OPTION

Installation and Maintenance of Ethernet Links

The User-friendly Ethernet Tester from 10 Gbps to 10 Mbps

CMA 3000 Ethernet is Anritsu's portable, compact and user-friendly field tester dedicated to Ethernet testing from 10 Gbps to 10 Mbps. The battery-powered, easy-to-use and portable CMA 3000 Ethernet is a comprehensive solution for testing and measuring LAN and WAN communication lines. Add-on options enable the CMA 3000 Ethernet to perform Service Activation test, multistream testing and to test stacked VLAN, MPLS and VoIP services. Furthermore a 10G WAN PHY option can be added

The CMA 3000 Ethernet comes in two versions: a single port and a dual port version at the 10 Gbps rate. Optional optical modules can be inserted in the 10G ports. Both versions include a dual-port Ethernet 1000/100/10 Mbps test interface equipped with electrical ports and ports for optional optical interfaces.

Easy-to-use Interface

The intuitive user interface, with a large color LCD display and easy-to-understand graphical symbols allows you to easily read and interpret results of measurements. Using the high-contrast touch-screen display you can easily customize and store both setup and result screens to fit your personal needs and work routines. You can store setups for particular applications in the CMA 3000 Ethernet. To allow quick and easy distribution of standardized test setups within the organization it's also possible to transfer setups to a USB memory stick and subsequently load to other instruments. With the powerful and flexible report generator you can create .pdf files for selected measurement results. With these files you can provide professional documentation of test results to your customers.

The CMA 3000 Ethernet has USB ports and a LAN interface for data transfer and external communication to give you full flexibility whether in the field or in the workshop. Remote operation is facilitated through an optional MS Windows® program simulating the instrument's front panel. With another option the CMA 3000 Ethernet can be remotely controlled with command line scripts, whereby the instrument turns into a fast and reliable tool for automated testing in manufacturing environments.

Transmitters and receivers permit out-of-service testing for installation, commissioning and Quality of Service (QoS) verification while a pass-through mode enables in-service monitoring for both fast troubleshooting and detailed analysis of the live traffic on the line. This makes CMA 3000 Ethernet the ideal instrument for measuring in-service and out-of-service transmission quality.

Key Features

- Single or dual port at the 10G rate with support of 10G LAN PHY
- Dual-port Ethernet 1000/100/10 Mbps test interface
- 10G WAN PHY option
- Traffic generation capabilities up to full line rate
- Comprehensive statistics
- Automated RFC 2544 testing of Throughput, Frame loss, Latency or Packet jitter, Burstability
- Simultaneous monitoring of both directions on a line
- IPv4 and IPv6 support
- Service Activation Test option - Service activation in accordance with ITU-T Y.1564
- Multistream, Stacked VLAN, MPLS and VoIP test options
- Synchronous Ethernet Test option
- IP channel statistics option
- Large color touch-display

Key Applications

- Comprehensive out-of-service testing for installation, provisioning and maintenance
- QoS verification
- End-to-end testing
- Rapid in-service diagnostics and troubleshooting
- Physical line monitoring

Installation, Commissioning and QoS Verification

For installation, commissioning and QoS verification CMA 3000 Ethernet provides powerful and flexible traffic generation capabilities, allowing you to easily test the network under various conditions, including generation of VLAN tagged traffic. Performance and QoS statistics are presented in tables and graphs facilitating results interpretation. Through preprogrammed thresholds, CMA 3000 Ethernet can isolate abnormal conditions on the tested line.

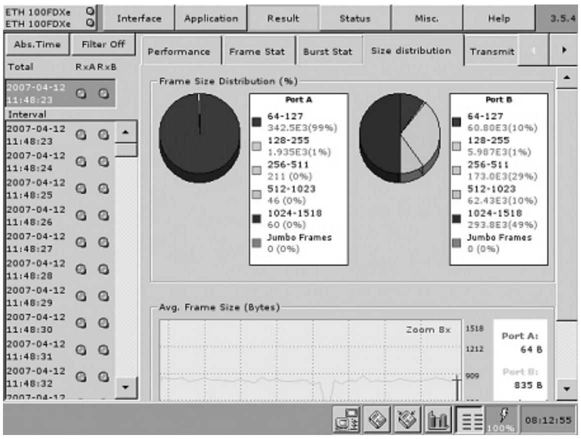

Figure 1 Statistics are presented in tables and easy to understand graphs.

RFC 2544 Analysis

The IETF RFC 2544 “Benchmarking Methodology for Network Interconnect Devices” defines a number of tests to be used for describing the performance characteristics of these network devices. With the CMA 3000 Ethernet, testing of performance parameters, such as throughput and frame loss, latency, packet jitter and burstability in compliance with RFC 2544 is straightforward. CMA 3000 Ethernet automates the testing procedure while still allowing you to configure the test to be as thorough as needed. To get full information on the performance of both sides of a line, the end-to-end test mode allows two CMA 3000 Ethernet to work together in a master-slave setup whereby the user can control both units and inspect the results of the test from both units on the master instrument.

In-service Troubleshooting

For fast troubleshooting the CMA 3000 Ethernet status monitor is always active, providing essential information on the monitored transmission system, including:

- Line alarms on LED indicators with a trap facility
- Display of current line status
- Optical level indication
- Electrical cable test facility
- Indication of main link quality parameters: Utilization, Throughput and Errored frames

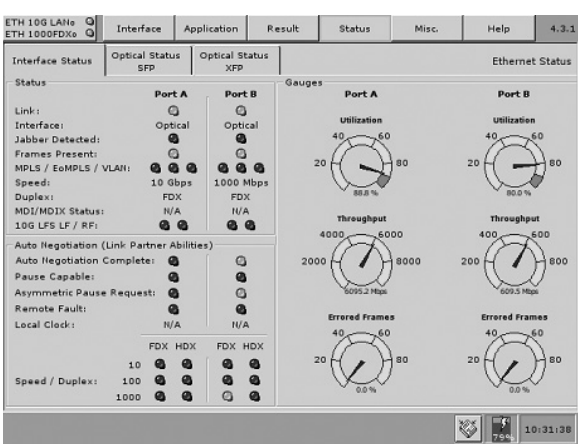

Figure 2 Interface status indicators for a quick overview of the line’s condition.

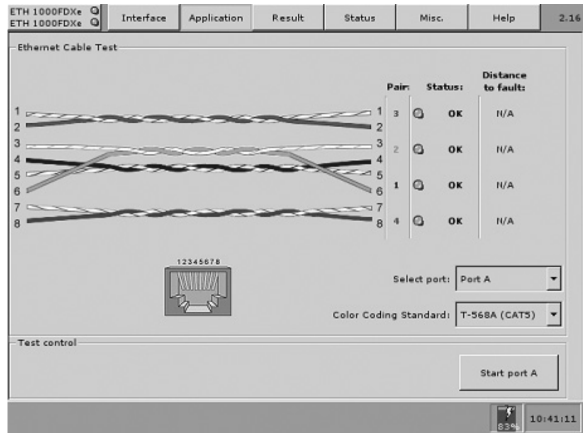

Figure 3 The CMA 3000 Ethernet cable test facility makes it easy to identify failures on electrical cables like short circuits or breaks of a wire pair.

Detailed In-service Analysis

CMA 3000 Ethernet can analyze live traffic in details by presenting statistics on the main performance indicators for a monitored line. To facilitate the analysis of data it’s possible to define threshold values for a number of parameters. CMA 3000 Ethernet uses the thresholds to color-highlight results outside the acceptable range.

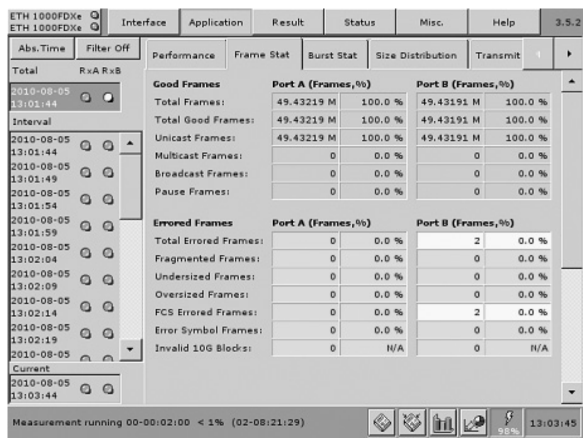

Figure 4 Tabular presentation of performance statistics.

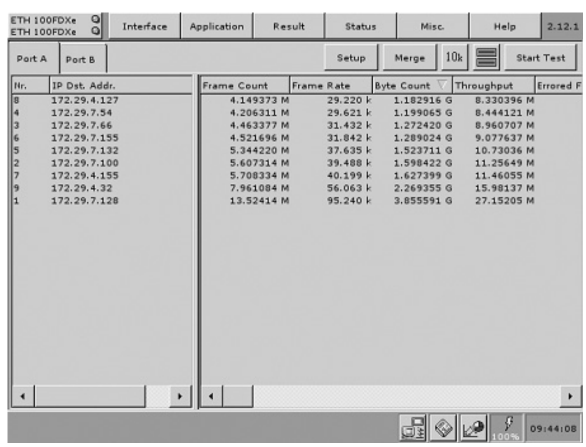

Figure 5 IP traffic analysis with the IP channel statistics option.

IP Channel Statistics Option

For further analysis of live IP traffic on the Ethernet line CMA 3000 Ethernet can be equipped with the IP channel statistics option. This option provides detailed information on the traffic on the monitored line for up to 232 individual channels, identified by parameters like Ethernet addresses, IP addresses, VLAN tags or MPLS labels. This allows you to identify whether a channel loads the line heavily, sends many errored frames or uses the line in an inefficient way.

Service Activation Test Option

The new ITU-T recommendation Y.1564 defines a new methodology for testing multiple Ethernet services simultaneously in a network. The Ethernet Service Activation Test option for the CMA 3000 allows the user to conduct tests in accordance with Y.1564 for up to 8 services. The test is typically done with two CMA 3000s performing the Service Activation Test in a Local-Remote setup. It can however also be done with one unit and a far-end loop back device. When the service activation test is done in the Local-Remote setup with two CMA 3000s you control the test from the local instrument. Easy to understand graphical symbols make it very fast to see if the tests passed. If further analysis is required the information presented can be expanded to show all details of each test. For measurements of Frame Transfer Delay (FTD) between two CMA 3000s, a GPS add-on option can provide true one-way measurements of Frame Transfer Delay. The GPS option can synchronize the clocks of the two CMA 3000s involved in the measurement, when a GPS signal can be received at the test sites.

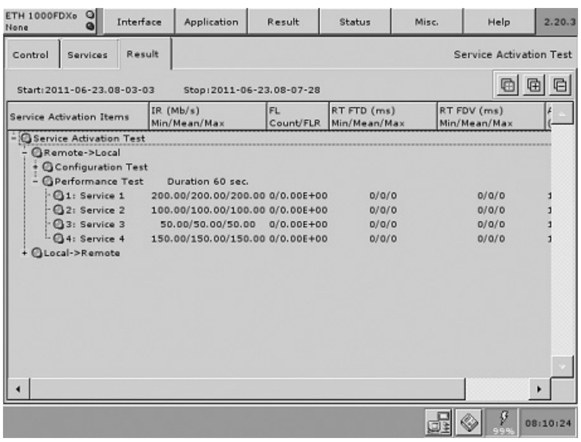

Figure 6 The Service Activation Test screen gives easy to understand indications on pass/fail of each of the conducted tests.

Ethernet Multistream Option

The Ethernet multistream option for the CMA 3000 Ethernet allows the user to test a congested networks ability to transport high priority traffic rather than lower priority traffic. The user can activate up to 8 streams per port with different priority settings on the Ethernet line and detect how they are affected by frame loss through the network. With the multistream option you also get information on packet jitter and latency per stream, issues that can cause problems for services like VoIP.

Synchronous Ethernet Test Option

Ethernet is today the dominant technology for data transmission, and legacy networks based on synchronous technology (PDH, SDH/SONET) migrate to packet-switched network based on Ethernet. However, the asynchronous nature of Ethernet provides certain transmission challenges as many existing networks have a strong requirement of frequency synchronization across the entire network. To support this requirement Synchronous Ethernet is introduced. The Synchronous Ethernet Test option for the CMA 3000 allows the user to conduct test and analysis of the two technologies defined for Synchronous Ethernet: SyncE (ITU-T G.826x) and IEEE 1588 v2 (PTP) including ITU-T G.8265.1 IEEE 1588 v2 profile for telecommunication.

The SyncE (ITU-T G.826x) functionality includes detection and generation of G.826x Synchronization Status Messages (SSM) for verification of the SyncE network. The SyncE (ITU-T G.826x) transmit clock can be synchronized to external clock signal sources to emulate a synchronous Ethernet signal. The transmit clock can be deviated to stress test network devices. Furthermore the CMA 3000 provides an indication of the bit rate of the received Ethernet signal relative to a chosen reference.
The IEEE 1588 v2 (PTP) functionality includes the CMA 3000 to act as a master using the internal instrument clock or a GPS signal (when present) as clock source. Alternatively the instrument can act in slave mode, including choosing the best master wall clock and constantly adjusting the clock. The clock is compared to a GPS signal (if present) to verify its precision. During a test the user will get comprehensive statistics on IEEE 1588 v2 including offset and offset variance, path delay variation, messages and clock state transitions.

Stacked VLAN Option

Stacked VLAN (Q-in-Q) is increasingly used in several types of Ethernet based networks. With a CMA 3000 Ethernet equipped with the Stacked VLAN options the user has a powerful tool for testing such networks. The Stacked VLAN option supports up to 8 levels of VLAN tags.

MPLS Option

MPLS (Multi Protocol Label Switching) allows efficient routing of traffic in packet based networks. With a CMA 3000 Ethernet equipped and the MPLS option the user has a powerful tool for testing this type of traffic. Up to 8 levels of MPLS labels can be inserted. The MPLS option also supports EoMPLS (Ethernet over MPLS) also known as PWE3 (Pseudo Wire Emulation Edge-to-Edge), which defines transport of layer 2 protocol across an MPLS network.

VoIP Test Options

With a CMA 3000 Ethernet equipped with VoIP options the field technician can use the same instrument for testing VoIP services and the basic Ethernet transport system. For VoIP testing the instrument can establish a call and answer incoming calls. By connecting an analog telephone to the CMA 3000 Ethernet the user can make a conversation with the called/calling party. Statistics collected during the call will inform the user on the performance of the communication line used for the call. Based on this an add-on option can present voice quality information in terms of Mean Opinion Score (MOS) and R-factor values for one call at the time.

10G WAN PHY Option

When the 10G interface is equipped with a 10G WAN PHY option the CMA 3000 Ethernet can be used for test and analyze of Ethernet traffic encapsulated in OC-192/STM-64 frames. The instrument provides powerful statistics for analysis of the transmission-error performance of a line together with information on pointer operations. G.826, G.828/G.829 or M2101 error-performance parameters are calculated for the measurement. When generating a 10G WAN PHY the instrument provides you with great flexibility for injecting errors, alarms and overhead byte changes into the transmitted signal.

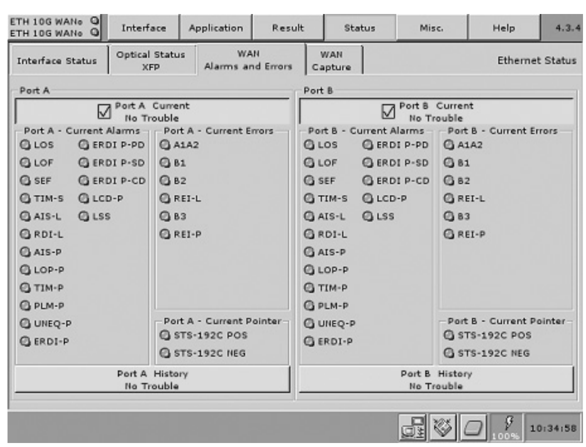

Figure 7 A quick overview of the alarm and error status on the line.

Specifications

Ethernet Test Interfaces	Interfaces	• Optical line interfaces 1 or 2 ports 10 Gbps, user-selectable optical modules: 850 nm (SR), 1310 nm (LR) and 1550 nm (ER) • Optical line interfaces 2 ports 1000 Mbps, user-selectable optical modules: 850 nm (SX), 1310 nm (LX) and 1550 nm (ZX) or 100 Mbps 1310 nm (FX or LX) • NB: Correct functioning can only be guaranteed with optical modules purchased from Anritsu for the CMA 3000 Ethernet. • Electrical line interfaces 2 ports (in addition to the optical ports) 10/100/1000 Mbps RJ45 (unshielded and shielded twisted pair cables, category 5, 5E, and 6) • Safety measures for laser products: Optical modules for the CMA 3000 comply with optical safety standards in IEC 60825-1.
	Ethernet Test Configurations	• Monitor/generate • Pass-through • Reflector
Ethernet Measurements	Encapsulations (Frame Formats)	• EtherType II (DIX v.2), IEEE 802.3 with 802.2 (LLC1), IEEE 802.3 with SNAP
	Traffic Generation	• Variable line rate traffic generation, up to full line rate • Line load profile: Constant or ramp • Traffic duration: Continuous, programmable number of seconds or frames • Adjustable frame size from 44 bytes to 16000 bytes • Frame sizes may be set to constant, stepped or random length • User-defined traffic mix of unicast and broadcast frames • User-defined VLAN ID and VLAN priority • Fixed or incremented IP identifier • Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6 addressing). Fixed, DHCP, DNS. • Generate pause frames and respond to pause frames • Answer incoming ARP and ping requests (On/Off) • User programmable DSCP/TOS byte • User programmable UDP/TCP address • Automatic TCP connect (user selectable)
	Receiver Settings	• User-defined expected preamble length (3 bytes to 15 bytes) • User-defined IFG lower threshold (8 bytes to 15 bytes) for Ethernet 10/100/1000 Mbps • User-defined Jumbo frame size upper limit (1519 bytes to 16000 bytes)
	Error Generation	• IFG for Ethernet 10/100/1000 Mbps, FCS, Preamble, Error symbol • Wrong IP checksum, fragmented IP, UDP with zero checksum • PRBS bit error, BERT sequence error
	Alarm Generation	• No link, Remote fault
	Cable Test	Identifies failures on electrical cables like short circuits or breaks of a wire pair and indicates the distance from the instrument to the fault. Max distance: 110 m, accuracy: ±3 m.
	BER Test	Generation and detection of test patterns. Count of errors in received test pattern. Pattern generation: Unframed, framed with IP header or framed with IP header and TCP/UDP header Detection of sequence errors and loss of sequence synchronization. Frame loss count and frame loss seconds Throughput measurement results are calculated for: Utilization layer, Physical layer, Physical layer excl. preamble, Link layer, Network layer and Data layer • Min, avg. and max. values are presented Test patterns supported: • PRBS 9, PRBS 11, PRBS 15, PRBS 20, PRBS 23, PRBS 29, PRBS 31, HF test pattern, CRPAT, JTPAT, SPAT, 55 Hex, Fox, 16 bit user programmable User-defined resolution: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hour
	Service Disruption Measurement	Service disruption measurement that can be activated as a part of the BER test • Max. and avg. service disruption time, resolution 0.1 µsec • Number of service disruptions
	RFC 2544 Installation and Commissioning	Switch/router test and Single ended network test modes: Throughput, Frame loss, Latency or packet jitter, Back-to-back frames (burstability) End-to-end network test mode (two CMA 3000 Ethernets or CMA 3000s in a master-slave setup): Throughput, Frame loss, Back-to-back frames (burstability) Router latency test mode: IP ping based latency test or packet jitter The user can choose to make the RFC 2544 throughput measurement for: Utilization layer, Physical layer, Physical layer excl. preamble, Link layer, Network layer or Data layer • Average or maximum values
	Ping Test	For connectivity and configuration check • Round Trip Time (RTT) • Supports IPv4 and IPv6 addressing • Answer incoming Ping requests (On/Off)
	Traceroute	Trace the IP route over the IP network • User-defined max no. of hops (1 to 255) Information per hop: Min/avg/max ping time and no. of ping time outs
	Reflector Mode	The following parameters are user selectable: • Swap all MAC addresses or one specific MAC address • Swap IP addresses • Swap port numbers on UDP/TCP frames • Force ACK on TCP frames

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Results	Status	Link status, Remote fault,Signal present, Jabber detected, Frames present, Speed, full or half duplex, Interface type, Local clock (Ethernet 1000), Pause capable and Asymmetric pause request (not Ethernet 10 Gbps), Link partner capabilities, Indicators for Utilization, throughput and errored frames CMA 3000 Ethernet indicates the signal level for optical Ethernet interfaces
	Resolution	For statistical measurements: 1, 2, 5, 10, 15, 30 s, 1, 5, 10, 15, 30 min, 1, 2, 4, 6, 12 hour
	Performance Statistics	Max/min/avg utilization, Max/min/avg throughput, Max/min/avg frame rate, Max/min/avg Latency, Max/min/avg Packet jitter
	Frame Statistics	Total frames, Total valid frames, Unicast/multicast/broadcast frames, Number of pause frames, Total errored frames, Fragmented frames, Number of oversized and undersized (runts) frames, Number of FCS errored frames, Error symbol frames (not Ethernet 10 Gbps)/Code violation frames (Ethernet 10 Gbps), Number of collisions (10/100 Mbps half duplex), Preamble violations, IFG violations (Ethernet 10/100/1000 Mbps), False carrier, 10G LFS LF (local fault), 10G LFS RF (remote fault)
	Burst Statistics	Total frames in bursts, Max/min/avg burst size
	Frame Distribution Statistics	Total valid/good frames, 64 - 127 byte frames, 128 - 255 byte frames, 256 - 511 byte frames, 512 - 1023 byte frames, 1024 - 1518 byte frames, Total number of jumbo frames, Max/min/avg frame size
	Filters	Up to 8 filter conditions can be defined. Each condition can filter on: IP or MAC source address, IP or MAC destination address, Broadcast address, IEEE OUI value, Encapsulation type, VLAN ID and VLAN tag priority, MPLS, TPC/UDP source and destination port, User-defined pattern at a defined offset
	Adjustable Thresholds	Utilization, Throughput, Collision rate, Unicast frames, Multicast frames, Broadcast frames, Pause frames, Errored frames, Undersized frames (runts), Oversized frames, FCS errored frames, FG violations (Ethernet 10/100/1000 Mbps), Preamble violations
	DHCP	• Show source IP address assigned by DHCP • Show current lease expire time • Show IP addresses of primary and secondary DNS server when obtained by DHCP
Ethernet Stacked VLAN Option	Number of VLAN tags	Up to 8 VLAN tags can be set by the user Only 1 level of VLAN is supported in ping, traceroute and RFC 2544 router latency tests
	Parameters per VLAN tag	• EtherType 0x8100 (802.1Q), 0x88a8 (802.1ad), 0x9100 or 0x9200 • User-defined VLAN ID, CFI and VLAN priority
	Status	Indicator for detection of VLAN tagged frames
	Statistics	Number of VLAN tagged frames, Max. number of VLAN layers detected
Ethernet Multistream Option	Number of Streams	Up to 8 streams per port can be activated
	Parameters per Stream	Encapsulation (frame format), Line rate traffic load, up to full line rate, Configurable IP and Ethernet source and destination addresses (supports IPv4 and IPv6), User-defined traffic mix of unicast and broadcast frames Adjustable frame size from 44 bytes to 16,000 bytes Frame sizes may be set to constant, stepped or random length User programmable VLAN ID and VLAN priority, DSCP/TOS byte and UDP/TCP address In stream 1 a BER test can be made
	Statistics	Available information per stream: Frame loss count/rate, Throughput, Latency, Packet jitter, Frames and bytes received and transmitted
IP Channel Statistics Option	Statistics	The statistics are provided for up to 232 channels, identified by user-defined combinations of: IPv4, IPv6 or MAC address, VLAN ID or MPLS label, Protocol information, IP next header (protocol), TPC/UDP ports Traffic Capacity: • 10 Mbps line speed, 100 Mbps line speed and 1 Gbps line speed: 100% line load • 10 Gbps line speed: - With average frame size 530 bytes (or higher) and the longest burst of short frames (64 bytes) is 84: 100% line load - For all frame sizes: The traffic capacity is up to 2.20 Mframes per second when the longest burst of short frames (64 bytes) is 84. - If the above conditions are not fulfilled, frames will be discarded from the IP Channel statistics. A special counter will show the number of frames discarded from the IP Channel statistics. Available information per channel: Frame count/rate, Throughput, Byte count, MPLS frames, Jumbo frames, Errored frames and errored frame rate, Errored throughput, Errored byte count, Frame/packet size distribution, IP header bytes, IP fragments, TTL threshold violations, IP packet count, rate, IP bytes, IP throughput, IP header errors, TCP/UDP bytes, TCP/UDP packet count, rate, throughput, TCP/UDP errored packets
Service Activation Test Option	Service Activation Test	Service Activation Test in accordance with ITU-T recommendation Y.1564 • Test up to 8 services • Color-Aware and Non-Color-Aware in combinations (IP DSCP or VLAN PCP) • Supported Ethernet interfaces: 10 Gbps, 1 Gbps, 100 Mbps, 10 Mbps • Test modes: One-way (uni- or bi-directional, symmetrical or asymmetrical), Round-trip • Test port: A or B • Verification against Service Acceptance Criteria: Information Rate, Frame Transfer Delay, Frame Delay Variation, Frame Loss Rate, Availability Optional GPS timing synchronization
	Service Configuration Test	• Subtests for: Committed Information Rate, Excess Information Rate, Traffic Policing, Committed Burst Size, Excess Burst Size • Step duration: 1 sec to 60 sec (user programmable) • Number of steps: 1 to 10 (user programmable) • Slope: rising or falling • Results: Pass/Fail indication, IR (Min/Mean/Max), FL (Count/FLR), FTD and FDV (Min/Mean/Max/Current (during measurement))
	Service Performance Test	• All services tested simultaneously at CIR • Duration 15 min, 2 hours, 24 hours or user programmable • Results: Pass/Fail indication, IR (Min/Mean/Max), FL (Count/FLR), FTD and FDV (Min/Mean/Max/Current (during measurement)), AVAIL (%), UNAVAIL (sec)

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Synchronous Ethernet Test Option	Timing Functionality	Timing sources (selectable): Internal, Ethernet port A, Ethernet port B (dual port version required at 10 Gbps), 2 MHz signal, E1 PDH signal, T1 PDH signal (requires unframed T1 option), IEEE 1588 clock A, IEEE 1588 clock B or a signal from an optional GPS receiver. Frequency deviation of ±100 ppm in 1 ppm steps. The frequency deviation of received Ethernet signals can be measured against a chosen reference timing source.
	SyncE (G.826x) functionality	Specify quality level (QL) of the transmitted Ethernet signal. Analysis of QL indicated in received Ethernet signal. An alarm is raised on missing QL indications. SyncE results: SSM Rx count and rate, SSM Tx count, Indicated QL statistics and SSF seconds. ESMC messages can be captured and exported in a Wireshark compatible format with the FrontSim option. In pass-through mode, the quality level indicated in ESMC messages can be changed on the fly to a given value in both directions independently.
	IEEE 1588v2 functionality	Each port of the Ethernet interface can act as a timing master or a timing slave independently. Supported modes: Multicast (native PTP) and Unicast (G.8265.1). When acting as master in Unicast (G.8265.1) mode one slave is accepted at a time; other slaves are ignored. If the slave requires 32, 64, or 128 Sync messages per second the IEEE 1588-2008 paragraph 7.7.2.1 concerning 90% confidence interval is not followed. Configurable parameters (per port): Clock identity, Port number, Priority 1. Priority 2, Domain number, Clock class, Slave only mode, Time source, Encapsulation, Announce receipt timeout, Clock accuracy, Clock step mode, Announce interval, Sync interval, Minimum delay request interval and Unicast duration. A UTC time offset to be used when acting as clock master can be specified. For G.8265.1: Support of stacked VLAN and MPLS (other options required). IEEE 1588 clock results: Clock state, Announce count, Sync count, Follow-up count, Delay request count, Delay response count, Delay follow-up count, Peer delay request/response/response-follow-up counters, Min-/max-/average offset, Min-/max-/average offset deviation, Min-/max-/average offset variance, Min-/max-/average mean path delay, Min-/max-/average peer mean path delay, Min-/max-/average path delay variance, Min-/max-/average path delay variation. With a GPS signal present the offset from UTC time is calculated. The offset time between the two clocks is always shown. Parent clock results: Identity and Port number. Grand-master results: Identity, Class, Accuracy, Priority 1, Priority 2, Announced- and observed offset variance. Foreign master clock result (up to five clocks per port): Identity, Port number and Announce count. Logged IEEE 1588 events: Clock state transitions, State transition events, Faults and Changes in grand-master clock. IEEE 1588 messages can be captured and exported in a Wireshark compatible format with the FrontSim option. In pass-through mode the CMA 3000 acts as an end-to-end transparent clock in one-step mode.
VoIP Call Emulation Options	Emulation modes	The instrument supports Client/Terminal emulation.
	Supported Protocols (Options)	SIP RFC 3261, RTP/RTCP RFC 3550 and RFC 3551, ITU-T H.323 Full connect, ITU-T H.323 Fast connect The VoIP call emulation options run on IP v4 only.
	Settings	The following settings are user selectable: Calling alias, IP address DHCP/static and Subnet mask, Gateway address and DNS server, DSCP/TOS byte, MAC address, VLAN ID and VLAN priority, RTCP on/off, Silence ringing signal
	Supported Voice Coding	The following Voice codings are supported: µ-law/A-law (G.711), ACELP 5.3, MPC-MLQ 6.3 kbps (G.723.1), ADPCM 16/24/32/40 kbps (G.726) (only with SIP call emulator), LD-CELP 16 kbps (G.728), CS-ACELP 8 kbps (G.729 a,b), GSM FR, GSM EFR, Fixed codec preference list User selectable: Silence suppression (depends on selected codec), Jitter buffer delay, Source: Voice conversation (optional telephone), tone, pre-recorded speech signal
	Simultaneous Calls	Up to 8 calls can manually be generated at a time
	Call Generator	Up to 8 simultaneous calls can automatically be generated repeatedly.
	Call Emulation Logs	The following information is provided for each call: IP address/Alias, RTP ports, Answer delay, Duration of call, Encoding (codec), Silence suppression On/Off, Call progress and error messages with 1 msec resolution
	Call Statistics	Throughput sent/Throughput received as Bytes and Packets, Out of sequence packets, Packet loss, Packet jitter (msec, (min/cur/max), Packet Round Trip Time (RTT) (msec, (min/cur/max)
	DTMF Detection	Received in-band DTMF (tone signal in the audio stream) can be recorded for one speech channel. DTMF detection can be enabled and disabled.
	Voice Quality (Optional)	Voice quality measurement on one call at the time: • Uses Telchemy's algorithms for achievement of MOS and R-factor values at live traffic end points: • MOS: Conversational, Listening, P.862 estimate, Maximum with selected codec • R-factor: Conversational, Listening, G.107 estimate, Listening during Burst and Gap periods, Maximum with selected codec • Voice quality evaluation summary, based on user defined thresholds
	VoIP Measurements	When a measurement is running Call emulation logs, call statistics are stored pre call that terminated during the measurement. DTMF information and the optional Voice quality information are stored for calls where they were measured. In addition there is a summary for all calls terminated during the measurement with information on: Total number of calls. Number of Incoming, Outgoing, succeed, failed calls, Call duration (min/avg/max). Answer delay (min/avg/max), Throughput sent/Throughput received as Bytes and Packets (min/avg/max/total), Out of sequence packets. (min/avg/max/total), Packet loss (min/avg/max/total), Packet jitter (msec, min/max), Packet Round Trip Time (RTT) (msec, min/max)
	Phone Interface	Interface for connection of an analog telephone AC impedance: Approx. 600Ω. The phone will be supplied with a constant current of approx. 20 mA The phone supports receiving and transmitting speech signals. Connector: RJ11 (1 × 6) Female

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Ethernet MPLS Option	MPLS Supported	MPLS unicast is supported (EtherType 0x8847) Support for MPLS in BERT, RFC 2544 (excluding router latency) Tests and general statistics MPLS can only transport VLAN and VoIP if EoMPLS is activated
	Number of MPLS Headers	Up to 8 MPLS headers can be set by the user
	Parameters per MPLS Headers	User-defined label, Exp and TTL fields in the MPLS header
	EoMPLS Support	An EoMPLS (Ethernet over MPLS) or PWE3 (Pseudo Wire Emulation Edge-to-Edge) label (the RFC4448 Control word) can be added.
	Status	Indicator for detection of MPLS frames and EoMPLS
	Statistics	Available information: • Number of MPLS frames and EoMPLS frames • Max. number of MPLS layers detected
10G WAN PHY Option	WAN Modes	10GigE (normal), WAN-PHY with Mixed-frequency test pattern, Square wave pattern, PRBS 31 pattern. SONET or SDH Terminology
	Error Insertion	SONET Terminology: A1A2, B1, B2, REI-L, B3, REI-P SDH Terminology: A1A2, B1, B2, MS-REI, B3, HP-REI
	Alarm Insertion	SONET Terminology: LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, ERDI P-PD, ERDI P-SD, ERDI P-CD SDH Terminology: LOS, LOF, OOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, LCD
	Error Measurement	SONET Terminology: A1A2, B1, B2, REI-L, B3, REI-P SDH Terminology: A1A2, B1, B2, MS-REI, B3, HP-REI G.826, G.828 + G.829 or M.2101.1 (M.2100) error performance parameters are calculated
	Alarm Detection	SONET Terminology: LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, ERDI P-SD, ERDI P-CD, ERDI P-PD, LCD-P, LSS SDH Terminology: LOS, LOF, OOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-PLM, HP-UNEQ, HP-TIM, HP-RDI, LCD, LSS
	Overhead Bytes	Generation of overhead bytes, defined by the user; capture and display of current overhead bytes
	Pointer Operations	Detection of: Positive movements, Negative movements, NDF
User Interface	Display	8 ¼ " active TFT display with VGA resolution (640 × 480 pixels) and touch screen
	LEDs	34 bi-color LEDs (with text on display)
Service Interfaces	USB Data Interface	Two USB 1.1 ports. Connector type A. CMA 3000 Ethernet will operate as host
	Ethernet Interface	Ethernet 10/100. One RJ45 connector
Other Interfaces	Built-in Loudspeaker	• The built-in loudspeaker monitors speech in both directions of a voice channel • Output level: user-controlled from front panel • A 3.5 mm diameter jack provides ear phone access to the audio signal. The built-in loudspeaker is disconnected when a headset is plugged in
Miscellaneous	Battery	10.8 V rechargeable and replaceable intelligent Li-Ion battery Operating time: Typically 1.5 hours, Charging time: Typically 5 to 6 hours Indicator for remaining capacity: % and hours/minutes
	Mains Adapter	Input: 100 V(ac) to 240 V(ac), 50 Hz to 60 Hz; Output: 18 V(dc), max. 3.4 A
	Mechanical	The CMA 3000 Ethernet consists of a base unit and a 10G module attached to the back of the base unit. Dimensions: Base unit approx. 33 (W) × 23 (H) × 7.5 (D) cm 10G module approx. 30.7 (W) × 10 (H) × 4.3 (D) cm Weight: Approx. 4.4 kg
	Environmental	Operating temperature: 0° to +40°C Storage temperature: –25° to +60°C CMA 3000 Ethernet is CE-marked and complies with EN 300 386, EN 61326-1 and EN 61010-1
	Standard Accessories	User's Guide, Li-Ion battery, Mains adapter with mains cable, Stylus

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• General guideline for ordering CMA 3000 Ethernet.

As a minimum the following shall be specified:
- CMA 3000 Ethernet instrument (005311XX)
- Accessories Supplied CMA 3000 Ethernet (075311YY)

Please remember to order SW options, optical modules and cables as required.

Order checklist for CMA 3000 Ethernet

1. Select CMA 3000 Ethernet single port or dual port at the 10 Gbps rate as required
2. Include the regional accessory kit with the CMA 3000 Ethernet
3. Include relevant optional optical modules
4. Include relevant SW options
5. Include cables as required
6. Check SW delivery option for field installation of SW options
7. Include Serial Number when ordering options for field installation

Ordering information

Model/Order No.	Name	Required Basic Software	Required Order No.
00531102	**CMA 3000 Ethernet** 10 GigE LAN single port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports NB: This item is **NOT** for sale in China Includes one 01200100 Li-Ion Battery and one 97600800 Stylus Touch Pen Includes one 075311YY "Accessories for CMA 3000 Ethernet", one must be selected.		
00531103	**CMA 3000 Ethernet – dual** 10 GigE LAN dual port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports NB: This item is **NOT** for sale in China Includes one 01200100 Li-Ion Battery and one 97600800 Stylus Touch Pen Includes one 075311YY "Accessories for CMA 3000 Ethernet", one must be selected.		
00531141	**CMA 3000 Ethernet – with labels required in the Chinese market** 10 GigE LAN single port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports NB: This item is **ONLY** for sale in China Includes one 01200100 Li-Ion Battery and one 97600800 Stylus Touch Pen Includes one 075311YY "Accessories for CMA 3000 Ethernet", one must be selected.		
00531142	**CMA 3000 Ethernet – dual – with labels required in the Chinese market** 10 GigE LAN dual port Interface incl. Ethernet 10/100/1000 Interface Testing with 2 RJ-45 Electrical Ports NB: This item is **ONLY** for sale in China Includes one 01200100 Li-Ion Battery and one 97600800 Stylus Touch Pen Includes one 075311YY "Accessories for CMA 3000 Ethernet", one must be selected.		
075311YY	**Accessories for CMA 3000 Ethernet** NB: This item can only be ordered together with a CMA 3000 Ethernet (0053110X or 0053114X) NB: The following versions are **NOT** for sale in China YY = 00: Europe - includes power cable 01453098 YY = 01: Australia - includes power cable 01453198 YY = 03: UK - includes power cable 01453298 YY = 04: USA - includes power cable 01453398 YY = 09: Japan - without power cable and mains adapter NB: The following versions are **ONLY** for sale in China YY = 11: China - includes power cable 01453098 YY = 12: China - includes power cable 01453398 YY = 13: China - includes power cable 01453198		0053110X or 0053114X
 00880947 00880945	**Calibration and Test Certificates** Factory calibration for CMA 3000 Ethernet, including factory-installed options Including detailed result form. NB: This only applies to already sold instruments. If test certificate including detailed result form is required when a new instrument is ordered, please order 00880945. Test Certificate for Function Test, including factory-installed options Including detailed result form. Only available if ordered at the same time as the instrument.		
 012006XX 012007XX 012008XX 012010XX 015941XX 015942XX 015943XX 012004XX 012005XX	**Optional Optical Modules for CMA 3000 Ethernet** 10 Gbps optical module SR/SW (850 nm), LC connector 10 Gbps optical module LR/LW (1310 nm), LC connector 10 Gbps optical module ER/EW (1550 nm, 40 km), LC connector 10 Gbps optical module ER/EW (1550 nm, 80 km), LC connector 1 Gbps 850 nm (SX) (one module), LC connector 1 Gbps 1310 nm (LX) (one module), LC connector 1 Gbps 1550 nm (ZX) (one module), LC connector 100 Mbps optical module FX (1310 nm MM), LC connector 100 Mbps optical module LX (1310 nm SM), LC connector Note: XX = 00 Factory installed XX = 90 Field installed. Please specify serial No of the target instrument		

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Model/Order No.	Name	Required Basic Software	Required Order No.
	Single Fiber Cables for Optical Modules		
01460198	Cable, optical, singlemode LC/PC to SC/PC, 3 meter		
01463190	Cable, optical, singlemode LC/PC to Radiall VFO/straight, 3 meter		
01463298	Cable, optical, singlemode LC/PC to FC/APC, 3 meter		
01463390	Cable, optical, singlemode LC/PC to DIN47256, 3 meter		
01463498	Cable, optical, singlemode LC/PC to FC/PC, 3 meter		
01463598	Cable, optical, singlemode LC/PC to E-2000/PC, 3 meter		
01463698	Cable, optical, singlemode LC/PC to E-2000/APC, 3 meter		
01463798	Cable, optical, singlemode LC/PC to ST/PC, 3 meter		
01463898	Cable, optical, singlemode LC/PC to LC/PC, 3 meter		
01468990	Cable, optical, multimode LC/PC to SC/PC, 3 meter		
01468890	Cable, optical, multimode LC/PC to LC/PC, 3 meter		
	Dual Fiber (Duplex) Cable for Optical Modules		
01474398	Cable, optical, singlemode LC/PC to LC/APC, Duplex, 3 meter		
	Optical Attenuator		
01463990	Optical Attenuator 10 dB LC/PC to LC/PC		
	Option: FrontSim for CMA 3000		
083101YY	FrontSim for CMA 3000		
	Option: Remote Control – Scripting for CMA 3000		
083384YY	Remote Control – Scripting for CMA 3000 YY=00: Instrument part factory installed; documentation delivered on CD-ROM YY=50: Field installed by customer; Instrument part delivered by E-mail; YY=90: Field installed by customer; Instrument part delivered on CD-ROM YY=95: Field installed by customer; Instrument part delivered on both CD-ROM and USB memory stick;		
	SW Delivery Options When ordering field-installed SW options and protocols, one of the delivery options below must also be ordered.		
08399990	SW is delivered on CD-ROM		
08399995	SW is delivered on a CD-ROM and on a USB memory stick		
08399950	The SW is delivered via E-mail. Please specify recipients E-mail address.		
	SW Options for CMA 3000 Ethernet		
083386XX	10 GigE WAN Information on serial number of the 10G module of 005311XX is required if post installed		
083089XX	IP over Ethernet channel statistics		
083399XX	Ethernet Service Activation Test (Y.1564) option	V4.20 or higher	
083401XX	Synchronous Ethernet Test option	V4.30 or higher	
083333XX	Ethernet Multistream option		
083377XX	Ethernet Stacked VLAN option		
083378XX	Ethernet MPLS option		
	VoIP Call Emulation SW Options for CMA 3000 Ethernet		
083354XX	Basic VoIP Functionality option		
083355XX	SIP call emulator option		083354XX
083357XX	H.323 call emulator option		083354XX
083356XX	Voice quality measurement option Note: XX = 00 Factory installed XX = 90 Field installed by customer. Please specify serial No of the target instrument		083354XX 083355XX or 083357XX
	CMA 3000 Ethernet Software Kits for Updating to Latest Release		
083395XX	WLD Please specify serial number of target instrument XX=90: The SW is delivered on a CD-ROM XX=95: The SW is delivered on a CD-ROM and on a USB memory stick		
	Miscellaneous		
07030599	Carrying Case - Full Size		
070306WW	Softbag WW = 90: When ordered separately. WW = 99: When ordered together with an instrument.		
09108700	CMA 3000 Ethernet User's Guide (Latest Release)		
84704100	USB Memory stick (2 Gbytes)		
01200100	Li-Ion Battery		
97600800	Stylus for Touch Screen		
07030000	Instrument Carrying Strap		
0753102Y	Stand-Alone Charger for Battery including Mains Adapter Y = 0: Europe - includes power cable 01453098 Y = 1: Australia - includes power cable 01453198 Y = 3: UK - includes power cable 01453298 Y = 4: USA - includes power cable 01453398		
01592500	Car 12 Vdc adapter for CMA 3000		
07530010	Telephone Set		
01475990	Cable, GPS adaptor for CMA 3000 Requires that 083399XX Ethernet Service Activation Test option is installed	V4.20 or higher	083399XX

MONITORING/SERVICE ASSURANCE

MasterClaw.. 189

SERVICE ASSURANCE PLATFORM
MasterClaw

Introduction

Network operators and service providers offering wireless (LTE), fixed line or VoIP services, are all confronted by the same basic challenges, namely how to optimize the profit by reducing the investments and operational expenditures, while securing customer satisfaction. New technology has enabled the introduction of new services, but at the same time as it provides a means of achieving differentiation, the new technology has in most cases also implied increased complexity and increased operational costs.

To support operators and service providers achieving competitive advantages, Anritsu has developed a set of integrated OSS service assurance solutions allowing operators and service providers to become uniquely competitive in the marketplace. Each of the solutions has been designed to maximize the profitability of the existing services and infrastructure, while reducing the cost of operation.

The underlying framework for the OSS solution portfolio is Anritsu's service assurance platform MasterClaw™.
Anritsu Service Assurance solutions build on many years of experience in network management, working with fixed and mobile network operators around the world. Our award-winning network monitoring systems are optimised to assist and support many technical and business functions. We offer solutions to provide full end-to-end monitoring of converged networks for LTE, IMS, UMTS/HSPA, GSM, GPRS, SS7 and VoIP.

Signaling and user plane data captured by the distributed intelligent MasterClaw probes is turned in to critical business and operational information available to the users in both real-time and via comprehensive reports.

MasterClaw integrates performance monitoring, troubleshooting as well as service and customer experience monitoring. Using MasterClaw benefits network operations, marketing, customer care, engineering and quality departments as well as providing network and service KPIs to C-Level executives. The integrated Service Assurance environment enables network operators and service providers to monitor their network as a unified service platform as opposed to treating each service and network segment as a separate entity.

MasterClaw System Overview

As an integrated service assurance solution, MasterClaw provides operators with reliable monitoring of network and services in a common platform. Integration of monitoring ensures all areas are monitored as part of an integrated system. This provides interworking analysis, as well as in-depth perspective on key services.
For wireless operators this implies an integrated monitoring of not only the circuit switched and packet switched core domains, but also the RAN/UTRAN/LTE access network domains. Likewise, VoIP service providers can benefit from an integrated monitoring that can be extended to the legacy SS7 network domain and all the way to major enterprise customers, or even residential users.

The MasterClaw system architecture is an open three-tired architecture based on distributed intelligence providing a truly reliable and scalable solution. The three levels in the MasterClaw architecture are:

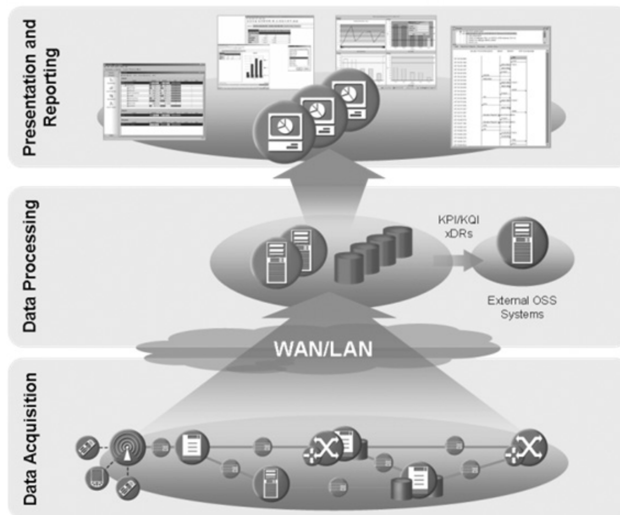


Figure 1: MasterClaw's Distributed System Architecture

The Service Assurance applications within the MasterClaw framework build on the data feed from the non-intrusive monitoring probes deployed in the network. Advanced Call- and Session Trace and Protocol Analysis applications are together with real-time dashboard graphs and traffic monitoring applications vital tools for operational personnel managing the network infrastructure.
In addition to these network-related applications MasterClaw offers state-of-the-art data warehouse capabilities that turn network data in to business critical information for operators and service providers. A combination of real-time applications and historical reporting offers an integrated quality of service monitoring universe, joining the network resource perspective with the service, customer and partner perspectives.

KPIs and aggregated KQIs are reported via an intuitive and personalized real-time Web interface, and as comprehensive reports. The KPIs and KQIs represent well defined service quality measurement points on which both internal and external Service Level Agreements (SLA) may be defined.

With its outset in the low-level signaling data and user data captured in the network, MasterClaw offers its users full drill-down- and drill-up capabilities. This allows users via call trace diagrams to drilldown to individual signal messages or message data (Protocol Data Units - PDU), having identified an abnormality in a real-time graph or in an alarm, by just a few mouse-clicks.

The non-intrusive probes enable operators and service providers to monitor converged multi-vendor networks, without any dependency on any one network equipment vendor. In fact, the network signaling is the only reliable reference point and common denominator when troubleshooting or monitoring the performance of heterogeneous networks. This only becomes more obvious when monitoring converged networks and performing end-to-end monitoring across different network domains.

MasterClaw is built on open technologies, thus simplifying integration with other OSS system, regardless whether it is a question of a northbound integration to a Fault Management system, export of xDRs for e.g. billing verification, export of KPIs/ KQIs for SLA management, or integration of customer definitions from CRM systems.

Data Presentation and Reporting Layer

Users access the MasterClaw system via a secure Web interface where the browser based MasterClaw Portal provides the user with a quick and integrated access to all applications, and real-time graphical overview of the network and service performance. The application launcher gives single sign-on access to the MasterClaw applications available to the individual users. Advanced administration capabilities allow the system administrator to assign user privileges per individual users.

The dashboard area of the MasterClaw Portal may be configured to provide an at-a-glance overview of network and service performance by selecting the most relevant KPIs, trend graphs, and alarm. The possibility to personalize the MasterClaw Portal drastically simplifies the access to the information provided by the system, allowing different user categories to optimize the user interface and information set for their particular needs.

Figure 2: User Configured Portal – Dashboard Elements

As all applications are browser based, MasterClaw may be accessed from anywhere using any ordinary workstation.

• Operation and Maintenance Utilities

To reduce the cost of ownership and minimize the need for system administration, MasterClaw includes a wide array of system utilities for operation and maintenance purposes of the actual MasterClaw system. Among the more important tools is a set self-monitoring and diagnostic tools for surveillance of all aspects of the monitoring solution.
In addition to the self monitoring functions, MasterClaw maintains a full system log that records any changes made to the system.
And the system of course also includes a security monitoring feature, prohibiting unauthorized configuration changes, and misuse of end-user sensitive data.

Being based on Oracle DB technology, MasterClaw's Data Warehouse (DWH) platform comes with a set of Oracle native system utilities for management and administration of the DBs.

Data Processing Layer

The processing layer contains a set of server applications required to collect, correlate and aggregate the preprocessed raw data captured by the distributed probes. Representing a limited segment of a call, CSDRs collected by the individual probes are correlated for complete data record (xDR) generation.

Dedicated server applications facilitate fundamental and mission critical troubleshooting applications as well as real-time network and service monitoring functions. Hence, there are servers hosting applications for call and session tracing, protocol analysis, real time traffic observation, alarm management and other central applications.

• Integrated Service Assurance Data platforms

The hub for MasterClaw integrated network, service, customer and partner service assurance solution is an advanced data warehouse (DWH) solution based on state of the art high-performance Oracle technology. Through sophisticated correlation mechanisms MasterClaw turns the raw network data, i.e., the correlated data records, in to valuable operational and business information focusing on the network, service, customer and partner dimensions.

In addition to the data warehouse, the eoLive platform presents real-time data modeling for high granularity statistical data.

Through flexible definition of data models and correlation, data and KPIs are available in an instance, with drill-down capability for analysis of the underlying dataset.

Both platforms support definition of alarm thresholds for any single KPI or aggregated KQI with full integration with the MasterClaw Alarm Manager. The combination of rich data, correlation as well as thresholds capabilities enables definition and modeling of internal and external Service Level Agreements (SLAs) and real-time monitoring of these SLAs. Although the passive MasterClaw probes are the main source for the information, data from other sources may be incorporated as well.

• Integration with External OSS Systems

MasterClaw also serves as an important source of signaling based information for a number of other OSS systems, including other Service Quality Management systems, CRM and SLA management systems, etc. Data exported include different types of event based data records (xDR) as well as network, service and customer related performance statistics (Key Performance Indicators).

A number of different technologies can be used integrating MasterClaw with other OSS systems, including Web Services and Service Oriented Architecture (SOA).
Anritsu is also a supporter of the OSS/J initiative and any KPI or KQI information can be propagated to external OSS, such as revenue assurance, fraud- and security management systems via open APIs. Also non-OSS related applications such as location based services, tracking services etc. can be served.
Additionally, network performance metric or correlated service quality alarm, handled by the alarm manager, can be exported northbound to accommodate integration with traditional fault management systems.

Data Acquisition Layer

• SW Architecture – Distributed Logic

The non-intrusive probes that MasterClaw uses for data capture are based on unique and highly modular software architecture that can be deployed in a set of fl exible HW platforms. Dependent of configuration the probes can be used for capturing and monitoring of one or more types of transaction data:

- Connection and session related signaling
- User plan sessions

As the collected data may be ciphered or contain temporary identities, such as TMSI (Temporary Mobile Subscriber Identities) in wireless networks, distributed deciphering logic and distributed translation logic plays a vital role for the real-time normalization of the collected information.

To facilitate real-time monitoring, protocol statistics, alarms and other relevant information is available to the server applications instantaneously. With measurement data stored locally in the probes it is possible to accumulate large amounts of historical data. Signaling data pertaining to events – such as PDP contexts, ISUP calls, TCAP transactions or SIP Invites – are available for troubleshooting long after an event or chain of events has occurred.

• HW Architecture

MasterClaw uses a set of different HW platforms for the probe applications, dependent on the type of network it is deployed in, to ensuring optimal performance and minimum CAPEX for the MasterClaw monitoring solution.

This allows Anritsu to provide a cost efficient probe solutions for converged networks, that virtually supports any network technology via the wide range of link units such as 10/100/1000 Mbit/s Ethernet, 1/10 Gbit/s Optical Ethernet, E1/T1 ATM or TDM, STM1/OC3 SDH/SONET, E1/T1 Frame Relay etc. and with upcomming support for 40GE. Probes are not traffic specific and can be combined in groups or in parallel if needed. This provides flexibility, scalability and full investment protection. The true workhorse of the Anritsu data acquisition is the Ethernet/IP probes and processing units based on high performance commoditiy servers. This ensures low cost of acquisition and low maintenance cost.

• High Reliability – High Scalability

As service providers rely more and more on high availability of their signaling system, robustness of the monitoring system becomes a factor. Thanks to the distributed architecture, MasterClaw accomplishes this requirement: Unexpected component failures in one part of the network (even on the same site) will not affect the remaining components because inter-probe communication is not used. To further enhance the system availability, redundant servers, timely backups and database replication is an option for any MasterClaw deployment. This distributed system architecture not only makes the solution extremely fast and reliable, it is the very key to the high scalability of the solution, as there is no one critical central component that becomes bottleneck in the solution.

The OSS Application Suite

The secret behind Anritsu's unique service assurance solution is the seamless integration between traditional network monitoring and troubleshooting applications on one hand, and the advanced service quality monitoring solutions on the other. As a part of Anritsu's overall OSS solution portfolio, MasterClaw provides a set of powerful and intuitive applications.

Network Troubleshooting

• eoFinder suite

The introduction of new technologies and new services has dramatically increased the operational complexity of both wireless and fixed-line networks; this to a degree where it has become essential to have fully integrated end-to-end troubleshooting tools. MasterClaw offers such end-to-end call and session tracing capabilities for both wireless networks and converged fixed-line networks.
MasterClaw eoFinder suite is built to meet this requirement. It is a collection of essential trouble shooting tools assembled in a unique common GUI framework. The eoFinder suite includes

eoFinder Trace	Call and session trace functionality
eoFinder Browse	Store and browse data records with long retention time and fast query response for customer complaint investigation.
eoFinder Capture	Caprure raw data from IP interfaces on the probe for analysis with external tools as Wireshark.
eoFinder Inspect	Low level protocol analysis of PDUs

• eoFinder Trace

In a complex UMTS network scenario MasterClaw can perform circuit and packet domain traces of mobile originating and terminating calls as well as SMS and PDP context activation and deactivation. This includes traces within the access or core networks and even traces across multiple interfaces, including the UMTS radio access network and the PSTN or ISP domains.

Due to the unique system architecture with the local data storage in the probes, calls and service sessions can inherently be traced in real-time and historically using the captured network data. Advanced filtering functions allow for tracing on individual parameters inside a dialogue, essentially making the eoFinder Trace application to a signaling procedure investigative application as well, that greatly easing debugging and fault analysis. As both CSDR (partial CDRs) and PDUs are stored and maintained in the MasterClaw's probes (see Figure 3) users can drill down in to individual PDUs directly from the eoFinder Trace application.

• IP Service Troubleshooting

To allow for efficient analysis and debugging of wireless data services the eoFinder Trace application has an extension for analysis of IP service session on user plane level over the Gn and Gp interfaces. The extension, the IP Service Troubleshooting Tool, provides complete visibility of data services by providing detailed indicators on IP flows and TCP connections on per user session. It also correlates the user plane service performance indicators, with related signaling messages.

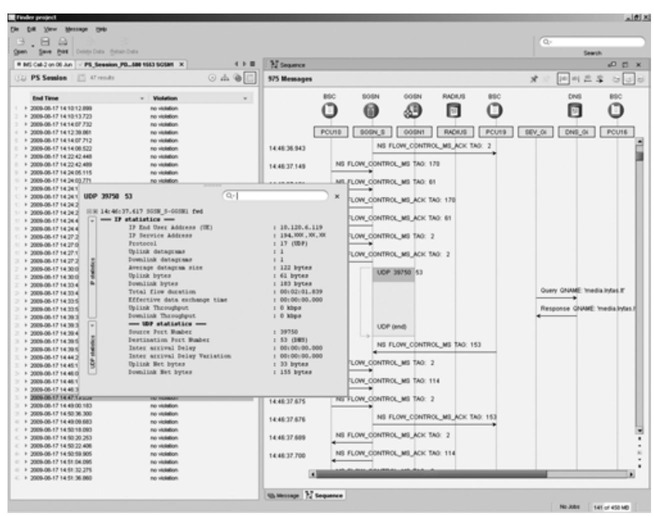


Figure 3: IP Service Troubleshooting with User Plane Tracing and Statistics

IP Service Troubleshooting tool integrates IP flow statistics in the eoFinder Trace application. Several indicators are provided for each IP data flow exchanged by all active GPRS and UMTS customers. Dedicated indicators are available for standard IP flows, TCP, UDP, WTP transport protocols and HTTP, WSP, MMS, POP3, SMTP and FTP services.

eoFinder Capture

In case of special needs, also a dedicated data capture feature allows for advanced captures of the datagram's that can be used for detailed troubleshooting and analysis of individual user's IP service sessions. The capturing filter possibilities include:

- End user address (IP)
- IMSI
- MSISDN
- Any advanced pcap filter to be applied at the transport IP level or within the GTP tunnel (user data level)

• eoFinder Inspect

The MasterClaw eoFinder Inspect application is a multi-user and multi-protocol systems tool used for seamless protocol decoding of historical and real-time PDUs. When performing protocol analysis, the user simply selects the links on which the application shall be applied and the system starts displaying the messages for those links. The different protocol layers are presented according to the ISO/OSI model and messages from different links or different protocol layers can be displayed with different colors in the monitor window with color schemes being user configurable.

• eoFinder Browse

eoFinder Browse is an ideal tool for handling customer complaints. Long data storage ensures that relevant information is available even after months of the original event. Reported failure causes can easily identify the nature of the problem.

eoFinder Browse is the natural step between high level KPI analysis and detailed Call Trace trouble shooting. After an issue has been detected with real-time monitoring tools, the application can be used to investigate the issue further. Comprehensive filtering capabilities help to nail-down the problem speeding up the whole troubleshooting process further.

• Real-Time- vs. Analytical Monitoring

There is no question that information critical to the overall operation, but what is more powerful; instant real-time insight into the network and services performance, or the ability to analyze customer usage patterns, level of service measured over contract periods or getting reliable network load figures to base next network extension decision on? Anritsu believes both aspects are equally important, and that's why MasterClaw combines advanced real-time monitoring with advanced data-warehouse functionality.

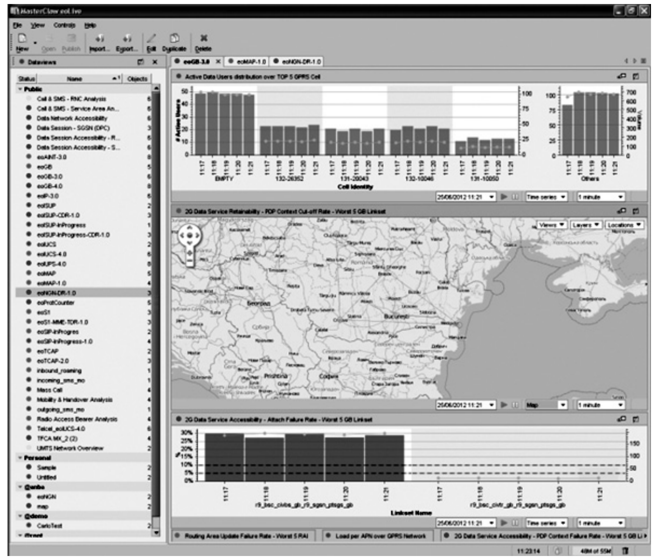


Figure 4: eoLive Provides Real-Time Overview of the Network and Service Performance

eoLive is a real-time dashboard application where users can configure charts to display the Key Performance Indicators (KPIs) of interests.
Visible performance is a precondition for the proactive prevention of network performance problems, moreover troubleshooting capabilities are required to locate rapidly faults.
eoLive supports tasks of first and second level Service Management Center (SMC) or Network Operations Center (NOC) personnel. These include monitoring of wireless (e.g GSM/GPRS/ UMTS) access and core networks, and fixed-line services Operating with self-adjusting alarm levels that considers busy hours, weekends, holidays, allows operational personnel to immediately detect abnormalities in the network load, quality of service, and the general performance and hence take action on network problem before they affect the end-user services.

MasterClaw Insight

MasterClaw Insight is an analytical operations- and business intelligence tool that is an optional add-on to MasterClaw. MasterClaw Insight provides an interactive analytical support that apart from four main operational domains: Network, Service, Customer and Partners (c.f. Figure below), also covers Device centric analysis.

Supported by MasterClaw's rich data warehouse infrastructure, Insight provides advanced analytical reporting capabilities. Integrated drilling capabilities and predefined workflows, guide the user through the analysis, which optimizes root-cause analysis process. Conditional formatting, smart filtering and sorting functions allow users to faster interpret a report, and find relevant information.

Advanced report scheduling and distribution features simplifies the information access as information can be pushed to relevant users, rather that each and single user manually requests a report.

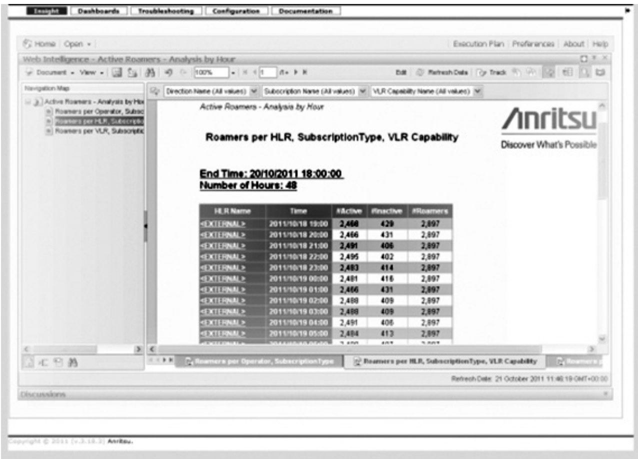


Figure 5: MasterClaw Insight has an Intuitive User Interface with Interactive Clickable Reports

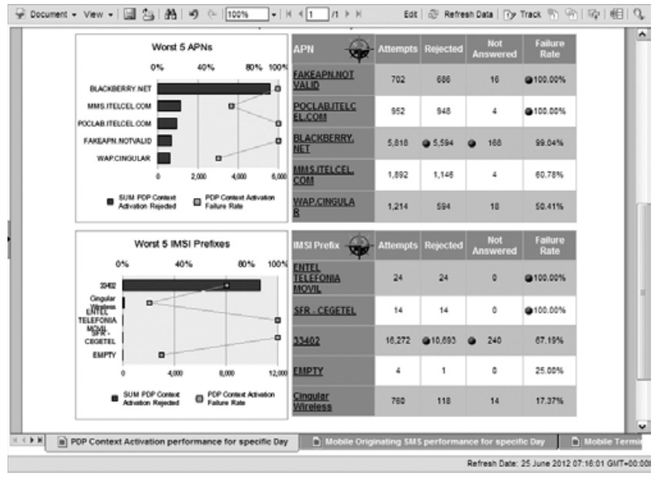


Figure 6: PDP context activation performance

The predefined dashboard objects allow for immediate drilldown from the MasterClaw dashboard in to related reports. Each Insight application package includes:

- A set of predefined reports
- Predefined workflows
- Predefined MasterClaw dashboard objects and alarms

• Network Quality Monitoring

With its outset in the actual network topology and service provisioning infrastructure, the Network Quality Monitoring area provides a set of KPIs for both network operational purposes as well as network planning purposes. Detailed statistics on link and message level allows for location of network bottlenecks, faulty network segments and general load and resource utilization. Thanks to the flexibility on probe level, the monitoring can be made across different technology domains, such as traditional ISUP and SIP as well as wireless network technologies.

• Service Quality Monitoring

Service Quality Monitoring represents the first level of data aggregation. Instead of focusing on the transmission performance, the perceived end-user quality and the performance of different discrete services is in focus. As discussed above, the perceived end-user quality is a combination of several individual quality measures. Only by combining these it is possible to understand the end-to-end perceive service quality. Different KQI reports exist for different services such as voice, MMS, GPRS, etc.

Apart from providing valuable service quality information, the service reports also provide important performance metrics vital for the management and optimization of the service portfolio. Based on the reporting provided by MasterClaw, operators and service providers can get a clear overview of the usage profile of different services, with respect to usage volume, basic usage profile (time of day, day in week, etc) and advanced usage profiles where parameters such as user profile, handset type (based on IMEI) and location may be taken into consideration. These reports provide critical business intelligence that can be used to monitor the effect of advertising campaigns or price adjustments, identification of real target groups, or general optimization of the service portfolio.

• Partner Performance Monitoring

Dedicated KPIs and KQIs allows for monitoring of roaming partners, interconnect partners and partners providing content and services. These reports are the base for SLA follow-up in relation to the underlying agreements, and provide important documentation negotiating new agreements. Strict follow-up on partners' performance not only raises the level of service for the customers, but it can dramatically reduce the operational expenses.

• Access Monitoring - eoCompass

Monitor, troubleshoot and optimize your 3G radio access network with MasterClaw eoCompass.
Your engineers, planners and optimizers can have the whole radio network on their desktop; all the KPIs they need: radio quality, traffic levels, trends, quality of service, device types, updated in real time and archived for analysis. Problems can be subjected to detailed analysis, down to examining the changing radio performance during an individual call.

Our radio experts understand your requirements. Anritsu has been providing radio analysis tools for over a decade. With eoCompass, you continuously capture real customer's activity directly off the network. Unlike drive testing, there is no disconnect from test calls to actual customer experience.

• eoPath GRQ

Roaming traffic is a low percentage of the entire network traffic, but a significant profit contributor. As providers are pressured more and more on creating profit from network traffic, roaming is getting more attention. You simply cannot risk that your revenue is affected by the poor performance of your roaming partners. The GRQ framework ensures that you have the most reliable, industry standard metrics to monitor and optimize the performance of your roaming partners.

The GRQ framework, initiated by the GSMA has a set of KPIs for voice, data and SMS, which enable providers to formulate standard SLAs (Service Level Agreements) between each other. Having standard SLAs enable adherence to predefined QoS KPIs.

The GRQ framework includes all the QoS parameters for SMS, voice and data that can be extracted from passive probing. eoPath GRQ is GSMA compliant.

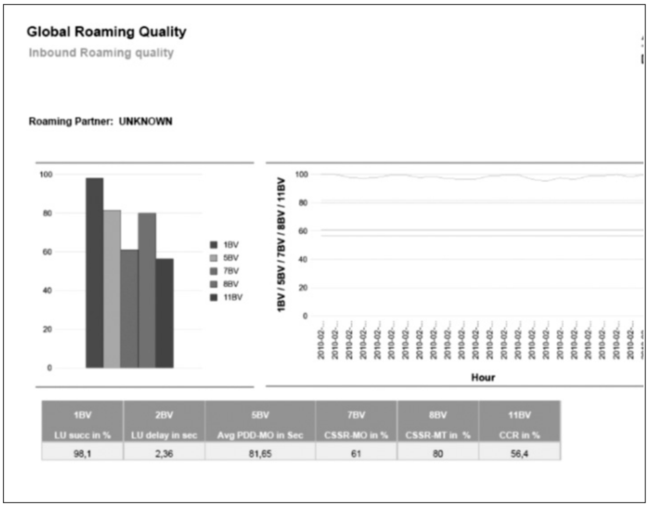


Figure 7: Roaming Quality

MasterClaw Data Record Gateway

Anritsu's Data Record Gateway offers unmatched flexibility in terms of configurability, comprehensive protocol and network technology support enabling mediation of value added data records towards fraud systems, billing verification platforms, service quality monitoring as well as MasterClaw data warehouse solution.

In a business environment where, among other, the use of wireless technologies along with IP based services keeps increasing the demand for revenue and service assurance systems. Those demands are fuelled by several facts.

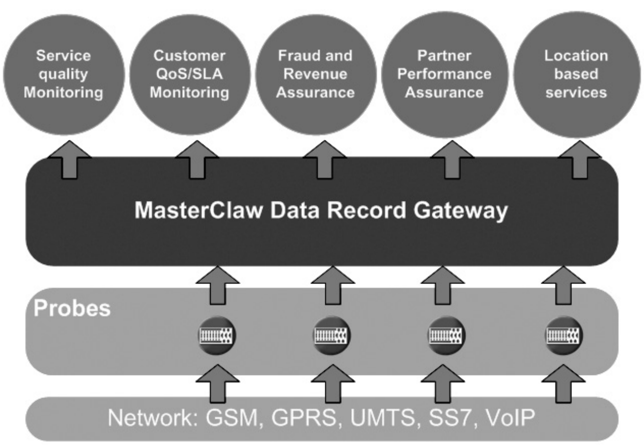


Figure 8: MasterClaw Data Record Gateway

Service Intelligence

Our service management product suite offers a range of eoPath applications to provide your entire organization with an unparalleled overview of your network and services. We help you reduce operational costs, improve service quality, manage partners and reduce churn. We refer to it as Service Intelligence.
eoPath provides an instant view of your service operation and the experience your customers have with your services. It gives you access to workflows, analytical reports, and SLA management to help you improve your service quality, allowing you to realize the potential in your converged network and services.

- **Customer Experience Management – eoPath A-CEM**

Operators are facing heavy competition. They need to be fast and smart to defend their business and generate new revenues to compensate the decreasing margins of current business. Customer insight is the key. The starting point is good, since operators have huge amounts of data in various technical and business databases. However, even though the data contains valuable business insight, it is often too slow and laborious to mine.
eoPath A-CEM (Advanced CEM) provides relevant information on operators' customers, their behavior, and the quality of service within minutes anytime. The application answers to questions such as who is using, what services, how much, where, when, on which device – and what is the actual quality of service provided to customers. The information is available in a previously unseen way, which allows users to drill down to information from any angle on a few mouse clicks within minutes anytime.
The application is designed to provide accurate and up-to-date answers to operators' key business questions. Advanced CEM allows users to view the living business from all relevant angles with the required level of detail: customer segment, demographics, ARPU, device, service, trends and problems, just to name a few.

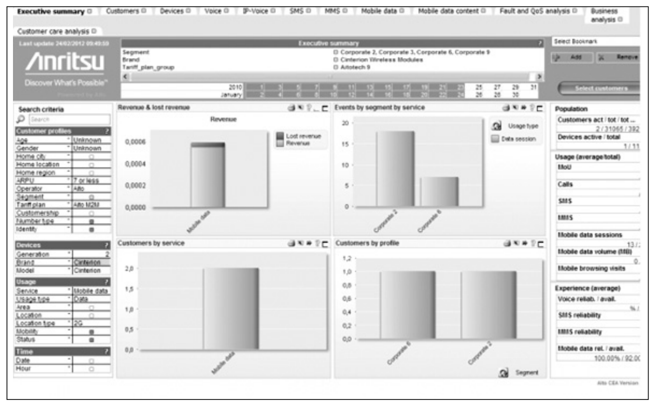


Figure 9: Executive Summary

Typical eoPath A-CEM users:

- Top management to get an easy access to full and up-to-date picture of their business
- Product managers to understand the usage patterns, trends, and cause & effect among customers, devices and services
- Segment managers to get insights into their customers, as well as their interests, dislikes, usage, and customer experience
- Sales and marketing managers to plan targeted activities to customers, and to easily measure the success of those activities
- Technical managers to understand and pinpoint reasons behind poor customer experience

- **Customer Care Interface - eoCCI**

Enabling you to build productive relationships with your customers, by providing the answers they need, is very important in your business to enhance the level of customer satisfaction.
The customer service experience can change the entire perception that a customer has of the organization.
Customer care agents, even non-technical experts, are helped to serve customers during the call with the purpose of reducing the number of escalated trouble tickets to more technical departments, while giving competent answers.

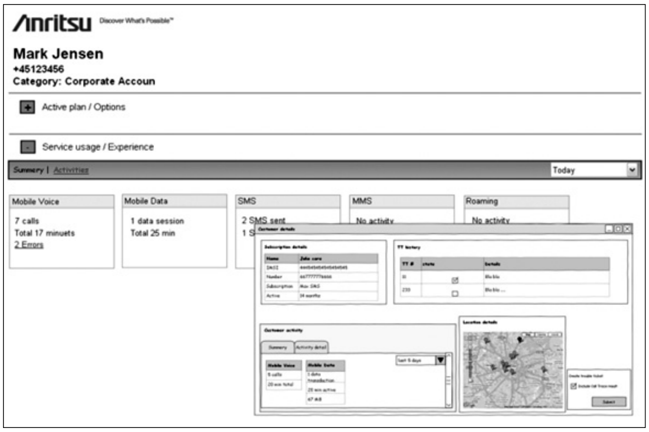


Figure 10: eoCCI Showing Subscriber Activity

eoCCI leverages on a flexible solution that enables usage as every MasterClaw application or integrated application into other systems. The Web service technology allows activity summary available into other application, so data can be embedded into existing customer care IT systems.

• Enterprise Centric Service Assurance – eoPath Enterprise
eoPath Enterprise puts key information in the hands of managers, by harnessing powerful analytical tools - almost in real-time - that monitor and manage the way enterprises experience your network services. This allows you to ensure that enterprise customers and VIPs get the service they need.

To offer an effective range of quality services, enterprises cannot be treated as monolith organizations made up of users with identical needs and user behavior. That is why eoPath Enterprise makes it possible to aggregate data and reporting on three levels: enterprise level, sub-groups/locations, and individual users. This enables you to optimize your dealings with individual user groups, such as senior management, sales, and service personnel that travel frequently and individual users for real-time alarms and dashboards, as well as reports.

• Cross-Organizational Focus – eoPath Insight
eoPath Insight offers a unique combination of near real-time visibility of your service, partner and network performance, and a set of powerful analytical capabilities. Its workflow definitions help you integrate Insight across your organization. This means that various parts of your organization have access to the same data, but with optimized views for each specific user's needs. This allows for cross-departmental workflows and sharing of information, which enable you to reach the right decisions quickly and accurately.

Near real-time dashboards and intelligent reports allow users to focus on important information so results are gained quickly and the risk of errors and misinterpretation is minimized. Thanks to eoPath's unique data richness, potential service problems can be instantly analyzed by drill-down to underlying data and individual data records if needed.

• Device Centric Service Intelligence – eoPath Device
A user's service perception is the sum of often very complex value chains. It is no longer enough to optimize the central network components without considering the device aspect. eoPath Device is a device-centric Service Intelligence application that allows wireless service providers understand service performance characteristics, and ensures seamless service operation across device platforms.
eoPath Device also provides intelligence about the devices used by own users and roaming users. The Device Tracker enables marketing and product management to gain an understanding of the devices used, and track subsidized handsets.

- Helps 3G service providers to manage increased device complexity and openness
- Device centric service intelligence provides marketing and product management with important intelligence on service usage per device type
- Pinpoints specific service, device interoperability issues and enables proactive resolution
- Provides vital intelligence for device vendor management
- Offers intelligence on what devices your subscribers are actually using

Business Value Services (BVS)

Anritsu's (BVS) Services enable customers to improve their business by optimizing the cost and increasing the Revenue and Customer loyalty. This can be achieved by maximizing the return of investment of Anritsu standard products and enabling the provisioning of valuable information driving customer business decisions.

Anritsu's Business Value Services (BVS) department will assist you in a number of different ways depending on your needs:

• **Training:** Get the most out of MasterClaw. Learn shortcuts, best practice and techniques to get the info you need when and use it to take the right decision

• **Customization:** Extend MasterClaw platform for your specific need. BVS will deliver for you ad-hoc KPIs for near real time monitoring and historical analysis, end to end Call Trace scenarios

• **Support to NOC:** Work together with your experts in order to get the most from your MasterClaw system

• **System Integration:** A quick and efficient integration of your Network Monitoring System

• **Business Consultancy:** Let Anritsu pinpoint your network's weaknesses, strengths and uncover hidden potential. Our consultants will provide you recommendation on your business optimization

• **Managed Services:** Focus on your business and allow Anritsu to manage the MasterClaw system. Outsource all admin and maintenance functions to us ensuring highest availability

MOBILE/WIRELESS COMMUNICATIONS MEASURING INSTRUMENTS

Selection Guide 197
Signalling Testers 198, 244
Fading Simulator 206
W-CDMA Signalling Tester 212
Protocol Test System (PTS)/
Protocol Conformance Test Toolkit 220
Rapid Test Designer (RTD) 223
SUPL Simulation Server 228
UTRAN/LTE Mobile Device Test Platform 230
LTE RF Conformance Test System 234
W-CDMA TRX/Performance Test System/
W-CDMA RRM Test System 238
Radio Communication Analyzer 255
Universal Wireless Test Set 269
Shield Box 290
Vector Signal Generator 291, 313
Digital Mobile Radio Transmitter Testers 323, 334
Digital Broadcast Signal Analyzer 337
High Performance Handheld Spectrum Master ... 357, 379
High Performance Handheld Spectrum Analyzer 374
Spectrum Master 395
Cell Master 402
BTS Master 409
Bluetooth Test Set 418
Bluetooth Audio Test Set 426
WLAN Test Set 431
PIM Master™ Passive Intermodulation Analyzer 446
PIM Master™ High-Performance Passive
Intermodulation Analyzer 451
Link Master™ Air Interface Logging and
Analysis Tools 457

Mobile Communication Measurement Equipment

(example of an application; various other types of measurement equipment are also available)

Anritsu Model	Mobile Communication System																								Mobile Equipment			Base Station		
	LTE-Advanced	LTE (FDD)	LTE (TDD)	W-CDMA	HSDPA	HSUPA	HSPA Evolution	CDMA2000 1X	1xEV-DO	GSM/GPRS	EGPRS	TD-SCDMA	W-LAN (11a/b/g/n)	W-LAN (11p)	W-LAN (11ac)	Mobile WiMAX	Fixed WiMAX	*Bluetooth*	ISDB-T	DVB-T/H	MediaFLO	XG-PHS	AXGP	Advanced PHS	R&D	Manufacture	Maintenance/Service	R&D	Manufacture	Construction/Service
MD8430A Signalling Tester	✓	✓	✓																						✓					
MD8480C W-CDMA Signalling Tester				✓	✓	✓	✓			✓	✓														✓					
MF6900A Fading Simulator		✓	✓	✓	✓		✓																		✓					
MX785201A Protocol Test System (PTS)				✓	✓	✓	✓			✓	✓														✓					
MX785220A Protocol Conformance Test Toolkit		✓	✓	✓	✓	✓	✓			✓*1	✓														✓					
MX786201A Rapid Test Designer (RTD)		✓	✓	✓	✓	✓	✓	✓		✓	✓														✓					
ME7834A/ME7834L UTRAN/LTE Mobile Device Test Platform		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓														✓					
ME7873L LTE RF Conformance Test System		✓	✓	✓	✓	✓	✓	✓*1	✓*1	✓*1															✓					
ME7873F/ME7874F W-CDMA TRX/Performance Test System W-CDMA RRM Test System				✓	✓	✓	✓			✓*1															✓					
MD8475A Signalling Tester		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓													✓					
MT8820C Radio Communication Analyzer		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓			
MT8870A Universal Wireless Test Set		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓						✓				
MA8120E*2 Shield Box		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓						✓	✓	✓	✓			
MG3710A Vector Signal Generator	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	
MG3700A Vector Signal Generator	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	
MS2690A/MS2691A/MS2692A Signal Analyzer	✓	✓	✓*3	✓	✓	✓	✓	✓*3	✓*3	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓			✓	✓		✓	✓	✓
MS2830A Signal Analyzer	✓	✓	✓*3	✓	✓	✓	✓	✓*3	✓*3	✓	✓	✓	✓	✓	✓	✓		✓	✓						✓	✓	✓		✓	✓
MS8609A/MS8608A Digital Mobile Radio Transmitter Tester				✓	✓			✓	✓	✓		✓	✓												✓	✓	✓	✓	✓	✓
MS8901A Digital Broadcast Signal Analyzer																			✓									✓	✓	✓
MS2721B Spectrum Master		✓		✓	✓			✓	✓	✓		✓				✓	✓		✓	✓									✓	✓
MS2722C/MS2723C/MS2724C/ MS2725C/MS2726C Spectrum Master		✓	✓	✓	✓			✓	✓	✓		✓				✓	✓												✓	✓
MT8212E/MT8213E Cell Master		✓		✓	✓		✓	✓	✓	✓		✓				✓	✓		✓	✓									✓	✓
MT8221B/MT8222B BTS Master		✓	✓	✓	✓		✓	✓	✓	✓		✓				✓	✓												✓	✓
MT8852B *Bluetooth* Test Set																		✓							✓	✓				
MT8855A *Bluetooth* Audio Test Set																		✓							✓	✓				
MT8860C WLAN Test Set													✓												✓	✓				

*1: Measurement items for InterRAT Handover are available.
*2: Frequency range: 800 MHz to 2500 MHz
*3: Downlink/Forward link only

SIGNALLING TESTER
MD8430A

Remote Control
Ethernet

Early Support for Developing Next-Generation LTE FDD & TDD Chipsets and Mobile UEs

Mobile UEs are quickly becoming fast multimedia terminals due to widespread adoption of the LTE radio communications standard. The MD8430A Signalling Tester is a key LTE base station simulator for developing LTE-compliant chipsets and mobile devices. Using its extensive experience in 3G markets, Anritsu has developed the MD8430A as a powerful LTE protocol R&D test solution to help developers bring LTE terminals to market as fast as possible.

Key Features

- Early support for 3GPP LTE (FDD/TDD) Release 9 (MBMS, Positioning RS, Transmission Mode 8: Dual Layer Beamforming)
- Early support for Carrier Aggregation, which is a key feature of 3GPP LTE-Advanced (FDD)
- One MD8430A support 2×2 MIMO Intra-RAT handover and 4×2 MIMO with 300 Mbps (Carrier Aggregation) DL and 50 Mbps UL speeds
- Inter-RAT tests making effective use of previous MD8480C (UTRAN/GERAN), and MD8470A (CDMA2000) hardware investments
- Optimized investment from first R&D to protocol conformance testing
- Full development and analysis toolset cuts L1, L2, and L3 protocol tests time and costs

Main Applications

- Coding/Decoding tests (RF/baseband)
- Protocol sequence tests
- Throughput and stress tests (performance test)
- Intra-RAT/Inter-RAT performance tests
- LTE Preconformance/Conformance tests
- Network interoperability tests
- LTE network operator acceptance tests (CAT)
- Troubleshooting field test problems
- Terminal QC inspection

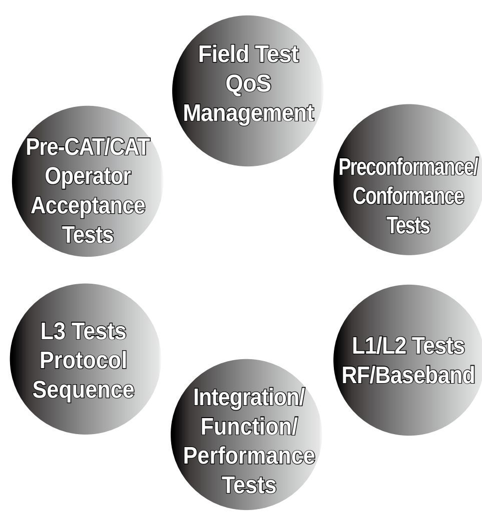
Main Test Functions

- LTE Intra-RAT performance test (Hard handover)
- LTE ↔ UTRAN/GERAN Inter-RAT handover test
- LTE/CDMA2000 Interoperability test
- Digital baseband slow clock test
- Protocol sequence analysis (Log analysis)
- Throughput monitoring
- UE Scheduling function (Time/MCS/Lowest RB/RB)
- H-ARQ Test (ACK/NACK/DTX)
- VoLTE Test (SPS, TTI Bundling, DRX, RoHC)

Basic Functions (LTE)

- Transmit Downlink (DL) signal
- Receive Uplink (UL) signal
- Call processing
- Transmit Power Control (TPC)
- Baseband interface
- Hard handover (HTM, STM, PTM)*
- 2×2 MIMO (MTM, STM, PTM)*
- 4×2 MIMO (PTM)*
- Encryption (option)

*: Please refer to Specifications of MD8430A Signalling Tester Models.



Supports Newest UE Categories

The MD8430A supports UE categories 1 to 4, 6 and will support all new future categories.
3GPP TS 36.306 V10.3.0 (2011-09)

LTE (DL)

UE Category	Maximum number of DL-SCH transport block bits received within a TTI	Maximum number of bits of a DL-SCH transport block received within a TTI	Total number of soft channel bits	Maximum number of supported layers for spatial multiplexing in DL
Category 1	10296	10296	250368	1
Category 2	51024	51024	1237248	2
Category 3	102048	75376	1237248	2
Category 4	150752	75376	1827072	2
Category 5	299552	149776	3667200	4
Category 6	301504	149776 (4 layers) 75376 (2 layers)	3654144	2 or 4
Category 7	301504	149776 (4 layers) 75376 (2 layers)	3654144	2 or 4
Category 8	2998560	299856	35982720	8

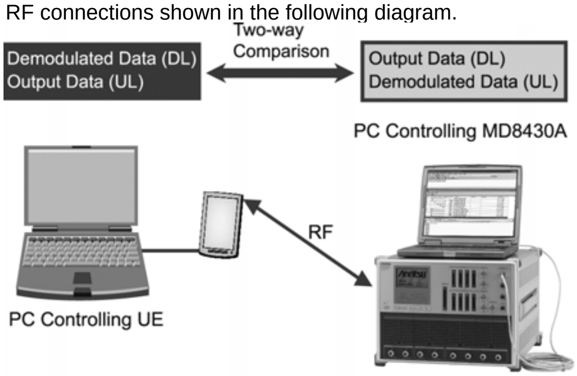
LTE (UL)

UE Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL
Category 1	5160	5160	No
Category 2	25456	25456	No
Category 3	51024	51024	No
Category 4	51024	51024	No
Category 5	75376	75376	Yes
Category 6	51024	51024	No
Category 7	102048	51024	No
Category 8	1497760	149776	Yes

For Developing LTE Chipsets and Mobile UE RF/Baseband Tests

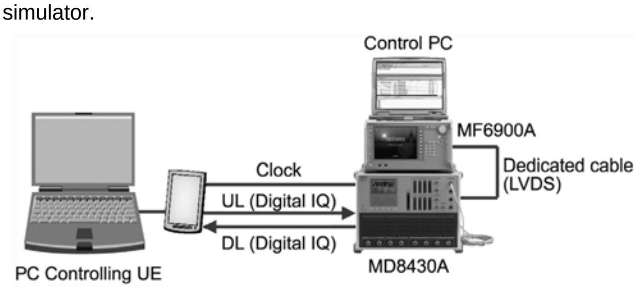
• Coding/Decoding Test

Coding/Decoding tests of LTE terminals are performed by making the RF connections shown in the following diagram.



Coding/Decoding Test Example (RF, Patch Test)

The MD8430A supports digital baseband I/O as standard functions. Using the baseband interface offers high-reproducibility coding/decoding tests free from the RF section, supporting stable evaluation of LTE chipset baseband performance.
Moreover, LTE coding/decoding tests are supported because the baseband chip can be evaluated using a slower clock than the clock frequency. And connecting the MF6900A Fading Simulator to the digital baseband interface supports slow clock evaluations in a fading environment, which are difficult to perform with an RF fading simulator.



Slow Clock Test Setup (Digital Baseband, Fading)

• Easy MIMO Test Configuration Settings

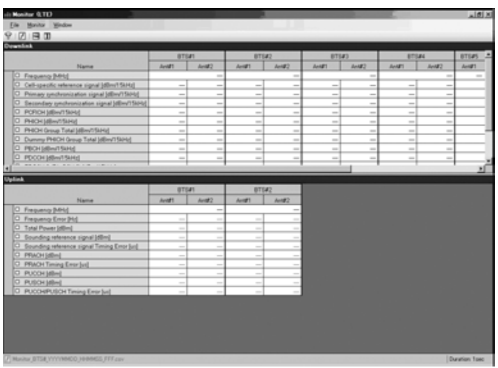
The MD8430A has 8 main and sub RF connectors as well as 8 digital IQ connectors as standard equipment for use with the MX843010A LTE Control Software to easily configure and monitor various settings, including RF parameters, channel power, MIMO, fading, connector selections, frame timing, BTS cell selections, etc.

Setup Screen Example

• **Fully Versatile L1/L2 Monitoring Functions**

The MX843010A software supports LTE development by processing large volumes of low-layer data at very high speeds using a full line of versatile power monitoring, throughput monitoring and log analysis functions. The Measure (Counter) functions can monitor Layer 1 and layer 2 throughputs in real time by counting parameter values such as ACK/NACK/DTX/CQI.

Measurement (Counter and Throughput) Screens



Monitor Screen Example

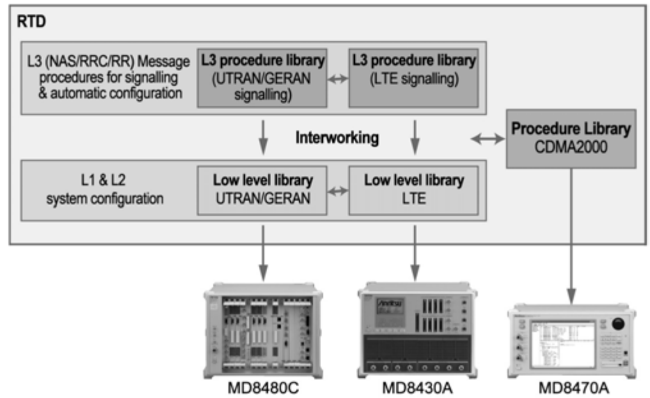
Complete LTE Protocol Test Environment

• **Intelligent Test Creation**

The MX786201A Rapid Test Designer (RTD) software tools gives users power to create tests that cannot be done with traditional language based tools. RTD Supports L1/L2/L3 testing using Lower Layer Configuration library and Layer 3 procedure library of UE development.
Moreover, each procedure auto-sets the connection with the lower Layers (L1/L2) based on full compliance with the 3GPP standards. RTD can simulater LTE↔UMTS InterRAT and LTE↔CDMA2000 Interworking.
The Reference Library test cases provides a reference to build the customized test cases and libraries with ease.

• **Cuts Test Case Development Time**

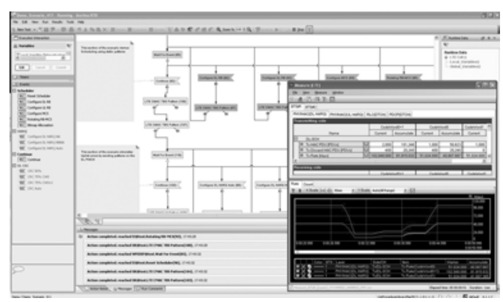
The RTD GUI offers intuitive test case creation by linking procedures with parameters, such as network conditions and message data, at easy-to-understand setting screens, quickly increasing the number of working test cases.
In addition, the Built-in Analyzer function checks for programming errors prior to testing, which can start immediately without recompiling after editing and changing settings.



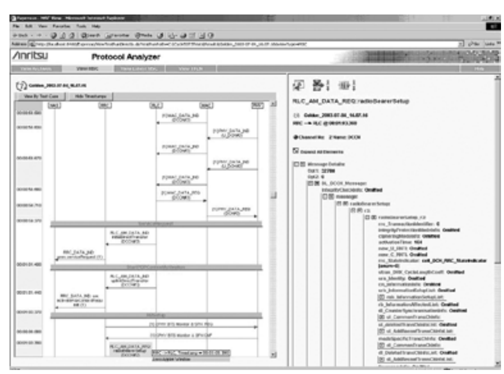
RTD Procedure Block

• **Flexibility in Testing & Analysis**

When the test finishes the execution, the RTD provides a preliminary judgment against predetermined criteria. This avoids the need to study complex message sequences and can show a test outcome explained in a local language. The Integrated protocol analyzer with RTD supports very detailed Message Sequence Analysis and provides a facility to export the Protocol Test logs in to HTML format which can be viewed at any PC with a Browser without a RTD license.



Test Execution Screen (RTD)



Log Analysis Screen (RTD)

Efficient UE Integration and Performance Tests

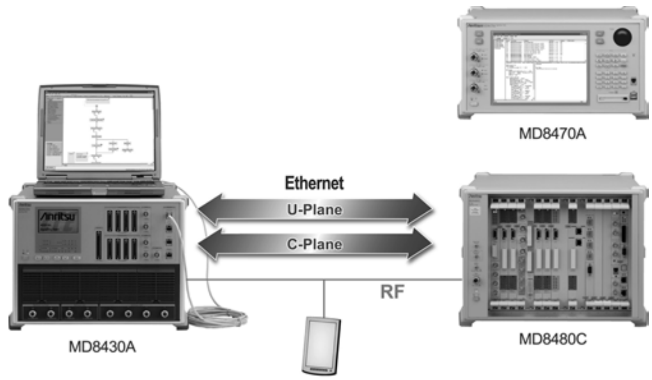
• Testing Throughput for Various Conditions

The MD8430A supports the latest UE categories with download speeds of 150 Mbps and uploads speeds of 50 Mbps.
The bundled sample scenarios make it easy to change parameters such as bandwidth, scheduling, HARQ, etc., for evaluating LTE throughputs under various conditions.
In addition, combination with the MF6900A Fading Simulator supporting LTE MIMO via the dedicated digital interface simplifies complex power control procedures for easy throughput testing in a fading environment with simple test setup.

Fading Setting Screen (MF6900A Fading Simulator)

• Handover Tests Optimizing Hardware Investment

The MD8430A supports up to six cells (two active cells) allowing handover tests between two LTE BTS with one tester. In addition, LTE-UTRAN/GERAN Inter-RAT handover tests are supported by connecting the MD8480C W-CDMA Signalling Tester. And the MD8430C is not limited to the globally dominant W-CDMA technology but also supports the HSPA/HSPA Evolution and GSM/GPRS/EGPRS technologies.
When combined with the MD8470A Signalling Tester, CDMA2000 interoperability tests (IOT) are supported too, maximizing support for both worldwide communications technologies and investment in hardware.



LTE-UTRAN/GERAN Handover Test Setup

Connecting three MF6900A units permits fading simulations for each of six cells.
∗ With LTE performance test model

Specifications of MD8430A Signalling Tester Models

Model/Name	MD8430A-010 LTE Function Test Model (FTM)	MD8430A-012 LTE MIMO Test Model (MTM)	MD8430A-014 LTE Handover Test Model (HTM)	MD8430A-020 LTE Standard Test Model (STM)	MD8430A-030 LTE Performance Test Model (PTM)
Interface	RF, Digital IQ				
Frequency Band	Max. 20 MHz				
UE Category	Category 1, 2, 3			Category 1, 2, 3, 4, 6	
Max. Data Rate (DL)	75 Mbps	100 Mbps	75 Mbps	300 Mbps*1	
Max. Data Rate (UL)	50 Mbps				
No. of Simultaneous Tx Frequencies	1		2 (2×2 MIMO), 4 (SISO)		
MIMO	No	2×2 MIMO	No	2×2 MIMO	2×2 MIMO, 4×2 MIMO
Max. No. of Base Station	Active + Adjacent BTS: 1 (Max. Active BTS: 1)		Active + Adjacent BTS: 4 (Max. Active BTS: 2)		Active + Adjacent BTS: 6*2 (Max. Active BTS: 2)
Hard Handover (inc. at MIMO)	No		Between same frequency and different frequencies		
Carrier Aggregation No. of Component Carrier (DL)*4	No			2*3	
Carrier Aggregation No. of Component Carrier (UL)*4	No			1*3	

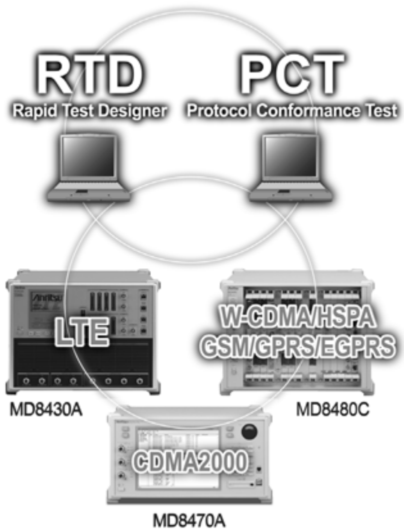
∗1: For Layer-1 testing; 150 Mbps for Layer-2 (or upper) testing.
∗2: For 4×2 MIMO, the maximum number of base stations is 1, the number of active base stations + number of adjacent base stations is 5.
∗3: The active base station is used as the component carrier.
∗4: Requires MD8430A-085.

Powerful Platform for Both Conformance and Operator Acceptance Tests

• Optimized Hardware Investment

A choice of five MD8430A models designed for early chipset and UE development, function tests, and performance tests ranging from carrier acceptance tests to protocol conformance tests as well as retrofit upgrades between models allows developers to tailor their hardware investment to current needs with future flexible upgrade options.

The Protocol Conformance Test Toolkit (PCT) with MD8430A and GCF/PTCRB approved TTCN test package provide an optimum environment for LTE protocol conformance testing. Hence, a Single Hardware Platform that extends its usage from Platform development to Conformance Testing and Operater Acceptance Test.



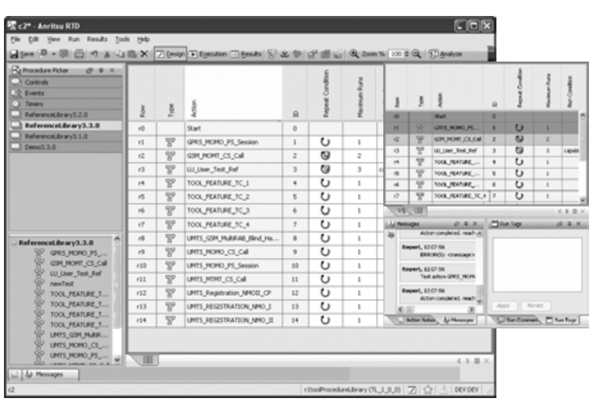
Full Line of Versatile L3 Analysis Tools

• Instant Firmware Switching

Because the MD8430A saves up to five firmware versions, the right firmware is selected easily at startup. There is no need to install/uninstall firmware when executing a test case that determines the firmware version.

• Powerful Automated Testing

The RTD software supporting the UE control interface makes it easy to setup automated test systems. Furthermore, multiple test cases can be executed continuously and test reports generated automatically, and many functions, including repeat testing under different conditions with multiple settings, can be automated, offering carriers, etc., an ideal turnkey solution for acceptance testing.



Example of Test Case Campaign

• Easy Test Case Maintenance

Test cases created by the RTD software can be updated easily when new 3GPP standard evolves, reducing the need for re-editing. In addition, guaranteed test case compatibility even when the MD8430A firmware version is changed removes the need to recompile, etc., resulting in greatly reduced costs for maintaining test cases to support regression testing when rolling out new terminals and performing pre-IOT to assure compatibility with network equipment worldwide.

Test Models/Options/Software

• Test Models

MD8430A-010 LTE Function Test Model (FTM)
MD8430A-012 LTE MIMO Test Model (MTM)
MD8430A-014 LTE Handover Test Model (HTM)
MD8430A-020 LTE Standard Test Model (STM)
MD8430A-030 LTE Performance Test Model (PTM)
Choose one of the above five models.

∗: Please refer to Specifications of MD8430A Signalling Tester Models.

• Test Model Upgrade

Required option when upgrading to higher order model.

Upgrade from Function Test Model (FTM)
Z1398A LTE FTM to MTM Upgrade Kit
Z1399A LTE FTM to HTM Upgrade Kit
Z1342A LTE FTM to STM Upgrade Kit
Z1344A LTE FTM to PTM Upgrade Kit

Upgrade from MIMO Test Model (MTM)
Z1401A LTE MTM to STM Upgrade Kit
Z1402A LTE MTM to PTM Upgrade Kit

Upgrade from Handover Test Model (HTM)
Z1403A LTE HTM to STM Upgrade Kit
Z1404A LTE HTM to PTM Upgrade Kit

Upgrade from Standard Test Model (STM)
Z1343A LTE STM to PTM Upgrade Kit

• Options

MD8430A-002 Extended Frequency Range to 3.8 GHz
Required software option when extending maximum frequency of MD8430A (Tx/Rx) to 3.8 GHz.

MD8430A-003 Extended Frequency Range to 3.8 GHz Hardware
Required hardware option when extending maximum frequency of MD8430A (Tx/Rx) to 3.8 GHz.

MD8430A-060 LTE FDD Option
Required option when simulating 3GPP LTE FDD.

MD8430A-061 LTE TDD Option
Required option when simulating TD-LTE.

MD8430A-080 LTE Ciphering Option
Option for adding ciphering function supporting EEA0, EEA1, and EEA2 (TS 33.401, TS 36.323) algorithms to LTE.

MD8430A-081 LTE ROHC Option
Option for adding LTE ROHC function supporting RTP/UDP/IP (RFC3095, RFC4815), UDP/IP (RFC3095, RFC4815), ESP/IP (RFC3095, RFC4815), and IP (RFC3843, RFC4815).
Required this option for VoLTE testing.

MD8430A-082 LTE MBMS Option
Option for adding LTE MBMS function supporting (P) MCH Transmission Scheduling, MCCH Message Transmission, MSI MAC control element Transmission and MTCH Message Transmission described in 3GPP (TS 36.211, TS36.221).

MD8430A-083 LTE ZUC Ciphering Option
Option for adding ciphering function supporting EEA3 and EIA3 (TS 33.401, TS 35.221) algorithms to LTE.

MD8430A-085 LTE Carrier Aggregation Option
Option for adding Carrier Aggregation (CA) function supporting transmission of up to two component carriers on downlink.

- **Application Products***

MF6900A Fading Simulator
This Fading Simulator supports LTE 4×2 MIMO using a dedicated connection with the Anritsu Signalling Tester.

MD8470A Signalling Tester
Base Station Simulator supporting CDMA2000 Multiple Sector/ Carrier or 1xEV-DO Rev.A. Realizes Inter-working tests between LTE and CDMA2000 by controlling MD8430A and MD8470A simultaneously from MX786201A Rapid Test Designer (RTD).

MD8480C W-CDMA Signalling Tester
Base Station Simulator supporting HSPA Evolution based on the 3GPP Release 8 specification, W-CDMA and GSM. Realizes Inter-RAT handover tests between LTE and UTRAN/GERAN by controlling MD8430A and MD8480C from MX786201A Rapid Test Designer (RTD).

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

*: For details, refer to the product brochure.

- **Software**

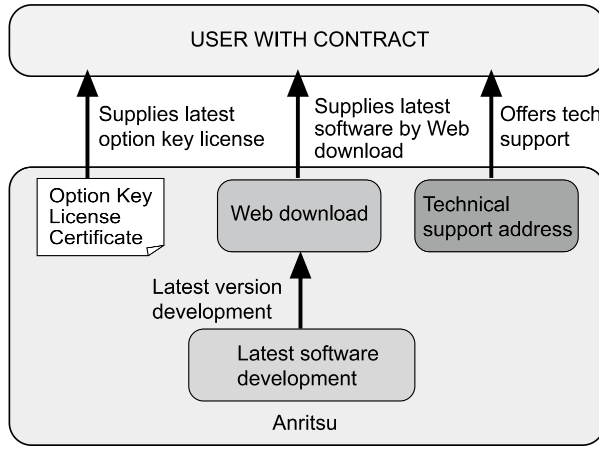
MX843010A LTE Control Software
Software for simulating L1 and L2 with test cases in C

MX786201A Rapid Test Designer (RTD)
Software for simulating L1 to L3 with test cases described by GUI for automating testing, analyzing test cases and creating reports

- **Software Maintenance Contract**

Service Provided
- Contract for adding/revising software functions in line with 3GPP revisions
- Technical support for troubleshooting user problems

Annual Support Service (1 year)
Option providing 1 year of service support for LTE functions including web downloads of latest software and technical enquiries. Services depend on option configuration.



MD8430A Support Services

MD8430A Support (FDD)

MD8430A-SS110	1 Year Support Service LTE FDD (FTM)
MD8430A-SS112	1 Year Support Service LTE FDD (MTM)
MD8430A-SS114	1 Year Support Service LTE FDD (HTM)
MD8430A-SS120	1 Year Support Service LTE FDD (STM)
MD8430A-SS130	1 Year Support Service LTE FDD (PTM)

MD8430A Support (TDD)

MD8430A-SS111	1 Year Support Service LTE TDD (FTM)
MD8430A-SS113	1 Year Support Service LTE TDD (MTM)
MD8430A-SS115	1 Year Support Service LTE TDD (HTM)
MD8430A-SS121	1 Year Support Service LTE TDD (STM)
MD8430A-SS131	1 Year Support Service LTE TDD (PTM)

MX843010A LTE Control Software Support

MX843010A-SS120	1 Year Support Service

Specifications

MD8430A Signalling Tester

Reference Oscillator	Reference Frequency	10 MHz
	Activation Characteristics	±5 × 10^{-7} (2 minutes after turning on the power) ±5 × 10^{-8} (5 minutes after turning on the power) ∗ At 25°C, Based on the frequency 24 hours after turning on the power
	Aging Rate	±1 × 10^{-8}/day (Specification per day, based on the frequency 48 hours after turning on the power) ±1 × 10^{-7}/year (Specification per day, based on the frequency 10 days after turning on the power)
	Temperature Characteristics	±2 × 10^{-8} (0° to 45°C) ∗ Based on the frequency at 25°C
	External Reference Input	Frequency: 10 MHz Operating range: ±1 ppm Input level: –15 dBm ≤ level ≤ +20 dBm (50Ω, AC coupling) Connector: BNC-J, 50Ω (nominal)
	Internal Reference Output	Frequency adjusted at shipment: 10 MHz ±0.02 ppm Output level: ≥0 dBm (50Ω, AC coupling) Connector: BNC-J, 50Ω (nominal)
Transmission Signal	Maximum Level	Main connector: –40 dBm (Maximum setting level at Main connector: –20 dBm) Sub connector: 0 dBm
	Level Accuracy	±1.5 dB Main connector: –113 dBm ≤ Level ≤ –40 dBm Sub connector: –113 dBm ≤ Level ≤ 0 dBm ∗ After calibration, 18° to 28°C, for calibration CW
	Frequency	350 MHz to 3.0 GHz* (setting resolution: 100 kHz) ∗: 350 MHz to 3.8 GHz using MD8430A-002.
	Access Method	OFDMA
	Modulation Method	QPSK, 16QAM, 64QAM
	Modulation Accuracy	≤2% Sub output, 0 dBm, 18° to 28°C LTE (OFDM, 64QAM, 20 MHz band)

Continued on next page

Received Signal	Input Level	Setting demodulation range Based on the value set for the Reference Power QPSK: –28 to +15 dB 16QAM: –21 to +15 dB 64QAM: –15 to +15 dB (Input signal: EVM ≤1%, BER ≤1 × 10^{-12}, 20 MHz band, SC-FDMA) • Main connector input: Reference Power setting range: −20 to +20 dBm However, within the input level range from −30 to +35 dBm • Sub connector input: Reference power setting range: –35 to +5 dBm However, within the input level range from −45 to +20 dBm
	Level Accuracy	Main: ±3.0 dB Sub: ±3.0 dB ∗At 18° to 28°C, for calibration CW, within the Main input level range from −30 to +35 dBm, the Sub input level range from −45 to +20 dBm, and the reference power range of ±15 dB
	Frequency	350 MHz to 3.0 GHz∗ (setting resolution: 100 kHz) ∗: 350 MHz to 3.8 GHz using MD8430A-002.
	Access Method	SC-FDMA
	Modulation Method	QPSK, 16QAM, 64QAM
	Synchronization Acquirable Range	PRACH: ±100 µs PUSCH: ±30 µs
Rf Connector	Main Connector	Type: N Impedance: 50Ω VSWR: ≤1.3
	Sub (Downlink) Connector	Type: N Impedance: 50Ω VSWR: ≤1.5
	Sub (Uplink) Connector	Type: N Impedance: 50Ω VSWR: ≤1.5
Front Panel Interface	Digital IQ I/F	DX20 connector (50 pin) × 8, 3.3 V-CMOS level Digital IQ signal, IQ: 16 bit
	Monitor I/F	DX20 connector (80 pin), 3.3 V-CMOS level Connection with the Monitor board (G0091)
	Sync Out	BNC connector, 3.3 V-CMOS level Internal Sync Start signal output
	Sync In	BNC connector, 3.3 V-CMOS level External Sync Start signal input
	Clock Out	BNC connector, 3.3 V-CMOS level Internal Clock signal output
	Clock In	BNC connector, 3.3 V-CMOS level, 10 kHz to 30.72 MHz External Clock signal input
MF6900 Interface	Sync Out	BNC connector × 3, 3.3 V-CMOS level Connection with the MF6900A (Sync Start signal)
	Port	HIB-B16LFYGA connector × 6, LVDS level Connection with the MF6900A (Digital IQ signal)
Specifications Related to EMC and LVD	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1
Temperature	Operating	0° to +45°C
	Storage	–20° to +60°C
Power Supply	Voltage	100 V (ac) to 120 V (ac)/200 V (ac) to 240 V (ac) (Automatic switching system)
	Frequency	50 Hz/60 Hz (Automatically changeover system)
	Power Consumption	≤1200 VA
Dimensions, Mass	Dimensions	426 (W) × 310 (H) × 500 (D) mm
	Mass	≤35 kg

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No	Name
	LTE Function Test Model
MD8430A	Signalling Tester*
MD8430A-003	Extended Frequency Range to 3.8 GHz Hardware
MD8430A-010	LTE Function Test Model (FTM)
	LTE MIMO Test Model
MD8430A	Signalling Tester*
MD8430A-003	Extended Frequency Range to 3.8 GHz Hardware
MD8430A-012	LTE MIMO Test Model (MTM)
	LTE Handover Test Model
MD8430A	Signalling Tester*
MD8430A-003	Extended Frequency Range to 3.8 GHz Hardware
MD8430A-014	LTE Handover Test Model (HTM)
	LTE Standard Test Model
MD8430A	Signalling Tester*
MD8430A-003	Extended Frequency Range to 3.8 GHz Hardware
MD8430A-020	LTE Standard Test Model (STM)
	LTE Performance Test Model
MD8430A	Signalling Tester*
MD8430A-003	Extended Frequency Range to 3.8 GHz Hardware
MD8430A-030	LTE Performance Test Model (PTM)
	Standard accessories
	CD-ROM
	(Operation Manual and Maintenance Software): 1 pc
J1440A	LAN Cable: 2 pcs
J1211	Power Cord, 3.0 m (15 A): 1 pc
J0127A	Coaxial Cord, 1.0 m (BNC-P · RG58A/U · BNC-P): 1 pc
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P): 2 pcs
J1398A	N-SMA Adaptor: 6 units
G0091	Monitor Board: 1 pc
J1005	Monitor Cable 80: 1 pc
J1459A	Digital IQ Cable (50 cm): 1 pc
	Options
MD8430A-002	Extended Frequency Range to 3.8 GHz
MD8430A-060	LTE FDD Option
MD8430A-061	LTE TDD Option
MD8430A-080	LTE Ciphering Option
MD8430A-081	LTE ROHC Option
MD8430A-082	LTE MBMS Option
MD8430A-083	LTE ZUC Ciphering Option
MD8430A-085	LTE Carrier Aggregation Option
MD8430A-103	Extended Frequency Range to 3.8 GHz Hardware Retrofit (for Asia, Oceania)
MD8430A-203	Extended Frequency Range to 3.8 GHz Hardware Retrofit
	Software options
MX843010A	LTE Control Software
MX786201A	Rapid Test Designer (RTD)
	Main frame support service
	[FDD]
MD8430A-SS110	1 Year Support Service LTE FDD (FTM)
MD8430A-SS112	1 Year Support Service LTE FDD (MTM)
MD8430A-SS114	1 Year Support Service LTE FDD (HTM)
MD8430A-SS120	1 Year Support Service LTE FDD (STM)
MD8430A-SS130	1 Year Support Service LTE FDD (PTM)
	[TDD]
MD8430A-SS111	1 Year Support Service LTE TDD (FTM)
MD8430A-SS113	1 Year Support Service LTE TDD (MTM)
MD8430A-SS115	1 Year Support Service LTE TDD (HTM)
MD8430A-SS121	1 Year Support Service LTE TDD (STM)
MD8430A-SS131	1 Year Support Service LTE TDD (PTM)
	LTE control software support service
MX843010A-SS120	1 Year Support Service
	Upgrade options
Z1398A	LTE FTM to MTM Upgrade Kit
Z1399A	LTE FTM to HTM Upgrade Kit
Z1342A	LTE FTM to STM Upgrade Kit
Z1344A	LTE FTM to PTM Upgrade Kit
Z1401A	LTE MTM to STM Upgrade Kit
Z1402A	LTE MTM to PTM Upgrade Kit
Z1403A	LTE HTM to STM Upgrade Kit
Z1404A	LTE HTM to PTM Upgrade Kit
Z1343A	LTE STM to PTM Upgrade Kit
	Application products
MF6900A	Fading Simulator
MD8470A	Signalling Tester
MD8480C	W-CDMA Signalling Tester

*: A PC*1 running Microsoft Visual C++ 2008 Express Edition or Microsoft Visual C++ 2010 Express Edition is required to use the MD8430A. It must be supplied by the customer.

*1: The PC controller for the MD8430A must meet or exceed the following specifications: OS: Windows XP (SP3), Windows 7 (64 bit) or later
CPU: Intel Core 2 Duo 2 GHz or faster
RAM: 2 GB or more
NIC: 1000 BASE-T

- Windows®, Visual C++® is a registered trademark of Microsoft Corporation in the USA and other countries.
- Intel®, Core™ 2 Duo is registered trademarks of Intel Corporation or its subsidiaries in the USA and other countries.

FADING SIMULATOR
MF6900A

Remote Control
GPIB | Ethernet | USB

All-in-One Full Digital Fading Simulator
Supporting LTE 2×2 MIMO 2-cell and 4×2 MIMO

The introduction of the LTE next-generation communication standard makes MIMO evaluation in a fading environment much more complex. Connecting the MF6900A Fading Simulator to the MD8430A Signalling Tester via dedicated digital interface to simulate a BTS greatly simplifies 3GPP LTE 2×2 MIMO and 4×2 MIMO fading tests.

Key Features
- High reproducibility and maintainability due to full digital baseband processing
- All-in-one unit supports LTE 4×2 MIMO or LTE 2×2 MIMO↔ W-CDMA/HSPA dual environment
- Easy fading settings using dedicated interface with MD8430A/ MD8480C/MD8475A Signalling Tester
- Highly extendible hardware platform

Main Uses
- Coding and Decoding Tests (RF/Baseband)
- Throughput Tests (Performance Tests)
- Intra-RAT/Inter-RAT Handover Tests
- LTE Pre-conformance/Conformance Tests
- LTE Carrier UE Acceptance Tests
- Fault Troubleshooting

Functions

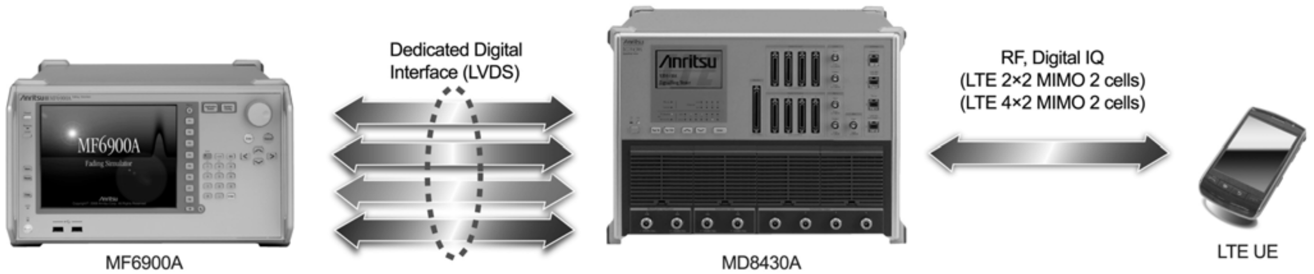
With MD8430A (LTE)
- 8 channels max. (MIMO)
- 1×1 SISO, 1×2 SIMO, 2×1 MISO, 2×2 MIMO (2 cells max.)
- 4×1 MISO, 4×2 MIMO (1 cell max.)
- Birth-Death, Moving, CQI, HST (2 cells max.)
- Correlation Matrix Setting (MIMO)

With MD8480C (W-CDMA/HSPA)
- 4 channels max.
- 1×1 SISO (4 cells max.)
- Birth-Death, Moving, HST (4 cells max.)
- Tx/TRx Diversity (2 cells max.)
- MBMS
- DC-HSDPA

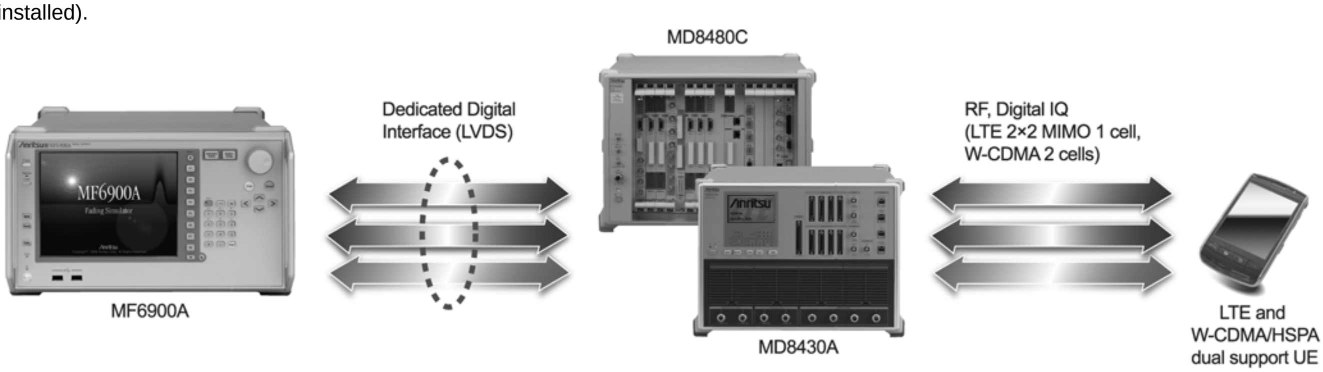
Common Functions
- Path Parameter Edit (12 paths/channel)
- Parameter Saving and Reading
- Slow Clock Tests
- External Control
- Clipping

• All-in-One Unit Supports LTE 4×2 MIMO or LTE 2×2 MIMO↔W-CDMA/HSPA Dual Environment

One unit supports LTE 2×2 MIMO 2-cell or 4×2 MIMO tests and combination with the MD8430A Signalling Tester offers a simple test setup for intra-system LTE 2×2 MIMO handover or 4×2 MIMO tests



The MD8480C Signalling Tester for W-CDMA supports all-in-one LTE/W-CDMA inter-system handover tests (with MF6900A-001 option installed).



• High Reproducibility and Maintainability due to Full Digital Baseband Processing

The MF6900A simulates fading using full digital baseband processing. As a result, high-reproducibility results are obtained using the same settings and complex MIMO power control settings are extremely easy and accurate. Moreover, complete elimination of all analog circuits supports easy maintenance and calibration-free stability.

• Easy Fading Setting using Dedicated Interface with MD8430A/ MD8480C/MD8480C (E configuration)/MD8475A (LTE only)

The MF6900A Fading Simulator uses a dedicated digital connection with the MD8430A/MD8480C/MD8480C (E configuration)/MD8475A (LTE). Elimination of internal RF circuits eliminates power control settings, and the simple display supports intuitive use.
In addition, fading setting is made easy just by calling preset fading profiles from MD8430A, MD8480C MD8480C (E configuration) and MD8475A (LTE) test scenarios, allowing chipset and UE protocol developers to run tests transparently without a deep understanding of fading settings.
Moreover, auto-synchronization at MD8430A, MD8480C, MD8480C (E configuration) and MD8475A (LTE) slow clock operation eliminates repeated fading setting.

Example of MF6900A Main Display

• Expandable Hardware Platform

The maximum number of input and output ports can be extended to four each to support 4×2 MIMO, 2×2 MIMO with 2 cells and dual RAT between W-CDMA/HSPA. Moreover, the MF6900A has GCF/ PTCRB certification with the ME7873F/ME7873L used commonly as an RF conformance test system, and can be used as a future RF conformance test system.

• Fading Profile

SISO	Case1, Case2, Case3, Case4, Case5, Case6, Case8, VA3, VA30, VA120, PA3, PB3 [3GPP TS 25.101 V8.13.0 (2010-12), TS 34.121-1 V8.11.0 (2010-06)]
	EPA, EVA, ETU [3GPP TS 36.101 V8.12.0 (2010-12)]
2×2 MIMO 1×2 SIMO*1	EPA, EVA, ETU [3GPP TS 36.101 V8.12.0 (2010-12)]
4×2 MIMO 4×1 MISO*2	EPA, EVA, ETU [3GPP TS 36.101 V8.12.0 (2010-12)]
1×2 CQI 1×1 CQI*3	Fading conditions for CQI tests [3GPP TS 36.101 V8.12.0 (2010-12)]
2×2 HST 1×2 HST 1×1 HST*4	HST [3GPP TS 25.101 V8.13.0 (2010-12), TS 34.121-1 V8.11.0 (2010-06), TS 36.101 V8.12.0 (2010-12)]
Moving*5	Moving propagation conditions [3GPP TS 25.101 V8.13.0 (2010-12)]
Birth-Death*5	Birth-Death propagation conditions [3GPP TS 25.101 V8.13.0 (2010-12)]
Tx/TRx Diversity*5	Case1, Case2, Case3, Case4, Case5, Case6, Case8, VA3, VA30, VA120, PA3, PB3 [3GPP TS 25.101 V8.13.0 (2010-12), TS 34.121-1 V8.11.0 (2010-06)]

∗1: Requires MX690010A 2×2 MIMO option
∗2: Requires MX690010A 2×2 MIMO and MX690010A-001 4×2 MIMO option
∗3: Requires MX690011A Propagation for CQI test option
∗4: Requires MX690030A High Speed Train option
∗5: Requires MX690020A WCDMA Extended model option

Options

MF6900A-001 Additional LVDS Interface
Hardware option to add two back LVDS interface ports
Required when using 2 cells or 4×2 MIMO with MD8430A and 3 or more cells with MD8480C

MF6900A-101 Additional LVDS Interface Retrofit
For MF6900A-001 retrofit at Anritsu plant

Software Options

MX690010A 2×2 MIMO
Software installed in main frame to use LTE MIMO functions

MX690010A-001 4×2 MIMO
Software installed option adding 4×2 MIMO capability

MX690011A Propagation for CQI test
Software installed option adding test conditions specified by 3GPP TS 36.521-1 Chapter 9.3 CQI Reporting under fading conditions and Chapter 9.4 Reporting of Precoding Matrix Indicator (PMI)

MX690020A WCDMA Extended Model
Software installed in main frame to use Moving, Birth-Death, Tx/TRx Diversity functions
∗: Connection with MD8480C requires MU848072C-40 MF6900 interface or MU848072E BTS Evolution option

MX690030A High Speed Train
Software installed option adding High Speed Train (HST) Scenario that is one of the mobility condition specified by 3GPP

	Standard configuration	MX690010A	MX690020A	Max. No. of LTE BS (MD8430A)		Max. No. of W-CDMA BS (MD8480C)	
				–	MF6900A-001	–	MF6900A-001
SISO (Standard)	✓	–	–	1	2	2	4
LTE MIMO, MISO, SIMO	–	✓	–	1	2	–	–
LTE Diversity	–	✓	–	1	2	–	–
LTE 2×2 MIMO	–	✓*	–	1	2	–	–
LTE 4×2 MIMO	–	✓*	–	–	1	–	–
LTE, W-CDMA/HSPA Inter-RAT	–	✓*	✓	–	1	–	2
Birth-Death	–	–	✓	1	2	2	4
Moving	–	–	✓	1	2	2	4
W-CDMA/HSPA Diversity	–	–	✓	–	–	1	2
W-CDMA MBMS	✓*	–	–	–	–	–	4

∗: Requires MF6900A-001 Additional LVDS Interface option

Specifications

MF6900A Fading Simulator

Connector	Digital I/F	I/F (Rear panel) for exchanging signals between MF6900A and MD8480C, MF6900A and MD8480C (E configuration) or MF6900A and MD8430A with one connector supporting both input and output
	No. of I/O Ports	2 ports (Standard), 4 ports (with MF6900A-001 Additional LVDS Interface (Opt-001))
	Sampling Clock	For future use
	Electrical Characteristics	Connector: BNC-J (Rear panel) Input level: LVTTL
	Sync Start	I/F for synchronizing between MF6900A and MD8480C, MF6900A and MD8480C (E configuration), or MF6900A and MD8430A with two settings (Sync Start1, Sync Start2)
	Electrical Characteristics	Connector: BNC-J (Rear panel) Input level: LVTTL
	External Controller	Supports control from external controller (except Power Supply)
	Ethernet (10/100/1000 BASE-T)	Connector: RJ-45 (Rear panel)
	GPIB	Supports IEEE488.2 Connector: IEEE bus connector (Rear panel) Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
	USB (B)	Supports USB2.0 Connector: USB-B (Rear panel)
	USB	For connecting external USB devices to save mainframe parameters Supports USB2.0 Connector: USB-A (Front panel: 2 ports, Rear panel: 2 ports)
	Monitor Out	Connector: Mini D-Sub 15 pins, VGA compatible (Rear panel)
	Display	XGA color LCD (Resolution: 1024 × 768) 8.4 inches (213 mm diagonal)

Continued on next page

Common Parameter		Defined by Digital I/F
	RF Frequency	100 MHz to 6000 MHz, Resolution: 1 Hz (except 1×1 HST/1×2 HST/2×2 HST) 89.937737 MHz to 36154.970475 MHz, Resolution: 1 Hz (1×1 HST/1×2 HST/2×2 HST, Display only)
	Sampling Frequency	10 MHz to 80 MHz, Resolution: 1 Hz (except 1×1 HST/1×2 HST/2×2 HST) 19.2 MHz, 30.72 MHz (1×1 HST/1×2 HST/2×2 HST)* * To assume normal simulator operation, it is necessary to set the input signal sampling frequency
	Port Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB, each port can be set
	Relative Channel Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB, each channel can be set
	Doppler Frequency	0 or 0.1 Hz to 20 kHz, Resolution: 0.01 Hz (except 1×1 HST/1×2 HST/2×2 HST) 50 Hz to 3350 Hz, Resolution: 1 Hz (1×1 HST/1×2 HST/2×2 HST)
	Moving Speed	0 km/h to ν_{max} km/h, Resolution: 0,01 km/h (except 1×1 HST/1×2 HST/2×2 HST) where ν_{max} found as; $\nu_{max} = c\frac{f_d}{f_c}$ f_c (Hz): Frequency, c: Velocity of light in vacuum (1.07925825 × 10^9 km/h), f_d: Maximum doppler frequency at 20 kHz 100 km/h to 600 km/h, Resolution: 100 km/h (1×1 HST/1×2 HST/2×2 HST)
Channel Configuration (SISO)		Defined by Digital I/F
	Number of Port	2 (Standard), 4 (with Opt-001)
	Number of Channel	2 (Standard), 4 (with Opt-001)
	Number of Path	12 paths/channel
	Relative Path Delay	0 to 600 µs, Resolution: 0.1 ns, Setting accuracy: ±0.1 ns * Based on delay 0, when connecting MD8430A, MD8480C or MD8480C (E configuration)
	Relative Path Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB
	Fading Type	Constant Phase, Pure Doppler, Rayleigh, Rice * Pure Doppler and Rice model can only be set for 1 path at 1 channel
	Phase Shift	Constant Phase 0 to 359.9°, Resolution: 0.1°, Setting accuracy: 0.1°
	Rice K Factor	Rice +30 to –30 dB, Resolution: 0.1 dB
	Angle of Arrival	Pure Doppler or Rice 0 to 359.9°, Resolution: 0.1°
	Standard Fading Profile	Case1, Case2, Case3, Case4, Case5, Case6, Case8, VA3, VA30, VA120, PA3, PB3 [3GPP TS 25.101 V8.13.0 (2010-12), TS 34.121-1 V8.11.0 (2010-06)], EPA, EVA, ETU [3GPP TS 36.101 V8.12.0 (2010-12)]
Channel Configuration (2×2 MIMO/ 2×1 MISO/ 1×2 SIMO)		Enabled with MX690010A and when MD8430A or MD8475A (LTE) connected, Defined by Digital I/F
	Number of Port	2 (Standard), 4 (with Opt-001)
	Number of Channel	2×2 MIMO: 4 (Standard), 8 (with Opt-001) 2×1 MISO/1×2 SIMO: 2 (Standard), 4 (with Opt-001)
	Number of Path	12 paths/channel
	Relative Path Delay	0 to 600 µs, Resolution: 0.1 ns, Setting accuracy: ±0.1 ns * Based on delay 0, when connecting MD8430A
	Relative Path Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB
	Fading Type	Constant Phase, Pure Doppler, Rayleigh, Rice * Pure Doppler and Rice model can only be set for 1 path at 1 channel
	Phase Shift	Constant Phase 0 to 359.9°, Resolution: 0.1°, Setting accuracy: 0.1°
	Rice K Factor	Rice +30 to –30 dB, Resolution: 0.1 dB
	Angle of Arrival	Pure Doppler or Rice 0 to 359.9°, Resolution: 0.1°
	Correlation Matrix	4×4 (2×2 MIMO), 2×2 (1×2 MISO, 2×1 SIMO) A 3GPP TS 36.101 V8.12.0 (2010-12) compliant correlation matrix can be set 2×2 High Correlation, 2×2 Medium Correlation, 2×2 Low Correlation Arbitrary correlation matrix can be set by following correlation coefficient range –1.00000 to 1.00000, Resolution: 0.00001 (Display only)
	Standard Fading Profile	EPA, EVA, ETU [3GPP TS 36.101 V8.12.0 (2010-12)]
	Correlation Coefficient	–0.99 to 0.99, Resolution: 0.01
Channel Configuration (Moving)		Enabled with MX690020A, Defined by Digital I/F
	Number of Port	2 (Standard), 4 (with Opt-001)
	Number of Channel	2 (Standard), 4 (with Opt-001)
	Standard Fading Profile	Moving Propagation conditions [3GPP TS 25.101 V8.13.0 (2010-12)]
	Delay Variation	0.5 µs to 10 µs, Resolution: 0.1 µs, Setting accuracy: 2 ns
	Delay Offset	0 to 50 µs, Resolution: 0.1 µs, Setting accuracy: 0.1 ns
	Angular Frequency (ω)	0.01 rad/s to 0.4 rad/s, Resolution: 0.01 rad/s, Setting accuracy: 0.0001 rad/s
	Variation Period	15.708 s to 628.318 s, Resolution: 0.001 s (Display only) where ω (rad/s) and T_s found as; $\omega = \frac{2\pi}{T}$
	Relative Path Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB

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Channel Configuration (Birth-Death)		Enabled with MX690020A, Defined by Digital I/F
	Number of Port	2 (Standard), 4 (with Opt-001)
	Number of Channel	2 (Standard), 4 (with Opt-001)
	Standard Fading Profile	Birth-Death propagation conditions [3GPP TS 25.101 V8.13.0 (2010-12)]
	Maximum Delay	1 µs to 600 µs, Resolution: 0.1 ns
	Delay Resolution	0.1 µs to 60 µs, Resolution: 0.1 µs, Setting accuracy: 0.1 ns where Delay resolution: ΔT (µs) and Maximum delay: T_{max} (µs) found as; $10 \bullet \Delta T = T_{max}$
	Dwell Time	0.1 ms to 2000 ms, Resolution: 0.1 ms, Setting accuracy: 0.05 µs
	Relative Path Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB
Channel Configuration (Tx/TRx diversity)		Enabled with MX690020A and when MD8480C or MD8480C (E configuration) connected, Defined by Digital I/F
	Number of Port	2 (Standard), 4 (with Opt-001)
	Number of Channel	Tx Diversity: 2 (Standard), 4 (with Opt-001) Trx Diversity: 4 (Standard), 8 (with Opt-001)
	Number of Path	12 paths/channel
	Relative Path Delay	0 to 600 µs, Resolution: 0.1 ns, Setting accuracy: ±0.1 ns * Based on delay 0, when connecting MD8480C
	Relative Path Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB
	Fading Type	Constant Phase, Pure Doppler, Rayleigh, Rice * Pure Doppler and Rice model can only be set for 1 path at 1 channel
	Phase Shift	Constant Phase 0 to 359.9°, Resolution: 0.1°, Setting accuracy: 0.1°
	Rice K Factor	Rice +30 to –30 dB, Resolution: 0.1 dB
	Angle of Arrival	Pure Doppler or Rice 0 to 359.9°, Resolution: 0.1°
	Standard Fading Profile	Case1, Case2, Case3, Case4, Case5, Case6, Case8, VA3, VA30, VA120, PA3, PB3 [3GPP TS 25.101 V8.13.0 (2010-12), TS 34.121-1 V8.11.0 (2010-06)]
Channel Configuration (4×2 MIMO/ 4×1 MISO)		Enabled with MF6900A-001, MX690010A, MX690010A-001 and when MD8430A connected, Defined by Digital I/F
	Number of Port	4
	Number of Channel	4×2 MIMO: 8, 4×1 MISO: 4
	Number of Path	12 paths/channel
	Relative Path Delay	0 to 600 µs, Resolution: 0.1 ns, Setting accuracy: ±0.1 ns * Based on delay 0, when connecting MD8430A
	Relative Path Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB
	Fading Type	Constant Phase, Pure Doppler, Rayleigh, Rice * Pure Doppler and Rice model can only be set for 1 path at 1 channel
	Phase Shift	Constant Phase 0 to 359.9°, Resolution: 0.1°, Setting accuracy: 0.1°
	Rice K Factor	Rice +30 to –30 dB, Resolution: 0.1 dB
	Angle of Arrival	Pure Doppler or Rice 0 to 359.9°, Resolution: 0.1°
	Correlation Coefficient	–0.99 to 0.99, Resolution: 0.01
	Correlation Matrix	8×8 (4×2 MIMO), 4×4 (4×1 MISO) A 3GPP TS 36.101 V8.12.0 (2010-12) compliant correlation matrix can be set 4×2 High Correlation, 4×2 Medium Correlation, 4×2 Low Correlation * when using Scaling factor Arbitrary correlation matrix can be set by following correlation coefficient range –1.00000 to 1.00000, Resolution: 0.00001 (Display only)
	Standard Fading Profile	EPA, EVA, ETU [3GPP TS 36.101 V8.12.0 (2010-12)]

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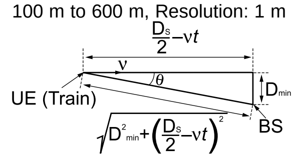
Channel Configuration (2×2 HST/ 1×2 HST/ 1×1 HST)		Enabled with MX690030A, Defined by Digital I/F
	Number of Port	2 (Standard), 4 (with Opt-001)
	Number of Channel	2×2 HST: 4 (Standard), 8 (with Opt-001) 1×2 HST/1×1 HST: 2 (Standard), 4 (with Opt-001)
	Number of Path	12 paths/channel
	D_S	100 m to 600 m, Resolution: 1 m  ∗ Unit of each found as: D_S (m), D_{min} (m), ν (m/s), t (s)
	D_{min}	1 m to 10 m, Resolution: 1 m ∗ D_{min} found as above
	T	1.2000 s to 43.2000 s, Resolution: 0.1 ms (Display only) ∗ D_S, Moving Speed and Variation Period found as D_S (m), ν (km/h), t (s) $T = \dfrac{2 \times D_S}{\nu \times \dfrac{1000}{3600}}$
	Standard Fading Profile	High Speed Train Scenario [3GPP TS 25.101 V8.13.0 (2010-12), TS 34.121-1 V8.11.0 (2010-06), and TS 36.101 V8.12.0 (2010-12)]
Channel Configuration (1×2 CQI/ 1×1 CQI)		Enabled with MX690011A, Defined by Digital I/F
	Number of Port	2 (Standard), 4 (with Opt-001)
	Number of Channel	2 (Standard), 4 (with Opt-001)
	Relative Path Delay	0.2 ns to 600 µs, Resolution: 0.1 ns, Setting accuracy: ±0.1 ns ∗ Based on delay 0, when connecting MD8430A, MD8480C or MD8480C (E configuration)
	Relative Path Gain	–50 to 0 dB, Resolution: 0.1 dB, Setting accuracy: 0.05 dB
	Fading Type	Path 1: Constant Phase Path 2: Pure Doppler
	Phase Shift	Constant Phase 0 to 359.9°, Resolution: 0.1°, Setting accuracy: 0.1°
	Angle of Arrival	Pure Doppler or Rice model 0 to 359.9°, Resolution: 0.1°
	Standard Fading Profile	Conditions for CQI tests [3GPP TS 36.101 V8.12.0 (2010-12)]
Dimension/Mass		340 (W) × 200 (H) × 448 (D) mm (excluding protrusions) ≤15 kg (with Opt-001)
Power Supply		Voltage: 100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) (–15/+10%, Maximum voltage: 250 V) Frequency: 50 Hz/60 Hz (±5%) Power consumption: ≤350 VA (Maximum value)
Temperature/Humidity		[Operating] Temperature: +5° to +45°C, Humidity: 20 to 80%, (no condensation) [Storage] Temperature: –20° to +60°C, Humidity: 90% or less, (no condensation)
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MF6900A	Fading Simulator	
	Standard accessories	
J1416A	LVDS Cable (2.0 m):	2 pcs
J0093C	Coaxial Code, 2.0 m (BNC-P · RG55A/U · BNC-P):	2 pcs
	Power Cord:	1 pc
P0031A	USB Memory (>256 MB, USB2.0 Flash Driver):	1 pc
Z0541A	USB Mouse:	1 pc
	Install CD-R (with manual):	1 pc
	Option	
MF6900A-001	Additional LVDS Interface*	
	Retrofit option	
MF6900A-101	Additional LVDS Interface Retrofit*	
	Software options	
MX690010A	2×2 MIMO	
MX690010A-001	4×2 MIMO	
MX690011A	Propagation for CQI test	
MX690020A	WCDMA Extended Model	
MX690030A	High Speed Train	

Model/Order No.	Name
	Warranty service
MF6900A-ES210	2 Years Extended Warranty Service
MF6900A-ES310	3 Years Extended Warranty Service
MF6900A-ES510	5 Years Extended Warranty Service
	Application parts
J1416A	LVDS Cable (2.0 m)
J0093B	Coaxial Code, 1.0 m (BNC-P · RG55A/U · BNC-P)
J0093C	Coaxial Code, 2.0 m (BNC-P · RG55A/U · BNC-P)
J1261A	Ethernet Cable (Shield type, Straight cable, 1.0 m)
J1261B	Ethernet Cable (Shield type, Straight cable, 3.0 m)
J1261C	Ethernet Cable (Shield type, Cross cable, 1.0 m)
J1261D	Ethernet Cable (Shield type, Cross cable, 3.0 m)
J0008	GPIB Cable, 2.0 m
B0606A	Rack Mount Kit
Z0975A	Keyboard (USB)

∗: LVDS Cable is not included.
Please make order for separate J1416A LVDS Cable in the Application parts.

W-CDMA SIGNALLING TESTER

MD8480C

Remote Control
Ethernet

All-in-One Solution for 2G/3G/3.5G Chipset and UE Development

The MD8480C W-CDMA Signalling Tester is a base station simulator with ideal protocol development and test functions for developing 3.5G W-CDMA UE supporting HSPA Evolution[*1]. It has an air interface conforming to 3GPP specifications as standard and supports a full range of applications and protocol tests, coding/decoding processing, protocol sequence testing (registration, origination, termination, handover), voice and data communications testing (circuit switch, packet switch), and UE end-to-end testing[*2] for chipsets and UE. Moreover, adding options for GSM/GPRS/EGPRS[*3] base stations supports Inter-RAT handover tests between 3G/3.5G and 2G systems. The MD8480C is the ideal instrument for developing increasingly popular UMTS UE and high-performance chipsets and UE for HSPA/EGPRS[*4].

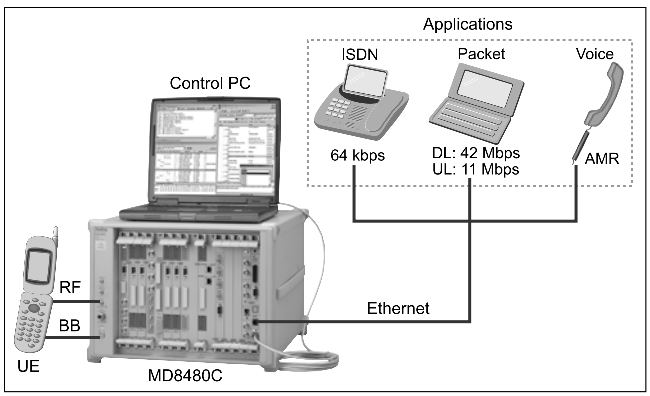
∗1: High Speed Packet Access Evolution
∗2: Enhanced GPRS
∗3: Requires two MD8480C units
∗4: Handover Testing between W-CDMA/HSPA and GSM/EGPRS at Voice/Data Communications

Features

- Supports 3GPP HSPA Evolution
- Full Support for All UE Categories (Release 8)
- Data Throughput Test (DL 42 Mbps/UL 11 Mbps)
- One Unit Supports Expanded Functions for 4 BTS max. (W-CDMA/HSPA)
- Optional GSM/GPRS/EGPRS 2BTS Functions
- Inter-RAT Handover Tests between HSPA and EGPRS

Main Uses

- 3G/3.5G UE Protocol Sequence Tests
- 3G/3.5G UE Coding/Decoding Function Tests (RF/BB)
- Inter/Intra-RAT Handover UE Protocol Sequence Tests
- Inter-RAT HO Packet Data Communications Tests (Ping, FTP, Browsing)
- HSPA/EGPRS Packet Data Communications Tests
- Applications Tests, including Voice and Packet
- Throughput Monitoring Test



Additional Options (Hardware)

- **W-CDMA Base Station**
  MU848072E BTS Evolution[*5]

The standard MD8480C configuration has one BTS unit for a single W-CDMA base station functionality. Adding this option in a single MD8480C supports for up to four W-CDMA base stations.

∗5: HSPA Evolution support type

- **HSDPA Base Station**
  MU848072C-01 HSDPA

This option adds the HSDPA functions for up to four base stations to the W-CDMA BTS Unit. Requires adding this option to each BTS unit.

- **HSUPA Base Station**
  MU848072C-02 HSUPA

This option adds the HSUPA functions for up to four base stations to the W-CDMA BTS Unit. Requires adding this option to each BTS unit.

- **Baseband Interface**
  MU848077C Baseband Interface Unit

This option adds I/O interfaces for DBB (digital baseband) and ABB (analog baseband) to the MD8480C. It support baseband evaluation of W-CDMA/HSPA chipsets and UE reference design boards.

- **Fading Simulator Connection Function**
  MU848072C-40 MF6900 Interface*1

The LVDS interface connects the MF6900A Fading Simulator to support high-reproducibility fading simulation.

*1: Installed in MU848072E BTS Evolution as standard function.
This option is required for the conventional MU848072C1 BTS unit.

- **GSM/GPRS Base Station**
  MU848060C TDMA2

This option installs the GSM/GPRS function in the MD8480C to support GSM/GPRS registration, mobile origination and termination, network origination and termination, and handover. In addition, it supports various applications, such as voice and data communications. And handover tests between W-CDMA (HSPA) and GSM/GPRS units are supported when used in combination with the MD8480C-04 Additional RF Unit 3 and the MX848001A-02 Compressed Mode described below. In addition, up to two units can be installed in one MD8480C, supporting the GSM transmit and receive function for each of two base stations.*2

*2: When two TDMA2 (MU848060C) units are installed, the Baseband Interface Unit (MU848077C) cannot be installed.

- **EGPRS Base Station**
  MU848060C-01 EGPRS (R99)

This option installs the EGPRS base station function in the MU848060C TDMA2 option. Using the EGPRS method (3GPP Release 99) supports packet testing at up to 230 kbps.

- **ISDN/CSD Unit**
  MU848055C ISDN/CSD

This unit is required when adding software supporting CSD (Circuit Switched Data). It also adds an ISDN interface for performing UDI communications and videophone tests at data rates up to a maximum of 2B (64 kbps). PPP packet testing can also be performed using the RS-232C I/F built into this option.

- **Additional RF Interface**
  MD8480C-04 Additional RF Unit 3

This option adds support for two different frequencies (transmit and receive) and is required when adding the GSM/GPRS base station option (MU848060C). When it is used with the above-described base station options, it supports hard handover testing (HHO) between different frequencies. The continuously covered transmit and receive frequency range is 350 MHz to 2700 MHz.

Additional Options (Software)

– W-CDMA/HSPA Related –

- **Diversity Function**
  MX848001A-01 W-CDMA Signalling Tester Tx Diversity

This option supports the Tx diversity functions, including TSTD, STTD, Closed Loop Mode 1 and Closed Loop Mode 2. This option requires more than one BTS unit (MU848072E – 2BTS) as the additional base station option.

- **HSDPA Diversity Function**
  MX848001C-11 HSDPA Tx Diversity

This option supports the Tx diversity function for HSDPA/HSUPA. This option requires the W-CDMA Tx diversity function (MX848001A-01).

- **Compressed Mode Function**
  MX848001A-02 W-CDMA Signalling Tester Compressed Mode

This option supports the compressed mode function used mainly for hard handover (HHO) tests. SF/2, Puncturing, and Higher Layer Scheduling are also supported by this option.

- **W-CDMA CSD Function**
  MX848001A-06 W-CDMA Signalling Tester W-CDMA CSD

This option supports W-CDMA CSD (Circuit Switched Data) and adds CSD-dedicated layers (L2RCOP, RLP) providing 14.4, 28.8, 57.6 kbps asynchronous and non-transparent mode test functions. This option requires the ISDN/CSD (MU848055C).

- **3GPP Release 7 Function**
  MX848001C-12 HSPA Evolution (Release 7)

This option supports the HSPA Evolution functions, including CPC (Continuous Packet Connectivity), Enhanced Cell FACH, L2 improvement, CS Voice over HSPA.

- **HSDPA 64QAM, HSUPA 16QAM Function**
  MX848001E-13 Higher Order Modulation (Release 7)

This option supports Higher Order Modulation defined by 3GPP Release 7. It supports downlink (DL) 64QAM modulation and Uplink (UL) 16QAM demodulation scheme. It also achieves maximum data transfer speed 21 Mbps (DL) and 11 Mbps (UL).

- **2 × 2 MIMO Function**
  MX848001E-14 2 × 2 MIMO (Release 7)

This option supports 2 × 2 MIMO defined by 3GPP Release 7. By adding this option, it achieves maximum data transfer speed 28 Mbps (DL).

- **3GPP Release 8 Function**
  MX848001E-15 HSPA Evolution for uplink (Release 8)

This option supports the Improved L2 for UL, and Enhanced UL for Cell FACH State defined by 3GPP Release 8.

- **Dual Cell HSDPA Function**
  MX848001E-16 DC-HSDPA (Release 8)

This option supports the DC-HSDPA function (3GPP Release 8). It also supports the maximum data transfer speed of 42 Mbps (DL).

- **64QAM and MIMO Function**
  MX848001E-17 64QAM and MIMO for HSDPA (Release 8)

This option supports the 64QAM and MIMO function defined by 3GPP Release 8. It also supports the maximum data transfer speed of 42 Mbps (DL).

- **W-CDMA Ciphering**
  MX848041E Firmware for Ciphering

This option*3 adds support for ciphering functions to KASUMI and SNOW 3G (3GPP standards integrity ciphering algorithm).

- **HSPA Ciphering**
  MX848041E-10 HSPA Ciphering

This option*3 adds supports for ciphering functions to KASUMI and SNOW 3G (3GPP standards integrity ciphering algorithm).

*3: The integrity function is also supported even without this option.

– GSM/GPRS/EGPRS Related –

- **GSM CSD Function**
  MX848001A-04 W-CDMA Signalling Tester GSM CSD

This option supports the GSM CSD (Circuit Switched Data) function and PPP packets at data rates from 9.6 kbps to 57.6 kbps (HSCSD). It also supports asynchronous mode data transmission in the non-transparent mode. This option requires the ISDN/CSD (MU848055C).

- **GSM Frequency Hopping Function**
  MX848001A-05
  W-CDMA Signalling Tester GSM Frequency Hopping

This option supports the GSM frequency hopping function, permitting frequency hopping in GSM communications channels at a frame sync of 4.62 ms. This option requires an Additional RF Unit (MD8480B-03 or MD8480C-04).

- **DTM Function**
  MX848001C-30 DTM (R99)

This option adds the Dual Transfer Mode (DTM) function which is able to simulate Voice (CS) + Data (PS) communication based on the 3GPP Release 99. In addition, this option is able to Handover test between DTM and Multi Call connection if used with the W-CDMA Multi Call configuration on the single unit. This option requires the TDMA2 (MU848060C).

- **GSM/GPRS Ciphering**
  MX848045C GSM/GPRS 2 Ciphering

This option adds the GSM/GPRS ciphering function to support the GSM A5/1, A5/2 and A5/3 ciphering algorithm as well as the GPRS GEA1, GEA2 and GEA3 ciphering algorithm.

– Shared –

- **Router Connection Function**
  MX848001A-03
  W-CDMA Signalling Tester Router Connection

This option provides support for data communications with PCs on a different subnet mask (segment) and can be used for both W-CDMA and GPRS data. RoHC (Robust Header Compression) is also supported. In addition, it can also be used for testing both IP and PPP packets.

- **Message Encoder/Decoder Function**
  MX848001A-07 Message Encoder/Decoder

The provided protocol message encoder/decoder library supporting RRC, NAS (RR, CC, MM, GMM, SM), SMS and SS (Supplementary Service) makes it easy to change or extract message information elements in test scenarios.
This feature supports scenario conditional branch processing and received message analysis.

- **WNS Function**
  MX848060E WNS Evolution
  MX848060E-001 3GPP Release 7
  MX848060E-002 3GPP Release 8

To install this software in control PC, the following simulation can be performed without creating scenario.

- Voice Call Test, Packet Communication Test, Video Call Test, SMS/MMS Test, Out of service Test, Packet Preservation Test, Emergency Call and Cell Barred Test, ICE_T Test, Battery Life Test.

- **Voice Codec Function**
  MX848062C Multimedia Interface Software*1

The Multimedia Interface Software (MIS) is application software providing a voice codec function. When it is installed in an external PC connected to the MD8480C by Ethernet cable, End-to-End Voice communications can be tested between a microphone and speaker connected to the external PC and a mobile terminal.

- **AMR-WB Function**
  MX848062C-001 AMR-WB*1

This option adds the ANSI-C code for the Adaptive Multi Rate - Wideband (AMR-WB) speech codec (Release 6) specified in 3GPP TS 26.173 to the MIS.

*1: A PC is required to use the MX848062C MIS.
The specifications required for stable operation are listed below.
<Recommended specifications>
OS: Windows 2000/XP
CPU: Pentium III (1.6 GHz) or better
Memory: 512 MB min.
Others: Microphone input connector, Headphone output connector, One free LAN port

Other Options

– Software Maintenance Contracts –

- **W-CDMA/GSM 1-year Support Service**
  MD8480C-SS120, MD8480C-SS121*2

This optional 1-year contract provides the following services for W-CDMA/GSM functions.

- 3GPP Software upgrades and revisions
- Technical support for solving user problems

The MD8480C-SS120 software service contract is for W-CDMA/GSM related functions of the MD8480C; the MD8480C-SS121 contract is for ciphering (MX848041E/MX848045C) related functions.

- **HSDPA 1-year Support Service**
  MD8480C-SS122, MD8480C-SS123*2

This optional 1-year contract provides the following services for HSDPA functions.

- 3GPP Software upgrades and revisions
- Technical support for solving user problems

The MD8480C-SS122 software service contract is for HSDPA-related functions of the MD8480C; the MD8480C-SS123 contract is for HSDPA ciphering (MX848041E-10) related functions. (These contracts also require the MD8480C-SS120/SS121 contracts.)

- **HSUPA 1-year Support Service**
  MD8480C-SS124, MD8480-C-SS125*2

This optional 1-year contract provides the following services for HSUPA functions.

- 3GPP Software upgrades and revisions
- Technical support for user problems

The MD8480C-SS124 software service contract is for HSUPA-related functions of the MD8480C; the MD8480C-SS125 contract is for HSDPA ciphering (MX848041E-10) related functions. (These contracts also require the MD8480C-SS120/SS121 contracts.)

*2: For contract details, see the appended materials.

- **MD8480C 1-year Package Support Service**
  MD8480C-SS150, MD8480C-151*3

This optional 1-year contract provides the following services for all system functions of the MD8480C

- 3GPP Software upgrades and revisions
- Technical support for solving user problems

The MD8480C-SS150 software service contract is for all MD8480C systems software (W-CDMA/GSM/HSPA functions); the MD8480C-SS151 contract is for MD8480C ciphering (MX848041E/MX848045C) related functions.

- **MD8480C 2-year Package Support Service**
  MD8480C-SS250, MD8480C-251*3

This optional 2-year contract provides the following services for all system functions of the MD8480C.

- 3GPP Software upgrades and revisions
- Technical support for solving user problems

The MD8480C-SS250 software service contract is for all MD8480C systems software (W-CDMA/GSM/HSPA functions); the MD8480C-SS251 contract is for MD8480C ciphering MX848041E/MX848045C) related functions.

*3: All options for MD8480C-SS120/SS121/SS122/SS123/SS124/SS125.
This option is valid for all W-CDMA/GSM/HSDPA/HSUPA functions of the MD8480C.
See the appended materials for the contract details.

Hardware Maintenance

- **2-year Extended Warranty Service**
  MD8480C-ES210*4

This service extends the MD8480C standard 1-year warranty to 2 years.

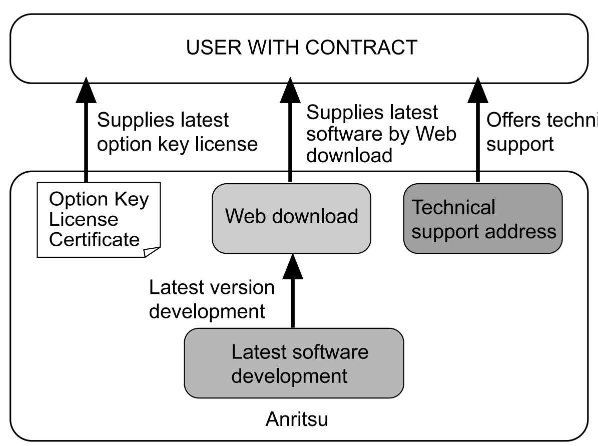
- **3-year Extended Warranty Service**
  MD8480C-ES310*4

This service extends the MD8480C standard 1-year warranty to 3 years.

- **5-year Extended Warranty Service**
  MD8480C-ES510*4

This service extends the MD8480C standard 1-year warranty to 5 years.

*4: Consumables not included



MD8480C Support System

Functions

• Decoding Test Channels

Logical	Transport	Physical	Symbol Rate
BCCH	BCH	P_CCPCH+P_SCH+S_SCH	15 ksps
–	–	P-CPICH	
		S-CPICH	
		AICH	
		PICH	
PCCH	PCH	S-CCPCH	15 ksps to 480 ksps
CCCH/DCCH/DTCH	FACH		
MCCH/MSCH/MTCH			
DCCH + DTCH	DCH	DPDCH	7.5 ksps to 960 ksps
		DPCCH	
	HS-DSCH*1	HS-PDSCH*1	240 ksps × 15 code
		HS-SCCH	30 ksps × 4 code
–	–	E-HICH*2	30 ksps
		E-AGCH*2	15 ksps
		E-RGCH*2	30 ksps
–	–	F-DPCH	15 ksps

• Coding Test Channels

Logical	Transport	Physical	Symbol Rate
CCCH/DCCH/DTCH	RACH	PRACH	15 ksps to 120 ksps
DCCH/DTCH	DCH	DPDCH	15 ksps to 960 ksps
		DPCCH	15 ksps
	E-DCH*2	E-DPDCH*2	15 ksps to 960 ksps × 4 code
		E-DPCCH*2	15 ksps
–	–	HS-DPCCH*1	15 ksps

*1: MU848072C-01 HSDPA is required
*2: MU848072C-02 HSUPA is required

• Supported Services

Service		Data Rate	Physical Channel Downlink (1 symbol = 2 bits)	Physical Channel Uplink (1 symbol = 1 bit)
Protocol	Standalone DCCH	–	1xDPCH (15 ksps)	1xDPDCH (15 ksps)
Voice (AMR)		12.2 kbps (VAD Opt. 01)	1xDPCH (30 ksps)	1xDPDCH (60 ksps)
ISDN 1B		64 kbps	1xDPCH (120 ksps)	1xDPDCH (240 ksps)
Packet		32 kbps	1xDPCH (60 ksps)	1xDPDCH (120 ksps)
		64 kbps	1xDPCH (120 ksps)	1xDPDCH (240 ksps)
		128 kbps	1xDPCH (240 ksps)	1xDPDCH (480 ksps)
		384 kbps	1xDPCH (480 ksps)	1xDPDCH (960 ksps)
Audio and Visual		32 kbps	1xDPCH (60 ksps)	1xDPDCH (120 ksps)
		64 kbps	1xDPCH (120 ksps)	1xDPDCH (240 ksps)
Reference Measurement Channel		DCCH	1xDPCH (15 ksps)	1xDPDCH (15 ksps)
		12.2 kbps	1xDPCH (30 ksps)	1xDPDCH (60 ksps)
		64 kbps	1xDPCH (120 ksps)	1xDPDCH (240 ksps)
		144 kbps	1xDPCH (240 ksps)	1xDPDCH (480 ksps)
		384 kbps	1xDPCH (480 ksps)	1xDPDCH (960 ksps)
		BTFD	1xDPCH (30 ksps)	1xDPDCH (60 ksps)
Multi Call	Voice + Packet	12.2 + 32 kbps	1xDPCH (15 ksps)	1xDPDCH (240 ksps)
		12.2 + 64 kbps		
		12.2 + 384 kbps		1xDPDCH (960 ksps)
	Voice + ISDN 1B	12.2 + 64 kbps		1xDPDCH (240 ksps)

Specifications

• MD8480C W-CDMA Signalling Tester

Electrical Characteristics	Frequency Range	Tx: 300 MHz to 3000 MHz Rx: 350 MHz to 2700 MHz*1
	Maximum Input Level (Total Level)	+40 dBm (Main connector), +20 dBm (Uplink connector)
	RF Input/Output Connector	Main: N type, Impedance: 50Ω, VSWR: ≤1.3 Downlink 1: SMA type, Impedance: 50Ω, VSWR: ≤2.0 Downlink 2*2: SMA type, Impedance: 50Ω, VSWR: ≤2.0 Uplink: SMA type, Impedance: 50Ω, VSWR: ≤2.0
	Reference Oscillator	Frequency: 10 MHz Startup characteristics: ≤±5 × 10^{-8} (10 minutes after power-on, referenced to 24 hours after power-on) Aging rate: ≤±2 × 10^{-8}/day, ≤±1 × 10^{-7}/year (referenced to 24 hours after power-on) Temperature: ≤±5 × 10^{-8} (0° to 40°C, referenced to 25°C) External reference input: BNC type, 10 MHz, 2 to 5 Vp-p Reference output: BNC connector, 10 MHz, TTL level
Transmitter	Frequency Resolution	100 kHz
	Maximum Tx Channels	30 ch (120 ch max. with option)
	Maximum Tx Power	Main: –25 dBm/ch Downlink 1: –10 dBm/ch Downlink 2: –10 dBm/ch
	Tx Power Setting Range	Setting range: 0 to –120 dB from Tx power (by ATT) Resolution: 0.1 dB steps
	Level Accuracy	±1.5 dB ≥–113 dBm (18° to 28°C with calibrated CW)
	Modulation	QPSK, 16QAM (with MU848072C-01), 64QAM (with MX848001E-13)
	Chip Rate	3.84 MHz
	Modulation Band Limit	Root Nyquist roll off (α = 0.22)
	EVM	≤7% rms (1 ch)
Receiver	Frequency Resolution	100 kHz
	Input Level Range	Main: –30 to +40 dBm Uplink: –50 to +20 dBm
	Modulation	BPSK, 4PAM (with MX848001E-13)
Others	Ambient Temperature (Operating)	0° to +40°C
	Ambient Temperature (Storage)	–40° to +70°C
	Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac), 50 Hz/60 Hz, ≤650 VA
	Dimensions and Mass	426 (W) × 310 (H) × 500 (D) mm, ≤35 kg
	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1

*1: With yellow "Uplink 350 MHz to 2700 MHz" label attached to MD8480C front panel.
Units with no label are 350 MHz to 550 MHz, 700 MHz to 1100 MHz and 1400 MHz to 2200 MHz.
*2: With MD8480C-04 Additional RF unit 3. MD8480C-04 electrical and transmission characteristics same as above.

• GSM Specifications: MU848060C TDMA2

Transmitter (GSM)	Frequency Resolution	100 kHz
	Maximum Tx RF Channel	2 ch*1
	Maximum Output Power	Main: –15 dBm Downlink 1: 0 dBm*1, *2 Downlink 2: 0 dBm
	Tx Power Setting Range	Setting range: 0 to –120 dB from average Tx power (by ATT) Resolution: 0.1 dB steps
	Level Accuracy	≤1.5 dB ≥–113 dBm (18° to 28°C with calibrated CW)
	Modulation	GMSK, 8PSK (with MU848060C-01)
	Symbol Rate	270.833 kHz
	Phase Error (GMSK)	≤5.0° rms
	EVM (8PSK)	≤7% rms
Receiver (GSM)	Frequency Resolution	100 kHz
	Input Level Range	Main: –30 to +35 dBm Uplink: –50 to +15 dBm
	Modulation	GMSK, 8PSK (with MU848060C-01)

*1: Only when two MU848060C TDMA2 units installed
*2: No GSM signal is output from this connector when only one TDMA2 unit is installed.

• ISDN Specifications: MU848055C ISDN/CSD

Electrical Characteristics (Interface and Others)	BRI 1	ISDN Basic rate interface (BRI) 1 Channels: 2B + D (B: 64 kbps, D: 16 kbps) Connector: 8 pin modular connector
	BRI 2	ISDN Basic rate interface (BRI) 2 Channels: 2B + D (B: 64 kbps, D: 16 kbps) Connector: 8 pin modular connector
	BRI 3	ISDN Basic rate interface (BRI) 3 Channels: 2B + D (B: 64 kbps, D: 16 kbps) Connector: 8 pin modular connector
	Serial	RS-232C Standard serial interface Connector: 9 pin D-Sub connector
Others	Functions	Connection with ISDN terminals.

Additional Unit/Option Selection Guide

The unit options/quantities marked in the table below are required for each additional function.

No.	Additional Function	Minimum Configuration (including 1BTS)							Hardware Options								Software Options																							Software Support Contract						
		MD8480C	MU848051A	MU848056A	MU848071E	MU848072E	MU848073C	Z1190A	MU848072E	MU848072C-01	MU848072C-02	MU848060C	MU848060C-01	MU848055C	MU848077C	MD8480C-04	MX848001A-01 MX848041A-01	MX848001C-11 MX848041C-11	MX848001A-02 MX848041A-02	MX848001A-03 MX848041A-03	MX848001A-04 MX848041A-04	MX848001A-05 MX848041A-05	MX848001A-06 MX848041A-06	MX848001A-07 MX848041A-07	MX848001C-30 MX848041C-30	MX848001C-12 MX848041C-12	MX848001E-13 MX848041E-13	MX848001E-14 MX848041E-14	MX848001E-15 MX848041E-15	MX848001E-16 MX848041E-16	MX848001E-17 MX848041E-17	MX848060E	MX848060E-001	MX848060E-002	MX848062C	MX848062C-001	MX848041E[*1]	MX848041E-10	MX848045C[*1]	MD8480C-SS120 MD8480C-SS121	MD8480C-SS122 MD8480C-SS123	MD8480C-SS124 MD8480C-SS125	MD8480C-SS150[*2] MD8480C-SS151[*2]	MD8480C-SS250[*2] MD8480C-SS251[*2]	Z1217A[*3] Z1218A[*3]	MC0011A[*4]
1	W-CDMA 1BTS				1																																			1					1[*3]	1[*4]
2	HSPA 1BTS				1				1																																		1[*2]	1[*2]	1[*3]	1[*4]
3	2BTS Soft Handover (HSPA)				1				1	2	2																																1[*2]	1[*2]	1[*3]	1[*4]
4	3BTS Soft Handover (HSPA)				1				2	3	3																																1[*2]	1[*2]	1[*3]	1[*4]
5	4BTS Soft Handover (HSPA)				1				3	4	4																																1[*2]	1[*2]	1[*3]	1[*4]
6	Hard Handover (WCDMA - WCDMA)				1				1							1			1																					1					1[*3]	1[*4]
7	Inter System Handover (GSM/GPRS/EGPRS)				1							1	1			1			1																					1					1[*3]	1[*4]
8	Intra-System Handover (GSM/GPRS/EGPRS)				1							2	2			1			1																					1					1[*3]	1[*4]
9	Baseband Interface (W-CDMA)				1										1																									1					1[*3]	1[*4]
10	HSPA Evolution (CPC, CS Voice over HSPA etc)				1					1	1															1																	1[*2]	1[*2]	1[*3]	1[*4]
11	DL 64QAM (21 Mbps), UL 16QAM (11 Mbps)				1					1	1															1	1																1[*2]	1[*2]	1[*3]	1[*4]
12	MIMO (RF)				1				1	2	1					1			1							1		1															1[*2]	1[*2]	1[*3]	1[*4]
13	MIMO (RF+Baseband)				1				1	2	1				2	1			1							1		1															1[*2]	1[*2]	1[*3]	1[*4]
14	Improved L2 for UL/ Enhanced UL for Cell FACH				1					1	1															1			1														1[*2]	1[*2]	1[*3]	1[*4]
15	DC-HSDPA				1					1	1															1				1													1[*2]	1[*2]	1[*3]	1[*4]
16	DL 64QAM+MIMO				1				1	2	2					1			1							1	1	1			1												1[*2]	1[*2]	1[*3]	1[*4]
17	Tx Diversity (1 Antenna W-CDMA)				1				1								1																							1					1[*3]	1[*4]
18	Tx Diversity (2 Antenna W-CDMA)				1				1							1	1		1																					1					1[*3]	1[*4]
19	Tx/Rx Diversity (1 Antenna HSPA)				1				1	2	2						1	1																									1[*2]		1[*3]	1[*4]
20	Tx/Rx Diversity (2 Antenna HSPA)				1				1	2	2					1	1	1	1																								1[*2]		1[*3]	1[*4]
21	Ciphering (W-CDMA)				1																																1[*1]			1					1[*3]	1[*4]
22	Ciphering (HSPA)				1					1	1																										1[*1]	1					1[*2]	1[*2]	1[*3]	1[*4]
23	Ciphering (GSM/GPRS)				1							1				1																							1[*1]	1					1[*3]	1[*4]
24	Router Connection (W-CDMA)				1															1																				1					1[*3]	1[*4]
25	RoHC				1															1																				1					1[*3]	1[*4]
26	L3 Message Encoder/ Decoder (W-CDMA)				1																			1																1					1[*3]	1[*4]
27	CSD (W-CDMA)				1									1									1																	1					1[*3]	1[*4]
28	CSD (GSM)				1							1		1		1					1																			1					1[*3]	1[*4]
29	GSM Frequency Hopping				1							1				1						1																		1					1[*3]	1[*4]
30	Dual Transfer Mode (DTM)				1							1				1									1															1					1[*3]	1[*4]
31	Voice Codec(AMR-NB, EFR, FR, HR)				1																														1					1					1[*3]	1[*4]
32	Voice Codec (AMR-WB)				1																														1	1				1					1[*3]	1[*4]
33	WNS (Rel-7)				1				1	2	2	1	1	1		1	1	1		1					1	1	1					1	1							1			1[*2]	1[*2]	1[*3]	1[*4]
34	WNS (Rel-8)				1				1	2	2	1	1	1		1	1	1		1					1	1	1			1		1	1	1						1			1[*2]	1[*2]	1[*3]	1[*4]
35	Support Service (W-CDMA/GSM)				1																																			1					1[*3]	1[*4]
36	Support Service (HSDPA)				1					1																														1	1				1[*3]	1[*4]
37	Support Service (HSUPA)				1						1																																1[*2]	1[*2]	1[*3]	1[*4]
	Your Choice				1																																									

*1: The MX848041A-xx, MX848041C-yy or MX848041E-zz must be ordered when the unit/option is used with MX848001A-xx, MX848001C-yy or MX848001E-zz.
*2: Package Support Option (supports all systems).
This option integrates the MD8480C-SS120, MD8480C-SS121, MD8480C-SS122, MD8480C-SS123, MD8480C-SS124, and MD8480C-SS125.
*3: Software CD-ROM including latest firmwares and documents.
*4: The Web Access Key (MC0011A) is for downloading the latest firmware and documents from the Anritsu download website.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MD8480C	W-CDMA Signalling Tester
	Standard unit (incorporated in main frame)
MU848051A	CPU
MU848056A	Voice Codec
MU848071E	L2 Evolution
MU848072E	BTS Evolution
MU848073C	Timing Generator (support HSPA Evolution type)
Z1190A	MD8480C 1st RF Unit 3 (standard RF Unit)
	Standard accessories
	Shield Power Cord (13 A): 1 pc
J1251	Cable (Twisted-pair, cross over): 1 pc
J0127A	Coaxial Cord, 1.0 m (BNC-P · ERG58A/U · BNC-P): 1 pc
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P): 1 pc
J0654A	Serial Interface Cable (IBM-PC/AT, for remote control): 1 pc
J1006	Monitor Cable (20/50-pin 0.5 m): 1 pc
F0111	Fuse, 15 A: 1 pc
T0001	Ferrite Core: 2 pcs
T0002	Ferrite Core: 1 pc
G0091	Monitor Board: 1 pc
A0058A	Handset: 1 pc
A0010	Blank Board (quantity varies with product configuration): 10 pcs
	MU848077C Standard accessories
J1306	Monitor Cable 68 [VHDCI-68P · DX30-50P, for connecting BTS Unit Monitor (LVCMOS)-MU848077C Monitor Input]
J1307	Digital I/Q Cable (DX30-50P · DX30-50P, for connecting MU848077C Digital IQ I/O-User Board, and executing self-diagnostic loopback test.)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
T0004	Ferrite Core (SFC-5)
	Hardware options
MU848055C	ISDN/CSD
MU848060C	TDMA2
MU848060C-01	EGPRS (R99)
MU848072E	BTS Evolution
MU848072C-01	HSDPA
MU848072C-02	HSUPA
MU848072C-40	MF6900 Interface (for MU848072C1 only. MU848072E supports this function as standard.)
MU848077C	Baseband Interface Unit
MD8480C-04	Additional RF Unit 3
	Software options
MX848001A-01	W-CDMA Signalling Tester Tx Diversity (license document)
MX848001A-02	W-CDMA Signalling Tester Compressed Mode (license document)
MX848001A-03	W-CDMA Signalling Tester Router Connection (license document)
MX848001A-04	W-CDMA Signalling Tester GSM CSD (license document)
MX848001A-05	W-CDMA Signalling Tester GSM Frequency Hopping (license document)
MX848001A-06	W-CDMA Signalling Tester W-CDMA CSD (license document)
MX848001A-07	Message Encoder/Decoder (license document)
MX848001C-11	HSDPA Tx Diversity (license document)
MX848001C-12	HSPA Evolution (Release 7) (license document)
MX848001E-13	Higher Order Modulation (Release 7) (license document)
MX848001E-14	2×2 MIMO (Release 7) (license document)
MX848001E-15	HSPA Evolution for uplink (Release 8) (license document)
MX848001E-16	DC-HSDPA (Release 8) (license document)
MX848001E-17	64QAM and MIMO for HSDPA (Release 8) (license document)
MX848001C-30	DTM (R99) (license document)
MX848041E	Firmware for Ciphering (CD-ROM, license document)
MX848041A-01	Tx Diversity for Ciphering (license document)
MX848041A-02	Compressed Mode for Ciphering (license document)
MX848041A-03	Router Connection for Ciphering (license document)
MX848041A-04	GSM CSD for Ciphering (license document)
MX848041A-05	GSM Frequency Hopping for Ciphering (license document)
MX848041A-06	W-CDMA CSD for Ciphering (license document)
MX848041A-07	Message Encoder/Decoder for Ciphering (license document)
MX848041E-10	HSDPA Ciphering (license document)
MX848041C-11	HSDPA Tx Diversity for Ciphering (license document)
MX848041C-12	HSPA Evolution (Release 7) for Ciphering (license document)
MX848041E-13	Higher Order Modulation (Release 7) for Ciphering (license document)
MX848041E-14	2×2 MIMO (Release 7) for Ciphering (license document)
MX848041E-15	HSPA Evolution for uplink (Release 8) for Ciphering (license document)

Model/Order No.	Name
MX848041E-16	DC-HSDPA (Release 8) for Ciphering (license document)
MX848041E-17	64QAM and MIMO for HSDPA (Release 8) for Ciphering (license document)
MX848041C-30	DTM (R99) for Ciphering (license document)
MX848045C	GSM/GPRS 2 Ciphering (CD-ROM, license document)
MX848060E	WNS Evolution
MX848060E-001	3GPP Release 7
MX848060E-002	3GPP Release 8
MX848062C	Multimedia Interface Software (license document)
MX848062C-001	AMR-WB (license document)
	Software CD-ROM
Z1217A	MD8480C Software CD-ROM (CD-ROM)
Z1218A	MD8480C Software CD-ROM with Ciphering (CD-ROM)
	Software support service
MD8480C-SS120	1-year Support Service (W-CDMA/GSM) (license document)
MD8480C-SS121	1-year Support Service Ciphering (W-CDMA/GSM) (license document)
MD8480C-SS122	1-year Support Service (HSDPA) (license document)
MD8480C-SS123	1-year Support Service Ciphering (HSDPA) (license document)
MD8480C-SS124	1-year Support Service (HSUPA) (license document)
MD8480C-SS125	1-year Support Service Ciphering (HSUPA) (license document)
MD8480C-SS150	1-year Support Service (W/G/HSPA) (license document)
MD8480C-SS151	1-year Support Service Ciphering (W/G/HSPA) (license document)
MD8480C-SS250	2-year Support Service (W/G/HSPA) (license document)
MD8480C-SS251	2-year Support Service Ciphering (W/G/HSPA) (license document)
MC0011A	Web Access Key (USB Dongle for online software download)
	Hardware extended warranty service
MD8480C-ES210	Extended Warranty Service (extended 2-year hardware warranty)
MD8480C-ES310	Extended Warranty Service (extended 3-year hardware warranty)
MD8480C-ES510	Extended Warranty Service (extended 5-year hardware warranty)
	Hardware retrofit option
Z1181A	MD8480B to HSPA Evolution Mainframe Upgrade (upgrade MD8480A/B to MD8480C Main frame for HSPA Evolution, 1RF, for Asia Oceania)
Z1181B	MD8480B to HSPA Evolution Mainframe Upgrade (upgrade MD8480A/B to MD8480C Main frame for HSPA Evolution, 2RF, for Asia Oceania)
Z1182A	MD8480B to HSPA Evolution Mainframe Upgrade (upgrade MD8480A/B to MD8480C Main frame for HSPA Evolution, 1RF)
Z1182B	MD8480B to HSPA Evolution Mainframe Upgrade (upgrade MD8480A/B to MD8480C Main frame for HSPA Evolution, 2RF)
Z1183A	MD8480B to HSPA Evolution Mainframe Upgrade (upgrade MD8480C to E type for HSPA Evolution, 1RF, for Asia Oceania)
Z1183B	MD8480B to HSPA Evolution Mainframe Upgrade (upgrade MD8480C to E type for HSPA Evolution, 2RF, for Asia Oceania)
Z1184A	MD8480B to HSPA Evolution Mainframe Upgrade (upgrade MD8480C to E type for HSPA Evolution, 1RF)
Z1184B	MD8480B to HSPA Evolution Mainframe Upgrade (upgrade MD8480C to E type for HSPA Evolution, 2RF)
Z1185A	MD8480B to MD8480C Mainframe Upgrade (upgrade MD8480A/B to MD8480C Main frame, 1RF, for Asia Oceania)
Z1185B	MD8480B to MD8480C Mainframe Upgrade (upgrade MD8480A/B to MD8480C Main frame, 2RF, for Asia Oceania)
Z1186A	MD8480B to MD8480C Mainframe Upgrade (upgrade MD8480A/B to MD8480C Main frame, 1RF)
Z1186B	MD8480B to MD8480C Mainframe Upgrade (upgrade MD8480A/B to MD8480C Main frame, 2RF)
Z1187A	BTS Evolution Upgrade (upgrade additional BTS MU848058A/72C/C1 to MU848072E, for Asia Oceania)
Z1188A	BTS Evolution Upgrade (upgrade additional BTS MU848058A/72C/C1 to MU848072E)
Z0772	MD8480C Baseband Interface (adds MU848077C, and updates MU848072C → MU848072C1, for Asia Oceania)
Z0807	MD8480C Baseband Interface (adds MU848077C, and updates MU848072C → MU848072C1)
Z0903A	TDMA2 Upgrade (changes MU848060B → MD848060C, for Asia Oceania)
Z0913A	TDMA2 Upgrade (changes MU848060B → MD848060C)

Continued on next page

Model/Order No.	Name
	Application parts
MF6900A	Fading Simulator
MX690020A	W-CDMA Extended Model (required for connecting with the MD8480C)
J1159A	Coaxial Cord (SMA · MQ198-10S-CV, 1.5 m)
J1176	IMT-2000 UE Connection Cable (SMA · MQ198-10S-CV, 0.3 m)
J1263	W-CDMA Interface Cable (SMA · Cable for UE Connection, USB)
J0004	N-SMA Adaptor
J0658	Adaptor (SMA, L-type)
J1308	Monitor I/Q Cable [DX50-80P · DX50-80P, for connecting G0091 monitor board (G0091 also supports use of J1006)]
J1419A	Fading Simulator Cable, 1.5 m (for connecting ELEKTROBIT PROPSim C2/C8)
J1310	VStation Cable (for connecting Mentor Graphics VStation)
J1420	Palladium Cable (for connecting Cadence Design Systems Palladium)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P, for extending Ref. connection)
P0035B	W-CDMA/GSM Test USIM (Standard UICC Size, for W-CDMA/GSM, different authentication key from P0019)
P0035B7	W-CDMA/GSM Test USIM (Micro UICC Size)

MD8480C requires PC*1 and Microsoft Visual C++ Version 6.0, .NET, Visual Studio 2005 or 2008 Express Edition, 2010 Express Edition.

*1: The PC is for controlling the MD8480C. It must meet the following specifications:
OS: Windows XP (SP3)/Vista (SP1)/7 (64 bit) English Version
CPU: Pentium 4 1.6 GHz min.
Memory: 512 MB min.
Interfaces: RS-232C, Ethernet, 10BASE-T/100BASE-Tx, CD/DVD-ROM drive

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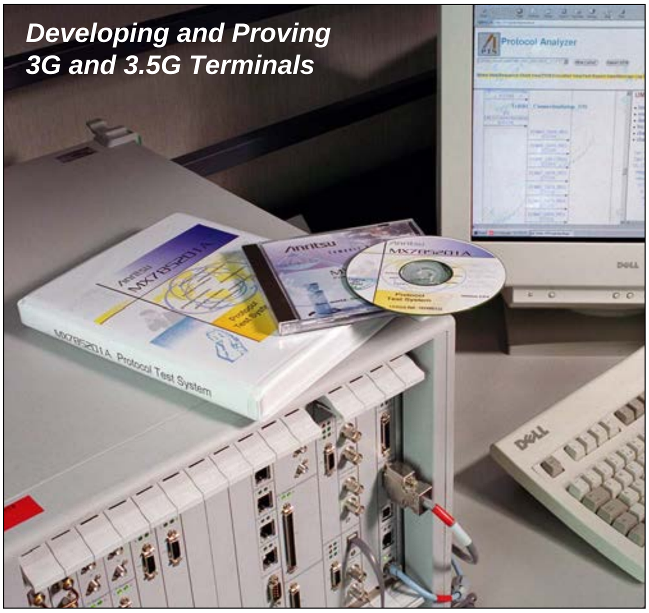
- Pentium® is registered trademarks of Intel Corporation or its subsidiaries in the USA and other countries

PROTOCOL TEST SYSTEM (PTS)
MX785201A

PROTOCOL CONFORMANCE TEST TOOLKIT
MX785220A



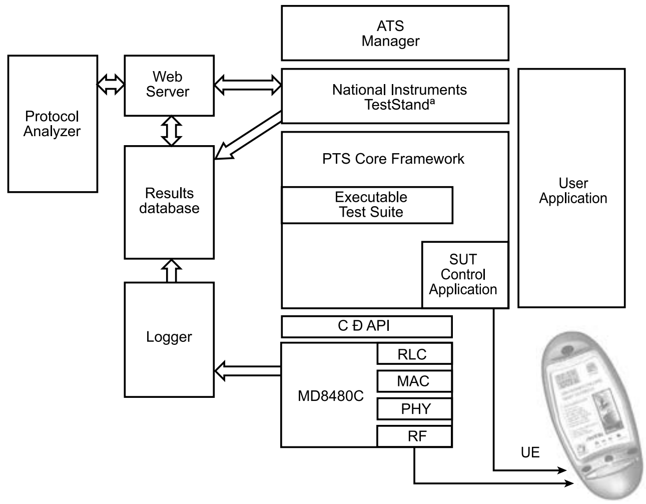
The MX785201A Protocol Test System (PTS) is a verification tool for 3G/3.5G wireless terminals. PTS have been developed to provide the test support today's research and development engineers need to successfully meet demanding performance and time to market targets.
PTS provides common user interface, thus reducing operator learning time as development progresses and migrates over the range of Anritsu's 3G/3.5G development tools.

Features
- W-CDMA protocol test capability including HSPA Evolution
- 3GPP standard compliant development tool
- Common user interface across Anritsu development tools
- InterRAT capability for 2G/3G/3.5G testing
- Environment supporting TTCN (Tree and Tabular Combined Notation) test case execution
- TTCN test libraries for development, integration and conformance testing

PTS
The PTS software is combined with the MD8480C W-CDMA Signalling Tester to make a system providing an environment to exercise Layer 3 and Layer 2 signalling protocols defined within the Third Generation Partnership Project (3GPP).
The PTS software component runs on a Windows XP PC.
PTS execute TTCN test cases through which can be defined:
- Sequences of Layer 3 messages and expected responses
- Layer 3 to Layer 2 service primitives to trigger specific Layer 2 procedures, or to configure Layer 2 operation
- Layer 3 to Layer 1 service primitives to configure and initiate Layer 1 operation
- Service primitives to and from user provided code modules for User Equipment (UE) control

An application-programming interface (API) to enable user generated "C" language test scenarios to be executed is available for the PTS.
Supports multiple 3G cells, enabling Soft and Hard handover.
In addition, supports inter-system handover between GSM to W-CDMA, GPRS to W-CDMA, and vice versa.

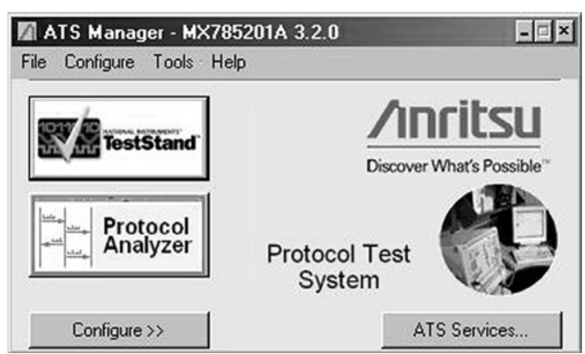
System Overview



PTS Core Software

Evolution with 3GPP
The capability of PTS continue to evolve and additional capabilities are added in-line with the changing 3GPP specifications. In addition, the PTS supports the Layer 1 and Layer 2 parameter sets defined in the 3GPP TS 34.108 specification.

- **ATS Manager**



The ATS Manager provides a user interface that allows configuration of the PTS, launch of the test sequencer tool to select and execute pre-prepared Layer 3 and Layer 2 test procedures and browsing of the results from executing the test procedures using the Protocol Analyzer.

• Protocol Analyzer
All Layer 3, Layer 2 and Layer 1 message exchanges between the PTS and the System Under Test are logged. These messages are decoded to show the name and content of each field and displayed using the Protocol Analyzer. Raw captured data is displayed in hexadecimal format.

• National Instruments TestStand
The PTS uses the National Instruments TestStand run-time engine as a high level sequencing tool.
The TestStand development system is used to create test sequences.

• C-API
As an alternative language to develop Layer 3 and Layer 2 test procedures, a 'C' based Application Programmer's Interface (C-API) is included in the form of a DLL.

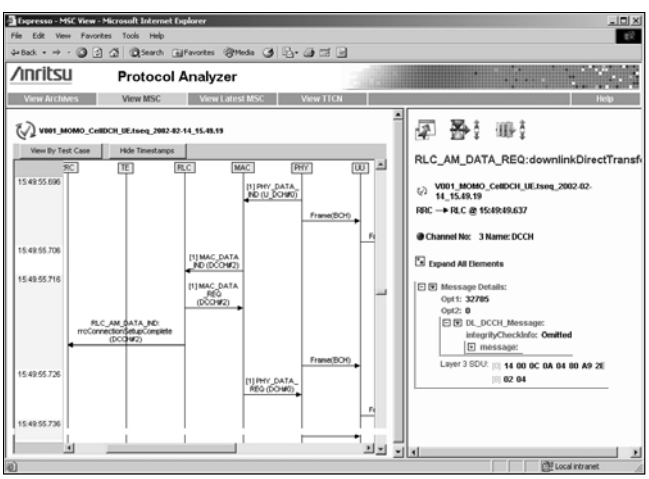
• Executable Test Suite
Layer 3 and Layer 2 test cases are implemented using TTCN. Created TTCN tests are compiled to an Executable Test Suite (ETS) which interfaces to the PTS via the GCI management interface and the GCI operational interface. These provide an open, standardized interface to TTCN based executable test suites. The PTS has been developed to work with the Telelogic Tau TTCN Test Suite.
The GCI framework provided by the PTS provides support for a number of Test Suite Operations (TSOs) and also Protocol Implementation Conformance Statement (PICS/PIXIT).

• Codec
The ETS is supported by a codec capable of encoding and decoding Radio Resource Control (RRC), Non Access Stratum (NAS) and lower layer configuration data.

• Thin RRC
A thin RRC is provided to load NAS messages into RRC direct transfer messages and unload NAS messages from RRC direct transfer messages transparently.

• SUT Control Application
The PTS framework provides an API to support test automation using standard AT commands and an MMI interface to automatically control the UE.

• Logger and Results Database
The logger captures data from the majority of components in the system and stores it in the results database. This data is used by the protocol analyzer to create message sequence charts and display decoded messages.



• RLC and MAC
RLC and MAC layers conforming to the 3GPP specifications TS 25.322 Radio Link Control Protocol Specification and TS 25.321 Medium Access Control Specification are supplied as part of MD8480C.

• Terminal Equipment (TE)
The TE is an optional software component available as part of the MD8480C in the PTS. It supports a number of features including voice AMR 12.2k Codec, ISDN, IP and PPP.

• Layer 1
The PTS provides a physical Layer 1 through the MD8480C that can communicate with a terminal.

Test Libraries

• Integration Library
The Integration Library provides a proven set of TTCN test scripts that have been tested on real terminals. These test cases take the user through specific milestones (e.g., RRC connection, location update, voice call, etc.) and provide a straightforward method for testing of terminals during the integration process. They provide a step by step test approach to prove functionality in a UE.
The test procedures are 3GPP compliant and are designed to be customized to the particular needs of an Integration Environment.
The PTS Integration Library provides TTCN test cases in both executable and source code form, allowing the more experienced user to make changes to the parameters in order to test more specific details of the terminal design.

Conformance Testing

Anritsu offers a range of solutions designed to meet specific customer requirements for UE protocol conformance testing based on the 3GPP standards.

• GCF/PTCRB Conformance Test Toolkits
These packages are designed for formal UE validation and pre-conformance testing of the GCF/PTCRB Work Items. The toolkits includes:
- GCF/PTCRB Approved Test Cases
- GCF/PTCRB Approved PTS Software Release
- RFI Certificate of GCF/PTCRB Approvals
- Product Release Notes
- Operations and Installation Manuals
- GCF/PTCRB Current Exceptions/Issues
- Test Time Estimates
- Copy of GCF/PTCRB Approval Submission Documentation

The annual support contract provides an update following each quarterly GCF (Global Certification Forum) CAG approval meeting.
Please see separate datasheet for MX785220A Conformance Test Toolkits for further details.

Options Available

• Upgrading Existing PTS License to Support RTD

MX786201A The Rapid Test Designer (RTD) Option provides a quick and easy method of developing test cases to run on the PTS license. Rapid Test Designer (RTD) is a revolutionary tool which speeds up the testing of UMTS and LTE terminals significantly by greatly simplifying the way in which tests are created, executed and analyzed. RTD has a mature customer base of 3G installations using the MD8480C W-CDMA Signalling Tester and is now able to provide a cost effective solution to migrate over to LTE with the MD8430A LTE Signalling Tester. This combination makes a comprehensive and flexible solution for the most powerful protocol development system for next generation wireless terminals.

The RTD is the fastest and most efficient way to ensure that modern terminal behaviour can be comprehensively exercised. Its ability to simulate network scenarios with actual network settings takes it beyond conformance testing and into real world situations. Network Operators are making use of the RTD's intelligent test tools to ensure that terminals behave correctly on their networks.

TERMINAL DEVELOPMENT from R&D to Conformance and Beyond:

R&D teams will spend thousands of hours developing, integrating and proving their terminal designs. The RTD now provides LTE design teams with procedures that test low level configuration as well as L3 protocol. Individually the procedure libraries provide tools for teams at different parts of the design process. By combining and merging them, very detailed proving and integration of designs is possible. As specifications evolve, the RTD provides a roadmap that reflects the fast moving needs of the developers. As a consequence increased dependence upon regression testing will be required to ensure changes do not affect the designs. RTD provides all the tools for immediate test definition, analysis and execution.

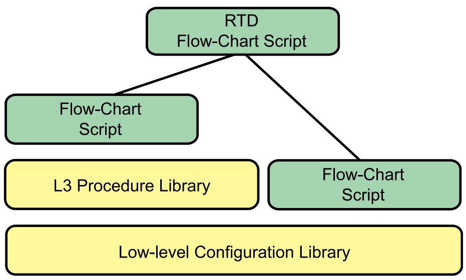
Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	PTS mainframe and options
MX785201A	Protocol Test System Core Software
MX785201A-10	Multi-Cell Capability (SHO)
MX785201A-11	Multi-Cell (Inter-frequency) Capability (HHO)
MX785201A-12	MultiRAT (FDD/GSM) Capability
MX785201A-14	Multiple MD8480 Support
MX785201A-31	TTCN Integration Library Source Code
MX785201A-40	Ciphering
MX785201A-053	PTS Run-time Engine, for Multi-cell Capability
MX785201A-058	TTCN-2 Scripting Interface For PTS
	Application/Tools options
MX787401A	Set of Signalling Application Support Tools
MX787401A-012	Remote Control Interface
MX787401A-013	Signalling Application Tool for Terminal Automation
MX787401A-014	Signalling Application Tool for Test Sequencing
MX787401A-015	Protocol Analyser (PTS/PCT)
MX787401A-043	OCNS Driver
	Framework/Technology options
MX787201A	Multi-RAT Framework for Signalling Testing Applications
MX787201A-012	Enabler for Multiple Signalling Testers
MX787201A-021	GERAN Framework for Signalling Testing Applications
MX787201A-023	Framework UTRAN Core (Incl. HSPA)
	Conformance Toolkit options
MX785220A	Protocol Conformance Test Toolkit Core Software
MX785220A-01	PCT System Certification Frequency Band 1
MX785220A-02	PCT System Certification Frequency Band 2
MX785220A-04	PCT System Certification Frequency Band 4
MX785220A-05	PCT System Certification Frequency Band 5
MX785220A-06	PCT System Certification Frequency Band 6
MX785220A-07	PCT System Certification Frequency Band 7
MX785220A-08	PCT System Certification Frequency Band 8
MX785220A-09	PCT System Certification Frequency Band 9
MX785220A-10	Conformance Test Cases for GCF WI-010
MX785220A-12	Conformance Test Cases for GCF WI-012
MX785220A-13	Conformance Test Cases for GCF WI-013
MX785220A-14	Conformance Test Cases for GCF WI-014
MX785220A-24	Conformance Test Cases for GCF WI-024
MX785220A-25	Conformance Test Cases for GCF WI-025
MX785220A-80	Conformance Test Cases for Release 7 (Package 1)
MX785220A-81	Conformance Test Cases for Release 7 (Package 2)
	Support service options
MX785201A-20	Software Update and Maintenance Contract
MX787401A-SS100	Maintenance for Software Tools
MX787201A-SS100	Maintenance for Technology Framework
MX785220A-20	Annual Software Update and Maintenance Contract

Note that libraries and options require the underlying core functionality to be present to function fully.

RAPID TEST DESIGNER (RTD)
MX786201A



- Faster Test Development
- Easier Test Maintenance
- Automatic Simulator Configuration
- Less Specific Protocol Knowledge Required

The MX786201A Rapid Test Designer (RTD) is a revolutionary tool which speeds up the testing of UMTS and LTE terminals significantly by greatly simplifying the way in which tests are created, executed and analyzed. RTD has a mature customer base of 3G installations using the MD8480C W-CDMA Signalling Tester and is now able to provide a cost effective solution to migrate over to LTE with the MD8430A LTE Signalling Tester. This combination makes a comprehensive and flexible solution for the most powerful protocol development system for next generation wireless terminals.
The RTD is already established as a proven multi-standard graphical flow chart tool for many organizations. MD8480C has now become a reference as an essential part of test systems reflected by its extensive use in all aspect of the 3G terminal development cycle including R&D, integration, regression, conformance, acceptance and validation. It has the ability to create almost limitless network simulations and is now complimented by the MD8430A for LTE and MD8470A for CDMA2000.
The RTD is the fastest and most efficient way to ensure that modern terminal behaviour can be comprehensively exercised. Its ability to simulate network scenarios with actual network settings takes it beyond conformance testing and into real world situations.
Network Operators are making use of the RTD's intelligent test tools to ensure that terminals behave correctly on their networks. Terminal development teams simulate conditions in networks that may be thousands of miles away and may not yet support the new functionality present in new handsets hence saving time and money.
Finally, the RTD provides one click, instant execution with no test case build or compilation phase necessary to enable very effective and efficient development of test case libraries for a wide variety of purposes:

- Acceptance Testing
- Integration Testing
- Generating variants
- Application Testing
- Regression Testing
- Pre-conformance Testing
- Prototyping Testing
- Hardware and Software Integration
- Software Development

Terminal Development from R&D to Conformance and Beyond

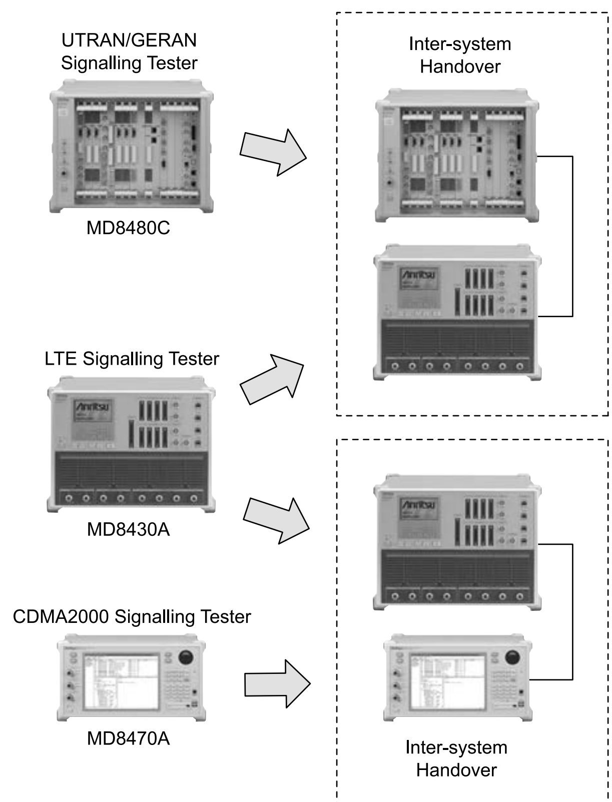
R&D teams will spend thousands of hours developing, integrating and proving their terminal designs. The RTD now provides LTE design teams with procedures that test low level configuration as well as L3 protocol.
Individually the procedure libraries provide tools for teams at different parts of the design process. By combining and merging them, very detailed proving and integration of designs is possible.
As specifications evolve, the RTD provides a roadmap that reflects the fast moving needs of the developers.
As a consequence increased dependence upon regression testing will be required to ensure changes do not affect the designs. RTD provides all the tools for immediate test definition, analysis and execution.

Time to Market

With competition being so great and staff movement an issue, teams cannot afford to add time to development of new products. The RTD provides an intuitive interface that is easy to learn and provides flexible and informative feedback to the operator. This allows developers to accelerate the learning curve for new technology and the tools needed for successful designs.

RTD Supports

GSM	HSPA Evolution
GPRS	CDMA2000
EGPRS	LTE (FDD/TDD)
UMTS	



Evolution to LTE

Key Facts

- Development environment for layer 1 to layer 3 signalling
- Integration test packages and software tools for developing LTE terminals
- Extensive procedure library with preconfigured messages and signalling
- Proven software tools for integration of legacy scenarios
- One button upgrade process for existing tests

Regression Testing

Regression testing also needs to be performed as new software is introduced into networks. RTD makes it possible to modify test scripts simply by applying a new set of network parameters or making a change to a reference that can populate a suite of tests. The test suite can then be run overnight or unattended, presenting the operator with an executive summary to enable software stability trends to be mapped.

Maintaining Tests

Wireless terminal developers will build up large libraries of tests for ongoing development and regression testing of their designs.
The RTD has the ability to update these libraries using the latest 3GPP Release automatically, saving many hours of test re-creation and debugging.

Beyond Conformance

Although conformance tests prove adherence to specifications, they play little part in simulating "real world" conditions where consideration to interfering signals and user plane data is involved. The RTD makes test scenarios easy to create and then iterate as there is no lengthy compilation stage and tests may be adjusted at run time if required.

Roaming and Network Selection

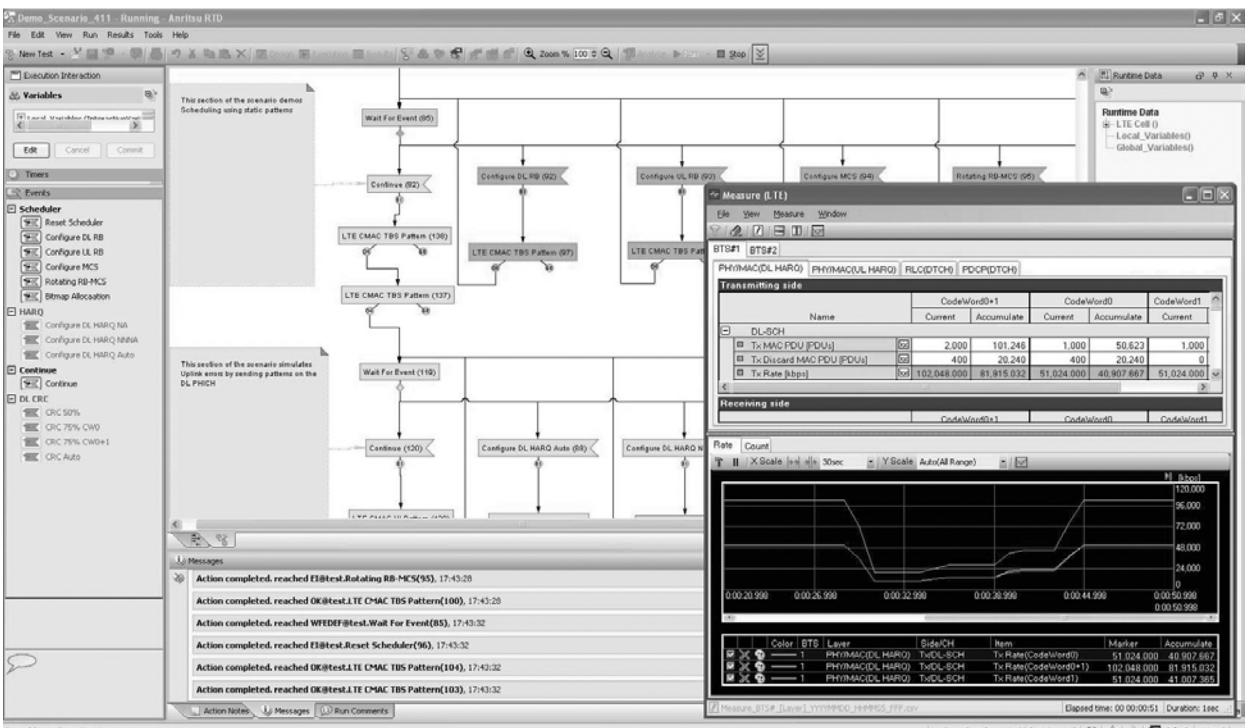
With multi-mode capability, terminals will have complex algorithms that select preferred networks and still maintain acceptable performance. Revenue streams will be threatened if UEs do not behave correctly and Network Operators will exercise them to ensure the best possible behaviour on their network configurations. RTD provides this type of testing which will be crucial to terminal selection - and rejection.

Simulating Live Network Conditions

Traditionally protocol and RF tests have been kept separate.
In order to reduce test times there is a trend to combine fading with protocol tests. The RTD provides a convenient way to add digital baseband fading by Using the MF6900A Fading Simulator to the system.

RTD Unique Graphical Flow Chart

The RTD's unique flowchart display provides a more natural way of creating scenarios and observing test flow and outcomes.
Debugging is especially straightforward as tests can be run and iterative changes made. Because there is no compilation phase, tests can be run immediately and aborted if the wrong path is taken. With well annotated tests, sharing and consolidation is possible and productive.



Acceptance Testing for Network Operators

With finite bandwidth and ever more traffic generated, the biggest challenge is for network operators to optimize their networks and ensure that terminals obey the rules they set. LTE attempts to make more efficient use of the spectrum available but still needs to inter-work with legacy systems. There are also regional variations and network specific requirements that terminals will be expected to conform to. Load balancing may be important to make best use of network resources and although aesthetics and applications may define a terminal's popularity, the behavior under specific conditions needs to be tested to ensure a reliable and friendly user experience.

• Cell Selection and Re-selection

The compromise between battery life and continuous caretaking activities will always challenge terminal designers. Thousands of hours of field trials may still not be able to identify why a terminal fails to maintain service on a preferred network.
Many conditions can only be reliably exercised using a simulation of network conditions in the laboratory. The RTD has the ability to use network logs and create tests that closely resemble the field environment. Iteration of the test is then straightforward to discover and rectify the problem.

• Application Testing

As we move to an all packet delivery network, data throughput and integrity is becoming more important.
Scenarios with a variety of radio bearers and configurations is possible with RTD, proving that data is not lost during handovers and reselection.

• Roaming Partners

Simulation of foreign networks using the RTD's many advanced features allows a convenient way to test roaming between networks with different configurations/parameters and even different ways of implementing procedures. Today the cost of sending engineering teams to perform network testing over many weeks can be a very significant portion of a Network Operator's proving budget.

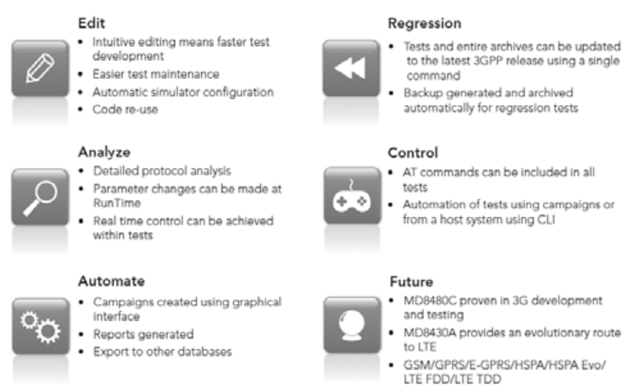
• New Network Services

Most Networks will not allow new terminals onto their live service without some proving. RTD provides a way to test new terminals and also new services that may be ready to be deployed. Future functionality and applications can be proved in a controlled way using a system simulator and problems resolved ahead of deployment.

• Stress Testing

Terminal stress testing can be automated and run overnight using RTD. With the ability to make thousands of reselections, calls, hand-overs etc. Tests that exercise the extremes and limits of the terminal provide quantitive and qualitative data for terminal selection.

RTD Top Features



Automation

The RTD provides many ways that test execution can be made more efficient using remote control, terminal control and campaign management tools.

• MX787401A-012 Remote Control Interface

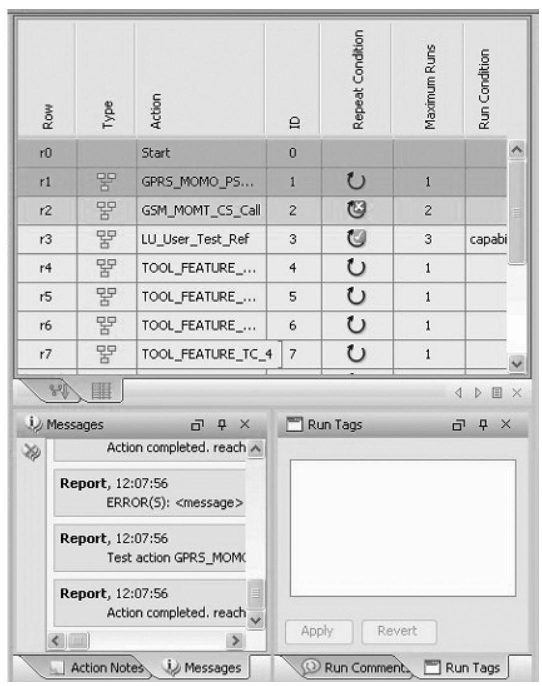
The RTD may be controlled using remote commands and integrated into a total test system. The RTD is compatible with a number of remote commands that allow Tests to be RUN, ANALYZED, etc. In this mode the RTD works as a slave to an existing test system where existing equipment and data is controlled and collected.

• MX787401A-013
Signalling Application Tool for Terminal Automation

The RTD provides proxy control of the AT command set to the terminal through the RTD Test Cases. It enables automated testing to be achieved through a serial port on the control PC.
An appropriate proxy.xml file is applied to map the AT/MMI commands to match those supported by the terminal. Prompts on the screen can be suppressed when automation is used. In general automated testing can be carried out via the use of the AT command set [3GPP TS 27.007].

• MX787401A-014
Signalling Application Tool for Test Sequencing

The RTD includes a campaign management tool. This provides the user with the ability to create test runs that can be run remotely without the need for any further control equipment. Tests can be repeated depending on rules set by the user. Results are generated in a tabular form and can be exported to form part of a formal report. A campaign may be used to run an entire suite of inter-operability tests, or any other large grouping of tests. Rules may be set to run all tests and then retest those that fail, making best use of time.



The Total System Solution

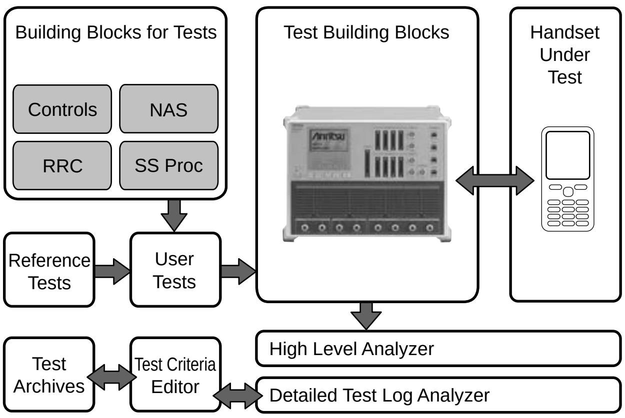
For some, the RTD will be a new concept and we aim to provide the tools and support to make the experience productive and logical.

• Using the RTD

An RTD test is constructed and edited using a graphical environment, which supports procedures, loops, delays & interactive dialogs. Compared to traditional "C" and "TTCN" based languages this GUI provides fast and simple test creation. Typically a test that may have taken several days to create may be created in hours using the RTD.

• Reference Tests

These reference tests are samples of commonly used functions to act as templates for the user. They allow Network specific parameters to be added manually or by means of a "catalogue" function. Packages of other test cases are also available on request.



• Test Execution Engine

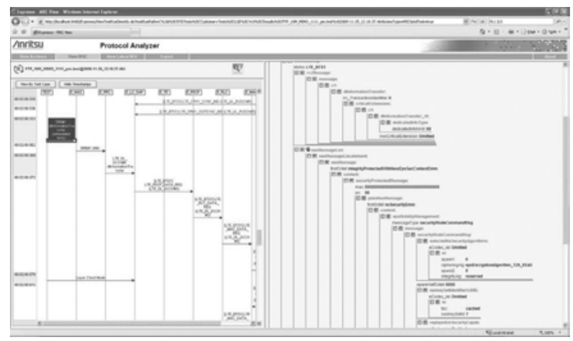
RTD tests are run immediately after they have been checked for simple errors, without a compile or build cycle.

• Test Criteria Editor

The test operative may use this tool to automatically make objective decisions on whether the right actions have been made by the UE. Criteria may be changed post testing and applied to existing results. This avoids the need to re-run the tests.

• Detailed Test Log Analyzer

The protocol log analyzer, which maintains the same look and feel as other Anritsu products, is provided to examine the message sequences that are produced by the terminal under test.



• Procedure Libraries

Procedures are the building blocks from which all tests are created. The RTD Procedures can be selected from a palette and added to the User Test simply by dragging onto the edit page. Compound procedures can be created to allow frequently used scripts to be added in a single action, further simplifying test creation.

These procedures are configured using parameters, which can be changed at three levels:

1) Parameter sets held in catalogues can be selected to parameterise groups of procedures rapidly.
2) The user can edit individual parameters after they have been selected from catalogue components, overriding values if they wish to. These parameters are used to populate the actual protocol messages sent by the procedure.
3) The expert user can edit the individual messages sent by the procedure, if needed, overriding any parameters previously selected or changed.

Ordering Information

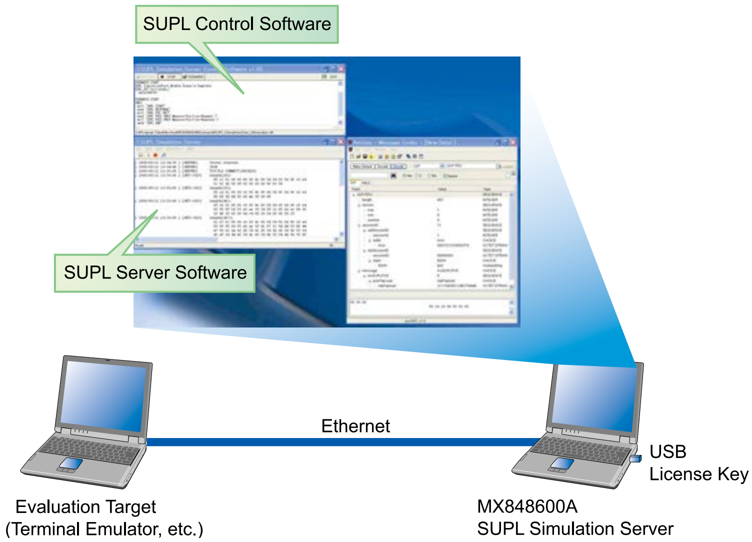
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Mainframe and options
MX786201A	Rapid Test Designer (RTD)
MX786201A-026	RTD PROCEDURE LIBRARY (IMS)
MX786201A-028	Layer 1/Layer 2 Statistics Monitor (LTE)
MX786201A-031	RTD Layer 3 Procedure Library (LTE)
MX786201A-038	Low-level Configuration Library for RTD (LTE)
MX786201A-40	Ciphering
MX786201A-041	RTD Layer 3 Procedure Library (UTRAN/GERAN)
MX786201A-45	RTD Test Creation and Editing Tools
MX786201A-46	RTD Run Time Engine
	Application/Tools options
MX787401A	Set of Signalling Application Support Tools
MX787401A-011	Protocol Analyser (RTD)
MX787401A-012	Remote Control Interface
MX787401A-013	Signalling Application Tool for Terminal Automation
MX787401A-014	Signalling Application Tool for Test Sequencing
MX787401A-062	Interface Driver For MF6900A (Fading Simulator)
	Framework/Technology options
MX787201A	Multi-rat Framework for Signalling Testing Applications
MX787201A-012	Enabler for Multiple Signalling Testers
MX787201A-021	GERAN Framework for Signalling Testing Applications
MX787201A-023	Framework UTRAN Core (Incl. HSPA)
MX786201A-026	RTD PROCEDURE LIBRARY (IMS)
MX787201A-027	LTE Core Framework for Signalling Testing Applications
MX787201A-028	LTE FDD Framework for Signalling Testing Applications
MX787201A-029	LTE TDD Framework for Signalling Testing Applications
	IMS Library and ProLab Package
MX787450A	PROLAB IMS BASIC
MX787450A-001	PROLAB IMS AUDIO
MX787450A-002	PROLAB IMS VIDEO
MX787450A-005	PROLAB RCS CAPABILITY (WITH XDM)
MX787450A-SS120	1 YEAR SUPPORT FOR PROLAB IMS BASIC
MX787450A-SS121	1 YEAR SUPPORT FOR PROLAB IMS AUDIO
MX787450A-SS122	1 YEAR SUPPORT FOR PROLAB IMS VIDEO
MX787450A-SS125	1 YEAR SUPPORT FOR PROLAB RCS CAPABILITY
	AT&T test case package options
MX786201A-100	AT&T UTRAN Test Package Subscription for RTD
MX786201A-101	AT&T UTRAN Test Package 1 for RTD
MX786201A-102	AT&T UTRAN Test Package 2 for RTD
MX786201A-103	AT&T UTRAN Test Package 3 for RTD
MX786201A-104	AT&T UTRAN Test Package 4 for RTD
MX786201A-105	AT&T UTRAN Test Package 5 for RTD
MX786201A-106	AT&T UTRAN Test Package 6 for RTD
MX786201A-107	AT&T UTRAN Test Package 7 for RTD
MX786201A-108	AT&T UTRAN Test Package 8 for RTD
MX786201A-109	AT&T UTRAN Test Package 9 for RTD
MX786201A-110	AT&T UTRAN Test Package 10 for RTD
MX786201A-111	AT&T UTRAN Test Package 11 for RTD

Model/Order No.	Name
	TMO USA IOT test case package options
MX786201A-200	T-mobile USA UMTS Protocol Library (Subscription)
MX786201A-201	T-mobile USA UMTS Protocol Library Package 1
MX786201A-202	T-mobile USA UMTS Protocol Library Package 2
MX786201A-203	T-mobile USA UMTS Protocol Library Package 3 (for RTD)
MX786201A-204	T-mobile USA UMTS Protocol Library Package 4 (for RTD)
MX786201A-205	T-mobile USA UMTS Protocol Library Package 5 (for RTD)
MX786201A-206	T-mobile USA UMTS Protocol Test Package 6 for RTD
MX786201A-207	T-mobile USA UMTS Protocol Test Package 7 for RTD
MX786201A-208	T-mobile USA UMTS Protocol Test Package 8 for RTD
	Band 13 Library
MX786201A-300	RTD Test Pkg Subscription, LTE Band 13
MX786201A-301	RTD Test Pkg 1, LTE Data Throughput
MX786201A-302	RTD Test Pkg 2, GMSS-Type 1
MX786201A-303	RTD Test Pkg 3, LTE Data Retry
MX786201A-304	RTD Test Pkg 4, LTE Supplementary Signaling
MX786201A-305	RTD Test Pkg 5, LTE-CDMA InterRAT Operations
MX786201A-306	RTD Test Pkg 6, LTE SMS
MX786201A-308	RTD Test Pkg 8, GMSS-Type 2
MX786201A-309	RTD Test Pkg 9, eHRPD
MX786201A-310	RTD Test Pkg 10, SVLTE LTE Data Throughput
MX786201A-311	RTD Test Pkg 11, SVLTE LTE-CDMA InterRAT
MX786201A-312	RTD Test Pkg 12, SVLTE GMSS-Type 1
MX786201A-313	RTD Test Pkg 13, eHRPD SMS
MX786201A-314	RTD Test Pkg 14, Multi-Mode SMS
MX786201A-315	RTD Test Pkg 15, LTE Stress Test
MX786201A-316	RTD Test Pkg 16, LTE Band 4 Data Throughput
	Band 13 VoLTE Library
MX786201A-320	RTD CAT VoLTE Test Package Subscription
MX786201A-321	RTD Test Pkg 21, VoLTE VoIP Functional
	AT&T LTE Test Package options
MX786201A-400	AT&T LTE Test Package Subscription for RTD
MX786201A-401	AT&T LTE Test Package 1 for RTD, Data Throughput
MX786201A-402	AT&T LTE Test Package 2 for RTD, LTE Only 1
MX786201A-403	AT&T LTE Test Package 3 for RTD, InterRAT
MX786201A-404	AT&T LTE Test Package 4 for RTD, LTE Only 2
MX786201A-405	AT&T LTE Test Package 5 for RTD, UICC
MX786201A-406	AT&T LTE Test Package 6 for RTD, SON/ANR & User Experience
	Support services
MX786201A-20	Software Update and Maintenance Contract
MX787401A-SS100	Maintenance for Software Tools
MX787201A-SS100	Maintenance for Technology Framework
	Accessories
Z1320B	Standard PC for RTD (with monitor)
Z1591A	USB Dongle (Protocol)
Z1614A	RTD ProLab USB Dongle
Z1321B	ADDITIONAL PC FOR RTD PROLAB (WITH MONITOR)

SUPL SIMULATION SERVER
MX848600A

SUPL Terminal Function Tests and Software Emulation



Following the expanding market for Location-Based Services (LBS) supporting emergency use of mobile terminals as Personal Navigation Devices (PND), more mobile manufacturers are now linking GPS signals with mobile networks by incorporating high-accuracy A-GPS*1 positioning functions into their terminals. In particular, SUPL*2 A-GPS is being widely adopted to receive global positioning services using packet data, irrespective of the communications carrier and location. Anritsu's MX848600A SUPL Simulation Server is a software package for performing tests meeting the SUPL v1.0 standard of the Open Mobile Alliance (OMA). Installing it in a PC simplifies testing, including ULP*3/RRLP*4 layer normal/sub-normal sequence tests and assistance data parameter variation tests to support efficient function tests and software emulation for various typical 2G and 3G mobile SUPL terminals (SET*5).

∗1: Assisted GPS
∗2: Secure User Plane Location
∗3: User Plane Location Protocol
∗4: Radio Resource LCS Protocol
∗5: SUPL Enable Terminal

Features

- OMA SUPL v1.0 Compliance
- TLS Authentication Function
- Objective SUPL Function Evaluation using Standalone Terminal Emulator
- Any Defined Test Sequence and Parameters
- Accessory Sample Scenarios
- External Control Function for 24/7 Testing
- Encode/Decode SUPL (ULP/RRLP) Messages
- Evaluation Results Reflected in Real Terminal Tests

Key Applications

- Terminal Emulator (OS, Middleware, etc.) SUPL Function Evaluation
- 2G/3G Terminal A-GPS Function Tests, Performance Tests
- ULP/RRLP Normal/Abnormal Sequence Tests
- TLS Normal Sequence Test
- Assistance Data Parameter Variation Test

OMA SUPL v1.0 Compliance

The MX848600A meets the Open Mobile Alliance (OMA) SUPL v1.0 standards. Moreover, it supports verification of popular SUPL A-GPS terminals used worldwide by implementing functions based on the following international standards.

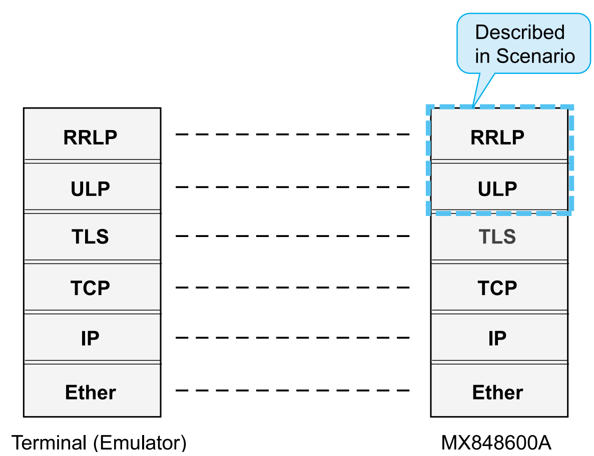
Reference Standards

SUPL: OMA-AD-SUPL-V1_0-20070615-A
ULP: OMA-TS-ULP-V1_0-20070615-A
RRLP: 3GPP TS 44.031 Radio Resource LCS Protocol v5.12.0
SSL/TLS: IETF RFC 2246 The TLS Protocol v1.0

TLS Authentication Function

The TLS (Transport Layer Security) authentication function is built into the MX848600A. The TLS normal sequence test*6 using server authentication and client authentication are supported by supplying a PEM-format CA certificate and private key file to the SET side.

∗6: The TLS abnormal tests are not supported.



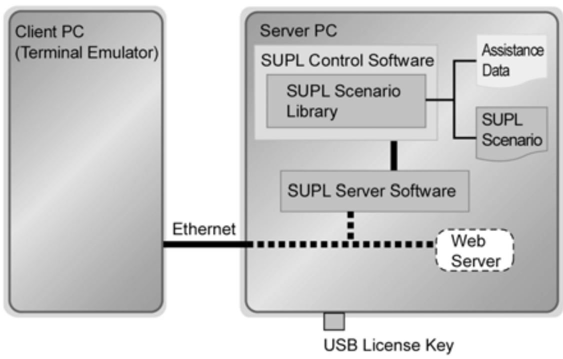
Efficient SUPL Terminal Emulation Environment

• Objective SUPL Evaluation using Standalone Terminal Emulator

The MX848600A uses a high-reliability platform architecture based on Anritsu's long experience in mobile terminal protocol evaluation. It delivers objective and highly reliable SUPL Location Platform (SLP)*.

*: Only one evaluation target (SET) can be connected to the SUPL simulation server. However, tests can also be run on one PC.

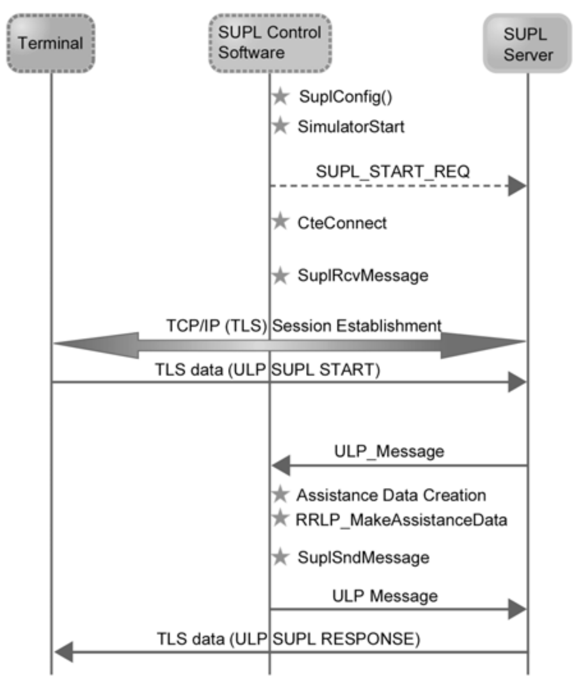
Any IP address can be set in the SUPL Server software and when the MX848600A is installed in the same PC running a Web server as shown below, application tests, using position results can also be performed.



Framework (Terminal Emulator Test)

• Any Defined Test Sequence and Parameters

The ULP/RRLP protocol sequence, message elements and parameters passing between the terminal and SUPL server can be freely defined in C++ scenarios. In addition to the usual normal sequence tests, sub-normal and abnormal sequence tests, which are not supported by a real server, can be performed too, offering flexible fault testing.



SUPL Sequence Test

• Accessory Sample Scenarios

Since sample scenarios describing basic SUPL sequences (Proxy Mode, SET Initiated support) are bundled with the control software as accessories, testing can start immediately.

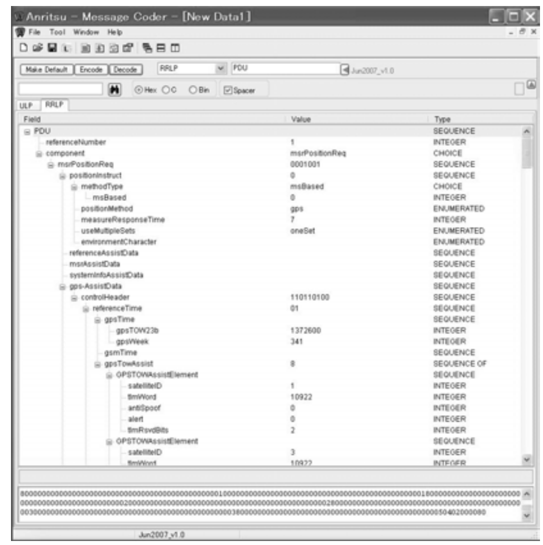
• External Control Function for 24/7 Testing

Commands such as scenario selection and execution can be remotely controlled from an external PC, supporting time-saving, 24/7 testing by configuring an SLP (SUPL Location Platform) test rig on a PC with installed terminal emulator.

Flexible SUPL Terminal Simulation Environment

• Encode/Decode SUPL (ULP/RRLP) Messages

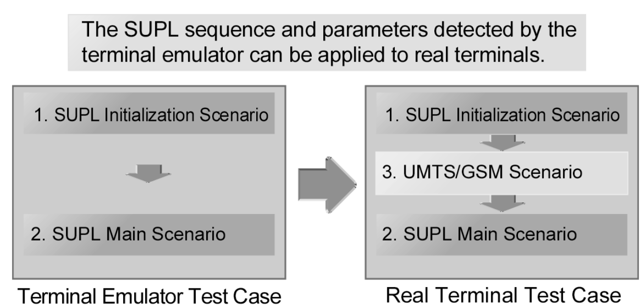
Not only does the SUPL control software support scenario execution, it also encodes the GPS Almanac and Ephemeris data defined in the assistance data file in ASN.1 format and sends the assistance data to the terminal. In addition, the SUPL server software displays and saves the communications log with the terminal.
Messages can be decoded to find problems using both the accessory MessageCoder tool as shown below and other commercial IP analysis tools.



RRLP Message Analysis

• Evaluation Results Reflected in Real Terminal Tests

Test efficiency is increased by using SUPL test scenarios created in the MX848600A terminal emulation environment in real terminal tests. Reflecting upstream evaluation results in real terminal tests helps clarify evaluation tasks and shortens the development cycle.



Test Scenario-Sharing

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MX848600A	**Software** SUPL Simulation Server (CD-ROM with software and USB license key)
MX848600A-TS110 MC0011A	**Technical Support Service** 1-year Technical Support Service Website Access Key (For downloading software upgrades)

UTRAN/LTE MOBILE DEVICE TEST PLATFORM

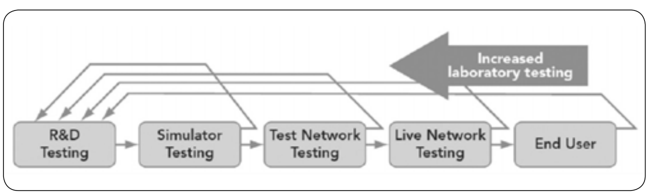
ME7834A/ME7834L

GCF/PTCRB, and Carrier Approved Test System for Mobile Protocol Testing

The ME7834 is a configurable system that provides flexible protocol test solutions throughout the lifecycle of modern wireless terminals. ME7834 systems are able to address applications in development and conformance and evolve to provide advanced system simulation. Anritsu led the way with 3G mobile development programs. It is now delivering intelligent test solutions to LTE development teams that need to accelerate their designs to stay competitive.

Protocol Test Solutions

- **2G/3G/LTE**
- **Development**
- **Conformance**
- **Carrier Acceptance**



Reduce Costs by finding errors earlier in the process

ME7834 System Simulators

Anritsu has a well-earned reputation for capable and dependable wireless simulators. The MD8430A has the ability to generate 6 LTE cells: which means that as terminal designs mature, the test system is ready to create new complex testing environments without the need to add more equipment or change out cables.
2×2 MIMO handovers are already possible using one MD8430A. Adding MD8480C(s) and MD8470A(s) provides simulations that add multiple UTRAN/GERAN cells and multiple CDMA2000 1xRTT/1xEV-DO (HRPD and/or eHRPD) cells. This means that for InterRAT handovers the most realistic network simulation is provided and resources are not time shared, with a likely performance compromise. The hardware is designed to ensure that an investment today provides capability for the future.

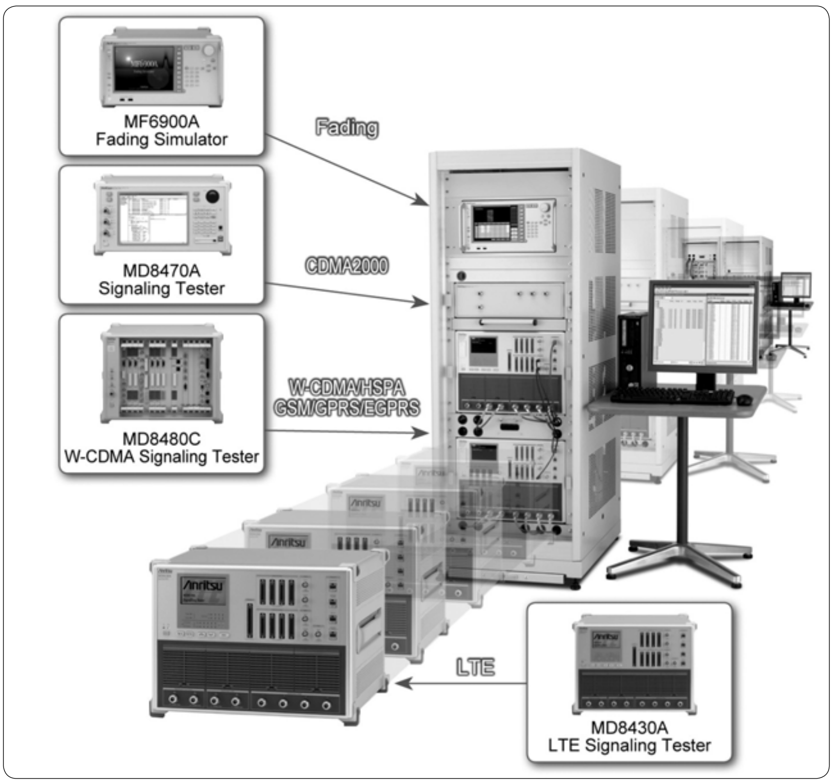
MD8430A Signalling Tester
- LTE for FDD and TDD covering 350 MHz to 3000 MHz frequency band
- 150 MB (DL), 50 MB (UL)
- 4-RF supports 2×2 MIMO handover
- Up to 6 Cells (2 communication, 4 neighbor)
- Future proof – Category 4 today
- Compliant with 3GPP TS 36.523 for GCF and PTCRB certification

MD8480C Signalling Tester
- Up to 4 W-CDMA cells and 2 GSM cells
- Up to 2 physical RF channels
- Enhancement to HSPA Evolution

MD8470A Signalling Tester
- All-in-one platform supporting functional testing of mobile terminal applications, including voice and video calling, content download and messaging.
- Wide frequency coverage (400 MHz to 2.7 GHz)
- Up to 6 CDMA Sectors and 3 EV-DO Sectors on up to 2 RFs
- CDMA2000 1X/1xEV-DO Rev. A

ME7834 Flexible Configurations

The ME7834 can be configured to provide solutions for individual applications or combinations that allow functionality to be shared or expanded as needs mature.
From a simple bench-top development system, to a rack that provides comprehensive simulation of real networks, ME7834 combines hardware with tools and a framework for efficient use of resources.
Additionally users that have purchased Anritsu's established protocol tools may integrate them into a ME7834 platform to protect their investment.



ME7834 systems are fully configured and can be supplied racked or as individual components.
Commissioning and training can be tailored to individual requirements.

ME7834 for Conformance Testing to Meet Evolving Specifications

The Global Certification Forum (GCF) and the PCS Type Certification Review Board (PTCRB) include the ME7834 as an approved platform to provide test coverage for GERAN, UTRAN, HSPA+ and LTE technologies.
The ME7834 is registered as GCF TP119 and tracks TS 36.523 for LTE and TS 34.123 for UTRAN. It has met critical deadlines set by the industry for test platform approval. The system may also be configured to meet tests mandated by several network operators.

ME7834 systems are easily upgraded as requirements change.
A system used for LTE development can easily be adapted to also run carrier acceptance tests. Existing PCT users will be able to upgrade to ME7834, protecting their equipment investment and more importantly tests.

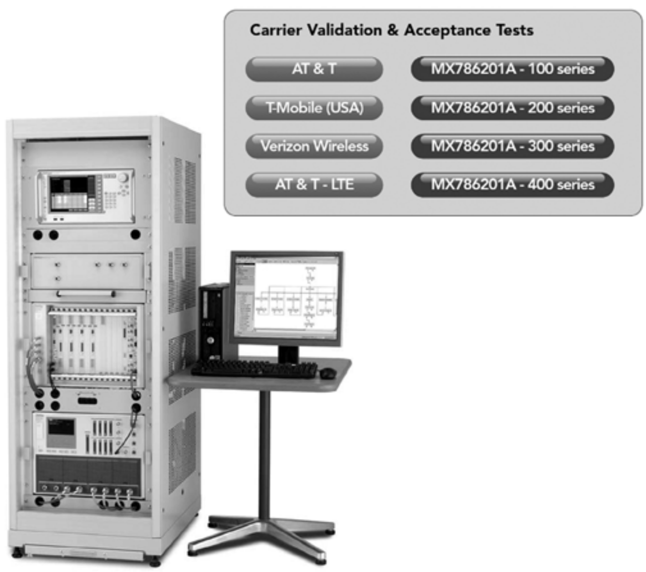
The systems are the most reliable and provide results that can be trusted.

- Comprehensive test case libraries to meet the requirements of GCF & PTCRB
- Test case modification in TTCN-3
- InterRAT capable solution

Registered as an approved GCF & PTCRB TP119 reference platform

ME7834 for Acceptance Testing for Carriers

Carriers are making use of the intelligent test tools to ensure that terminals behave correctly on their networks. Terminal development teams simulate conditions in networks that may be thousands of miles away and may not yet support the updated functionality present in new handsets.
The tests are created and validated with the RTD to take advantage of the graphical layout. This makes it straight forward to visualize test flow and hence verify and debug the terminals behavior. These tests are validated against stringent requirements before they are provided as a commercial test package.
Test packages that keep pace with network requirements Anritsu are able to provide and support a number of carrier specific tests. (Note: some test packages may need to be obtained directly from carriers)
ME7834 users now have the ability to purchase carrier acceptance test packages outright or subscribe to them on an annual basis to suit their fiscal needs.



- Purchasing the tests requires the customer to order each individual test package as they are introduced.
- Subscription provides all the tests available at the time of purchase and any that are introduced through the period of subscription.

• Automation
Where possible, tests are automated allowing overnight unattended runs for greater efficiency. By using a definable proxy, control of a wide range of devices is possible.

• Campaign Manager
The Campaign Manager can run within the system, making automation very simple. Results are generated that can be filtered and exported for executive reports in XML and CSV format.

• Pass/Fail Results
Test results will be given a pass/fail verdict based on criteria set within the test. The verdict is variable visually or can be generated in a report.

• Protocol Analyzer
The Protocol Analyzer displays the message flow between the ME7834 and the terminal under test. By selecting a message in the main protocol window, the message is decoded in a new window, allowing simple debug.

ME7834 the Complete System Solution

• Cost of Ownership
The ME7834 provides a suite of support and training options to suit different users and applications. Anritsu is able to supply turnkey solutions or individual components. Systems are installed and supported by teams of highly skilled engineers that are deployed world-wide.

• Electronic Software Delivery
Customer wishes to install the update themselves, software is available 24-7 via the ESD (Electronic Software Delivery) service.

• Updates
Updates for the test system may be triggered for a number of different reasons. Some of the requirements relate to ongoing product development and are therefore scheduled according to Anritsu's engineering programs and these are described in the product roadmap.

• Calibration
Calibration can be arranged at one of the many accredited calibration and repair laboratories or even on-site in some Instances.

• Training
Training courses are available for the ME7834 and comprise a combination of classroom and practical activities. Training can be provided either at the customer site or at Anritsu facilities.

• Installation and Commissioning
Installation and commissioning can be provided if required.
This service is offered in addition to the initial training for the product.

• Support Desk
Local support is provided in territory or from a local field office. This is the first line of support, which is backed up from our international support desks. Users are given a dedicated login to Support Suite so tracking of support issues can be managed via a secure internet connection.

Ordering Information

ME7834 systems are fully configured and can be supplied racked or as individual components; also the ME7834 provides a suite of support and training options to suit different users and applications. Customer can configure the ME7834 system based on the technology (3G/LTE) and project requirements. For example; the system configured for R&D only or Protocol Conformance Test only or Carrier Acceptance Test only or combinations.

Model/Order No.	Name
	Core platform
ME7834A	UTRAN Mobile Device Test Platform
ME7834L	LTE Mobile Device Test Platform
	System option
ME7834L-010	LTE Signalling Unit (Functional Test Model)
ME7834L-011	LTE Signalling Unit (Standard Test Model)
ME7834L-012	LTE Signalling Unit (Performance Test Model)
ME7834L-013	LTE FDD for LTE Signalling Unit
ME7834L-014	LTE TDD for LTE Signalling Unit
ME7834L-015	2nd LTE Signalling Unit (Functional Test Model)
ME7834L-016	2nd LTE Signalling Unit (Standard Test Model)
ME7834L-017	2nd LTE Signalling Unit (Performance Test Model)
ME7834L-018	LTE FDD for 2nd LTE Signalling Unit
ME7834L-019	LTE TDD for 2nd LTE Signalling Unit
ME7834A-020	UTRAN (R99-R6) Signalling Unit
ME7834A-021	2nd UTRAN (R99-R6) Signalling Unit
ME7834A-022	3rd UTRAN (R99-R6) Signalling Unit
ME7834A-023	Signalling Unit Extension for UTRAN R7
ME7834A-024	Signalling Unit Extension for UTRAN R8
ME7834A-025	Signalling Unit Extension for UTRAN CAT
ME7834A-026	Signalling Unit Extension for Additional GERAN BTS
ME7834A-030	RF Combiner
ME7834A-031	Fading Simulator
ME7834A-032	CDMA2000 Signalling Unit
ME7834A-033	2nd CDMA2000 Signalling Unit
ME7834A-034	3rd CDMA2000 Signalling Unit
ME7834A-040	Common System Software
ME7834L-041	LTE Technology Framework
ME7834L-042	LTE FDD Framework
ME7834L-043	LTE TDD Framework
ME7834A-044	UTRAN (R99 - R7) Technology Framework
ME7834A-045	UTRAN (R8) Technology Framework
ME7834A-046	C2K Technology Framework
ME7834A-047	Fading Simulation Driver
ME7834A-050	PCT Application Core
ME7834A-051	PCT Frequency Bands
ME7834L-053	PCT Custom Test Option
ME7834A-054	PCT TTCN-2 Execution Engine
ME7834L-055	PCT TTCN-3 Execution Engine
ME7834A-056	PCT Parallel Test Controller
ME7834A-070	RTD Application Core
ME7834A-071	RTD Test Creation and Editing Capability
ME7834L-072	RTD LTE Low Level Library
ME7834L-073	RTD LTE Layer 3 Library
ME7834A-074	RTD UTRAN/GERAN Low Level Library
ME7834A-075	RTD UTRAN/GERAN Layer 3 Library
ME7834A-076	RTD CDMA2000 Library
ME7834L-079	RTD SV-LTE CAT Capability
ME7834A-087	CAT Automation Capability
ME7834A-088	CAT Data Throughput Capability
ME7834A-089	CAT IMS/SMS Capability
ME7834A-090	Rack 1
ME7834A-091	Rack 2
ME7834A-092	Rack 3
ME7834L-400	AT&T LTE Test Package Subscription
ME7834L-401	AT&T LTE Test Package 1 for RTD, Data Throughput
ME7834L-402	AT&T LTE Test Package 2 for RTD, LTE Only 1
ME7834L-403	AT&T LTE Test Package 3 for RTD, InterRAT
ME7834L-404	AT&T LTE Test Package 4 for RTD, LTE Only 2
ME7834L-405	AT&T LTE Test Package 5 for RTD, UICC
ME7834L-406	AT&T LTE Test Package 6 for RTD, SON/ANR & User Experience
ME7834A-410	AT&T UTRAN Test Package Subscription
ME7834A-411	AT&T UTRAN Test Package 1
ME7834A-412	AT&T UTRAN Test Package 2
ME7834A-413	AT&T UTRAN Test Package 3
ME7834A-414	AT&T UTRAN Test Package 4
ME7834A-415	AT&T UTRAN Test Package 5
ME7834A-416	AT&T UTRAN Test Package 6
ME7834A-417	AT&T UTRAN Test Package 7
ME7834A-418	AT&T UTRAN Test Package 8
ME7834A-419	AT&T UTRAN Test Package 9
ME7834A-420	AT&T UTRAN Test Package 10
ME7834A-421	AT&T UTRAN Test Package 11
ME7834A-429	AT&T Automation Accessories

Model/Order No.	Name
ME7834L-430	RTD TEST PKG SUBSCRIPTION, LTE BAND 13
ME7834L-431	RTD TEST PKG 1, LTE DATA THROUGHPUT
ME7834L-432	RTD TEST PKG 2, GMSS-TYPE 1
ME7834L-433	RTD TEST PKG 3, LTE DATA RETRY
ME7834L-434	RTD TEST PKG 4, LTE SUPPLEMENTARY SIGNALING
ME7834L-435	RTD TEST PKG 5, LTE-CDMA InterRAT OPERATIONS
ME7834L-436	RTD TEST PKG 6, LTE SMS
ME7834L-438	RTD TEST PKG 8, GMSS-TYPE 2
ME7834L-439	RTD TEST PKG 9, eHRPD
ME7834L-440	RTD TEST PKG 10, SVLTE LTE DATA THROUGHPUT
ME7834L-441	RTD TEST PKG 11, SVLTE LTE-CDMA InterRAT
ME7834L-442	RTD TEST PKG 12, SVLTE GMSS-TYPE 1
ME7834L-443	RTD TEST PKG 13, eHRPD SMS
ME7834L-444	RTD TEST PKG 14, Multi-Mode SMS
ME7834A-475	T-Mobile UTRAN Test Package Subscription
ME7834A-476	T-Mobile UTRAN Test Package 1
ME7834A-477	T-Mobile UTRAN Test Package 2
ME7834A-478	T-Mobile UTRAN Test Package 3
ME7834A-479	T-Mobile UTRAN Test Package 4
ME7834A-480	T-Mobile UTRAN Test Package 5
ME7834A-481	T-Mobile UTRAN Test Package 6
ME7834A-482	T-Mobile UTRAN Test Package 7
ME7834A-483	T-Mobile UTRAN Test Package 8
ME7834L-755	36.523-1 FDD Test Package Subscription
ME7834L-731	36.523-1 FDD Test Package 1, LTE Intra and Interband
ME7834L-732	36.523-1 FDD Test Package 2, LTE Intra and Interband
ME7834L-740	36.523-1 FDD Test Package 3, LTE Intra and Interband
ME7834L-743	36.523-1 FDD Test Package 4, LTE Intra and Interband
ME7834L-744	36.523-1 FDD Test Package 5, LTE/UTRAN and LTE/UTRAN/GERAN IRAT
ME7834L-745	36.523-1 FDD Test Package 6, LTE/GERAN IRAT
ME7834L-748	36.523-1 FDD Test Package 8, AT&T LTE PCT
ME7834L-756	36.523-1 TDD Test Package Subscription
ME7834L-735	36.523-1 TDD Test Package 1, LTE Intra and Interband
ME7834L-736	36.523-1 TDD Test Package 2, LTE Intra and Interband
ME7834L-750	36.523-1 TDD Test Package 3, LTE Intra and Interband
ME7834L-751	36.523-1 TDD Test Package 4, LTE Intra and Interband
ME7834L-754	36.523-1 TDD Test Package 6, LTE/GERAN IRAT
ME7834A-771	R99 Test Cases
ME7834A-772	R4/5 Test Cases
ME7834A-773	Interband Test Cases
ME7834A-774	HSDPA Test Cases
ME7834A-775	DSAC and Network Sharing Test Cases
ME7834A-776	HSUPA Test Cases
ME7834A-780	Rel.7 HSPA Evo Test Cases Package 1
ME7834A-781	Rel.7 HSPA Evo Test Cases Package 2
ME7834A-782	Rel.7 HSPA Evo Test Cases Package 3
ME7834A-783	Rel.8 HSPA Evo Test Cases Package 1
ME7834L-821	KDDI Test Package 1

LTE RF CONFORMANCE TEST SYSTEM
ME7873L

Remote Control
Ethernet

RF/RRM Conformance Test System Supporting Most and First GCF/PTCRB Approved TCs

Supporting Most and First GCF*1/PTCRB*2 Approved Test Cases*3

This GCF/PTCRB-compatible test platform targets the most and first Test Cases approved at quarterly GCF/PTCRB meetings.
It uses the MD8430A Signalling Tester as a LTE base station simulator, and is configured from various test instruments and dedicated software. It supports RF/RRM tests while communicating with LTE mobile terminals.

ME7873L LTE RF Conformance Test System

This system is for testing the RF TRx characteristics, performance requirements, and RRM performance of FDD/TDD LTE mobile terminals in compliance with the requirements of 3GPP TS 36.521-1 Chapter 6 (Transmitter Characteristics), Chapter 7 (Receiver Characteristics), Chapter 8 (Performance Requirement), Chapter 9 (Reporting of Channel State Information) and TS 36.521-3 RRM including LTE→GSM/UMTS/CDMA2000/TD-SCDMA Inter-RAT tests.*4, *5
TS 34.121-1 UMTS→LTE and TS 34.122 TD-SCDMA→LTE Inter-RAT tests are also supported.
Moreover, UMTS 3GPP TS 34.121-1 Rel-7/8 tests are supported.*5

Supports Mobile Terminal Carrier Acceptance Tests

This single, multi-purpose platform supports acceptance tests mainly for North American operators, as well as 3GPP RF/RRM conformance tests.

∗1 GCF (Global Certification Forum):
Certifies conformance to standards for mobile terminals and test systems. Composed mainly of operators, mobile terminal vendors and chipset vendors and performs certification for frequency bands used in Europe.
∗2 PTCRB (PCS Type Certification Review Board):
A similar test system certification organization to GCF composed mainly of N. American carriers and UE vendors and performing conformance certification for frequency bands used in N. America.
∗3 As of November, 2012.
∗4 RRM: Radio Resource Management
∗5 In principle, defined by GCF Work Item*6 and targeting measurement items certified by GCF/PTCRB.
(Contact our sales staff for timing of supported items and option configurations.)
∗6 Work Item:
Name of function test items selected by GCF for mobile terminal approval.

Supports Global Mobile Terminals

• Worldwide Frequency Bands

Not only are GCF/PTCRB-approved Bands planned for use in Europe and North America fully supported, but the following bands defined by 3GPP are also supported too.
Unlisted bands can be supported by request.

E-UTRA Operating Band	UL Operating Band (MHz)	DL Operating Band (MHz)	Operation Area
1	1920 to 1980	2110 to 2170	Europe, Asia
2	1850 to 1910	1930 to 1990	North America
3	1710 to 1785	1805 to 1880	Europe, Asia
4	1710 to 1755	2110 to 2155	North America
5	824 to 849	869 to 894	North America, Asia
7	2500 to 2570	2620 to 2690	Europe
8	880 to 915	925 to 960	Europe, Asia
9	1749.9 to 1784.9	1844.9 to 1879.9	Japan
10	1710 to 1770	2110 to 2170	North America
11	1427.9 to 1447.9	1475.9 to 1495.9	Japan
12	698 to 716	728 to 746	North America
13	777 to 787	746 to 756	North America
14	788 to 798	758 to 768	North America
17	704 to 716	734 to 746	North America
18	815 to 830	860 to 875	Japan
19	830 to 845	875 to 890	Japan
20	832 to 862	791 to 821	Europe
21	1447.9 to 1462.9	1495.9 to 1510.9	Japan
24	1626.5 to 1660.5	1525 to 1559	North America
25	1850 to 1915	1930 to 1995	North America
33	1900 to 1920	1900 to 1920	TBD
34	2010 to 2025	2010 to 2025	TBD
35	1850 to 1910	1850 to 1910	North America
36	1930 to 1990	1930 to 1990	North America
37	1910 to 1930	1910 to 1930	North America
38	2570 to 2620	2570 to 2620	Asia
39	1880 to 1920	1880 to 1920	Asia
40	2300 to 2400	2300 to 2400	Asia
41	2496 to 2690	2496 to 2690	North America, Asia

Focus on Improving Test Efficiency, Measurement Stability and Reliability

• Continuous Testing of Multiple Terminals
Since the standard system configuration has four RF interfaces, it can test up to four terminals continuously. Fully automated testing of multiple terminals is supported by DC power supply and serial control line auto-switching.

• Control via Networks
The PC server in the rack can be operated remotely over a network. Measurement progress can be monitored remotely and measurement sequences can be created and edited, allowing tests to be run while working elsewhere.

• Easy Control of External Devices
The system software has built-in functions for controlling the DC power supply* and temperature chamber* in the same way as selecting test items. Using these standard functions makes automation easy.

*: Users must provide the DC power supply and temperature chamber. Refer to the ordering information for recommended models.

• R&TTE-compliant Test Items (option)
This option is fully compliant with the European ETSI-defined R&TTE RF TRx test items. Anritsu launched this European-test-house approved option ahead of market competitors.
Simple operation supports easy R&TTE-compliant tests like normal test items.

• Improve Reliability using Correction Function
System measurement stability and reliability are improved by the following three calibration and correction methods:

1. Basic calibration at acceptance inspection
2. Auto-calibration at work start
3. Individual measurement correction

Individual measurement correction immediately before measurement eliminates temperature-related drift and greatly improves the reliability of measurements.
In addition, Anritsu engineers perform basic calibration when installing the system at acceptance inspection, eliminating the need for operators to perform this complex calibration and correction work.

• Detailed Support System
An Anritsu Support Service contract keeps the system operating at peak performance, maximizing return on investment, minimizing downtime, and keeping work on schedule.

- Latest software updates matching the latest changes to the 3GPP standards
- Information on 3GPP trends, consultation and technical support for troubleshooting test problems
- Free hardware repair and maintenance with a back-up loan unit

Specifications

ME7873L LTE RF Conformance Test System

Input and Output connector	N-type, 50 Ω
Max. input level	+33 dBm (2 W)
Reference oscillator	MS2692A (with option-001 Rubidium Reference Oscillator) as standard External oscillator signal input available (Frequency: 10 MHz, Connector: BNC)
Frequency range	Defined by 3GPP E-UTRA Operating Band 1 to 5, 7 to 14, 17 to 21, 24, 25, 33 to 41
Temperature range	15° to 35°C (operating), 0° to 50°C (storage)*1
Power supply (rating)	Select either 100 V(ac) to 120 V(ac) or 200 V(ac) to 240 V(ac) ME7873L : 50 Hz/60 Hz, <3300 VA*2 ME7873L (with options 002, 003, 004, 007, 011, 012, 013, 044, 048) : 50 Hz/60 Hz, <4400 VA*2
Dimensions	1597 (H) × 570 (W) × 797 (D) mm (1 rack)*3 1597 (H) × 1140 (W) × 797 (D) mm (2 racks)*3
Mass	ME7873L : <260 kg*4 ME7873L (with options 002, 003, 004, 007, 011, 012, 013, 044, 048) : <510 kg*4
EMC	EN61326-1 EN61000-3-2
LVD	EN61010-1

*1: Ambient temperature
Basic calibration at acceptance inspection must meet this requirement.
Use in air-conditioned room recommended for stable measurement.
*2: Power consumption
Sufficient power (600 VA) for basic calibration at acceptance inspection as well as for ME7873L must be supplied.
*3: Topple prevention
Secure using hooks at rack top recommended.
*4: Mass/Floor Loads
The installation location must be able to safely bear the above floor loads plus 100 kg for basic calibration equipment at acceptance inspection.

Supported Test Standards

The system design is based on the following standards:

3GPP TS 36.521-1 E-UTRA UE Conformance Specification Radio Transmission and Reception Part 1: Conformance Testing
3GPP TS 36.521-3 E-UTRA UE Conformance Specification Radio Transmission and Reception Part 3: RRM Conformance Testing
3GPP TS 36.508 E-UTRA and EPC Common Test Environments for UE Conformance Testing
3GPP TS 36.509 E-UTRA and EPC Special Conformance Testing Functions for UE

Release 8 and 9 of above standards is also supported. Contact our sales representative for detailed of the supported versions.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
ME7873L	LTE RF Conformance Test System
	Configuration items
MD8430A	Signalling Tester
MS2692A	Signal Analyzer
MG3692C	Synthesized Signal Generator
MG3700A	Vector Signal Generator
ML2488B	Wideband Power Meter
SC7816	Thermal Sensor
MF6900A	Fading Simulator
MD8480C	W-CDMA Signalling Tester
MD8470C	Signalling Tester
MT8820C	Radio Communication Analyzer
MN7462A	RF Interface Unit
MN7464D	Filter Unit
MN7451A	RF Switch Driver Unit
MN7463B	RF Combiner Unit
MN7464E	Additional Filter Unit
MN7464F	Filter Unit2
MN7464G	Filter Unit3
ME7873L-002	LTE Common Kit
MX787311L	LTE RF Conformance Test Software
MX787361L	TD-LTE RF Conformance Test Software
MX787391L	HSPA RF Conformance Test Software
	Standard accessory
	ME7873L Operation Manual (CD-ROM): 1 set
	Options
ME7873L-001	HSPA Common Kit
ME7873L-003	LTE TRX Hardware
ME7873L-004	LTE Performance Hardware
ME7873L-007	LTE TRX Additional Hardware
ME7873L-010	HSPA to LTE Upgrade Kit
ME7873L-011	LTE RRM Hardware
ME7873L-012	LTE to UMTS/GSM Inter-RAT RRM
ME7873L-013	LTE to CDMA2000 Inter-RAT RRM
ME7873L-022	Fading Accessory
ME7873L-038	Filter Unit3 Accessory
ME7873L-044	Filter Unit2 Accessory
ME7873L-048	SV-LTE CDMA2000 RF Test Accessory
MX787311L-002	LTE TRX Test Cases Conformance Package1
MX787311L-003	LTE TRX Test Cases Conformance Package2
MX787311L-004	LTE Performance Test Cases Conformance Package1
MX787311L-005	LTE 4×2 MIMO Test Cases Conformance Package1
MX787311L-006	LTE CQI Test Cases Conformance Package1
MX787311L-011	LTE RRM Test Cases Conformance Package1
MX787311L-012	LTE to UMTS/GSM Test Cases Conformance Package1
MX787311L-013	LTE to CDMA2000 Test Cases Conformance Package1
MX787311L-021	LTE TRX Test Cases Conformance Package3
MX787311L-022	UMTS to LTE Test Cases Conformance Package1
MX787311L-023	LTE RRM Test Cases Conformance Package2
MX787311L-024	LTE to UMTS/GSM Test Cases Conformance Package2
MX787311L-033	R&TTE Test Cases
MX787311L-034	Band4 Supplementary TRx Test Cases
MX787311L-035	Band4 Supplementary Performance Test Cases
MX787311L-036	Band4 Supplementary 4×2 MIMO Test Cases
MX787311L-037	Band17 Supplementary RF Test Cases
MX787311L-044	SV-LTE TRX Test Cases
MX787311L-045	SV-LTE Power Backoff Test Case
MX787311L-046	SV-LTE Power Headroom Reporting Test Cases
MX787311L-047	Band13 Supplementary RF Test Cases
MX787311L-048	SV-LTE CDMA2000 RF Test Cases
MX787361L-002	TD-LTE TRX Test Cases Conformance Package1
MX787361L-003	TD-LTE TRX Test Cases Conformance Package2
MX787361L-004	TD-LTE Perf Test Cases Conformance Package1
MX787361L-005	TD-LTE 4×2 MIMO Test Cases Conformance Package1
MX787361L-006	TD-LTE CQI Test Cases Conformance Package1
MX787361L-011	TD-LTE RRM Test Cases Conformance Package1
MX787361L-022	TD-SCDMA to TD-LTE Test Cases Conformance Package1
MX787361L-023	TD-LTE RRM Test Cases Conformance Package2
MX787361L-024	TD-LTE to UMTS/GSM Test Cases Conformance Package1
MX787361L-025	TD-LTE to TD-SCDMA Test Cases Conformance Package1
MX787361L-026	TD-LTE CQI Test Cases Conformance Package2
MX787391L-001	WI-069 TRx Test Case
MX787391L-002	WI-069 Performance Test Cases
MX787391L-011	WI-070 Performance Test Cases
MX787391L-021	WI-113 Performance Test Cases
MX787391L-031	WI-129 TRx Test Cases
MX787391L-032	WI-129 Performance Test Cases
MX787300L-0xx	FDD/TDD Band xx Capability
B0630A	2nd Rack for LTE RF CTS
Z1514A	Additional Accessory Kit for Power Supply

Model/Order No.	Name
	UMTS Option
MD8480C	W-CDMA Signalling Tester
MS8609A	Digital Mobile Radio Transmitter Tester
MP8302A	Bit Error Rate Tester
MG3692C	Synthesized Signal Generator
MG3700A	Vector Signal Generator
MF6900A	Fading Simulator
ME7416B	RF Switch Driver Unit
MN7451A	RF Switch Driver Unit
MN7462A	RF Interface Unit
MN7463A	RF Combiner Unit
MN7465A	RF Switch Unit
MX787103F	W-CDMA TRX/Performance Test Software
MX787104F	W-CDMA RRM Test Software
MX787135F	Selftest Software for Conformance Test System
ME7873F-10	RRM Test Addition
ME7873F-60	WI-113 Toolkit
ME7873F-61	WI-129 Toolkit
ME7873F-70	WI-013 Toolkit (TRx/Performance)
ME7873F-72	WI-013 Toolkit (RRM)
ME7873F-74	WI-014 Toolkit
ME7873F-75	WI-024 Toolkit
ME7873F-76	WI-025 Toolkit
ME7873F-77	WI-049 Toolkit
ME7873F-78	WI-076 Toolkit
ME7873F-79	Additional Hardware for Diversity
ME7873F-80	WI-069 Toolkit
ME7873F-81	WI-070 Toolkit
ME7873F-90	MF6900A Exchange
ME7874F-72	WI-013 Toolkit (RRM)
ME7874F-75	WI-024 Toolkit
ME7874F-76	WI-025 Toolkit
ME7874F-77	WI-049 Toolkit
MX787103F-09	JAPAN TRCC TEST
MX787190F	MCTS Integration Software
MN7462A-01	4 Antenna Connections
ME7419B	Mobile Radio Switching Unit
Z0788	Additional Accessory Kit for Power Supply
Z1396A	User Operation PC
Z1629A	Express Card-GPIB
J1415A	USB-Serial Converter Cable
	Frequency Band Options (without RRM Test Function)
ME7873F-11	3GPP Band I Addition
ME7873F-12	3GPP Band II Addition
ME7873F-13	3GPP Band III Addition
ME7873F-14	3GPP Band IV Addition
ME7873F-15	3GPP Band V Addition
ME7873F-16	3GPP Band VI Addition
ME7873F-18	3GPP Band VIII Addition
ME7873F-19	3GPP Band IX Addition
ME7873F-31	3GPP Band XI Addition
ME7873F-32	3GPP Band XIX Addition
	(with RRM Test Function)
ME7873F-21	3GPP Band I Addition (Including RRM)
ME7873F-22	3GPP Band II Addition (Including RRM)
ME7873F-23	3GPP Band III Addition (Including RRM)
ME7873F-24	3GPP Band IV Addition (Including RRM)
ME7873F-25	3GPP Band V Addition (Including RRM)
ME7873F-26	3GPP Band VI Addition (Including RRM)
ME7873F-28	3GPP Band VIII Addition (Including RRM)
ME7873F-29	3GPP Band IX Addition (Including RRM)
ME7873F-41	3GPP Band XI Addition (Including RRM)
ME7873F-42	3GPP Band XIX Addition (Including RRM)
	(only RRM Test Function)
ME7874F-11	3GPP Band I Addition
ME7874F-12	3GPP Band II Addition
ME7874F-13	3GPP Band III Addition
ME7874F-14	3GPP Band IV Addition
ME7874F-15	3GPP Band V Addition
ME7874F-16	3GPP Band VI Addition
ME7874F-18	3GPP Band VIII Addition
ME7874F-19	3GPP Band IX Addition
ME7874F-31	3GPP Band XI Addition
ME7874F-32	3GPP Band XIX Addition

In addition to the above-described accessories, the following items are required to use the ME7873L.

• DC Power Supply

The following models are required when controlling the power supply using the ME7873L.

Model	Name	pcs	Manufacturer
ME6700B	Main frame	1	Agilent Technologies Inc.
ME6732B	8 V, 6.25 A, 50 W DC Power Module	4*1	
ME6700B-908	Rack Mount Kit	1	

*1: Four modules are required when testing up to four mobiles continuously.

In addition, the following equipment can also be controlled. However, since rack-mounting is not possible when using the 2306-PJ, decide on the installation location for the DC power supply in advance.

Model	Name	pcs	Manufacturer
2306-PJ	Dual-Channel Battery/ Charger Simulator with 500 mA Range	2*2	Keithley Instruments Inc.

*2: Two sets of the 2306-PJ are required when testing up to four mobiles continuously.

• Temperature Chamber

The following equipment is required to control the temperature chamber from the ME7873L.
Additionally, GPIB Cable (Double-Shield, 2 m) is required to control this chamber automatically.

Model	Name	Manufacturer
SH-241	Compact Environment Test	ESPEC Corp.

Contact your Anritsu sales representative for details.

W-CDMA TRX/PERFORMANCE TEST SYSTEM ME7873F

W-CDMA RRM TEST SYSTEM ME7874F

Remote Control
Ethernet

RF Conformance Test System Supporting Most Approved Test Cases

ME7873F with ME7873F-10 (Option)

Features

• Supporting Most GCF*1/PTCRB*2 Approved Test Cases*3

These test platforms support the GCF/PTCRB requirements for TS 34.121 Conformance Testing and offer the industry leading GCF/PTCRB approved test cases*3.
By configuring a test system from various instruments and dedicated software centered around the MD8480C W-CDMA Signalling Tester, these Test Platforms support the testing of W-CDMA User Equipment (UE) with non-call-processing conditions as well as loopback conditions*4.
The ME7873F is for testing the Tx and Rx characteristics of W-CDMA UE in accordance with measurement items*5 in Chapter 5 (Transmitter Characteristics), Chapter 6 (Receiver Characteristics), and Chapter 7 (Performance Requirements) of the 3GPP TS 34.121 standards. Measurement items defined by Chapter 8 (Requirements for Support of RRM*6), Chapter 9 (Performance requirements for HSDPA), Chapter 10 [Performance requirement (E-DCH)], and Chapter 11 [Performance requirement (MBMS)] can also be measured by installing the ME7873F-xx options.
In addition, all Inter-RAT tests, including handover tests, can be performed.
The ME7874F is for the specific testing of the Radio Resource Management functions (RRM) defined in 3GPP TS 34.121. It supports the measurement items defined by Chapter 8 (Requirements for Support of RRM) of the 3GPP TS 34.121 standard.

*1 GCF (Global Certification Forum)
Abbreviation for Global Certification Forum responsible for certifying conformance to standards for UE and test systems
Composed mainly of European carriers and UE vendors and performs certification for frequency bands used in Europe
*2 PTCRB (PCS Type Certification Review Board)
A similar test system certification organization to GCF composed mainly of N. American carriers and UE vendors and performing conformance certification for frequency bands used in N. America
*3 This is based on GCF and PTCRB test case approvals following the GCF and PTCRB meeting in July 2012
*4 Not supported by RRM tests
*5 In principle, defined by GCF Work Item*7 and targeting measurement items certified by GCF/PTRCB
*6 RRM: Abbreviation for Radio Resource Management
*7 Work Item: Name for test item group for each function chosen by GCF for test items for certifying UE conformance

• Supports High-speed HSUPA/HSDPA/HSPA Evolution Test

This system supports both high-speed uplinks as well as high-speed downlinks, permitting evaluation of both HSDPA and HSUPA mobile terminals with one platform.
Additionally, WI-024 test items included in the Release-6 Enhancements, WI-076 HSDPA RF Performance, WI-069 HSPA-64QAM for HSDPA, WI-070 HSPA-CPC, WI-113 Type 3, and WI-129 DC-HSDPA are also supported, making this system the optimum test solution for high-speed data communications terminals.

• Optimized for LTE Mobile Terminal Tests

When LTE function is added, this system can support RF TRx characteristics, performance requirements, and RRM performance of FDD/TDD LTE mobile terminals in compliance with the requirements of 3GPP TS 36.521-1 Chapter 6 (Transmitter Characteristics), Chapter 7 (Receiver Characteristics), Chapter 8 (Performance Requirement), Chapter 9 (Reporting of Channel State Information) and TS 36.521-3 RRM including LTE→GSM/UMTS/CDMA2000/TD-SCDMA Inter-RAT tests.*5
Moreover, TS 34.121 UMTS→LTE and TS34.122 TD-SCDMA→LTE Inter-RAT test is supported.*5

• Parallel W-CDMA and LTE Testing

Supports parallel independent W-CDMA and LTE RF conformance test with upgrade from ME7873F or ME7874F.
Simultaneous parallel measurement of W-CDMA and LTE terminals cuts test times and optimizes equipment cost-performance investment.

• Supports Global Mobile Terminals

W-CDMA

This system supports common national systems in most countries worldwide, including Europe and Japan.
In addition to 3GPP Band I (2 GHz), Band II (1.9 GHz), Band IV (1.7 GHz/2 GHz), and Band V (850 MHz) used in the USA, Band VI (800 MHz), Band IX (1.7 GHz) and Band XIX (800 MHz) used in Japan, are also supported.
Moreover, the following bands used in worldwide are also supported.

UTRA Operating Band	UL Operating Band (MHz)	DL Operating Band (MHz)
I	1920 to 1980	2110 to 2170
II	1850 to 1910	1930 to 1990
III	1710 to 1785	1805 to 1880
IV	1710 to 1755	2110 to 2155
V	824 to 849	869 to 894
VI	830 to 840	875 to 885
VIII	880 to 915	925 to 960
IX	1749.9 to 1784.9	1844.9 to 1879.9
XI	1427.9 to 1452.9	1475.9 to 1500.9
XIX	830 to 845	875 to 890

LTE

Not only are GCF/PTCRB-approved bands planned for use in Europe and North America fully supported, but the following bands defined by 3GPP are also supported too.
Unlisted bands can be supported by request.

E-UTRA Operating Band	UL Operating Band (MHz)	DL Operating Band (MHz)	Operation Area
1	1920 to 1980	2110 to 2170	Europe, Asia
2	1850 to 1910	1930 to 1990	North America
3	1710 to 1785	1805 to 1880	Europe, Asia
4	1710 to 1755	2110 to 2155	North America
5	824 to 849	869 to 894	North America, Asia
7	2500 to 2570	2620 to 2690	Europe
8	880 to 915	925 to 960	Europe, Asia
9	1749.9 to 1784.9	1844.9 to 1879.9	Japan
10	1710 to 1770	2110 to 2170	North America
11	1427.9 to 1447.9	1475.9 to 1495.9	Japan
12	698 to 716	728 to 746	North America
13	777 to 787	746 to 756	North America
14	788 to 798	758 to 768	North America
17	704 to 716	734 to 746	North America
18	815 to 830	860 to 875	Japan
19	830 to 845	875 to 890	Japan
20	832 to 862	791 to 821	Europe
21	1447.9 to 1462.9	1495.9 to 1510.9	Japan
24	1626.5 to 1660.5	1525 to 1559	North America
25	1850 to 1915	1930 to 1995	North America
33	1900 to 1920	1900 to 1920	TBD
34	2010 to 2025	2010 to 2025	TBD
35	1850 to 1910	1850 to 1910	North America
36	1930 to 1990	1930 to 1990	North America
37	1910 to 1930	1910 to 1930	North America
38	2570 to 2620	2570 to 2620	Asia
39	1880 to 1920	1880 to 1920	Asia
40	2300 to 2400	2300 to 2400	Asia
41	2496 to 2690	2496 to 2690	North America, Asia

• Calibration Functions Supporting Increased Measurement Reliability

To improve measurement stability and reliability, the system has the following three calibration and correction methods:

(1) Basic calibration at acceptance inspection
(2) Auto-calibration at work start
(3) Individual measurement correction (Patent applied for)

Since measurement correction applies a correction immediately before measurement, temperature-related changes in the measurement system are eliminated to greatly improve the reliability of the measured value.
In addition, Anritsu engineers perform calibration when installing the system at acceptance inspection, eliminating the need for operators to perform this complex calibration and correction work.

• Support Service

An Anritsu Support Service contract keeps the system operating at peak performance, maximizing return on investment, minimizing downtime, and keeping work on schedule.

- Latest software updates matching the latest changes to the 3GPP standards
- Information on 3GPP trends, consultation and technical support for troubleshooting test problems
- Free hardware repair and maintenance with a back-up loan unit

• Remote Systems Control via Network

This system supports remote control of the PC measurement controller from another PC on the network.
Until now, the operator has been required to remain at the test site to monitor the test status, but by using this remote monitoring function, the measurement progress can be remotely monitored over a networked PC and measurement sequences can be selected and set, bench-top testing while working in office.

• Easy Control of Various External Devices

The system software has built-in functions for controlling a DC power supply and temperature chamber.*
A DC power supply and temperature chamber can be controlled easily in the same way as selecting test items.
Using these standard functions makes W-CDMA current consumption measurement and temperatures tests easy.

*: Current consumption measurements and temperature tests requires a separate DC power supply and temperature chamber.
Refer to the ordering information for more details.

• Test Items Based on Technical Regulations Conformity Certification (W-CDMA Option)

W-CDMA terminal used in Japan must be in compliance with the Technical Regulations Conformity Certification (TRCC).*
This option adds test items based on the TRCC test items, so the operator can perform tests easily based on the TRCC items.

*: This function offers tests based on the TRCC tests, which the operator can use to perform 3GPP-compliant measurements. However, since the transmission speed test items are not supported, note that this function is exactly equivalent to the TRCC test.

• R&TTE-compliant Test Items (LTE Option)

This option is fully compliant with the European ETSI-defined R&TTE RF TRx test items. Anritsu launched this European-test-house approved option ahead of market competitors.
Simple operation supports easy R&TTE-compliant tests like normal test items.

• Continuous Testing (Auto-testing) of Multiple Measurement Items

Auto-testing is supported by sequencing 3GPP-compliant test items. Automation allows long measurements to run overnight, making more efficient use of available test time by producing results early next morning*.

*: Requires option for continuing sequence files created using several software

• Useful Measurement Functions (Search Method) for Optimum Measurement

Measurements can be searched repeatedly while changing measurement parameters such as interference signal level. Using this function supports both PASS/FAIL evaluation at 3GPP-defined conditions as well as efficient measurement of UE equipment in the development stage.

Supported Test Items and Options

Work Item*	3GPP TS 34.121 Chapter	ME7873F TRX/Performance Test System	ME7874F RRM Test System
WI-010	5	✓	
	6	✓	
	7	✓	
	8	✓ (Option)	✓
WI-012	7	✓	
WI-013	5	✓ (Option)	
	6	✓ (Option)	
	7	✓ (Option)	
	8	✓ (Option)	✓ (Option)
WI-014	5	✓ (Option)	
	6	✓ (Option)	
	9	✓ (Option)	
WI-024	5	✓ (Option)	
	7	✓ (Option)	
	8	✓ (Option)	✓ (Option)
WI-025	5	✓ (Option)	
	8	✓ (Option)	✓ (Option)
	10	✓ (Option)	
WI-038	5	✓ (Option)	
	6	✓ (Option)	
	8	✓ (Option)	✓ (Option)
WI-049	8	✓ (Option)	✓ (Option)
	11	✓ (Option)	
WI-076	9	✓ (Option)	
WI-069	6	✓ (Option)	
	9	✓ (Option)	
WI-070	9	✓ (Option)	
WI-113	9	✓ (Option)	
WI-129	6	✓ (Option)	
	9	✓ (Option)	
WI-148	5	✓ (Option)	

*: Work Item is the name for test groups chosen by GCF indicating test items required for UE conformance certification.

For detailed test cases, contact our sales representative.

Specifications

ME7873F W-CDMA TRX/Performance Test System
ME7874F W-CDMA RRM Test System

I/O Connector	N-type, 50Ω
Max. Input Level	33 dBm (2 W) 37 dBm (5 W, no path switching)
Reference Oscillator	Uses MS8609A Digital Mobile Radio Transmitter Tester (with MS8609A-01 High-Stability Reference Oscillator) as reference Supports input of external reference signal Frequency: 10 MHz/13 MHz (selectable), BNC connector
Frequency Range	As defined by 3GPP UTRA Operating Band I, II, III, IV, V, VI, VIII, IX, XI, XIX As defined by 3GPP E-UTRA Operating Band 1 to 5, 7 to 14, 17 to 21, 24, 25, 33 to 41
Temperature Range	15° to 35°C (operating), 0° to 50°C (storage)*1
Power Supply	100 V(ac) to 120 V(ac) or 200 V(ac) to 240 V(ac) ME7873F : 50 Hz/60 Hz, ≤3300 VA*2 ME7873F (with LTE Option) : 50 Hz/60 Hz, ≤6600 VA*2 ME7874F : 50 Hz/60 Hz, ≤3000 VA*2
Dimension	1710 (W) × 1597 (H) × 797 (D) mm*3 2280 (W) × 1597 (H) × 797 (D) mm*3 (with LTE Option)
Mass	ME7873F : ≤600 kg*4 ME7873F (with LTE Option) : ≤930 kg*4 ME7874F : ≤530 kg*4
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

∗1: Ambient Temperature
The ambient temperature must meet the conditions when delivery calibration was performed. To assure stable measurement, we recommend installation in an air-conditioned environment.
∗2: Power Consumption
In addition to the typical power consumption of the ME7873F/ME7874F, it is necessary to provide sufficient power (600 VA) for the instruments used at delivery calibration.
∗3: To prevent the risk of the rack toppling over, we recommend securing the top of the rack to the wall, etc.
∗4: About Equipment Weight and Floor Strength
At delivery, the floor of the installation location must be strong enough to support the above mass of the equipment plus 100 kg.

Supported Test Standard

UMTS Measurement

The design of the ME7873F test platform is based on the following standards.

3GPP TS 34.121	Terminal Conformance Specification
3GPP TS 34.108	Common Test Environment for UE
3GPP TS 34.109	Terminal logical test interface

And the Release 99, Release 4, Release 5, Release 6, Release 7, Release 8, and Release 9 parts of these specifications are supported. Contact your Anritsu sales representative for details of the supported versions.

LTE Measurement

The design of the ME7873F with LTE option is based on the following standards.

3GPP TS 36.521-1	E-UTRA UE Conformance Specification Radio Transmission and Reception Part 1: Conformance Testing
3GPP TS 36.521-3	E-UTRA UE Conformance Specification Radio Transmission and Reception Part 3: RRM Conformance Testing
3GPP TS 36.508	E-UTRA and EPC Common Test Environments for UE Conformance Testing
3GPP TS 36.509	E-UTRA and EPC Special Conformance Testing Functions for UE

Release 8 and 9 of above standards is also supported. Contact our sales representative for detailed of the supported versions.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
ME7873F	W-CDMA TRX/Performance Test System
	Configuration items
MD8480C	W-CDMA Signalling Tester
MS8609A	Digital Mobile Radio Transmitter Tester
MP8302A	Bit Error Rate Tester
MG3692C	Synthesized Signal Generator
MG3700A	Vector Signal Generator
MF6900A	Fading Simulator
ME7416B	RF Switch Driver Unit
MN7451A	RF Switch Driver Unit
MN7462A	RF Interface Unit
MN7463A	RF Combiner Unit
MX787103F	W-CDMA TRX/Performance Test Software
MX787135F	Selftest Software for Conformance Test System
Z1396A	User Operation PC
Z1629A	Express Card-GPIB
J1415A	USB-Serial Converter Cable
	Standard accessory
	ME7873F Operation Manual (CD-ROM): 1 set
	Options
ME7873F-10	RRM Test Addition*2
ME7873F-60	WI-113 Toolkit
ME7873F-61	WI-129 Toolkit
ME7873F-70	WI-013 Toolkit (TRx/Performance)
ME7873F-72	WI-013 Toolkit (RRM)
ME7873F-74	WI-014 Toolkit
ME7873F-75	WI-024 Toolkit
ME7873F-76	WI-025 Toolkit
ME7873F-77	WI-049 Toolkit
ME7873F-78	WI-076 Toolkit*2
ME7873F-79	Additional Hardware for Diversity
ME7873F-80	WI-069 Toolkit
ME7873F-81	WI-070 Toolkit
ME7873F-90	MF6900A Exchange
MX787190F	MCTS Integration Software
MX787103F-09	JAPAN TRCC TEST*3
MN7462A-01	4 Antenna Connections*4
ME7419B	Mobile Radio Switching Unit
Z0788	Additional Accessory Kit for Power Supply
	Frequency band options*5
	(without RRM Test Function)
ME7873F-11	3GPP Band I Addition
ME7873F-12	3GPP Band II Addition
ME7873F-13	3GPP Band III Addition
ME7873F-14	3GPP Band IV Addition
ME7873F-15	3GPP Band V Addition
ME7873F-16	3GPP Band VI Addition
ME7873F-18	3GPP Band VIII Addition
ME7873F-19	3GPP Band IX Addition
ME7873F-31	3GPP Band XI Addition
ME7873F-32	3GPP Band XIX Addition
	(with RRM Test Function)
ME7873F-21	3GPP Band I Addition (Including RRM)
ME7873F-22	3GPP Band II Addition (Including RRM)
ME7873F-23	3GPP Band III Addition (Including RRM)
ME7873F-24	3GPP Band IV Addition (Including RRM)
ME7873F-25	3GPP Band V Addition (Including RRM)
ME7873F-26	3GPP Band VI Addition (Including RRM)
ME7873F-28	3GPP Band VIII Addition (Including RRM)
ME7873F-29	3GPP Band IX Addition (Including RRM)
ME7873F-41	3GPP Band XI Addition (Including RRM)
ME7873F-42	3GPP Band XIX Addition (Including RRM)

*1: Requires two or three MG3700A units.
*2: Remember to order additional equipment such as signal generators. Consult your Anritsu sales representative when matching the ME7873F test platform with previously purchased equipment.
*3: Requires MX787103F and frequency band options.
*4: Please order with the order for MN7462A. Addition after the system delivery is not possible.
*5: When configuring system, requires at least one frequency band option.

Model/Order No.	Name
	Main frame
ME7874F	W-CDMA RRM Test System
	Configuration items
MD8480C	W-CDMA Signalling Tester
MS8609A	Digital Mobile Radio Transmitter Tester
MG3700A	Vector Signal Generator*1
ME7416B	RF Switch Driver Unit
MN7451A	RF Switch Driver Unit
MN7462A	RF Interface Unit
MN7463A	RF Combiner Unit
MN7465A	RF Switch Unit
MX787104F	W-CDMA RRM Test Software
MX787135F	Selftest Software for Conformance Test System
Z1396A	User Operation PC
Z1629A	Express Card-GPIB
J1415A	USB-Serial Converter Cable
	Standard accessory
	ME7874F Operation Manual (CD-ROM): 1 set
	Options
ME7874F-72	WI-013 Toolkit (RRM)*2
ME7874F-75	WI-024 Toolkit
ME7874F-76	WI-025 Toolkit
ME7874F-77	WI-049 Toolkit
MX787190F	MCTS Integration Software
MN7462A-01	4 Antenna Connections*4
ME7419B	Mobile Radio Switching Unit
Z0788	Additional Accessory Kit for Power Supply
	Frequency band options*5
ME7874F-11	3GPP Band I Addition
ME7874F-12	3GPP Band II Addition
ME7874F-13	3GPP Band III Addition
ME7874F-14	3GPP Band IV Addition
ME7874F-15	3GPP Band V Addition
ME7874F-16	3GPP Band VI Addition
ME7874F-18	3GPP Band VIII Addition
ME7874F-19	3GPP Band IX Addition
ME7874F-31	3GPP Band XI Addition
ME7874F-32	3GPP Band XIX Addition

Model/Order No.	Name
	LTE options
MD8430A	Signalling Tester
MS2692A	Signal Analyzer
MG3692C	Synthesized Signal Generator
MG3700A	Vector Signal Generator
MF6900A	Fading Simulator
ML2488B	Wideband Power Meter
SC7816	Thermal Sensor
MD8470A	Signalling Tester
MT8820C	Radio Communication Analyzer
MN7462A	RF Interface Unit
MN7464D	Filter Unit
MN7451A	RF Switch Driver Unit
MN7463B	RF Combiner Unit
MN7484B	RF Interface Unit for Diversity
MN7464E	Additional Filter Unit
MN7464F	Filter Unit2
MN7464G	Filter Unit3
MX787311L	LTE RF Conformance Test Software
MX787361L	TD-LTE RF Conformance Test Software
MX787391L	HSPA RF Conformance Test Software
ME7873F-82	LTE Common Kit
ME7873F-83	LTE TRX Hardware
ME7873F-84	LTE Performance Hardware
ME7873F-85	LTE 4×2 MIMO Performance
ME7873F-86	LTE CQI Performance
ME7873F-87	LTE TRX Additional Hardware
ME7873F-91	LTE RRM Hardware
ME7873F-92	LTE to UMTS/GSM Inter-RAT RRM
ME7873F-93	LTE to CDMA2000 Inter-RAT RRM
ME7873L-022	Fading Accessory
ME7873L-038	Filter Unit3 Accessory
ME7873L-044	Filter Unit2 Accessory
ME7873L-048	SV-LTE CDMA2000 RF Test Accessory

Continued on next page

Model/Order No.	Name
MX787311L-002	LTE TRX Test Cases Conformance Package1
MX787311L-003	LTE TRX Test Cases Conformance Package2
MX787311L-004	LTE Performance Test Cases Conformance Package1
MX787311L-005	LTE 4×2 MIMO Test Cases Conformance Package1
MX787311L-006	LTE CQI Test Cases Conformance Package1
MX787311L-011	LTE RRM Test Cases Conformance Package1
MX787311L-012	LTE to UMTS/GSM Test Cases Conformance Package1
MX787311L-013	LTE to CDMA2000 Test Cases Conformance Package1
MX787311L-021	LTE TRX Test Cases Conformance Package3
MX787311L-022	UMTS to LTE Test Cases Conformance Package1
MX787311L-023	LTE RRM Test Cases Conformance Package2
MX787311L-024	LTE to UMTS/GSM Test Cases Conformance Package2
MX787311L-033	R&TTE Test Cases
MX787311L-034	Band4 Supplementary TRx Test Cases
MX787311L-035	Band4 Supplementary Performance Test Cases
MX787311L-036	Band4 Supplementary 4×2 MIMO Test Cases
MX787311L-037	Band17 Supplementary RF Test Cases
MX787311L-044	SV-LTE TRX Test Cases
MX787311L-045	SV-LTE Power Backoff Test Case
MX787311L-046	SV-LTE Power Headroom Reporting Test Cases
MX787311L-047	Band13 Supplementary RF Test Cases
MX787311L-048	SV-LTE CDMA2000 RF Test Cases
MX787361L-002	TD-LTE TRX Test Cases Conformance Package1
MX787361L-003	TD-LTE TRX Test Cases Conformance Package2
MX787361L-004	TD-LTE Perf Test Cases Conformance Package1
MX787361L-005	TD-LTE 4×2 MIMO Test Cases Conformance Package1
MX787361L-006	TD-LTE CQI Test Cases Conformance Package1
MX787361L-011	TD-LTE RRM Test Cases Conformance Package1
MX787361L-022	TD-SCDMA to TD-LTE Test Cases Conformance Package1
MX787361L-023	TD-LTE RRM Test Cases Conformance Package2
MX787361L-024	TD-LTE to UMTS/GSM Test Cases Conformance Package1
MX787361L-025	TD-LTE to TD-SCDMA Test Cases Conformance Package1
MX787361L-026	TD-LTE CQI Test Cases Conformance Package2
MX787391L-001	WI-069 TRx Test Cases
MX787391L-002	WI-069 Performance Test Cases
MX787391L-011	WI-070 Performance Test Cases
MX787391L-021	WI-113 Performance Test Cases
MX787391L-031	WI-129 TRx Test Cases
MX787391L-032	WI-129 Performance Test Cases
MX787300L-0xx	FDD/TDD Band xx Capability
Z1514A	Additional Accessory Kit for Power Supply
Z1524A	ME7873L Upgrade Kit

In addition to the previous, use of the ME7873F requires the following customer-supplied parts.

UMTS Measurement

● DC Power Supply
One of the following models is required when using the ME7873F or ME7874F to control power supply.
In addition, rack mounting requires a rack-mount kit from the manufacturer.

Model	Name	Manufacturer
2303	High Speed Precision Readback Power Supply	Keithley Instruments Inc.
2306-PJ	Dual-Channel Battery/Charger Simulator	Keithley Instruments Inc.
66311	Mobile Communication DC source	Agilent Technologies Inc.

Consult the power supply manufacturer for details of the supported power supply accessory kit.

● Temperature Chamber
The following model is required when using the ME7873F or ME7874F to control the temperature chamber.
Additionally, GPIB Cable (Double-Shield, 2 m) is required to control this chamber automatically.

Model	Name	Manufacturer
SH-241	Temperature & Humidity Chamber	ESPEC Corp.

Contact your Anritsu sales representative for details.

LTE Measurement

● DC Power Supply
The following models are required when controlling the power supply.

Model	Name	pcs	Manufacturer
ME6700B	Main frame	1	Agilent Technologies Inc.
ME6732B	8 V, 6.25 A, 50 W DC Power Module	4*1	
ME6700B-908	Rack Mount Kit	1	

*1: Four modules are required when testing up to four mobiles continuously.

In addition, the following equipment can also be controlled. However, since rack-mounting is not possible when using the 2306-PJ, decide on the installation location for the DC power supply in advance.

Model	Name	pcs	Manufacturer
2306-PJ	Dual-Channel Battery/ Charger Simulator with 500 mA Range	2*2	Keithley Instruments Inc.

*2: Two sets of the 2306-PJ are required when testing up to four mobiles continuously.

● Temperature Chamber
The following equipment is required to control the temperature chamber from the ME7873F.
Additionally, GPIB Cable (Double-Shield, 2 m) is required to control this chamber automatically.

Model	Name	Manufacturer
SH-241	Compact Environment Test	ESPEC Corp.

Contact your Anritsu sales representative for details.

SIGNALLING TESTER

MD8475A

Total Smartphone Application Testing

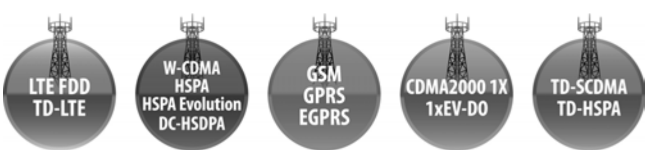
NEW

Excellent Eco Product

SmartStudio

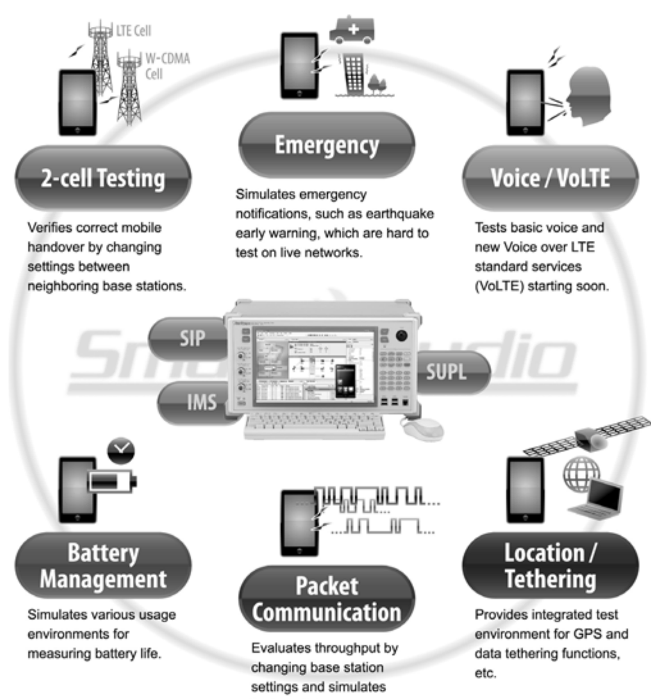
Supports LTE and Earlier Communications Technologies

All the world's main communications technologies, including triple-system LTE/W-CDMA/GSM mobiles and TD-LTE/TD-SCDMA/GSM as well as LTE/CDMA2000 hybrids, can be tested using the all-in-one MD8475A (requires installation of optional units and software for each system).



Supports Versatile Smartphone Tests

Complex tests of multifunction smartphones are supported by the all-in-one MD8475A with interactive SmartStudio interface.

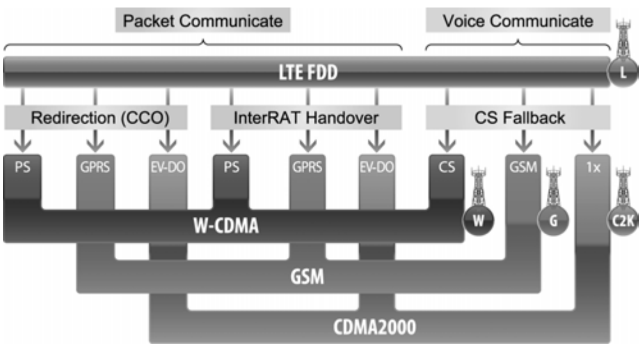


2-cell Testing

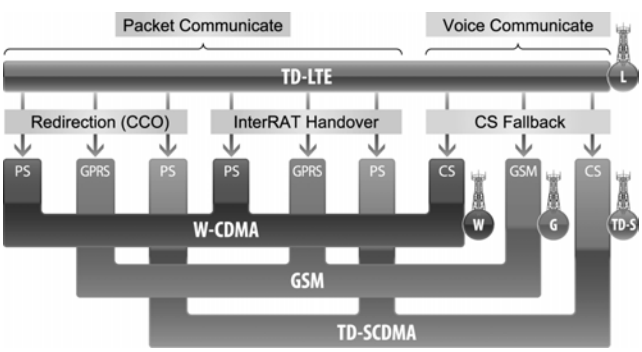
● Handover Test

Handover test previously required many instruments and the time-consuming task of creating scenarios for Handover between LTE and legacy systems.
The SmartStudio simplifies this by offering scenario-less environment.

[LTE FDD]



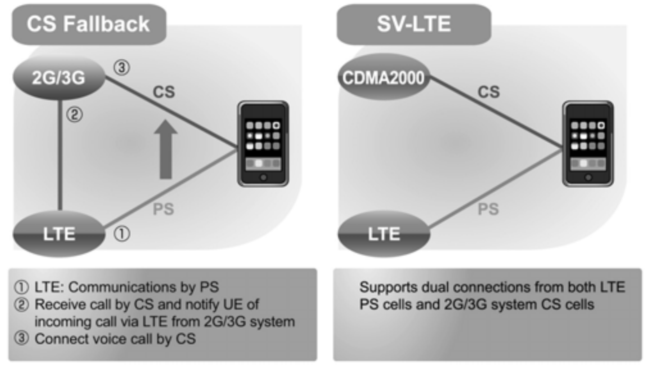
[TD-LTE]

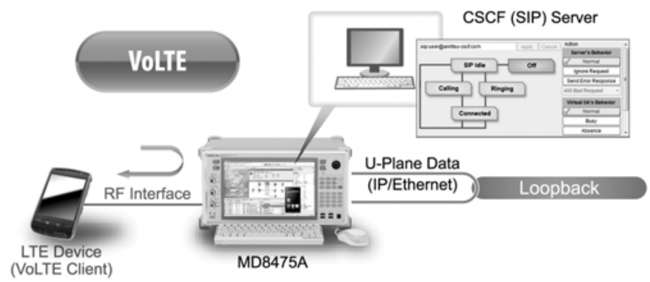


- **Redirection (CCO: Cell Change Order)**
  In an LTE network, when a connected UE moves to another network system, Redirection disconnects the LTE network and re-connects to the other system.
- **InterRAT Handover**
  In an LTE network, when a connected UE moves to another network system, InterRAT Handover disconnects after performing connection processing with the other network system.
- **CS Fallback**
  When a mobile connected to an LTE system makes or receives a voice call, CS Fallback is used to connect with other network systems.

Voice Testing

Configuring a 2-cell test environment with SmartStudio makes it easy to support CS Fallback, SV-LTE (Simultaneous Voice and LTE) and 2G/3G system voice quality tests.
Using the CSCF function supports VoLTE (AMR/W-AMR Codec) tests in the loopback mode.

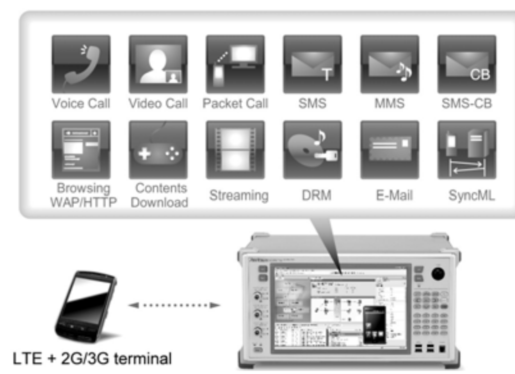




Packet Communication Testing

● Popular Server Environment

Because the MD8475A runs Windows 7, commercial application servers can be easily installed.



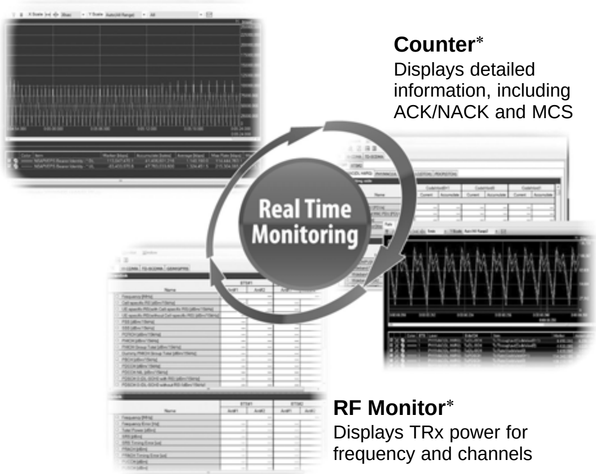
• Network Setting

Supports intuitive PDN parameter network settings.

• Status Evaluation

A line of function tools can be used to check communication status, including throughput, ACK/NACK counts, and RF monitor. Simultaneous checking of multiple layers allows quick troubleshooting during data communications.

Throughput Monitor*
Checks data communications each layer for base station



Counter*
Displays detailed information, including ACK/NACK and MCS

RF Monitor*
Displays TRx power for frequency and channels

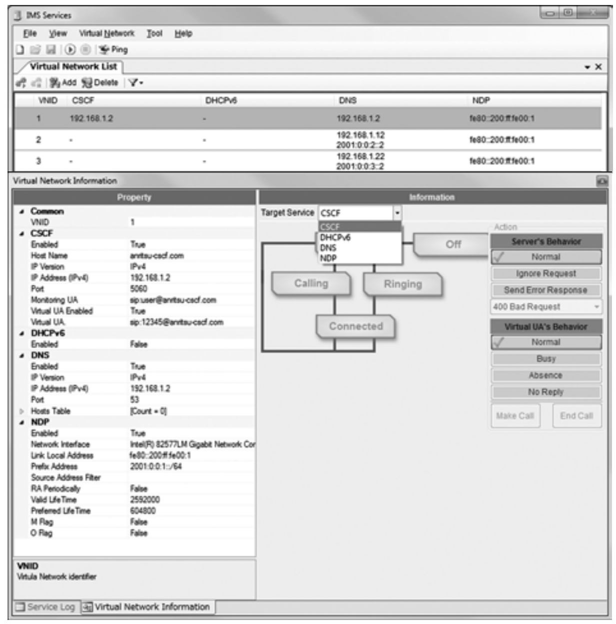
*: Not support for CDMA2000

• Network Troubleshooting Tests

The Access Point Name (APN) requested by the mobile at packet communications can be referenced to the APN in the SmartStudio PDN list.
Additionally, various error codes can be sent if there is a mismatch with the specified APN.

IMS Service Function

SmartStudio has the built-in server group required by IMS services as a standard function.
New LTE services such as VoLTE, IMS over SMS, etc., can be tested easily.



- **CSCF (Call Session Control Function)**
  Supports standard server function for VoLTE and SMS over IMS tests as well as voice data loopback function
- **DHCPv6 (Dynamic Host Configuration Protocol v6)**
  Allocates IPv6 address and notifies DNS/SIP server address to network node
- **DNS (Domain Name Server)**
  Operates as DNS cache server
- **NDP (Neighbor Discovery Protocol)**
  Supports function to transmit RA (Router Advertisement) and regularly transmit RA to RS (Router Solicitation)

• Network-Side Calling, Quasi-Normal and Abnormal Status Tests

When combined with the MX847570A-080 Extended CSCF option, calls can be made from the network side to the mobile side. Additionally, IP network faults can be reproduced intentionally to troubleshoot network faults at VoLTE calling and data packet communications.

• IMS Supplementary Service Tests

Installing the MX847580A-081 IMS Supplementary Service software adds functions for displaying caller and receiver ID at the VoLTE terminal and for simulating XCAP servers. VoLTE service call holding and call transfer can be tested too.

The Environment which Cannot be Examined in a Live Network is Built (Emergency)

• Call Blocking, Emergency Call Test
The Voice test also supports Call Blocking and Emergency Call which are so difficult to run on live networks.

Access Class Control
Sometimes, carriers limit access at events where there are too many people trying to call at once or during abnormally busy times like New Year. The SmartStudio can configure an access control test environment, which is difficult to do on a live network.

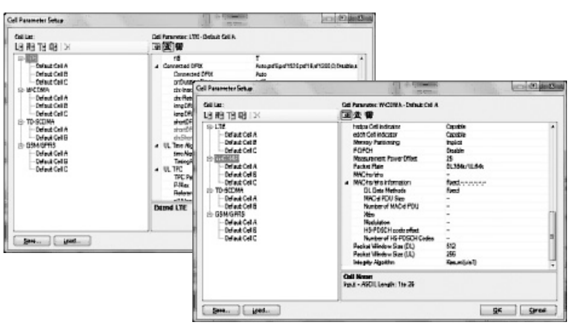
Emergency Call Test
Obviously, emergency calls cannot be tested on a live network but this is an essential test that must be performed. The SmartStudio offers, emergency call test settings and execution.

System	Control Method	Operation
W-CDMA/ GSM	Not Normal	No Access Control
	Barred	Call blocking for all communications
	Emergency	Call blocking for communications except emergency call
CDMA2000/ EV-DO	PSIST	Call blocking for 1xEV-DO
	ACCT	Call blocking for ACCT1X

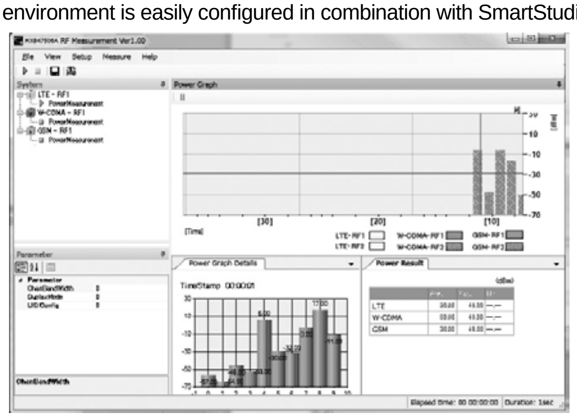
• ETWS/CMAS Test
The PWS Centre built into SmartStudio sends ETWS/CMAS earthquake and tsunami alerts to smartphones*. The alert messages can be created and edited freely for sending at any timing. Supported by LTE/W-CDMA/CDMA2000.

Configure Battery Life Test Environment

The need for Smartphone battery life tests is increasing and SmartStudio supports base station settings for measuring power consumption, such as CDRX and TPC.



• RF Power Measurement
Installing the MX847506A RF Measurement software supports MD8475A measurements of mobile wireless signals. A battery life test environment is easily configured in combination with SmartStudio.



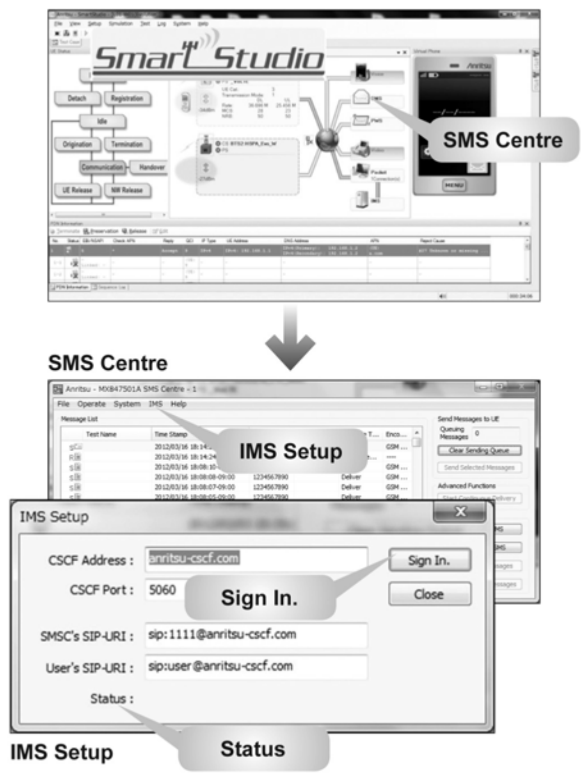
• SMS over IMS Test (Packet Communication)

▪ Confirm SMS sending/receiving via built-in IMS server

▪ Send and receive SMS as SIP messages via IMS service

IMS Setup

- Set SMS over IMS and register at CSCF server using IMS setting window
- Register at CSCF server using [Sign In] button; CSCF server registration status displayed at [Status] field as one of following five:
  - Off : Not registered
  - REGISTER : Registering
  - REGISTER Fail : Registration failed
  - REGISTER Timeout : Registration timed out
  - REGISTER Idle : Registration completed
- At CSCF registration, SMS sent/received via IMS server



SmartStudio Test Functions

Function	Description	SmartStudio LTE	W-CDMA	GSM	CDMA2000	TD-SCDMA
General						
Location Registration		✓	✓	✓	✓	✓
L1/L2 Counter	Measured values indicating the performance of Layer 1 and Layer 2.	✓	✓	–	–	✓
Throughput Monitor Counter	Actual data throughput can be verified at a fixed rate or at a rate determined by UE.	✓	✓	✓	–	✓
Trace View	The sequence of each layer is displayed on real time.	✓	✓	✓	–	✓
RF Relation						
Power Control for GUI	Power control for BS is changed into IDLE and Communication.	✓	✓	✓	✓	✓
Out of Service Setting	Sets BTS Power output to OFF and sets UE to outside NW condition.	✓	✓	✓	✓	✓
RF Monitor	The channel power , such as frequency, a frequency error and PDSCH, and PUSCH, is displayed.	✓	✓	✓	–	✓
TPC Setting	TPC (Transmit Power Control) can be changed arbitrarily.	✓	✓	✓	–	✓
Remote Control						
Ethernet	SmartStudio operation control (parameter selection, start, etc.) from external PC.	✓	✓	✓	✓	✓
GPIB	SmartStudio parameter setting control from external PC.	✓	✓	✓	✓	✓
Voice/Video Call						
LTE FDD/TD-LTE						
VoLTE Call (Loopback/Echoback)	Voice over LTE (VoLTE) UE call tests.	✓				
W-CDMA/GSM/CDMA2000/TD-SCDMA						
UE Originated/Terminated Voice Call (Loopback/Echoback)	Performs loopback communication test[*1].		✓	✓	✓	✓
UE Originated/Terminated Voice Call (Handset)	Performs handset communication test.		✓	✓	–	✓
Emergency Call	Performs Emergency Call test with or without Test SIM[*2].		✓	✓	✓	✓
Voice Call Released			✓	✓	✓	✓
Caller ID Setting	Performs Show ID/Hide ID/Unknown ID/Payphone/International call settings.		✓	✓	✓	✓
Access Class Barred (Release99) [Barred]	Bars all calls according to Release 99 standard.		✓	✓		✓
Access Class Barred (Release99) [Emergency]	Bars all calls except emergency calls according to Release 99 standard.		✓	✓		✓
Access Class Barred (PSIST/ACCT)	Bars all calls according to CDMA2000.				✓	
W-CDMA/TD-SCDMA						
UE Originated/Terminated Video Call (Loopback)	Performs loopback communication test[*1].		✓			✓
Video Call Released			✓			✓
Packet Connection						
IPv4 Packet Test	Data supporting IPv4 can be sent and received.	✓	✓	✓	✓	✓
IPv6 Packet Test	Data supporting IPv6 can be sent and received.	✓	✓	✓	✓	✓
Packet Preservation/Dormant Test	Releases RRC Connection while maintaining PDP Context.	✓	✓	–	✓	✓
LTE FDD/TD-LTE						
UE Originated SISO/MIMO[*3] Packet Call	Performs application tests utilizing packet data communications by connecting to server.	✓				
UE Terminated SISO/MIMO[*3] Packet Call	Performs application tests utilizing packet data communications by connecting to server.	✓				
SISO/MIMO[*3] Packet Call Released from UE		✓				
SISO/MIMO[*3] Packet Call Released from NW		✓				
Multiple PDP Context/PDN Connect	Performs Multi Session packet communications test (Maximum 8-pass).	✓				
W-CDMA						
UE Originated W-CDM/HSPA[*4]/HSPA Evolution[*5] Packet Call	Performs application tests utilizing packet data communications by connecting to server.		✓			
UE Terminated W-CDM/HSPA[*4]/HSPA Evolution[*5] Packet Call	Performs application tests utilizing packet data communications by connecting to server.		✓			
W-CDM/HSPA[*4]/HSPA Evolution[*5] Packet Call Released from UE			✓			
W-CDM/HSPA[*4]/HSPA Evolution[*5] Packet Call Released from NW			✓			
RRC Status Change	The mobile RRC Status can be changed during packet data communications (Cell DCH ↔ Cell FACH ↔ Cell PCH).		✓			
UE Originated PPP Packet Call	Performs PPP (Built-in server) packet data communication test (Not support Serial connection).		✓			
PPP Packet Call Released from UE	Performs PPP (Built-in server) packet data communication test.		✓			
PPP Packet Call Released from NW	Performs PPP (Built-in server) packet data communication test.		✓			
GSM						
UE Originated GPRS/EGPRS[*6] Packet Call	Performs application tests utilizing packet data communications by connecting to server.			✓		
UE Terminated GPRS/EGPRS[*6] Packet Call	Performs application tests utilizing packet data communications by connecting to server.			✓		
GPRS/EGPRS[*6] Packet Call Released from UE				✓		
GPRS/EGPRS[*6] Packet Call Released from NW				✓		
CDMA2000						
UE Originated CDMA2000/EVDO[*7] Packet Call	Performs application tests utilizing packet data communications by connecting to server.				✓	
CDMA2000/EVDO[*7] Packet Call Released from UE					✓	
CDMA2000/EVDO[*7] Packet Call Released from NW					✓	
SV-DO	Simultaneous voice call and packet data connections.				✓	
TD-SCDMA						
UE Originated TD-SCDMA/HSPA[*8] Packet Call	Performs application tests utilizing packet data communications by connecting to server.					✓
UE Terminated TD-SCDMA/HSPA[*8] Packet Call	Performs application tests utilizing packet data communications by connecting to server.					✓
TD-SCDMA/HSPA[*8] Packet Call Released from UE						✓
TD-SCDMA/HSPA[*8] Packet Call Released from NW						✓
Messaging						
ETWS Transmission	ETWS alert tests during IDLE and Communication conditions.	✓	✓	–	–	–
CMAS Transmission	CMAS alert tests during IDLE and Communication conditions.	✓	✓	–	✓	–
SMS Transmission/Reception	SMS (7bit-ASCII, Unicode, Binary) tests on PS and CS networks[*1].	✓	✓	✓	✓	✓
SMS over IMS	SMS TRx tests via IMS server.	✓	–	–	–	–
Continuous SMS Sending	Continuous sending of selected multiple SMS messages to UE.	✓	✓	✓	✓	✓
MMS Transmission/Reception[*9]	Performs MMS transmission/reception test.	✓	✓	✓	✓	✓

*1: Not support for 2-UE testing by one MD8475A
*2: Test SIM not use by CDMA2000
*3: Requires MIIMO option (MX847550A-020) and 2nd RF (MD8475A-001)
*4: Requires HSPA option (MX847510A-001)
*5: Requires HSPA Evolution option (MX847510A-011, MX847570A-011)
*6: Requires EGPRS option (MX847520A-001)
*7: Requires 1xEV-DO option (MD8475A-032)
*8: Requires TD-SCDMA option (MX847540A-001)
*9: Requires separate MMS application sever

Hardware Options

MD8475A-001 2nd RF

This option is required for tests using two RF signals, such as 2-cell and MIMO tests.

MD8475A-003 Fading IO Option

This option adds LVDS and BNC connectors to connect the Anritsu MF6900A Fading Simulator for use with LTE FDD systems.
It requires LVDS and BNC cables (each supplied with MF6900A).

Software Options

MX847502A Multi-cell Software

Combined used with the MD8475A-001 2nd RF option supports simultaneous startup of two systems. However, this is not required for CDMA2000 and EV-DO hybrid tests.

MX847506A RF Measurement

Installing combinations of the MX847510A, MX847520A, and MX847550A software options supports extended RF Tx power accuracy, RF Rx power, frequency, and BLER measurements for each system.

MX847570A SmartStudio

Installing this software in the MD8475A supports a scenario-less test user interface for sending/receiving SMS and ETWS messages (LTE FDD only), voice calls, packet data, etc., as well as CSCF server functions required by IMS service tests.

MX847570A-080 Extended CSCF Option

This software option reproduces network congestion and adds extended responses to the CSCF server functions.
It is supported only by LTE FDD.

MX847570A-081 IMS Supplementary Service Option

This software option is required for performing supplementary service tests of terminal VoLTE functions. It adds simulation functions, such as VoLTE mobile caller ID, call forwarding, and call holding to the MX847570A SmartStudio software.

LTE

● **Basic Configuration**

MD8475A-070 Multi-signalling Unit
MX847550A LTE Simulation Software
MX847550A-010 LTE FDD Option
MX847550A-015 LTE TDD Option
MX847570A-050 LTE FDD Option
MX847570A-055 LTE TDD Option

Basic Configuration for LTE FDD Tests.
This is the basic LTE FDD configuration. These tests support confirmation of connections with LTE terminals during SISO, packet communications, and SMS sending/receiving. In addition, 2-cell tests are supported by installing the MX847502A Multi-cell Software.

3GPP TS 36.306 V8.4.0 (2009-06) Category List

The MD8475A supports UE categories 1 to 4 and will support all new future categories.

LTE (DL)

UE Category	Maximum number of DL-SCH transport block bits received within a TTI	Maximum number of bits of a DL-SCH transport block received within a TTI	Total number of soft channel bits	Maximum number of supported layers for spatial multiplexing in DL
1	10296	10296	250368	1
2	51024	51024	1237248	2
3	102048	75376	1237248	2
4	150752	75376	1827072	2
5	299552	149776	3667200	4

LTE (UL)

UE Category	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL
1	5160	No
2	25456	No
3	51024	No
4	51024	No
5	75376	Yes

● **Options**

MX847550A-020 LTE 2×2 MIMO Option

Installing the MD8475A-001 2nd RF option configures an environment*1 using 2×2 MIMO for testing maximum throughput, etc.

∗1: Handover tests not supported when testing 2×2 MIMO

LTE 2×2 MIMO Correspondence Function

	2×2 MIMO without option	2×2 MIMO with option
Transmission Mode	TM1	TM1, TM2, TM3
Maximum TBS of each subframe	75376	75376 (per 1CW) 102048 (sum of 2CWs)

MX847550A-050 LTE Ciphering Option

This options adds the LTE ciphering function*2, *3 and support SNOW 3G (3GPP-recommended algorithm) and AES.

∗2: Not support for MX847570A
∗3: The Integrity function does not require the MX847550A-050

● **Support Service**

MX847550A-SS110 MX847550A 1Year Support Service

This service supports Help enquiries and maintenance releases (bug fixes) for 1 year.

W-CDMA

• Basic Configuration (Voice/Video/HSPA Packet)

MD8475A-070 Multi-signalling Unit

MX847510A W-CDMA Simulation Software

MX847570A-010 W-CDMA Option

Basic Configuration for W-CDMA Tests.
This is the basic W-CDMA configuration. These tests support voice, videophone, packet, and SMS communications.

• Options

MX847510A-001 HSPA Option

This option performs evaluation of all HSPA UE categories defined by the 3GPP Release 5/Release 6 standards.

3GPP TS 25.306 Category List

HSDPA

HS-DSCH Category	HS-DSCH Codes	Minimum Inter-TTI	TB-Sizes	Total Number of Soft Channel Bits	Modulation	Maximum Throughput [bps]
1	5	3	7298	19200	QPSK/16QAM	1216333
2	5	3	7298	28800	QPSK/16QAM	1216333
3	5	2	7298	28800	QPSK/16QAM	1824500
4	5	2	7298	38400	QPSK/16QAM	1824500
5	5	1	7298	57600	QPSK/16QAM	3649000
6	5	1	7298	67200	QPSK/16QAM	3649000
7	10	1	14411	115200	QPSK/16QAM	7205500
8	10	1	14411	134400	QPSK/16QAM	7205500
9	15	1	20251	172800	QPSK/16QAM	10125500
10	15	1	27952	172800	QPSK/16QAM	13976000
11	5	2	3630	14400	QPSK	907500
12	5	1	3630	28800	QPSK	1815000

HSUPA

E-DCH Category	E-DCH Codes	Minimum Spreading Factor	Support for 10 and 2 ms TTI EDCH	TB-Sizes within 10 ms E-DCH TTI	TB-Sizes within 2 ms E-DCH TTI	Maximum Throughput [bps]
1	1	SF4	10 ms TTI only	7110	–	729600
2	2	SF4	10 ms and 2 ms TTI	14484	2798	1459200
						1459500
3	2	SF4	10 ms TTI only	14484	–	1459200
4	2	SF2	10 ms and 2 ms TTI	20000	5772	2000000
						2918500
5	2	SF2	10 ms TTI only	20000	–	2000000
6	4	SF2	10 ms and 2 ms TTI	20000	11484	2000000
						5760000

MX847510A-050 W-CDMA Ciphering Option

This options adds the W-CDMA ciphering function*1, *2 and support KASUMI (3GPP-recommended algorithm).

*1: Not support for MX847570A
*2: The Integrity function does not require the MX847510A-050

MD8475A-090 ISDN Interface

This hardware option adds an ISDN interface (BRI).

MX847510A-011 HSPA Evolution/DC-HSDPA Option

MX847570A-011 HSPA Evolution/DC-HSDPA Option

Combination with the MX847510A-001 HSPA software option supports W-CDMA high-speed packet service HSPA Evolution and DC-HSDPA tests.

3GPP TS 25.306 Category List

HSPA Evolution/DC-HSDPA

HS-DSCH Category	Maximum number of HS-DSCH codes received	Minimum inter-TTI interval	Maximum number of bits of an HS-DSCH transport block received within an HS-DSCH TTI	Total number of soft channel bits	Supported modulations with dual cell operation	Maximum Throughput [bps]
6	5	1	7298	67200	QPSK/16QAM	3649000
8	10	1	14411	134400	QPSK/16QAM	7205500
9	15	1	20251	172800	QPSK/16QAM	10125500
10	15	1	27952	172800	QPSK/16QAM	13976000
12	5	1	3630	28800	QPSK	1815000
13	15	1	35280	259200	Not Applicable (dual cell operation not supported)	17640000
14	15	1	42192	259200		21096000
23	15	1	35280	518400	QPSK, 16QAM, 64QAM	35280000
24	15	1	42192	518400		42192000

HSUPA

E-DCH Category	E-DCH Codes	Minimum Spreading Factor	Support for 10 and 2 ms TTI EDCH	TB-Sizes within 10 ms E-DCH TTI	TB-Sizes within 2 ms E-DCH TTI	Maximum Throughput [bps]
2	2	SF4	10 ms and 2 ms TTI	14484	2798	1459500
4	2	SF2	10 ms and 2 ms TTI	20000	5772	2918500
6	4	SF2	10 ms and 2 ms TTI	20000	11484	5760000

• Support Service

MX847510A-SS110 MX847510A 1Year Support Service

This service supports Help enquiries and maintenance releases (bug fixes) for 1 year.

GSM

● **Basic Configuration**

MD8475A-020 GSM Signalling Unit

MX847520A GSM/GPRS Simulation Software

MX847570A-020 GSM Option

This is the basic GSM/GPRS configuration.
These tests support voice, video phone, packet, and SMS tests.

● **Options**

MX847520A-001 EGPRS Option

This option supports EGPRS evaluation — a GPRS high-speed, data communication method. Application tests using EGPRS communications are supported.

EGPRS Supported Specifications

Layer 1	Frequency Bandwidth	850, 900, 1800, 1900 MHz
	Modulation & Coding Scheme	MCS 1, 2, 3, 4 (GMSK) MCS 5, 6, 7, 8, 9 (8PSK)
	Number of Slots	Up to Multi Slot Class 12 (DL: 4 / UL: 4 / SUM: 5)
	Channel Combination	Combination 11 & 13
Layer 2, 3	Broadcasting Control Channel	BCCH/CCCH, PBCCH/PCCH
	ARQ Type	Type 1
	Window Size	64 to 192
Standard		3GPP Release99

MX847520A-050 GSM/GPRS Ciphering Option

This option adds the GSM/GPRS ciphering function*1, *2 and supports both the GSM A5/1, A5/2, and A5/3 ciphering algorithms as well as the GPRS GEA/1, GEA/2, and GEA/3 ciphering algorithms.

*1: Not support for MX847570A
*2: The Integrity function does not require the MX847520A-050

● **Support Service**

MX847520A-SS110 MX847520A 1Year Support Service

This service supports Help enquiries and maintenance releases (bug fixes) for 1 year.

CDMA2000

● **Basic Configuration**

MD8475A-030 CDMA2000 1X Signalling Unit

MD8475A-032 CDMA2000 1xEV-DO Signalling Unit

MX847530A CDMA2000 Simulation Software

MX847570A-030 CDMA2000 Option

This is the basic CDMA2000 1X/1xEV-DO configuration.
These tests support voice communications (echoback), packet, and SMS tests. Combination with the MD8475A-001 2nd RF option configures a hybrid environment.

● **Options**

MX847530A-001 Multi-sector/Multi-carrier Option

This software option supports simulation of various handover tests including Soft, Softer, Hard, Idle, and Access, by dynamically changing the CDMA2000 1X/1xEV-DO multi-carrier (Max. 2) and multi-sector (1X: Max. 6, 1xEV-DO: Max. 3). One MD8475A unit supports testing in multi-carrier/multi-sector environments where verification using a live network is difficult. It improves the efficiency of operation verification, the Inter Operability Test (IOT) at mobile R&D, and the field-testing pre-verification.

● **Support Service**

MX847530A-SS110 MX847530A 1Year Support Service

This service supports Help enquiries and maintenance releases (bug fixes) for 1 year.

TD-SCDMA

● **Basic Configuration**

MD8475A-040 TD-SCDMA Signalling Unit

MX847540A TD-SCDMA Simulation Software

MX847570A-040 TD-SCDMA Option

This is the standard configuration for TD-SCDMA tests measuring voice, video, throughput, and SMS transmissions.

● **Options**

MX847540A-001 TD-HSPA Option

This is used to evaluate all 3GPP TS 25.306 HSPA UE categories.

3GPP TS 25.306

TD-HSDPA

HS-DSCH Category	Maximum number of HSDSCH codes per timeslot	Maximum number of HSDSCH timeslots per TTI	Maximum number of HSDSCH transport channel bits can be received within an HSDSCH TTI	Total number of soft channel bits	Maximum Throughput [bps]
Category 1	16	2	2788	11264	557600
Category 2	16	2	2788	22528	557600
Category 3	16	2	2788	33792	557600
Category 4	16	2	5600	22528	1120000
Category 5	16	2	5600	45056	1120000
Category 6	16	2	5600	67584	1120000
Category 7	16	3	8416	33792	1688200
Category 8	16	3	8416	67584	1688200
Category 9	16	3	8416	101376	1688200
Category 10	16	4	11226	45056	2245200
Category 11	16	4	11226	90112	2245200
Category 12	16	4	11226	135168	2245200
Category 13	16	5	14043	56320	2808600
Category 14	16	5	14043	112640	2808600
Category 15	16	5	14043	168960	2808600

TD-HSUPA

E-DCH category	Maximum number of E-DCH timeslots per TTI	Maximum number of E-DCH transport channel bits that can be received within an E-DCH TTI	Maximum Throughput [bps]
Category 1	2 (Note 1, 3)	2754	550800
Category 2	3 (Note 1, 3)	4162	832400
Category 3	2 (Note 2, 3)	5532	1106400
Category 4	3 (Note 2, 3)	8348	1669600
Category 5	4 (Note 2, 3)	11160	2232000
Category 6	5 (Note 2, 3)	11160	2232000

Note 1: Categories 1 and 2 support QPSK.
Note 2: Categories 3, 4, 5 and 6 support QPSK and 16QAM.
Note 3: One timeslot supports two physical channels when 16QAM not used.

MX847540A-050 TD-SCDMA Ciphering Option

This options adds the TD-SCDMA ciphering function*1, *2.

*1: Not support for MX847570A
*2: The Integrity function does not require the MX847540A-050

● **Support Service**

MX847540A-SS110 MX847540A 1Year Support Service

This service supports Help enquiries and maintenance releases (bug fixes) for 1 year.

System Configuration

<table>
<tr><th rowspan="2">System</th><th colspan="2">LTE</th><th rowspan="2">W-CDMA</th><th rowspan="2">GSM</th><th rowspan="2">CDMA2000</th><th rowspan="2">TD-SCDMA</th></tr>
<tr><th>FDD</th><th>TDD</th></tr>
<tr><td rowspan="3">Basic Configuration</td><td colspan="2">MX847550A
LTE Simulation Software</td><td>MX847510A
W-CDMA
Simulation Software</td><td>MX847520A
GSM/GPRS
Simulation Software</td><td>MX847530A
CDMA2000
Simulation Software</td><td>MX847540A
TD-SCDMA
Simulation Software</td></tr>
<tr><td>MX847550A-010
LTE FDD Option</td><td>MX847550A-015
LTE TDD Option</td><td rowspan="2">MD8475A-070
Multi-signalling Unit</td><td rowspan="2">MD8475A-020
GSM Signalling Unit</td><td>MD8475A-030
CDMA2000 1X
Signalling Unit</td><td rowspan="2">MD8475A-040
TD-SCDMA
Signalling Unit</td></tr>
<tr><td colspan="2">MD8475A-070
Multi-signalling Unit</td><td>MD8475A-032
CDMA2000 1xEV-DO
Signalling Unit</td></tr>
<tr><td>User Interface</td><td colspan="6">MX847570A SmartStudio</td></tr>
<tr><td rowspan="3">SmartStudio License</td><td>MX847570A-050
LTE FDD Option</td><td>MX847570A-055
LTE TDD Option</td><td>MX847570A-010
W-CDMA Option</td><td rowspan="3">MX847570A-020
GSM Option</td><td rowspan="3">MX847570A-030
CDMA2000 Option</td><td rowspan="3">MX847570A-040
TD-SCDMA Option</td></tr>
<tr><td colspan="2">MX847580A-080
CSCF Option</td><td rowspan="2">MX847570A-011
HSPA Evolution/
DC-HSDPA Option</td></tr>
<tr><td colspan="2">MX847580A-081
IMS Suplimentary Service Option</td></tr>
<tr><td>Support Service</td><td colspan="2">MX847550A-SS110
MX847550A 1Year Support Service</td><td>MX847510A-SS110
MX847510A 1Year
Support Service</td><td>MX847520A-SS110
MX847520A 1Year
Support Service</td><td>MX847530A-SS110
MX847530A 1Year
Support Service</td><td>MX847540A-SS110
MX847540A 1Year
Support Service</td></tr>
<tr><td rowspan="4">Options</td><td colspan="2" rowspan="2">MX847550A-020
LTE 2×2 MIMO Option</td><td>MX847510A-001
HSPA Option</td><td rowspan="2">MX847520A-001
EGPRS Option</td><td rowspan="4">MX847530A-001
Multi-sector/
Multi-carrier Option</td><td rowspan="2">MX847510A-001
HSPA Option</td></tr>
<tr><td>MX847510A-011
HSPA Evolution/
DC-HSDPA Option</td></tr>
<tr><td colspan="2">MD8475A-003
Fading IO Option</td><td>MD8475A-090
ISDN Interface</td><td rowspan="2">MX847520A-050
GSM/GPRS
Ciphering Option</td><td rowspan="2">MX847540A-050
TD-SCDMA
Ciphering Option</td></tr>
<tr><td colspan="2">MX847550A-050
LTE Ciphering Option</td><td>MX847510A-050
W-CDMA
Ciphering Option</td></tr>
<tr><td>RF Accuracy</td><td colspan="4">MX847506A RF Measurment</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">Main Frame Options</td><td colspan="6">MD8475A-001 2nd RF</td></tr>
<tr><td colspan="6">MX847502A Multi-cell Software</td></tr>
</table>

2-cell Testing Support

BTS2 \ BTS1		FDD					TDD	
		LTE-FDD	HSPA Evolution	W-CDMA	GSM	CDMA2000	TD-LTE	TD-SCDMA
FDD	LTE-FDD	✓	✓	✓	✓	✓*	✓	
	HSPA Evolution	✓	✓	✓	✓		✓	
	W-CDMA	✓	✓	✓	✓		✓	
	GSM	✓	✓	✓	✓		✓	✓
	CDMA2000	✓*						
TDD	TD-LTE	✓	✓	✓	✓		✓	✓
	TD-SCDMA				✓		✓	✓

∗: Two MD8475A sets are required for LTE-CDMA2000 tests.

Specifications

MD8475A Signalling Tester

RF Connector	RF Input/Output connector (RF Main, RF Aux1, RF Aux2) Connector: N type, Impedance: 50Ω, VSWR: ≤1.5 (500 MHz to 3 GHz) Reference oscillator Frequency: 10 MHz Level: TTL level Connector: BNC type Startup characteristics: ±5 × 10^{-8} (5 minutes after power-on, referenced to frequency 24 hours after power-on) Aging rate: 2 × 10^{-8}/day, ≤1 × 10^{-7}/year (referenced to frequency 24 hours after power-on) Temperature characteristics: ≤±2 × 10^{-8} External reference input Frequency: 10 MHz, Acceptable frequency range: ±0.5 ppm, Level: ≥0 dBm, Impedance: 50Ω, Connector: BNC type
Transmission Characteristics	Frequency Frequency range: 350 MHz to 3.6 GHz Setting resolution: 100 kHz (Depending on MX847501A used) Accuracy: Based on reference oscillator accuracy Output level Level range: –130 to –10 dBm (Main, Aux1, Aux2) Resolution: 0.1 dB Transmission level (with MX847506A) ±1.0 dB (–120 dBm ≤ Output level, 350 MHz ≤ Frequency ≤ 3 GHz, 20° to 30°C, after CAL, with MX847506A) ±1.2 dB (–120 dBm ≤ Output level, 3 GHz < Frequency ≤ 3.6 GHz, 20° to 30°C, after CAL, with MX847506A) Signal purity Non-harmonic spurious: ≤–40 dBc (at ≥500 kHz frequency offset) Harmonics: ≤–25 dBc
Reception Characteristics	Frequency Frequency range: 350 MHz to 3.6 GHz Setting resolution: 100 kHz (Depending on MX847501A used) Level Maximum input level: +35 dBm (Average) Input level range: –60 to +35 dBm (with MD8475A-010, MD8475A-011, MD8475A-030, MD8475A-032, MD8475A-050) –30 to +40 dBm (in-burst average power) (with MD8475A-020) Reference level: –60 to +35 dBm Reception level (with MX847506A) ±1.1 dB (+35 to –60 dBm, 350 MHz ≤ Frequency ≤ 3 GHz, 20° to 30°C, after CAL, with MX847506A) ±1.3 dB (+35 to –60 dBm, 3 GHz < Frequency ≤ 3.6 GHz, 20° to 30°C, after CAL, with MX847506A) (GSM: –30 to +40 dBm) Variable range Rx level setting resolution: 1 dB
General	Display: Color TFT LCD screen, 12.1 inches (wide type), 1280 × 800 dots External interface Trigger I/O: BNC Call Proc Timing I/O: 15-pin mini D-Sub connector Call Proc Serial I/O: D-sub connector, RS-232C level Call Proc Ethernet A/B: RJ45 connector, 10/100/1000BASE-T Handset: RJ-11 connector Headphone: 3.5-mm dia. headphone jack Microphone: 3.5-mm dia. microphone jack USB: USB2.0, Type A, 4 ports RS-232C: D-sub connector, conforms to RS-232C GPIB: IEEE488 connector VGA: Mini D-Sub connector Ethernet 0/1: RJ-45 connector 10/100/1000BASE-T
Power Supply	100 Vac to 120 Vac (±10%)/200 Vac to 240 Vac (–15%/+10%, Max.: 250 Vac), 50 Hz to 60 Hz (Rating), ≤480 VA (Max.)
Dimensions and Mass	426 (W) × 221.5 (H) × 398 (D) mm (excl. protrusions), <25 kg (with all options)
Temperature Range & Humidity	Operation: +5° to +40°C, Storage: –20° to +60°C, ≤90% (no condensation)
EMC	EN 61326-1, EN 61000-3-2
LVD	EN 61010-1

Ordering Information

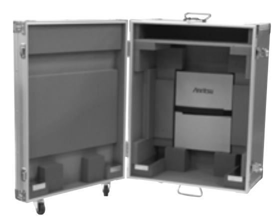
Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MD8475A	Signalling Tester
	Standard accessories
MX847500A	Platform Software (Factory-installed)
MX847501A	Control Software (Factory-installed)
	Power Cord
	MD8475A CD-ROM (Operation manual)
P0035B	W-CDMA/GSM Test USIM (Standard UICC size)
J1440A	LAN Cable (3 m)
Z0541A	USB Mouse
Z0975A	Keyboard (USB)
A0058A	Handset
	Hardware option
MD8475A-001	2nd RF
	Software option
MX847502A	Multi-cell Software (License)
MX847506A	RF Measurement
MX847580A	SIDE Execution Software (License)
MX847580A-092	SIDE SIP Execution Option (License)
	User interface
MX847570A	SmartStudio (License)
MX847570A-010	W-CDMA Option (License)
MX847570A-011	HSPA Evolution/DC-HSDPA Option (License)
MX847570A-020	GSM Option (License)
MX847570A-030	CDMA2000 Option (License)
MX847570A-040	TD-SCDMA Option (License)
MX847570A-050	LTE FDD Option (License)
MX847570A-055	LTE TDD Option (License)
MX847570A-080	Extended CSCF Option (License)
MX847570A-081	IMS Supplementary Service Option (License)
	LTE system
MD8475A-070	Multi-signalling Unit
MX847550A	LTE Simulation Software (License)
MX847550A-010	LTE FDD Option (License)
MX847550A-015	LTE TDD Option (License)
MX847550A-020	LTE 2×2 MIMO Option (License)
MX847550A-050	LTE Ciphering Option (License)
MX847550A-060	LTE RoHC Option (License)
MD8475A-003	Fading IO Option
	W-CDMA system
MD8475A-070	Multi-signalling Unit
MX847510A	W-CDMA Simulation Software (License)
MX847510A-001	HSPA Option (License)
MX847510A-011	HSPA Evolution/DC-HSDPA Option (License)
MX847510A-050	W-CDMA Ciphering Option (License)
MD8475A-090	ISDN Interface
	GSM system
MD8475A-020	GSM Signalling Unit
MX847520A	GSM/GPRS Simulation Software (License)
MX847520A-001	EGPRS Option (License)
MX847520A-050	GSM/GPRS Ciphering Option (License)
	CDMA2000 system
MD8475A-030	CDMA2000 1X Signalling Unit
MD8475A-032	CDMA2000 1xEV-DO Signalling Unit
MX847530A	CDMA2000 Simulation Software (License)
MX847530A-001	Multi-sector/Multi-carrier Option (License)
	TD-SCDMA system
MD8475A-040	TD-SCDMA Signalling Unit
MX847540A	TD-SCDMA Simulation Software (License)
MX847540A-001	TD-HSPA Option (License)
MX847540A-050	TD-SCDMA Ciphering Option (License)

Model/Order No.	Name
	Software support services
MX847510A-SS110	MX847510A 1Year Support Service (License)
MX847520A-SS110	MX847520A 1Year Support Service (License)
MX847530A-SS110	MX847530A 1Year Support Service (License)
MX847540A-SS110	MX847540A 1Year Support Service (License)
MX847550A-SS110	MX847550A 1Year Support Service (License)
MC0011A	Web Access Key (USB dongle)
	Warranty
MD8475A-ES210	2 Years Extended Warranty Service
MD8475A-ES310	3 Years Extended Warranty Service
MD8475A-ES510	5 Years Extended Warranty Service
	Application parts
B0651A	Carrying Case
B0329D	Front Cover for 1MW 5U
Z0749	MN8110B + Inch Screw Cable (for call processing I/O)
J0004	Coaxial Adaptor (N (male)-SMA (female))
J0127A	Coaxial Cord, 1.0 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2.0 m (BNC-P · RG58A/U · BNC-P)
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2.0 m (N-P · 5D-2W · N-P)
J0658	Adapter (SMA male-female L-type)
J1262A	RS-232C Cable (Straight 2 m, male-female)
J1262B	RS-232C Cable (Crossover 2 m. male-female)
J1263	W-CDMA Interface Cable (Terminal connection cable)
J1265	Adapter (Serial connector, male-male)
J1287	HDD-SUB15P Cable (milli-inch, for connecting MN8110B)
J1333A	HDD-SUB15P Crossover Cable (inch)
J1440A	LAN Cable
J1524A	Dsub15-BNC Conversion Cable
P0035B	W-CDMA/GSM Test USIM (Standard UICC Size)
P0035B7	W-CDMA/GSM Test USIM (Micro UICC Size)
J1334A	CDMA2000 Cable
J1416A	LVDS Cable
J1549A	LTE-C2K Sync Cable

B0651A Carrying Case



Anritsu

RADIO COMMUNICATION ANALYZER

MT8820C

30 MHz to 2.7 GHz (3.4 GHz to 3.8 GHz)

Remote Control
GPIB | Ethernet

All-in-One Platform Supporting RF Tx and Rx Tests Up to 3.9G System

Excellent Eco Product

• Supports Multi-Communication Systems
The MT8820C platform covers a frequency range of 30 MHz to 2.7 GHz (3.4 GHz to 3.8 GHz with MT8820C-018). When the dedicated optional measurement software and hardware is installed, the major Tx and Rx characteristics of LTE FDD/TDD, W-CDMA/HSPA/HSPA Evolution/DC-HSDPA, GSM/GPRS/EGPRS, CDMA2000 1X (IS-2000), CDMA2000 1xEV-DO Rev. A, PHS/Advanced PHS and TD-SCDMA/HSPA terminals can be measured using a single MT8820C unit.

• Advanced Digital Signal Processing and Batch Measurement
Manufacturing and inspection test times have been dramatically cut by incorporating advanced DSP and parallel measurement technologies. Furthermore, several measurement items can be selected freely for batch measurement, and the number of measurements for each measurement item can be configured separately.
The one-touch operation supports easy and quick measurement of Tx and Rx characteristics, including transmit frequency, modulation accuracy, transmit power, spectrum emission mask, adjacent channel leakage power ratio, occupied bandwidth, and BER.

• Parallelphone Measurement
When the Parallelphone Measurement option is installed in the MT8820C main frame, two different mobile terminals can be connected and tested simultaneously with a single MT8820C using its second RF, AF, GPIB, and Ethernet port. This functionality significantly improves manufacturing efficiency by reducing production costs (return on investment and energy saving) and space.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

Measurement Software

Measurement Software	System	Description
MX882000C	W-CDMA	Tx and Rx measurements of mobile terminals including call processing (requires MT8820C-001 and MX882050C)
MX882000C-011	HSDPA	Tx and Rx measurements of mobile terminals including call processing (requires MT8820C-001, MX882000C and MX882050C)
MX882000C-021	HSUPA	Tx and Rx measurements of mobile terminals including call processing (test loop mode) (requires MT8820C-001, MX882000C, MX882000C-011 and MX882050C)
MX882000C-031	HSPA Evolution	Tx and Rx measurements of mobile terminals including call processing (requires MT8820C-001, MX882000C, MX882000C-011, MX882000C-021 and MX882050C)
MX882000C-032	DC-HSDPA	Rx measurement of mobile terminals including call processing (requires MT8820C-001 2 sets, MT8820C-012, MX882000C, MX882000C-011, MX882000C-021, MX882000C-031, MX882010C, MX882050C)
MX882001C	GSM/GPRS	Tx and Rx measurements of mobile terminals including call processing (requires MT8820C-002)
MX882001C-011	EGPRS	Tx and Rx measurements of mobile terminals including call processing (requires MT8820C-002 and MX882001C)
MX882002C	CDMA2000 1X	Tx and Rx measurements of mobile terminals including call processing (requires MT8820C-003)
MX882005C	PHS	Tx and Rx measurements of mobile terminals including call processing, Tx and Rx measurements of base stations without call processing (requires MT8820C-002)
MX882005C-011	Advanced PHS	Tx and Rx measurements of mobile terminals including call processing, PHS Tx and Rx measurements of base stations without call processing (requires MT8820C-002 and MX882005C)
MX882006C	CDMA2000 1xEV-DO Rev. 0	Tx and Rx measurements of 1xEV-DO Rev. 0 access terminals including call processing (requires MT8820C-003, MT8820C-005 and MX882002C)

Continued on next page

Measurement software	System	Description
MX882006C-011	CDMA2000 1xEV-DO Rev. A	Tx and Rx measurements of 1xEV-DO Rev. A access terminals including call processing (ETAP) (requires MT8820C-003, MT8820C-005, MX882002C and MX882006C)
MX882007C	TD-SCDMA	Tx and Rx measurements of TD-SCDMA terminals including call processing (requires MT8820C-001 and MT8820C-007)
MX882007C-011	TD-SCDMA HSDPA	Tx and Rx measurements of TD-SCDMA/ HSDPA terminals including call processing (requires MT8820C-001, MT8820C-007, and MX882007C)
MX882007C-021	TD-SCDMA HSUPA	Tx measurements of TD-SCDMA/HSUPA terminals including call processing (requires MT8820C-001, MT8820C-007, MX882007C, and MX882007C-011)
MX882012C	LTE FDD	Tx and Rx measurement of LTE FDD terminals including call processing (requires MT8820C-008)
MX882013C	LTE TDD	Tx and Rx measurement of LTE TDD terminals including call processing (requires MT8820C-008)
MX882042C	LTE FDD	Tx measurement of LTE FDD terminals excluding call processing
MX882043C	LTE TDD	Tx measurement of LTE TDD terminals excluding call processing

∗ For LTE FDD/TDD, W-CDMA/HSPA/HSPA Evolution/DC-HSDPA, and TD-SCDMA/HSPA terminal connectivity, contact Anritsu sales representative.

Transmitter Measurement

• Output Power

The MT8820C enables measuring output power of mobile stations. When the number of measurements is set to two or more, the max., mean, and min. values of the result are displayed, providing evaluation of the terminal randomness. This repeat measurement function is also available for other measurements.

Example of Transmission Power Measurement (HSDPA)

• Modulation Analysis

The MT8820C enables modulation analysis of mobile equipment. For example in GSM, simultaneous measurement and display of frequency, frequency error (in kHz and ppm), phase error and peak phase error is performable. Amplitude error at the burst-on section can be also measured.

• Occupied Frequency Bandwidth

This test measures the occupied frequency bandwidth of the W-CDMA terminal. The ratio of the frequency bandwidth to the total power can be changed in the range of 80.0 to 99.9%.

• Adjacent Channel Power

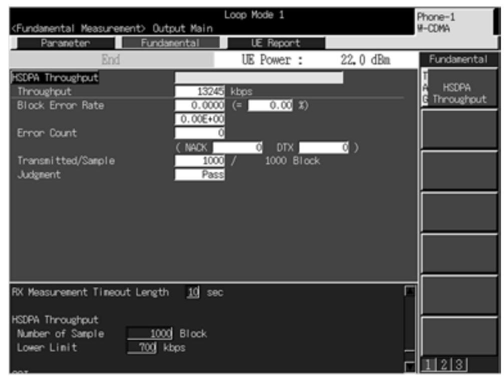
Adjacent channel power is measured according to each communication system.
In W-CDMA, the power can be measured in ±5 MHz, ±10 MHz from center frequency. In GSM, the power of 25 points can be measured in ±2 MHz from center frequency.

• Spectrum Waveform Display

MT8820C has the spectrum waveform display function by W-CDMA. This function monitors the existence of the frequency ingredient with the spectrum exceeding the standard line defined by 3GPP standards.

Receiver Measurement

Measurement of the error rate conforming to the standard of each communication system is performable. For example, in HSPA Evolution, the bit error rate can be measured by the loopback test mode specified in the 3GPP standards.

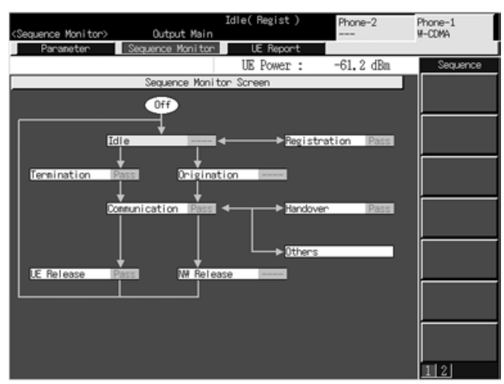


Example of Error Rate Measurement (HSPA Evolution)

Call Processing

• Connection Tests

Various connection tests, such as registration, origination, termination, handover, terminal disconnect, and network disconnect, can be tested using the call processing functionality. Moreover, voice from the mobile terminal can be echoed back while calling to test simple voice communications.



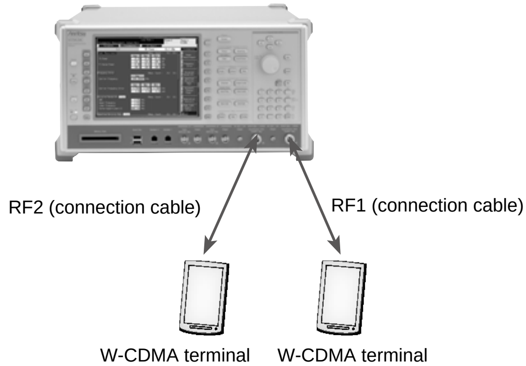
Example of Sequence Monitor (W-CDMA)

• Mobile Terminal Report Monitor

The mobile terminal status can be displayed as a periodic report sent by the mobile terminal to the MT8820C. The downlink RF signal level at the mobile receiver can be checked with the Rx level reported from the mobile terminal.

Simultaneous Measurement of Two Mobile Terminals

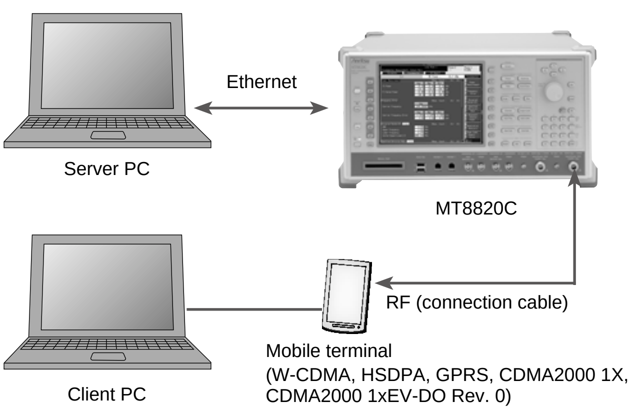
Installing the Parallelphone Measurement option supports simultaneous measurement of two terminals using the second RF, AF, GPIB, or Ethernet port of a single MT8820C unit.



Packet Communication Data Transfer Test

• End-to-End Data Transfer Tests

The External Packet Data option supports data transfer to/from external equipment via the Ethernet port. End-to-end data transfer between an application server connected to the MT8820C and the mobile terminal (W-CDMA, HSDPA, GPRS, CDMA2000 1X, CDMA2000 1xEV-DO Rev. 0) or client PC connected to the mobile terminal can be tested using the External Packet Data option (MX882050C-002, MX882050C-011, MX882001C-002, MX882002C-002, MX882006C-002).



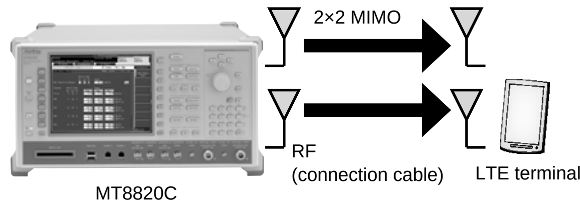
Sample MT8820C connection

∗ Requires MX882050C-002, MX882050C-011, MX882001C-002, MX882002C-002, or MX882006C-002

LTE 2×2 MIMO

• Rx Throughput Test

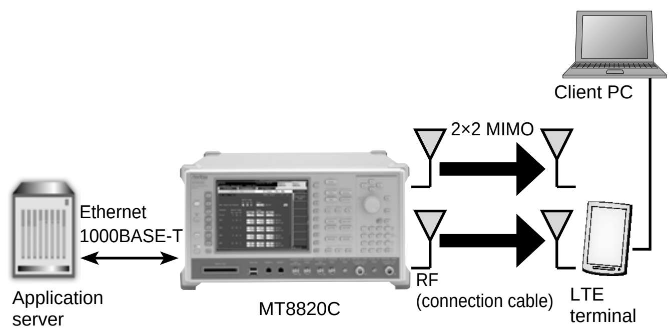
The LTE FDD 2×2 MIMO DL (LTE TDD 2×2 MIMO DL) option supports throughput measurements for 2×2 MIMO downlink signals connected with the MT8820C.



MT8820C Connection Example

IP Data Transfer Test (2×2 MIMO)

Simultaneous installation of the LTE FDD (TDD) IP Data Transfer option and the LTE FDD (TDD) 2×2 MIMO DL option supports connection with an external server and enables IP data communication at the maximum 2×2 MIMO Category 3 data rate.



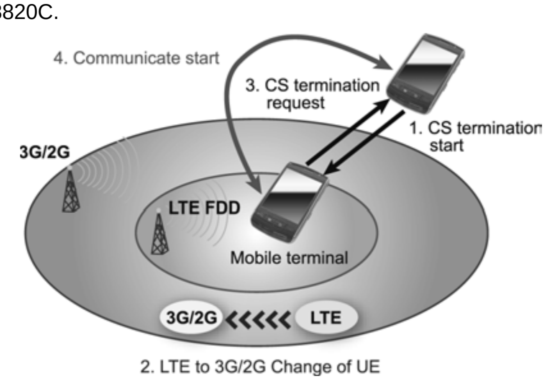
MT8820C Connection Example

MX882012C-006 LTE FDD IP Data Transfer	MX882012C-011 LTE FDD 2×2 MIMO DL
MX882012C LTE FDD Measurement Software	
MT8820C-008 LTE Measurement Hardware	
MT8820C-012 Parallel Phone Measurement Hardware	
MT8820C Main frame	

Example of IP Data Transfer (2×2 MIMO) Options Stack (LTE FDD)

LTE FDD CS Fall Back to W-CDMA/GSM/CDMA2000 Tests

LTE FDD CS Fallback option supports simple CS Fallback tests* (Redirection base) for LTE FDD/3G/2G terminals connected to the MT8820C.



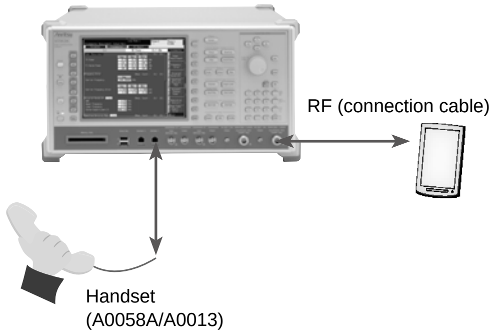
CS Fallback Functional Image

∗: LTE/3G/2G mobile terminals must support CS Fallback function.

Real-time Voice Encoding and Decoding

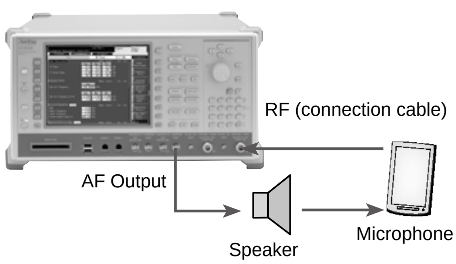
• End-to-End Communications Test

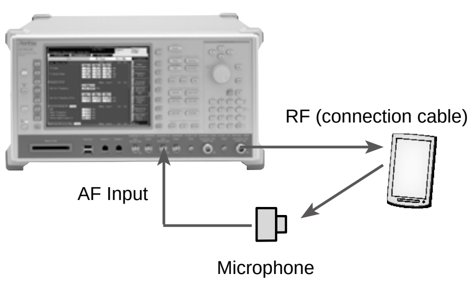
This supports the end-to-end communications test between a handset (A0058A/A0013) connected to the RJ11 connector on the MT8820C and a mobile terminal.



• Audio Transmitter Measurement

The tone signal from the MT8820C AF Output connector is supplied to the microphone of the mobile terminal and the audio transmitter characteristics of the mobile terminal can be measured using the MT8820C to demodulate the uplink RF signal and measure the level, frequency, and distortion of the demodulated tone signal.



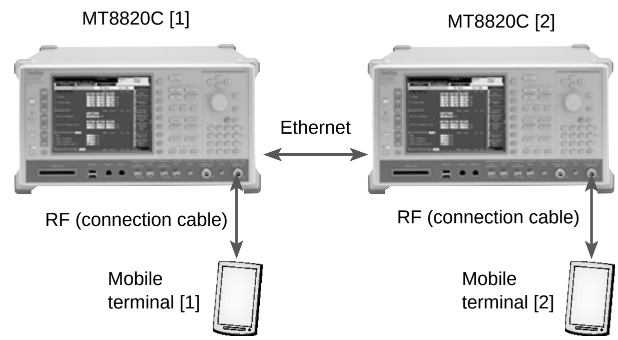


∗ Requires MT8820C-011, MX882000C-001, MX882001C-001, MX882002C-001, or MX882007C-001

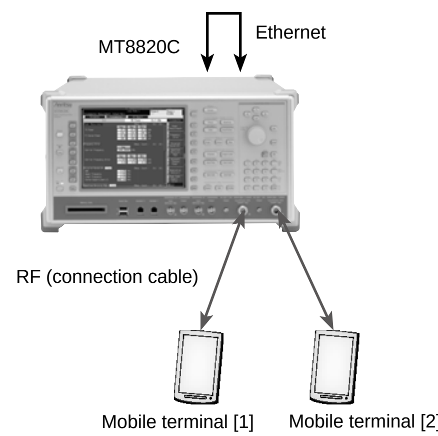
∗ Audio Transmitter and Receiver Measurement supports W-CDMA, GSM, and TD-SCDMA.
Audio Transmitter and Receiver Measurement does not support CDMA2000 1X.

Video Phone Test

End-to-end video communication between two W-CDMA/TD-SCDMA terminals supporting a video phone can be tested via the Ethernet port in the rear panel of the MT8820C. End-to-end video communication can be tested with two MT8820C units or a single MT8820C configured with Parallelphone Measurement.



Sample MT8820C connection: when MT8820C is two sets



Sample MT8820C connection: when MT8820C is one set (Parallelphone measurement correspondence)

∗ Requires MX882050C-003 or MX882007C-003

CDMA2000 1X/1xEV-DO Synchronous Function

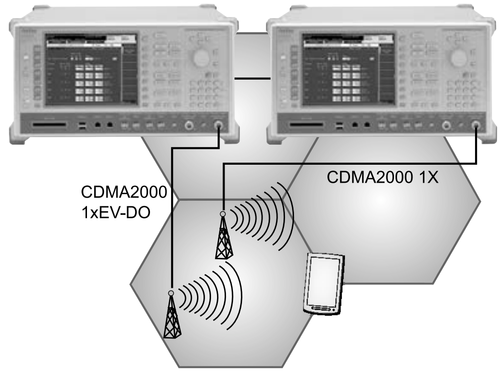
• CDMA2000 1X/1xEV-DO Hybrid Terminal Function Tests

By using the MX882002C and MX882006C with two MT8820C units or one MT8820C unit with the Parallelphone*1 measurement option, the CDMA2000 1X and 1xEV-DO (Rev. 0) forward link signals can be output with synchronized system times, supporting function tests of terminals for both CDMA2000 1X and 1xEV-DO (Rev. 0) systems*2, *3.

*1: Parallelphone is the registered trademark of Anritsu Corporation

*2: This function cannot be used when the MX882000C W-CDMA Measurement Software or MX882007C TD-SCDMA Measurement Software is loaded. Please perform unload, when MX882000C or MX882007C is loaded.

*3: Installing the MX882002C, MX882006C, and MX882006C-011 option supports the UE-connection test with ETAP only.

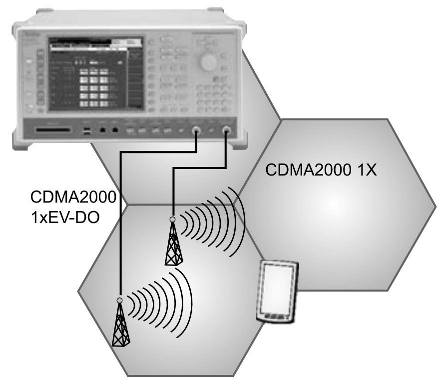


Sample MT8820C connection: when MT8820C is two sets

GPIB Control

• Batch Readout Command for Measured Results

All results obtained by batch measurement can be read out with the single command: "ALLMEAS?". If required, only desired measurement results can be read out using a command such as "ALLMEAS? MOD" (modulation analysis).
The reduced number of GPIB commands cuts the overhead of both the MT8820C and control PC, increasing measurement throughput. Moreover, since the control program step size is also reduced, easy-to-read control programs with high maintainability are easily created.



Sample MT8820C connection: when MT8820C is one set (Parallelphone measurement correspondence)

Specifications

*Typical values are only for reference and are not guaranteed specifications.

• MT8820C Radio Communication Analyzer

General	Frequency range: 30 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Max. input level: +35 dBm (Main) Main I/O Impedance: 50 Ω, VSWR: ≤1.2 (<1.6 GHz), ≤1.25 (1.6 GHz to 2.2 GHz), ≤1.3 (>2.2 GHz), Connector: N type AUX output Impedance: 50 Ω, VSWR: ≤1.3 (at SG Output level: ≤–10 dBm), Connector: SMA type Reference oscillator Frequency: 10 MHz Level: TTL Startup characteristics: ≤±5 × 10^{-8} (at 10 min. after startup referenced to frequency 24 h after startup) Aging rate: ≤±2 × 10^{-8}/day, ≤±1 × 10^{-7}/year (referenced to frequency 24 h after startup) Temperature characteristics: ≤±5 × 10^{-8} Connector: BNC type External reference input Frequency: 10 MHz or 13 MHz (±1 ppm) Level: ≥0 dBm Impedance: 50 Ω, Connector: BNC type
RF Signal Generator	Frequency Frequency range: 30 MHz to 2.7 GHz (Setting range: 0.4 MHz to 2.7 GHz) 3.4 GHz to 3.8 GHz (with MT8820C-018) Setting resolution: 1 Hz Accuracy: Due to reference oscillator accuracy Output level Level range: –140 to –10 dBm (Main), –130 to 0 dBm (AUX) Resolution: 0.1 dB Accuracy Main: ±1.0 dB, ±0.7 dB typ. (Output frequency: ≥50 MHz), ±1.5 dB (Output frequency: <50 MHz) (–120 to –10 dBm, after calibration, at 10° to 40°C) AUX: ±1.0 dB, ±0.7 dB typ. (Output frequency: ≥50 MHz), ±1.5 dB (Output frequency: <50 MHz) (–110 to 0 dBm, after calibration, at 10° to 40°C) Signal purity Non-harmonic spurious: ≤–40 dBc (Offset frequency: ≥100 kHz), Harmonics: ≤–25 dBc

Continued on next page

Others	Display Color 8.4-inch TFT LCD, 640 × 480 dots External control GPIB: Control from external host with main unit as device (excluding some functions such as power-on), no external device control Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2 Ethernet (100BASE-TX/10BASE-T): Controlled by an external controller, assuming the MT8820C as a device (except some functions such as power switch etc.). No controller function
Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) (–15/+10%, 250 V max.), 47.5 Hz to 63 Hz, ≤750 VA (with all Options)
Dimensions and Mass	426 (W) × 221.5 (H) × 498 (D) mm (excluding projections), ≤30 kg (with all Options)
Environmental Conditions	Operating temperature and humidity: 0° to +50°C, ≤95% (no condensation) Storage temperature and humidity: –20° to +60°C, ≤95% (no condensation) EMC: EN61326-1, EN61000-3-2 LVD: EN61010-1

• MT8820C-001 W-CDMA Measurement Hardware, MX882000C W-CDMA Measurement Software, MX88205xC W-CDMA Call Processing Software

Modulation Analysis	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +35 dBm (Main) Carrier frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy (residual vector error): ≤2.5% (at input of single DPCCH and single DPDCH)
RF Power	Frequency range: 300 MHz to 2.7 GHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration, at 10° to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm) Measurement object: DPCH, PRACH
Occupied Bandwidth	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +35 dBm (Main)
Adjacent Channel Leakage Power	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +35 dBm (Main) Measurement range: ≥50 dB (at ±5 MHz), ≥55 dB (at ±10 MHz)
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Channel level CPICH, P-CCPCH, SCH, PICH, DPCH, S-CCPCH, AICH: Off, –30 to 0 dB [0.1 dB step, relative level for Ior (total level)] OCNS: Off, Auto-setting Channel level accuracy: ±0.2 dB (relative level accuracy for Ior) AWGN level: Off, –20 to +5 dB [0.1 dB step, relative level for Ior (total level)] AWGN level accuracy: ±0.2 dB (relative level accuracy for Ior)
Error Rate Measurement	Measurement items: BER, BLER Measurement object: Loopback data imposed on DTCH (BER, BLER), serial data input from rear panel call processing I/O port (BER)
Call Processing	Call control: Registration, Origination, Termination, Handover, Network disconnect, Terminal disconnect (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) Mobile terminal control: Output level, Loopback (executes each terminal control conforming to 3GPP standards)

• MX882000C-011 HSDPA Measurement Software

RF Power	Frequency range: 300 MHz to 2.7 GHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration, at 10° to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm) Measurement object: DPCH, HS-DPCCH
Throughput Measurement	Functions: Transmit HS-SCCH, HS-PDSCH based on Fixed Reference Channel Measurement items: BLER, Throughput Measurement object: ACK and NACK data imposed on HS-DPCCH
CQI Measurement	Functions: Statistical analysis of CQI values reported from a mobile terminal
Call Processing	Call control: Registration, Connection based on Fixed Reference Channel (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) Mobile terminal control: Output level (executes each terminal control conforming to 3GPP standards)

• MX882000C-013 HSDPA High Data Rate

Throughput Measurement	Functions: Transmit HS-SCCH, HS-PDSCH based on Fixed Reference Channel (H-Set 6) Transmit HS-SCCH, HS-PDSCH based on HSDPA full rate for Category 6, 8, 9, and 10 Measurement items: BLER, Throughput Measurement object: ACK and NACK data imposed on HS-DPCCH
Call Processing	Call control: Registration, Fixed Reference Channel (H-Set 6), Connection based on HSDPA full rate for Category 6, 8, 9, and 10 (executes each processing conforming to 3GPP standards and performs pass/fail evaluation)

• MX882000C-021 HSUPA Measurement Software

RF Power	Frequency range: 300 MHz to 2.7 GHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration, at 10° to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm) Measurement object: DPCH, HS-DPCCH, E-DPCCH, E-DPDCH
Call Processing	Call control: Registration, Connection for E-DCH RF Test (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) Mobile terminal control: Output level (executes each terminal control conforming to 3GPP standards)

• MX882000C-031 HSPA Evolution Measurement Software

Throughput Measurement	Functions: Transmit HS-SCCH, HS-PDSCH based on Fixed Reference Channel (H-Set 8) Transmit HS-SCCH, HS-PDSCH based on HSDPA full rate for Category 13 and 14 Measurement items: BLER, Throughput Measurement object: ACK and NACK data imposed on HS-DPCCH
Call Processing	Call control: Fixed Reference Channel (H-Set 8) HSDPA Full Rate (Category 13 and Category 14) and E-DCH RF Test (executes operation conforming to 3GPP standards and performs Pass/Fail evaluation)

• MX882000C-032 DC-HSDPA Measurement Software

Throughput Measurement	Functions: Transmit HS-SCCH and HS-PDSCH based on Fixed Reference Channel Measurement items: BLER, Throughput Measurement object: ACK and NACK applied to HS-DPCCH
CQI Measurement	Measurement object: Periodic CQI reports over HS-DPCCH
Call Processing	Call control: Fixed Reference Channel (H-Set 1A, H-Set 3A, H-Set 6A, H-Set 8A, H-Set 12) and at Full Rate from Category 22 and Category 24 HSDPA mobile terminals (executes operation conforming to 3GPP standards and performs Pass/Fail evaluation)

• MT8820C-011 Audio Board, MX882000C-001 W-CDMA Voice Codec

Voice Codec	AMR 12.2 kbps
Codec Level Adjustment	Encoder input gain: –3 to +3 dB, 0.01 dB step Handset microphone volume: 0, 1, 2, 3, 4, 5 Handset speaker volume: 0, 1, 2, 3, 4, 5
AF Output	Frequency range: 30 Hz to 10 kHz, 1 Hz step Frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 0.1 Hz) Level setting range: 0 to 5 Vpeak (AF output) Level setting resolution: 1 mV (≤5 Vpeak), 100 µV (≤500 mVpeak), 10 µV (≤50 mVpeak) Level accuracy: ±0.2 dB (≥10 mVpeak, ≥50 Hz), ±0.3 dB (≥10 mVpeak, <50 Hz) Waveform distortion ≤30 kHz bandwidth: ≤–60 dB (≥500 mVpeak, ≤5 kHz), ≤–54 dB (≥70 mVpeak) Output impedance: ≤1Ω Max. Output current: 100 mA
AF Input	Frequency range: 50 Hz to 10 kHz Frequency accuracy: ± (Reference oscillator accuracy + 0.5 Hz) Level range: 1 mVpeak to 5 Vpeak (AF input) Max. allowable Input level: 30 Vrms Level accuracy: ±0.2 dB (≥10 mVpeak, ≥50 Hz), ±0.4 dB (≥1 mVpeak, ≥1 kHz) SINAD measurement at 1 kHz: ≥60 dB (≥1000 mVpeak), ≥54 dB (>50 mVpeak), ≥46 dB (≥10 mVpeak) Distortion rate measurement at 1 kHz: ≤–60 dB (≥1000 mVpeak), ≤–54 dB (>50 mVpeak), ≤–46 dB (≥10 mVpeak) Input impedance: 100 kΩ
Frequency Measurement	Accuracy: ± (Reference oscillator accuracy + 0.5 Hz)
Level Measurement	Accuracy: ±0.2 dB (≥10 mVpeak, ≥50 Hz), ±0.4 dB (≥1 mVpeak, ≥1 kHz)
SINAD Measurement	Frequency: 1 kHz in ≤30 kHz band ≥60 dB (≥1000 mVpeak), ≥54 dB (>50 mVpeak), ≥46 dB (≥10 mVpeak)
Distortion Rate Measurement	Frequency: 1 kHz in ≤30 kHz band ≤–60 dB (≥1000 mVpeak), ≤–54 dB (>50 mVpeak), ≤–46 dB (≥10 mVpeak)

• MT8820C-002 TDMA Measurement Hardware, MX882001C GSM Measurement Software

Modulation Analysis	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst, RACH Carrier frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 10 Hz), Normal burst measurement ± (Setting frequency × Reference oscillator accuracy + 20 Hz), RACH measurement Residual phase error: ≤0.5° rms, ≤2° peak
RF Power	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst, RACH Measurement accuracy: ±0.3 dB (typ.), ±0.5 dB (–20 to +40 dBm), ±0.7 dB (–30 to –20 dBm) *After calibration, at 10° to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–30 dBm) Carrier-off power: ≥65 dB (≥–10 dBm), ≥45 dB (–30 to –10 dBm) Burst waveform display: Rise, Fall, Time slot, Burst-on
Output RF Spectrum	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst Measurement range in modulation area: ≤–55 dB (≤250 kHz offset), ≤–66 dB (≥400 kHz offset) Measurement range in transient area: ≤–57 dB (≥400 kHz offset) Measurement points: ±100, ±200, ±250, ±400, ±600, ±800, ±1000, ±1200, ±1400, ±1600, ±1800, ±2000 kHz
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Phase error: ≤1° rms, ≤4° peak Output patterns: CCH, TCH, CCH+TCH TCH data: PN9, PN15, All 0, All 1, fixed pattern (PAT 0 - PAT 9)
Error Rate Measurement	Functions: frame, bit, and CRC error measurement Measurement object: Loopback date imposed on uplink TCH Serial data input from rear panel call processing I/O port Number of blocks received from terminal imposed on uplink TCH for GPRS Number of USF blocks received from terminal for GPRS

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Call Processing	Call control GSM: Registration, Origination, Termination, Network disconnect, Terminal disconnect GPRS: Connection, Disconnection, Data transfer Mobile terminal control GSM: Output level, Time slot, Timing advance, Loopback On/Off GPRS: Test Mode A, Test Mode B, BLER Channel coding: FS, EFS, HS0, HS1, AFS, AHS0, AHS1 Coding scheme: CS-1, CS-2, CS-3, CS-4 Frequency bands: GSM450, GSM480, GSM710, GSM750, T-GSM810, GSM850, P-GSM, E-GSM, R-GSM, DCS1800, PCS1900

• MX882001C-011 EGPRS Measurement Software

Modulation Analysis	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst (GMSK, 8PSK), RACH Carrier frequency accuracy: ± (Setting frequency x Reference oscillator accuracy + 10 Hz), Normal burst measurement ± (Setting frequency x Reference oscillator accuracy + 20 Hz), RACH measurement Residual phase error (GMSK) : ≤0.5° rms, ≤2° peak Residual EVM (8PSK): ≤1.5% rms
RF Power	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst (GMSK, 8PSK), RACH Measurement accuracy: ±0.3 dB (typ.), ±0.5 dB (–20 to +40 dBm), ±0.7 dB (–30 to –20 dBm) *After calibration, at 10° to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–30 dBm) Carrier-off power: ≥65 dB (≥–10 dBm), ≥45 dB (–30 to –10 dBm) Burst waveform display: Rise, Fall, Time slot, Burst-on
Output RF Spectrum	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst (GMSK, 8PSK) Measurement range in modulation area: ≤–55 dB (≤250 kHz offset), ≤–66 dB (≥400 kHz offset) Measurement range in transient area: ≤–57 dB (≥400 kHz offset) Measurement points: ±100, ±200, ±250, ±400, ±600, ±800, ±1000, ±1200, ±1400, ±1600, ±1800, ±2000 kHz
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Phase error (GMSK): ≤1° rms, ≤4° peak Modulation accuracy (8PSK): ≤3% rms Output patterns: CCH, TCH, CCH+TCH TCH data: PN9, PN15, All 0, All 1, Fixed pattern (PAT 0 - PAT 9)
Error Rate Measurement	Functions: bit, and CRC error measurement Measurement object: Loopback date imposed on uplink TCH (GMSK, 8PSK) Number of blocks received from terminal imposed on uplink TCH for EGPRS Number of USF blocks received from terminal for EGPRS
Call Processing	Call control: Registration, Connection, Disconnection, Data transfer Mobile terminal control: Output level, Time slot, Timing advance, Test Mode A, BLER, SRB Loopback Coding scheme: MCS-1 to MCS-4 (GMSK), MCS-5 to MCS-9 (8PSK) Puncturing scheme: P1, P2, P3 Frequency bands: GSM450, GSM480, GSM710, GSM750, T-GSM810, GSM850, P-GSM, E-GSM, R-GSM, DCS1800, PCS1900

• MT8820C-011 Audio Board, MX882001C-001 GSM Voice Codec

Voice Codec	GSM_EFR, GSM_AMR
Codec Level Adjustment	Encoder input gain: –3 to +3 dB, 0.01 dB step Handset microphone volume: 0, 1, 2, 3, 4, 5 Handset speaker volume: 0, 1, 2, 3, 4, 5
AF Output	Frequency range: 30 Hz to 10 kHz Frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 0.1 Hz) Level setting range: 0 to 5 Vpeak (AF output) Level setting resolution: 1 mV (≤5 Vpeak), 100 µV (≤500 mVpeak), 10 µV (≤50 mVpeak) Level accuracy: ±0.2 dB (≥10 mVpeak, ≥50 Hz), ±0.3 dB (≥10 mVpeak, <50 Hz) Waveform distortion ≤30 kHz bandwidth: ≤–60 dB (≥500 mVpeak, ≤5 kHz), ≤–54 dB (≥70 mVpeak) Output impedance: ≤1Ω Max. output current: 100 mA
AF Input	Frequency range: 50 Hz to 10 kHz Frequency accuracy: ± (Reference oscillator accuracy + 0.5 Hz) Level range: 1 mVpeak to 5 Vpeak (AF input) Max. allowable Input level: 30 Vrms Level accuracy: ±0.2 dB (≥10 mVpeak, ≥50 Hz), ±0.4 dB (≥1 mVpeak, ≥1 kHz) SINAD measurement at 1 kHz: ≥60 dB (≥1000 mVpeak), ≥54 dB (>50 mVpeak), ≥46 dB (≥10 mVpeak) Distortion rate measurement at 1 kHz: ≤–60 dB (≥1000 mVpeak), ≤–54 dB (>50 mVpeak), ≤–46 dB (≥10 mVpeak) Input impedance: 100 kΩ

• MT8820C-003 CDMA2000 Measurement Hardware, MX882002C CDMA2000 Measurement Software

The function for outputting and measuring the AF signal can be used when installing the MT8820C Option 11 Audio Board.

Modulation Analysis	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +35 dBm (Main) Carrier frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy Residual waveform quality: >0.999
RF Power	Frequency range: 300 MHz to 2.7 GHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration, at 10° to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm) (Filtered Power measurement, Input Level setting for reference)
Occupied Bandwidth	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +35 dBm (Main)
Code Domain Power Measurement	At Reverse RC3, RC4 Input level: –30 to +35 dBm (Main) Measurement accuracy: ±0.2 dB (Code power ≥–15 dBc), ±0.4 dB (Code power ≥–23 dBc)
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Channel level [Relative level for Ior (total level)] Pilot Channel: Off, –30 to 0 dB, 0.25 dB step FCH, SCH, DCCH: Off, –30 to 0 dB, 0.1 dB step SYNCH, PCH: Off, –30 to 0 dB, 0.25 dB step OCNS: Off, Auto-setting (0.01 dB step) [Relative level for Pilot Channel] QPCH: Off, –5 to +2 dB, 1 dB step Channel level accuracy: ±0.2 dB (typ., ≥–20 dB) PN offset: 0 to 511 Waveform quality: >0.99 (Pilot only, AWGN Off) AWGN level: Off, –40 to +12 dB (relative level for CDMA signal) Max. Output level at AWGN ON: –28 dBm (MAIN Output), –18 dBm (AUX Output)
Error Rate Measurement	Functions: FER measurement with Service Option 2, 9, 55, and 32 (TDSO) Display items: FER, Confidence level, Sample frame count, Error frame count
Call Processing	Band Class: BC 0 to 12, 14, 15, 18, 19, 20 Call control: Registration, Origination, Termination, Network disconnect, Terminal disconnect Radio Configuration: F-RC1+R-RC1, F-RC2+R-RC2, F-RC3+R-RC3, F-RC4+R-RC3, F-RC5+R-RC4 Service Option: SO1, 2, 3, 9, 32, 33, 55, 32768 PCH Data Rate: Full QPCH Data Rate: Full Fwd. FCH Data Rate: Full, Half, Quarter, Eighth (RC1 to 5) Fwd. FCH Walsh Code: 10, 14, 26, 30, 42, 46, 58, 62 Fwd. DCCH Data Rate: Full (RC3 to 5) Fwd. DCCH Walsh Code: 10, 14, 26, 30, 42, 46, 58, 62 Fwd. SCH: Max. 1 channel Fwd. SCH Data Rate RC3: 9.6, 19.2, 38.4, 76.8, 153.6 kbps RC4: 9.6, 19.2, 38.4, 76.8, 153.6 kbps RC5: 14.4, 28.8, 57.6, 115.2, 230.4 kbps Access Probe: Access Channel Rev. Closed Loop Power Control modes: Closed Loop, Alternate, All 0 (All up), All 1 (All down) Protocols: IS-95B, J-STD-008C, ARIB T-53, Korean PCS, IS-2000 (SR1) Handoff: Universal Handoff, Band Class/Channel Handoff, Protocol Revision Handoff, RC/SO Handoff
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Channel level Pilot Channel: –30 to 0 dB, 0.25 dB step or Off SYNCH, PCH: –30 to 0 dB, 0.25 dB step or Off QPCH (Relative leve to Pilot Channel): –5 to +2 dB, 1 dB step or Off FCH, DCCH, SCH: –30 to 0 dB, 0.1 dB step or Off OCNS: Auto (0.1 dB step) or Off Channel level accuracy: <±0.2 dB typ. (≥–20 dB) PN offset: 0 to 511 can be set. Waveform quality: >0.99 (Pilot only, AWGN Off) AWGN level: Off, –40 to +12 dB (relative level for CDMA signal) Max. Output level at AWGN ON: –28 dBm (MAIN Output), –18 dBm (AUX Output)
AF Output	Frequency range: 30 Hz to 10 kHz Set Resolution: 1 Hz Frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 0.1 Hz) Level setting range: 0 to 5 Vpeak (AF output) Level setting resolution: 1 mV (≤5 Vpeak), 100 µV (≤500 mVpeak), 10 µV (≤50 mVpeak) Level accuracy: ±0.2 dB (≥10 mVpeak, ≥50 Hz), ±0.3 dB (≥10 mVpeak, <50 Hz) Waveform distortion: ≤30 kHz bandwidth ≤–60 dB (≥500 mVpeak, ≤5 kHz), ≤–54 dB (≥70 mVpeak) Output impedance: ≤1Ω Max. Output current: 100 mA
AF Input	Frequency range: 50 Hz to 10 kHz Level range: 1 mVpeak to 5 Vpeak (AF input) Max. allowable Input level: 30 Vrms Frequency accuracy: ± (Reference oscillator accuracy + 0.5 Hz) Level accuracy: ±0.2 dB (≥10 mVpeak), ±0.4 dB (≥1 mVpeak, ≥1 kHz) SINAD measurement at 1 kHz: ≥60 dB (≥1000 mVpeak), ≥54 dB (>50 mVpeak), ≥46 dB (≥10 mVpeak) Distortion rate measurement at 1 kHz: ≤–60 dB (≥1000 mVpeak), ≤–54 dB (>50 mVpeak), ≤–46 dB (≥10 mVpeak) Input impedance: 100 kΩ

• MT8820C-005 1xEV-DO Measurement Hardware, MX882006C 1xEV-DO Measurement Software

Modulation Analysis	Measurement level range: –30 to +35 dBm Carrier frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy Residual waveform quality: >0.999
RF Power	Dependent on the performance of MX882002C
Occupied Bandwidth	Dependent on the performance of MX882002C
Code Domain Power Measurement	Input level: –30 to +35 dBm (Main) Measurement accuracy: ±0.2 dB (code power ≥–15 dBc), ±0.4 dB (code power ≥–23 dBc)
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Channel level [Relative level for Ior (total level)] Pilot Channel, MAC channel, Control channel, Traffic channel: 0 dB PN offset: 0 to 511 Waveform quality: >0.99 (Pilot only, AWGN Off) AWGN level: Off, –40 to +12 dB (relative level for CDMA signal) Max. Output level at AWGN ON: –28 dBm (MAIN Output), –18 dBm (AUX Output)
Error Rate Measurement	Functions: PER measurement with FTAP Display items: PER, Confidence level, Sample packet count, Error packet count
Call Processing	Band class: BC 0 to 12, 14, 15, 18, 19, 20 Call control: Close Session, Open Session, AT Origination, AT Release, NW Origination, NW Release, Hard Handoff, Softer Handoff Rev. Closed Loop Power Control modes: Closed Loop, Alternate, All 0 (All up), All 1 (All down) Test application protocol: RTAP, FTAP, FTAP+RTAP

• MX882006C-011 1xEV-DO Rev. A Measurement Software

Modulation Analysis	Dependent on the performance of MX882006C
RF Power	Dependent on the performance of MX882006C
Occupied Bandwidth	Dependent on the performance of MX882006C
Code Domain Power Measurement	Dependent on the performance of MX882006C
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Channel: 0 dB for Pilot, MAC, Control and Traffic channels (Ior reference) PN offset: 0 to 511 can be set. Waveform quality: >0.99 (Pilot only, AWGN Off) AWGN level: Off, –40 to +12 dB (relative level for CDMA signal) Max. Output level at AWGN ON: –28 dBm (MAIN Output), –18 dBm (AUX Output)
Error Rate Measurement	Functions: PER Measurement with FETAP Display items: PER, Confidence Level, Sample packet count, Error packet count
Call Processing	Band class: BC 0 to 12, 14, 15, 18, 19, 20 Call control: Close Session, Open Session, AT Origination, AT Release, NW Origination, NW Release, Hard Handoff, Softer Handoff Rev. Closed Loop Power Control modes: Closed Loop, Alternate, All 0 (All up), All 1 (All down) Physical Layer Protocol: Subtype 2 Enhanced Test Application Protocol: RETAP, FETAP, FETAP+RETAP

• MT8820C-011 Audio Board, MX882002C-001 CDMA2000 Voice Codec

Voice Codec	EVRC (SO3)
Codec Level Adjustment	Encoder input gain: –3 to +3 dB, 0.01 dB step Handset microphone volume: 0, 1, 2, 3, 4, 5 Handset speaker volume: 0, 1, 2, 3, 4, 5

∗: Audio Transmitter and Receiver Measurement does not support MX882002C-001

• MT8820C-002 TDMA Measurement Hardware, MX882005C PHS Measurement Software

Modulation Analysis	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +40 dBm (Main) (Measurement object: PS-TCH, PS-SYNC, CS-TCH, CS-SYNC) –30 to +35 dBm (Main) (Measurement object: Continuous wave) Carrier frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy: ± (indicated value of 2% + 0.7%) rms Origin offset: ±0.5 dB to single level of –30 dBc Transmission rate: ±1 ppm (Measurement range: 384 kbps ±100 ppm)
RF Power	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +40 dBm (Main) (Measurement object: PS-TCH, PS-SYNC, CS-TCH, CS-SYNC) –30 to +35 dBm (Main) (Measurement object: Continuous wave) Measurement accuracy: ±0.5 dB (–20 to +40 dBm), ±0.7 dB (–30 to –20 dBm) ∗After calibration, at 10° to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–30 dBm) Carrier-off power measurement: ≥55 dB (≥–10 dBm) ≥ (RF power [dBm] + 70) dB (Wide dynamic range power measurement)
Occupied Bandwidth	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +40 dBm (Main) (Measurement object: PS-TCH, PS-SYNC, CS-TCH, CS-SYNC) –10 to +35 dBm (Main) (Measurement object: Continuous wave)
Adjacent Channel Leakage Power	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +40 dBm (Main) (Measurement object: PS-TCH, PS-SYNC, CS-TCH, CS-SYNC) –10 to +35 dBm (Main) (Measurement object: Continuous wave) Measurement range: ≤–60 dB at ±600 kHz, ≤–65 dB at ±900 kHz

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RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Modulation accuracy: ≤3% rms Modulation data Output continuous wave: PN9, PN15, 4 bits data Output burst wave: PS-TCH, CS-TCH (PN9, PN15 are selectable as communication data) PS-SYNC, CS-SYNC (output synchronized burst wave)
Error Rate Measurement	Function: BER measurement Measurement object: serial data input from rear panel call processing I/O port
Call Processing	Call control: Registration, Origination, Termination, Communication, Network disconnect, Terminal disconnect, Handover

• MX882005C-011 Advanced PHS Measurement Software

Measuring Object	Same performance as MX882005C PHS Measurement Software Measurement objects are as follows: Measurement object: PS-TCH (π/4 DQPSK, π/2 DBPSK, 8PSK, 16QAM) PS-SYNC (π/4 DQPSK, π/2 DBPSK) PS-SCCH (π/2 DBPSK) CS-TCH (π/4 DQPSK, π/2 DBPSK, 8PSK, 16QAM) CS-SYNC (π/4 DQPSK, π/2 DBPSK) (For modulation measurement, guaranteed only when no bias in symbol point, when measurement object modulation type is 16QAM)
Call Processing	Call control: Registration, Origination, Termination, Communication, Network disconnect, Terminal disconnect, Handover (in π/4 DQPSK, π/2 DBPSK)

• MT8820C-001 W-CDMA Measurement Hardware, MT8820C-007 TD-SCDMA Measurement Hardware, MX882007C TD-SCDMA Measurement Software

Modulation Analysis	Frequency range: 300 MHz to 2.7 GHz Input level: –30 to +35 dBm (Main) Carrier frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy (residual vector error): ≤2.5% (at single code input)
RF Power	Frequency range: 300 MHz to 2.7 GHz Input level: –70 to +35 dBm (Main) Measurement accuracy: ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–70 to –55 dBm) *After calibration, at 10° to 40°C Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm) Measurement object: DPCH, UpPCH
Occupied Bandwidth	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +35 dBm (Main)
Adjacent Channel Leakage Power	Frequency range: 300 MHz to 2.7 GHz Input level: –10 to +35 dBm (Main) Measurement range: ≥50 dB at ±1.6 MHz, ≥55 dB at ±3.2 MHz
RF Signal Generator	Output frequency range: 300 MHz to 2.7 GHz, 1 Hz step Channel level DPCH: –30 to 0 dB [0.1 dB step, Relative level for Ior (total level)] Channel level accuracy: ±0.2 dB (Relative level accuracy for Ior) AWGN level: Off, –20 to +5 dB [0.1 dB step, Relative level for Ior (total level)] AWGN level accuracy: ±0.2 dB (Relative level accuracy for Ior)
Error Rate Measurement	Measurement items: BER, BLER Measurement object: Loopback data imposed on DTCH (PN9, PN15)
Call Processing	Call control: Registration, Origination, Termination, Network disconnect, Terminal disconnect (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) Mobile terminal control: Output level, Loopback (executes each terminal control conforming to 3GPP standards)

• MX882007C-011 TD-SCDMA HSDPA Measurement Software

Throughput Measurement	Functions: Throughput measurement using RMC Reference channel: RMC 0.5 Mbps UE Class (QPSK), RMC 1.1 Mbps UE Class (QPSK), RMC 1.1 Mbps UE Class (16QAM) RMC 1.6 Mbps UE Class (QPSK), RMC 1.6 Mbps UE Class (16QAM) RMC 2.2 Mbps UE Class (QPSK), RMC 2.2 Mbps UE Class (16QAM) RMC 2.8 Mbps UE Class (QPSK), RMC 2.8 Mbps UE Class (16QAM) Measurement object: ACK and NACK data imposed on HS-SICH
CQI Measurement	Functions: Statistical analysis of CQI values reported from a mobile terminal on HS-SICH
Call Processing	Call control: Registration, Connection based on RMC (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) Mobile terminal control: Output level (executes each terminal control conforming to 3GPP standards)

• MX882007C-021 TD-SCDMA HSUPA Measurement Software

Modulation Analysis	Dependent on the performance of MX882007C (when HSUPA RMC Code is input)
Call Processing	Origination control: Registration, call processing for FRC1, FRC2 (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) Mobile terminal control: Output level (executes each terminal control conforming to 3GPP standards)

• MT8820C-011 Audio Board, MX882007C-001 TD-SCDMA Voice Codec

Voice Codec	AMR 12.2 kbps
Codec Level Adjustment	Encoder input gain: –3 to +3 dB, 0.01 dB step Handset microphone volume: 0, 1, 2, 3, 4, 5 Handset speaker volume: 0, 1, 2, 3, 4, 5
AF Output	Frequency range: 30 Hz to 10 kHz Frequency accuracy: ± (Setting frequency × Reference oscillator accuracy + 0.1 Hz) Level setting range: 0 to 5 Vpeak (AF output) Level setting resolution: 1 mV (≤5 Vpeak), 100 µV (≤500 mVpeak), 10 µV (≤50 mVpeak) Level accuracy: ±0.2 dB (≥10 mVpeak, ≥50 Hz), ±0.3 dB (≥10 mVpeak, <50 Hz) Waveform distortion ≤30 kHz bandwidth: ≤–60 dB (≥500 mVpeak, ≤5 kHz), ≤–54 dB (≥70 mVpeak) Output impedance: ≤1Ω Max. Output current: 100 mA
AF Input	Frequency range: 50 Hz to 10 kHz Frequency accuracy: ± (Reference oscillator accuracy + 0.5 Hz) Level range: 1 mVpeak to 5 Vpeak (AF input) Max. allowable Input level: 30 Vrms Level accuracy: ±0.2 dB (≥10 mVpeak, ≥50 Hz), ±0.4 dB (≥1 mVpeak, ≥1 kHz) SINAD measurement at 1 kHz: ≥60 dB (≥1000 mVpeak), ≥54 dB (>50 mVpeak), ≥46 dB (≥10 mVpeak) Distortion rate measurement at 1 kHz: ≤–60 dB (≥1000 mVpeak), ≤–54 dB (>50 mVpeak), ≤–46 dB (≥10 mVpeak) Input impedance: 100 kΩ

• MT8820C-008 LTE Measurement Hardware, MX882012C LTE FDD Measurement Software/MX882013C LTE TDD Measurement Software

Modulation Analysis	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –40 to +35 dBm (Main1) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy (residual vector error): ≤2.5% (400 MHz to 2.7 GHz) (3.4 GHz to 3.8 GHz, 18° to 28°C) (Measurement count: 20) ≤3.0% (3.4 GHz to 3.8 GHz, Measurement count: 20) In-Band Emissions: ≤–40 dB (≥–10 dBm, Allocated RB≤18) Measurement object: PUSCH, PRACH, PUCCH
RF Power	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –60 to +35 dBm (Main1) Measurement accuracy: 400 MHz to 2.7 GHz, After calibration, 10° to 40°C ±0.5 dB, ±0.3 dB (typ.)(–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm) 3.4 GHz to 3.8 GHz, After calibration, 10° to 40°C ±0.5 dB, ±0.3 dB (typ.)(–20 to +35 dBm, 18° to 28°C), ±0.7 dB (–50 to +35 dBm), ±0.9 dB (–60 to –50 dBm) Linearity: 400 MHz to 2.7 GHz, After calibration, 10° to 40°C ±0.2 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm) 3.4 GHz to 3.8 GHz, After calibration, 10° to 40°C ±0.2 dB (–40 to 0 dB, ≥–50 dBm, 18° to 28°C), ±0.3 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm) Relative measurement error: <2 dB ±0.10 dB (typ., –40 to 0 dB, ≥–50 dBm) Measurement object: PUSCH, PRACH, PUCCH
Occupied Bandwidth	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –10 to +35 dBm (Main1)
Adjustment Channel Leakage Power Ratio	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –10 to +35 dBm (Main1) Measurement point: E-UTRA ACLR1, UTRA ACLR1, UTRA ACLR2 Measurement range: ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2)
Spectrum Emission Mask	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –10 to +35 dBm (Main1)
RF Signal Generator	Output frequency: 400 MHz to 2.7 GHz (1 Hz steps) 3.4 GHz to 3.8 GHz (with MT8820C-018) AWGN level: Off, –20 to +5 dB [0.1 dB steps, Relative level between Ior (Total power) and AWGN] AWGN level accuracy: ±0.2 dB (Relative level between Ior AWGN)
Throughput Measurement	Function: Throughput measurement according to Reference Measurement Channel (RMC) Measurement object: ACK and NACK data imposed on uplink from terminal
Call Processing	Call controlling: Registration, Call processing for Reference Measurement Channel (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) Mobile terminal controlling: Output level (executes each mobile terminal control conforming to 3GPP standards)

• MX882042C LTE FDD Measurement Software Lite/MX882043C LTE TDD Measurement Software Lite

Modulation Analysis	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –40 to +35 dBm (Main1) Carrier frequency accuracy: ± (Set frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy (residual vector error): ≤2.5% (400 MHz to 2.7 GHz) (3.4 GHz to 3.8 GHz, 18° to 28°C) (Measurement count: 20) ≤3.0% (3.4 GHz to 3.8 GHz, Measurement count: 20) In-Band Emissions: ≤–40 dB (≥–10 dBm, Allocated RB≤18) Measurement object: PUSCH
RF Power	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –60 to +35 dBm (Main1) Measurement accuracy: 400 MHz to 2.7 GHz, After calibration, 10° to 40°C ±0.5 dB, ±0.3 dB (typ.)(–20 to +35 dBm), ±0.7 dB (–50 to –20 dBm), ±0.9 dB (–60 to –50 dBm) 3.4 GHz to 3.8 GHz, After calibration, 10° to 40°C ±0.5 dB, ±0.3 dB (typ.)(–20 to +35 dBm, 18° to 28°C), ±0.7 dB (–50 to +35 dBm), ±0.9 dB (–60 to –50 dBm) Linearity: 400 MHz to 2.7 GHz, After calibration, 10° to 40°C ±0.2 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm) 3.4 GHz to 3.8 GHz, After calibration, 10° to 40°C ±0.2 dB (–40 to 0 dB, ≥–50 dBm, 18° to 28°C), ±0.3 dB (–40 to 0 dB, ≥–50 dBm), ±0.4 dB (–40 to 0 dB, ≥–60 dBm) Relative measurement error: Less than 2 dB ±0.10 dB (typ., –40 to 0 dB, ≥–50 dBm) Measurement object: PUSCH
Occupied Bandwidth	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –10 to +35 dBm (Main1)
Adjustment Channel Leakage Power Ratio	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –10 to +35 dBm (Main1) Measurement point: E-UTRA ACLR1, UTRA ACLR1, UTRA ACLR2 Measurement range: ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2)
Spectrum Emission Mask	Frequency: 400 MHz to 2.7 GHz 3.4 GHz to 3.8 GHz (with MT8820C-018) Input level: –10 to +35 dBm (Main1)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MT8820C	Radio Communication Analyzer
	Standard accessories
	Power Cord: 1 pc
	CF Card: 1 pc
	PC Card Adapter (For CF card): 1 pc
W3320AE	MT8820C Operation Manual (CD-ROM): 1 pc
	Options
MT8820C-017	Extended RF Hardware*1
MT8820C-001	W-CDMA Measurement Hardware
MT8820C-002	TDMA Measurement Hardware
MT8820C-003	CDMA2000 Measurement Hardware
MT8820C-005	1xEV-DO Measurement Hardware*2
MT8820C-007	TD-SCDMA Measurement Hardware
MT8820C-008	LTE Measurement Hardware
MT8820C-011	Audio Board
MT8820C-012	Parallel Phone Measurement Hardware
MT8820C-018	Extended RF 3.4 GHz to 3.8 GHz (requires MT8820C-017, MT8820C-119, or MT8820C-120)
MT8820C-043	CDMA2000 Time Offset CAL for GPS SG (requires MT8820C-003 and MX882002C)
MT8820C-101	W-CDMA Measurement Hardware Retrofit
MT8820C-102	TDMA Measurement Hardware Retrofit
MT8820C-103	CDMA2000 Measurement Hardware Retrofit
MT8820C-105	1xEV-DO Measurement Hardware Retrofit*2
MT8820C-107	TD-SCDMA Measurement Hardware Retrofit
MT8820C-108	LTE Measurement Hardware Retrofit
MT8820C-111	Audio Board Retrofit
MT8820C-112	Parallel Phone Measurement Hardware Retrofit
MT8820C-119	Extended RF Hardware for SPM Retrofit
MT8820C-120	Extended RF Hardware for PPM Retrofit
MT8820C-143	CDMA2000 Time Offset CAL for GPS SG Retrofit (requires MT8820C-003 and MX882002C)
MT8820C-177	TD-SCDMA Measurement Retrofit (requires MT8820C-001)

Model/Order No.	Name
	Software options
MX882000C	W-CDMA Measurement Software (requires MT8820C-001 and MX88205xC)
MX882000C-001	W-CDMA Voice Codec (requires MT8820C-011 and MX882000C)
MX882000C-011	HSDPA Measurement Software (requires MT8820C-001, MX882000C, and MX882050C)
MX882000C-013	HSDPA High Data Rate (requires MT8820C-001, MX882000C, MX882000C-011, and MX882050C)
MX882000C-021	HSUPA Measurement Software (requires MT8820C-001, MX882000C, MX882000C-011, and MX882050C)
MX882000C-031	HSPA Evolution Measurement Software*3 (requires MT8820C-001, MX882000C, MX882000C-011, MX882000C-021, and MX882050C)
MX882000C-032	DC-HSDPA Measurement Software*3, *4 (requires MT8820C-001 (2 sets), MT8820C-012, MX882000C, MX882000C-011, MX882000C-021, MX882000C-031, MX882010C, and MX882050C)
MX882001C	GSM Measurement Software (requires MT8820C-002)
MX882001C-001	GSM Voice Codec (requires MT8820C-011 and MX882001C)
MX882001C-002	GSM External Packet Data (requires MX882001C)
MX882001C-011	EGPRS Measurement Software (requires MX882001C)
MX882001C-041	GSM High-speed Adjustment (requires MX882001C)
MX882002C	CDMA2000 Measurement Software (requires MT8820C-003)
MX882002C-001	CDMA2000 Voice Codec (requires MT8820C-011 and MX882002C)
MX882002C-002	CDMA2000 External Packet Data (requires MX882002C)
MX882005C	PHS Measurement Software (requires MT8820C-002)
MX882005C-011	Advanced PHS Measurement Software (requires MX882005C)

Continued on next page

Model/Order No.	Name
MX882006C	1xEV-DO Measurement Software (requires MT8820C-003, MT8820C-005, and MX882002C)
MX882006C-002	1xEV-DO External Packet Data (requires MX882006C)
MX882006C-011	1xEV-DO Rev. A Measurement Software (requires MX882006C)
MX882007C	TD-SCDMA Measurement Software (requires MT8820C-001 and MT8820C-007)
MX882007C-001	TD-SCDMA Voice Codec (requires MT8820C-011 and MX882007C)
MX882007C-003	TD-SCDMA Video Phone Test (requires MX882007C)
MX882007C-011	TD-SCDMA HSDPA Measurement Software[*3] (requires MT8820C-001, MT8820C-007, and MX882007C)
MX882007C-021	TD-SCDMA HSUPA Measurement Software[*3] (requires MT8820C-001, MT8820C-007, MX882007C, MX882007C-011)
MX882010C	Parallel Phone Measurement Software[*5] [requires MT8820C-012, the two same measurement hardware (2 board/set) and one measurement software]
MX882012C	LTE FDD Measurement Software[*3] (requires MT8820C-008)
MX882012C-006	LTE FDD IP Data Transfer[*3] (requires MX882012C)
MX882012C-011	LTE FDD 2×2 MIMO DL[*3, *6] (requires MT8820C-012 and MX882012C)
MX882012C-016	LTE FDD CS Fallback to W-CDMA/GSM[*7] (requires MX882012C)
MX882012C-017	LTE FDD CS Fallback to CDMA2000[*7] (requires MX882012C)
MX882013C	LTE TDD Measurement Software[*3] (requires MT8820C-008)
MX882013C-006	LTE TDD IP Data Transfer[*3] (requires MX882013C)
MX882013C-011	LTE TDD 2×2 MIMO DL[*3, *6] (requires MT8820C-012 and MX882013C)
MX882042C	LTE FDD Measurement Software Lite[*3]
MX882043C	LTE TDD Measurement Software Lite[*3]
MX882050C	W-CDMA Call Processing Software[*3, *8] (requires MX882000C)
MX882050C-002	W-CDMA External Packet Data[*3] (requires MX882050C)
MX882050C-003	W-CDMA Video Phone Test[*3] (requires MX882050C)
MX882050C-007	W-CDMA Band XII, XIII, XIV, XIX, XX, XXI[*3, *9] (requires MX882050C)
MX882050C-008	W-CDMA Band XI[*3] (requires MX882050C)
MX882050C-009	W-CDMA Band IX[*3] (requires MX882050C)
MX882050C-011	HSDPA External Packet Data[*3] (requires MX882000C-011)
MX882051C	W-CDMA Call Processing Software[*3, *8] (requires MX882000C)
MX882051C-002	W-CDMA External Packet Data[*3] (requires MX882051C)
MX882051C-003	W-CDMA Video Phone Test[*3] (requires MX882051C)
MX882070C	W-CDMA Ciphering Software[*3] (requires MX882050C)
MX882071C	W-CDMA Ciphering Software[*3] (requires MX882051C)
	Warranty
MT8820C-ES210	2 years Extended Warranty Service
MT8820C-ES310	3 years Extended Warranty Service
MT8820C-ES510	5 years Extended Warranty Service
	Application parts
P0019	Test USIM 001[*10]
P0035B	W-CDMA/GSM Test USIM
P0035B7	W-CDMA/GSM Test USIM[*11]
A0058A	Handset
J1195A	PP2S Output Cable
J1249	CDMA2000 Cable [D-Sub (15 pin, P-type) · D-Sub (15 pin, P-type), used in combination with J1267 (sold separately)]
J1267	CDMA2000 Cross Cable [D-Sub (9 pin, P-type) · D-Sub (9 pin, P-type), reverse cable used in combination with J1249 (sold separately)]
J0576B	Coaxial Cord, 1 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG58A/U · BNC-P)
J0007	408JE-104 GPIB Cable (1 m)
J0008	GPIB Cable (2 m)
MN8110B	I/O Adapter (for call processing I/O)
B0332	Joint Plate (4 pcs/set)
B0643A	Rack Mount Kit (MT8820C)
B0499	Carrying Case (Hard type) (with protective cover and casters)
B0499B	Carrying Case (Hard type) (with protective cover, without casters)

*1: MT8820C-017 has been a standard option that MT8820C are shipped with until July 2012 (Simultaneous order is required MT8820C and MT8820C-017).
*2: The MT8820C-005 hardware supports both IS-856-0 (1xEV-DO Rev. 0) and IS-856-A (1xEV-DO Rev. A) RF measurements.
*3: For terminal connectivity, contact your Anritsu sales representative.
*4: MX882000C-032 is required a Parallelphone measurement configuration of W-CDMA HSPA Evolution.
For use MT8820C 2units, contact your Anritsu sales representative.
*5: The following measurement hardware supports the Parallelphone measurement option: MT8820C-001, MT8820C-002, MT8820C-003, MT8820C-005, MT8820C-007, MT8820C-008.
All the measurement hardware can be installed simultaneously.
*6: MX882012C-011 is required MT8820C-012.
*7: The MX882012C-016 (017) LTE FDD CS Fallback to W-CDMA/GSM (CDMA2000) requires a separate MT8820C with the W-CDMA/GSM (CDMA2000) configuration. Contact our sales representative for the CS Fallback function test configuration.
*8: These options preinstall the integrity protection function.
*9: MX882050C-007 supports W-CDMA Band 12, 13, 14, 19, 20, 21.
*10: This Test USIM can be worked on only W-CDMA mode.
When the connection of GSM or TD-SCDMA is necessary, P0035B can be applied.
*11: The P0035B7 MicroSIM is a cut-down P0035B W-CDMA/GSM Test USIM. The P0035B7 Test USIM is a microSIM. It CANNOT be used in a normal size USIM card slot. A commercial SIM adapter CANNOT be used with the P0035B7. If used, it may jam and break in the terminal.

- Parallelphone™ is a registered trademark of Anritsu Corporation.
- CF® card is a registered trademark of SanDisk Corporation in the United States and is licensed to CFA (Compact Flash Association).

UNIVERSAL WIRELESS TEST SET

MT8870A

10 MHz to 3.8 GHz, 10 MHz to 6 GHz (Option)

Remote Control
GPIB | **Ethernet**

For Production Lines of Smartphone and Communications Module

Excellent Eco Product

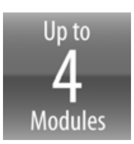
NEW

CE

The remarkable success of smartphones and tablets is driving demand for faster inspection speeds on smartphone and communication module production lines and this market trend is expected to continue. Coupled with this, wireless communication standards are continuing to evolve and develop, leading to a growing range of specifications. In these circumstances, terminal and module makers are looking to increase line efficiency while assuring smooth and flexible support for the various new standards. With support for up to four test modules, the MT8870A Universal Wireless Test Set is the ideal cost-effective solution for high-efficiency inspection lines.

Four High-performance Modules in One Chassis

To enhance efficiency and reduce initial costs, up to four TRX modules can installed in each MT8870A. This modular system brings with it the flexibility to adapt to changes in volume and to shifts and developments in wireless standards.

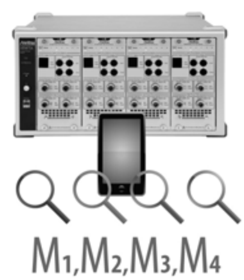


Up to four modules can be installed in one chassis

- **Simultaneous Measurement of Multiple Communication Standards**

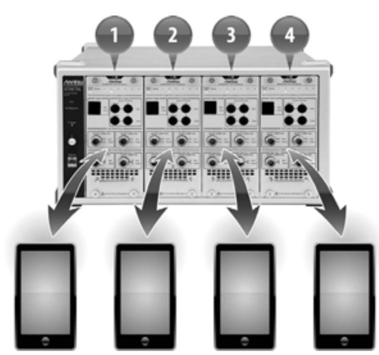
Smartphones and tablets with various wireless chipsets and antennas can all be tested with one MT8870A Universal Wireless Test Set.
Because each installed module can be controlled independently, multiple wireless tests can be run simultaneously.

Four standards can be measured at once using four modules in one chassis



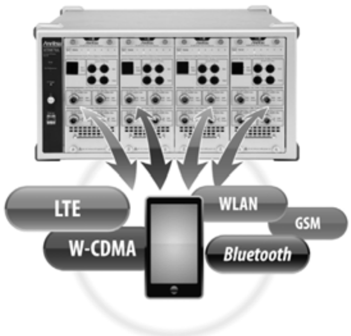
- **Simultaneous Control of Four Modules**

Installing four independent modules in the MT8870A Universal Wireless Test Set supports simultaneous measurement of four separate wireless devices. A unique IP address can be allocated to each slot and each module supports remote control by Ethernet or optional GPIB connections.



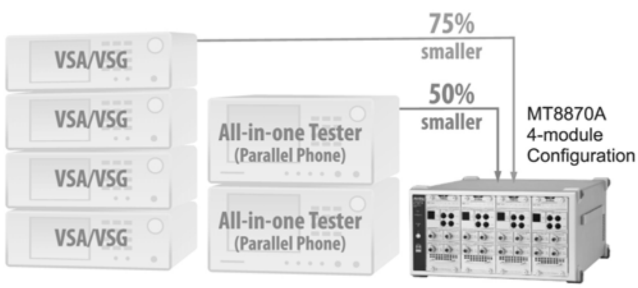
- **Four Simultaneous Measurements**

Today's smartphones and tablets often support multiple wireless chipsets that all need to be tested and approved in the shortest possible time. Configuring an MT8870A with four modules enables simultaneous testing of all wireless standards and greatly increases throughput efficiency.



- **50% to 75% Smaller Instrument Footprint**

Instead of four separate test stations each requiring setup, the all-in-one, high-performance MT8870A main frame with up to four test modules saves both production line space and setup time.



Compared to conventional Anritsu products	All-in-one Tester (Parallel Phone)	VSA/VSG
MT8870A 4-module Configuration	50% smaller	75% smaller

- **40%* Reduction in Infrastructure Costs with Four Installed Modules**

With four TRX modules in one MT8870A main frame, the shared components cut capital costs by about 40%.

*: Typical 4-module configuration compared to single module design

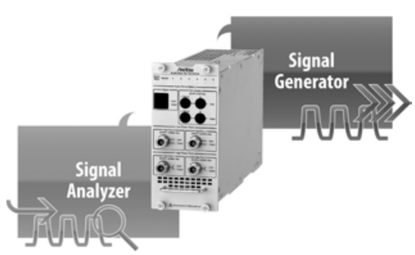
High Performance Module with Flexibility and Expandability

- **Future-proof Inspection Lines**

Mobile terminal manufacturers require not only production line efficiency but also the flexibility to adapt to changes in wireless standards. The MT8870A is the ideal instrument to meet these needs.

- **Built-in Signal Generator and Signal Analyzer in Each Module**

The MU887000A TRX Test Module has been developed for communication terminal device inspection lines. Each installed module has an independent high-performance signal generator and signal analyzer.

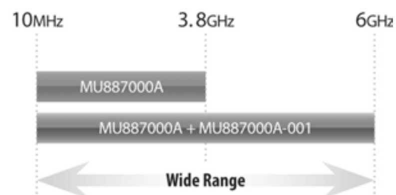


- **160 MHz Wide Bandwidth**

To support the WLAN 802.11ac and (extended) LTE-Advanced wireless standards requiring bandwidths of 100 MHz or more, the MU887000A incorporates a signal generator and signal analyzer with a bandwidth of 160 MHz.

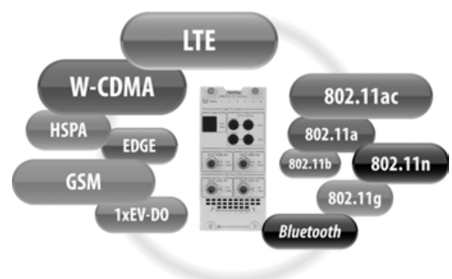
- **Wide Frequency Range from 10 MHz to 6 GHz (option)**

The MU887000A signal generator and signal analyzer cover a frequency range from 10 MHz to 3.8 GHz (extended to 6 GHz as option), assuring flexible support for new wireless standards.



- **Each Module Supports Multiple Wireless Standards**

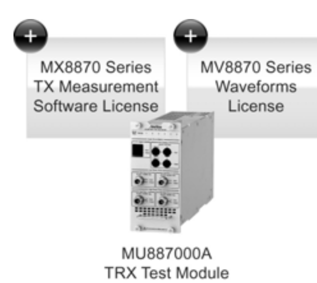
One MU887000A TRX Test Module supports multiple wireless communication standards.



Wireless Standards	Specifications
W-CDMA/HSDPA	3GPP TS 34.121-1
GSM/EDGE	3GPP TS 51.010-1
LTE	3GPP TS 36.521-1
CDMA2000	3GPP2 TSG-C.S0011-C
1xEV-DO	3GPP2 TSG-C.S0033-B
WLAN	IEEE 802.11a/b/g/n/ac
Bluetooth	Basic Rate/EDR/*Bluetooth* Low Energy

- **Each standard is Supported Easily Using a Cost-effective Licensing Scheme**

Licenses are obtained by adding TX measurement software packages and waveform files.

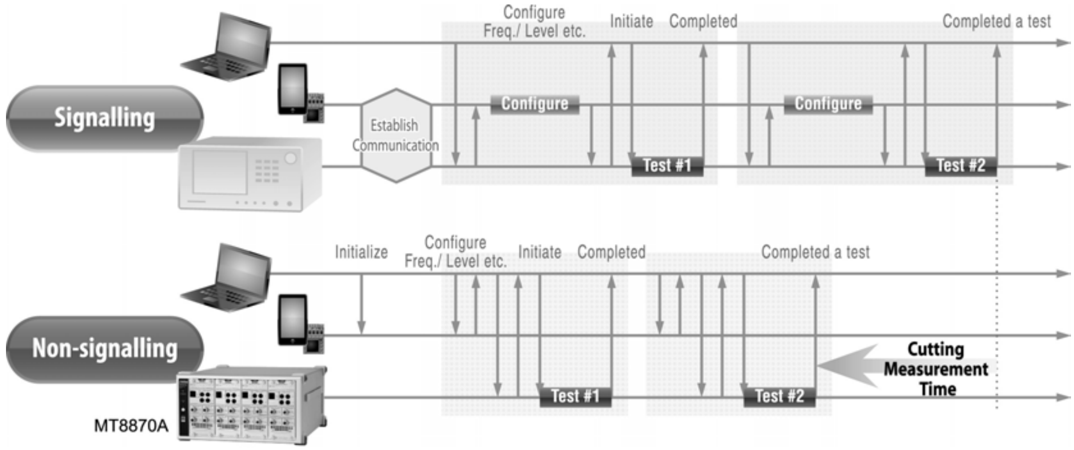


Integration with Leading-edge High-speed Measurement Methods

Times for manufacturing and testing mobile terminals have been slashed using leading-edge hardware architecture and parallel measurement technology. Additionally, multiple items for batch measurement processing can be freely selected for any number of repeat measurements. Batch measurement of selected items greatly simplifies and speeds up key tests.

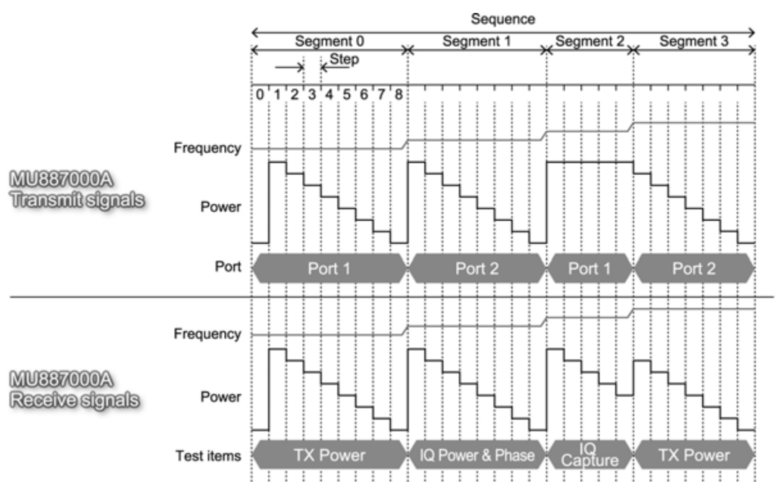
• Non-signalling Measurement Support

The MT8870A performs measurements in a non-signalling environment. As shown in the figure below, alleviating the need to establish direct communication with the DUT brings considerable savings in both time and manufacturing costs.



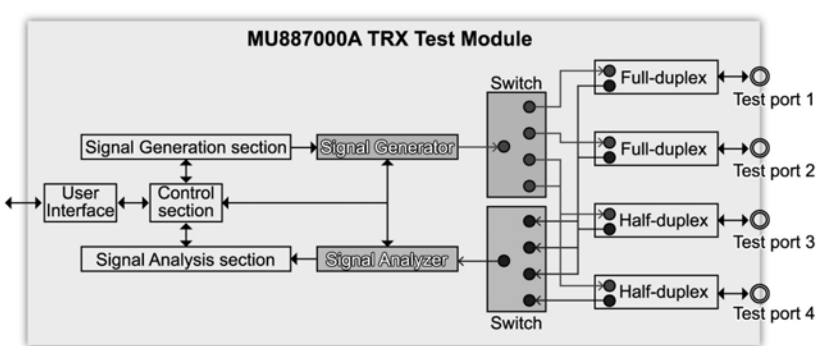
• Sequence Measurement (Mobile Communication Terminals)

- For mobile terminals supporting sequence measurements (list mode), TRX tests are performed in accordance with a sequence table (list) where measurement conditions are recorded while changing the test conditions.
- Since each measurement is executed at high speed in accordance with a predetermined sequence without using remote control commands, line tact times are greatly reduced, increasing line throughput and efficiency.



Four Test Ports per Module

Each MU887000A TRX Test Module has two duplex and two half-duplex RF connectors.
The duplex ports (Test port 1 and 2) incorporate dividers at the front end to support simultaneous tests in both TX and RX directions when testing typical wireless standards.
The half-duplex ports (Test port 3 and 4) incorporate switches at the front end to switch between each test port when used either for TX or RX tests. These half-duplex ports have higher sensitivity than the full-duplex ports and are ideal for low-level wireless signals.



The four test ports can be used for level calibration because they have high level accuracy over a wide frequency range from 10 MHz to 6 GHz (option). Internal switches can switch the TRX ports between input and output. Normally, simultaneous coupling measurements of multiple antennas require troublesome calibration corrections when using the required external dividers and external switches. With four test ports each incorporating the internal switch level deviation, the MU887000A modules supports high level accuracy measurements over a wide frequency range.

Ease of Configuration

Line capacity can change from week to week or month to month, depending on customers' needs and the specifications of the device under test. The number of MU887000A modules installed*1 in the MT8870A Universal Wireless Test Set can be tailored to meet changes in line test stations and items, keeping the line efficiency high without needing major configuration changes to the line and stations.

*1: Modules cannot be hot-swapped with the power on.

One License for All Modules

• Versatile Software Licenses

TX and RX measurement capabilities are enabled through licenses that can be purchased as required. Each license enables the associated capabilities on all installed modules and represents excellent value for money in comparison to traditional, non-modular test systems.

• Software for MU887000A TRX Test Module

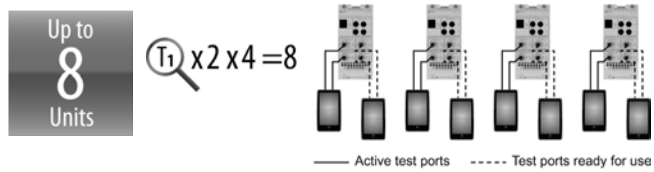
MX887x Series Measurement Software

Model	Description
MX887010A	Cellular Standards Sequence Measurement
MX887011A	W-CDMA/HSPA Uplink TX Measurement
MX887012A	GSM/EDGE Uplink TX Measurement
MX887013A	LTE FDD Uplink TX Measurement
MX887015A	CDMA2000 Reverse Link TX Measurement
MX887016A	1xEV-DO Reverse Link TX Measurement
MX887030A	WLAN 802.11b/g/a/n TX Measurement
MX887031A	WLAN 802.11ac TX Measurement
MX887040A	*Bluetooth* TX Measurement
MX887050A	Short Range Wireless Average Power and Frequency Measurement

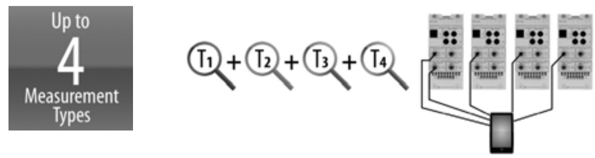
MV887x Series Waveforms

Model	Description
MV887011A	W-CDMA/HSPA Downlink Waveforms
MV887012A	GSM/EDGE Downlink Waveforms
MV887013A	LTE FDD Downlink Waveforms
MV887015A	CDMA2000 Forward Link Waveforms
MV887016A	1xEV-DO Forward Link Waveforms
MV887030A	WLAN 802.11b/g/a/n Waveforms
MV887031A	WLAN 802.11ac Waveforms
MV887040A	*Bluetooth* Waveforms

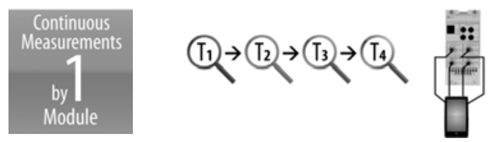
Cellular Technology Measurement Solution



Simultaneous 8 Units Connection: Since LTE mobiles have RX diversity antenna, both TRX and RX diversity antennas must be adjusted and tested. The MU887000A TRX Test Module supports four ports in one module for connecting two LTE terminals. Up to four modules can be installed in one MT8870A Universal Wireless Test Set, supporting connection of up to eight LTE terminals and simultaneous testing up to four terminals.



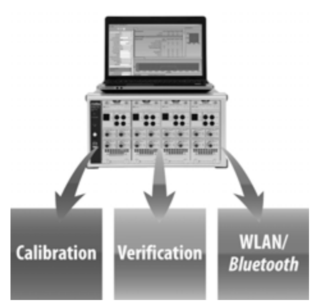
Four Simultaneous Measurements: Recent smartphones support various wireless interfaces, such as *Bluetooth* and WLAN, in addition to cellular. Test times are cut by testing multiple wireless standards simultaneously.



Continuous Measurements of Multiple Communications Standards: Licensing the TX measurement software packages and waveforms support continuous multiple measurements with one MU887000A TRX Test Module.

• Supports Flexible Line Changes

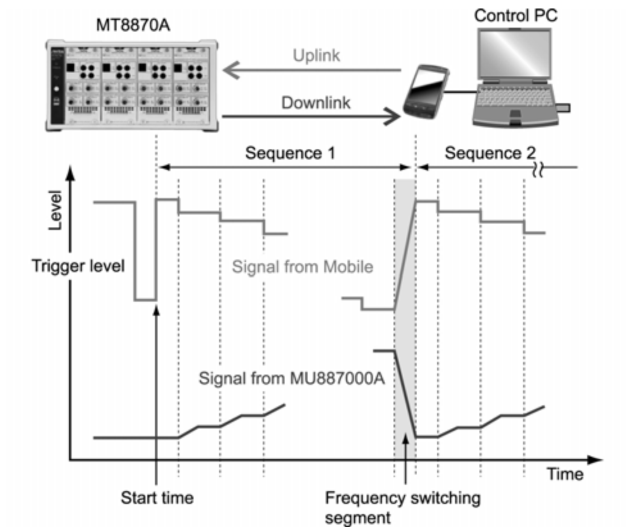
Generally, mobile terminal production lines are divided into different processing stages such as calibration, inspection, and function testing. Using different equipment at each stage causes problems, such as different test times, as well as the need to provide spare capacity to cover any faults at each process. Since the MT8870A Universal Wireless Test Set has high versatility due to its modular configuration, it minimizes the need for spare capacity when reconfiguring the production line, etc.



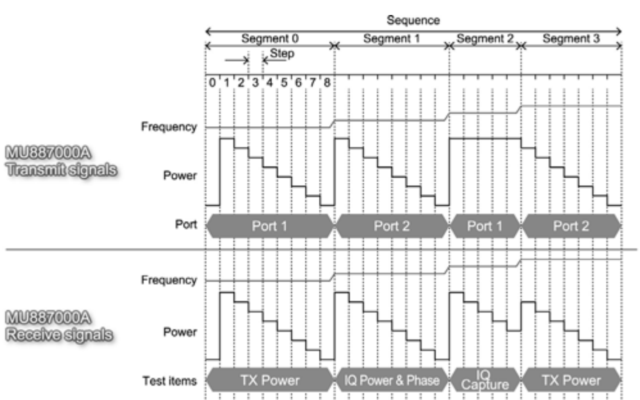
• MX887010A Cellular Standards Sequence Measurement

Installing the MX887010A Cellular Standards Sequence Measurement software package in the MT8870A Universal Wireless Test Set can be operated with preconfigured frequency and level in a sequence list to the signal generator and signal analyzer.
This software is able to greatly reduce calibration and verification time in conjunction with a chipset that supports capability for high-speed calibration and sequence measurement.

∗1: Sequence measurement requires MX88701xA TX Measurement software
∗2: Requires MV88701xA Waveforms for downlink signal modulation waveforms



TRX vs. Frequency Measurement



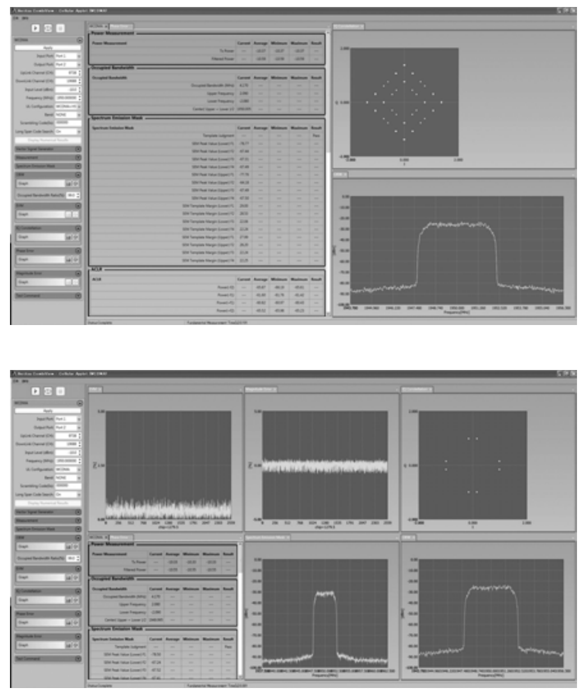
Sequence Measurement

• MX887011A W-CDMA/HSPA Uplink TX Measurement
MV887011A W-CDMA/HSPA Downlink Waveforms

Installing the MX887011A W-CDMA/HSPA Uplink TX Measurement software in the MT8870A provides support for the following 3GPP W-CDMA and HSPA related TX characteristics measurements.

- TX Power
- Frequency Error
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Additionally, the package of MV887011A W-CDMA/HSPA Downlink Waveforms contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.



W-CDMA/HSPA Uplink TX Measurement using CombiView

• **MX887012A GSM/EDGE Uplink TX Measurement**
MV887012A GSM/EDGE Downlink Waveforms

Installing the MX887012A GSM/EDGE Uplink TX Measurement software in the MT8870A provides support for the following 3GPP GSM and EDGE related TX characteristics measurements.

TX Power
Power vs. Time
TX Frequency
Phase Error
EVM
Origin Offset
Output RF Spectrum

Additionally, the package of MV887012A GSM/EDGE Downlink Waveforms contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.

• **MX887013A LTE FDD Uplink TX Measurement**
MV887013A LTE FDD Downlink Waveforms

Installing the MX887013A LTE FDD Uplink TX Measurement software in the MT8870A provides support for the following 3GPP LTE FDD related TX characteristics measurements.

TX Power
Frequency Error
Occupied Bandwidth
Spectrum Mask
Adjacent Channel Leakage Power
Modulation Analysis

Additionally, the package of MV887013A LTE FDD Downlink Waveforms contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.

• **MX887015A CDMA2000 Reverse Link TX Measurement**
MV887015A CDMA2000 Forward Link Waveforms

Installing the MX887015A CDMA2000 Reverse Link TX Measurement software in the MT8870A provides support for the following 3GPP2 CDMA2000 related TX characteristics measurements.

TX Power
Modulation Analysis
Occupied Bandwidth
Code Domain Power
Spurious Emissions

Additionally, the package of MV887015A CDMA2000 Forward Link Waveforms contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.

• **MX887016A 1xEV-DO Reverse Link TX Measurement**
MV887016A 1xEV-DO Forward Link Waveforms

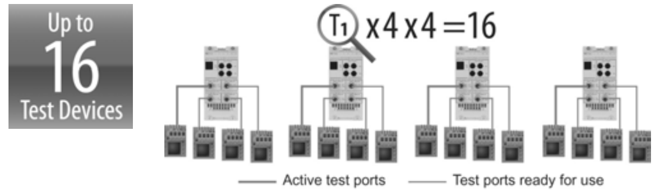
Installing the MX887016A 1xEV-DO Reverse Link TX Measurement software in the MT8870A provides support for the following 3GPP2 CDMA2000 1xEV-DO related TX characteristics measurements.

TX Power
Modulation Analysis
Occupied Bandwidth
Code Domain Power
Spurious Emissions

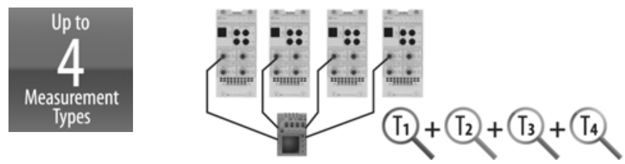
Additionally, the package of MV887016A 1xEV-DO Forward Link Waveforms contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.

WLAN and *Bluetooth* Measurement Solution

• **Flexible Test System Configuration**



16 Simultaneous Connections: Each MU887000A TRX Test Module has four test ports. Up to four test modules can be installed in one MT8870A Universal Wireless Test Set, supporting simultaneous connection of 16 test devices. This versatility eliminates the need for external combiners and also reduces test fixture calibration.



Four simultaneous measurements: Simultaneous testing reduces test times and allows devices to be tested in a realistic multi-wireless environment.

- **MX887030A WLAN 802.11b/g/a/n TX Measurement**
  MV887030A WLAN 802.11b/g/a/n Waveforms

The MT8870A Universal Wireless Test Set/MU887000A TRX Test Module supports non-signalling transmitter and receiver tests for all WLAN 802.11b/g/a/n-compliant devices.
The MU887000A-001 6 GHz Frequency Extension Option is required to measure 802.11a/n in 5 GHz band.

• Transmitter Test

Installing the MX887030A WLAN 802.11b/g/a/n TX Measurement Software in the MT8870A Universal Wireless Test Set provides support for measurement of key IEEE 802.11 2007 and IEEE 802.11n-2009 Tx characteristics using all installed TRX test modules.

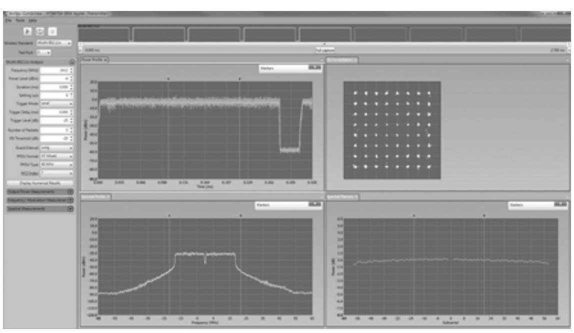
Supported 802.11b TX Measurement

802.11b	Measurement
IEEE 802.11-2007 (18.4.7.1)	Transmit Power Levels
IEEE 802.11-2007 (18.4.7.2)	Transmit Power Level Control
IEEE 802.11-2007 (18.4.7.3)	Transmit Spectrum Mask
IEEE 802.11-2007 (18.4.7.4)	Transmit Center Frequency Tolerance
IEEE 802.11-2007 (18.4.7.5)	Chip Clock Frequency Tolerance
IEEE 802.11-2007 (18.4.7.6)	Transmit Power-on and Power-down Ramp
IEEE 802.11-2007 (18.4.7.7)	RF Carrier Suppression
IEEE 802.11-2007 (18.4.7.8)	Transmit Modulation Accuracy

Supported 802.11a/g/n TX Measurement

802.11a	802.11g	802.11n	Measurement
IEEE 802.11-2007 (17.3.9.1)	IEEE 802.11-2007 (19.4.7.1)	IEEE 802.11n-2009 (20.3.21.3)	Transmit Power Levels
IEEE 802.11-2007 (17.3.9.2)	IEEE 802.11-2007 (19.5.4)	IEEE 802.11n-2009 (20.3.21.1)	Transmit Spectrum Mask
IEEE 802.11-2007 (17.3.9.4)	IEEE 802.11-2007 (19.4.7.2)	IEEE 802.11n-2009 (20.3.21.4)	Transmit Center Frequency Tolerance
IEEE 802.11-2007 (17.3.9.5)	IEEE 802.11-2007 (19.4.7.3)	IEEE 802.11n-2009 (20.3.21.6)	Symbol Clock Frequency Tolerance
IEEE 802.11-2007 (17.3.9.6.1)	IEEE 802.11-2007 (19.4.7) (17.3.9.6.1)	IEEE 802.11n-2009 (20.3.21.7.2)	Transmitter Center Frequency Leakage
IEEE 802.11-2007 (17.3.9.6.2)	IEEE 802.11-2007 (19.4.7) (17.3.9.6.2)	IEEE 802.11n-2009 (20.3.21.2)	Transmitter Spectral Flatness
IEEE 802.11-2007 (17.3.9.6.3) (17.3.9.7)	IEEE 802.11-2007 (19.7.2.7)	IEEE 802.11n-2009 (20.3.21.7.3) (20.3.21.7.4)	Transmitter Modulation Accuracy

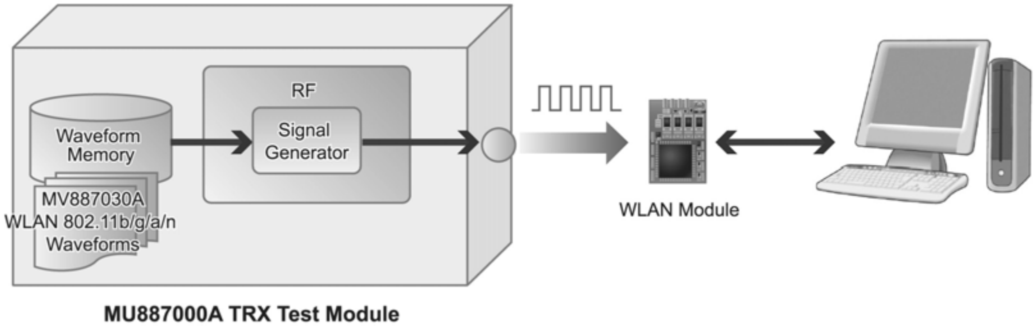
The CombiView software that ships with the MT8870A displays measurement results graphically. Multiple displays can be defined and all numeric results can be displayed in one window.



802.11n TX Measurement using CombiView

• Receiver Test

The MV887030A application provides support for transmission of WLAN 802.11b/g/a/n signals from the vector signal generator to the device under test. The number of received packets can then be read using the chipset vendor's control software.



Waveform Parameter

802.11 Standard	Data Rate/Modulation	Bandwidth	Packet Length	Remarks
802.11b	11, 5.5, 2, 1 Mbps	–	1024 or 100 bytes	Long Preamble
802.11a/g	54, 48, 36, 24, 18, 12, 9 and 6 Mbps	–	1000 or 100 bytes	
802.11n	MCS 0 to 7 and 32	20 MHz and 40 MHz	4096 or 500 bytes	Nss: 1, Guard Interval: Long

Supported 802.11b RX Measurement

802.11b	Measurement
IEEE 802.11-2007 (18.4.8.1)	Receiver Minimum Input Level Sensitivity
IEEE 802.11-2007 (18.4.8.2)	Receiver Maximum Input Level
IEEE 802.11-2007 (18.4.8.3)	Receiver Adjacent Channel Rejection*1

Supported 802.11a/g/n RX Measurement

802.11a	802.11g	802.11n	Measurement
IEEE 802.11-2007 (17.3.10.1)	IEEE 802.11-2007 (19.5.1)	IEEE 802.11n-2009 (20.3.22.1)	Receiver Minimum Input Level Sensitivity
IEEE 802.11-2007 (17.3.10.2)	IEEE 802.11-2007 (19.5.2)	IEEE 802.11n-2009 (20.3.22.2)	Adjacent Channel Rejection*1
IEEE 802.11-2007 (17.3.10.3)		IEEE 802.11n-2009 (20.3.22.3)	Non-adjacent Channel Rejection*1
IEEE 802.11-2007 (17.3.10.4)	IEEE 802.11-2007 (19.5.3)	IEEE 802.11n-2009 (20.3.22.4)	Receiver Maximum Input Level

*1: Requires separate signal generator

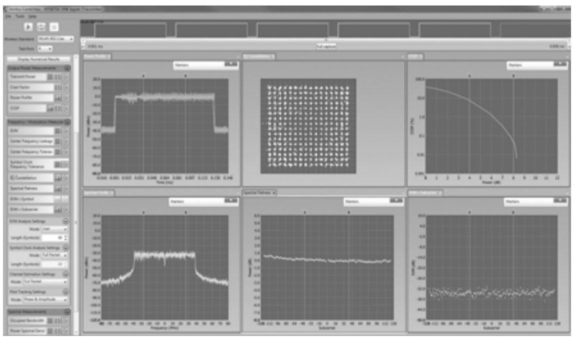
• MX887031A WLAN 802.11ac TX Measurement
MV887031A WLAN 802.11ac Waveforms

The MT8870A Universal Wireless Test Set/MU887000A TRX Test Module (with MU887000A-001 6 GHz Frequency Extension) supports non-signalling transmitter and receiver tests for all WLAN 802.11ac-compliant devices.

• Transmitter Test

Installing the MX887031A WLAN 802.11ac TX Measurement Software in the MT8870A Universal Wireless Test Set supports in-band wireless measurements defined by the latest IEEE P802.11ac/D3.0 standard (June 2012 provisional version) on all installed TRX test modules.
The 802.11ac 20/40/80/160 MHz bandwidths and 256QAM (MCS9) modulation method are supported.

Using the CombiView PC application bundle displays graphs of 802.11ac TX measurements.



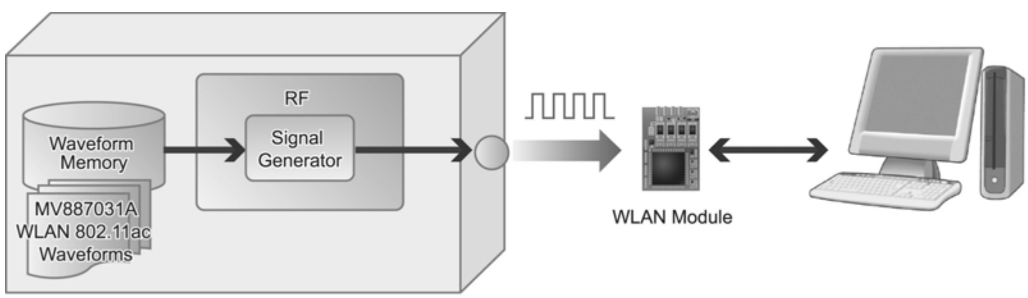
802.11ac TX Measurement using CombiView

Supported 802.11ac TX Measurement

IEEE	Measurement
IEEE P802.11ac/D3.0, June 2012 (22.3.18.1)	Transmit Spectrum Mask
IEEE P802.11ac/D3.0, June 2012 (22.3.18.2)	Spectral Flatness
IEEE P802.11ac/D3.0, June 2012 (22.3.18.3)	Transmit Center Frequency Tolerance
IEEE P802.11ac/D3.0, June 2012 (22.3.18.4)	Symbol Clock Frequency Tolerance
IEEE P802.11ac/D3.0, June 2012 (22.3.18.5)	Modulation Accuracy
IEEE P802.11ac/D3.0, June 2012 (22.3.18.5.2)	Transmitter Center Frequency Leakage
IEEE P802.11ac/D3.0, June 2012 (22.3.18.5.3)	Transmitter Constellation Error
IEEE P802.11ac/D3.0, June 2012 (22.3.18.5.4)	Transmitter Modulation Accuracy (EVM) Test
	Transmit Power Level

• Receiver Test

The MV887031A application provides support for transmission of WLAN 802.11ac signals from the vector signal generator to the device under test. The number of received packets can then be read using the chipset vendor's control software.



MU887000A TRX Test Module

Waveform Parameter

802.11 Standard	Data Rate/Modulation	Bandwidth	Packet Length	Remarks
802.11ac	MCS 0 to 9	20, 40, 80, 160 MHz	4096 or 500 bytes	Nss: 1, Guard Interval: Long

Supported 802.11ac RX Measurement

802.11ac	Measurement
IEEE P802.11ac/D3.0, June 2012 (22.3.19.1)	Receiver Minimum Input Level Sensitivity
IEEE P802.11ac/D3.0, June 2012 (22.3.19.2)	Adjacent Channel Rejection*1
IEEE P802.11ac/D3.0, June 2012 (22.3.19.3)	Non-adjacent Channel Rejection*1
IEEE P802.11ac/D3.0, June 2012 (22.3.19.4)	Receiver Maximum Input Level

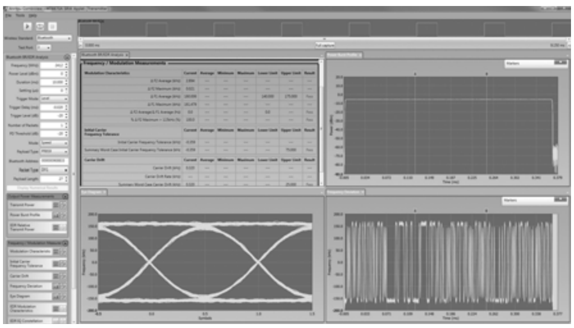
*1: Requires separate signal generator

• MX887040A *Bluetooth* TX Measurement
MV887040A *Bluetooth* Waveforms

The MT8870A Universal Wireless Test Set/MU887000A TRX Test Module supports non-signalling transmitter and receiver tests for *Bluetooth* Basic Rate (BR), Enhanced Data Rate (EDR) and low-energy (Smart) devices.

• Transmitter Test

The MX887040A *Bluetooth* TX Measurement Software has two *Bluetooth* TX test modes. The SIG Standard mode measures TX test packets sent from the device under test according to the *Bluetooth* RF Test Specifications. In SIG standard mode, the system returns only measurements that are compatible with the payload type of the captured packets. In Speed Test mode, the system returns results for all enabled measurements regardless of the packet payload.
Because the Speed Test mode supports all BR/EDR measurements for individual packet types, it is ideal for rapid testing on production lines.



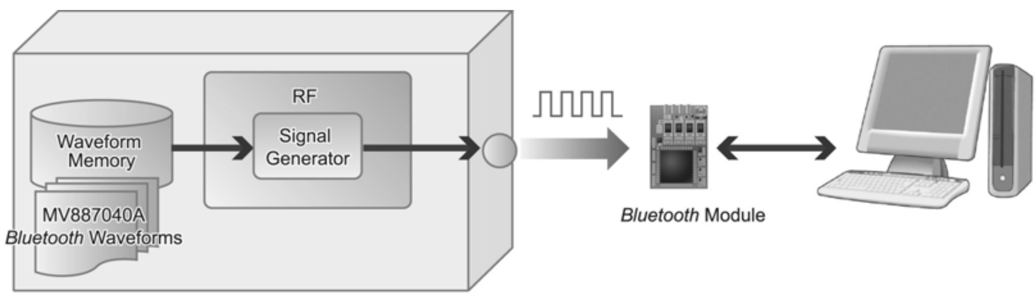
***Bluetooth* TX Measurement using CombiView**

Supported *Bluetooth* TX Measurement

Bluetooth SIG RF	Measurement
TRM/CA/01/C	Output Power
TRM/CA/03/C	Power Control
TRM/CA/08/C	Initial Carrier Frequency Tolerance
TRM/CA/09/C	Carrier Frequency Drift
TRM/CA/07/C	Modulation Index
TRM/CA/11/C	EDR Carrier Frequency Stability
TRM/CA/11/C	EDR Modulation Accuracy
TRM/CA/10/C	EDR Relative Transmit Power
TRM-LE/CA/01/C and TRM-LE/CA/02/C	BLE Output Power
TRM-LE/CA/05/C	BLE Modulation Characteristics
TRM-LE/CA/06/C and TRM-LE/CA/07/C	BLE Carrier Frequency Offset and Drift

• Receiver Test

The MV887040A application provides support for transmission of *Bluetooth* signals from the vector signal generator to the device under test. The number of received packets can then be read using the chipset vendor's control software.



MU887000A TRX Test Module

Standard Waveforms

Bluetooth	Waveform Type
Basic Rate	DH1/DH3/DH5
Enhanced Data Rate (EDR)	2-DH1/2-DH3/2-DH5/3-DH1/3-DH3/3-DH5
Bluetooth Low Energy	BLE/PER Report Integrity Test
Others	GFSK/PSK CW (Interference Waveform)

Supported *Bluetooth* RX Measurement

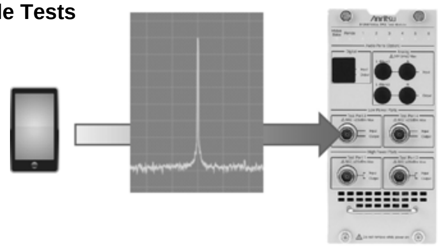
Bluetooth SIG RF Standards	Measurement
RCV/CA/01/C	Sensitivity – Single Slot Packets
RCV/CA/02/C	Sensitivity – Multi-slot Packets
RCV/CA/06/C	Maximum Input Level
RCV/CA/07/C	EDR Sensitivity
RCV/CA/08/C	EDR BER Floor Performance
RCV/CA/10/C	EDR Maximum Input Level
RCV-LE/CA/01/C and RCV-LE/CA/02/C	BLE Receiver Sensitivity
RCV-LE/CA/06/C	BLE Maximum Input Signal Level
RCV-LE/CA/07/C	PER Report Integrity

• MX887050A Short Range Wireless Average Power and Frequency Measurement Software

Installing the MX887050A Short Range Wireless Average Power and Frequency Measurement Software in the MT8870A Universal Wireless Test Set provides support for simple tests for WLAN and *Bluetooth* short range wireless. The MX887050A supports CW power and frequency measurements on unmodulated signals and on signals modulated using the methods shown in the table below.

Supported Modulation Methods	
WLAN	DSSS, OFDM
Bluetooth	GFSK, PSK

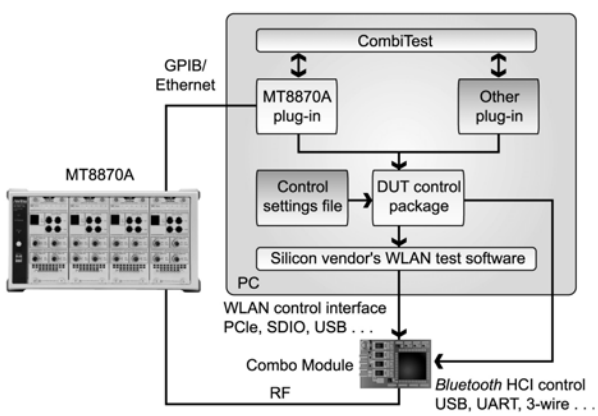
For Simple Tests



MX887050A
Short Range Wireless Average Power and Frequency Measurement

• CombiTest Automated Manufacturing

CombiTest is supplied with the instrument as a fast and easy means of building test plans. Just select the required calibration or verification tasks from the menu and drag them to position in the test plan.
Test plans can be as brief or as comprehensive as required and can include transmitter and receiver tasks for both *Bluetooth* and WLAN. All results are automatically archived to a database.
Control packages developed in partnership with leading silicon vendors result in test plans that configure and control the device under test for each test item as required. When using a control package, fully automated test plans can be created and edited in minutes, eliminating the need to write custom manufacturing test programs.




Anritsu
CombiTest
Test Plan Result: Passed
Short Range Wireless Test Results
Result: Passed
WLAN 802.11ac Test Results

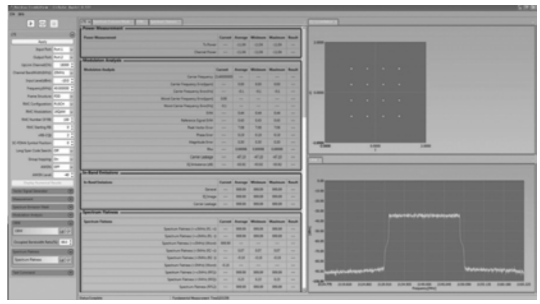
PC Applications

• CombiView

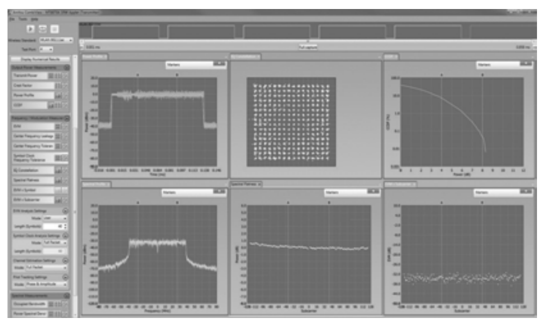
CombiView is a PC application used to control the MT8870A and display graphical and numerical test results.
It has the following functions:

Key Features

- Graphical display of TX measurement results using Windows interface
- Remote control of MT8870A (MU887000A) via Ethernet and GPIB (option)
- Setting of MT8870A (MU887000A)
- Signal generator interface for RX tests



LTE FDD Uplink TX Measurement with Cellular Application Applet



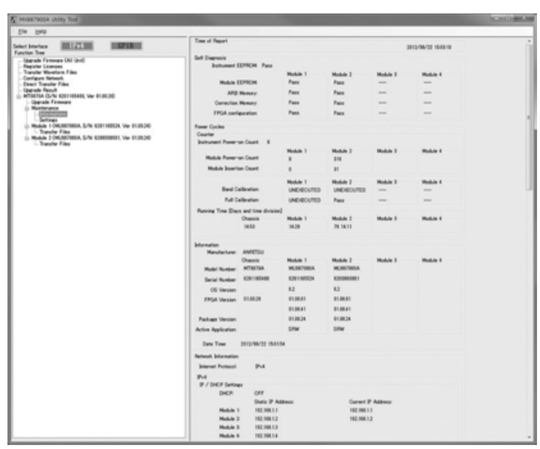
WLAN 802.11ac TX Measurement with SRW Application Applet

• Utility Tool

The utility tool is a PC application used to detect the network and perform firmware updates.

Key Features

- Displays details of MT8870A and MU887000A TRX Test Module(s) detected on network
- MU887000A TRX Test Module firmware upgrade
- Waveform file transfer
- License registration



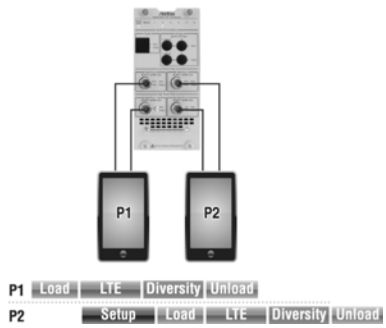
Application Examples

• Manufacturing Smartphones

Two smartphones can be measured alternately using one TRX Test Module. While one smartphone is being measured, the second is being prepared for measurement. When measurement of the first phone is completed, measurement of the second phone starts and the phone measured first can be replaced with a third phone to start measurement preparation.
This continuing sequence greatly reduces wasted time at connection and measurement to improve line throughput.

LTE Smartphone Measurement Examples

Model	Description	Qty.
MT8870A	Universal Wireless Test Set	1
MU887000A	TRX Test Module	1
MX887013A	LTE FDD Uplink TX Measurement	1
MV887013A	LTE FDD Downlink Waveforms	1

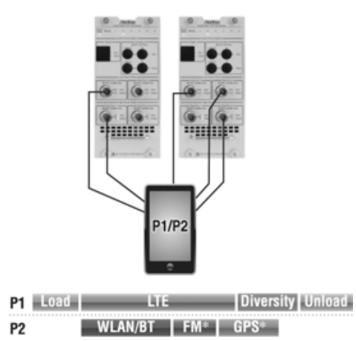


Two TRX Test Modules can be used to measure multiple wireless technologies in one smartphone.
The multiple antennas for the various wireless technologies in the smartphone are connected all at one time to execute measurements in parallel, greatly reducing the problems of moving smartphones between test stations and re-booting time for smartphone.

Smartphone Measurement Examples
(Simultaneous Measurement of Multiple Wireless Technologies)

Model	Description	Qty.
MT8870A	Universal Wireless Test Set	1
MU887000A	TRX Test Module	2
MX887013A	LTE FDD Uplink TX Measurement	1
MX887030A	WLAN 802.11b/g/a/n TX Measurement	1
MX887031A	WLAN 802.11ac TX Measurement	1
MX887040A	*Bluetooth* TX Measurement	1
MV887013A	LTE FDD Downlink Waveforms	1
MV887030A	WLAN 802.11b/g/a/n Waveforms	1
MV887031A	WLAN 802.11ac Waveforms	1
MV887040A	*Bluetooth* Waveforms	1

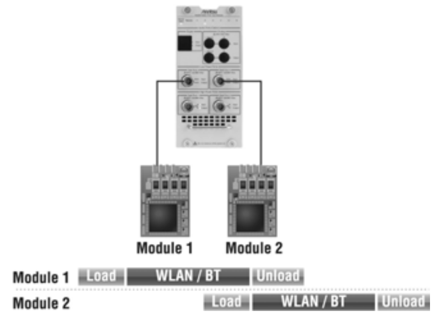
∗: FM and GPS Capability of the MT8870A are supported in the future.



• Manufacturing Communication Modules

One TRX Test Module can be used to measure WLAN 802.11b/g/a/n+ac, *Bluetooth* modules.

Model	Description	Qty.
MT8870A	Universal Wireless Test Set	1
MU887000A	TRX Test Module	1
MX887030A	WLAN 802.11b/g/a/n TX Measurement	1
MX887031A	WLAN 802.11ac TX Measurement	1
MX887040A	*Bluetooth* TX Measurement	1
MV887030A	WLAN 802.11b/g/a/n Waveforms	1
MV887031A	WLAN 802.11ac Waveforms	1
MV887040A	*Bluetooth* Waveforms	1



Specifications

● MT8870A Universal Wireless Test Set

Electrical Characteristics

<table>
<tr><td colspan="2">Number of Slots</td><td>4</td></tr>
<tr><td colspan="2">Internal Reference Oscillator</td><td>Starting characteristics
25°C, Referenced to frequency at 24-hour after power-on
±5 × 10^{-7} (2 minutes after power-on)
±5 × 10^{-8} (5 minutes after power-on)
Aging rate: ±1 × 10^{-7}/year
Temperature characteristics: ±2 × 10^{-8} (5° to 45°C)</td></tr>
<tr><td rowspan="4">Connector</td><td>External Reference Input</td><td>Connector: BNC-J (Rear panel), 50Ω (nominal)
Frequency: 10 MHz
Operating range: ±1 ppm
Input level: –15 to +20 dBm, 50Ω (AC coupling)</td></tr>
<tr><td>Reference Signal Output</td><td>Connector: BNC-J (Rear panel), 50Ω (nominal)
Frequency: 10 MHz
Output level: ≥0 dBm (AC coupling)</td></tr>
<tr><td>Trigger</td><td>Input/Output switching: Trigger Input/Output selectable
Connector: BNC-J (Rear panel: 4 ports)
Input/Output level: TTL level</td></tr>
<tr><td>Ethernet Controller</td><td>Control from external controller (Excluding power-On/Off)
Ethernet (1000BASE-T)
Connector: RJ-45 (Front panel, Rear panel)
GPIB (With MT8870A-001)
Connector: IEEE488 bus connector (Rear panel: 4 ports)
Aux
Connector: 50-pin (Correspond to DX10BM-50S, Rear panel)</td></tr>
</table>

General

Dimensions and Mass	426 (W) × 221.5 (H) × 498 (D) mm (Exclusive of surface projections) ≤11.5 kg (Excluding all options and modules) ≤30.0 kg (Including options and modules)
Power Supply	Power voltage: 100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) Frequency: 50 Hz/60 Hz Power consumption: ≤900 VA (Including all options and modules)
Temperature Range	+5° to +45°C (Operating), –20° to +60°C (Storage)
EMC	EN61326-1, EN61000-3-2

● MU887000A TRX Test Module

Input/Output Connector

RF Test Port	4
Connector	N(f)
Impedance	50Ω (nominal)
VSWR	Test port 1 and 2 <1.5 (10 MHz ≤ f < 400 MHz) <1.2 (400 MHz ≤ f ≤ 2.7 GHz) <1.3 (2.7 GHz < f ≤ 3.8 MHz) <1.5 (3.8 GHz < f ≤ 6.0 GHz) Test port 3 and 4 <1.8 (10 MHz ≤ f < 30 MHz) <1.5 (30 MHz ≤ f ≤ 3.8 GHz) <1.6 (3.8 GHz < f ≤ 6.0 MHz)
Maximum Input Level	+35 dBm (Test port 1 and 2) +25 dBm (Test port 3 and 4)

Signal Generator

<table>
<tr><td rowspan="3">Frequency</td><td>Setting Range</td><td>10 MHz to 3.8 GHz
10 MHz to 6.0 GHz (with MU887000A-001)</td></tr>
<tr><td>Resolution</td><td>1 Hz</td></tr>
<tr><td>Accuracy</td><td>Depends on MT8870A reference oscillator accuracy</td></tr>
</table>

Continued on next page

Amplitude	Setting Range	Test port 1 and 2 –130 to –10 dBm (≤3.8 GHz) –130 to –18 dBm (>3.8 GHz) Test port 3 and 4 –120 to 0 dBm (≤3.8 GHz) –120 to –8 dBm (>3.8 GHz)
	Setting Resolution	0.1 dB
	Accuracy	CW, After CAL, 10° to 40°C Test port 1 and 2 Output level: ≥–120 dBm (≤3.8 GHz), ≥–100 dBm (>3.8 GHz) ±1.3 dB (10 MHz ≤ f < 400 MHz) (Signal Analyzer input level: +15 dBm) ±1.0 dB, ±0.7 dB (typ.) (400 MHz ≤ f ≤ 3.8 GHz) ±1.3 dB, ±1.0 dB (typ.) (3.8 GHz < f ≤ 6.0 GHz) Test port 3 and 4 Output level: ≥ –110 dBm ±1.3 dB (10 MHz ≤ f < 400 MHz) ±1.0 dB, ±0.7 dB (typ.) (400 MHz ≤ f ≤ 3.8 GHz) ±1.3 dB, ±0.7 dB (typ.) (3.8 GHz < f ≤ 6.0 GHz)
Spurious Response	Harmonic Distortion	<–25 dBc
Vector Modulation	Bandwidth	Maximum 160 MHz

Signal Analyzer

Frequency	Setting Range	10 MHz to 3.8 GHz 10 MHz to 6.0 GHz (with MU887000A-001)
	Resolution	1 Hz
Amplitude	Setting Range	CW Test port 1 and 2 –65 to +15 dBm (10 MHz ≤ f < 350 MHz) –65 to +35 dBm (350 MHz ≤ f ≤ 6.0 GHz) Test port 3 and 4 –65 to +15 dBm (10 MHz ≤ f < 350 MHz) –65 to +25 dBm (350 MHz ≤ f ≤ 6.0 GHz)
	Resolution	0.1 dB
	Accuracy	CW, Measurement bandwidth: 300 kHz, RBW: 100 kHz, After CAL Test port 1 and 2 10 MHz ≤ f < 400 MHz, Signal Generator: Off, +10° to +40°C ±0.7 dB (–30 dBm ≤ p ≤ +15 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) 400 MHz ≤ f ≤ 3.8 GHz, +10° to +40°C ±0.5 dB, ±0.3 dB (typ.) (–30 dBm ≤ p ≤ +35 dBm) ±0.7 dB (–55 dBm ≤ p < –30 dBm) ±0.9 dB (–65 dBm ≤ p < –55 dBm) 3.8 GHz < f ≤ 6.0 GHz, +20° to +30°C ±0.7 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) Test port 3 and 4 10 MHz ≤ f < 400 MHz, +10° to +40°C ±0.7 dB (–30 dBm ≤ p ≤ +15 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) 400 MHz ≤ f ≤ 3.8 GHz, +10° to +40°C ±0.7 dB (–30 dBm ≤ p ≤ +25 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) 3.8 GHz < f ≤ 6.0 GHz, +20° to +30°C ±0.7 dB (–30 dBm ≤ p ≤ +25 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm)
	Linearity	CW, Measurement bandwidth: 300 kHz, RBW: 100 kHz ±0.2 dB (0 to –40 dB, ≥ –55 dBm) ±0.4 dB (0 to –40 dB, ≥ –65 dBm)
Modulation Analysis	Maximum Bandwidth	25 MHz (10 MHz ≤ f < 500 MHz) 80 MHz (500 MHz ≤ f < 1.9 GHz) 160 MHz (1.9 GHz ≤ f ≤ 6.0 GHz)

General

Interface	Trigger	Trigger signals Input/Output at Trigger connectors (Rear panel)
	Remote Control	Ethernet: via MT8870A interface GPIB: with MT8870A GPIB option (MT8870A-001) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
Dimensions and Mass		90 (W) × 193.6 (H) × 325 (D) mm (Exclusive of surface projections) ≤5 kg (Including options)

• MX887010A Cellular Standards Sequence Measurement

<table>
<tr><td rowspan="2">Common Item</td><td>Measuring Object</td><td>W-CDMA/GSM/LTE Uplink signal, CDMA2000/1xEV-DO Reverse Link signal</td></tr>
<tr><td>Frequency Range</td><td>400 MHz to 3.8 GHz</td></tr>
<tr><td rowspan="5">Spectrum Monitor</td><td>Analysis Time</td><td>1 ms, 10 ms</td></tr>
<tr><td>Span</td><td>1, 2.5, 5, 10, 25, 50, 100 MHz</td></tr>
<tr><td>Resolution</td><td><table>
<tr><th>Span</th><th>Resolution</th></tr>
<tr><td>1 MHz</td><td>100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz</td></tr>
<tr><td>2.5 MHz</td><td>1 kHz, 3 kHz, 10 kHz, 30 kHz</td></tr>
<tr><td>5 MHz</td><td>3 kHz, 10 kHz, 30 kHz, 100 kHz</td></tr>
<tr><td>10 MHz</td><td>3 kHz, 10 kHz, 30 kHz, 100 kHz</td></tr>
<tr><td>25 MHz</td><td>10 kHz, 30 kHz, 100 kHz, 300 kHz</td></tr>
<tr><td>50 MHz</td><td>30 kHz, 100 kHz, 300 kHz, 1 MHz</td></tr>
<tr><td>100 MHz</td><td>30 kHz, 100 kHz, 300 kHz, 1 MHz</td></tr>
<tr><td>160 MHz</td><td>30 kHz, 100 kHz, 300 kHz, 1 MHz</td></tr>
</table></td></tr>
<tr><td>Detection Mode</td><td>Average, Peak</td></tr>
<tr><td>Power Measurement Bandwidth</td><td>Range: 0.001 MHz to (Setting span) MHz, Resolution: 0.001 MHz</td></tr>
<tr><td rowspan="5">Multiple Power Measurement</td><td>Number of Steps</td><td>10 to 100 steps</td></tr>
<tr><td>Power Step Time</td><td>0.5, 1,2, 4, 5, 10, 20, 30, 40, 50, 60, 70, 80 ms</td></tr>
<tr><td>Filter Type</td><td>Low-pass filter: 1.23, 1.4, 3, 5, 10, 15, 20 MHz
RRC filter: 3.84 MHz</td></tr>
<tr><td>Measurement Window</td><td>1 to 90%, Resolution 1%</td></tr>
<tr><td>Trigger Level</td><td>–40 to 0 dB (Based on the input level value)</td></tr>
<tr><td rowspan="5">TX/RX vs. Frequency</td><td>Segment Duration</td><td>Range: 1 to 80 ms, Resolution: 1 ms, W-CDMA, CDMA2000, LTE</td></tr>
<tr><td>Measurement Filter</td><td>Low-pass filter: 1.23, 1.4, 3, 5, 10, 15, 20 MHz
RRC filter: 3.84 MHz</td></tr>
<tr><td>Measurement Window</td><td>Range: 1 to 90%, Resolution: 1%</td></tr>
<tr><td>Number of Segment*</td><td>2 to 1600</td></tr>
<tr><td>Number of Sequence*</td><td>1 to 40</td></tr>
<tr><td rowspan="4">Narrowband Power vs. Time</td><td>Segment Duration</td><td>Range: 200 µs to 20000 µs, Resolution: 1 µs</td></tr>
<tr><td>Measurement Bandwidth</td><td>15 kHz</td></tr>
<tr><td>Measurement Window</td><td>Range: 10 to 100%, Resolution: 1%</td></tr>
<tr><td>Number of Segment</td><td>1 to 1000</td></tr>
</table>

*: (Number of Segment × Number of Sequence) ≤1600

• MX887011A W-CDMA/HSPA Uplink TX Measurement

Common Item	Measuring Object	W-CDMA Uplink signal
	Frequency Range	400 MHz to 2.7 GHz
RF Power	Setting Input Range	–65 to +35 dBm (Test port 1 and 2) –65 to +25 dBm (Test port 3 and 4)
	Measurement Accuracy	After CAL, 10° to 40°C Test port 1 and 2 ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) Test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm)
	Linearity	±0.2 dB (≥–55 dBm, 0 to 40 dB) ±0.4 dB (≥–65 dBm, 0 to 40 dB)
	Relative Level Accuracy	At the power level difference within 2 dB ±0.1 dB (typ.) (≥–55 dBm, 0 to 40 dB)
Frequency/ Modulation Analysis	Input Level	–30 to +35 dBm (Test port 1 and 2) –30 to +25 dBm (Test port 3 and 4)
	Carrier Frequency Accuracy	± (Setting frequency × Reference oscillator accuracy + 10 Hz)
	Modulation Accuracy	Residual EVM: at input of single DPCCH and single DPDCH ≤2.5%
Occupied Bandwidth	Input Level	–10 to +35 dBm (Test port 1 and 2) –10 to +25 dBm (Test port 3 and 4)
	OBW Ratio	80.0 to 99.9%
Adjacent Channel Leakage Power Ratio	Input Level	–10 to +35 dBm (Test port 1 and 2) –10 to +25 dBm (Test port 3 and 4)
	Measurement Points	±5 MHz, ±10 MHz
	Measurement Range	≥50 dB (±5 MHz), ≥55 dB (±10 MHz)

• MX887012A GSM/EDGE Uplink TX Measurement

Common Item	Measuring Object	Normal Burst (GMSK, 8PSK)
	Frequency Range	400 MHz to 2.0 GHz
RF Power	Input Level Range	Average power of burst signal –30 to +35 dBm (Test port 1 and 2) –30 to +25 dBm (Test port 3 and 4)
	Measurement Accuracy	After CAL, 10° to 40°C Test port 1 and 2 ±0.3 dB (typ.), ±0.5 dB (–30 to +35 dBm) Test port 3 and 4 ±0.7 dB (–30 to +25 dBm)
	Linearity	±0.2 dB (≥–30 dBm, 0 to 40 dB)
	Carrier Off Power	≥65 dB (≥–10 dBm), ≥45 dB (–30 to –10 dBm)
Frequency/ Modulation Measurement	Input Level Range	Average power of burst signal –30 to +35 dBm (Test port 1 and 2) –30 to +25 dBm (Test port 3 and 4)
	Carrier Frequency Accuracy	± (Setting frequency × Reference oscillator accuracy + 10 Hz)
	Modulation Accuracy (GMSK Modulation)	Residual phase error ≤0.5°rms (f ≥500 MHz), ≤0.7°rms (f <500 MHz) ≤2° peak
	Modulation Accuracy (8PSK Modulation)	Residual EVM ≤1.5% rms
Output RF Spectrum Measurement	Input Level Range	Average power of burst signal –10 to +35 dBm (Test port 1 and 2) –10 to +25 dBm (Test port 3 and 4)
	Measurement Point	±100 kHz, ±200 kHz, ±250 kHz, ±400 kHz, ±600 kHz, ±800 kHz, ±1000 kHz, ±1200 kHz, ±1600 kHz, ±1800 kHz, ±2000 kHz
	Measurement Range of due to Modulation	Average of 10 measurements ≤–55 dB (200 kHz, 250 kHz offset), ≤–66 dB (≥400 kHz offset)
	Measurement Range of Switching Transient	≤–57 dB (≥400 kHz offset)

• MX887013A LTE FDD Uplink TX Measurement

Common Item	Measuring Object	PUSCH, PUCCH
	Frequency Range	600 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz
RF Power	Input Level Range	–65 to +35 dBm (Test port 1 and 2) –65 to +25 dBm (Test port 3 and 4)
	Measurement Accuracy	After CAL, 10° to 40°C Test port 1 and 2 ±0.3 dB (typ.), ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–50 to –20 dBm) ±0.9 dB (–60 to –50 dBm) Test port 3 and 4 ±0.7 dB (–20 to +25 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm)
	Linearity	±0.2 dB (≥–50 dBm, 0 to 40 dB) ±0.4 dB (≥–60 dBm, 0 to 40 dB)
	Relative Level Accuracy	At the power level difference within 2 dB ±0.1 dB (typ.)
Frequency/ Modulation Measurement	Input Level Range	–40 to +35 dBm (Test port 1 and 2) –40 to +25 dBm (Test port 3 and 4)
	Carrier Frequency Accuracy	± (Setting frequency × Reference oscillator accuracy + 15 Hz)
	Modulation Accuracy	Residual EVM: Average of 20 measurements ≤2.5%
	In-band Emission	Input level: ≥–10 dBm, Allocated RB: ≤18 ≤–40 dBc
Occupied Bandwidth	Input Level Range	–10 to +35 dBm (Test port 1 and 2) –10 to +25 dBm (Test port 3 and 4)
	OBW Ratio	80.0 to 99.9%
Adjacent Channel Leakage Power Ratio	Input Level Range	–10 to +35 dBm (Test port 1 and 2) –10 to +25 dBm (Test port 3 and 4)
	Measurement Range	≥45 dB (E-UTRA ACLR1) ≥50 dB (UTRA ACLR1) ≥55 dB (UTRA ACLR2)
Spectrum Emission Mask	Input Level Range	–10 to +35 dBm (Test port 1 and 2) –10 to +25 dBm (Test port 3 and 4)

• MX887015A CDMA20000 Reverse Link TX Measurement

Common Item	Measuring Object	Reverse RC-1/2/3/4
	Frequency Range	400 MHz to 2.7 GHz
RF Power	Input Level Range	–65 to +35 dBm (Test port 1 and 2) –65 to +25 dBm (Test port 3 and 4)
	Measurement Accuracy	After CAL, 10° to 40°C Test port 1 and 2 ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) Test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm)
	Linearity	±0.2 dB (≥–55 dBm, 0 to 40 dB) ±0.4 dB (≥–65 dBm, 0 to 40 dB)
Frequency/ Modulation Measurement	Input Level Range	–30 to +35 dBm (Test port 1 and 2) –30 to +25 dBm (Test port 3 and 4)
	Carrier Frequency Accuracy	± (Setting frequency × Reference oscillator accuracy + 10 Hz)
	Waveform Quality	>0.999
Code Domain Power Measurement	Reverse RC3 or RC4	
	Input Level Range	–30 to +35 dBm (Test port 1 and 2) –30 to +25 dBm (Test port 3 and 4)
	Measurement Accuracy	±0.2 dB (Code power: ≥–15 dBc), ±0.4 dB (Code power: ≥–23 dBc)
Occupied Bandwidth	Input Level Range	–10 to +35 dBm (Test port 1 and 2) –10 to +25 dBm (Test port 3 and 4)
	OBW Ratio	80.0 to 99.9%

• MX887016A 1xEV-DO Reverse Link TX Measurement

Common Item	Measuring Object	Reverse Link Rev. 0/Rev. A
	Frequency Range	400 MHz to 2.7 GHz
RF Power	Input Level Range	–65 to +35 dBm (Test port 1 and 2) –65 to +25 dBm (Test port 3 and 4)
	Measurement Accuracy	After CAL, 10° to 40°C Test port 1 and 2 ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) Test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm)
	Linearity	±0.2 dB (≥–55 dBm, 0 to 40 dB) ±0.4 dB (≥–65 dBm, 0 to 40 dB)
Frequency/ Modulation Measurement	Input Level Range	–30 to +35 dBm (Test port 1 and 2) –30 to +25 dBm (Test port 3 and 4)
	Carrier Frequency Accuracy	± (Setting frequency × Reference oscillator accuracy + 10 Hz)
	Waveform Quality	>0.999
Code Domain Power Measurement	Input Level Range	–30 to +35 dBm (Test port 1 and 2) –30 to +25 dBm (Test port 3 and 4)
	Measurement Accuracy	±0.2 dB (Code power: ≥–15 dBc), ±0.4 dB (Code power: ≥–23 dBc)
Occupied Bandwidth	Input Level Range	–10 to +35 dBm (Test port 1 and 2) –10 to +25 dBm (Test port 3 and 4)
	OBW Ratio	80.0 to 99.9%

• MV887011A W-CDMA/HSPA Downlink Waveforms

EVM	≤3% rms (400 MHz ≤ f ≤ 2.7 GHz)

• MV887012A GSM/EDGE Downlink Waveforms

Phase Error	≤1° rms (400 MHz ≤ f ≤ 2.7 GHz, GMSK modulation)
EVM	≤1.8% rms (400 MHz ≤ f ≤ 2.7 GHz, 8PSK modulation)

• MV887013A LTE FDD Downlink Waveforms

Max. Output Level	Test port 1 and 2 –12 dBm (f ≤ 3.8 GHz) –20 dBm (f > 3.8 GHz) Test port 3 and 4 –2 dBm (f ≤ 3.8 GHz) –10 dBm (f > 3.8 GHz)
EVM	≤2% rms (400 MHz ≤ f ≤ 2.7 GHz) ≤3% rms (3.4 GHz ≤ f ≤ 3.8 GHz)

• MV887015A CDMA2000 Forward Link Waveforms

Waveform Quality	>0.99 (400 MHz ≤ f ≤ 2.7 GHz)

• MV887016A 1xEV-DO Forward Link Waveforms

Waveform Quality	>0.99 (400 MHz ≤ f ≤ 2.7 GHz, Pilot channel)

• MX887030A WLAN 802.11b/g/a/n TX Measurement

Common Item	Measuring Object	WLAN Signal Packet
	Frequency Range	2.4 GHz Band: 2412 MHz to 2484 MHz 5 GHz Band: 4920 MHz to 5825 MHz (Required MX887000A-001)
RF Power	Input Setting Range	–65 to +25 dBm (Test port 3 and 4)
	Accuracy	After CAL, 20° to 30°C ±0.7 dB (–30 dBm ≤ Level ≤ +25 dBm), ±1.0 dB (–50 dBm ≤ Level < –30 dBm)
	Bandwidth	40 MHz, 20 MHz (802.11n) 20 MHz (802.11b/g/a)
	Capture Time	Up to 1.34 s
	Pre-trigger	Up to 1.34 s
	Resolution (time domain profile)	5 ns/sample
	CCDF	CCDF defined as a percentage of samples against dB, where percentage of samples is normalized to the average power in the 'gate', and dB is defined as the relative value of samples greater than the average.
	Power Distribution Value	A single numeric value called the power distribution value defines the number of dB above the average power below which a user defined percentage of the total number of samples falls.
Spectral Profile Measurement	Span	±65 MHz (802.11n) ±35 MHz (802.11b/g/a)
	Minimum Capture Time	50 µs
	Input Signal Measurement Range (RBW: 100 kHz)	–27 to +25 dBm
	Linearity	CW, RBW: 100 kHz, Same as MU887000A Level Linearity Test port 3 and 4. ±0.2 dB (≥ –55 dBm, 0 to –40 dB)
	Resolution	0.1 dB
	Bandwidth	100 kHz
EVM (Modulation Accuracy)	Measurement Range	–20 to +25 dBm
	Residual EVM	DSSS: <–28 dB (Signal level: >–20 dBm, Averaged over 20 packets) OFDM: <–40 dB (Signal level: >–20 dBm, Averaged over 20 packets, Channel Estimation: FULLPACKET)
	EVM Data Format	dB, %
	Resolution	0.1% or 0.1 dB, All limit checking in dB to 0.1 dB resolution
	Speed	>20 readings/second
DSSS EVM Measurement Setting	RX Filter Type	None, Gaussian, Root Raised Cosine
	Gaussian Filter Setting BT	BT 0.3 to 1.0, Resolution: 0.1
	Root Raised Cosine Filter Setting	α 0.30 to 1.00, Resolution: 0.01
	Measurement Start	It shall be possible to measure EVM from the first data chip of the packet
	Measurement Method	Header or payload. Header measures the EVM of the first 1000 chips of the PLCP preamble and header.
	User Specified Measurement Range	220 to 11000 chips
	Measurement Functional Range	Measurement only possible if channel frequency error <±150 kHz (±60 ppm)
	Carrier Lock	Phase tracking automatically applied as per carrier lock 802.11-2007 18.4.7.8
OFDM EVM Measurement Setting	Channel Estimation	User selection of Long Training Sequence or Full Packet.
	User Specified Measurement Range	Min. 16 symbols, Max. 1000 symbols
	OFDM Pilot Tracking	"Phase tracking only" or "Phase and Amplitude Tracking". Peak and Average EVM on all sub-carriers, dB or percentage Peak and Average on each sub-carrier – frequency domain % vs. sub-carrier EVM vs. Symbol – time domain % vs. Symbol number, 1 to max
DSSS Additional Measurement	Transmit Center Frequency Tolerance	Definition: Average frequency of the DSSS carrier signal Accuracy: ± (Setting frequency × Reference oscillator accuracy + 1 kHz) Resolution: Hz to no decimal places, ppm to one decimal place
	Chip Clock Frequency Tolerance	Definition: Frequency error relative to the 11 MHz chip clock. Measurement averaged over a fully coded DSSS packet with minimum payload length 3300 chips, 300 µs Display format: Hz, ppm Range: ±50 ppm Resolution: Hz to no decimal places, ppm to one decimal place Data Analysis width: 20 µs (220 chips) minimum User Specified measurement range: 3300 to 30250 chips
	Transmit Power-on and Power Down Ramp	Definition: Time for burst to transit from 10 to 90% or 90 to 10% of linear power. Data outputs: 10%, 90%, Delta values Resolution: 5 ns
	RF Carrier Suppression	Method: IEEE Std 802.11-2007 (18.4.7.7), IQ offset method IEEE method: Relative level of the carrier to the highest sideband for a 10101010 test pattern with scrambler disabled, data rate 2 Mbps. IQ Offset method: Calculated from the relative values of the peak frequency response and the channel center frequency with the data rate processing gain.

Continued on next page

OFDM Additional Measurement	Transmit Center Frequency Tolerance	Definition: Average frequency of the OFDM carrier signal Data output format: Hz, ppm Accuracy: >1 ms packet, ± (Setting frequency × Reference oscillator accuracy + 1 kHz) Resolution: Hz to no decimal places, ppm to one decimal place Symbol clock frequency tolerance Definition: Frequency error relative to the 250 kHz symbol clock as per 19.4.7.3/17.3.9.5 Measurement averaged over a fully coded OFDM packet with a minimum payload length of 16 symbols (64 µs) Data output format: Hz, ppm Range: ±40 ppm Resolution: ppm to one decimal place User specified measurement range: 16- (Define numbers)
	Transmitter Center Frequency Leakage	Definition: Measurement of the leakage of the center carrier Data output format: dB Resolution: dB to two decimal places Transmitter spectral flatness Definition: Measurement of RF sub-carrier power level Unit of measurement: dB
Additional Measurement (DSSS and OFDM)	Power Spectral Density	The maximum power measured in a 1 MHz bandwidth within the occupied bandwidth of the signal
	Occupied Bandwidth	Measures the frequency range within which the specified percentage power is contained
	Occupied Bandwidth Percentage Range	1 to 99%

● MX887031A WLAN 802.11ac TX Measurement

Common Item	Measuring Object	WLAN Signal Packet
	Frequency Range	5 GHz Band: 4920 MHz to 5825 MHz (Required MX887000A-001)
RF Power	Input Setting Range	–65 to +25 dBm (Test port 3 and 4)
	Accuracy	After CAL, 20° to 30°C ±0.7 dB (–30 dBm ≤ Level ≤ +25 dBm), ±1.0 dB (–50 dBm ≤ Level < –30 dBm)
	Bandwidth	160, 80, 40, 20 MHz
	Capture Time	Up to 1.34 s
	Pre-trigger	Up to 1.34 s
	Resolution (time domain profile)	5 ns/sample
	CCDF	CCDF defined as a percentage of samples against dB, where percentage of samples is normalized to the average power in the 'gate', and dB is defined as the relative value of samples greater than the average.
	Power Distribution Value	A single numeric value called the power distribution value defines the number of dB above the average power below which a user defined percentage of the total number of samples falls.
Spectral Profile Measurement	Spectral Profile Measurement Span	±80 MHz
	Minimum Capture Time	50 µs
	Input Signal Measurement Range (RBW: 100 kHz)	–27 to +25 dBm
	Linearity	CW, RBW: 100 kHz ±0.2 dB (≥ –55 dBm, 0 to –40 dB)
	Resolution	0.1 dB
	Measurement Bandwidth	100 kHz
EVM (Modulation Accuracy)	EVM Measurement Range	–20 to +25 dBm
	Residual EVM	<–38 dB (Signal level: >–10 dBm, Averaged over 20 packets, Channel estimation: FULLPACKET)
	EVM Data Format	dB, %
	Measurement Resolution	0.1% or 0.1 dB, All limit checking in dB to 0.1 dB resolution
	Measurement Speed	>20 readings/second
OFDM EVM Measurement Setting	Channel Estimation	User selection of Long Training Sequence or Full Packet.
	User Specified Measurement Range	Min. 16 symbols, Max. 1000 symbols
	OFDM Pilot Tracking	"Phase tracking only" or "Phase and Amplitude Tracking". Peak and Average EVM on all sub-carriers, dB or percentage Peak and Average on each sub-carrier – frequency domain % vs. sub-carrier EVM vs. Symbol – time domain % vs. Symbol number, 1 to max.
OFDM Additional Measurement	Transmit Center Frequency Tolerance	Definition: Average frequency of the OFDM carrier signal Data output format: Hz, ppm Accuracy: >1 ms packet, ± (Setting frequency × Reference oscillator accuracy + 1 kHz) Resolution: Hz to no decimal places, ppm to one decimal places Symbol clock frequency tolerance Definition: Frequency error relative to the 250 kHz symbol clock as per 19.4.7.3/17.3.9.5 Measurement averaged over a fully coded OFDM packet with a minimum payload length of 16 symbols (64 µs) Data output format: Hz, ppm Range: ±40 ppm Resolution: ppm to one decimal places User specified measurement range: 16- (Define numbers)
	Transmitter Center Frequency Leakage	Definition: Measurement of the leakage of the center carrier Data output format: dB Resolution: dB to two decimal places Transmitter spectral flatness Definition: Measurement of RF sub-carrier power level Unit of measurement: dB

• **MX887040A *Bluetooth* TX Measurement**

Common Item	Measuring Object	*Bluetooth* Signal Packet (DH-1,3,5 2-DH-1,3,5 3-DH-1,3,5 LE)
	Frequency Range	2402 MHz to 2480 MHz
	Measurement Mode	'SIG Standard' Supports RF measurements on selected packet types as per the SIG RF test standard.
RF Power	Input Signal Measurement Range	–65 to +25 dBm (Test port 3 and 4)
	Measurement Accuracy	After CAL, 20° to 30°C ±0.7 dB (–30 dBm ≤ Level ≤ +25 dBm), ±1.0 dB (–50 dBm ≤ Level < –30 dBm)
EDR Relative Transmit Power	Input Signal Measurement Range	–35 to +25 dBm
	Measurement	Maximum, Minimum, Average differential power
	Relative Power Measurement Range	Relative power measurement range between the GFSK and π/4DQPSK or 8DSPK sections of the packet.
	Power Measurement Bandwidth	1.3 MHz (IF filter response 'flat' fc ±550 kHz)
	Maximum Resolution (time domain)	0.01 dB
Bluetooth Modulation	GFSK, π/4DQPSK, 8DPSK	
	DEVM (Modulation Accuracy)	
	Input Signal Measurement Range	–20 to +25 dBm
	Residual DEVM	<5% (Signal level: >–20 dBm, Averaged over 10 packets)
	Measurement Resolution	0.1%
	GFSK Modulation	Deviation measurement range: 0 to 350 kHz Accuracy: Modulation index: 0.32, Signal level: >–20 dBm, Averaged over 10 packets 1% (±0.01 × expected deviation [Hz]) (nominal)
	Initial Carrier Frequency Tolerance	Input signal measurement range: –35 to +25 dBm Initial frequency measurement range: 0 to ±150 kHz Resolution: 1 kHz
	Carrier-frequency Drift	Input signal measurement range: –35 to +25 dBm Frequency drift range: 0 to ±200 kHz Time settings: 50 µs, >2000 µs
EDR Carrier Frequency Stability	Measurement Range	±100 kHz
	Resolution	1 kHz
	Accuracy	Signal level: >–20 dBm, Averaged over 10 packets ± (Setting frequency × Reference oscillator accuracy + 500 Hz)
	Displayed Results	Initial frequency error ωi, Frequency error ωo, Frequency error ωi + ωo
EDR Modulation Accuracy	RMS DEVM Range	0 to 30% π/4DQPSK, 0 to 20% 8DPSK
	Peak DEVM Range	0 to 50% π/4DQPSK, 0 to 30% 8DPSK
BLE Modulation Characteristics	GFSK	
	Input Signal Measurement Range	–35 to +25 dBm
	Frequency Deviation Measurement Range	0 to ±500 kHz peak
	Resolution	1 kHz
	Accuracy	Modulation index: 0.5, Signal level: >–20 dBm, Averaged over 10 packets 1% (±0.01 × expected deviation [Hz]) (nominal)
BLE Carrier Frequency Offset and Drift	Input Signal Measurement Range	–35 to +25 dBm
	Frequency Measurement Range	0 to ±500 kHz
	Accuracy	Signal level: >–20 dBm, Averaged over 10 packets ± (Setting frequency × Reference oscillator accuracy + 500 Hz)
	Displayed Results	Carrier frequency error, Frequency drift, Drift rate

• **MX887050A Short Range Wireless Average Power and Frequency Measurement**

RF Power (CW and Continuously Modulated)	Input Setting Range	–65 to +25 dBm (Test port 3 and 4)
	Frequency Range	2.4 GHz Band: 2402 MHz to 2484 MHz 5 GHz Band: 4920 MHz to 5825 MHz (Require MU887000A-001)
	Measurement Accuracy	After CAL 400 MHz ≤ f ≤ 3.8 GHz, 10° to 40°C ±0.7 dB (–30 ≤ Level ≤ +25 dBm) ±0.9 dB (–55 ≤ Level < –30 dBm) ±1.1 dB (–65 ≤ Level < –55 dBm) 3.8 GHz ≤ f ≤ 6 GHz, 20° to 30°C ±0.7 dB (–30 ≤ Level ≤ +25 dBm) ±0.9 dB (–55 ≤ Level < –30 dBm) ±1.1 dB (–65 ≤ Level < –55 dBm)
	Linearity	CW, RBW: 100 kHz ±0.2 dB (≥–55 dBm, 0 to –40 dB)
Frequency (CW and Continuously Modulated)	Power Measurement Range	–35 to +25 dBm
	Frequency Measurement Range	0 to ±500 kHz (CW, *Bluetooth*) 0 to ±100 kHz (WLAN)
	Accuracy	± (Setting frequency × Reference oscillator accuracy + 500 Hz)

• MV887030A WLAN 802.11b/g/a/n Waveforms

EVM	802.11b	Packet length: 1024 byte, Gaussian filter: BT 0.5 ≤–38 dB rms (2402 MHz to 2484 MHz)
	802.11g	Packet length: 1000 byte, 20° to 30°C ≤–40 dB rms (2402 MHz to 2484 MHz)
	802.11a	Packet length: 1000 byte, 20° to 30°C ≤–38 dB rms (4920 MHz to 5825 MHz)
	802.11n	Packet length: 4096 byte, Long guard interval, Channel bandwidth: 40 MHz, 20° to 30°C ≤–40 dB rms (2402 MHz to 2484 MHz) ≤–38 dB rms (4920 MHz to 5825 MHz)

• MV887040A *Bluetooth* Waveforms

Deviation	Frequency: 2402 MHz to 2480 MHz, GFSK modulation 1% (±0.01 × Deviation Hz) (nominal)
DEVM	Frequency: 2402 MHz to 2480 MHz, π/4-DQPSK or 8-DPSK modulation <5% rms

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MT8870A	Universal Wireless Test Set
	Standard accessories
	Power Cord: 1 pc
B0666A	Blank Panel: 3 pcs*1
	DVD-R: 1 pc
MX880050A	CombiView (DVD-R)
MX880051A	Cellular Application Applet (DVD-R)
MX880052A	SRW Application Applet (DVD-R)
MX880054A	Signal Generator Application Applet (DVD-R)
MX887900A	MT8870A Utility Tool (DVD-R)
W3605AE	MT8870A Operation Manual (DVD-R)
W3606AE	MU887000A Operation Manual (DVD-R)
	Options
MT8870A-001	GPIB Control
MT8870A-101	GPIB Control Retrofit
	Warranty
MT8870A-ES210	2 Years Extended Warranty Service
MT8870A-ES310	3 Years Extended Warranty Service
MT8870A-ES510	5 Years Extended Warranty Service
	Application parts
B0666A	Blank Panel
B0664A	Rack Mount Kit (MT8870A)
B0665A	Carrying Case (MT8870A)
B0669A	Front Cover for 1MW5U (MT8870A)
J0006	GPIB Cable, 0.5 m
J0007	GPIB Cable, 1.0 m
J0008	GPIB Cable, 2.0 m
J0127A	Coaxial Cord, 1 m (BNC-P · RG-58A/U · BNC-P)
J0127B	Coaxial Cord, 2.0 m (BNC-P · RG-58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG-58A/U · BNC-P)
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2.0 m (N-P · 5D-2W · N-P)
J0322A	Coaxial Cord, 0.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322B	Coaxial Cord, 1.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322C	Coaxial Cord, 1.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322D	Coaxial Cord, 2.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0004	Coaxial Adapter (N-P · SMA-J)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Crossover, 1 m)
J1261D	Ethernet Cable (Shield type, Crossover, 3 m)

*1: Installed in empty slots

Model/Order No.	Name
	Test module
MU887000A	TRX Test Module
	Standard accessories
	DVD-R: 1 pc
W3606AE	MU887000A Operation Manual (DVD-R)
	Options
MU887000A-001	6 GHz Frequency Extension
MU887000A-101	6 GHz Frequency Extension Retrofit
	Warranty
MU887000A-ES210	2 Years Extended Warranty Service
MU887000A-ES310	3 Years Extended Warranty Service
MU887000A-ES510	5 Years Extended Warranty Service

Model/Order No.	Name
	Software
MX887010A	Cellular Standards Sequence Measurement
MX887011A	W-CDMA/HSPA Uplink TX Measurement
MX887012A	GSM/EDGE Uplink TX Measurement
MX887013A	LTE FDD Uplink TX Measurement
MX887015A	CDMA2000 Reverse Link TX Measurement
MX887016A	1xEV-DO Reverse Link TX Measurement
MX887030A	WLAN 802.11b/g/a/n TX Measurement*2
MX887031A	WLAN 802.11ac TX Measurement*2
MX887040A	*Bluetooth* TX Measurement
MX887050A	Short Range Wireless Average Power and Frequency Measurement
	Waveform file
MV887011A	W-CDMA/HSPA Downlink Waveforms
MV887012A	GSM/EDGE Downlink Waveforms
MV887013A	LTE FDD Downlink Waveforms
MV887015A	CDMA2000 Forward Link Waveforms
MV887016A	1xEV-DO Forward Link Waveforms
MV887030A	WLAN 802.11b/g/a/n Waveforms*2
MV887031A	WLAN 802.11ac Waveforms*2
MV887040A	*Bluetooth* Waveforms

*2: Requires MU887000A-001 for 5 GHz (802.11a/n/ac) frequency measurements

SHIELD BOX
MA8120E
800 MHz to 2500 MHz

Shield Box Suitable for Testing Mobile Phones

Features
- The internal wide-band antenna (800 MHz to 2500 MHz) enables testing of W-CDMA, CDMA2000, GSM, PDC, and PHS mobile terminals as well as Wireless LAN, Bluetooth, and other such mobile devices using an air connection.
- Both air and coaxial connections between mobile phones and the MA8120E are available.
- UE multi holder can hold various shape UEs, allowing air connection measurements in proper position.

• CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).
• The *Bluetooth*® mark and logos are owned by Bluetooth SIG, Inc. and are used by Anritsu under license.

Specifications

Frequency		800 MHz to 2500 MHz
Shield Performance		≥60 dB
Antenna Coupling Amount		≥–25 dB
Interface	External	RF connector: N type Control connector: DX50 type
	Internal	RF connector: SMA type Control connector: DX36 type
Dimensions and Mass (excluding protrusion)		Within 330.8 (W) × 181 (H) × 393 (D) mm ≤7 kg
Temperature Range		0° to +50°C (Operating), –20° to +60°C (Storage)
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1

Ordering Information
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MA8120E	Shield Box	
	Standard accessories	
B0560A	UE Multi Holder:	1 pc
W2651AE	MA8120E Operation Manual:	1 copy
	Application parts	
J1150D	Coaxial Cord (N-P · N-P, 170 mm)	
J1150G	Coaxial Cord (N-P · N-P, 3 m)	
J1151B	Control Cable for PC (USB cable externally connected to MA8120E, used in combination with J1215A, sold separately)	
J1153A	UE I/F Cable (for W-CDMA mobile phone connection inside MA8120E, control signal)*1	
J1155A	UE I/F Cable with RF (for W-CDMA mobile phone connection inside MA8120E, control signal and RF)*1	
J1157B	Connecting Cable for RS232C (Serial cable externally connected to MA8120E, used in combination with J1311A/B, sold separately)	

Model/Order No.	Name
J1215A	Terminal I/F Cable [DX36 · USB A type Female], (for USB connection inside MA8120E, used in combination with J1151B, sold separately)
J1266A	Control I/F Cable [DX50 · DX50, 170 mm, for external measurement equipment connection cable (control signal line)]
J1311A	Connecting Cable for RS232C (DX36 · D-Sub 9 pin, J type, 100 mm, Serial cable internally connected to MA8120E)
J1311B	Connecting Cable for RS232C (DX36 · D-Sub 9 pin, J type, 300 mm, Serial cable internally connected to MA8120E)
	Optional parts
J1312	DX-50-CV1 Plug Cover Case*2
Z0820A	Rubber Band (for B0560A)

*1: The W-CDMA UE connector complies with EIAJ STD.
*2: In case of using MA8120A's connecting cable for MA8120E, cover for DX-50-CV need to change DX-50-CV1.

VECTOR SIGNAL GENERATOR

MG3710A

100 kHz to 2.7 GHz, 100 kHz to 4.0 GHz, 100 kHz to 6.0 GHz

Remote Control
GPIB | Ethernet | USB

Multi-Band/Multi-System/Multi-Channel – Cut Costs for New Wireless Tests –

NEW

Excellent Eco Product

The MG3710A is a vector signal generator with 6-GHz upper frequency limit and 160-MHz* wide RF modulation baseband generator. It outputs various radio systems signals for cellular communications, such as LTE FDD/TDD, W-CDMA, GSM as well as narrowband communications, such as WLAN, WiMAX, *Bluetooth* and GPS.

Cuts Equipment Costs

The dual waveform memory cuts equipment costs for tests, such as ACS, Blocking and IM, which require two modulation signal sources.
The dual RF cuts MIMO equipment costs and reduces workloads for phase synchronization between equipment.
It is important for tests using separate signals, such as MSR and multi-band.

Improves Yield

The excellent signal generator ACLR and SSB phase noise reduces the effect on wideband and narrow-band measurements to improve test margins and yields.

–71 dBc @W-CDMA, TestModel1, 64DPCH, 2 GHz
<–140 dBc/Hz (nom.) @100 MHz, 20 kHz offset, CW

Cuts Tact Time

The List/Sweep mode switches the frequency and level faster than 600 µs. Moreover, the 4-GB waveform memory upgrade can load many waveform patterns while instantaneous switching eliminates time wasted reloading waveform patterns.

*: Supports firmware version 2.00.00 and later.
The latest version can be downloaded from the Anritsu homepage.
<https://www1.anritsu.co.jp/Download/MService/Login.asp>

Key Features

• Dual RF & Dual Waveform Memory

• One Unit Supports Two RF Outputs Max.

Frequency Range
1stRF: 100 kHz to 2.7/4.0/6.0 GHz [Opt. 032/034/036]
2ndRF: 100 kHz to 2.7/4.0/6.0 GHz [Opt. 062/064/066]
Independent Baseband and RF Outputs

• Output Two Signals from One RF Out [Opt. 048/078]

Wanted Signal + Interfere Signal
Wanted Signal + Delayed Signal, etc.

• Basic Performance

• ACLR Performance

–71 dBc @W-CDMA, TestModel1, 64 DPCH, 2 GHz

• High-power Output [Opt. 041/071]

+23 dBm @CW, 400 MHz to 3 GHz

• High-speed Switching

< 600 µs @List/Sweep mode

• High Level Accuracy

Absolute Level Accuracy: ±0.5 dB
Linearity: ±0.2 dB (typ.)

• Choice of Reference Oscillators

Standard
Aging rate $\pm 1 \times 10^{-6}$/year, $\pm 1 \times 10^{-7}$/day
High Stability Reference Oscillator [Opt. 002]
Aging rate $\pm 1 \times 10^{-7}$/year, $\pm 1 \times 10^{-8}$/day
Rubidium Reference Oscillator [Opt. 001]
Aging rate $\pm 1 \times 10^{-10}$/month

• SSB Phase Noise Performance

<–140 dBc/Hz (nom.)	@100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.)	@1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.)	@2 GHz, 20-kHz offset, CW

• High All-purpose Baseband Performance

• Wide Vector Modulation Bandwidth
160 MHz* (using Internal baseband signal generator)
160 MHz (using External IQ input)
*: Supports firmware version 2.00.00 and later.

• Large-capacity Waveform Memory

• Arbitrary Waveform Generation

• Expandability

• BER Test Function [Opt. 021]

• Built-in analog modulation (AM/FM/ΦM) functions and pulse modulation (PM) functions [Standard]

• Adding additional analog modulation input options [Opt. 050/080]

• AWGN Generator [Opt. 049/079]

• USB Power Sensors [Sold separately]

• Local Signal I/O for MIMO Signal Source [Opt. 017]

• Operability

• Simple Touch-panel Operation

• Signal Flowcharts with Signal Block Diagrams

• Frequency Channel Table

• Connections with External Equipment

• Remote Control Interfaces

• USB Connections

• Analog IQ Input/Output [Opt. 018]

• Trigger Input

• Marker Output Editing

Marker 1 output [Standard]
Marker 2 and 3 output [Requires J1539A AUX Conversion Adapter]

• Security

• Windows 7 OS Upgrade [Opt. 029]
Note: This option can only applied at ordering and cannot be retrofitted.

• User Data Storage on 2ndary HDD [Opt. 011]

• Removable HDD [Opt. 313]
*: Opt. 029 cannot be applied to this HDD option.

• Pre-installed Key Waveform Patterns

• Waveform Patterns [Pre-installed]
Waveform patterns for the world's main communications systems (below) are pre-installed in the MG3710A for license-free use.
LTE FDD (E-TM1.1 to E-TM3.3)
LTE TDD (E-TM1.1 to E-TM3.3)
W-CDMA/HSDPA
GSM/EDGE
CDMA2000 1X/1xEV-DO
Bluetooth®
GPS
PDC
PHS
Digital Broadcast (ISDB-T/BS/CS/CATV)
WLAN (IEEE802.11a/11b/11g)

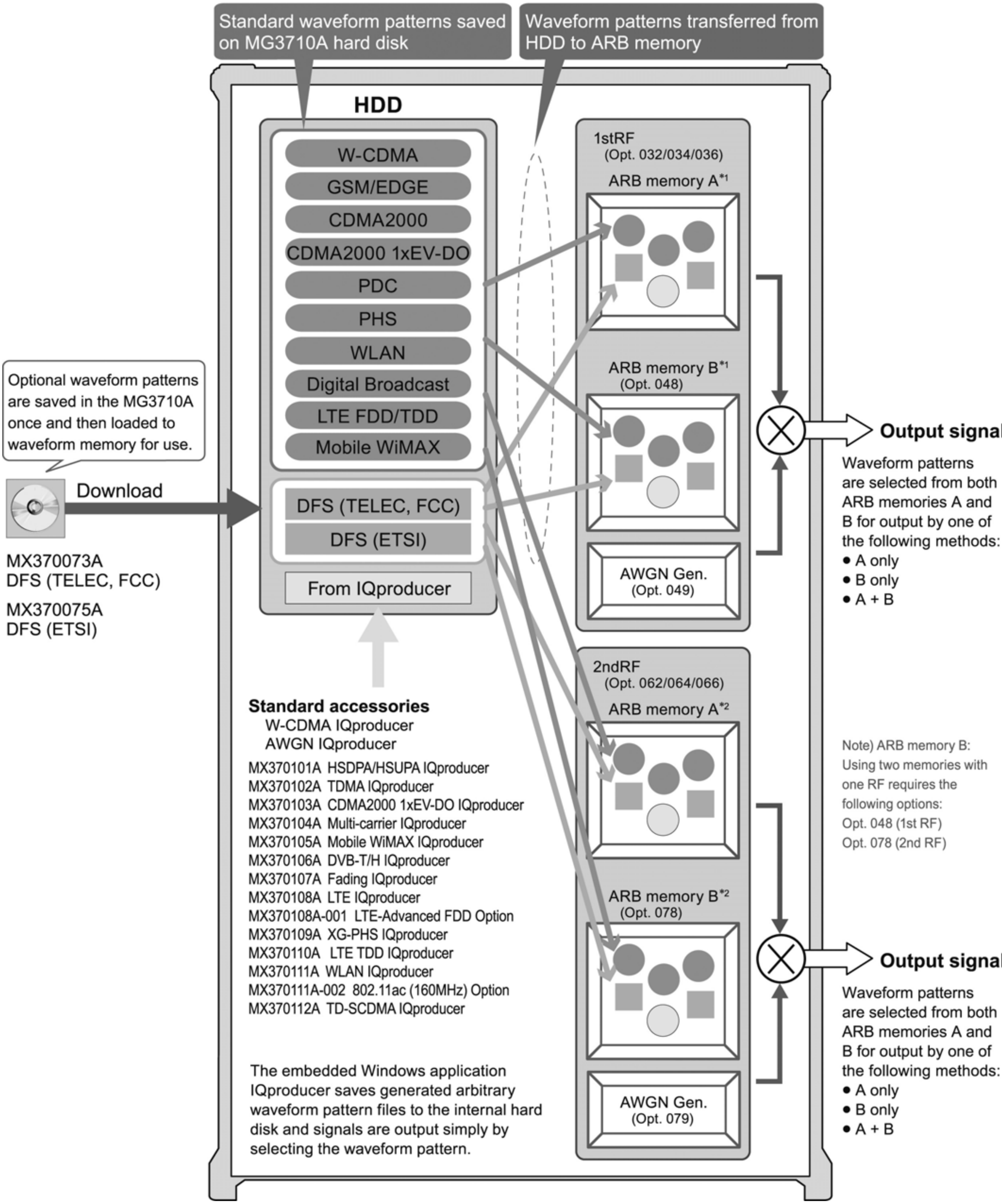
• Waveform Pattern Options and Generation

• Optional Waveform Pattern [Optional License]

DFS Radar Pattern (For TELEC & FCC)
DFS (ETSI) Waveform Pattern
ISDB-Tmm Waveform Pattern

• IQproducer Waveform Generation Software [Optional License]
LTE FDD/LTE-Advanced
LTE TDD
HSDPA/HSUPA/W-CDMA
TD-SCDMA
CDMA2000 1xEV-DO
Mobile WiMAX
WLAN 11a/b/g/n/j/p/ac
TDMA (PDC, PHS, Public Radio System.)
DVB-T/H
Multi-carrier
Fading

MG3710A Vector Signal Generator



*1: 1stRF ARB memory size
256 MB × 1 pc = 64 Msamples (Std.)
1 GB × 1 pc = 256 Msamples × 1 pc (Opt. 045)
1 GB × 2 pcs = 256 Msamples × 2 pcs (Opt. 045 + Opt. 048)
4 GB × 1 pc = 1024 Msamples × 1 pc (Opt. 046)
4 GB × 2 pcs = 1024 Msamples × 2 pcs (Opt. 046 + Opt. 048)

*2: 2ndRF ARB memory size
256 MB × 1 pc = 64 Msamples (Std.)
1 GB × 1 pc = 256 Msamples × 1 pc (Opt. 075)
1 GB × 2 pcs = 256 Msamples × 2 pcs (Opt. 075 + Opt. 078)
4 GB × 1 pc = 1024 Msamples × 1 pc (Opt. 076)
4 GB × 2 pcs = 1024 Msamples × 2 pcs (Opt. 076 + Opt. 078)

Dual RF & Dual Waveform Memory

● Dual VSG: Two RF Outputs

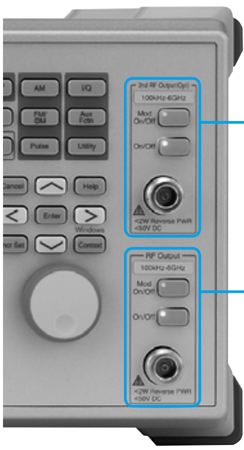
The MG3710A supports two RF outputs (1stRF/2ndRF) max. in one unit. Moreover, different frequencies can be set independently at 1stRF and 2ndRF.
Not only different frequencies but also different levels and waveform patterns can be set independently at each SG while each is tracking the other. This is convenient in the R&D phase for evaluating interference between two different systems using different frequency bands.

Notes: Supported frequency bands cannot be changed after shipment.
IQ input is supported only by SG1 (1stRF) and requires Opt. 017.

● Dual Waveform Memory: Four Waveform Outputs Max.

In the standard configuration, one VSG (1stRF or 2ndRF) has one waveform memory. However, adding the baseband signal combine option (Opt. 048/078) upgrades to two memories for one VSG. In other words, models with two VSGs (1stRF and 2ndRF) installed can have a maximum of four waveform memories. Two waveform patterns can be set easily on-screen for one VSG, each with different frequency offset, level offset and delay time settings to output a combined baseband RF signal. With this setup, one MG3710A supports the following test environment — a setup that previously required two expensive signal generators:

Wanted Signal + Interference Signal
Wanted Signal + Delayed Signal



2ndRF
Frequency Range:
2ndRF 100 kHz to 2.7 GHz [Opt. 062]
2ndRF 100 kHz to 4.0 GHz [Opt. 064]
2ndRF 100 kHz to 6.0 GHz [Opt. 066]
∗ Whether or not install and the frequency model can be selected at any time.

1stRF
Frequency Range:
1stRF 100 kHz to 2.7 GHz [Opt. 032]
1stRF 100 kHz to 4.0 GHz [Opt. 034]
1stRF 100 kHz to 6.0 GHz [Opt. 036]
∗ Must install any one of these.

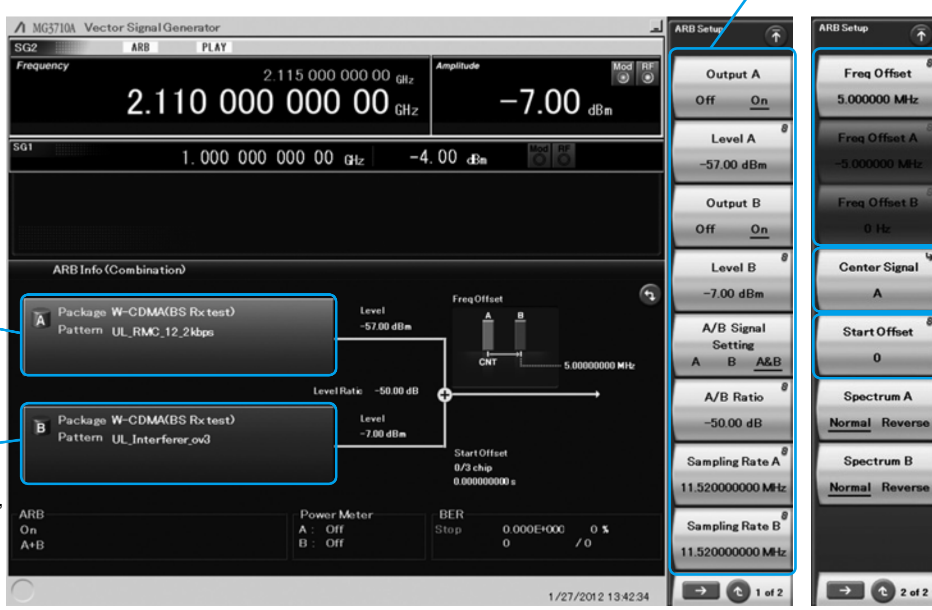
Synthesizing Signals with Different Sampling Rates
~ Rate Matching Function ~

When signals with different sampling rates are set in memory A and memory B, a synthesized signal maintaining each of the different sampling rates can be output. This is useful when synthesizing signals for standards with different rates, such as multi-standard signals.
However, depending on the combination of waveform sampling rates, sometimes it may not be possible to match rates due to internal operation clock limitations. The Mismatch warning dialog is displayed in this case.

Level Setting
Setting Range: –80 to +80 dB
Resolution: 0.01 dB

Waveform Pattern A
Example:
Wanted Signal

Waveform Pattern B
Example:
Interference Signal,
Delayed Signal



Frequency Offset Setting
Setting Range:
–80 to +80 MHz
Resolution: 1 Hz

Center Frequency Selection
A: Pattern A center
B: Pattern B center
Baseband DC:
Centered at baseband DC position

Time Offset Setting
Setting Range:
0 ~ pattern B sampling data count – 1

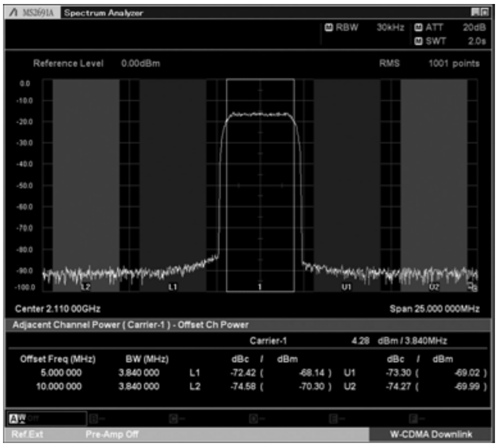
Baseband Signal Combine Example

Basic Performance

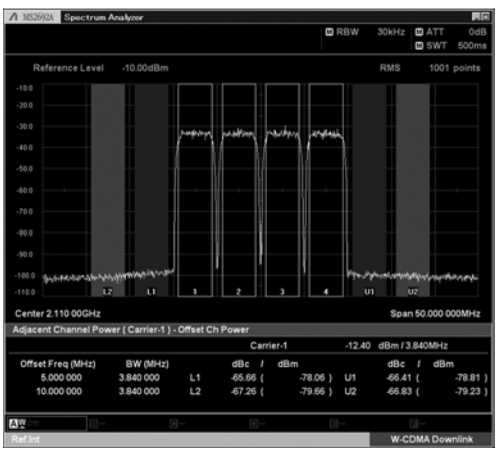
● ACLR Performance

–71 dBc/3.84 MHz @W-CDMA, TestModel1, 64DPCH, 2 GHz

Evaluation of base station amplifiers, etc., requires excellent adjacent channel leakage power (ACLR) performance. Normally, the signal from the vector signal generator is inserted to an amplifier, and the amplifier output signal ACLR characteristics, etc., are measured with a spectrum analyzer. Instruments for these measurements require high ACLR performance.



W-CDMA ACLR, 1 Carrier (TestModel1, 64DPCH)



W-CDMA ACLR, 4 Carrier (TestModel1, 64DPCH, 4 Carrier)

LTE FDD ACLR, 1 Carrier (E-TM1.1, Bandwidth 20 MHz)

● High-power Output [Opt. 041*1/071*2]

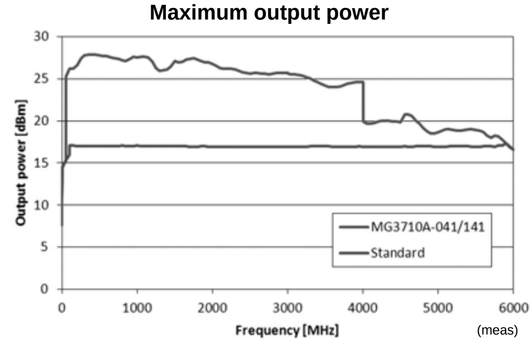
*1: High Power Extension for 1stRF [Opt. 041]
*2: High Power Extension for 2ndRF [Opt. 071]

Level Accuracy is assured at high levels (CW)

Frequency Range	Standard	Opt. 041/071
100 kHz ≤ f < 10 MHz	+5 dBm	+5 dBm
10 MHz ≤ f < 50 MHz	+10 dBm	+10 dBm
50 MHz ≤ f < 400 MHz	+13 dBm	**+20 dBm**
400 MHz ≤ f ≤ 3 GHz		**+23 dBm**
3 GHz < f ≤ 4 GHz		**+20 dBm**
4 GHz < f ≤ 5 GHz		+13 dBm
5 GHz < f ≤ 6 GHz	+11 dBm	+11 dBm

These options expand the MG3710A RF output upper limit. They are used when compensating for level losses of parts in the measurement path.

Maximum output power



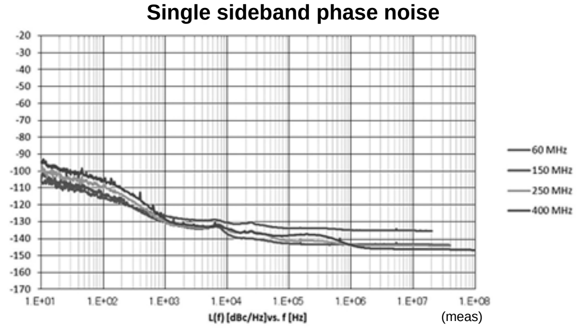
• SSB Phase Noise

<–140 dBc/Hz (nom.) @100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.) @1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.) @2 GHz, 20-kHz offset, CW

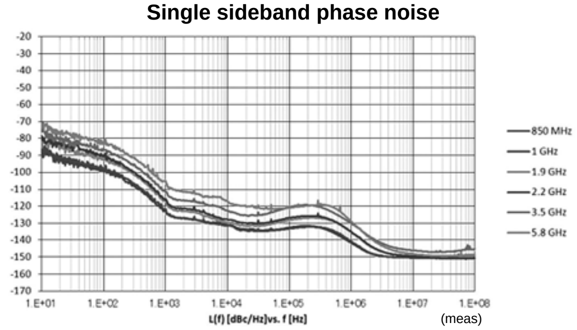
SSB phase noise is an important performance index for signal generators. For example, when using a signal generator for the following purposes, it is important to pre-confirm that the signal generator performance satisfies the measurement specifications.

- Communications with narrow bandwidth of several kHz
- OFDM Signals with narrow subcarrier gap
- CW interference waveforms

Single sideband phase noise



Single sideband phase noise



SSB Phase Noise

(Phase Noise Optimization <200 kHz, CW, Optimize S/N Off, with Opt. 002)

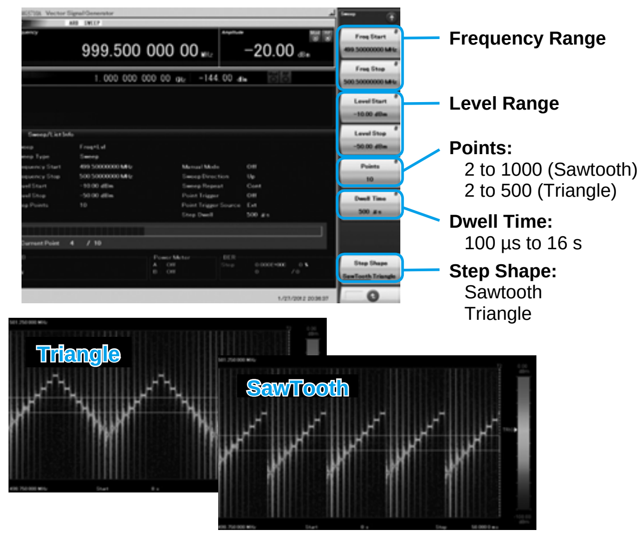
• High-speed Switching

<600 µs @List/Sweep mode

To shorten tact times on production lines the MG3710A supports two standard modes each with high-speed frequency and level switching.

Sweep Mode

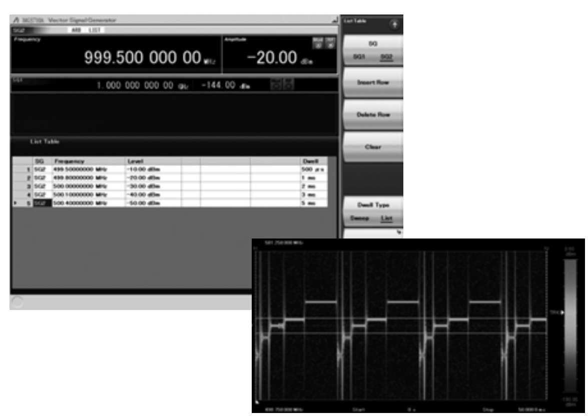
In this mode, the dwell time per point or number of points is split between the frequency range and level range (Start/Stop).
This mode is used when matching dwell time per point and frequency/level steps.



10 points, 500-µs Dwell Time

List Mode

In this mode, the frequency, level and dwell time can be set for each of up to 500 points. This mode is used when wanting to set any dwell time, and frequency/level step per point.



5 points, Any Dwell Time

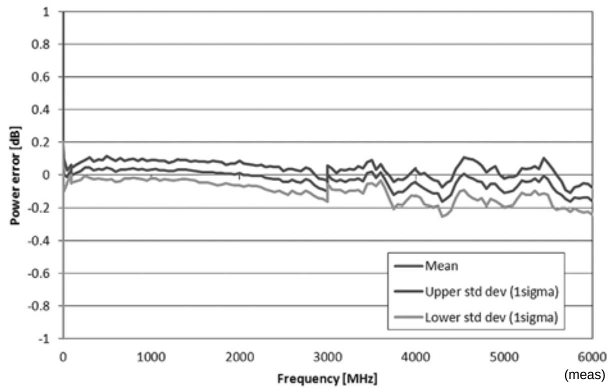
• High Level Accuracy

Absolute Level Accuracy: ±0.5 dB*1
Linearity: ±0.2 dB (typ.)*2

∗1: 400 MHz to 3 GHz, –110 to +10 dBm
∗2: 50 MHz to 3 GHz, –110 to –1 dBm

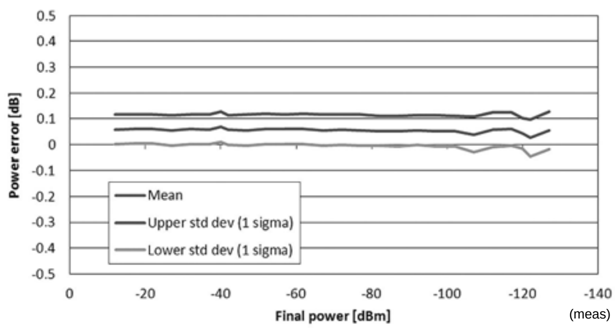
Excellent level accuracy and linearity are key factors with a large impact on measurement accuracy.

Level accuracy at –112 dBm



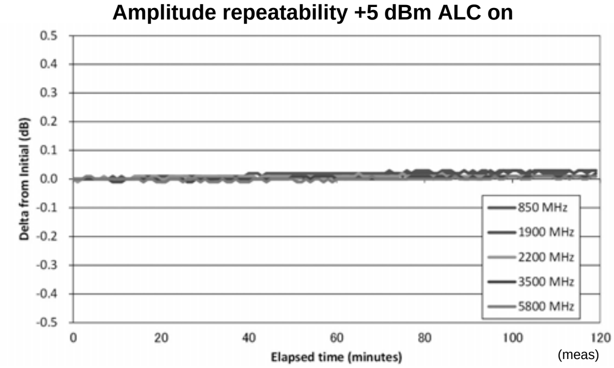
Frequency Characteristic

Relative level accuracy at 850 MHz initial power +10 dBm



Linearity

Amplitude repeatability +5 dBm ALC on



Aging

• Supports Rubidium Reference Oscillator (Option)

Three reference oscillator options are supported. Select the high-stability reference oscillator option [Opt. 002] when requiring high accuracy depending on the measurement conditions; for even higher accuracy, select the rubidium reference oscillator [Opt. 001]. However, if external high-accuracy reference signals are available, selecting the standard reference oscillator option helps reduce unnecessary costs.

• Reference Oscillator

Standard
Aging Rate: ±1 × 10^{-6}/year, ±1 × 10^{-7}/day
Temperature Stability: ±2.5 × 10^{-6} (5° to 45°C)

High Stability Reference Oscillator [Opt. 002]
Aging Rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
Temperature Stability: ±2 × 10^{-8} (5° to 45°C)
Start-up Characteristics*: ±5 × 10^{-7} (2 minutes after power-on)
±5 × 10^{-8} (5 minutes after power-on)

• Rubidium Reference Oscillator [Opt. 001]
Aging Rate: ±1 × 10^{-10}/month
Temperature Stability: ±2 × 10^{-9} (5° to 45°C)
Start-up Characteristics*: ±1 × 10^{-9} (7.5 minutes after power-on)

∗: Compared to frequency after 24-h warm-up at 23°C

High All-purpose Baseband Performance

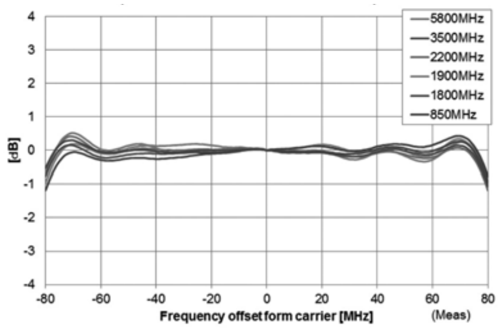
• Wide Vector Modulation Bandwidth

160 MHz* (using Internal baseband signal generator)
160 MHz (using External IQ input)

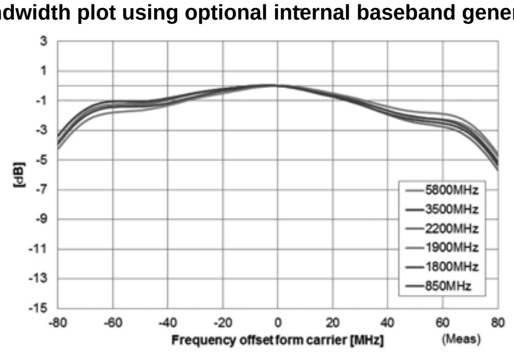
Using the standard internal baseband signal generator offers a wide vector modulation bandwidth of 160 MHz.

∗: Supports firmware version 2.00.00 and later.
The latest version can be downloaded from the Anritsu homepage.
<https://www1.anritsu.co.jp/Download/MService/Login.asp>

I/Q bandwidth plot using optional internal baseband generator (Internal Channel Corrections ON)



I/Q bandwidth plot using optional internal baseband generator



Point:

One unit supports WLAN IEEE802.11ac signal generation and output !
• Upper Frequency Limit: 6 GHz
• RF Modulation Bandwidth: 160 MHz
• Dual RF: Two RF Outputs
• Waveform Generation Software
• WLAN IQproducer (MX371011A & MX370111A-002)
The MG3710A supports output from 160-MHz bandwidth signals to non-contiguous 80 MHz + 80 MHz signals in one unit, which generally requires two signal generators.

Example: Support IEEE802.11ac signal generation and output

11ac Bandwidth	20/40/80/160 MHz	80 MHz + 80 MHz (non-contiguous)
MG3710A*1	✓	✓*2

∗1: MX370111A WLAN IQproducer and MX370111A-002 802.11ac (160 MHz) option installed. For detail, refer to the IQproducer catalog.
∗2: 2ndRF option MG3710A-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) installed.

• Large-capacity Waveform Memory

64 Msamples (256 MB) [with 1stRF, 2ndRF]
256 Msamples (1 GB) [Opt. 045*1/075*2]
1024 Msamples (4 GB) [Opt. 046*1/076*2]

∗1: ARB Memory Upgrade 256 Msample for 1stRF [Opt. 045]
ARB Memory Upgrade 1024 Msample for 1stRF [Opt. 046]
∗2: ARB Memory Upgrade 256 Msample for 2ndRF [Opt. 075]
ARB Memory Upgrade 1024 Msample for 2ndRF [Opt. 076]

Memory size is the most important specification for arbitrary waveform memory. If the memory is small, large waveform patterns cannot be handled and the number of cases when multiple waveform patterns cannot be loaded increases. When this happens, the time to reload another waveform pattern wastes evaluation time and lowers efficiency. The MG3710A has a large 64 Msamples memory as standard and this can be upgraded to either 4 times (256 Msamples) or 16 times (1024 Msamples) by adding these options.

Point:

Adding the baseband signal combine function (Opt. 048/078) supports waveform memories which can either be used separately or linked to multiply the memory size.

∗: When attempting to load a waveform pattern exceeding the size of one memory, the memories are linked automatically to load the large pattern. However, in this case, other waveform patterns cannot be loaded into any remaining free space.
When dealing with many waveform patterns, we recommend upgrading the ARB memory size. If the waveform pattern can be handled by one memory, other waveform patterns can be loaded into the remaining free space and the other memory.
The MG3710A supports a maximum waveform pattern size of 1024 Msamples.

• Free Waveform Generation

ASCII-format IQ sample data files created by other general-purpose EDA tools, such as MATLAB, can be converted into MG3710A waveform pattern files. Support for customer waveform pattern file creation makes the MG3710A ideal for R&D simulation applications too.

• Maximum Waveform Pattern Size and Required Options for Simultaneous Use

1stRF (Opt. 032/034/036)

Combination of Baseband Signal (Opt. 048)	ARB Memory Upgrade 256 Msample (Opt. 045) ARB Memory Upgrade 1024 Msample (Opt. 046)		
	W/O	With Opt. 045	With Opt. 046
W/O	64 Msamples × 1 pc	256 Msamples × 1 pc	1024 Msamples × 1 pc
With Opt. 048*2	64 Msamples × 2 pcs 128 Msamples × 1 pc	256 Msamples × 2 pcs 512 Msamples × 1 pc	1024 Msamples × 2 pcs*1

2ndRF (Opt. 062/064/066)

Combination of Baseband Signal (Opt. 078)	ARB Memory Upgrade 256 Msample (Opt. 075) ARB Memory Upgrade 1024 Msample (Opt. 076)		
	W/O	With Opt. 075	With Opt. 076
W/O	64 Msamples × 1 pc	256 Msamples × 1 pc	1024 Msamples × 1 pc
With Opt. 078*2	64 Msamples × 2 pcs 128 Msamples × 1 pc	256 Msamples × 2 pcs 512 Msamples × 1 pc	1024 Msamples × 2 pcs*1

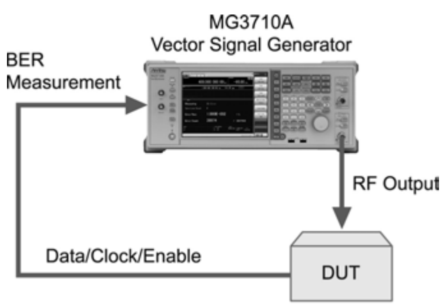
∗1: The MG3710A supports a maximum waveform pattern size of 1024 Msamples.
∗2: The Baseband Signal Combine option supports two ARB memories and can either set two different waveform patterns or combine them as one memory to support one large waveform pattern.

Expandability

• BER Test Function [Opt. 021]

This option installs a BER measurement function for measuring error rates between 100 bps and 40 Mbps using the DUT demodulated Data/Clock/Enable signals. The results are displayed on the MG3710A screen.

- Input Bit Rate: 100 bps to 40 Mbps
- Input Signal: Data, Clock, Enable
  (Polarity reversal supported)
- Input Level: TTL
- Measured Patterns:
  PN9/11/15/20/23, ALL1, ALL0,
  Alternate (0101...), User Data,
  PN9fix/11fix/15fix/20fix/23fix
- Count Mode
  Data: Measures until specified Data count
  Error: Measures until specified Error count
- Measurable Bit Count: ≤2^{32} – 1 (4,294,967,295 bits)
- Measurement Mode
  Single: Measures specified measurement bit count once
  Continuous: Repeats Single measurement
  Endless: Continues measurement to upper limit of measurement bits

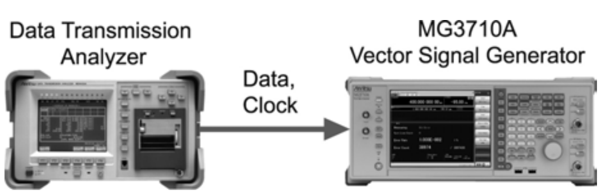


The BER can be measured using the DUT-demodulated Data/Clock/Enable.

BER Measurement Upper Limit

The table below shows one example of a BER measurement that indicates SyncLoss. Actual results depend on the specific communication systems and data rate, and will not necessarily match the measurement values below.

Error Rate	PN9	PN11	PN15	PN20	PN23
6.0%	–	–	–	–	–
5.0%	OK	–	–	–	–
4.0%	OK	OK	–	–	–
3.0%	OK	OK	OK	–	–
2.5%	OK	OK	OK	–	–
2.0%	OK	OK	OK	OK	OK
1.0%	OK	OK	OK	OK	OK

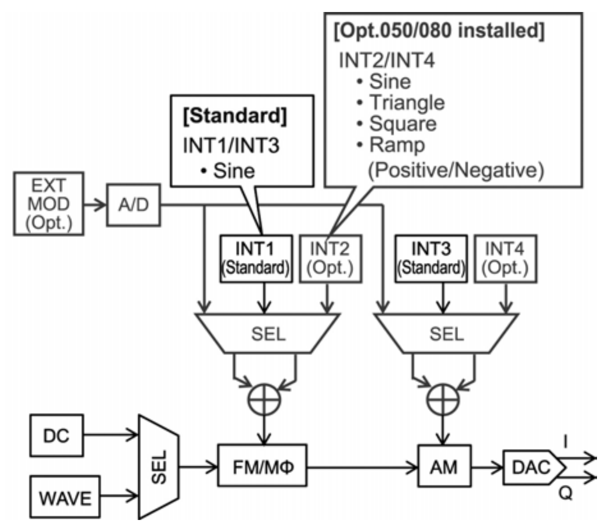


• AM/FM/ΦM/PM Function

This option supports the following modulation functions as standard. Analog modulations (AM/FM/ΦM) are performed on CW signals or arbitral (ARB) waveform pattern signals.
Pulse modulation can be performed at any cycle or timing and also supports modulation using an external input signal.

- Amplitude Modulation
  Depth: 0 to 100% (Linear)
  0 to 10 dB (Exponential)
  Modulation Frequency: 0.1 Hz to 50 MHz
- Frequency Modulation
  Deviation: 0 to 40 MHz
  Modulation Frequency: 0.1 Hz to 40 MHz, or (50 MHz-FM Rate), whichever smaller
- Φ-Modulation
  Deviation angle: 0 to 160 rad.
  or (40 MHz/ΦM Rate) rad., whichever smaller
  Modulation Frequency: 0.1 Hz to 40 MHz,
  or (40 MHz/ΦM Deviation), whichever smaller
- Pulse Modulation
  Modulation Frequency: 0.1 Hz to 10 MHz
  Modulation Period: 10 ns to 20 s
- Additional Analog Modulation Input [Opt.050/080]
  Adding additional analog modulation input options (Opt.050/080) extends to two internal modulation sources (AM/FM/ΦM) and one external modulation source supporting simultaneous two-signal modulation.
  - AM + FM
  - AM + ΦM
  - Internal 1 + Internal 2
  - Internal + External

  *: FM + ΦM does not support.

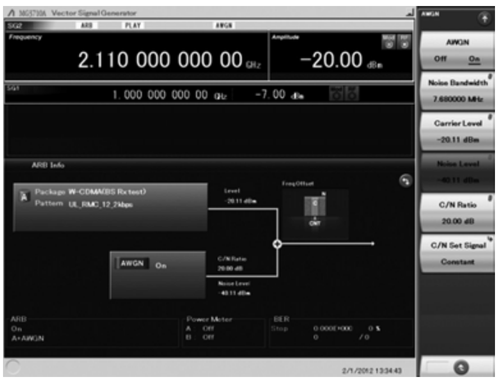


• AWGN Generator [Opt. 049*[1]/079*[2]]

*1: AWGN for 1stRF [Opt. 049]
*2: AWGN for 2ndRF [Opt. 079]

This option adds internally generated AWGN to the wanted signal. The AWGN output is switched on and off just by pressing the On/Off button.

• Absolute C/N Ratio: ≤40 dB

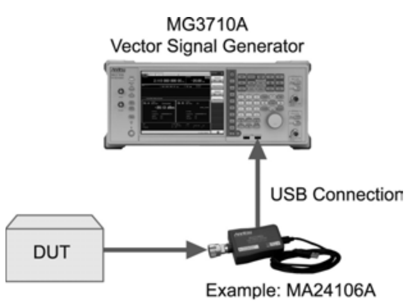


AWGN Signal Addition Screen

• USB Power Sensors [Sold separately]

Up to two USB power sensors can be connected to the MG3710A to display the measurement results on the MG3710A screen.

• USB Power Sensor
  Frequency Range: 50 MHz to 6 GHz [MA24106A]
  10 MHz to 18 GHz [MA24118A]
  10 MHz to 26 GHz [MA24126A]
  Level Offset: –100 to +100 dB
  Average: 1 to 2048
  Unit: dBm, W
  COM Port: 2 to 8



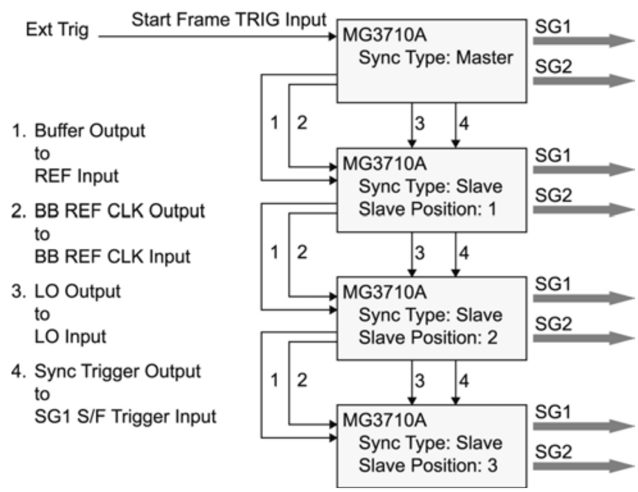
Power Meter Measurement Screen

• Local Signal I/O for MIMO Signal Source [Opt. 017]

The Sync Multi SG function shares local, baseband and trigger signals between multiple MG3710A units to output phase coherency signals synchronized with the signal output timing.
An 8×8 MIMO test system is configured easily from four MG3710A units composed of one master and three slaves.

Synchronization mode: Master, Slave, SG1 & 2
Number of Slaves: 1 to 3
Slave Position: 1 to 3
Local Synchronization: On/Off
IQ Phase Adjustment: –360 deg. to +360 deg., Resolution 0.01 deg.
IQ Delay: –400 ns to +400 ns, Resolution 1 ps

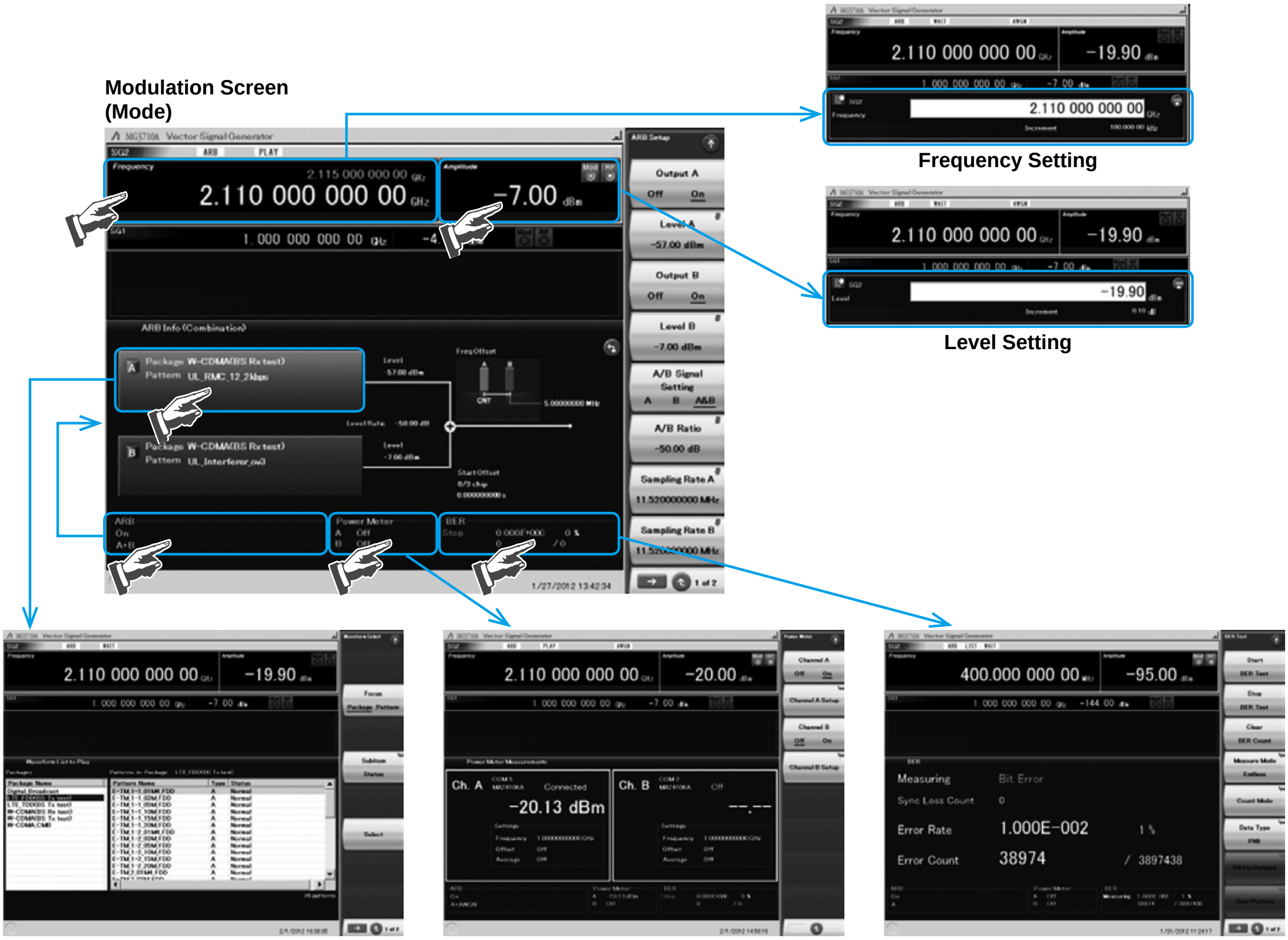
Common Setting
Number of Slaves: 3
LO Sync: On



Operability

● Easy Touch-panel Operation

Simply touching parts of the screen display with a finger fetches related function keys and numeric inputs, offering a fast and easy way of navigating through multilayer menus.



Modulation Screen (Mode)

Frequency Setting

Level Setting

Waveform Pattern Selection

Power Meter Function

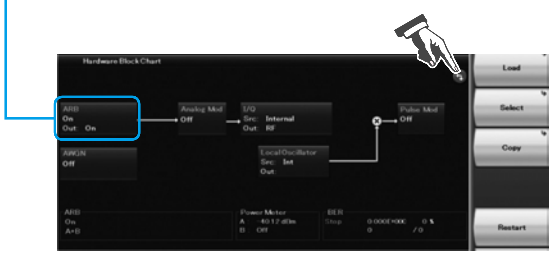
BER Function

• Two Signal Flowcharts

Pressing the on-screen button toggles instantly between the Hardware Block Chart and the ARB Info screens.

The Hardware Block Chart is a quick-and-easy way to grasp the status of each block (ARB, AWGN, I/Q, Analog Mod, Pulse Mod, Local) at a glance. The ARB Info screen displays more details about the ARB/AWGN block showing the baseband signal combine status of memory A + memory B, memory A + AWGN, etc.

ARB Info Screen



Hardware Block Chart Screen

• Frequency Channel Table

Sometimes frequencies need setting by Channel No. The built-in frequency channel table where frequencies are set by channel number is ideal for this application. Once set and saved, these pre-settings can be read whenever needed.

• Channel Table Setting
  Group: 1 to 19
  Start Channel: 0 to 20000
  End Channel: (Start Channel) to 20000
  Start Frequency
  Channel Spacing

Channel Table Setting Screen

Connection with External Equipment

• Remote Control Interfaces

The MG3710A has GPIB, Ethernet and USB interfaces as standard, supporting the following functions:

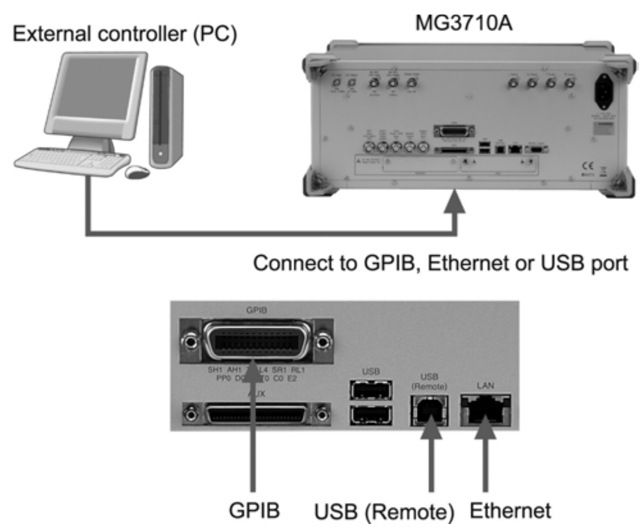
- Control all functions, except power switch
- Read all status conditions and settings
- Interrupts and serial polls

While in the Local status, the interface is determined automatically by the communication start command from the external controller (PC). To change the interface, put the MG3710A into the Local status again by pressing the Local key on the front panel and then send a command via the desired interface.

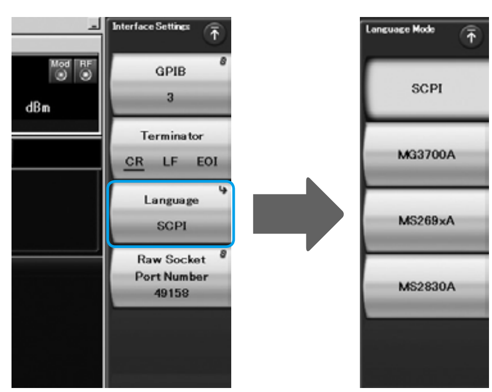
• GPIB: Conforms to IEEE488.1/IEEE488.2 standards
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2

• Ethernet: Conforms to VXI-11 protocol using TCP/IP Control programs
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0

• USB: Conforms to USBTMC-USB488 protocols
  SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0n



To remotely control the MG3710A, either select the SCPI mode command format defined by the SCPI Consortium, or select backwards compatible modes supporting earlier MG3700A, MS269xA, and MS2830A commands

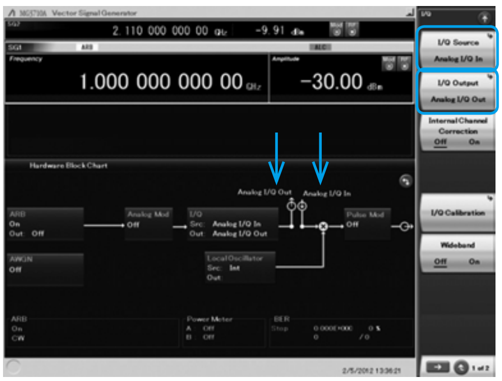


Command Format Setting Example

● USB Connections
The two type-A USB2.0 connectors on the front and rear panels support keyboard, mouse and USB memory connections.
Supported USB power sensors can be connected too.

• USB Power Sensor [Sold separately]
Frequency Range: 50 MHz to 6 GHz [MA24106A]
10 MHz to 18 GHz [MA24118A]
10 MHz to 26 GHz [MA24126A]

● Analog IQ Input/Output [Opt. 018]
This option adds analog IQ input and output connectors to the front and rear panels, respectively. It only supports SG1 (1stRF).
Input: I Input, Q Input
Output: I Output, $\overline{\text{I}}$ Output, Q Output, $\overline{\text{Q}}$ Output,



Analog IQ I/O Setting Screen

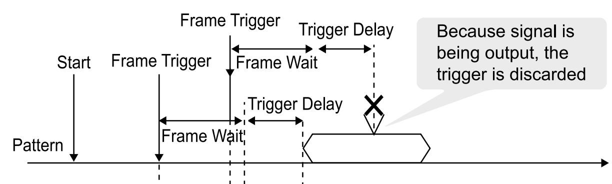
• Analog IQ Input Adjustment
Setting Range: –100 mV to +100 mV
• Analog IQ Output Adjustment
Output Voltage: 0.0 to 120.0%
In-phase DC offset: –2.5 V to +5.0 V
Differential DC offset: –50 mV to +50 mV

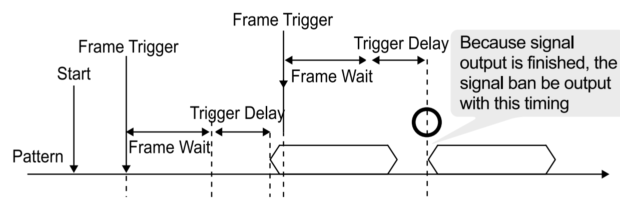
● Trigger Input
Start and Frame triggers are installed as standard for outputting waveform patterns synchronized with externally input trigger signals.

• Start Trigger Operation
At Start Trigger operation, after the waveform pattern is selected, output is started and continued by the rise timing of the first external trigger signal. Second and subsequent input external trigger signals are disabled. This is used when receiving a Start Trigger signal and reference frequency signal from the DUT at the MG3710A.

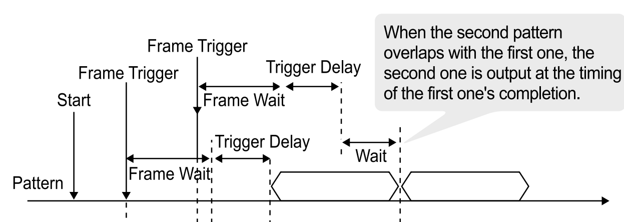
• Frame Trigger Operation
At Frame Trigger operation, one frame of the waveform pattern is output at the rise timing of the external trigger signal. When frame output is finished, the trigger wait state is returned. This is used when receiving a Frame Trigger signal from the DUT at the MG3710A.
Frame Trigger supports three operations as follows:

(1) No Retrigger
Ignores triggers received during pattern output (default setting)

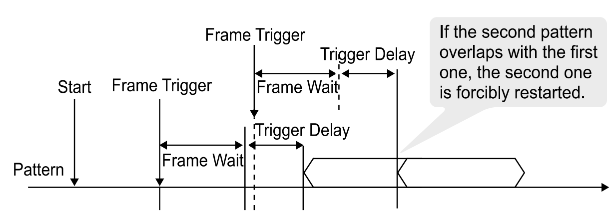




(2) Buffered Trig
Holds triggers received during pattern output until current pattern output completed and then outputs next frame



(3) Restart on Trig
Immediately restarts pattern when trigger received during pattern output

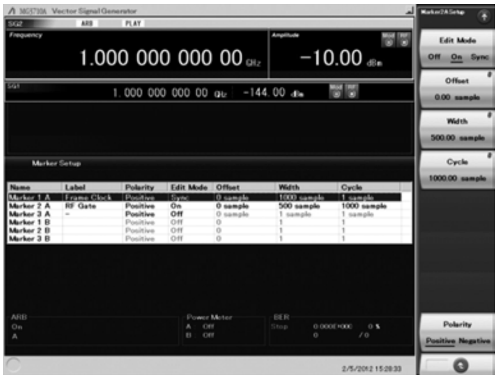


• Marker Output Editing

• Marker 1 Output [Standard]

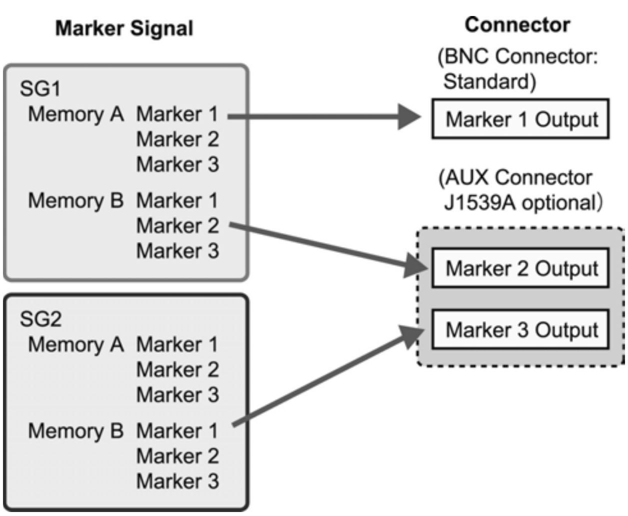
• Marker 2 & Marker 3 Output [Requires J1539A AUX Conversion Adapter]

When the Marker Setup function Edit Mode is Off, a marker signal combining the preset waveform pattern with marker information is output. When the Edit Mode is On, any marker for output can be set at the MG3710A screen. Up to 12 markers can be set for SG1/SG2, memory A/B and Marker 1 to 3.



SG2 Marker Setup Screen
Memory A (1A/2A/3A), Memory B (1B/2B/3B)

There are three output connectors: Marker 1 Output on the rear panel and the AUX connector (Marker 2 Output and Marker 3 Output). The connector output signal layout can be selected freely.



The defaults are as follows:

Marker Signal	Connector
SG1/Memory A/Marker 1	Marker 1 Output
SG1/Memory A/Marker 2	Marker 2 (@AUX)
SG1/Memory A/Marker 3	Marker 3 (@AUX)

Software Options
Waveform Patterns & License

＊ Read the "Waveform Pattern catalog" for details.

• MX370073A DFS Radar Pattern
Sets pulse signals for testing 5-GHz band WLAN DFS functions. The MX370073A supports the waveform patterns for the TELEC and FCC test specifications. Pulse signals are output simply by selecting the pattern.

• MX370075A DFS (ETSI) Waveform Pattern
Sets pulse signals for testing 5-GHz band WLAN DFS functions. The MX370075A supports the waveform patterns for the ETSI specifications. Pulse signals are output simply by selecting the pattern.

What is DFS?

5-GHz band wireless LAN devices like meteorological radar, marine radar, etc., have a Dynamic Frequency Selection (DFS) function for switching to an empty channel when detecting a radio wave. At testing, pulse, chirping and hopping signals like those used by radar are output from the SG to the WLAN equipment to check that it does not output signals in that channel.

• MX370084A ISDB-Tmm Waveform Pattern
Archive of ARIB STD-B46 waveform patterns. Supports MER and spectrum evaluation of Tx characteristics tests and sensitivity/ simple BER tests at Rx characteristics tests.

IQproducer License

IQproducer is PC application software for generating waveform patterns. The parameters are set using IQproducer and the waveform pattern is created to output the signal by selection at the MG3710A. This one software application includes all the following systems.
Since it runs on any PC, the supported functions and parameter range can be verified before purchase.
When outputting a waveform pattern from the MG3710A, no signal is output unless a license for that system is installed in the main frame.

＊ Read the "IQproducer catalog" for details.

• MX370101A HSDPA/HSUPA IQproducer
Sets parameters according to HSDPA/HSUPA (Uplink and Downlink) specifications, and generates HSDPA/HSUPA waveform patterns including Fixed Reference Channel (3GPP TS 25.101 Annex A.7).

• MX370102A TDMA IQproducer
Sets required parameters for TDMA waveform patterns and generates various waveform patterns. Setting parameters include Modulation, Frame, Slot, Data, Filter, etc. Supports wide application range including public wireless.

• MX370103A CDMA2000 1xEV-DO IQproducer
Sets parameters according to CDMA2000 1xEV-DO Forward/ Reverse specifications and generates 1xEV-DO waveform patterns.

• MX370104A Multi-carrier IQproducer
Generates multi-carrier waveform patterns combination files using MG3710A Baseband Signal Combine function (requires Opt. 048/078).

• MX370105A Mobile WiMAX IQproducer
Sets parameters according to IEEE 802.16e-2005, IEEE P802.16Rev2/D3 WirelessMAN-OFDMA MAC, PHY specifications and generates waveform patterns. Supports WirelessMAN-OFDMA specification used by 802.16e mobile standard.

• MX370106A DVB-T/H IQproducer
Sets parameters according to ETSI EN 300 744 V1.5.1 (2004-11) physical layer standard and generates DVB-T/H waveform patterns. Generated waveform patterns can be used for device TRx characteristics evaluation tests (Error Correction, BER graphics).

• MX370107A Fading IQproducer

Performs IQ channel fading processing, correlation matrix calculation, AWGN combination. Input data file created by selecting waveform pattern file created with other IQproducer software, and IQ data (ASCII) created with other general-purpose simulation tools.

• MX370108A LTE IQproducer

Generates wanted waveform patterns with parameters modified according to 3GPP TS 36.211, TS 36.212, TS 36.213 LTE FDD specifications.

• MX370108A-001 LTE-Advanced FDD Option

Installing in the MX370108A supports waveform patterns generation compliant with LTE-Advanced FDD specifications.

∗: Requires MX370108A

• MX370109A XG-PHS IQproducer

Generates wanted waveform patterns with parameters modified according to Next Generation PHS Specification PHS (XGP: eXtended Global Platform) specifications.

• MX370110A LTE TDD IQproducer

Generates wanted waveform patterns with parameters modified according to 3GPP TS 36.211, TS 36.212, TS 36.213 LTE TDD specifications.

• MX370111A WLAN IQproducer

Generates waveform patterns for IEEE Std 802.11-2007 and IEEE Std 802.11n-2009 IEEE 802.11a/b/g/j/n/p specifications.

• MX370111A-002 802.11ac (160 MHz) Option

Installing in the MX370111A supports waveform patterns generation compliant with IEEE802.11ac specifications.

∗: Requires MX370111A. Only for MG3710A.

• MX370112A TD-SCDMA IQproducer

Generates wanted waveform patterns with parameters modified according to TD-SCDMA specifications standardized by TRx characteristics evaluation tests (excluding performance tests) for 3GPP TS 25.221, TS 25.222, TS 25.223, TS 25.105, TS 25.142

• Vector Signal Generator series

Supported LTE-Advanced Carrier Aggregation Modes

Vector Signal Generator series / Carrier Aggregation Mode	Vector Signal Generator		Vector Signal Generator Option for Signal Analyzer	
	MG3710A∗1	MG3700A∗1	MS2690A series Opt.020∗2	MS2830A Opt.020/021∗2
Intra-band contiguous Carrier Aggregation	✓	✓	✓	✓
Intra-band non-contiguous Carrier Aggregation	✓	✓	✓	✓
Inter-band non-contiguous Carrier Aggregation	✓∗3, 4	✓∗3	✓∗3	✓∗3

∗1: MX370108A LTE IQproducer and MX370108A-001 LTE-Advanced FDD Option installed.
∗2: MX269908A LTE IQproducer and MX269908A-001 LTE-Advanced FDD Option installed.
∗3: Requires Two Vector Signal Generators.
∗4: One unit supports this mode when MG3710A-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) 2ndRF Option is installed.

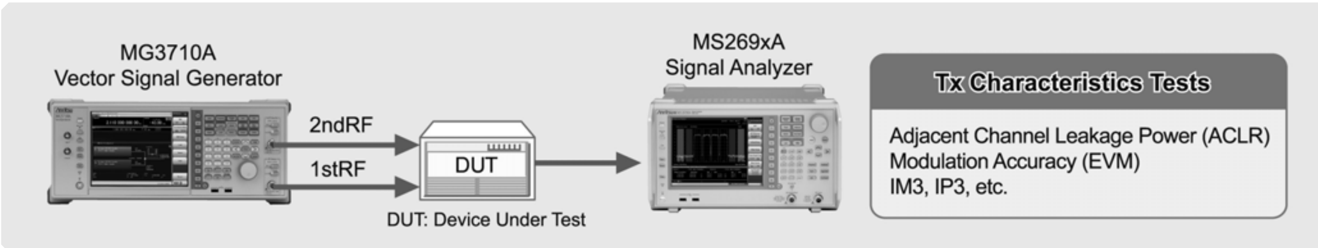
• Vector Signal Generator series

Supported WLAN IEEE802.11ac Signal Bandwidth

Vector Signal Generator / IEEE802.11ac Signal Bandwidth	Vector Signal Generator		Vector Signal Generator Option for Signal Analyzer	
	MG3710A∗1	MG3700A∗2	MS2690A series Opt.020∗3	MS2830A Opt.020/021∗3
20 MHz/40 MHz/80 MHz	✓	✓	✓	✓
160 MHz	✓	—	—	—
80 MHz + 80 MHz (non-contiguous)	✓∗4, 5	✓∗4	✓∗4	✓∗4

∗1: MX370111A WLAN IQproducer and MX370111A-002 802.11ac (160 MHz) Option installed.
∗2: MX370111A WLAN IQproducer and MX370111A-001 802.11ac (80 MHz) Option installed.
∗3: MX269911A WLAN IQproducer and MX269911A-001 802.11ac (80 MHz) Option installed.
∗4: Requires Two Vector Signal Generators.
∗5: One unit supports this mode when MG3710A-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) 2ndRF Option is installed.

Reference Signal Source for Tx Characteristics Tests of Amplifiers, etc.

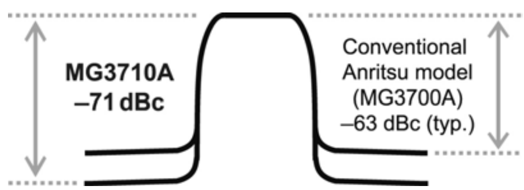


Large Measurement Margin → **Stable Measurements** / **Improves Yield**

● Supports –71 dBc* ACLR Performance

High ACLR performance increases specification margin and improves stable measurement and yield.

*: W-CDMA, TestModel1, 64DPCH, 2 GHz



Dual RF Outputs → **Cuts Costs** / **Cuts Workload**

● Supports Maximum Two RF Outputs

In general, two signal generators are required to output CW × 2 waveforms with IM3 or modulation signals with different communication methods. Not only is the cost for two signal generators high, but two separate software licenses are required to output modulation signals. In addition, setting two separate signal generators doubles the work load.

The MG3710A supports two signal generators (RF output) in one unit cutting equipment costs. And only one license is required to use modulation signals at two RF outputs.

Moreover, the frequency and level synchronization function cuts work loads.

No External Amp → **Stable Level Accuracy** / **Cuts Risk of Damage to DUT**

● High-power Output Option (Opt. 041/071) Supports CW Levels of +23 dBm

In general, an external amp is required when the output of a signal generator is insufficient, such as covering the measurement system transmission path loss and inputting high-level modulation signals for amp distortion characteristics tests. Since the output of an external amp cannot be assured, it must be checked with a power meter each time the frequency and level are changed. Moreover, when using an external amp, sometimes the DUT may be damaged by mishandling errors. The MG3710A high-power output supports signals required for measuring path loss. In addition, stable measurement is assured when used within the guaranteed setting range. And the risk of mistakenly damaging the DUT is reduced, even at the output limit.

Pre-installed Waveform Patterns → **Cuts Costs**

License-free Pre-installed Waveform Patterns
LTE FDD/TDD (E-TM1.1 to E-TM3.3), W-CDMA/HSPA, GSM, CDMA2000/1xEV-DO, WLAN 11a/b/g, Mobile WiMAX, etc.

Optional waveform generation tools are also available (license sold separately):

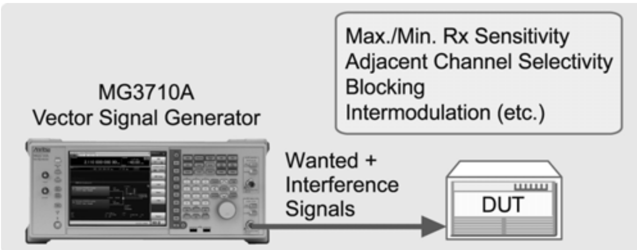
LTE FDD	(MX370108A)
LTE-Advanced FDD	(MX370108A-001)
LTE TDD	(MX370110A)
Mobile WiMAX	(MX370105A)
WLAN 11a/b/g/n/j/p	(MX370111A)
WLAN 11ac	(MX370111A-002)
TD-SCDMA	(MX370112A) (etc.)

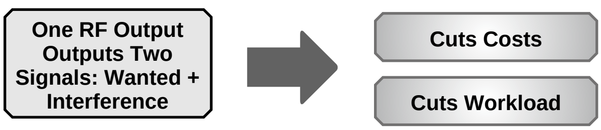
USB Power Sensor → **Efficient Equipment Investment**

Up to two USB power sensors (separately sold) can be connected to the MG3710A.
USB connectors to display the measurement results on the MG3710A screen.

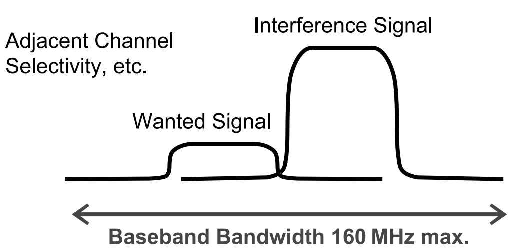
• USB Power Sensor
Frequency Range: 50 MHz to 6 GHz [MA24106A]
10 MHz to 18 GHz [MA24118A]
10 MHz to 26 GHz [MA24126A]

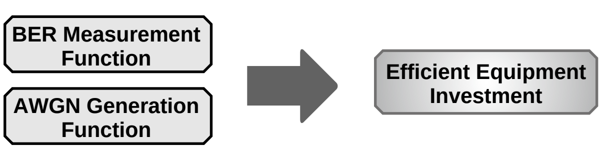
Wanted and Interference Waveforms for Rx Characteristics Evaluations of Cellular Base Station, etc.



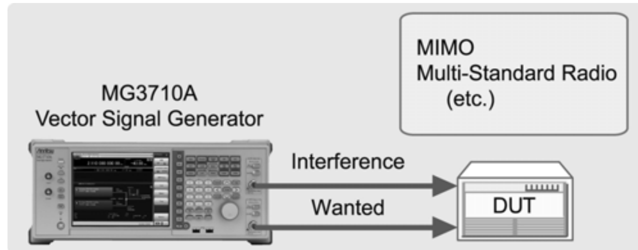


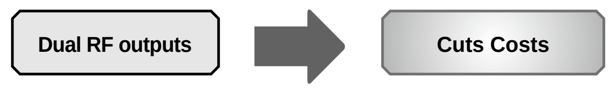
Two modulation signals can be output from one RF output using the baseband signal combine function (Opt. 048/078). The level ratio (CN = 80 dB) and the frequency offset (±80 MHz max.) can be set as well.
Tests using two modulation signals, such as Adjacent Channel Selectivity (ACS), Blocking, and Intermodulation (IM), etc., require two separate signal generators and a license for each, greatly increasing equipment costs and setting work loads.
The MG3710A has two waveform memories for each RF output for setting and outputting different waveform data. One RF outputs the combined wanted + interference signals for a baseband bandwidth. Not only are equipment costs greatly reduced, but fewer external equipment, such as couplers, level adjusters, etc., as well as less setup time are required. In comparison to previous Anritsu instruments, frequency offsets can be set for both memory A and B, and the sampling rate for memory A and B can be adjusted automatically.





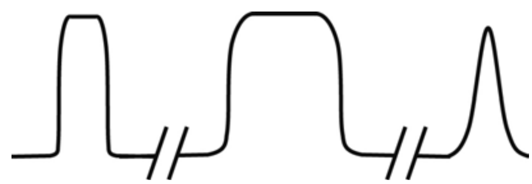
Installing the BER measurement (Opt. 021) and AWGN Generation (Opt. 049/079) options supports the extra functions required for Rx tests of each type of communications system.

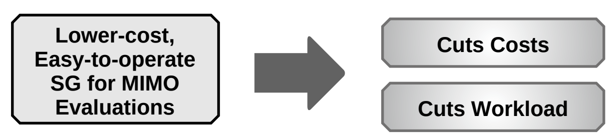




Two RF outputs can be installed as an option.
A different frequency, level and waveform pattern/CW can be set for each RF output, which is ideal for Rx tests using two signals for frequency offset that cannot be set using the baseband combine function. For example, sometimes at MSR, multiple signals must be output simultaneously in the 200-MHz band, requiring two RF outputs.

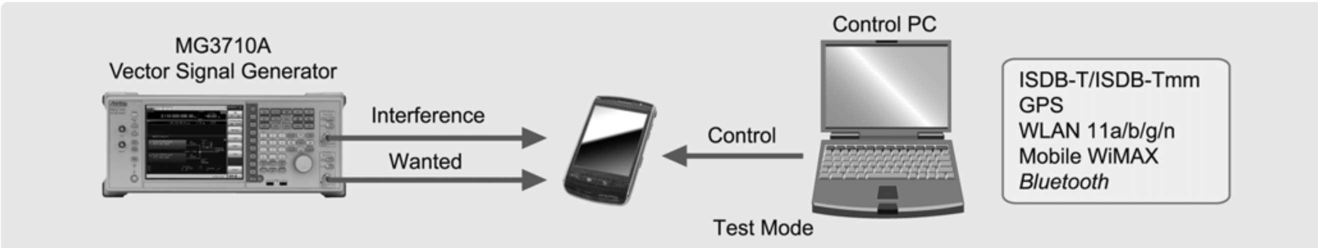
Multi-Standard Radio Rx Characteristics Tests





Installing two RF units in one MG3710A unit makes it easy to synchronize between channels. And adding the Universal Input/Output option (Opt. 017) supports Local Signal I/O for synchronizing with other MG3710A units.
The IQproducer waveform generation software can be used with one license when two RF units are installed. For example, for LTE 2×2 MIMO tests, LTE IQproducer can generate two patterns for the Tx antenna signals and Fading IQproducer can generate two patterns with spatial multiplexing for the Rx antennas. Previously, using two signal generators required two separate licenses for LTE and fading, but now only one license is required to use IQproducer with the MG3710A with two RF units installed, helping cut software costs too.

Rx Sensitivity Tests for Multi-system Mobile Terminals, etc.



Large 4-GB Memory Max. → **Reduces Reload Times** / **Cuts Test Times**

The MG3710A can save up to 1024 Msamples (4 GB) per RF. Memory size is one of the most important specifications for an arbitrary waveform signal generator. Small memory cannot save multiple waveform data and requires time-wasting reloading and measurement to output different signals each time.

With large waveform memory
- Switch loaded waveform data instantaneously
- Load multiple test waveforms
  → Reduce number of reloads → Cuts times

Pre-installed Waveform Patterns → **Cuts Costs**

License-free Pre-installed Waveform Patterns

WLAN 11a/b/g, Bluetooth, GPS, etc.

The following waveform patterns are available as options.

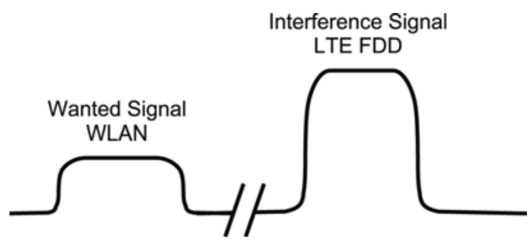
ISDB-Tmm	(MX370084A)

Optional waveform generation tools are also available (license separately sold):

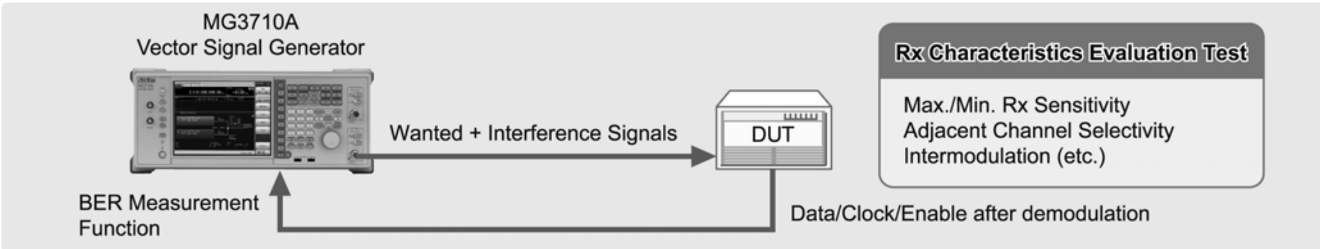
DVB-T/H	(MX370106A)
Mobile WiMAX	(MX370105A)
WLAN 11a/b/g/n/j/p	(MX370111A)
WLAN 11ac	(MX370111A-002)

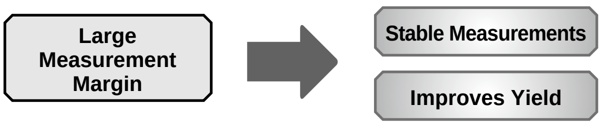
Dual RF outputs → **Cuts Costs**

Two RF outputs can be installed as an option.
Additionally, two RF output models with different frequencies can be installed. For example, if WLAN 11b/g are the wanted waveforms, mobile signals for LTE FDD, LTE TDD, W-CDMA, GSM, etc., are considered interference signals. Generally, these tests have high hardware and software costs because two separate signal generators are required. Using the MG3710A, the total investment costs for interference tests under simulated service conditions, such as WLAN + LTE FDD, or ISDB-T + W-CDMA, are reduced by selecting models with different frequencies for the 1stRF and 2ndRF outputs.



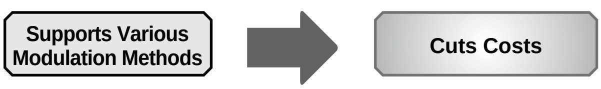
Rx Characteristics Evaluation Tests for Digital Narrowband Communications, Public Safety, etc.





Supports SSB Phase Noise Performance –140 dBc/Hz nom. (@100 MHz)
Phase noise performance affects measurement results at narrow bandwidths of several kHz. In particular, high phase-noise performance is required for interference waveforms.
Improved SSB phase noise supports wider specification margins and stable measurements to improve yields.

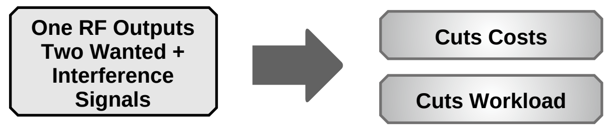
<–140 dBc/Hz (nom.)	@100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.)	@1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.)	@2 GHz, 20-kHz offset, CW



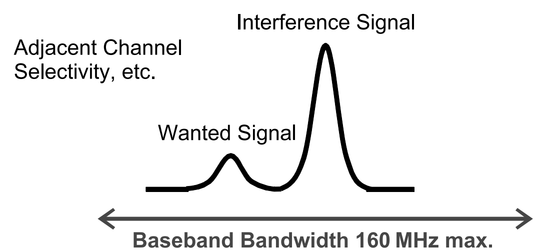
TDMA IQproducer [MX370102A] Supports Following Modulation Methods

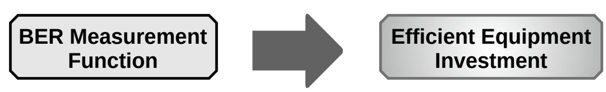
BPSK, DBPSK, PI/2DBPSK, QPSK, DQPSK, PI/4DQPSK, 8PSK, D8PSK, 16QAM, 32QAM, 256QAM, ASK, 2FSK, 4FSK,

The TDMA IQproducer PC software generates waveform patterns with any frame format or filter settings. One software package supports various narrowband digital communications.



Two modulation signals can be output from one RF output using the baseband signal combine function (Opt. 048/078). The level ratio (CN = 80 dB) and the frequency offset (±80 MHz max.) can be set as well. Usually, tests using two modulation signals, such as adjacent channel selectivity (ACS) and intermodulation characteristics (IM) require two signal generators as well as a software license for each signal generator.
The MG3710A has two waveform memories for each RF output for setting and outputting different waveform data. One RF outputs the combined wanted + interference signals for a baseband bandwidth. Not only are equipment costs greatly reduced, but fewer external equipment, such as couplers, level adjusters, etc., as well as less setup time are required.





Supports BER Measurement Function [Opt. 021]
The BER can be measured using the DUT-demodulated Data/Clock/Enable. The measurement results are displayed on the MG3710A screen.

- Input Bit Rate: 100 bps to 40 Mbps

Specifications

• Frequency Setting Range

• 1stRF
MG3710A-032 9 kHz to 2.7 GHz
MG3710A-034 9 kHz to 4 GHz
MG3710A-036 9 kHz to 6 GHz

• 2ndRF
MG3710A-062 9 kHz to 2.7 GHz
MG3710A-064 9 kHz to 4 GHz
MG3710A-066 9 kHz to 6 GHz

• Switching Speed (List Mode)
Frequency ≤600 µs
Level ≤600 µs

• Amplitude Setting Range

Options	Setting Range [dBm] without Reverse Power Protection	Setting Range [dBm] with Reverse Power Protection
Standard	–110 to +17	–110 to +17
with High-power Extension	–110 to +30	–110 to +25
with Low-power Extension	–144 to +17	–144 to +17
with High-power Extension and Low-power Extension	–144 to +30	–144 to +25

Level Accuracy is assured at high levels (CW)

Frequency Range	Standard	Opt. 041/071
100 kHz ≤ f < 10 MHz	+5 dBm	+5 dBm
10 MHz ≤ f < 50 MHz	+10 dBm	+10 dBm
50 MHz ≤ f < 400 MHz	+13 dBm	**+20 dBm**
400 MHz ≤ f ≤ 3 GHz		**+23 dBm**
3 GHz < f ≤ 4 GHz		**+20 dBm**
4 GHz < f ≤ 5 GHz		+13 dBm
5 GHz < f ≤ 6 GHz	+11 dBm	+11 dBm

• Absolute Level Accuracy
(at CW, 18° to 28°C, –110 to +5 dBm)
±0.5 dB (typ.) (100 kHz ≤ f < 50 MHz)
±0.5 dB (50 MHz ≤ f ≤ 3 GHz)
±0.7 dB (3 GHz < f ≤ 4 GHz)
±0.8 dB (4 GHz < f ≤ 6 GHz)

• Harmonics
<–30 dBc

• Non-Harmonics
Output level ≤+5 dBm, CW, Frequency offset ≥10 kHz
<–62 dBc (100 kHz ≤ f ≤ 187.5 MHz)
<–68 dBc (187.5 MHz < f ≤ 750 MHz)
<–62 dBc (750 MHz < f ≤ 1.5 GHz)
<–56 dBc (1.5 GHz < f ≤ 3 GHz)
<–50 dBc (3 GHz < f ≤ 6 GHz)

• Single Sideband Phase Noise (at CW, 20 kHz offset)
<–140 dBc/Hz (nom.) (100 MHz)
<–131 dBc/Hz (typ.) (1 GHz)
<–125 dBc/Hz (typ.) (2 GHz)

• Analog Modulation

• Amplitude Modulation
Depth: 0 to 100% (Linear)
0 to 10 dB (Log)
Modulation Frequency: 0.1 Hz to 50 MHz

• Frequency Modulation
Deviation: 0 Hz to 40 MHz
Modulation Frequency: 0.1 Hz to 40 MHz, or (50-MHz FM Rate), whichever smaller

• Φ-Modulation
Deviation angle: 0 to 160 rad., or (40 MHz/ΦM Rate) rad., whichever smaller
Modulation Frequency: 0.1 Hz to 40 MHz, or (40 MHz/ΦM Deviation), whichever smaller

• Pulse Modulation
Modulation Frequency: 0.1 Hz to 10 MHz
Modulation Period: 10 ns to 20 s

• Baseband Performance

• RF Modulation Bandwidth
160 MHz* (using Internal baseband signal generator)
*: Supports firmware version 2.00.00 and later.

• ARB Memory Size
64 Msamples (256 MB) [with 1stRF, 2ndRF]
256 Msamples (1 GB) [Opt. 045/075]
1024 Msamples (4 GB) [Opt. 046/076]

• Sampling Rate
20 kHz to 200 MHz*
*: Supports firmware version 2.00.00 and later.

• DAC Resolution
14/15/16 bits

• EVM Performance
≤0.6%rms (typ.) (W-CDMA, TestModel4)
≤0.8° rms (typ.) (GSM)
≤0.8%rms (typ.) (EDGE)
≤0.8%rms (typ.) (LTE TestModel3.1)

• Dimensions, Weight
177 (H) × 426 (W) × 390 (D) mm
≤13.7 kg (with 1stRF, excluding other option)

• Power Requirements
100 V(ac) to 120 V(ac), 200 V(ac) to 240 V(ac)
50 Hz to 60 Hz

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	- Main frame -
MG3710A	Vector Signal Generator
	- Standard accessories -
	Power Cord: 1 pc
P0031A	USB Memory (USB2.0 Flash Driver, ≥256 MB)
	Install CD-ROM [Operation manual (PDF) and application software (IQproducer)]
	- Options -
	(Common Parts)
MG3710A-001	Rubidium Reference Oscillator[*1] (Aging rate: ±1 × 10^{-10}/month)
MG3710A-002	High Stability Reference Oscillator[*1] (Aging rate: ±1 × 10^{-7}/year)
MG3710A-011	2ndary HDD[*1] (Spare HDD for saving user data without Windows OS)
MG3710A-017	Universal Input/Output[*1] [Adds BNC connectors for following signals to rear panel of main frame, includes J1539A AUX Conversion Adapter (Baseband Reference Clock Input/Output, Sweep Output, Local Signal Input/Output)]
MG3710A-021	BER Test Function[*1] (Built-in BER measurement, Bit Rate: 100 bps to 40 Mbps J1539A AUX Conversion Adapter required for Data/Clock/Enable signal input)
MG3710A-029	OS Upgrade to Windows 7[*1] (Upgrades MG3710A OS to Windows 7 (32 bit, Professional) (retrofit not supported))
MG3710A-101	Rubidium Reference Oscillator Retrofit[*2]
MG3710A-102	High Stability Reference Oscillator Retrofit[*2]
MG3710A-111	2ndary HDD Retrofit[*2]
MG3710A-117	Universal Input/Output Retrofit[*2]
MG3710A-121	BER Test Function Retrofit[*2]
MG3710A-313	Removable HDD [Spare HDD for storing user data with Windows OS MG3710A with Opt. 029 (Windows 7) cannot apply Opt. 313.]
	(For 1stRF)
MG3710A-032	1stRF 100 kHz to 2.7 GHz[*1, 3]
MG3710A-034	1stRF 100 kHz to 4 GHz[*1, 3]
MG3710A-036	1stRF 100 kHz to 6 GHz[*1, 3]
MG3710A-041	High Power Extension for 1stRF[*1] (Increases upper limit of output signal power setting range)
MG3710A-042	Low Power Extension for 1stRF[*1] (Increases lower limit of output signal power setting range)
MG3710A-043	Reverse Power Protection for 1stRF[*1] (Prevents damage caused by reverse input to output connector)
MG3710A-045	ARB Memory Upgrade 256 Msample for 1stRF[*1] (Expands ARB memory capacity)
MG3710A-046	ARB Memory Upgrade 1024 Msample for 1stRF[*1] (Expands ARB memory capacity)
MG3710A-048	Combination of Baseband Signal for 1stRF[*1] (Adds baseband combine function)
MG3710A-049	AWGN for 1stRF[*1] (Adds AWGN combine function)
MG3710A-050	Additional Analog Modulation Input for 1stRF[*1] (Adds BNC connector for inputting external signals to rear panel of mainframe)
MG3710A-018	Analog IQ Input/Output[*1] (Installs IQ input/output BNC connector in main frame)
MG3710A-141	High Power Extension for 1stRF Retrofit[*2]
MG3710A-142	Low Power Extension for 1stRF Retrofit[*2]
MG3710A-143	Reverse Power Protection for 1stRF Retrofit[*2]
MG3710A-145	ARB Memory Upgrade 256 Msample for 1stRF Retrofit[*2]
MG3710A-146	ARB Memory Upgrade 1024 Msample for 1stRF Retrofit[*2]
MG3710A-148	Combination of Baseband Signal for 1stRF Retrofit[*2]
MG3710A-149	AWGN for 1stRF Retrofit[*2]
MG3710A-150	Additional Analog Modulation Input for 1stRF Retrofit[*2]
MG3710A-118	Analog IQ Input/Output Retrofit[*2]

Model/Order No.	Name
	(For 2ndRF)
MG3710A-062	2ndRF 100 kHz to 2.7 GHz[*1, 4]
MG3710A-064	2ndRF 100 kHz to 4 GHz[*1, 4]
MG3710A-066	2ndRF 100 kHz to 6 GHz[*1, 4]
MG3710A-071	High Power Extension for 2ndRF[*1] (Increases upper limit of output signal power setting range)
MG3710A-072	Low Power Extension for 2ndRF[*1] (Increases lower limit of output signal power setting range)
MG3710A-073	Reverse Power Protection for 2ndRF[*1] (Prevents damage caused by reverse input to output connector)
MG3710A-075	ARB Memory Upgrade 256 Msample for 2ndRF[*1] (Expands ARB memory capacity)
MG3710A-076	ARB Memory Upgrade 1024 Msample for 2ndRF[*1] (Expands ARB memory capacity)
MG3710A-078	Combination of Baseband Signal for 2ndRF[*1] (Adds baseband combine function)
MG3710A-079	AWGN for 2ndRF[*1] (Adds AWGN combine function)
MG3710A-080	Additional Analog Modulation Input for 2ndRF[*1] (Adds BNC connector for inputting external signals to rear panel of mainframe)
MG3710A-162	2ndRF 100 kHz to 2.7 GHz Retrofit[*2, 5]
MG3710A-164	2ndRF 100 kHz to 4 GHz Retrofit[*2, 5]
MG3710A-166	2ndRF 100 kHz to 6 GHz Retrofit[*2, 5]
MG3710A-171	High Power Extension for 2ndRF Retrofit[*2]
MG3710A-172	Low Power Extension for 2ndRF Retrofit[*2]
MG3710A-173	Reverse Power Protection for 2ndRF Retrofit[*2]
MG3710A-175	ARB Memory Upgrade 256 Msample for 2ndRF Retrofit[*2]
MG3710A-176	ARB Memory Upgrade 1024 Msample for 2ndRF Retrofit[*2]
MG3710A-178	Combination of Baseband Signal for 2ndRF Retrofit[*2]
MG3710A-179	AWGN for 2ndRF Retrofit[*2]
MG3710A-180	Additional Analog Modulation Input for 2ndRF Retrofit[*2]
	- Maintenance service -
MG3710A-ES210	2 Years Extended Warranty Service
MG3710A-ES310	3 Years Extended Warranty Service
MG3710A-ES510	5 Years Extended Warranty Service
	- Softwares -
	(Waveform pattern)
MX370073A	DFS Radar Pattern [WLAN 5.3/5.6 GHz band DFS tests (for TELEC and FCC) waveform pattern, license for main frame, manual (PDF)]
MX370075A	DFS (ETSI) Waveform Pattern [WLAN 5.3/5.6 GHz DFS test (ETSI) waveform pattern, license for main frame, manual (PDF)]
MX370084A	ISDB-Tmm Waveform Pattern [ISDB-Tmm Waveform Patterns, license for main frame, manual (PDF)]
	(IQproducer)
MX370101A	HSDPA/HSUPA IQproducer[*6]
MX370102A	TDMA IQproducer[*6]
MX370103A	CDMA2000 1xEV-DO IQproducer[*6]
MX370104A	Multi-carrier IQproducer[*6]
MX370105A	Mobile WiMAX IQproducer[*6]
MX370106A	DVB-T/H IQproducer[*6]
MX370107A	Fading IQproducer[*6]
MX370108A	LTE IQproducer[*6]
MX370108A-001	LTE-Advanced FDD Option[*6] (Requires MX370108A)
MX370109A	XG-PHS IQproducer[*6]
MX370110A	LTE TDD IQproducer[*6]
MX370111A	WLAN IQproducer[*6]
MX370111A-002	802.11ac (160 MHz) Option[*6] (Only for MG3710A. Requires MX370111A)
MX370112A	TD-SCDMA IQproducer[*6]

*1: Select when ordering main frame
*2: Retrofitted to shipped MG3710A
*3: Select 1stRF frequency range, frequency cannot be changed after installation
*4: Select 2ndRF frequency range, frequency cannot be changed after installation
*5: Retrofitted to shipped MG3710A when 2ndRF not installed
*6: IQproducer software, license for main frame, manual (PDF)

Model/Order No.	Name
	- Optional accessories -
W3580AE	MG3710A/MG3740A Operation Manual (Main Unit) [Booklet, for MG3710A/MG3740A Main Frame (Operation, Remote Control)]
W2496AE	MG3710A/MG3740A Operation Manual (IQproducer) [Booklet, for IQproducer (Operation for Common Parts)]
W3581AE	MG3710A Operation Manual (Pre-installed Waveform Patterns) [Booklet, for Pre-installed Waveform Patterns (Usage, Detailed Parameters)]
W3596AE	MX370073A Operation Manual [Booklet, for DFS (TELEC and FCC) Waveform Patterns]
W3597AE	MX370075A Operation Manual [Booklet, for DFS (ETSI) Waveform Patterns]
W3508AE	MX370084A Operation Manual (Booklet, for ISDB-Tmm Waveform Patterns)
W2915AE	MX370101A Operation Manual (Booklet, for HSDPA/HSUPA IQproducer)
W2916AE	MX370102A Operation Manual (Booklet, for TDMA IQproducer)
W2505AE	MX370103A Operation Manual (Booklet, for CDMA2000 1xEV-DO IQproducer)
W2917AE	MX370104A Operation Manual (Booklet, for Multi-carrier IQproducer)
W2918AE	MX370105A Operation Manual (Booklet, for Mobile WiMAX IQproducer)
W2798AE	MX370106A Operation Manual (Booklet, for DVB-T/H IQproducer)
W2995AE	MX370107A Operation Manual (Booklet, for Fading IQproducer)
W3023AE	MX370108A Operation Manual (Booklet, for LTE IQproducer/LTE-Advanced FDD Option)
W3153AE	MX370109A Operation Manual (Booklet, for XG-PHS IQproducer)
W3221AE	MX370110A Operation Manual (Booklet, for LTE TDD IQproducer)
W3488AE	MX370111A Operation Manual (Booklet, for WLAN IQproducer/802.11ac Option)
W3582AE	MX370112A Operation Manual (Booklet, for TD-SCDMA IQproducer)
J1539A	AUX Conversion Adapter (Converts MG3710A rear-panel AUX connector to BNC connector)
Z1594A	Standard Waveform Pattern for Backup (Latest MG3710A Pre-installed waveform pattern set for backup)
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini-B Cable)
MA24118A	USB Power Sensor (10 MHz to 18 GHz, with USB A to mini-B Cable)
MA24126A	USB Power Sensor (10 MHz to 26 GHz, with USB A to mini-B Cable)
K240B	Power Divider (K connector) (DC to 26.5 GHz, K-J, 50Ω, 1 Wmax)
MA1612A	Four-Port Junction Pad (5 MHz to 3 GHz, N-J)
MP752A	Termination (DC to 12.4 GHz, 50Ω, N-P)
MA2512A	Band Pass Filter (For W-CDMA, passband: 1.92 GHz to 2.17 GHz)
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2.0 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1.0 m (BNC-P · RG-58A/U · BNC-P)
J0127B	Coaxial Cord, 2.0 m (BNC-P · RG-58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG-58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322B	Coaxial Cord, 1.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322C	Coaxial Cord, 1.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322D	Coaxial Cord, 2.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0004	Coaxial Adapter (N-P · SMA-J Conversion Adapter, DC to 12.4 GHz)
J1261B	Ethernet Cable (Shield Type) (Straight-through, 3 m)
J1261D	Ethernet Cable (Shield Type) (Crossover, 3 m)
J0008	GPIB Cable, 2.0 m
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636A	Carrying Case (Hard Type, With Casters)
B0645A	Soft Carrying Case (Soft Type)
Z0975A	Keyboard (USB)
Z0541A	USB Mouse

Typical (typ.): Performance not warranted. Must products meet typical performance.
Nominal (nom.): Values not warranted. Included to facilitate application of product.
Measured (meas): Performance not warranted. Data actually measured by randomly selected measuring instruments.

VECTOR SIGNAL GENERATOR

MG3700A

250 kHz to 3 GHz, 250 kHz to 6 GHz (Option)

Remote Control
GPIB | Ethernet

Supports the Evaluation of Wireless Communications Evolving into the 4th Generation

Excellent Eco Product

The MG3700A Vector Signal Generator is based on a 160 MHz arbitrary waveform generator, including a wide vector modulation bandwidth and large-capacity baseband memory.
The MG3700A supports digital modulation signals for a wide range of wireless systems, supporting evaluation of general-purpose mobile communications, such as mobile phones as well as wireless LANs. Anritsu's IQproducer software can create waveform data for transfer to the MG3700A via 100BASE-TX Ethernet.
In addition, IQ sample data files (ASCII) created using general Electronic Design Automation (EDA) tools such as MATLAB can also be converted to waveform patterns for the MG3700A.

Performance and Functions

- **Frequency Range**
  250 kHz to 3 GHz (Standard), 250 kHz to 6 GHz (Option)
- **Wide Vector Modulation Bandwidth**
  120 MHz (Internal baseband generator)
  150 MHz (External IQ input)
- **High Level Accuracy**
  ±0.5 dB (Absolute level accuracy)
  ±0.2 dB (typ.) (Linearity)
- **High-speed Waveform Transfer over 100BASE-TX Ethernet**
- **Built-in 40 GB Hard Disk**
- **Large-capacity Baseband Memory**
  1 GB = 256 Msamples/channel (Standard)
  2 GB = 512 Msamples/channel (Option)
- **Waveform Addition Function**
  Adds and outputs two signals, such as wanted signal + interference signal or wanted signal + AWGN
- **Built-in Standard 20 Mbps BERT Analyzer**
  1 kbps to 20 Mbps (Standard)
  100 bps to 120 Mbps (Option)

Supports Various Communication Systems*1

- **Waveform Patterns**

Waveform patterns for communication systems bundled as standard:
W-CDMA/HSDPA, GSM/EDGE, CDMA2000 1X/1xEV-DO
Wireless LAN (IEEE802.11a/b/g), PDC, PHS, AWGN,
Bluetooth, GPS, Digital Broadcast (ISDB-T, BS, CS, CATV)

- **Optional Waveform Patterns**

Waveform patterns for the following communication systems are offered as options:
TD-SCDMA
Public Radio System (RCR STD-39, ARIB STD-T61/T79/T86)
DFS (TELEC, FCC, ETSI)

- **IQproducer Waveform Generation Software (Optional software license)**

IQproducer is GUI-based PC application software for changing parameters and generating waveform patterns in compliance with the following system standards:
W-CDMA, AWGN, HSDPA/HSUPA*2, TDMA*2, CDMA2000 1xEV-DO*2, Multi-carrier*2, Mobile WiMAX*2, DVB-T/H*2, Fading*2, Next generation PHS (XGP)*2, LTE FDD*2, LTE TDD*2, WLAN*2, TD-SCDMA*2

*1: Read the MX3701xxA series Software Catalog for details.
*2: A license key must be installed in the main frame.

- MATLAB® is a registered trademark of The MathWorks, Inc.
- CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).
- *Bluetooth*® and related logomarks are owned by Bluetooth SIG, Inc. and are used by Anritsu under license.
- WiMAX® is a trademark or registered trademark of WiMAX Forum.
- IQproducer™ is a registered trademark of Anritsu Corporation.
- Other companies, product names and service names are registered trademarks of their respective companies.

• High Level Accuracy

Absolute level accuracy:

±0.5 dB (≥–120 dBm 25 MHz ≤fc ≤3 GHz, E-ATT*)
±0.8 dB (≥–120 dBm 3 GHz <fc ≤6 GHz, E-ATT*)
±0.5 dB (≥–120 dBm 25 MHz ≤fc ≤3 GHz, M-ATT*)
±0.8 dB (≥–100 dBm 3 GHz <fc ≤6 GHz, M-ATT*)

*: E-ATT: Electronic attenuator, M-ATT: Mechanical attenuator

• Wide Vector Modulation Bandwidth

An RF modulation bandwidth of 120 MHz is available when using internal baseband signal generation.
The modulation bandwidth of 150 MHz can be achieved when using external IQ input.
Both bandwidths are supported up to 6 GHz.

• High-speed Transfer over 100BASE-TX Ethernet

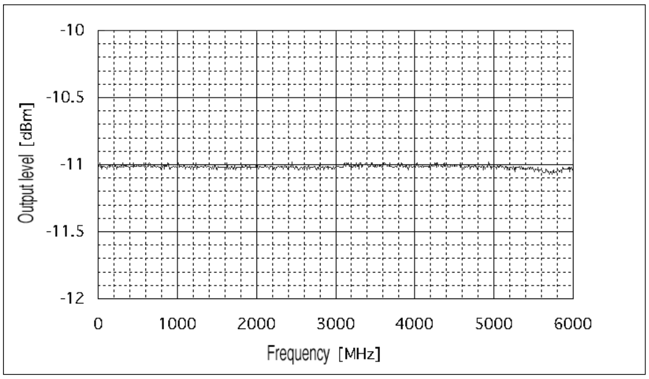
Wideband high-speed communication systems require transmission of long waveform patterns. To transfer long patterns at high speed, the MG3700A supports 100BASE-TX LAN connections. When the waveform patterns of two or more MG3700A systems must be updated, waveform data can be transferred simultaneously to all MG3700A units over the LAN, shortening update times.

• Built-in 40 GB Hard Disk

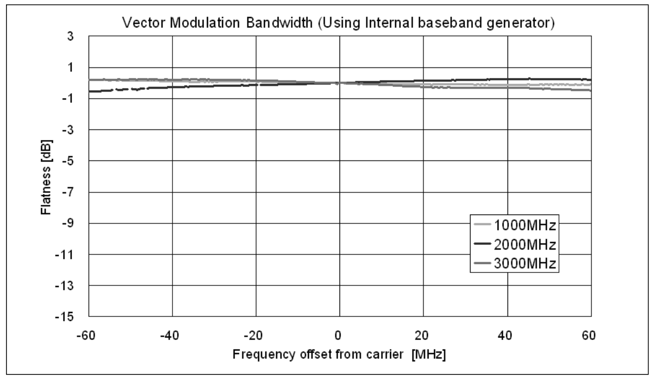
Various large-capacity waveform patterns and MG3700A parameters can be saved the built-in 40 GB hard disk. The transfer speed between the hard disk and waveform memory is fast (14 MB/s, typ.). If the hard disk fails, it can be changed using the optional HDD ASSY.

• Up to 2 GB Waveform Memory

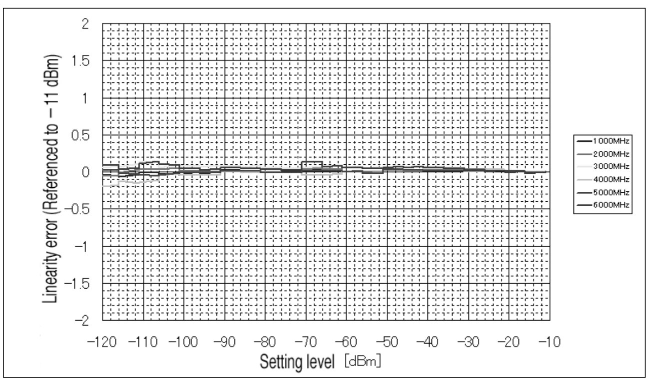
The large-capacity waveform memory can save many waveform patterns.
Waveform patterns are read from the hard disk and saved to memory for instant output without accessing the hard disk again.



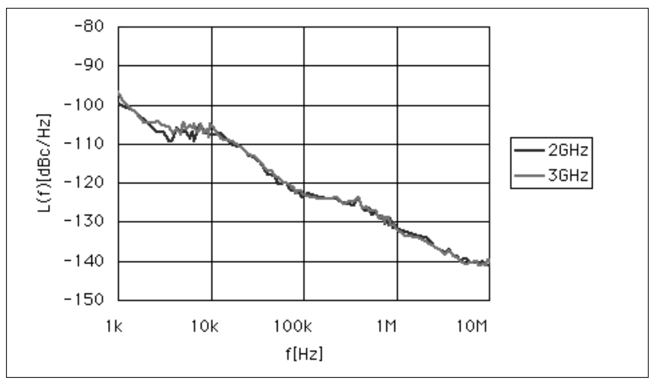
Frequency Characteristic



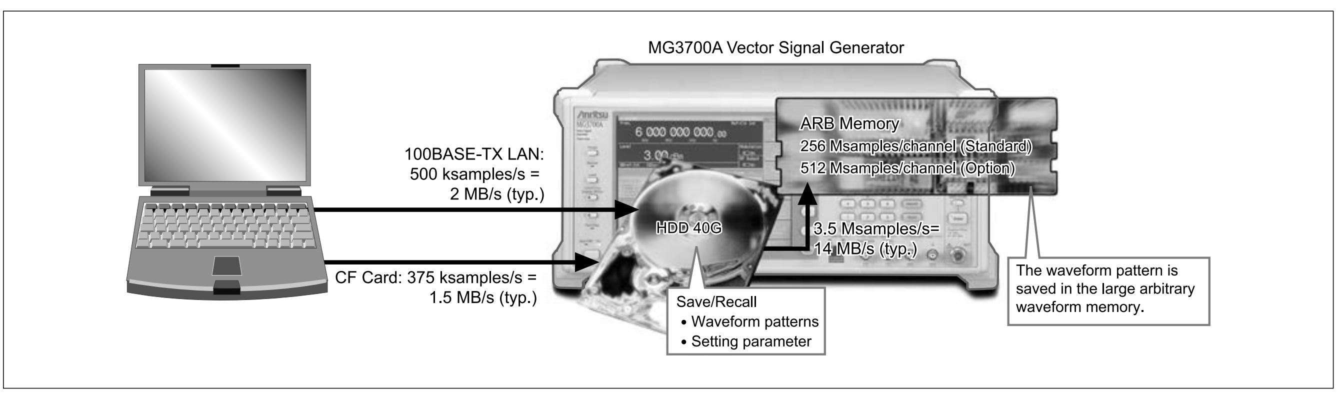
Vector Modulation Bandwidth (Using external IQ input)



Linearity

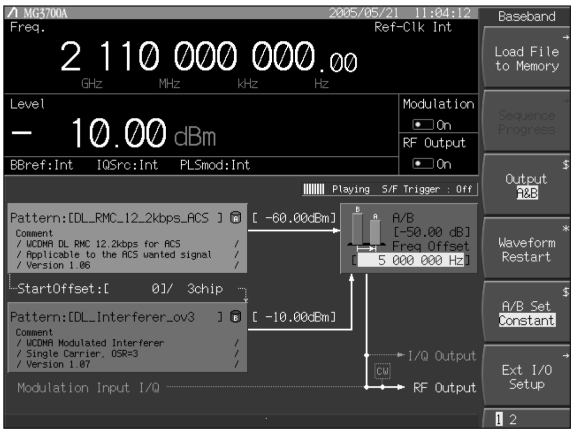


SSB Phase Noise (25 MHz ≤ f ≤3 GHz)
(CW, Continuous mode: OFF, Frequency changing speed: Normal)



• Waveform Combining Function

The MG3700A has two built-in arbitrary waveform memories, each of which can hold one waveform pattern. The MG3700A can output a signal from either memory, as well as combine and output both signals simultaneously. When measuring receiver characteristics, such as Adjacent Channel Selectivity (ACS) or Blocking characteristics, one MG3700A can output both the Wanted signal and the Interfering signal or the Wanted signal with AWGN.
Digital signal processing ensures excellent level accuracy.



Wanted Signal + Interfering Signal Screen

• Built-in Standard 20 Mbps BER

The built-in BER analyzer supports easy BER measurement.
Input bit rate: 1 kbps to 20 Mbps
Measurable BER: 0 to 1%
A BER option supports measurement from 100 bps to 120 Mbps.

Software Options: Waveform Pattern*

Waveform pattern options provide waveform data meeting the requirements of various communication systems and can be used by the MG3700A built-in arbitrary waveform generator. Waveform patterns are downloaded to the MG3700A for use.

• MX370001A TD-SCDMA Waveform Pattern

Waveform patterns for transmission/reception test of 3GPP 1.28 Mcps TDD Option (TD-SCDMA)

• MX370002A Public Radio System Waveform Pattern

Waveform patterns complying with RCR STD-39 and ARIB STD-T61/T79/T86.
Waveform patterns, such as Uplink/Downlink and PN9/PN15 continuous waves.
RCR STD-39: Narrow band digital-communications system
ARIB STD-T61: Narrow band digital-communications system
ARIB STD-T79: Public digital-communications system
ARIB STD-T86: Public digital-communications system

• MX370073A DFS Radar Pattern
MX370075A DFS (ETSI) Waveform Pattern

Waveform patterns for testing 5-GHz band WLAN Dynamic Frequency Selection (DFS) functions. The MX370073A supports the waveform patterns for the TELEC and FCC test specifications. The MX370075A supports the waveform patterns for the ETSI test specifications.

Software Options: IQproducer License*

The IQproducer software can be installed in a PC for evaluation before purchase. To download generated waveform patterns to the MG3700A and output signals, the following IQproducer licenses are required:

• MX370101A HSDPA/HSUPA IQproducer

Parameters can be changed and the required waveform patterns can be generated for HSDPA Uplink/Downlink and HSUPA E-DPDCH/EDPCCH.

• MX370102A TDMA IQproducer

Parameters can be changed and the required waveform patterns can be generated for TDMA system signals. The parameters that can be set include Modulation, Frame, Slot, Data, and Filter.

• MX370103A CDMA2000 1xEV-DO IQproducer

Parameters can be changed and the required waveform patterns can be generated for CDMA2000 1xEV-DO Forward/Reverse signals.

• MX370104A Multi-carrier IQproducer

The MX370104A Multi-carrier IQproducer software is GUI-driven PC application software for creating multi-carrier waveform patterns for the modulation and tone signals of various communication systems. There is also a function for converting two waveform patterns with different sampling rates to a waveform pattern with one sampling rate, as well as a function for creating a waveform pattern with W-CDMA Downlink multi-carrier and clipping.

• MX370105A Mobile WiMAX IQproducer

Create UL and DL waveforms that comply with the IEEE 802.16e standard using a drop-and-drag GUI. Use these files wherever a mobile WiMAX signal is required. Test receivers per IEEE 802.16e standard section 8.4.13 - Receiver Requirements (excluding the tests that require test equipment other than a Signal Generator).

• MX370106A DVB-T/H IQproducer

The parameters for the ETSI EN 300 744 V1.5.1 (2004-11) Physical Layer specification are set and a waveform pattern is generated.
A video file waveform pattern is generated by reading the user's MPEG-2 TS file. The generated waveform pattern can be used for the receiver sensitivity test using BER measurement and for the final operation check using the video.

• MX370107A Fading IQproducer

The MX370107A Fading IQproducer supports generation of faded waveform patterns (fading of each IQ channel, calculation of correlation line, addition of AWGN) by reading waveform patterns for the MG3700A.
Waveform patterns created by another IQproducer or IQ data (ASCII) created by general simulation tools can be selected as the input file.
The Channel Configuration can be selected from 1×1 SISO, 2×1 MISO, 1×2 SIMO, and 2×2 MIMO.

• MX370108A LTE IQproducer

The MX370108A LTE IQproducer supports creation of required waveform patterns by changing parameters standardized in the 3GPP LTE FDD specifications of 3GPP TS 36.211, TS 36.212, and TS 36.213.

• MX370108A-001 LTE-Advanced FDD Option

Installing in the MX370108A supports waveform patterns generation compliant with LTE-Advanced FDD specifications.
*: Requires MX370108A

• MX370109A XG-PHS IQproducer

The MX370109A XG-PHS IQproducer supports creation of required waveform patterns by changing parameters standardized in the next generation PHS (XGP: eXtended Global Platform).

• MX370110A LTE TDD IQproducer

The MX370110A LTE TDD IQproducer supports creation of required waveform patterns by changing parameters standardized in the 3GPP LTE TDD specifications of 3GPP TS 36.211, TS 36.212, TS 36.213, and TS 25.814.

• MX370111A WLAN IQproducer

The MX370111A WLAN IQproducer supports creation of required waveform patterns by changing parameters standardized in the IEEE Std 802.11-2007 and IEEE Std 802.11n-2009 specifications.
This software can create a waveform pattern compliant with IEEE802.11a/b/g/j/p/n standards by editing the parameters.

• MX370111A-001 802.11ac (80 MHz) Option

Installing in the MX370111A supports waveform patterns generation compliant with IEEE802.11ac specifications.
*: Requires MX370111A. Only for MG3700A.

• MX370112A TD-SCDMA IQproducer

Generates wanted waveform patterns with parameters modified according to TD-SCDMA specifications standardized by TRx characteristics evaluation tests (excluding performance tests) for 3GPP TS 25.221, TS 25.222, TS 25.223, TS 25.105, TS 25.142.

*: Read the MX3701xxA Software catalog for details.

Selection guide

	Communication System	AWGN	W-CDMA	HSDPA (Test Model5)	HSDPA/HSUPA	CDMA2000 1xEV-DO	CDMA2000	GSM/EDGE	TD-SCDMA	Next-generation PHS (XGP)	Advanced-PHS	PHS	PDC	ETC/DSRC	Digital Broadcast (BS/CS/CATV/ISDB-T)	Digital Broadcast (DVB-T/H)	WLAN (IEEE802.11a/b/g)	WLAN (IEEE802.11n/p/a/b/g/j)	WLAN (IEEE802.11ac)	DFS (TELEC, FCC)	DFS (ETSI)	Mobile WiMAX (IEEE802.16e)	*Bluetooth*	GPS	RCR STD-39	ARIB STD-T61/T79/T86	Multi-carrier	Fading	3GPP LTE (FDD)	3GPP LTE-Advanced (FDD)	3GPP LTE (TDD)
Waveform Pattern	Pre-installed	✓	✓	✓		✓	✓	✓				✓	✓		✓		✓						✓	✓							
Waveform Pattern	MX370001A TD-SCDMA								✓																						
Waveform Pattern	MX370002A Public Radio System																								✓	✓					
Waveform Pattern	MX370073A DFS (TELEC, FCC)																			✓											
Waveform Pattern	MX370075A DFS (ETSI)																				✓										
IQproducer	Standard accessories AWGN	✓																													
IQproducer	Standard accessories W-CDMA		✓																												
IQproducer	MX370101A HSDPA/HSUPA		✓		✓																										
IQproducer	MX370102A TDMA										✓	✓	✓	✓											✓	✓					
IQproducer	MX370103A CDMA2000 1xEV-DO					✓																									
IQproducer	MX370104A Multi-carrier	Multi-carrier IQproducer is software that generates the multi carrier signal based on waveform pattern of various telecommunications systems.																													
IQproducer	MX370105A Mobile WiMAX																					✓									
IQproducer	MX370106A DVB-T/H															✓															
IQproducer	MX370107A Fading	Fading IQproducer is software that generates the Fading signal based on waveform pattern of various telecommunication systems.																													
IQproducer	MX370108A LTE FDD																												✓		
IQproducer	MX370108A-001 LTE-Advanced FDD																													✓	
IQproducer	MX370109A XG-PHS									✓																					
IQproducer	MX370110A LTE TDD																														✓
IQproducer	MX370111A WLAN																	✓													
IQproducer	MX370111A-001 802.11ac (80 MHz)																		✓												
IQproducer	MX370112A TD-SCDMA								✓																						

Read the MX3701xxA Software catalog for details.

● Vector Signal Generator series
Supported LTE-Advanced Carrier Aggregation Modes

Carrier Aggregation Mode \ Vector Signal Generator series	Vector Signal Generator		Vector Signal Generator Option for Signal Analyzer	
	MG3710A*1	MG3700A*1	MS2690A series Opt. 020*2	MS2830A Opt. 020/021*2
Intra-band contiguous Carrier Aggregation	✓	✓	✓	✓
Intra-band non-contiguous Carrier Aggregation	✓	✓	✓	✓
Inter-band non-contiguous Carrier Aggregation	✓*3, *4	✓*3	✓*3	✓*3

*1: MX370108A LTE IQproducer and MX370108A-001 LTE-Advanced FDD Option installed.
*2: MX269908A LTE IQproducer and MX269908A-001 LTE-Advanced FDD Option installed.
*3: Requires another Vector Signal Generator.
*4: One unit supports this mode when MG3710A-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) 2ndRF Option is installed.

● Vector Signal Generator series
Supported WLAN IEEE802.11ac Signal Bandwidth

IEEE802.11ac Signal Bandwidth \ Vector Signal Generator	Vector Signal Generator		Vector Signal Generator Option for Signal Analyzer	
	MG3710A*1	MG3700A*2	MS2690A series Opt. 020*3	MS2830A Opt. 020/021*3
20 MHz/40 MHz/80 MHz	✓	✓	✓	✓
160 MHz	✓	—	—	—
80 MHz + 80 MHz (non-contiguous)	✓*4, *5	✓*4	✓*4	✓*4

*1: MX370111A WLAN IQproducer and MX370111A-002 802.11ac (160 MHz) Option installed.
*2: MX370111A WLAN IQproducer and MX370111A-001 802.11ac (80 MHz) Option installed.
*3: MX269911A WLAN IQproducer and MX269911A-001 802.11ac (80 MHz) Option installed.
*4: Requires another Vector Signal Generator.
*5: One unit supports this mode when MG3710A-062 (2.7 GHz)/064 (4 GHz)/066 (6 GHz) 2ndRF Option is installed.

Specifications

MG3700A Vector Signal Generator

The following conditions are applied unless otherwise specified.
Common to CW mode and modulation mode. [Continuous mode: Off, External ALC: Off, Frequency switching speed: Normal, Pulse modulation: Off],
Only during modulation mode [Input level to DAC (RMS): Full scale 14 dB to full scale 17 dB, Sampling rate: >100 kHz,
Memory mode: Except combining two waveform, IQ Output: Off, After CAL execution, During internal modulation]

<table>
<tr><td rowspan="7">Frequency</td><td>Range</td><td>250 kHz to 3 GHz (Standard), 250 kHz to 6 GHz (Option)</td></tr>
<tr><td>Resolution</td><td>0.01 Hz</td></tr>
<tr><td>Internal Reference Oscillator</td><td>Frequency: 10 MHz, Aging rate: ±1 × 10^{-8}/day, ±1 × 10^{-7}/year, Temperature stability: ±2 × 10^{-8} (0˚ to 50˚C),
Start-up characteristics (at 23˚C):
±5 × 10^{-8} (After 5 min, compared to frequency after 24 h warm-up)</td></tr>
<tr><td>External Reference Input</td><td>Frequency: 5 MHz/10 MHz (auto-switching), Operating range: ±1 ppm,
Input level: ≥0.7 Vp-p/50Ω (AC coupled), Connector: BNC-J (Rear panel, Ref Input)</td></tr>
<tr><td>Buffer Output (Reference Output)</td><td>Frequency: 10 MHz, Output level: TTL (DC coupled), Connector: BNC-J (Rear panel, Buffered Output)</td></tr>
<tr><td>Switching Time</td><td>Response time from final command to ±0.1* ppm of set frequency on GPIB
* (When set frequency is 1 GHz or less, response time from final command to ±100 Hz)
When Frequency change speed = Normal:
≤40 ms (When exceeding 3 GHz)
≤15 ms (When the amount of frequency change is less than 1 GHz without exceeding 3 GHz)
≤20 ms (When the amount of frequency change is 1 GHz or more without exceeding 3 GHz)
When Frequency change speed = Fast:
≤40 ms (When exceeding 3 GHz)
≤10 ms (When not exceeding 3 GHz)
With Mechanical Attenuator Option
Regardless of frequency change speed.:
≤100 ms (When exceeding 3 GHz)
≤80 ms (When not exceeding 3 GHz)</td></tr>
<tr><td>Frequency Setup and Display</td><td>Direct setup: Absolute value of frequency is set up and displayed.
Setup by CH: CH assigned to frequency. Separate CH tables can be assigned to two or more systems (groups). Group names and CH numbers are set and displayed. Furthermore, the corresponding frequency is displayed simultaneously.</td></tr>
<tr><td rowspan="7">Output Level</td><td>Settable Range</td><td>–140 to +13 dBm (At CW, Accuracy range: –136 to +6 dBm)
With Mechanical Attenuator Option
–140 to +19 dBm (At CW, Accuracy range: –136 to +10 dBm)
* Refer to Vector modulation. At vector modulation, level error in compared with CW for level accuracy at vector modulation.</td></tr>
<tr><td>Unit</td><td>Power: dBm
Voltage: dBµV (Terminate voltage display), dBµV (Open voltage display)</td></tr>
<tr><td>Resolution</td><td>0.01 dB (dBm, dBµV)</td></tr>
<tr><td>Accuracy</td><td>At CW and 23 ±5˚C:
<table>
<tr><td rowspan="2">Level (p) [dBm]</td><td colspan="3">Frequency (f) [Hz]</td></tr>
<tr><td>250 k ≤ f < 25 M</td><td>25 M ≤ f ≤3 G</td><td>3 G < f ≤6 G*</td></tr>
<tr><td>+3 <p ≤+6</td><td>—</td><td>±0.5 dB</td><td>—</td></tr>
<tr><td>–1 <p ≤+3</td><td>—</td><td>±0.5 dB</td><td>±0.8 dB</td></tr>
<tr><td>–120 ≤p ≤–1</td><td>±0.5 dB (typ.)</td><td>±0.5 dB</td><td>±0.8 dB</td></tr>
<tr><td>–127 ≤p <–120</td><td>—</td><td>±0.7 dB</td><td>±2.5 dB (typ.)</td></tr>
<tr><td>–136 ≤p <–127</td><td>—</td><td>±1.5 dB (typ.)</td><td>—</td></tr>
</table>
* Upper frequency 6 GHz option required for 3 GHz < f ≤6 GHz.

With Mechanical Attenuator Option
<table>
<tr><td rowspan="2">Level (p) [dBm]</td><td colspan="3">Frequency (f) [Hz]</td></tr>
<tr><td>250 k ≤ f < 25 M</td><td>25 M ≤ f ≤3 G</td><td>3 G < f ≤6 G*</td></tr>
<tr><td>+7 <p ≤+10</td><td>±0.5 dB (typ.)</td><td>±0.5 dB</td><td>—</td></tr>
<tr><td>–100 ≤p ≤+7</td><td>±0.5 dB (typ.)</td><td>±0.5 dB</td><td>±0.8 dB</td></tr>
<tr><td>–120 ≤p <–100</td><td>±0.5 dB (typ.)</td><td>±0.5 dB</td><td>±1.0 dB</td></tr>
<tr><td>–127 ≤p <–120</td><td>—</td><td>±0.7 dB</td><td>±2.5 dB (typ.)</td></tr>
<tr><td>–136 ≤p <–127</td><td>—</td><td>±1.5 dB (typ.)</td><td>—</td></tr>
</table>
* Upper frequency 6 GHz options required for 3 GHz < f ≤6 GHz.</td></tr>
<tr><td>Linearity</td><td>At CW, –11 dBm and at 23 ±5˚C:
±0.2 dB (typ., –120 to –11 dBm, 25 MHz ≤ f ≤3 GHz)
±0.3 dB (typ., –120 to –11 dBm, 3 GHz < f ≤6 GHz)
With Mechanical Attenuator Option
At CW, –7 dBm and at 23 ±5˚C:
±0.2 dB (typ., –120 to –7 dBm, 25 MHz ≤ f ≤3 GHz)
±0.3 dB (typ., –120 to –7 dBm, 3 GHz < f ≤6 GHz)</td></tr>
<tr><td>Switching Time</td><td>Response time from final command to ±0.1 dB of final level on GPIB.
f <25 MHz: ≤15 ms (Normal mode), ≤10 ms (Continuous mode)
f ≥25 MHz: ≤10 ms (Not based on mode)
With Mechanical Attenuator Option
≤80 ms (Normal mode), ≤10 ms (Continuous mode)</td></tr>
<tr><td>VSWR</td><td>At ≤–11 dBm output level: 1.3 (250 kHz ≤ f ≤3 GHz), 1.55 (3 GHz < f ≤6 GHz)
With Mechanical Attenuator Option
At ≤–7 dBm output level: 1.25 (250 kHz ≤ f ≤3 GHz), 1.35 (3 GHz < f ≤6 GHz)</td></tr>
</table>

Continued on next page

Output Level	Special Setting Mode	Continuous mode and EXT ALC mode are exclusive modes
	Continuous Mode	By switching to the Continuous mode, the reference output level can be adjusted continuously in 0.01 dB steps over the range of +3 to –10 dB.
	EXT ALC Mode	Output level is changed according to DC voltage input externally Variable range: –8/+3 dB, Input impedance: 600Ω (nominal), Connector: BNC-J (Rear panel, Ext. ALC)
	Output Connector	50Ω, N-J (Front panel, RF Output)
	Maximum Reverse Input	Reverse input power: 1 W peak (≥300 MHz), 0.25 W peak (<300 MHz), 0 Vdc With Mechanical Attenuator Option Reverse input power: 1 W peak, 0 Vdc
Signal Purity	Spurious	At CW, ≤–1 dBm (With Mechanical Attenuator Option: ≤+3 dBm)
	Harmonics	<–30 dBc (f ≥300 MHz @E-ATT, f ≥250 kHz @M-ATT)
	Non Harmonic	<–60 dBc (Expect the intersection spurious* of 2.4 GHz, 25 MHz to 3 GHz) <–54 dBc (Expect the intersection spurious* of 4.4 GHz, 3 GHz to 6 GHz) *Intersection spurious: 4.8 GHz – [output frequency] (at 25 MHz to 3 GHz), 8.8 GHz – [output frequency] (at 3 GHz to 6 GHz)
	Power Supply Relation	<–50 dBc (250 kHz to 3 GHz), <–44 dBc (3 GHz to 6 GHz)
Vector Modulation	EVM	At 23 ±5˚C and Output level: ≤–1 dBm (With Mechanical Attenuator Option: ≤+3 dBm) ≤2% rms., ≤1% rms (typ., at W-CDMA Downlink 1 code modulation, Output frequency: 800 MHz to 1000 MHz, 1800 MHz to 2400 MHz) At 23 ±5˚C and Output level: ≤–4 dBm (With Mechanical Attenuator Option: ≤0 dBm) ≤1% rms. (at OFDM modulation equal to IEEE802.11a/g, Output frequency: 2400 MHz to 2497 MHz, 4,900 MHz to 5,925 MHz) ≤5% peak (at modulation equal to IEEE802.11b, Output frequency: 2,400 MHz to 2,497 MHz)
	ACLR (5 MHz offset)	At 23 ±5˚C when using signal of W-CDMA (Test Model1 64DPCH): –61 dBc/3.84 MHz, –63 dBc/3.84 MHz (typ., ≤–4 dBm, 800 MHz to 1000 MHz, 1800 MHz to 2400 MHz) With Mechanical Attenuator Option –62 dBc/3.84 MHz, –64 dBc/3.84 MHz (typ., ≤0 dBm, 800 MHz to 1000 MHz, 1800 MHz to 2400 MHz)
	ACLR (10 MHz offset)	At 23 ±5˚C when using signal of W-CDMA (Test Model1 64DPCH): –66 dBc/3.84 MHz (typ., ≤–1 dBm, 800 MHz to 1000 MHz, 1800 MHz to 2400 MHz) With Mechanical Attenuator Option –67 dBc/3.84 MHz (typ., ≤+3 dBm, 800 MHz to 1000 MHz, 1800 MHz to 2400 MHz)
	At Vector Modulation, Level Error in Comparison with CW* * At modulation mode, ALC: Off	±0.2 dB [when outputting W-CDMA Downlink 1 code, 1 carrier] At guaranteed range (Level) of level accuracy under following modulation conditions 50 MHz ≤ f ≤3 GHz: Level ≤+2 dBm 3 GHz < f ≤6 GHz: Level ≤–1 dBm With Mechanical Attenuator Option 50 MHz ≤ f ≤3 GHz: Level ≤+7 dBm 3 GHz < f ≤6 GHz: Level ≤+4 dBm
	Carrier Leakage	≤–40 dBc (at 23 ±5˚C)
	Image Rejection	≤–40 dBc (at 23 ±5˚C. When using complex sine wave of 10 MHz or less)
	External Modulation	Input level: $\sqrt{(I^2 + Q^2)}$ = 0.5 V (rms.), Maximum input level: –5 V (peak) ≤I, Q ≤+5 V (peak), Input impedance: 50Ω, Input connector: BNC-J (Front panel, Modulation Input IQ)
	RF Spectrum Invert	I, Q signal changeable when internal modulation. Spectrum Normal: Usual spectrum output Spectrum Reverse: Inverted spectrum output
Pulse Modulation	Internal Modulation	ON/OFF ratio: >60 dB, Rise/Fall time: <90 ns (10 to 90%), Pulse repetition frequency: DC to 1 MHz, (Duty 50%)
	External Modulation	Input range: 0 to 5 V, Input level threshold: about 1 V, ON/OFF ratio: >60 dB, Rise/Fall time: <90 ns (10 to 90%), Pulse repetition frequency: DC to 1 MHz, (Duty 50%), Input connector: 50Ω BNC-J (Rear panel, Ext Pulse Mod Input)
IQ Output	Output Voltage Range	When output open. Output voltage amplitude + DC offset: –3.5 V to +3.5 V
	Output Voltage Amplitude	When output open. Amplitude change: • I and $\overline{I}$ changes simultaneously • Q and $\overline{Q}$ changes simultaneously • I/$\overline{I}$ and Q/$\overline{Q}$ changes independently Amplitude variable range: 0 to 120% (100% = 640 mV rms, rms = 1634) Variable step: 0.1% Accuracy: ±0.5 dB (1 kHz sine wave, Amplitude variable range ≥10%)
	DC Offset Variable Range	In-phase DC offset: Variable range: –1 V to +3 V, Resolution: 10 mV Differential DC offset: Variable range: –50 mV to +50 mV, Resolution: 50 µV
	Output Connector	50Ω, D-Sub 15-J (Rear panel, IQ Output, differential), Pin assignment (10 = I, 11 = $\overline{I}$, 13 = Q, 14 = $\overline{Q}$, other = GND)
Arbitrary Function Generation	Waveform Resolution	14 bit
	LPF	Automatic selection and manual selection 100, 300 kHz, 1, 3, 10, 30, 70 MHz, Through
Marker Output	Function	When a signal is allotted to a marker signal bit at waveform generation, up to three signals, such as pulse modulation signal (for internal modulation), frame timing signal, etc., can be output. The polarity can also be reversed.
	Number of Ports	3 ports
	Connector	TTL, BNC-J (Rear panel, AUX Input/Output Connector 1/2/3)

Continued on next page

Baseband Reference Clock Signal	Internal Clock Signal	Range: 20 kHz to 160 MHz, Resolution: 0.001 Hz
	External Clock Input Signal	Input frequency range: 20 kHz to 40 MHz Divide and multiply functions: Signal of 1, 2, 4, 8, 16, 1/2, 1/4, 1/8, 1/16 times of input frequency generated internally, and used as DAC sampling clock Connector: BNC-J (Rear panel, Baseband Reference Clock) Input level: ≥0.7 V (p-p)/50Ω (AC coupled)
Waveform Memory	Memory Capacity	Waveform memories. A and B. 128 Msamples/channel × 2, 256 Msamples/channel Max. With ARB Memory Upgrade 512 Msample option 256 Msamples/channel × 2, 512 Msamples/channel Max.
	Number of Opened Files	Up to 4096 waveform patterns opened per waveform memory (A/B) 100 packages per waveform memory, 100 patterns in one package. Minimum number of samples per pattern: 100
	Memory Mode	Defined Mode Selection of a single waveform pattern to be used in either waveform memory A or B, selection of waveform patterns using a combination file that defines addition of multiple waveform patterns, and the addition level ratio can be set in this mode. If a combination file that specifies two or more waveform patterns in waveform memory A is selected, the following sequence operations become enabled. • Selection of pattern switching mode (Auto/Manual) • Selection of pattern switching point (Frame end/Pattern end) • Switching of pattern by an external trigger signal (enabled when the pattern switching mode is Manual) • Restart of sequence • Maximum number of elements: 200 • Minimum number of points per pattern: 1000 Level ratio setting range: Two-signal level ratio <80 dB or OFF Level setting resolution: 0.01 dB Frequency offset variable width: ± (0.8 × Sampling Clock × 2^n – Bandwidth)/2 (n: Maximum integer that satisfying Sampling Clock × 2^n ≤80 MHz. when sampling clock greater than 20 MHz.) Frequency setting resolution: 1 Hz In this mode, two waveform memories can be connected for use as a 256 Msamples long memory (512 Msamples long when ARB Memory Upgrade 512 Msample option installed). Edit Mode One waveform each is selected from waveform memory A and waveform memory B, these two waveforms are added and then output. Two signal levels, the waveform memory B start offset and frequency offset, can be set. Level ratio setting range: Two-signal level ratio <80 dB or OFF Level setting resolution: 0.01 dB Frequency offset variable width: ± (0.8 × Sampling Clock × 2^n – Bandwidth)/2 (n: Maximum integer that satisfying Sampling Clock × 2^n ≤80 MHz when sampling clock greater than 20 MHz.) Frequency setting resolution: 1 Hz
Start/Frame Trigger	Function	Switchable between continuous output and burst output.
	Input Connector	Functional change: Connector shared by Start trigger and Frame trigger; switched depending on situation Connector: BNC-J (Front panel, Start/Frame Trigger), Input level: TTL, Logic: Polarity Rise/Fall selected.
	Start Trigger	Starts waveform output
	Frame Trigger	Searches for burst timing at burst output Burst length data output and timing of frame trigger and waits for next frame trigger
Pattern Trigger	Function	When using the sequence mode, the pattern trigger will force a pattern switch.
	Input Connector	Connector: Front panel, Pattern Trigger, BNC-J connector Input level: TTL Logic: Rising or falling polarity
BER Measurement Function (Standard)	Function	BER Measurement of demodulated data sequence
	Input Connector	TTL, BNC-J (Rear panel, BER Input)
	Input Signal	Data, Clock, Enable (Polarity reversal supported.)
	Input Level	TTL
	Input Threshold Level	Matches threshold (0.8 to 2.4 V) of TTL
	Input Bit Rate	1 kbps to 20 Mbps
	Measurable Patterns	PN 9, 11, 15, 20, 23, ALL0, ALL1 (alternating 0 and 1)
	Measurable BER	0 to 1% (Reference value; changes with system conditions and data rate)
	Measurable Time	≤359999.0 sec
	Mode	Single, Endless, Continuous.
	Display	BitError, SyncLoss, ClockError, EnableError, Error Rate, Error Count
	Measurable Bit Count	1000 to 4294967295 (2^{32} – 1) bit
	Auto Resync Function	Switched between Enable/Disable

Continued on next page

BER Measurement Function (Option: MG3700A-031, MG3700A-131)	Function	BER Measurement of demodulated data
	Connector	Rear panel, BER Input, BNC-J connector
	Input Signal	Data, Clock, Enable (Polarity reversal supported)
	Input Level	0 to 5 V
	Input Threshold Level	0.20 to 3.00 V (0.05 V step)
	Input Impedance	50Ω, High impedance
	Adjustable Range of Input Timing	–1 to +15 clock (Data/Enable adjusted for input Clock)
	Input Bit Rate	100 bps to 120 Mbps
	Measurable Patterns	PN 9, 11, 15, 20, 23, ALL0, ALL1, ALT (alternating 0 and 1) PN 9fix, 11fix, 15fix, 20fix, 23fix, UserDefine
	Measurable BER	0 to 10% (Reference value; changes with system conditions and data rate)
	Measurable Bit Count	1000 to 4294967295 (2^{32} – 1) bit
	Measurable Error Bit	1 to 2147483647 (2^{31} – 1) bit
	Auto Resync	ON/OFF: Select ON when SyncLoss and Threshold error detecting is used to control the measurement cycle. Measurement will stop when the SyncLoss or Threshold error criteria is satisfied. Select OFF when SyncLoss and Threshold error detecting is not to be performed. Threshold setting range: [numerator/denominator] Choose from denominator = 500, 5000, 50000, numerator = 1 to denominator/2, (Default: 200/500)
	Measurement Mode	Single, Continuous, Endless
	Display	BitError, SyncLoss, ClockError, Enable Error, SyncLoss Count, Overflow Data Count, Overflow SyncLoss, Error Rate, Error Count
External Interface	GPIB	Control target: All functions except MAIN PWR switch, [Local] key, and screen contrast keys. Interface: SH1, AH1, T6, L4, TE0, SR1, RL1, PP0, DC1, DT1, C0, E2 Connector: GPIB (rear panel, GPIB)
	100BASE-TX Ethernet	Function: Waveform pattern transfer and control. Connector: RJ45 jack (front panel and rear panel, Ethernet) In order to use the Ethernet jack on the front panel, it is necessary to jumper the two jack on the rear panel using the straight-through cable (standard accessory).
	Memory Card	Function: Waveform pattern, memory parameters, software, and CH table can be saved or recalled to/from CompactFlash card Connector: Slot (front panel, CF Card)
Display	Size	8.4-inch, 640 × 480 dots, color TFT LCD
	On/Off Setting	Panel display On/Off
	Screen Save	Currently displayed screen saved to HDD/CF card as bitmap file
Power Supply	Voltage	100 V(ac) to 120 V(ac), 200 V(ac) to 240 V(ac), (–15/+10%, 250 V Max.)
	Frequency	47.5 Hz to 63 Hz
	Power Consumption	≤200 VA
Temperature Range		Operating: +5˚ to +45˚C, Storage: –20˚ to +60˚C
Dimensions and Mass		426 (W) × 177 (H) × 451 (D) mm, ≤15 kg (excluding option)
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1

Configuration Guide

The MG3700A Vector Signal Generator supports a variety of general hardware and software as standard equipment.
Use the chart below to select options when higher performance than provided by the standard configuration is desired.

Classification	Outline	Standard	Option	Note
Frequency Range	250 kHz to 3 GHz	✓		
	250 kHz to 6 GHz		✓	6 GHz Frequency Extension Option
Reference Oscillator	Standard	✓		Frequency: 10 MHz, Aging rate: ±1 × 10^{-8}/day, ±1 × 10^{-7}/year
Attenuator	Electron Attenuator	✓		
	Mechanical Attenuator		✓	Mechanical Attenuator Option Changes electronic attenuator to mechanical attenuator
Memory	1 GB = 256 Msamples/channel	✓		128 Msamples/channel × 2 Maximum of 256 Msamples/channel
	2 GB = 512 Msamples/channel		✓	ARB Memory Upgrade 512 Msample Option 256 Msamples/channel × 2 Maximum of 512 Msamples/channel
Baseband Generator	Internal/External	✓		Vector modulation bandwidth (Internal): 120 MHz Vector modulation bandwidth (External): 150 MHz
BER Analyzer		✓		Input bit rate: 1 kbps to 20 Mbps Measurable Patterns: PN 9/11/15/20/23, ALL0, ALL1, repetition of 0 and 1
			✓	High speed BER Test function Input bit rate: 100 bps to 120 Mbps Measurable Patterns: PN 9/11/15/20/23, ALL0, ALL1, repetition of 0 and 1 PN9fix/11fix/15fix/20fix/23fix, UserDefine
Hard Disk	40 GB	✓		Hard disk for saving waveform patterns and parameters
Waveform Patterns Software*	W-CDMA	✓		Waveform patterns saved hard disk License required
	GSM/EDGE	✓		
	CDMA2000 1X/1xEV-DO	✓		
	W-LAN (IEEE802.11a/b/g)	✓		
	PDC	✓		
	PHS	✓		
	Bluetooth	✓		
	GPS	✓		
	Digital Broadcast (ISDB-T, BS, CS, CATV)	✓		
	AWGN	✓		
	TD-SCDMA		✓	License required (Model: MX370001A)
	Public Radio System (ARIB STD-T61/T79/T86)		✓	License required (Model: MX370002A)
	DFS (TELEC/FCC)		✓	License required (Model: MX370073A)
	DFS (ETSI)		✓	License required (Model: MX370075A)
IQproducer License for Each System*	HSDPA/HSUPA		✓	License required (Model: MX370101A)
	Universal TDMA		✓	License required (Model: MX370102A)
	CDMA2000 1xEV-DO		✓	License required (Model: MX370103A)
	Multi-carrier		✓	License required (Model: MX370104A)
	Mobile WiMAX		✓	License required (Model: MX370105A)
	DVB-T/H		✓	License required (Model: MX370106A)
	Fading		✓	License required (Model: MX370107A)
	LTE FDD		✓	License required (Model: MX370108A)
	LTE-Advanced FDD		✓	License required (Model: MX370108A-001) ∗: Requires MX370108A
	Next generation PHS (XGP)		✓	License required (Model: MX370109A)
	LTE TDD		✓	License required (Model: MX370110A)
	WLAN		✓	License required (Model: MX370111A)
	WLAN (IEEE802.11n/p/a/b/g/j)		✓	License required (Model: MX370111A)
	WLAN (IEEE802.11ac)		✓	License required (Model: MX370111A-001) ∗: Requires MX370111A. Only for MG3700A.
	TD-SCDMA		✓	License required (Model: MX370112A)
IQproducer (PC Application Software)*	Parameter setting function	✓		Various parameters of waveform pattern edited easily Parameter edit results saved as a setting file and can recalled
	Data converter function	✓		Setting files converted to MG3700A waveform pattern License required for each system Setting file programmed in C or MATLAB converted to a waveform pattern without license
	Data transfer function	✓		Waveform patterns, display copy files, and update programs transferred from PC to MG3700A via Ethernet
	Simulator function	✓		For checking waveform pattern before transferring to MG3700A
Warranty Service	1 year	✓		
	2 years		✓	Standard 1 year + 1 year
	3 years		✓	Standard 1 year + 2 years
	5 years		✓	Standard 1 year + 4 years

∗: Read the waveform pattern and IQproducer data sheet for details.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MG3700A	Vector Signal Generator
	Standard accessories
	Power Cord: 1 pc
J1276	LAN Straight Cable (10 cm, For U link connection on Rear panel): 1 pc
	CompactFlash: 1 pc
J1254	CompactFlash Adapter: 1 pc
Z0742	MG3700A CD-ROM (Main frame operation manual, IQproducer operation manual, Standard waveform operation manual, IQproducer software): 1 pc
	Options
MG3700A-002	Mechanical Attenuator (Changes standard electronic attenuator to mechanical attenuator)
MG3700A-011	Upper Frequency 6 GHz (250 kHz to 3 GHz extended to 250 kHz to 6 GHz)
MG3700A-021	ARB Memory Upgrade 512 Msample (Extends standard 128 Msample/channel × 2 to 256 Msample/channel × 2)
MG3700A-031	High Speed BER Test Function (Extends standard BER test function)
MG3700A-102	Mechanical Attenuator Retrofit (Retrofitted to shipped MG3700A)
MG3700A-103	Electronic Attenuator Retrofit (Retrofitted to shipped MG3700A)
MG3700A-111	Upper Frequency 6 GHz Retrofit (Retrofitted to shipped MG3700A)
MG3700A-121	ARB Memory Upgrade 512 Msample Retrofit (Retrofitted to shipped MG3700A)
MG3700A-131	High Speed BER Test Function Retrofit (Retrofitted to shipped MG3700A)
	Maintenance service
MG3700A-ES210	Extended Warranty Service (2 years)
MG3700A-ES310	Extended Warranty Service (3 years)
MG3700A-ES510	Extended Warranty Service (5 years)
	Softwares (Waveform pattern)
MX370001A	TD-SCDMA Waveform Pattern
MX370002A	Public Radio System Waveform Pattern (RCR STD-39, ARIB STD-T61/T79/T86
MX370073A	DFS Radar Pattern (WLAN 5.3/5.6 GHz band DFS tests (for TELEC and FCC))
MX370075A	DFS (ETSI) Waveform Pattern (WLAN 5.3/5.6 GHz DFS test (ETSI))
	Softwares (License key for IQproducer system)
MX370101A	HSDPA/HSUPA IQproducer
MX370102A	TDMA IQproducer
MX370103A	CDMA2000 1xEV-DO IQproducer
MX370104A	Multi-carrier IQproducer
MX370105A	Mobile WiMAX IQproducer
MX370106A	DVB-T/H IQproducer
MX370107A	Fading IQproducer
MX370108A	LTE IQproducer
MX370108A-001	LTE-Advanced FDD Option (Requires MX370108A)
MX370109A	XG-PHS IQproducer
MX370110A	LTE TDD IQproducer
MX370111A	WLAN IQproducer
MX370111A-001	802.11ac (80 MHz) Option (Requires MX370111A. Only for MG3700A)
MX370112A	TD-SCDMA IQproducer

Model/Order No.	Name
	Optional accessories
Z0777	Standard Waveform Pattern Upgrade Kit (DVD 4 piece sets)
W2495AE	MG3700A Operation Manual (Main Unit)
W2496AE	MG3700A Operation Manual (IQproducer)
W2539AE	MG3700A Operation Manual (Standard Waveform Pattern)
W2533AE	MX370001A TD-SCDMA Waveform Pattern Operation Manual
W3596AE	MX370073A DFS Rader Pattern (TELEC and FCC) Operation Manual
W3597AE	MX370075A DFS (ETSI) Waveform Pattern Operation Manual
W2503AE	MX370101A HSDPA/HSUPA IQproducer Operation Manual
W2504AE	MX370102A TDMA IQproducer Operation Manual
W2505AE	MX370103A CDMA2000 1xEV-DO IQproducer Operation Manual
W2633AE	MX370104A Multi-carrier IQproducer Operation Manual
W2734AE	MX370105A Mobile WiMAX IQproducer Operation Manual
W2798AE	MX370106A DVB-T/H IQproducer Operation Manual
W2995AE	MX370107A Fading IQproducer Operation Manual
W3022AE	MX370108A LTE IQproducer Operation Manual
W3152AE	MX370109A XG-PHS IQproducer Operation Manual
W3221AE	MX370110A LTE TDD IQproducer Operation Manual
W3488AE	MX370111A WLAN IQproducer Operation Manual
W3582AE	MX370112A TD-SCDMA IQproducer Operation Manual
G0141	HDD ASSY (hard disk)
K240B	Power Divider (K connector, DC to 26.5 GHz, K-J, 50Ω, 1 Wmax)
MA1612A	Four-port Junction Pad (5 MHz to 3 GHz, N-J)
MP752A	Termination (DC to 12.4 GHz, 50Ω, N-P)
MA2512A	Band Pass Filter (for W-CDMA, Pass band: 1.92 GHz to 2.17 GHz)
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2.0 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1.0 m (BNC-P · RG-58A/U · BNC-P)
J0127B	Coaxial Cord, 2.0 m (BNC-P · RG-58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG-58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322B	Coaxial Cord, 1.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322C	Coaxial Cord, 1.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322D	Coaxial Cord, 2.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0004	Coaxial Adapter (N-P · SMA-J Conversion Adapter, DC to 12.4 GHz)
J1261B	Ethernet Cable (Shield Type, Straight-through, 3 m)
J1261D	Ethernet Cable (Shield Type, Cross, 3 m)
J0008	GPIB Cable, 2.0 m
J1277	IQ Output Conversion Adapter (D-Sub/BNC)
B0329C	Front Cover for 1MW 4U
B0331C	Front Panel Handle Kit (2 pcs/set)
B0332	Joint Plate (4 pcs/set)
B0333C	Rack Mount Kit (EIA)
B0334C	Hardtype Carrying Case (with Front cover and Casters)

Typical (typ.):
Performance not warranted. Must products meet typical performance.
Nominal:
Values not warranted. Included to facilitate application of product.
Example:
Performance not warranted. Data actually measured by randomly selected measuring instruments.

DIGITAL MOBILE RADIO TRANSMITTER TESTER

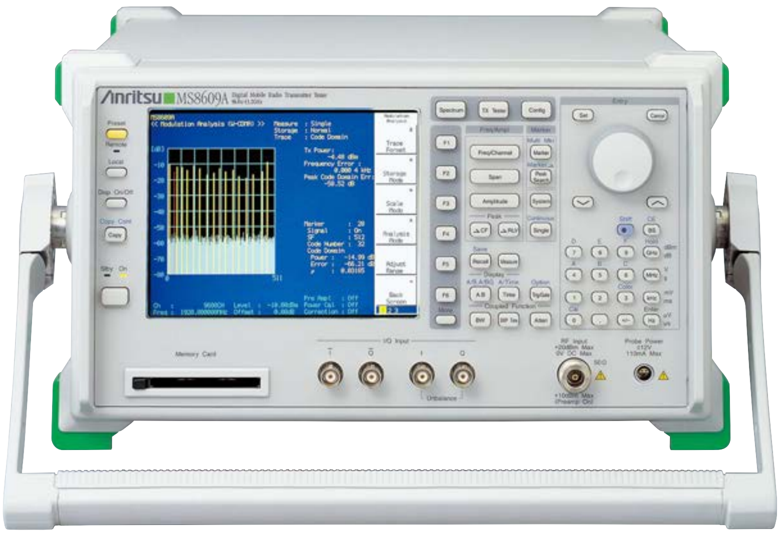
MS8609A

9 kHz to 13.2 GHz

Remote Control
GPIB | Ethernet OPTION

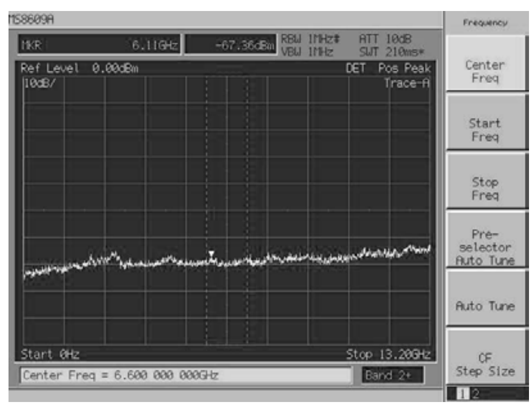
For Evaluation of 2G, 3G and 3.5G Communication Standards

Excellent Eco Product



CE

The MS8609A Digital Mobile Transmitter Tester has an internal spectrum analyzer, modulation analyzer and power meter. One tester supports development and manufacturing of base stations and mobile stations through to construction and maintenance of base stations.
The spectrum analyzer resolution bandwidth of up to 20 MHz readily supports measurement of wide-band signals.
The modulation analyzer uses high-speed DSP to support all Vector Signal Analysis (VSA) functions. The power sensor offers high-accuracy power measurements of ±0.4 dB using an amorphous sensor.
Up to three dedicated measurement software options (such as W-CDMA and GSM/EDGE) can be installed simultaneously. Input signals can be selected from either RF or I/Q inputs. Balanced or unbalanced input can also be selected for I/Q signals.
Remote measurement is supported by GPIB, RS-232C and 10BASE-T (optional) interfaces. The high-speed GPIB of 120 kbps enables high-speed measurement on production lines.
The monitor uses a clear 6.5-inch TFT color LCD.



Spectrum Analyzer Functions

• Frequency

Frequency range: 9 kHz to 13.2 GHz
Resolution bandwidth: 300 Hz to 3, 5, 10, 20 MHz (Up to 3 GHz)
Frequency span: Zero, 1 kHz to 13.2 GHz
Span accuracy: ±1%
Reference frequency accuracy: $\pm 2 \times 10^{-8}$/day, $\pm 5 \times 10^{-10}$/day (option)

• Level

Maximum input level: +20 dBm
Input attenuator: 0 to 62 dB (2 dB steps)
1 dB gain compression: +3 dBm (≥500 MHz)
Two tone 3rd order distortion: ≤–85 dBc (0.1 GHz to 3.2 GHz)

• Sweep

Frequency span: 10 ms to 1000 s
Time span: 1 µs to 1000 s
Refresh rate: >20 times/s

• Others

Detection mode:
  Normal, Positive, Negative, Sample, Average, RMS (option)
Measurement functions:
  Frequency counter, Noise power, C/N, ACP, OBW, etc.
GPIB transmission speed: 120 kbps

MX860901B W-CDMA Measurement Software

• Parameter Setting

Measurement parameters such as modulation accuracy and code domain power, etc., are set on the screen.
Measurement is easy using a soft-key menu after setting measurement parameters.

• Code Domain Power

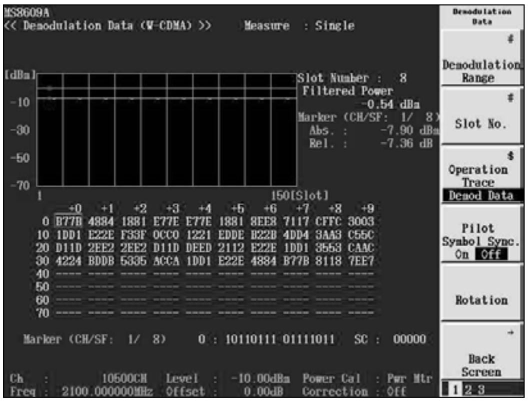
Measurement requires only 1.5 seconds. Either automatic detection of scrambling code from SCH, or specification of scrambling code can be selected.

• Modulation Accuracy Measurement

The modulation accuracy of base stations and mobile UE can be measured and modulation analysis of multiple waveforms can be performed. The residual vector error (rms) accuracy is high (1%, typ.).

● **Demodulation Data Monitoring**

After de-spreading, up to 10 frames of demodulation data can be evaluated.



● **I/Q Level Measurement**

This function measures and displays each I and Q input voltage (rms, p-p value). The units are dBmV or mV.

● **CCDF Measurement**

This supports either distribution display or cumulative distribution display of the power difference between instantaneous power and average power. The 20 MHz (max.) filter bandwidth supports multi-carrier measurement.

● **Power Meter Function**

The built-in power meter uses an amorphous power sensor to support very high measurement accuracy (±0.4 dB).

MX860902A GSM Measurement Software

● **Parameter Setting**

Measurement parameters such as GMSK modulation for GSM and 8PSK modulation for EDGE are set on-screen. Measurement is easy using a soft-key menu after setting measurement parameters.

● **Modulation Accuracy Measurement**

The modulation accuracy is high. (The residual phase error of GMSK modulation is <0.5° rms and the residual EVM of 8PSK modulation is <1.0% rms.)

● **Transmitter Power Measurement**

The screen displays the amplitude waveform simultaneously with templates with the horizontal axis as symbols and the vertical axis as level.

● **Output RF Spectrum Measurement**

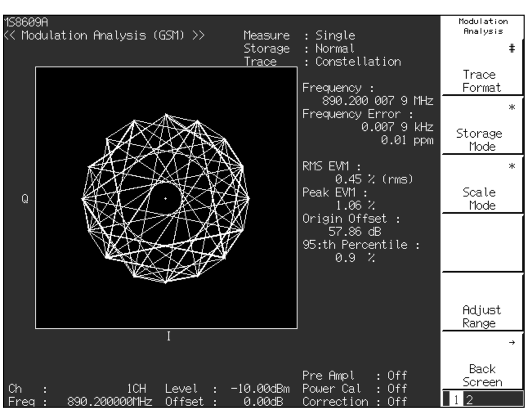
Measurement of the output RF spectrum is simple and quick.

● **Spurious Measurement**

Spurious can be measured in three ways: Sweep, Search, and Spot, which can be selected according to usage.

● **EDGE Constellation Display**

The following screen shows a constellation filtered through the GSM standard for the EDGE constellation display. It represents the constellation for 8PSK modulation through a Nyquist filter and Gaussian inverse correction filter.



MX860903A CDMA Measurement Software

● **Parameter Setting**

A setup screen supports easy input of parameters required for modulation accuracy and code domain power measurements at cdmaOne or CDMA2000 1xRTT analysis.

Measurement can be performed after parameter setup.

● **Modulation Accuracy Measurement**

Frequency error, modulation accuracy and code domain analysis are performed and the results are displayed on-screen. The measurement accuracy is 1% (typ.) for residual vector error (rms).

● **BTS Code Domain Analysis**

Only 2 seconds are required for code domain analysis of 1xRTT signals, and RC* 1 through RC5 can be measured.

The spreading factor of each code is detected automatically and displayed on-screen.

*: Radio Configuration

● **MS Code Domain Analysis**

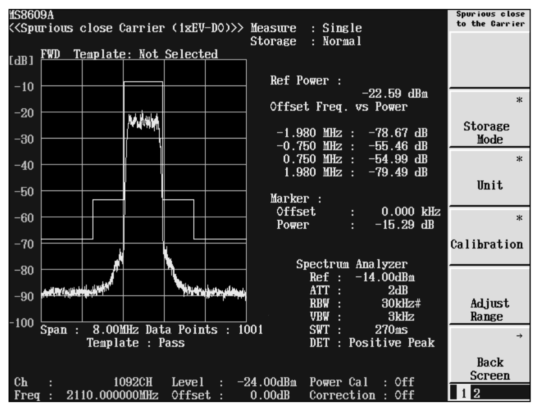
Code domain analysis of 1xRTT signals in RC3 and RC4 is performed in just 2 seconds. The I/Q phase code domains are displayed on-screen.

● **Transmission Power Measurement**

When transmission power is measured, both the value and signal waveform are displayed on-screen. High-accuracy power measurements are achieved using the built-in power meter function.

● **Spurious Close to Carrier Measurement**

Spurious close to the carrier is measured using the spectrum analyzer function. The template PASS/FAIL evaluation is displayed on-screen.



● **Spurious Measurement**

A frequency table can be set up at spurious measurement to provide PASS/FAIL measurement results. Fifteen frequencies and limit values can be input.

MX860904A
CDMA2000 1xEV-DO Measurement Software

● **BTS Code Domain Analysis**

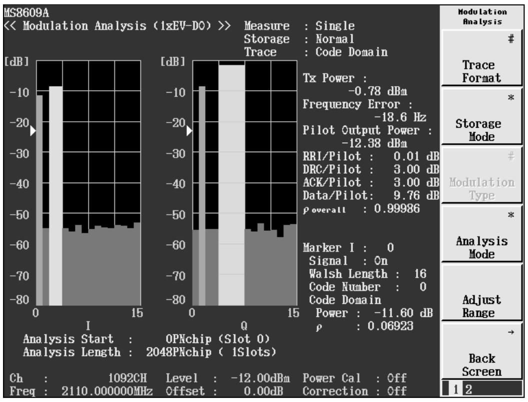
This performs code domain analysis of forward link signals in about 2 seconds. I/Q phase code domains are displayed on-screen.

● **Transmission Power Measurement**

When transmission power is measured, both the value and signal waveform are displayed on-screen. High-accuracy power measurement is achieved using the built-in power meter function.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

• **MS Code Domain Analysis**
This performs code domain analysis of reverse link signals in about 2 seconds. I/Q phase code domains are displayed on-screen.



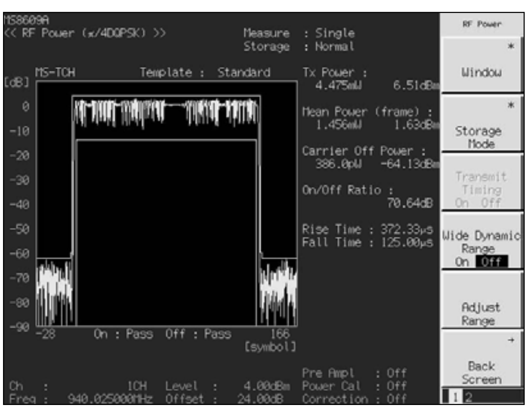
• **Spurious Close to Carrier Measurement**
Spurious close to the carrier is measured using the spectrum analyzer function. The template PASS/FAIL evaluation is displayed on-screen.

MX860905A π/4DQPSK Measurement Software

• **Parameter Setting**
Analysis of PDC, PHS and NADC (IS-136) systems requires setting of parameters for important measurement such as modulation accuracy at this screen. Changing the symbol rate also permits analysis of systems other than PDC, PHS and NADC.

• **Modulation Accuracy Measurement**
The constellation display is combined with the modulation accuracy measurement results to monitor the residual vector error (rms) with a high accuracy of 0.5% (PDC).

• **Transmitter Power Measurement**
This screen displays the transmitter power and waveform.
The power value is calibrated by the built-in power meter to achieve even higher accuracy power measurement.



• **Transmission Timing Measurement**
This screen displays the PHS send timing. In addition, when average measurement is selected, the send jitter is displayed.

• **Occupied Bandwidth Measurement**
The occupied bandwidth is measured with a spectrum analyzer or by FFT using DSP and displayed.

MX860930A Wireless LAN Measurement Software

• **Parameter Setting**
This screen is used to set common parameters such as signaling system, input level, frequency, data rate, and target system before starting analysis. Setting these parameters simplifies measurement operations.

• **Modulation Analysis**
This displays numeric results, including frequency, execution value and maximum value of the modulation accuracy (EVM) and the execution value of the phase error.

• **Power: Slot Display**
This displays the burst waveform of one slot. Numeric results such as the average power and maximum instantaneous power are also displayed.

• **Occupied Bandwidth**
This displays the occupied bandwidth including 99% of total emission power as a graph and numeric data. It also supports IEEE802.11b/11g to display the numeric data for spreading bandwidth, including 90% of total emission power.

• **Adjacent Channel Leakage Power**
This displays the results for a wide range up to the second adjacent channel as a graph and numeric data. The power for each channel can also be displayed separately.

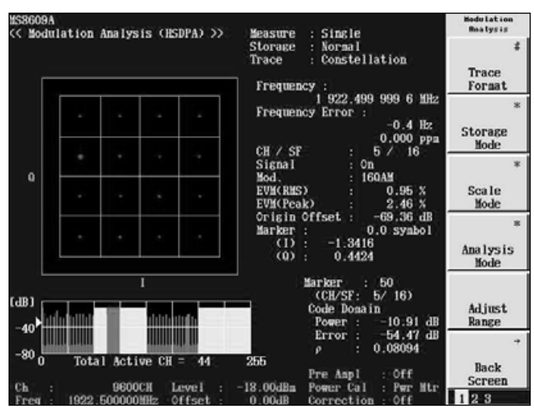
• **Spectrum Mask**
This executes PASS/FAIL judgement using the standard line for each wireless LAN system. The level difference of the measured value or the measured level value is also displayed with frequency.

• **Spurious**
This displays the measured results for spurious, including frequency, level, PASS/FAIL results, specifications, RBW and VBW in three sweep modes on three screens.
Measured results are evaluated automatically and PASS/FAIL is displayed by comparison with a preset limit.

• **Macro Command Function (Batch Processing)**
Each item listed can be batch measured and evaluated against preset values.

MX860950A HSDPA Measurement Software

• **Modulation Analysis (Constellation)**
The displayed pattern can be selected from either constellation only or constellation + code domain. The constellation of the code channel selected at the code domain screen is displayed.



• **Parameter Setting**
This screen is for setting conditions required for HSDPA analysis, such as modulation accuracy and code domain power measurement. Operation is simple after parameters have been set.

• **Modulation Analysis (Vector Error)**
The display pattern can be selected from either vector error only or vector error + code domain. The residual vector error (rms) is 1% (typ.), supporting high-accuracy measurement.

• **Code Domain Analysis**
Both Code vs. Slot and normal code domain analysis can be displayed.

• IQ Level Measurement
Input voltage (rms, p-p) for IQ can be measured.

• Demodulation Data Display
Display of demodulation data for multiple signals, including 16QAM (10 frames max.), is supported per code channel. A maximum of 10 frames of demodulation data can be output to a PC card.

• CCDF Measurement
The displayed pattern can be selected from either CCDF for instantaneous power, and average power difference or APD.
The CCDF for multi carriers can be measured.

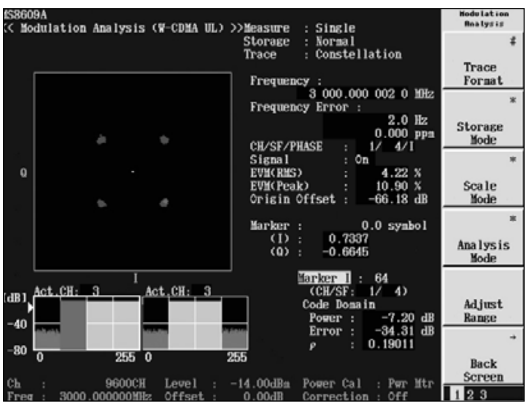
• Adjacent Channel Power Measurement
When measuring with a spectrum analyzer, adjacent channel power is measured after passage through a built-in filter (root Nyquist).
A high-speed measurement method can also be selected.

• Spurious Measurement
There are three spurious measurement methods: Spot, Sweep and Search. Up to 15 frequencies and limit values can be set in a table and measurement results are displayed with a limit evaluation.

MX860951A W-CDMA Release5 Uplink Measurement Software

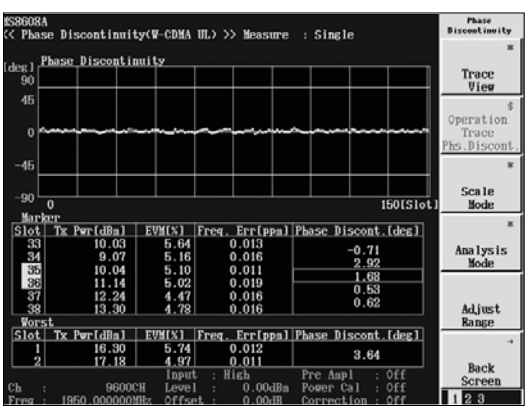
• Parameter Setting
This screen is used to set basic parameters, such as frequency and signal type. Operation is simple after completing each setting.

• Modulation Analysis Measurement [1]
The results for modulation analysis, such as frequency error, EVM and PCDE are all displayed on a screen. Also, the user can view the constellation of the code selected on the code domain screen.

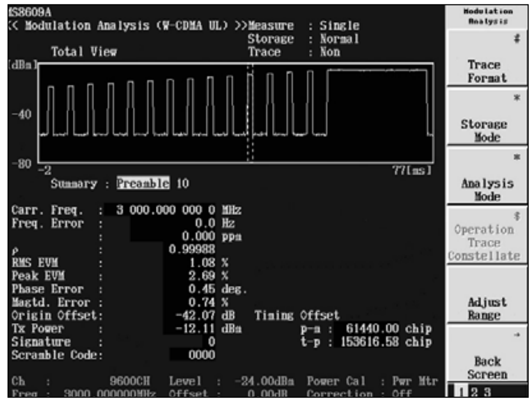


• Modulation Analysis Measurement [2]
Test results such as Tx Power, RMS EVM and Peak EVM per slot are listed on-screen, helping the user detect slot-dependent degradation easily.

• Phase Discontinuity Measurement
Test results such as Tx Power, EVM, Frequency Error and Phase discontinuity per slot, and Worst values are displayed on a single screen, allowing the user to understand the analysis results instantaneously.



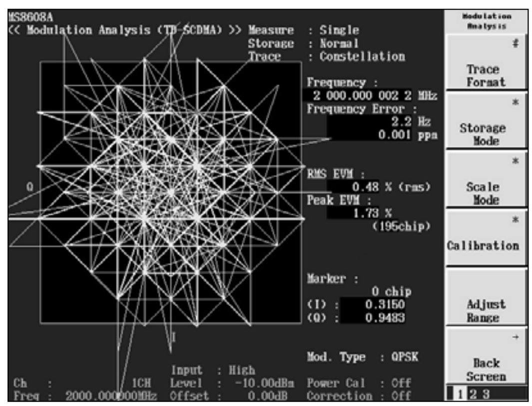
• RACH Analysis
Test results such as Tx Power and EVM of the Preamble and Messages, as well as the constellation are displayed. Also, timing differences between the Preamble and Message, plus the external trigger and Preamble can be measured.



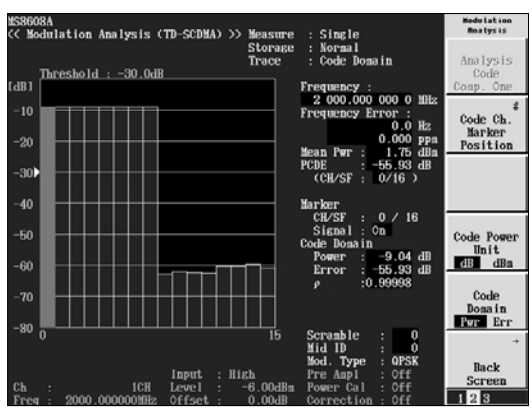
MX860960A TD-SCDMA Measurement Software

• Parameter Setting
This screen is used to set basic parameters, such as frequency and signal type. Measurement is simple after completing each setting.

• Modulation Analysis Measurement [1]
Results such as frequency error, EVM, and PCDE as well as modulation analysis results are displayed together.
Various display methods, such as Phase Error and Magnitude Error can be chosen. High-accuracy measurements are performed, reducing residual vector error (rms) to 0.8% (typ.).

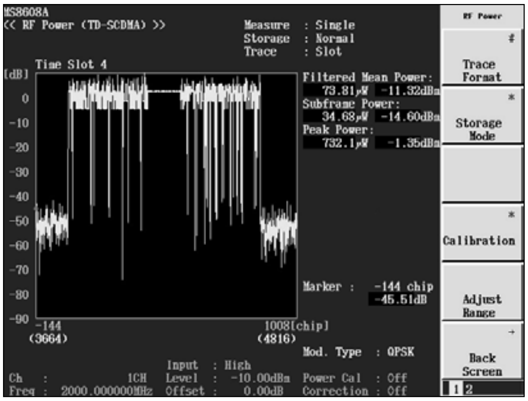


• Modulation Analysis Measurement [2]
The power of each code can be visualized using code domain displays (Code Domain Power, Code Domain Error).



• RF Power Measurement

The specified burst is searched from DwPTS and the RF power is measured. The Filtered Mean Power, Subframe Power, and Peak Power are listed.



For details and specifications, see the data sheet.

Specifications

• MS8609A Digital Mobile Radio Transmitter Tester

Frequency Range		9 kHz to 13.2 GHz
Max. Input Level		+20 dBm (100 mW), Continuous average power, DC input: 0 Vdc
Input Impedance		Power meter 50Ω, VSWR: ≤1.3 (30 MHz to 3 GHz) Except power meter 50Ω, VSWR: ≤1.5 (Input attenuator: ≥4 dB, ≤3 GHz), ≤2.3 (Input attenuator: ≥10 dB, >3 GHz)
Input Connector		N-type (RF input), BNC-type (I/Q input)
I/Q Input		Input: Balanced, Unbalanced Input impedance: 1 MΩ (Parallel capacitance: <100 pF), 50Ω Balanced input Differential voltage: 0.1 to 1 V(p-p), In-phase voltage ±2.5 V Unbalanced input: 0.1 to 1 V(p-p), AC/DC switchable
Reference Oscillator		Frequency: 10 MHz Starting characteristics: ≤5 × 10^{-8}/day (after 10 minute warm-up, compared to frequency after 24 hour warm-up) Aging rate: ≤2 × 10^{-8}/day, ≤1 × 10^{-7}/year (compared to frequency after 24 hour warm-up) Temperature characteristics: ±5 × 10^{-8} (0° to 50°C, compared to frequency at 25°C)
Power Meter		Frequency range: 30 MHz to 3 GHz Level range: –20 to +20 dBm Measurement accuracy (after zero calibration): ±10%
Spectrum Analyzer	Frequency	Frequency setting Setting range: 9 kHz to 13.2 GHz, Pre-selector range: 3.15 GHz to 13.2 GHz (Band 1 and 2) Frequency accuracy Accuracy: ± (Display frequency × Reference frequency accuracy + Span × Span accuracy + Resolution bandwidth × 0.15 + 10 × N Hz) ∗N: Mixer harmonic order Normal marker: Same as display frequency accuracy Delta marker: Same as span accuracy Frequency span setting range: 0 Hz, 5 kHz to 13.2 GHz Span accuracy: ±1.0% (at single band sweep, number of data points: 1001) RBW (Resolution Bandwidth) Setting range: 300 Hz to 3 MHz (1-3 sequence), 5 MHz, 10 MHz, 20 MHz (Band 0) Accuracy: ±20% (300 Hz to 10 MHz), ±40% (20 MHz) Selectivity (60 dB: 3 dB): ≤15:1 VBW (Video Bandwidth): 1 Hz to 3 MHz (1-3 sequence), off Sideband noise: ≤–108 dBc/Hz (1 GHz, 10 kHz offset), ≤–120 dBc/Hz (1 GHz, 100 kHz offset)

Continued on next page

Spectrum Analyzer	Amplitude	Maximum input level Continuous average power: +20 dBm, DC voltage: 0 V Average noise level (RBW: 300 Hz, VBW: 1 Hz, Input attenuator: 0 dB): [Without Option 08] ≤–124 dBm + 1.5f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + 1.5f [GHz] dB (2.5 GHz to 3.2 GHz, Band 0) ≤–116 dBm (3.15 GHz to 7.8 GHz, Band 1) ≤–107 dBm (7.7 GHz to 13.2 GHz, Band 2) [With Option 08] ≤–122 dBm + 1.8f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + 1.8f [GHz] dB (2.5 GHz to 3.2 GHz, Band 0) ≤–116 dBm (3.15 GHz to 7.8 GHz, Band 1) ≤–107 dBm (7.7 GHz to 13.2 GHz, Band 2) Residual response: ≤–100 dBm (1 MHz to 3.2 GHz, Band 0), ≤–90 dBm (3.15 GHz to 7.8 GHz, Band 1) Reference level Setting range: –100 to +30 dBm Accuracy: ±0.75 dB (+0.1 to 20 dBm), ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm), ±1.5 dB (–80 to –70 dBm) *After calibration, frequency: 50 MHz, Span: 1 MHz (Input attenuator, RBW, VBW and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10 MHz, 20 MHz) *After calibration, with RBW 3 kHz referenced Input attenuator: 0 to 62 dB (2 dB steps) Switching uncertainty: ±0.3 dB (10 to 50 dB), ±0.5 dB (52 to 62 dB) *After calibration, referenced to 50 MHz, RF ATT: 10 dB Frequency response: ±0.6 dB (9 kHz to 3.2 GHz, Band 0), ±1.5 dB (3.15 GHz to 7.8 GHz, Band 1), ±2.0 dB (7.7 GHz to 13.2 GHz, Band 2) *Reference frequency: 50 MHz, Input attenuator: 10 dB, 18° to 28°C Log linearity: ±0.4 dB (0 to –20 dB, RBW: ≤1 kHz), ±1.0 dB (0 to –90 dB, RBW: ≤1 kHz) 2nd harmonic distortion: ≤–60 dBc (10 MHz to 200 MHz), ≤–75 dBc (200 MHz to 850 MHz, Band 0), ≤–70 dBc (850 MHz to 1.6 GHz, Band 0), ≤–90 dBc (1.6 GHz to 6.6 GHz, Band 1 and 2) 2-tone 3rd-order distortion: ≤–70 dBc (10 MHz to 100 MHz), ≤–85 dBc (100 MHz to 3.2 GHz), ≤–80 dBc (3.15 GHz to 7.8 GHz), ≤–75 dBc (7.7 GHz to 13.2 GHz) *Frequency difference of two signals: ≥50 kHz, Mixer input: –30 dBm 1 dB gain compression: ≥0 dBm (≥100 MHz), ≥+3 dBm (≥500 MHz, Band 0), ≥–3 dBm (≥3150 MHz, Band 1 and 2)
	Sweep	Setting range: 10 ms to 1000 s (Frequency axis sweep), 1 µs to 1000 s (Time axis sweep) Trigger switch: Free-run, Triggered Trigger source: Wide IF video, Line, External (TTL level), External (±10 V) Trigger delay Pre-trigger range: –time span to 0 s Resolution: time span/500 ns or 100 ns whichever is larger Post trigger: 0 µs to 65.5 ms Resolution: 100 ns (Sweep time: ≤4.9 ms), 1 µs (Sweep time: ≥5 ms) Gate sweep mode Gate delay range: 0 to 65.5 ms (Resolution: 1 µs), Gate length range: 2 µs to 65.5 ms (Resolution: 1 µs)
	Functions	Number of data points: 501, 1001 Detection modes: Normal, Positive peak, Negative peak, Sample, Average, RMS (Option 04) Display functions: Trace A, Trace B, Trace A/B, Trace A/BG, Trace A/Time Storage functions: Normal, View, Max hold, Min hold, Average, Linear average, Cumulative, Overwrite Markers Signal search: Auto tune, Peak → CF, Peak → Ref, Scroll Zone markers: Normal, Delta Marker function: Marker → CF, Marker → Ref, Marker → CF step size, Δ marker → Span, Zone → Span Peak search: Peak, Next peak, Min dip, Next dip Multi-marker: 10 max. Measurements Noise power: dBm/Hz, dBm/ch, dBµ√Hz C/N: dBc/Hz, dBc/ch Frequency counter Resolution: 1, 10, 100 Hz, 1 kHz Measurement accuracy: ± (Display frequency × Reference frequency accuracy + 2 × N Hz + 1 LSB) *At S/N 20 dB or more and RBW 3 MHz or less, N: Mixer harmonic order Occupied bandwidth: Power N% method, X-dB down method Adjacent channel power Reference measurement: Total power, Reference level, In-band method Display methods: Channel specified display (3 channels × 2), Graphic display Average power of burst signal: Average power within specified time range of time domain waveform Template comparison measurement (time sweep): Upper limit × 2, Lower limit × 2 Mask measurement (frequency sweep): Upper limit × 2, Lower limit × 2
Others		Display: Color TFT-LCD, VGA 6.5-inch Hard copy: Hard copy of screen via parallel interface (ESC/P compatible printer) Memory card interface: ATA flash card (3.3 V/5 V) GPIB: Can be controlled (except power switch) from external controller when specified as device Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2 Parallel interface: Centronics printer I/F, D-Sub 25 pin connector (female) Video output: Analog RGB output, D-Sub 15 pin connector (female)
Dimensions and Mass		320 (W) × 177 (H) × 411 (D) mm (except handle, feet, front cover and fan cover), ≤16 kg (nominal)
Power Supply		100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) (–15/+10% max., voltage: 250 V, voltage auto-switching), 47.5 Hz to 63 Hz, ≤400 VA
Operating Temperature and Humidity		0° to 50°C, ≤85% (no condensation)
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1

• MX860901B W-CDMA Measurement Software

Guaranteed specifications after pressing Adjust Range and Power Calibration keys

Modulation/Frequency Measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08) Input level: –60 to +20 dBm (Average power, Preamp: off), –80 to +10 dBm (Average power, Preamp: on[*1]) Carrier frequency accuracy: ± (Reference oscillator accuracy + 10 Hz) ∗Input level: ≥–30 dBm (Preamp: off), ≥–40 dBm (Preamp: on[*1]), 1 code channel Modulation accuracy (Residual vector error): <2% (rms) ∗Input level: ≥–30 dBm (Preamp: off), ≥–40 dBm (Preamp: on[*1]), 1 code channel Origin offset accuracy: ±0.5 dB ∗Input level: ≥–30 dBm (Preamp: off), ≥–40 dBm (Preamp: on[*1]), 1 code channel, relative to signal with origin offset of –30 dBc Waveform display (for one-channel to multi-channel) Constellation, Eye pattern, Vector error vs. chip, Phase error vs. chip, Amplitude error vs. chip, Code vs. slot
Code Domain Analysis	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08) Input level: –60 to +20 dBm (Average power, Preamp: off), –80 to +10 dBm (Average power, Preamp: on[*1]) Code domain power accuracy: ±0.1 dB (Code power: ≥–10 dBc), ±0.3 dB (Code power: ≥–25 dBc) ∗Input level: ≥–10 dBm (Preamp: off), ≥–20 dBm (Preamp: on[*1]) Code domain error Residual error: <–50 dB Accuracy: ±0.5 dB (error: relative to signal with origin offset of –30 dBc) ∗Input level: ≥–10 dBm (Preamp: off); ≥–20 dBm (Preamp: on[*1]), Spread factor: 512 (downlink), 256 (uplink) Display Function: Code domain power, Code domain error Spread factor: 4 to 256 (uplink), 4 to 512 (downlink), Spread factor auto detection function, SCH level measurement function, I/Q separately at uplink Code vs. Slot measurement: Measures code domain power per slot of specified code channel for Max.150 slots. (Supporting compressed mode in downlink)
Amplitude Measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08) Input level: –60 to +20 dBm (Average power, Preamp: off), –80 to +10 dBm (Average power, Preamp: on[*1]) Transmitter power measurement Measurement range: –20 to +20 dBm (Average power, Preamp: off), –20 to +10 dBm (Average power, Preamp: on[*1]) ∗Auto calibrated at internal power meter Accuracy: ±0.4 dB Power measurement linearity: ±0.2 dB (0 to –40 dB) ∗Input level: ≥–10 dBm (Preamp: off); ≥–20 dBm (Preamp: on[*1]), after the range adjusted, with the reference level setting unchanged Filter selection function: Power measurement through RRC (α = 0.22) filter Transmitter power control measurement function: Relative power display per slot for 150 slots max., NO/GO evaluation RACH measurement function: Measures time difference between preamble RACH signal and message RACH signal
Occupied Bandwidth Measurement	Frequency range: 50 MHz to 3 GHz Input level: –60 to +20 dBm (Average power, Preamp: off), –80 to +10 dBm (Average power, Preamp: on[*1]) Measurement method Sweep method: Displays result after signal measured with sweep spectrum analyzer FFT method: Displays result after FFT
Adjacent Channel Power Measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08, 30) Input level: –10 to +20 dBm (Average power, Preamp: off) Measurement method Sweep method (all): Calculates and displays result after signal measured with sweep spectrum analyzer Sweep method (separate): Calculates and displays power after each adjacent channel measured with sweep spectrum analyzer Filter method: Measures and displays power of adjacent channels after passing via built-in receiving filters (RRC: α = 0.22) Measurement range Input level: ≥0 dBm (Filter method, Wide dynamic range mode) Code channel (1 code): ≥55 dBc (5 MHz offset), ≥62 dBc (10 MHz offset) Code channel (16 multi-code): ≥50 dBc (5 MHz offset), ≥60 dBc (10 MHz offset, without Option 08) Input level: ≥–10 dBm (Filter method, Wide dynamic range mode) Code channel (1 code): 55 dBc (5 MHz offset, typ.), 62 dBc (10 MHz offset, typ.) Code channel (16 multi-code): 50 dBc (5 MHz offset, typ.), 60 dBc (10 MHz offset, typ.)
Spurious Measurement	Measurement frequency: 9 kHz to 12.75 GHz (Except within carrier frequency ±50 MHz) Input level (Transmitter power): 0 to +20 dBm (Average power, Preamp: off) Measurement method Sweep method: Sweeps specified range of frequency using spectrum analyzer and then detects and displays peak value Calculates rate for transmission power value and displays as power rate. Waveform detection mode: average Spot method: Measures specified frequency with time domain from spectrum analyzer and displays average value Calculates rate for transmission power value and displays as power rate. Waveform detection mode: average Search method: Sweeps specified frequency range using spectrum analyzer to detect peak value, then measures frequency using time domain to display average value. Calculates rate for transmission power value and displays as power rate. Waveform detection mode: average Measurement range[*2]: ≥79 dB (RBW: 1 kHz, 9 kHz to 150 kHz, Band 0) ≥79 dB (RBW: 10 kHz, 150 kHz to 30 MHz, Band 0) ≥79 dB (RBW: 100 kHz, 30 MHz to 1000 MHz, Band 0) ≥76 – f [GHz] dB (RBW: 1 MHz, 1 GHz to 3.15 GHz, Band 0) ≥76 dB (RBW: 1 MHz, 3.15 GHz to 7.8 GHz, Band 1) ∗Carrier frequency: 1.8 GHz to 2.2 GHz
Spectrum Emission Mask Measurement	Measures signal with sweep spectrum analyzer and displays template evaluation result
Demodulation Display	Outputs 10 frames max. of de-spread data for specified code channel

Continued on next page

CCDF Measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08, 30) Measurement level range: –60 to +20 dBm (Average power, Preamp: off), +30 dBm (Peak power, Preamp: off) –80 to +10 dBm (Average power, Preamp: on), +20 dBm (Peak power, Preamp: on) Measurement method CCDF: Cumulative distribution display of power difference between instantaneous power and average power APD: Distribution display of power difference between instantaneous power and average power Filter selection function: 20, 10, 5, 3 MHz, RRC: α = 0.22, RC: α = 0.22
I/Q Signal	Input: Balanced, Unbalanced Input impedance: 1 MΩ (Parallel capacitance: <100 pF), 50Ω Balanced input Differential voltage: 0.1 to 1 V (p-p), In-phase voltage: ±2.5 V Unbalanced input: 0.1 to 1 V (p-p), AC/DC switchable Measurement items: Modulation accuracy, Code domain power, Amplitude, Occupied bandwidth (FFT method), I/Q level Residual vector error: <2% (rms) ∗Input level: ≥0.1 V (rms), DC coupled I/Q level measurement: Measures and displays each I, Q input voltage (rms, p-p) I/Q phase difference measurement: When CW signal input to I and Q input terminals, measures and displays phase difference between I- and Q-phase signals

∗1: Set when MS8609A-08 option installed in main frame
∗2: When the carrier frequency is in the range 2030.354 MHz to 2200 MHz, spurious is generated at the frequency shown below.
f (spurious) = f (input) – 2030.345 MHz

• MX860902A GSM Measurement Software

Guaranteed specifications after pressing Adjust Range and Power Calibration keys

Modulation/Frequency Measurement	Frequency range: 50 MHz to 2.7 GHz Input level: –40 to +20 dBm (Burst average power, Preamp: off), –60 to +10 dBm (Burst average power, Preamp: on∗1) Carrier frequency accuracy: ± (Reference oscillator accuracy + 10 Hz) ∗Input level (Burst average power): ≥–30 dBm (Preamp: off), ≥–40 dBm (Preamp: on∗1) Residual phase error (GMSK modulation): <0.5 deg (rms), <2.0 deg (peak) ∗Input level (Burst average power): ≥–30 dBm (Preamp: off), ≥–40 dBm (Preamp: on∗1) Residual EVM (8PSK modulation): <1% (rms) Waveform display: Trellis (GMSK modulation), Eye pattern, EVM vs. Bit (8PSK modulation), Phase vs. Bit, Amplitude vs. Bit, I/Q diagram
Amplitude Measurement	Frequency range: 50 MHz to 2.7 GHz Input level: –40 to +20 dBm (Burst average power, Preamp: off), –60 to +10 dBm (Burst average power, Preamp: on∗1) Transmitter power measurement (Auto calibrated at internal power meter) Measurement range: –10 to +20 dBm (Burst average power), –10 to +10 dBm (Burst average power, Preamp: on∗1) Accuracy: ±0.4 dB Power measurement linearity: ±0.2 dB (–30 to 0 dBm) ∗Input level (Burst average power): ≥–10 dBm (Preamp: off); ≥–20 dBm (Preamp: on∗1), without changing reference level setting after range optimization Carrier-off power measurement range Input level (Burst average power): ≥–10 dBm (Preamp: off), ≥–20 dBm (Preamp: on∗1) Normal mode: ≥60 dB (Compared with burst average power) Wide dynamic range mode: ≥80 dB (Compared with 10 mW of burst average power) ∗Measurement limit determined by average nose level (≤–70 dBm, 50 MHz to 2.7 GHz). Rise/Fall characteristics: Display rising/falling edges while synchronizing to modulation data of measured signal data. Standard line display possible (measured by 1 MHz bandwidth). PASS/FAIL judgment function
Output RF Spectrum Measurement	Frequency range: 100 MHz to 2.7 GHz Input level: –10 to +20 dBm (Burst average power, Preamp: off), –20 to +10 dBm (Burst average power, Preamp: on∗1) Modulation part measurement range: ≥60 dB (≥200 kHz offset), ≥68 dB (≥250 kHz offset) ∗CW signal, RBW: 30 kHz (<1.8 MHz offset), RBW: 100 kHz (≤1.8 MHz offset) Transient part measurement range: ≥63 dB (CW, ≥400 kHz offset)
Spurious Measurement	Measurement frequency: 100 kHz to 12.75 GHz (Except within carrier frequency ±50 MHz) Input level (Transmitter power): 0 to +20 dBm (Burst average power, Preamp: off) Measurement method Sweep method: Sweeps specified range of frequency using spectrum analyzer and detects and displays peak value Calculates rate for transmission power value and displays as power rate. Waveform detection mode: average Spot method: Measures specified frequency with time domain from spectrum analyzer and then displays average value Calculates rate for transmission power value and displays as power rate. Waveform detection mode: average Search method: Sweeps specified frequency range using spectrum analyzer to detect peak value, then measures frequency using time domain to display average value. Calculates rate for transmission power value and displays as power rate. Waveform detection mode: average Measurement range: ≥72 dB (RBW: 10 kHz, 100 kHz to 50 MHz, Band 0) ≥72 dB (RBW: 100 kHz, 50 MHz to 500 MHz, Band 0) ≥66 – f [GHz] dB (RBW: 3 MHz, 0.5 GHz to 3.15 GHz, Band 0, Except harmonic frequency) ≥66 dB (RBW: 3 MHz, 3.15 GHz to 7.8 GHz, Band 1) ∗Carrier frequency: 0.8 GHz to 1 GHz, 1.8 GHz to 2 GHz

Continued on next page

I/Q Signal	Input: Balanced, Unbalanced Input impedance: 1 MΩ (Parallel capacitance: <100 pF), 50Ω Balanced input Differential voltage: 0.1 V (p-p) to 1 V (p-p), In-phase voltage: ±2.5 V Unbalanced input: 0.1 V (p-p) to 1 V (p-p), AC/DC switchable Measurement items: Modulation accuracy, I/Q level Modulation accuracy Residual phase error: <0.5 deg (rms), DC coupled Residual EVM: <1.0% (rms), DC coupled ∗Input level: ≥0.1 V (rms), 18° to 28°C I/Q level measurement: Measures and displays each I, Q input voltage (rms, p-p) I/Q phase difference measurement: When CW signal input to I and Q input terminals, measures and displays phase difference between I- and Q-phase signals

∗1: Can be set when MS8609A-08 option is installed in the main unit.

• Option 01: Precision Frequency Reference

Frequency	10 MHz
Start-up Characteristics	≤5 × 10^{-8}/7 min. (Referenced to frequency at 24 hours after power-on)
Aging Rate	≤±5 × 10^{-10}/day (Referenced to frequency at 24 hours after power-on)
Temperature Characteristics	≤±5 × 10^{-10} (0° to 50°C, referenced to frequency at 25°C)

• Option 02: Narrow Resolution Bandwidths (FFT)

Resolution Bandwidth	Setting range: 1 Hz to 1 kHz (1-3 sequence) Bandwidth accuracy: ±10% (RBW = 30, 300 Hz), ±10% typ. (RBW = 1, 3, 10, 100 Hz, 1 kHz) RBW selectivity (60 dB: 3 dB): ≤5:1 RBW switching uncertainty: ±0.5 dB
Span Setting	Minimum setting span: 100 Hz
Average Noise Level Display	Without Option 08, when RBW: 1 Hz, RF ATT: 0 dB, Sample detection mode ≤–148.5 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤–144.5 dBm + 1.5f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤–138.5 dBm (typ., 3.15 GHz to 7.8 GHz, band 1) ≤–129.5 dBm (typ., 7.7 GHz to 13.2 GHz, band 2) With Option 08, Preamp: off, RBW: 1 Hz, RF ATT: 0 dB, Sample detection mode ≤–146.5 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤–144.5 dBm + 1.5f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤–138.5 dBm (typ., 3.15 GHz to 7.8 GHz, band 1) ≤–129.5 dBm (typ., 7.7 GHz to 13.2 GHz, band 2)

• Option 04: Digital Resolution Bandwidth

Resolution Bandwidth	Setting range: 10 Hz to 1 MHz (1-3 sequence) Bandwidth accuracy: ±10% (RBW ≥100 Hz), ±10% (typ., RBW ≤30 Hz) Bandwidth selectivity (60 dB: 3 dB): ≤5:1 (RBW ≥100 Hz), ≤5:1 (typ., RBW ≤30 Hz) RBW switching uncertainty: ±0.5 dB
Detection Mode	NORMAL, POSITIVE PEAK, NEGATIVE PEAK, SAMPLE, RMS RMS: displays root-mean-square value of average power between sample points
Average Noise Level Display	Without Option 08, RBW: 10 Hz, RF ATT: 0 dB, Sample detection mode ≤–136.5 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤–132.5 dBm + 1.5f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤–128.5 dBm (typ., 3.15 GHz to 7.8 GHz, band 1) ≤–119.5 dBm (typ., 7.7 GHz to 13.2 GHz, band 2) With Option 08, Preamp: off, RBW: 10 Hz, RF ATT: 0 dB, Sample detection mode ≤–134.5 dBm + 1.8f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤–132.5 dBm + 1.8f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤–128.5 dBm (typ., 3.15 GHz to 7.8 GHz, band 1) ≤–119.5 dBm (typ., 7.7 GHz to 13.2 GHz, band 2)

• Option 08: Preamplifier

Gain	20 dB (typ.)
Noise Figure	6.5 dB (typ., Input frequency: ≤2 GHz) ,12 dB (typ., Input frequency: >2 GHz)
Frequency	Frequency range: 100 kHz to 3 GHz Band 0: 100 kHz to 3 GHz, 1–: 3.15 GHz to 6.3 GHz, 1+: 6.2 GHz to 7.8 GHz, 2+: 7.7 kHz to 13.2 GHz ∗Only band 0 can use preamplifier
Amplitude	Level measurement: Average noise level to +10 dBm Max. input level: +10 dBm Average noise level: –137 dBm + 2f [GHz] dB (1 MHz to 2.5 GHz, band 0) ∗RBW: 300 Hz, VBW: 1 Hz, RF ATT: 0 dB, and Sample detection mode Reference level Setting range Log scale: –120 to +10 dBm, or equivalent level Linear scale: 2.24 µV to 707 mV Reference level accuracy: ±0.90 dB (–69.9 to +10 dBm), ±1.50 dB (–90 to –70 dBm) ∗After calibration, referenced to 50 MHz, 1 MHz span (RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.5 dB (300 Hz to 5 MHz), ±0.75 dB (10 MHz, 20 MHz) ∗After calibration, referenced to RBW 3 kHz RF ATT switching uncertainty: ±0.5 dB (10 to 50 dB), ±1.0 dB (52 to 62 dB) Frequency response: ±2.0 dB (100 kHz to 3 GHz) ∗Referenced to 100 MHz, RF ATT: 10 to 50 dB, Temperature: 18° to 28°C Linearity of waveform display Log scale (after calibration): ±0.5 dB (0 to –20 dB, RBW ≤1 kHz), ±1.0 dB (0 to –60 dB, RBW ≤1 kHz), ±1.5 dB (0 to –75 dB, RBW ≤1 kHz) Linear scale (after calibration): ±5% (relative to reference level) Spurious response: Two tone 3rd order distortion: ≤–70 dBc (10 MHz to 3 GHz) ∗Frequency difference of two signals ≥50 kHz, Preamp input level∗1 of –55 dBm 1 dB gain compression: ≥–35 dBm (Input frequency ≥100 MHz) ∗Preamp input level∗1 Input impedance: VSWR ≤2.5 (typ.)

∗1: Preamp input level shown as: Preamp input level = RF input level – RF ATT setting level

• Option 09: Ethernet Interface

Function	Control (except power switch) from external controller
Connector	10BASE-T

• Option 30: LPF for 2 GHz Band Carrier Cut

Function	Suppresses distortion in spectrum analyzer by carrier wave (1.8 GHz to 2 GHz) at W-CDMA low-frequency band spurious measurement ∗Cannot be installed simultaneously with Option 08
Frequency Range	9 kHz to 3.2 GHz (LPF: OFF), 9 kHz to 1.0 GHz (LPF: ON)
LPF Attenuation Characteristics	≤–20 dB, –30 dB (typ.), at 1.8 GHz to 2.2 GHz
Average Noise Level Display	[LPF: ON] ≤–122 dBm + 2f [GHz] dB (1 MHz to 1.0 GHz, band 0) ∗RBW: 300 Hz, VBW: 1 Hz, RF ATT: 0 dB
Frequency Response	[LPF: ON] ±1.0 dB (9 kHz to 1.0 GHz, band 0) ∗Referenced to 50 MHz, RF ATT: 10 dB, Temperature: 18° to 28°C

• Option 31: Low Noise Floor

Function	Used to decrease floor noise in frequency band 2+
Average Noise Level Display	≤–112 dBm (7.7 GHz to 13.2 GHz, band 2) ∗RBW: 300 Hz, VBW: 1 Hz, RF ATT: 0 dB

• Option 32: Maximum Input Level Extension

Function	Extends measurement level range to +26 dBm
Max. Input Level	+30 dBm (1 W), continuous wave average power
Power Meter Function	Level range: –14 to +26 dBm
Spectrum Analyzer Amplitude	Setting range Log scale: –100 to +40 dBm or equivalent level Linear scale: 22.4 µV to 22.4 V Reference level accuracy: ±0.75 dB (+0.1 to +30 dBm), ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm), ±1.5 dB (–80 to –70 dBm) ∗After calibration, Frequency: 50 MHz, Span: 1 MHz (RF ATT, RBW, VBW, and sweep time set to AUTO)

- **Option 33: High Accuracy Power Measurement**

Function	Improves power measurement accuracy without using internal power meter using MX860901A W-CDMA Measurement Software
Frequency Range	1848 MHz to 2171 MHz (Except 1995 MHz to 2105 MHz)
Transmission Power Measurement Range	–50 to +20 dBm (average power)
Reference Level	–10 to +20 dBm
Transmission Power Accuracy	±0.4 dB ∗At reference input level, 25° ±3°C, Input ATT: AUTO, after calibration and excluding mismatch error
Power Measurement Linearity	±0.2 dB (0 to –40 dB) ∗Input level: ≥–10 dBm, at range optimization and no change of reference level setting
Temperature Coefficient	0.015 dB/°C
Accessories	ATA Flash memory card
Calibration Interval	6 months

- **Option 36: Power Meter Maximum Frequency Extension (6 GHz)**

Function	Extends power meter maximum frequency from 3 GHz to 6 GHz.
Frequency Range	30 MHz to 3 GHz
Level Range	–20 to +20 dBm
Measurement Accuracy	±10% (after calibration of 0 points)

- **Option 37: Power Meter Maximum Frequency Extension (6 GHz) Retrofit**

Function	Retrofits Option 36 to shipped MS8609A units

- **Option 46: Auto-power Recovery**

Function	Disables the power switch on the front panel and automatically restores power after power failure. ON/OFF operation can be performed using the standby switch on the rear panel. ∗Power switch on the front panel of this unit does not have a latching function. Therefore, if power is interrupted in the ON status, the standby status is kept even after power is restored.

- **Option 47: Rack Mount without Handle (IEC)**

Function	Mount for IEC standard rack When mounted, the tilt handle (standard) is eliminated.

- **Option 48: Rack Mount without Handle (JIS)**

Function	Mount for JIS rack When mounted, the tilt handle (standard) is eliminated.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MS8609A	Digital Mobile Radio Transmitter Tester	
	Standard accessories	
	Power Cord:	1 pc
J0996B	RS-232C Cable:	1 pc
Z0808	Memory Card [ANR-CFX00T64(P), ≥32 MB]:	1 pc
F0014	Fuse, 6.3 A:	1 pc
J0576B	Coaxial Cord (N-P · 5D-2W · N-P), 1 m:	1 pc
MX268001A	File Transfer Utility:	1 pc
W1709AE	MS8608A/MS8609A Operation Manual (Vol. 1):	1 copy
W1744AE	MS8608A/MS8609A Operation Manual (Vol. 2):	1 copy
W1745AE	MS8608A/MS8609A Operation Manual (Vol. 3):	1 copy
	Options	
MS8609A-01	Precision Frequency Reference (Aging rate: 5×10^{-10}/day)	
MS8609A-02	Narrow Resolution Bandwidth (FFT)	
MS8609A-04	Digital Resolution Bandwidth	
MS8609A-08	Preamplifier	
MS8609A-09	Ethernet Interface	
MS8609A-30	LPF for 2 GHz Band Carrier Cut	
MS8609A-31	Low Noise Floor	
MS8609A-32	Maximum Input Level Extension	
MS8609A-33	High Accuracy Power Measurement	
MS8609A-36	Power Meter Maximum Frequency Extension (6 GHz)	
MS8609A-37	Power Meter Maximum Frequency Extension (6 GHz, Retrofit)	
MS8609A-46	Auto Power Recovery	
MS8609A-47	Rack Mount without Handle (IEC)	
MS8609A-48	Rack Mount without Handle (JIS)	
MU860920A	Demodulation Unit	
	Software	
MX860901B	W-CDMA Measurement Software	
MX860902A	GSM Measurement Software	
MX860903A	CDMA Measurement Software	
MX860904A	CDMA2000 1xEV-DO Measurement Software	
MX860905A	π/4DQPSK Measurement Software	
MX860920A	W-CDMA BER/BLER Measurement Software (requires MU860920A)	
MX860930A	Wireless LAN Measurement Software	
MX860950A	HSDPA Measurement Software	
MX860951A	W-CDMA Release 5 Uplink Measurement Software	
MX860960A	TD-SCDMA Measurement Software	
	Optional accessories	
J0576D	Coaxial Cord (N-P · 5D-2W · N-P), 2 m	
J0127C	Coaxial Cord (BNC-P · RG-58A/U · BNC-P), 0.5 m	
J0127A	Coaxial Cord (BNC-P · RG-58A/U · BNC-P), 1 m	
J0007	408JE-104 GPIB Cable (1 m)	
J0008	GPIB Cable, 2 m	
MA1612A	Four-port Junction Pad (5 MHz to 3000 MHz)	
J0395	Fixed Attenuator for High-power (30 dB, 30 W, DC to 9 GHz)	
B0472	Fixed Attenuator for High-power (30 dB, 100 W, DC to 18 GHz)	
B0452A	Hard Carrying Case (with casters)	
B0452B	Hard Carrying Case (without casters)	
B0329G	Front Cover for 3/4 MW4U	
B0488	Rear Panel Protective Pad	
B0480	Tilt Handle Soft Type	
A3933	Circulator (1760 MHz to 2115 MHz)	
H3930	Isolator (1760 MHz to 2115 MHz)	
W1746AE	MX860x01B/MX268x01B Operation Manual	
W1795AE	MX860x02A Operation Manual	
W1865AE	MX860x03A/MX268x03A Operation Manual	
W2090AE	MX860x04A/MX268x04A Operation Manual	
W1866AE	MX860x05A/MX268x05A Operation Manual	
W2154AE	MX860820A/MX860920A Operation Manual	
W2080AE	MX268x30A/MX860x30A Operation Manual	
W2131AE	MX860x50A Operation Manual	
W2617AE	MX860x51A/MX268x51A Operation Manual	
W2593AE	MX860x60A/MX268x60A Operation Manual	
	Maintenance service	
MS8609A-90	Extended Three Year Warranty Service	
MS8609A-91	Extended Five Year Warranty Service	

DIGITAL MOBILE RADIO TRANSMITTER TESTER

MS8608A

9 kHz to 7.8 GHz

Remote Control

GPIB | Ethernet OPTION

For Evaluation of 2G, 3G and 3.5G Communication Standards

The MS8608A Digital Mobile Radio Transmitter Tester has an internal spectrum analyzer, modulation analyzer, and power meter. One tester covers development to manufacturing of base stations, mobile stations, and devices.
The spectrum analyzer resolution bandwidth of up to 20 MHz readily supports measurement of wide-band signals.
The modulation analyzer uses high-speed DSP processing to support all Vector Signal Analysis (VSA) functions.
The power sensor offers high-accuracy power measurements of ±0.4 dB using an amorphous sensor.

Up to three dedicated measurement software options (such as W-CDMA and GSM/EDGE) can be installed simultaneously.
Input signals can be selected from either RF or I/Q inputs. Balanced or unbalanced input can also be selected for I/Q signals.
Remote measurement is supported by GPIB, RS-232C and 10BASE-T (optional) interfaces. The high-speed GPIB of 120 kbps enables high-speed measurement on production lines. The monitor uses a clear 6.5-inch TFT color LCD.

Features

Broadband signal support (up to IMT-2000 2 Mbps)

Specifications

MS8608A Digital Mobile Radio Transmitter Tester

Frequency Range	9 kHz to 7.8 GHz, 9 kHz to 7.9 GHz (with Option 35)
Max. Input Level	High-power input: +40 dBm (10 W), Low-power input: +20 dBm (100 mW)
Input Impedance	High-power input 50Ω, VSWR: ≤1.2 (≤3 GHz), ≤1.3 (>3 GHz) Low-power input Power meter: 50Ω, VSWR: ≤1.3 (≤3 GHz) Except power meter: 50Ω, VSWR: ≤1.5 (≤3 GHz), ≤2.0 (>3 GHz) ∗Input attenuator: ≥4 dB
Input Connector	N-type (High-power input), SMA-type (Low-power input), BNC-type (I/Q input)
I/Q Input	Input: Balanced, Unbalanced Input impedance: 1 MΩ (Parallel capacitance: <100 pF), 50Ω Balanced input Differential voltage: 0.1 to 1 V(p-p), In-phase voltage ±2.5 V Unbalanced input: 0.1 to 1 V(p-p), AC/DC switchable
Reference Oscillator	Frequency: 10 MHz Starting characteristics: ≤5 × 10^{-8} (after 10 minute warm-up, compared to frequency after 24 hour warm-up) Aging rate: ≤2 × 10^{-8}/day, ≤1 × 10^{-7}/year (compared to frequency after 24 hour warm-up) Temperature characteristics: ≤5 × 10^{-8} (0˚ to 50˚C, compared to frequency at 25˚C)
Power Meter	Frequency range: 30 MHz to 3 GHz Level range: 0 to +40 dBm (High-power input), –20 to +20 dBm (Low-power input) Measurement accuracy (after zero calibration): ±10%

Continued on next page

Spectrum Analyzer	Frequency	Frequency setting Setting range: 9 kHz to 3.2 GHz (Band: 0), 3.15 GHz to 7.8 GHz (Band: 1) ∗Setting resolution: 1 Hz Pre-selector range: 3.15 GHz to 7.8 GHz (Band: 1) Frequency accuracy Display accuracy: ± (Display frequency × Reference frequency accuracy + Span × Span accuracy + Resolution bandwidth × 0.15 + 10 Hz) Normal marker: Same as display frequency accuracy Delta marker: Same as span accuracy Frequency span setting range: 0 Hz, 5 kHz to 7.8 GHz Span accuracy: ±1.0% (Single band sweep) RBW (Resolution bandwidth) Setting range: 300 Hz to 3 MHz (1-3 sequence), 5, 10, 20 MHz (Band 0) Accuracy: ±20% (300 Hz to 10 MHz) Selectivity (60 dB: 3 dB): ≤15:1 VBW (Video bandwidth): 1 Hz to 3 MHz (1-3 sequence), Off Sideband noise: ≤–108 dBc/Hz (1 GHz, 10 kHz offset), ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Amplitude	Maximum input level Continuous average power: +40 dBm (High-power input), +20 dBm (Low-power input) DC Voltage: 0 V Average noise level (at RBW: 300 Hz, VBW: 10 Hz): [Without Option 08] ≤–104 dBm + 1.5f [GHz] dB (High-power input, 1 MHz to 2.5 GHz, Band 0, Input attenuator: 20 dB) ≤–100 dBm + 1.5f [GHz] dB (High-power input, 2.5 GHz to 3.2 GHz, Band 0, Input attenuator: 20 dB) ≤–100 dBm + 0.8f [GHz] dB (High-power input, 3.15 GHz to 7.8 GHz, Band 1, Input attenuator: 20 dB) [With Option 08] ≤–102 dBm + 1.8f [GHz] dB (High-power input, 1 MHz to 2.5 GHz, Band 0, Input attenuator: 20 dB) ≤–100 dBm + 1.8f [GHz] dB (High-power input, 2.5 GHz to 3.2 GHz, Band 0, Input attenuator: 20 dB) ≤–100 dBm + 0.8f [GHz] dB (High-power input, 3.15 GHz to 7.8 GHz, Band 1, Input attenuator: 20 dB) [Without Option 08] ≤–124 dBm + 1.5f [GHz] dB (Low-power input, 1 MHz to 2.5 GHz, Band 0, Input attenuator: 0 dB) ≤–120 dBm + 1.5f [GHz] dB (Low-power input, 2.5 GHz to 3.2 GHz, Band 0, Input attenuator: 0 dB) ≤–120 dBm + 0.8f [GHz] dB (Low-power input, 3.15 GHz to 7.8 GHz, Band 1, Input attenuator: 0 dB) [With Option 08] ≤–122 dBm + 1.8f [GHz] dB (Low-power input, 1 MHz to 2.5 GHz, Band 0, Input attenuator: 0 dB) ≤–120 dBm + 1.8f [GHz] dB (Low-power input, 2.5 GHz to 3.2 GHz, Band 0, Input attenuator: 0 dB) ≤–120 dBm + 0.8f [GHz] dB (Low-power input, 3.15 GHz to 7.8 GHz, Band 1, Input attenuator: 0 dB) Residual response: ≤–80 dBm (High-power input, 1 MHz to 3.2 GHz, Input attenuator: 20 dB) ≤–70 dBm (High-power input, 3.15 GHz to 7.8 GHz, Input attenuator: 20 dB) ≤–100 dBm (Low-power input, 1 MHz to 3.2 GHz, Input attenuator: 0 dB) ≤–90 dBm (Low-power input, 3.15 GHz to 7.8 GHz, Input attenuator: 0 dB) Reference level Setting range: –80 to +50 dBm (High-power input), –100 to +30 dBm (Low-power input) Accuracy (High-power input, after calibration): ±0.5 dB (–29.9 to +20 dBm), ±0.75 dB (–49.9 to –30 dBm, +20.1 to +40 dBm), ±1.5 dB (–60 to –50 dBm) Accuracy (Low-power input, after calibration): ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, +0.1 to +20 dBm), ±1.5 dB (–80 to –70 dBm) ∗Frequency: 50 MHz, Span: 1 MHz (Input attenuator, RBW, VBW and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (300 Hz to 5 MHz, referenced to RBW: 3 kHz) Input attenuator: 20 to 82 dB (High-power input), 0 to 62 dB (Low-power input), 2 dB steps Frequency response: ±0.6 dB (9 kHz to 3.2 GHz, Band 0), ±1.0 dB (3.15 GHz to 7.8 GHz, Band 1) ∗Referenced to 50 MHz, Input attenuator: 30 dB (High-power input), 10 dB (Low-power input), 18˚ to 28˚C Log linearity: ±0.5 dB (0 to –20 dB, RBW: ≤1 kHz), ±1.0 dB (0 to –90 dB, RBW: ≤1 kHz) 2nd harmonic distortion: ≤–60 dBc (10 MHz to 200 MHz, Band 0, Mixer input: –30 dBm) ≤–75 dBc (200 MHz to 850 MHz, Band 0, Mixer input: –30 dBm) ≤–70 dBc (850 MHz to 1.6 GHz, Band 0, Mixer input: –30 dBm) ≤–90 dBc (1.6 GHz to 3.9 GHz, Band 1, Mixer input: –10 dBm) 2-tone 3rd-order intermodulation distortion: ≤–70 dBc (10 MHz to 100 MHz), ≤–85 dBc (0.1 GHz to 7.8 GHz) ∗Frequency difference of two signals: ≥50 kHz, Mixer input: –30 dBm 1 dB gain compression: ≥0 dBm (≥100 MHz), ≥+3 dBm (≥500 MHz)
	Sweep	Setting range: 10 ms to 1000 s (Frequency axis sweep), 1 µs to 1000 s (Time axis sweep) Trigger switch: Free-run, Triggered Trigger source: Wide IF video, Video, External (TTL level), External (±10 V), Line Trigger delay Pre-trigger range: –time span to 0 s Resolution: Time span/500 ns or 100 ns, whichever larger Post trigger: 0 to 65.5 ms, Resolution: 100 ns (Sweep time: ≤4.9 ms), 1 µs (Sweep time: ≤5 ms) Gate sweep mode Gate delay range: 0 to 65.5 ms (Resolution: 1 µs) Gate length range: 2 µs to 65.5 ms (Resolution: 1 µs)

Continued on next page

Spectrum Analyzer	Functions	Number of data points: 501 Detection modes: Normal, Positive peak, Negative peak, Sample, Average, rms (Option 04) Display functions: Trace A, Trace B, Trace A/B, Trace A/BG, Trace A/Time Storage functions: Normal, View, Max hold, Min hold, Average, Cumulative, Overwrite Markers Signal search: Auto tune, Peak → CF, Peak → Ref, Scroll Zone markers: Normal, Delta Marker function: Marker → CF, Marker → Ref, Marker → CF step size, Δ marker → Span, Zone → Span Peak search: Peak, Next peak, Min dip, Next dip Multi-marker: 10 max. Measurements Noise power: dBm/Hz, dBm/ch, dBμV/$\sqrt{Hz}$ C/N: dBc/Hz, dBc/CH Occupied bandwidth: Power N% method, X-dB down method Adjacent channel power Reference measurement: Total power, Reference level, In-band method Display methods: Channel specified display (3 channels × 2), Graphic display Average power of burst signal: Average power within specified time range of time domain waveform Template comparison measurement (Time sweep): Upper limit × 2, Lower limit × 2 Mask measurement (Frequency sweep): Upper limit × 2, Lower limit × 2
Others		Display: Color TFT-LCD, VGA 6.5-inch Hard copy: Hard copy of screen via parallel interface (ESC/P compatible printer) Memory card interface: ATA Flash card (3.3 V/5 V) GPIB: Controlled (except power switch) from external controller when specified as device Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2 Parallel interface: Centronics printer I/F, D-Sub 25 pin connector (female) Video output: Analog RGB output, D-Sub 15 pin connector (female)
Dimensions and Mass		320 (W) × 177 (H) × 411 (D) mm (except Handle, Feet, Front cover and Fan cover), ≤16 kg (nominal)
Power Supply		100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) (–15/+10% max., voltage: 250 V, voltage auto-switching), 47.5 Hz to 63 Hz, ≤400 VA
Operating Temperature and Humidity		0˚ to 50˚C, ≤85% (no condensation)
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MS8608A	Digital Mobile Radio Transmitter Tester	
	Standard accessories	
	Power Cord:	1 pc
J0996B	RS-232C Cable:	1 pc
Z0808	Memory Card [ANR-CFX00T64(P), ≥32 MB]:	1 pc
F0014	Fuse, 6.3 A:	1 pc
J0576B	Coaxial Cord (N-P · 5D-2W · N-P), 1 m:	1 pc
MX268001A	File Transfer Utility:	1 pc
W1709AE	MS8608A/MS8609A Operation Manual (Vol. 1):	1 copy
W1744AE	MS8608A/MS8609A Operation Manual (Vol. 2):	1 copy
W1745AE	MS8608A/MS8609A Operation Manual (Vol. 3):	1 copy
	Options	
MS8608A-01	Precision Frequency Reference (aging rate: 5 × 10^{-10}/day)	
MS8608A-02	Narrow Resolution Bandwidths (FFT)	
MS8608A-03	Extension of Pre-selector Lower Limit (to 1.6 GHz)	
MS8608A-04	Digital Resolution Bandwidth	
MS8608A-08	Pre-amplifier (100 kHz to 3 GHz)	
MS8608A-09	Ethernet Interface	
MS8608A-35	7.9 GHz Frequency Extension	
MS8608A-36	Power Meter Maximum Frequency Extension (6 GHz)	
MS8608A-37	Power Meter Maximum Frequency Extension (6 GHz, Retrofit)	
MS8608A-46	Auto Power Recovery	
MS8608A-47	Rack Mount without Handle (IEC)	
MS8608A-48	Rack Mount without Handle (JIS)	
MU860820A	Demodulation Unit	
	Measurement software	
MX860801B	W-CDMA Measurement Software	
MX860802A	GSM Measurement Software	
MX860803A	CDMA Measurement Software	
MX860804A	CDMA2000 1xEV-DO Measurement Software	
MX860805A	π/4DQPSK Measurement Software	
MX860820A	W-CDMA BER/BLER Measurement Software (requires MU860820A)	
MX860830A	Wireless LAN Measurement Software	
MX860850A	HSDPA Measurement Software	
MX860851A	W-CDMA Release 5 uplink Measurement Software	
MX860860A	TD-SCDMA Measurement Software	

Model/Order No.	Name
	Optional accessories
J0576D	Coaxial Cord (N-P · 5D-2W · N-P), 2 m
J0127C	Coaxial Cord (BNC-P · RG-58A/U · BNC-P), 0.5 m
J0127A	Coaxial Cord (BNC-P · RG-58A/U · BNC-P), 1 m
MA1612A	Four-port Junction Pad (5 MHz to 3000 MHz)
J0395	Fixed Attenuator for High-power (30 dB, 30 W, DC to 9 GHz)
B0472	Fixed Attenuator for High-power (30 dB, 100 W, DC to 18 GHz)
J0007	408JE-104 GPIB Cable (1 m)
J0008	GPIB Cable, 2 m
B0452A	Hard Carrying Case (with casters)
B0452B	Hard Carrying Case (without casters)
B0329G	Front Cover for 3/4 MW4U
B0488	Rear Panel Protective Pad
B0480	Tilt Handle Soft Type
A3933	Circulator (1760 MHz to 2115 MHz)
H3930	Isolator (1760 MHz to 2115 MHz)
W1746AE	MX860x01B/MX268x01B Operation Manual
W1795AE	MX860x02A Operation Manual
W1865AE	MX860x03A/MX268x03A Operation Manual
W2090AE	MX860x04A/MX268x04A Operation Manual
W1866AE	MX860x05A/MX268x05A Operation Manual
W2154AE	MX860820A/MX860920A Operation Manual
W2080AE	MX268x30A/MX860x30A Operation Manual
W2131AE	MX860x50A Operation Manual
W2617AE	MX860x51A/MX268x51A Operation Manual
W2593AE	MX860x60A/MX268x60A Operation Manual
	Maintenance service
MS8608A-90	Extended Three Year Warranty Service
MS8608A-91	Extended Five Year Warranty Service

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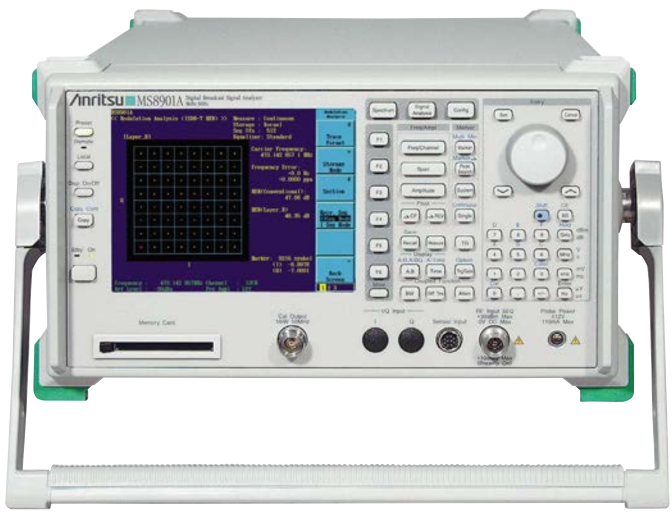
DIGITAL BROADCAST SIGNAL ANALYZER

MS8901A

9 kHz to 3 GHz

Remote Control
GPIB | Ethernet OPTION

For Digital Broadcast from Maintenance to Device R&D and Manufacturing



MS8901A Digital Broadcast Signal Analyzer analyzes the signals very accurately, in the various kinds of fields like development and manufacturing field or maintenance field to manage service area or transmission station. MS8901A is equipped with spectrum analyzer of highly dynamic-range. This analyzer is realized to analyze broad band vector signal, by using the frequency converter with superior SSB phase noise characteristic, in conjunction with frequency characteristic. Up to three signal analyzing software can be installed into the platform, which can analyze the digital terrestrial broadcasting signals.

- Fusion of RF microwave and DSP technologies
- All-in-one

Features

• SSB Phase Noise Characteristics of High Purity

MS8901A uses the synthesizer, of which SSB phase noise characteristic is –95 dBc/Hz (1 kHz offset typ.) and –108 dBc/Hz (10 kHz offset) as local signal source. The performance of the frequency converter, which is an important component for the signal analysis of the digital broadcasting, is highly improved.

• IF-stage SAW Filter

To assure high channel selectivity for field measurement, the MS8901A has a SAW filter at the IF processing stage.
The combination of SAW filter and digital filter at the DSP stage offers greatly improved selectivity.

• High-performance Spectrum Analyzer

MS8901A includes the spectrum analyzer as standard equipment. This analyzer features various display screens and major functions, which enables to measure frequency counter, occupied bandwidth, and channel power.

• Wide Dynamic Range

When analyzing the digital broadcasting signal, lower level of noise floor characteristic is required for the nonlinear components like mixer or preamplifier used for the frequency converter. The frequency converter included within MS8901A is equipped with spectrum analyzer and vector signal analyzer, both of which is highly dynamic range.
Together with this, this frequency converter compresses 1 dB gain within +3 dBm and includes –148 dBm/Hz floor noise (–163 dBm/Hz at preamplifier).

• High-level DSP Technology

The MS8901A uses high-performance digital signal processing functions with a 14-bit A/D converter to assure superior analog front-end performance.

• Two Functions in One Unit

The MS8901A Digital Broadcast Signal Analyzer combines a spectrum analyzer and vector signal analyzer in a convenient modular platform supporting all the functions needed for measuring digital broadcast signals.

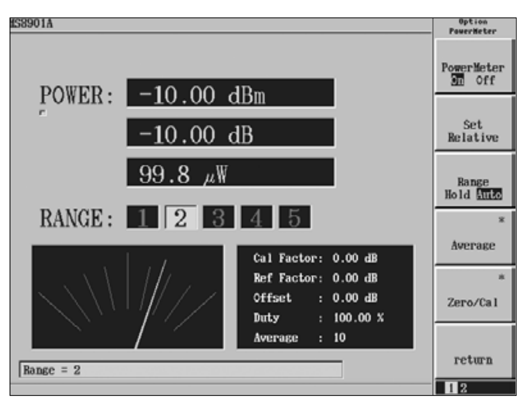
• PCMCIA Card Slot

For the external memory interface, the ATA flash memory card is employed. The measurement data or the parameter setting status in the field can be saved on a flash card.
The measurement screen can be saved as bit map file in monochrome or color optionally and used to make reports.
Measurement data can be saved as CSV format file, too.

• Power Meter Function (Option)

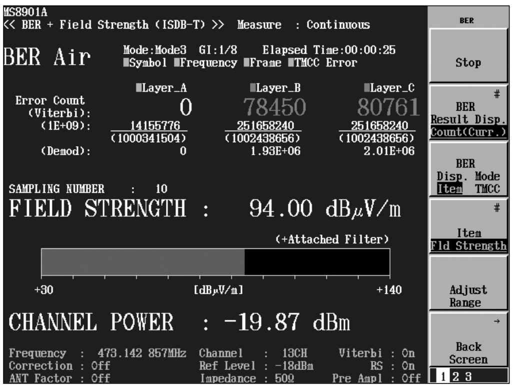
Power Measurement of High Accuracy

MS8901A includes the power meter function which enables to measure up to 32 GHz. Only by installing the power sensor to the front connector, high-accurate power measurement is realized.

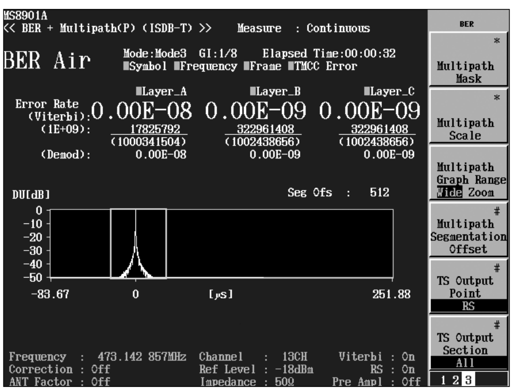


MU890100A ISDB-T Demodulation Unit

Installing the MU890100A ISDB-T Demodulation Unit in the MS8901A supports real-time demodulation of terrestrial digital signals when used in combination with the MX890110A ISDB-T Field Test Software. This is a powerful tool supporting BER evaluation of on-air and pseudorandom signals as well as service area inspection and Rx tuner evaluations for monitoring video and audio. The Rx signal can be analyzed and evaluated from various perspectives by simultaneously measuring and displaying the BER, delay profile and field strength for each layer supporting BER, delay profile and field strength measurement.



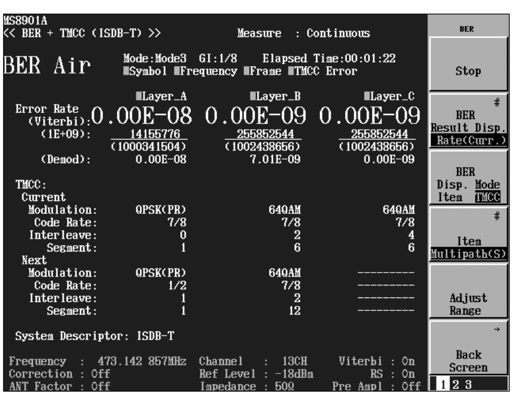
BER (Count) + Field Strength



BER (Rate) + Delay Profile

• Transmission Parameter Monitor Function

From the received signal, Mode, GI and transmission parameter for each layer (TMCC) can be extracted and then monitored.
TMCC information includes the current parameter and next one at a time.



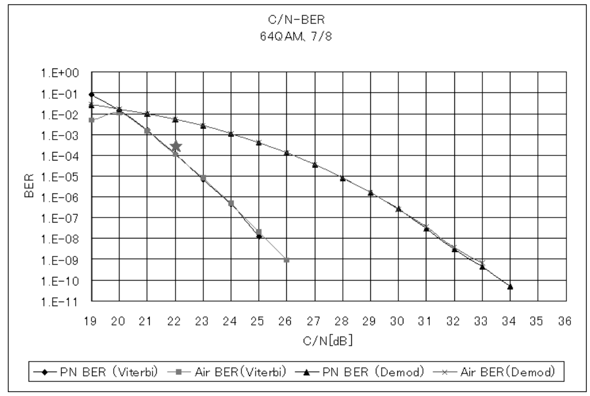
BER + TMCC Information

• External TS Output Function

With this external TS output function, demodulated MPEG-TS signal can be output to the external instrument through DVB-ASI interface. By connecting MPEG decoder and image monitor as the external instrument, real-time image and sound can be monitored. Besides, the layer of the output signal can be selected.

Note: This instrument does not include the scramble

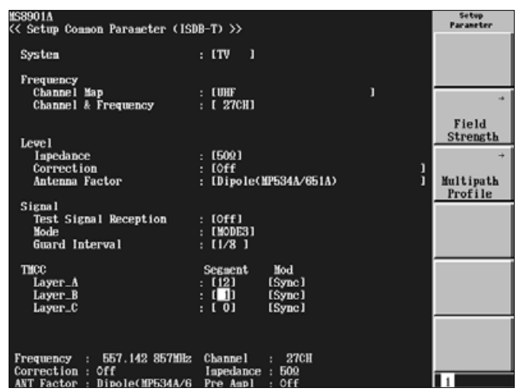
• BER Measurement Result Example



MX890110A ISDB-T Field Test Software

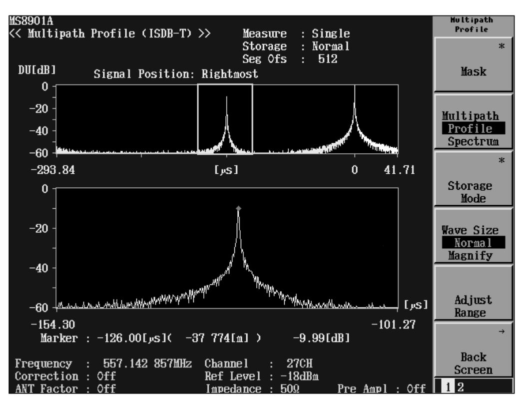
For SFN Field Maintenance

SFN measurements include not only field strength measurement for general-purpose field maintenance but also essential delay profile measurements. The MX890110A ISDB-T Field Test Software is an all-in-one measurement solution for field maintenance of ISDB-T service networks. Installing it in the MS8901A supports transmitter and repeater measurements when used in combination with the spectrum analyzer functions.



• Delay Profile Measurement

Delay profiles are easily measured to assure monitoring of multipath effects caused by changes in ground geography.
Moreover, in an SFN environment, sometimes the delay wave appears before the wanted wave (pre-ghosting); these pre-ghosting faults can be analyzed in the actual field environment, helping optimize the repeater, etc., installation location design.



• Repeater Bypass Echo Analysis

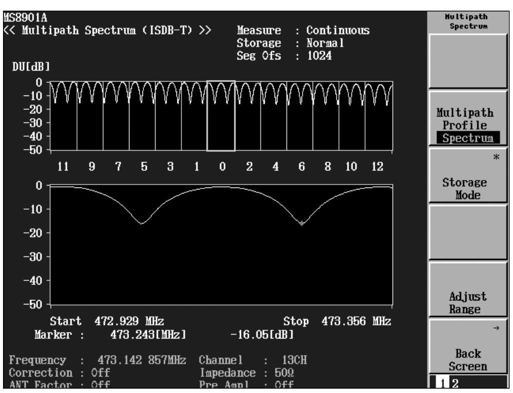
To assure that SFN network repeaters use the same frequency at the input and output sides, the repeater output is bypassed to the input side to generate echo. The echo can be analyzed using the delay profile measurement function because the same characteristics as the delay profile are displayed.

• Precision Field Strength Measurement

The built-in SAW filter and DSP technology used in the MS8901A support high-accuracy measurement of the field strength of all segments in one channel as well as just the one segment. Using DSP, the on-air ISDB-T 5.57-MHz band power can be measured with high accuracy. Furthermore, the antenna factor can be calibrated (frequency data set via ATA flash-memory card) and displayed as dBµV/m. The measured level is displayed as a power graph, supporting antenna angle adjustment, etc.

• Multipath Analysis in Frequency Domain

The multipath spectrum measurement function measures the frequency selectivity fading caused by multipaths. This is very useful when managing severe delays at SFN repeater send time adjustment, etc.



For ISDB-T SFN Installation and Field Maintenance

• Repeater Bypass Canceller Operation Test

When a canceller is used to suppress repeater bypass, the frequency ripple generated by echo becomes flat. The multipath spectrum measurement function can be used to accurately measure how much the ripple is improved.

MX890120B ISDB-T Signal Analysis Software

For ISDB-T Broadcast Equipment Monitoring and Maintenance

• All-in-one for Broadcast Equipment Measurements

The MX890120B ISDB-T Signal Analysis Software is application software for the MS8901A. Installing it in the MS8901A supports the MER measurements needed for manufacturing and maintaining ISDB-T terrestrial digital transmitters and repeaters, as well as for signal analysis using constellation displays, etc. In addition, when used with the MS8901A spectrum analyzer function, it supports the many measurements needed for manufacturing inspection and operation of transmitters and repeaters.

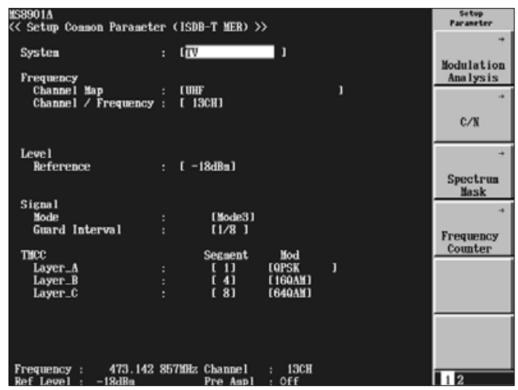
• MS8901A + MX890120B Measurement Items

Frequency error, signal strength, occupied bandwidth, spectrum mask, spurious, phase noise characteristics, amplitude frequency measurement, IM measurement, MER measurement, constellation monitoring, delay profile (requires MX890110A).

• Constellation Monitoring

The constellation for each layer can be displayed according to the each layer segment specifications at the TMCC setting of the Setup Parameter screen.

Extremely fast measurement is achieved using high-speed DSP. As shown in the following diagram, all ISDB-T modulations can be analyzed and data signals such as TMCC and AC can be displayed as a constellation to evaluate fault locations.

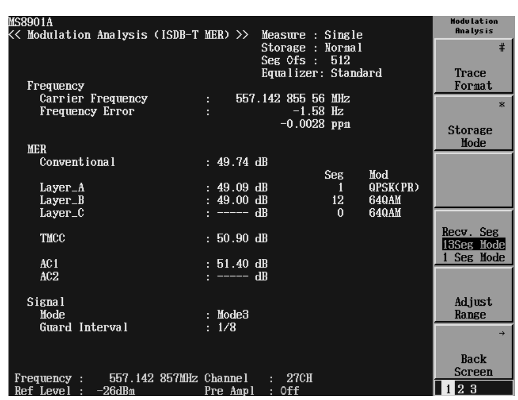


• Modulation Frequency Measurement

The center carrier frequency and frequency error of the 5.57-MHz OFDM modulation signal can be measured with a high accuracy of ±0.15 Hz (Mode3, 64QAM). In addition, the frequency range from 32 MHz to 1 GHz covers the entire spectrum from the public (nominal) IF (37.15 MHz) to all UHF channels.

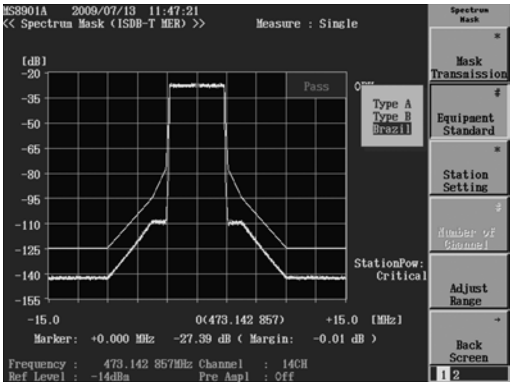
• MER (Modulation Error Ratio) Measurement Function

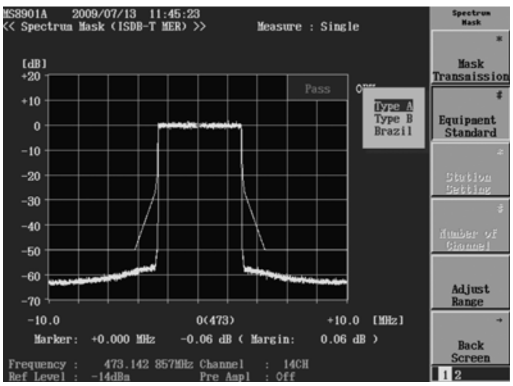
The Modulation Error Ratio (MER) is defined as the ratio of the vector error power converted from the ideal constellation point to the power of the ideal constellation point. MER is used by the European DVB standard as an index of the OFDM modulation signal quality. The MX890120B supports MER measurement for all modulation signals, as well as simultaneous MER measurement for each layer and MER measurement for data signals, such as TMCC and AC.

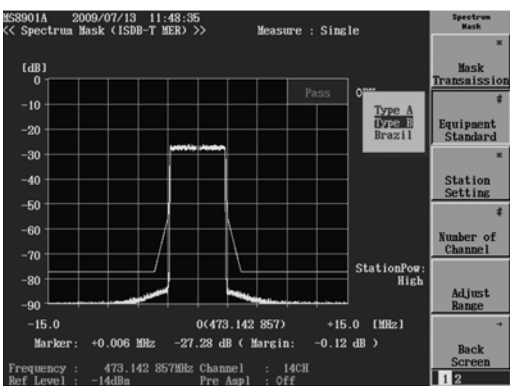


● **Spectrum Mask Conformance Test**

Compliance with the Tx spectrum mask standardized by laws governing radio installations can be checked automatically. In addition, any spectrum mask standard line can be set in three ways.







Complete ISDB-T Signal Analysis Functions

● **Equalizer Operation Switching Function**

The modulation analysis mode can be switched between the Standard mode, which is compatible with the previous MX890120A, and the Advanced mode. The Advanced mode is best for field use in a multipath environment and supports constellation and MER analysis. Even in a multipath environment like that in Figure 2, the waveform behavior can be confirmed using both MER analysis, like in Figure 1, as well as constellation monitoring, making it a useful field troubleshooting tool.

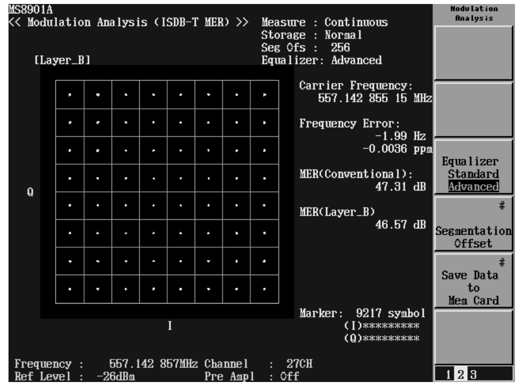


Figure 1 Advanced Mode: Constellation Monitor Screen

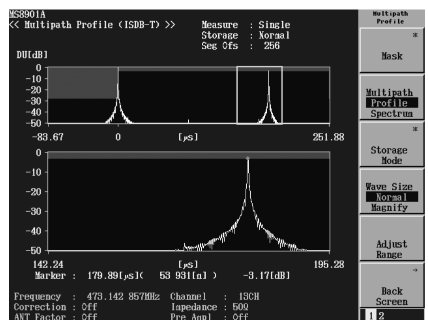
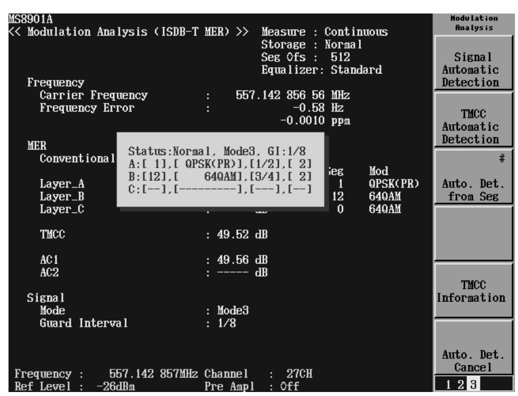


Figure 2 Delay profile measurement screen using MX890110A ISDB-T Field Test Software

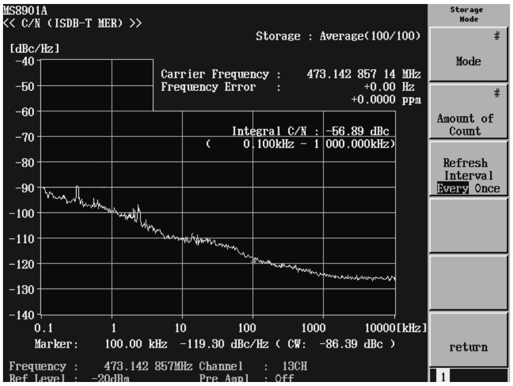
● **Transmission Parameter Detection Function**

Inputting the input signal frequency (channel) at ISDB-T signal analysis allows one-touch detection and setting of transmission parameters (MODE, GI, TMCC data).



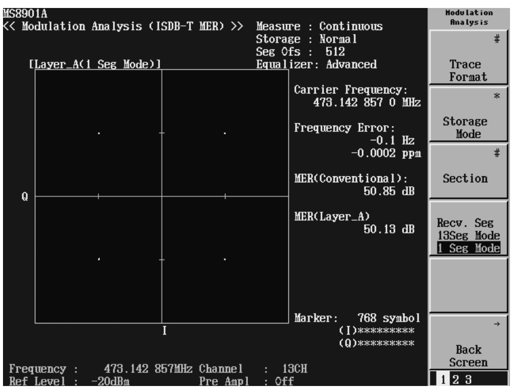
• C/N, C/N Integer Function

The integrated results for any range of C/N curve described in the specification like JEITA transmitter handbook, etc., can be calculated and displayed using this function.



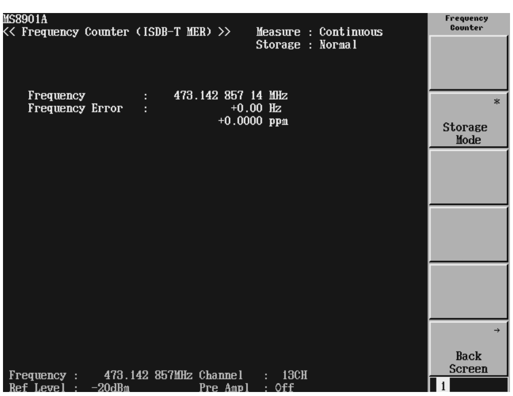
• One Segment Analysis Function

The only one segment of the ISDB-T signal can be measured to display the constellation and perform MER analysis.



• Frequency Counter Functions

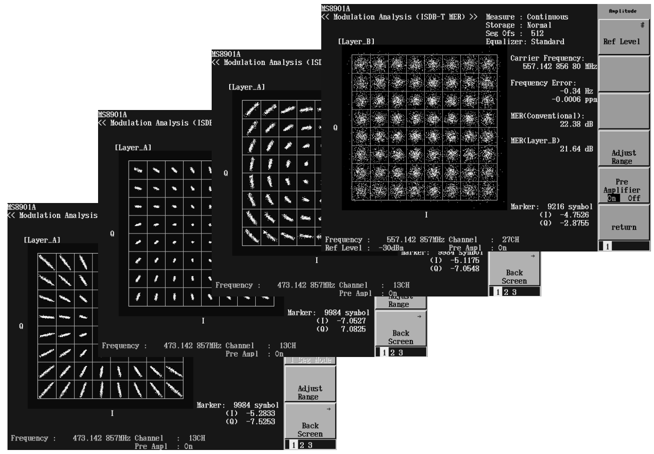
The frequency counter function can be used to measure the continuous waveform over a range of 3.9 MHz to 1000 MHz at a display resolution of 0.01 Hz.



For R&D and Design Ranging from ISDB Devices to STB

• Constellation Monitor Function

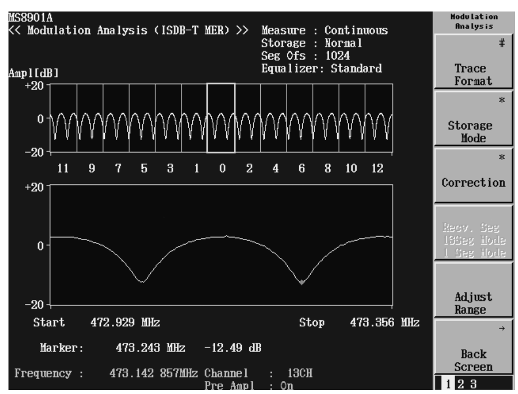
The constellation monitor function is a useful tool for troubleshooting faults based on their behavior. In addition, the MER measurement function is useful for managing MER and easy determination of aging of device and CN.



• Frequency Characteristics Measurement

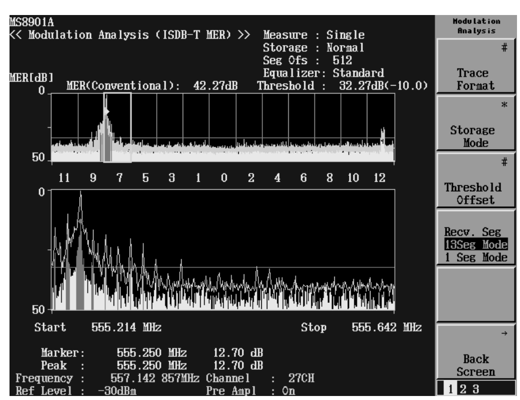
This function displays the 5.57-MHz in-band frequency characteristics using SP and CP in the OFDM modulation signal. The in-service frequency characteristics of transmitters and repeaters can be monitored using the modulation signal.

Moreover, since there is a correction function, combination with a digital broadcast signal generator supports simple measurement of frequency characteristics like using a network analyzer. After the MS8901A and digital broadcast signal generator have been calibrated while directly linked and the frequency characteristics have been flattened, the 5.57-MHz band frequency characteristics of a device inserted between them can be measured.



• OFDM In-band Interference Analysis (Sub-carrier MER measurement)

Signals (such as interference) hidden in the ISDB-T signal band can be analyzed for each sub-carrier. This is useful for field analysis of waveform quality, and in-circuit crosstalk or interference.

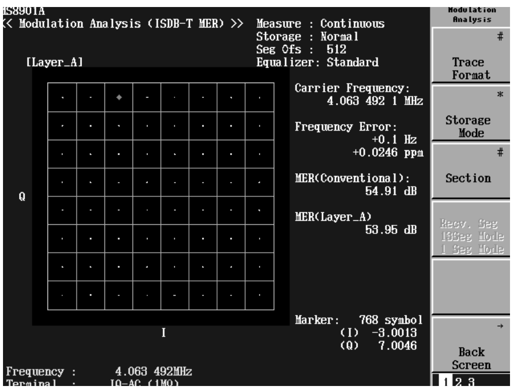


• MS8901A-18 Low IF/IQ Unbalance Input

The general characteristics of 1-segment tuners and devices used in mobile phones receiving terrestrial digital broadcasts and requiring small size, low power consumption, and low frequency, can be quantified by monitoring the constellation, and measuring the MER and 1-segment in-band frequency characteristics using the MX890120B ISDB-T Signal Analysis Software and inputting a 1-segment OFDM modulation signal (Low IF or IQ) from the MS8901A-18 Low IF/IQ Unbalance Input connector.

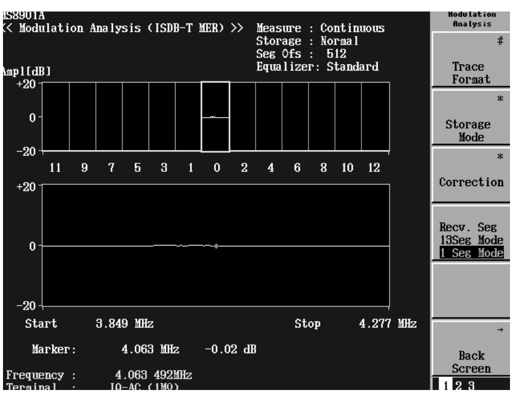
• MER (Modulation Error Ratio) Measurement

The Modulation Error Ratio (MER) is defined as the ratio of the vector error power converted from the ideal constellation point to the power of the ideal constellation point. MER is used by the European DVB standard as an index of the OFDM modulation signal quality. Since both the OFDM signal modulation frequency can be measured and the constellation can be monitored on one screen, this is a useful tool for troubleshooting faults based on their behavior.



• Frequency Characteristics Measurement

This function displays the 5.57-MHz, in-band frequency characteristics using SP and CP in the OFDM modulation signal (1-segment Rx at bottom screen). Measuring the frequency characteristics helps clarify the tuner local leakage and mobile signal interference conditions.



MX890140A Digital CATV Analysis Software

For Monitoring and Maintaining Digital CATV

• All-in-one Measurement of Single QAM Signal

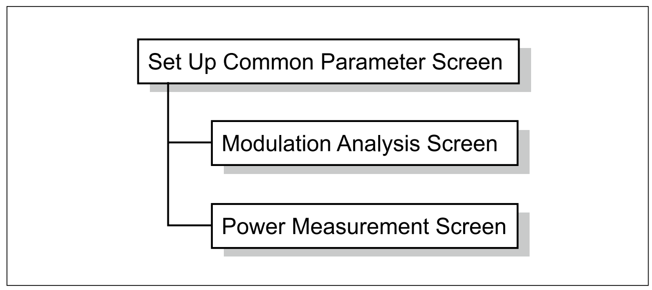
The MX890140A Digital CATV Analysis Software is installed in the MS8901A to support analysis of ITU-T J83 Annex B/C Digital CATV downlink signals for measuring MER and residual noise required to monitor and maintain digital CTAV networks.

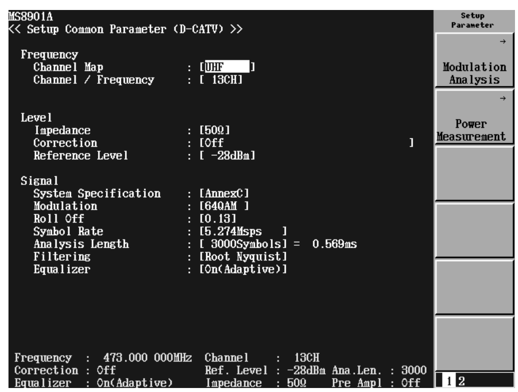
• MX890140A Measurement Items

- Modulation Analysis
- Channel Power
- Frequency Measurement/Frequency Error Measurement

• Easy-to-use Interface (Set Up Common Parameter screen)

Integrating the measurement parameter setting screen and the measurement screen gives a clearer understanding of the setting and measurement flow, and parameters can even be changed at the measurement screen. Dividing the parameter input field into Frequency/Level/Signal Quality makes input easier to understand.

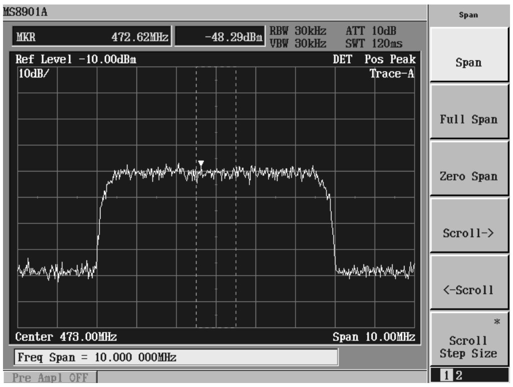




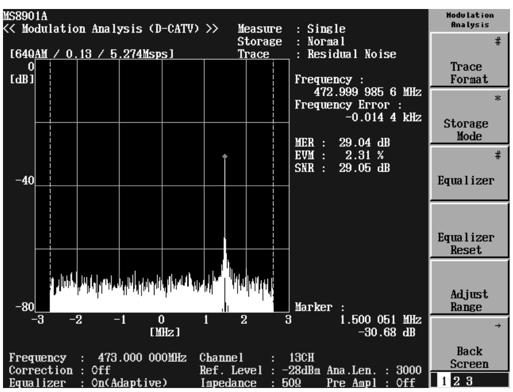
Setup Common Parameter Screen

• **Versatile Measurement Items**
In addition to general modulation analysis items such as vector error, the MX890140A supports the important measurement items defined by ETSI TR 101 290, such as MER.

• **Displays Unseen Residual Noise**
This display detects superimposed, in-channel, residual noise. As shown in the following diagram, this function can be used to find unnecessary waveforms even where there seem to be no particular abnormalities.

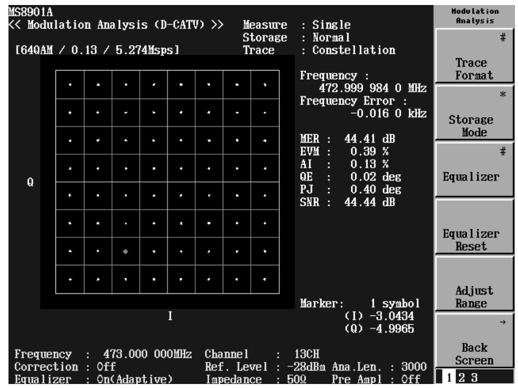


Spectrum Waveform

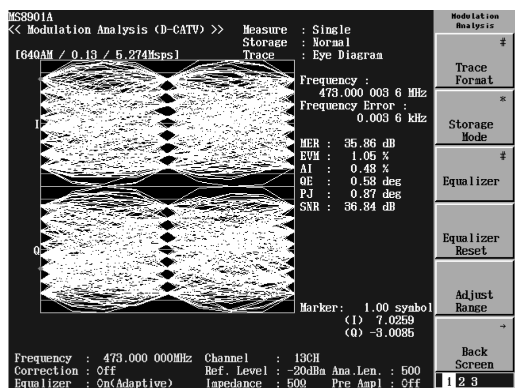


Residual Noise Display

• **Displays Degraded Waveform (Constellation, Eye Diagram Displays)**
The constellation display showing the I and Q components as Cartesian coordinates is ideal for easily confirming the signal amplitude error, frequency error, etc., at a glance using the scatter and convergence of sample points. This display is also useful for quantifying the cause of the degraded signal using the sample point scatter.
The MX890140A supports both 64QAM and 256QAM displays and can also display an Eye Diagram showing the I and Q components as respective time series.



Constellation Display



Eye Diagram Display

Specifications

• **MS8901A Digital Broadcast Signal Analyzer**
Except were noted otherwise, specified values were obtained after warming up the equipment for 30 minutes at a constant ambient temperature and then performing calibration. The typical values are given for reference, and are not guaranteed.

Frequency	Frequency Range	9 kHz to 3.0 GHz
	Setting Frequency Resolution	Minimum 1 Hz
	Frequency Read Out Accuracy	± (Frequency readout × Reference frequency accuracy + Span × Span accuracy + Resolution bandwidth × 0.15 + 10 Hz)
	Marker Frequency Readout Accuracy	Normal: Same as frequency readout accuracy Delta: Same as frequency span accuracy
	Frequency Counter	Resolution: 1 Hz, 10 Hz, 100 Hz, 1 kHz Accuracy: ± (Frequency readout × Reference frequency accuracy + 1 LSD + 2 Hz) (S/N: ≥20 dB)
	Frequency Span	Setting range: 0 Hz, 1 kHz to 3.1 GHz Accuracy: ±1.0%
	Resolution Bandwidth (3 dB BW) (RBW)	Setting range: 300 Hz to 3 MHz (1-3 sequence), 5 MHz, 10 MHz, 20 MHz (manually or automatically settable according to frequency span) Bandwidth accuracy: ±20% (RBW: 300 Hz to 10 MHz), ±40% (RBW: 20 MHz) Selectivity (60 dB: 3 dB): ≤15:1
	Video Bandwidth (VBW)	1 Hz to 3 MHz (1-3 sequence), Off (manually or automatically settable according to resolution bandwidth)
	Signal Purity	Noise side bands: ≤–108 dBc/Hz (1 GHz, 10 kHz offset), ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Reference Oscillator	Frequency: 10 MHz Aging rate: ≤2 × 10^{-8}/day , ≤1 × 10^{-7}/year (referred to frequency after 24 hours warm-up) Temperature characteristics: ±5 × 10^{-8} (0° to 50°C, referred to frequency at 25°C)

Continued on next page

Amplitude	Level Measurement	Measuring range Average noise level to +30 dBm (Preamplifier: Off) Average noise level to +10 dBm (Preamplifier: On) Maximum input level +30 dBm (CW average power, Input attenuator: 10 dB, Preamplifier: Off), ±0 Vdc +10 dBm (CW average power, Preamplifier: Off) Average noise level: Preamplifier: On ≤–139 dBm + 2 × f [GHz] dB (1 MHz to 2.5 GHz) Preamplifier: Off ≤–124 dBm + 2 × f [GHz] dB (1 MHz to 2.5 GHz) ≤–120 dBm + 2 × f [GHz] dB (2.5 GHz to 3 GHz) (Input attenuator: 0 dB, RBW: 300 Hz, VBW: 1 Hz) Residual response: ≤–100 dBm (1 MHz to 3.0 GHz) (Input attenuator: 0 dB, Input: 50Ω termination)
Amplitude	Reference Level	Setting range Preamplifier: Off Log scale: –100 to +40 dBm or equivalent level Linear scale: 2.24 µV to 22.4 V Preamplifier: On Log scale: –120 to +10 dBm or equivalent level Linear scale: 0.224 µV to 707 mV Unit Log scale: dBm, dBµV, dBmV, dBµV (emf), W, dBµV/m Linear scale: V Reference level accuracy: Preamplifier: Off ±0.75 dB (+0.1 to +30 dBm), ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm), ±1.5 dB (–80 to –70 dBm) Preamplifier: On ±0.75 dB (–19.9 to +10 dBm), ±0.9 dB (–69.9 to –20 dBm), ±1.1 dB (–89.9 to –70 dBm) *After CAL, at 50 MHz frequency, Span 1 MHz, Input attenuator, Resolution bandwidth, Video bandwidth, Sweep time: AUTO Resolution bandwidth switching uncertainly: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10 MHz, 20 MHz) *After CAL, Referenced to resolution bandwidth 3 kHz Input attenuator Setting range: 0 to 62 dB, 2 dB step (manually or automatically settable according to reference level) Switching uncertainly: Preamplifier: Off ±0.3 dB (10 to 50 dB), ±0.5 dB (52 to 62 dB) *After CAL, Referenced to input attenuator 10 dB Preamplifier: On ±0.5 dB (10 to 50 dB), ±1.0 dB (52 to 62 dB) *After CAL, Referenced to input attenuator 10 dB Input attenuator switching mode: 2 dB, 10 dB step mode
Reference Level	Frequency Response	Referred to 50 MHz frequency, Input attenuator: 10 dB, temperature 18° to 28°C ±0.6 dB (Preamplifier: Off) ±1.0 dB (Preamplifier: On) Referred to 50 MHz frequency, Input attenuator: 10 to 62 dB ±1.0 dB (Preamplifier: Off) ±2.0 dB (Preamplifier: On)
Reference Level	Scale Fidelity	Scale: 10 div Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after CAL) Preamplifier: Off Log scale: ±0.4 dB (0 to –20 dB, RBW ≤1 kHz), ±1.0 dB (0 to –90 dB, RBW ≤1 kHz) Linear scale: ±4% of reference level Preamplifier: On Log scale: ±0.5 dB (0 to –20 dB, RBW ≤1 kHz), ±1.0 dB (0 to –60 dB, RBW ≤1 kHz), ±1.5 dB (0 to –75 dB, RBW ≤1 kHz) Linear scale: ±5% of reference level Marker level resolution Log scale: 0.01 dB Linear scale: 0.02% of reference level
Reference Level	Spurious Response	2nd harmonic distortion: ≤–60 dBc (10 MHz to 200 MHz, Mixer input level: –30 dBm) ≤–72 dBc (0.2 GHz to 0.85 GHz, Mixer input level: –30 dBm) ≤–70 dBc (0.85 GHz to 1.5 GHz, Mixer input level: –30 dBm) 2-tone 3rd-order intermodulation distortion: ≤–70 dBc (10 MHz to 100 MHz), –85 dBc (0.1 GHz to 3.0 GHz) *Frequency reference of two signal: ≥50 kHz, Mixer input level: –30 dBm Image response: ≤–70 dBc
Reference Level	1 dB Gain Compression	At mixer input level Preamplifier: Off ≥0 dBm (≥100 MHz), ≥+3 dBm (≥500 MHz) Preamplifier: On ≥–35 dBm (≥100 MHz)
Reference Level	Maximum Dynamic Range	1 dB gain compression vs. Averaging noise level 124 dB – 2f [GHz] dB (≥100 MHz)

Continued on next page

Frequency Domain	Frequency Response	In frequency sweep Setting range: 10 ms to 1000 s (manual settable, or automatically settable according to span, resolution bandwidth, video bandwidth) Setting resolution: 5 ms (10 ms to 1 s), Most significant 3-digits (≥1 s) Accuracy: ±3%
	Sweep Mode	Continuous, Single
	Trigger Switch	Freerun, Triggered
	Trigger Source	Wide IF Video, Line, Ext (±10 V), Ext (TTL)
	Gate Mode	Off, Random sweep mode Gate delay: 0 µs to 65.5 ms, resolution 1 µs Gate length: 2 µs to 65.5 ms, resolution 1 µs Gate end: Internal/External
	Zone Sweep	Sweeps only in frequency range indicated by zone marker
	Tracking Sweep	Sweeps while tracking peak points within zone marker (zone sweep also possible)
Time Domain	Sweep Time	Setting range: 1 µs to 1000 s Setting resolution: 1, 2, 5 sequence (1 µs to 50 µs), 100 µs (100 µs to 4.9 ms), 5 ms (5 ms to 1 s), Most significant 3-digits (>1 s) Accuracy: ±1%
	Trigger Switch	Freerun, Triggered
	Trigger Source	Wide IF Video, Video, Line, Ext (±10 V), Ext (TTL)
	Trigger Delay	Pre-trigger: Display waveform before triggering Setting range: – (time span) to 0 s Setting resolution: bigger value between (time span)/500 ns or 100 ns Post-trigger: Display waveform before triggering Setting range: 0 µs to 65.5 ms Setting resolution: 100 ns (sweep time: ≤4.9 ms), 1 µs (sweep time: ≥5 ms)
Function	Numbers of Point	501,1001 points
	Detection Mode	Normal, Positive Peak, Negative Peak, Sample, Average Normal: Simultaneously displays max. and min. points between sample points Positive Peak: Displays max. points between sample points Negative Peak: Displays min. points between sample points Sample: Displays momentary value at sample points Average: Displays average value between sample points
	Display Function	Trace-A, Trace-B, Trace-Time, Trace-A/B, Trace-A/BG, Trace-A/Time
	Trace Calculation	A → B, B → A, A ↔ B, A + B → A, A – B → A, A – B + DL → A
	Storage Function	Normal, Max Hold, Min Hold, Average, Linear Average, Cumulative, Over Write
	Signal Search	Auto Tune, Peak → CF, Peak → REF, Scroll
	Zone Marker	Normal, Delta
	Marker Function	Marker → CF, Marker → REF, Marker → CF Step Size, ∆Marker → Span, Zone → Span
	Peak Search	Peak, Next Peak, Min Dip, Next Dip, Next Right Peak, Next Left Peak
	Multi Marker	Number of points: 10 max. (Highest 10, Harmonics, Manual Set)
	Measurement Function	Noise power: dBm/Hz, dBm/CH, dBV/$\sqrt{\text{Hz}}$ C/N: dBc/Hz, dBc/CH Occupied bandwidth: Power N% method, × dB Down method Adjacent channel leakage power: 2 channels × 2, graphic display Average power of burst signal: Average power in designate time range of time domain waveform Channel power: dBm/Hz, dBm, dBµV, dBµV (emf), dBmV, dBµV/m Template comparison measurement: Upper/Lower limits × each 2 (time domain) MASK: Upper/Lower limits × each 2 (time domain)
	Correction	The user can correct frequency response optionally, max. 150 points
General specification	Display	Color TFT-LCD, Size: VGA 17 cm (6.5” Type), 4096 colors (RGB, 16-scale settable)
	Hard Copy	Display data can be hard-copied via the parallel interface (model corresponded to PCL Level 3 or less, ESC/P-J83 or J84)
	PC Card Interface	PC-ATA card or Compact Flash card (3.3 V/5 V) can be accessed Function: Save/recall measurement settings and waveform data, Save bitmap files of waveform display Connector: PC Card Type I or Type II
	RS-232C	Can be controlled as device from external controller (excluding power switch) Baud rate: 1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 kbps Connector: D-Sub 9 pins, plug
	GPIB	Function: Meets to IEEE488.2 Can be controlled as device from external controller (excluding power switch) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
	Parallel Interface	Based on centronics, output printing data to printer Connector: D-Sub 25 pins, jack
	Input Connector	N-type connector, jack 50Ω, VSWR: 1.5 typ. (Input attenuator: 10 dB)
	If Output	BNC, 50Ω nominal value Frequency: 10.69 MHz/66 MHz Output level: –10 dBm (typ., Frequency: 100 MHz, at upper edge of display scale)
	Wideband IF Output	BNC, 50Ω nominal value Frequency: 60.69 MHz/66 MHz Gain: 0 dB (typ., Frequency: 100 MHz, Input attenuator: 0 dB)
	Video Output (Y)	BNC, 75Ω nominal value Output level: 0 to 0.5 V ±0.1 V (log scale), 0 to 0.4 V ±0.1 V (linear scale) (Frequency: 100 MHz, at upper edge of display scales)

Continued on next page

General specification	Video Output	Analog RGB, Connector: D-Sub 15 pins, jack
	External Reference Signal Input	BNC connector, Frequency: 10 MHz ±10 Hz, 13 MHz ±13 Hz, Level: ≥0 dBm (50Ω termination)
	Buffered Output	BNC connector, Frequency: 10 MHz, Output level: 2 to 5 Vp-p (200Ω termination)
	Sweep Output (X)	BNC connector Output level: 0 to 10 V ±1 V (100 kΩ termination, from left edge to right edge in display scale, single sweep)
	Sweep Status Output (Z)	BNC connector, Output level: TTL (when sweeping, at low level)
	Probe Source	4-pin connector, +12 V, –12 V, each ±10%, each max. 110 mA
	Trig/Gate Input	BNC connector Input level: ±10 V (0.1 V resolution), or TTL level
Others	Dimension	320 (W) × 177 (H) × 411 (D) mm (exclude handle, legs, front cover, fan cover)
	Mass	≤16 kg (nominal value)
	Power Supply (operating range)	85 V(ac) to 132 V(ac), 170 V(ac) to 250 V(ac) (automatic voltage change), 47.5 Hz to 63 Hz, ≤400 VA
	Temperature Range	Operating: 0° to +50°C, ≤RH85%, Storage: –20° to +60°C
	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1

∗ Typical value and nominal value are reference data, so that not warrant them as spec.

● Option

Option 01: Precision Frequency Reference Oscillator

Frequency	10 MHz
Aging Rate	≤5 × 10^{-10}/day (Referred to frequency after 24 hours warm-up)
Temperature Stability	≤5 × 10^{-10} (0 to 50°C, Referenced to frequency at 25°C)
Warm-up Time within ≤5 × 10^{-8}	7 minutes (typ., at 25°C)

Option 02: Narrow Resolution Bandwidth

Resolution Bandwidth	Setting range: 1 Hz to 1 kHz (1-3 sequence) Switching uncertainly: ±0.5 dB ∗Reference to RBW 3 kHz (analog) Resolution bandwidth accuracy: ±10% (RBW: 30 Hz, 300 Hz) ±10% typ. (RBW: 1, 3, 10, 100 Hz, 1 kHz) Selectivity (60 dB: 3 dB): ≤5: 1
Span	Minimum span setting: 100 Hz
Average Noise Level	At Input attenuator: 0 dB, RBW: 1 Hz, Preamplifier: Off ≤–146.3 dBm + 1.5 × f [GHz] dB (typ.) (1 MHz to 2.5 GHz) ≤–144.3 dBm + 1.5 × f [GHz] dB (typ.) (2.5 GHz to 3 GHz)

Option 04: Digital Resolution Bandwidth

Resolution Bandwidth	Setting Range: 10 Hz to 1 MHz (1-3 sequence) Resolution Bandwidth Accuracy: ±10% (RBW: ≥100 Hz), ±10% (RBW: ≤30 Hz, typ.) Resolution Bandwidth Selectivity: ≤5:1 (RBW: ≥100 Hz), ≤5:1 (RBW: ≤30 Hz, typ.) Resolution Switching Deviation: ±0.5 dB (Referenced to RBW: 3 kHz)
Detection Mode	Normal, Positive Peak, Negative Peak, Sample, RMS RMS: Displays RMS Value between sample points
Span	Setting Range: Minimum 1 kHz
Detection Mode	At Input attenuator: 0 dB, RBW: 10 Hz Preamplifier: Off ≤–134.5 dBm + 1.5 × f [GHz] dB (typ.) (1 MHz to 2.5 GHz) ≤–130.5 dBm + 1.5 × f [GHz] dB (typ.) (2.5 GHz to 3 GHz)

Option 09: Ethernet Interface

Function	Controlled by the external computer (Except power switch)
Connector	10BASE-T

Option 18: Low IF/IQ Unbalance Input

Input Format	Low IF, IQ Unbalanced selectable When Low IF is selected, only the I connector is valid (unbalanced input).
Measurement Item	Modulation analysis only
Function, Performance	(Function and performance equivalent to modulation analysis when RF is input) • Equalizer function • Reception segment switch function • Constellation • Frequency characteristics • Segmentation offset • Signal parameter automatic detection • Sub-carrier MER
Frequency Setting Range	250 kHz to 5 MHz, 1 Hz steps
Impedance	1 MΩ (parallel capacity: <100 pF) or 50Ω selectable
Input Level Range	0.1 to 1.0 Vp-p (unbalanced input, via input pin) DC connection or AC connection selectable

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Modulation Analysis	When one OFDM modulation signal wave conforming to ISDB-T is input	
	Frequency Lock Range	+99 kHz
	Frequency Measurement Accuracy	(When 1 Seg is selected for reception segment switch function) • When Terminal: Low IF-DC or IQ-DC selected Impedance: 50Ω Mode: Mode3 Guard interval: 1/8 Segmentation offset: 512 Modulation mode: 64QAM partial reception signal Input level: 0.1 V (rms) Average count: 5 times for 1 Seg signal. ±0.3 Hz + (Reference frequency accuracy × Measurement frequency) • When option: The MS8901A-53 or the MS8901A-73 is installed Impedance: 50Ω Mode: Mode3 Guard interval: 1/8 Segmentation offset: 512 Modulation system: 64QAM partial reception signal Input level: 0.1 V (rms) Average count: 5 times for 1 Seg ±0.15 Hz + (Reference frequency accuracy × Measurement frequency) When average count: 40 in the above condition ±0.1 Hz + (Reference frequency accuracy × Measurement frequency)
	MER Measurement Item	Conventional (total), Layer_A, Layer_B, Layer_C, TMCC, AC1, AC2
Modulation Analysis	Residual MER	(When 1 Seg is selected for reception segment switch function) Conventional value when terminal: Low IF-DC or IQ-DC selected Impedance: 50Ω Mode: Mode3 Guard interval: 1/8 Segmentation offset: 512 Modulation mode: 64QAM partial reception signal In-put level: 0.1 V (rms) Average count: 10 times for 1 Seg signal. ≥50 dB (507.9 kHz, typ.) 507.9 kHz: Frequency of 1/16 of FFT clock (512 MHz/63 MHz)

Option 21: Power Meter (Option 41 is an option retrofit)

Outline	High accuracy electric power measurement in frequency range of 100 kHz to 32 GHz can be performed.
Frequency Range	100 kHz to 32 GHz
Level Range	–10 to +20 dBm
Conformity Power Sensor	MA4601A, MA4701A, MA4703A, MA4705A
Readout	Selection of W, dBm, and dB (Relative) is possible. Digital 4 figure display, 20% of over range
Power Range	4 range/10 dB step (The measurement level range is indicated to the standard of Power sensor.)
Change of Range	Automatic, Manual (A setup to ranges arbitrary regardless of Range hold and Input level is possible.)
Equipment Accuracy	±0.7% (W mode) ±0.03 dB (dBm mode, dB (Relative) mode) ∗If ZERO ADJ key is pushed, it will adjust to a zero point automatically.
Zero Set	±0.5% of full scale typical. (100 µW range of the highest sensitivity)
Zero Movement Between Ranges	±0.2% of full scale (It is 100 µW range of the highest sensitivity and is after zero set.)
Oscillator for Calibration	Frequency: 50 MHz Level: 1 mW ±1.2% (For one year) Averaging: Setting is possible in four stages in sample rate time.

Option 34: 4 GHz LO Output

Frequency	4 GHz
Frequency Accuracy	± (4 GHz × Reference frequency accuracy) ±1 Hz
Output Level	–10 dBm (typ.)
Spurious	≤–40 dBc (typ.)

Option 46: Auto Power Recovery

Outline	Cancels the power switch on front panel and automatically recovers to power-on after power failure.

∗ This equipment enters the standby state when the line has to be disconnected and reconnected, because power switch on front panel doesn't have latch function.
If this equipment is built into remote systems, please install this option.

Option 47: Rack Mount (IEC)

Outline	Attachment of rack mount which meets IEC spec The standard tilt handle is eliminated when rack mount kit is attached.

Option 48: Rack Mount (JIS)

Outline	Attachment of rack mount which meets JIS spec The standard tilt handle is eliminated when rack mount kit is attached.

Option 53: High Accuracy Modulation Frequency Measurement (Option 73 retrofit)

Outline	Measures the center frequency of the OFDM modulation wave of the software sold separately (MX890120B) with high accuracy.
Frequency Display	Displays the measured result of the center frequency in 0.01 Hz unit. (0.1 Hz, heretofore)
Frequency Accuracy	Refer to the Section 1.2 "Product Configuration" and 1.4 "Specifications" of the Operation Manual MX890120B for details on the Specifications of the frequency accuracy.

• MX890110A ISDB-T Field Test Software (MU890100A ISDB-T Demodulation Unit)

The specifications of the MX890110A Field Test Software shown in the table below.
These specifications are based on when the MX890110A is installed in the MS8901A. For performance specifications, each value is assumed to be obtained from measurement by implementing calibration after 30 minute preheating under constant ambient temperature conditions and then executing Adjust Range immediately before measurement.

Frequency	Channel Map	The following frequencies can be set according to the item selected for Channel Map: • General: A frequency from 32 MHz to 1000 MHz can be set in steps of 1 Hz • Interim-1: A frequency calculated from the following expression with N = 13 to 32 (channels) can be set. 473 + (N – 13) × 6 + 0.142857 MHz • Interim-2: A frequency calculated from the following expression with N = 13 to 32 (channels) can be set. 473 + (N – 13) × 6 + 0.15 MHz • VHF: A frequency calculated from the following expression with N = 1 to 12 (channels) can be set. 1 ≤N ≤3: 93 + (N – 1) × 6 + 0.142857 MHz 4 ≤N ≤7: 173 + (N – 4) × 6 + 0.142857 MHz 8 ≤N ≤12: 195 + (N – 8) × 6 + 0.142857 MHz • UHF: A frequency calculated from the following expression with N = 13 to 62 (channels) can be set. 473 + (N–13) × 6 + 0.142857 MHz • CATV: A frequency calculated from the following expression with N = 13 to 63 (channels) can be set. 13 ≤N ≤21: 111 + (N – 13) × 6 + 0.142857 MHz N = 22: 167.142857 MHz 23 ≤N ≤63: 225 + (N – 23) × 6 + 0.142857 MHz • UHF (Brazil): A frequency calculated from the following expression with N = 14 to 69 (channels) can be set. 473 + (N – 14) × 6 + 0.142857 MHz
	Spectrum Direction (only when Channel Map is set to General)	Normal and Reverse can be selected for the spectrum direction based on the Spectrum setting.
Level	The reference level setting method can be switched between the manual setting by a user (Ref Setting) and the automatic setting (Adjust Range).	
	Reference Level (Ref setting)	Preamplifier: Off: –28 to +10 dBm (setting resolution: 2 dB) Preamplifier: On: –48 to –10 dBm (setting resolution: 2 dB)
	Adjust Range	This is a function used to set the reference level automatically. The reference level is determined by measuring the input power for the full frequency band.
	Refer to BER	The MS8901A measures BER for each layer at the Adjust Range execution and sets the reference level so that the measured result becomes optimal. (This function is valid when the MU890100A ISDB-T demodulation unit is installed and also the measurement is carried out on the BER screen)
Receiver Performance (Valid for measurement on the Field strength screen when Channel Map is not set to General.)	Detuning Characteristics	Attenuation with Preamplifier: Off, Input attenuator: 0 dB, 101 dBµV (emf) input: OFDM signal conforming to ISDB-T ≥35 dBc (±6 MHz offset), ≥50 dBc (±12 MHz offset) CW signal ≥46 dBc (–3.25 MHz offset), ≥54 dBc (–7.75 MHz offset), ≥46 dBc (+4.25 MHz offset), ≥54 dBc (+8.75 MHz offset)
	2-tone 3rd-order Intermodulation Distortion	Preamplifier: Off, Input attenuator: 0 dB, CW signal, 93 dBµV (emf) input, 2-tone signal frequency difference 6 MHz: ≤–56 dBc Preamplifier: On, Input attenuator: 0 dB, CW signal, 73 dBµV (emf) input, 2-tone signal frequency difference 6 MHz: ≤–53 dBc
	1 dB Gain Compression	Preamplifier: Off, Input attenuator: 0 dB, OFDM signal conforming to ISDB-T: ≥107 dBµV (emf) Preamplifier: On, Input attenuator: 0 dB, OFDM signal conforming to ISDB-T: ≥78 dBµV (emf)
Field Strength (Valid when Channel Map is not set to General.)	For J1032 UHF bandpass filter input when the supplied 30 cm coaxial cable and J1032 UHF bandpass filter are connected to the RF input connector (The loss is automatically corrected only for 5.57 MHz band when Channel Map is set to Interim-1 or Interim-2.) At RF input connector end when Channel Map is set to UHF, VHF, or CATV.	
	Voltage Measurement	Range: 43 to 123 dBµV (emf) (Preamplifier: Off), 27 to 103 dBµV (emf) (Preamplifier: On) Accuracy: ±2 dB (average value from sampling count of 100) Resolution: 0.01 dB Noise floor: ≤35 dBµV (emf) (Preamplifier: Off), ≤19 dBµV (emf) (Preamplifier: On) (At RF input terminal, average value from sampling count of 100)
	Field Strength Measurement	Range: Voltage measurement range + cable loss + antenna factor (The cable loss and antenna factor can be corrected by the Correction function and Antenna Factor function respectively.) Unit: dBµV/m Sampling count: 1 to 100 points Display system Instantaneous value: Displays instantaneous field strength Maximum value: Displays the maximum field strength for the number of measurement samples Minimum value: Displays the minimum field strength for the number of measurement samples Average value: Displays the average field strength for the number of measurement samples Bar graph: Displays the instantaneous field strength on a bar graph Display system for 1-segment measurement Displays the field strength of the central one segment (0.43 MHz bandwidth). Displays simultaneously with 13 segments' field strength Bar graph: Displays the instantaneous field strength of the central one segment. Displays simultaneously with that of 13 segments Relative value: Displays the theoretical figure calculated from the 13-segments' field strength and the relative value from the 1-segment field strength

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<table>
<tr><td colspan="2">Channel Power</td><td>Displays the voltage and power (5.57 MHz bandwidth) from RF input connector
Unit: W, dBm, dBmV, dBμV, dBμV(emf)
Range: –70 to +10 dBm (Preamplifier: Off, typ.), –86 to –10 dBm (Preamplifier: On, typ.)
Display system for 1-segment measurement:
Displays the channel power of the central 1 segment (0.43 MHz bandwidth)
Displays simultaneously with the 13 segments' channel power</td></tr>
<tr><td rowspan="16">Delay Profile</td><td colspan="2">Measurement using a signal conforming to the Digital Terrestrial Broadcasting system</td></tr>
<tr><td>Mode</td><td>Mode1, Mode2, Mode3</td></tr>
<tr><td>Guard Interval</td><td>1/4, 1/8, 1/16, 1/32</td></tr>
<tr><td>TMCC</td><td><table><tr><td></td><td>Segment</td><td>Modulation</td></tr><tr><td>Layer A</td><td>1 to 13</td><td>Sync/Diff</td></tr><tr><td>Layer B</td><td>1 to 12</td><td>Sync/Diff</td></tr><tr><td>Layer C</td><td>1 to 11</td><td>Sync/Diff</td></tr></table>
• Total number of segments for Layer A to Layer C is 13
• The number of segments for Layer C is automatically set to the value calculated from the following expression: 13 – (segments for Layer A) – (segments for Layer B)
• Sync: Synchronous modulation
• Diff: Differential modulation</td></tr>
<tr><td>Mode, GI Auto Setting</td><td>Sets the mode and guard interval automatically by analyzing an input signal</td></tr>
<tr><td>D/U</td><td>Display range: –60 to 0 dB
Can be switched among –20, –30, –40, –50, –60
Marker resolution: 0.01 dB
D/U accuracy
Input signal:
RF input level: 63 dBμV (emf) or greater (Preamplifier: Off), 43 dBμV(emf) or greater (Preamplifier: On)
Modulation system: Synchronous modulation (for all segments), By using a 2-wave evaluation signal with the averaging count of 10:
±2 dB (–3 dB ≥D/U >–20 dB)
±3 dB (–20 dB ≥D/U >–30 dB)
Evaluation signals (delay time/level):
Path1: 0 s/0 dB, Path2: 0.95 GI/–3 dB
Path1: 0 s/0 dB, Path2: 1.48 μs/–3 dB
Path1: 0 s/0 dB, Path2: 0.95 GI/–20 dB
Path1: 0 s/0 dB, Path2: 3.69 μs/–20 dB
Path1: 0 s/0 dB, Path2: 0.95 GI/–30 dB
Path1: 0 s/0 dB, Path2: 6.27 μs/–30 dB</td></tr>
<tr><td>Delay Time</td><td>Display range:
Fixes the screen display range/ can switch to the variable
• Fixing the range
– (1/12 of valid symbol length) to (1/4 of valid symbol length)
• Varies the range: 5 types of display range can be selected
– (2/48 of valid symbol length) to (14/48 of valid symbol length)
– (5/48 of valid symbol length) to (11/48 of valid symbol length)
– (8/48 of valid symbol length) to (8/48 of valid symbol length)
– (11/48 of valid symbol length) to (5/48 of valid symbol length)
– (14/48 of valid symbol length) to (2/48 of valid symbol length)
Valid range: 0 μs to Guard interval length
Marker resolution: 0.123 μs</td></tr>
<tr><td>Display Method</td><td>Entire display: Displays all measured results of delay profile
Magnified display: Magnifies a part of Entire display.
(Two scaling factors can be selected in the Delay Profile screen.)</td></tr>
<tr><td>Marker</td><td>D/U ratio and delay time can be read using a marker in Magnified display
A delta marker is available</td></tr>
<tr><td>Mask</td><td>A standard line can be displayed on the Delay Profile display screen
0 μs or shorter: –28 dB
From 0 μs to Guard interval length:–3 dB
Guard interval length or longer: –28 dB</td></tr>
<tr><td>Relative Level</td><td>Display range: –60 to 0 dB
Can be switched among –20, –30, –40, –50, –60
Marker resolution: 0.01 dB</td></tr>
<tr><td>Frequency</td><td>Display range: ±2.79 MHz
Marker resolution: 1 kHz</td></tr>
<tr><td>Display Method</td><td>Entire display: Displays all measured results of multipath spectrum
Magnified display: Magnifies a part of Entire display</td></tr>
<tr><td>Marker</td><td>Frequency and relative level can be read using a marker in Magnified display.</td></tr>
<tr><td>Average (on the Delay Profile screen only)</td><td>Times: 2 to 100
Method
Log: Averages the D/U value and relative level value in dB units.
Liner: Converts the D/U value and relative level value once to a antilog value for averaging.</td></tr>
</table>

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Level Correction	Antenna Factor	Type: Corr-1 to Corr-5, Off No. of points: Up to 150 points Type: Dipole (MP534A/MP651A), Log-1 (MP635A), Log-2 (MP666A), User-1 to User-4, Off No. of points: Up to 150 points
	Impedance Switch	50Ω 75Ω: The insertion loss of the MA1621A impedance converter is automatically corrected.
BER Measurement (Valid when MU890100A ISDB-T demodulation unit is installed)	Measurement using a signal conforming to the Digital Terrestrial Broadcasting system	
	BER Mode	Can be switched between PN and Air.
	BER Measurement	Two measurement functions of PN BER measurement and Air BER measurement are available. • PN BER: Possible only when the measurement target is PN. • Air BER: Possible even if the measurement target is not PN, such as an actual image. The following selections are available when measuring. • The BER measurement mode can be selected from the single mode (Single) and continuous mode (Continuous). • The BER measurement result display method can be selected from the following according to the combination of Rate/Count and Current/Last: Rate (Current), Rate (Last), Count (Current), Count (Last) PN BER measurement BER measurement is performed using a PN pattern. • Target data: Can be selected from After demodulation, After Viterbi decoder, and After RS decoder. • PN pattern: Can be selected from PN9, PN15, and PN23. • Range: Can be set by measuring time (1 to 359999 s (= 99 h 59 m 59 s), in steps of 1 s) • Result display: Can be switched between Rate and Count. • BER output: The measurement target data can be out-put. In this event, the target layer can be selected from A, B, and C. Air BER measurement BER measurement is performed by actual broadcasting. • Target data: Can be selected from After Viterbi decoder (BER measurement after demodulation) and After RS (BER measurement after Viterbi decoder). • Measuring bits: 1e5, 1e6, 1e7, 1e8, 1e9, 1e10 • TS output: The measurement target data can be output with the packet length of 188 bytes, regardless of the target data type. In this event, the target layer can be selected from A, B, C, and All.
	Transmission Parameter Automatic Search	The target items for the transmission parameter automatic search function can be selected from the following: • Mode, GI, TMCC: The mode, guard interval, and TMCC are automatically searched. • TMCC: The TMCC is automatically searched.
	TMCC Information Monitor	The information of the following items can be automatically obtained and displayed from the received signals. • System identification: ISDB-T (TV)/ISDB-TSB (Radio) • Transmission parameter switching index: 1 to 15 frames before switching/normal value • Emergency alarm broadcasting start flag: Emergency alarm (starting is controlled)/ None (starting is not controlled) • Partial reception flag (TV): PR (partial reception)/None • Format identification flag (Radio): 1 segment/3 segments • Carrier modulation system (for each layer): DQPSK/QPSK/16QAM • Convolution code ratio (for each layer): 1/2, 2/3, 3/4, 5/6, 7/8 • Interleave length (for each layer): 0, 4, 8, 16 (Mode1) 0, 2, 4, 8 (Mode2) 0, 1, 2, 4 (Mode3) • Number of segments (for each layer): 1 to 13, unused (TV)
	Status Display	Synchronization The status of the following synchronization is displayed in green (synchronized) and red (not synchronized): • Symbol synchronization: Synchronized (green)/not synchronized (red) • Frequency synchronization: Synchronized (green)/not synchronized (red) • Frame synchronization: Synchronized (green)/not synchronized (red) TMCC error The TMCC error status is displayed in green (no error) and red (error). Green (no error)/Red (error) PN synchronization (for PN BER measurement only) The PN synchronization status is displayed in green (synchronized) and red (not synchronized). When PN was once not synchronized but now synchronized, it is displayed in yellow. Error for each layer The BER measurement status for each layer (A/B/C) is displayed in green (no error), red (error), and yellow (currently no error but an error existed before).
	Buzzer	This is a function to alarm the status change from green/yellow to red by beeping.
	Output Connector	The following two outputs are exclusive according to the BER Mode (PN BER measurement/Air BER measurement). BER output Output for external BER measurement Two types of signals Data (Pos/Neg switch) and Clock (Rise/Fall switch) can be output. Connector: BNC-J Impedance: 75Ω Output level: 0 to 5 V (typ.) DVB-ASI output Connector used to input TS data after demodulation to an external MPEG decoder, etc. Connector: BNC-J Impedance: 75Ω Output level: 800 mVp-p (typ.)

• MX890120B ISDB-T Signal Analysis Software

The specifications of the MX890120B are shown in the table below. These specifications are based on when the MX890120B is installed in the MS8901A. For performance specifications, each value is assumed to be obtained by implementing calibration after 30 minute preheating under constant ambient temperature conditions.

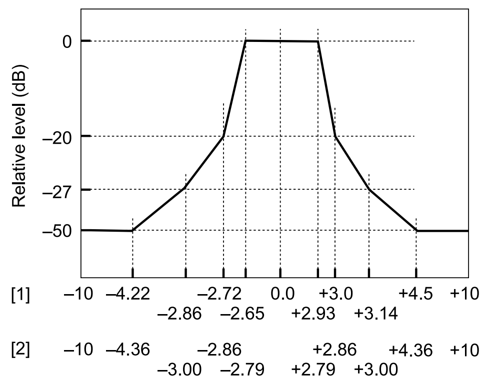
Frequency	Setting Range	When Interim-1 or Interim-2 is selected for Channel Map: 13 to 32 channels When UHF is selected for Channel Map: 13 to 62 channels Center frequency of transmission bandwidth for N channels: 473 + (N – 13) × 6 + 0.142857 MHz (Interim-1, UHF) 473 + (N – 13) × 6 + 0.15 MHz (Interim-2) General is selected for Channel Map: 32 MHz to 3000 MHz, 1 Hz steps IF Band is selected for Channel Map: 3.9 MHz to 38 MHz, 1 Hz steps VHF is selected for Channel Map: 1 to 12 channels Nch center frequency of VHF 1 ≤N ≤3: 93 + (N – 1) × 6 + 0.142857 MHz 4 ≤N ≤7: 173 + (N – 4) × 6 + 0.142857 MHz 8 ≤N ≤12: 195 + (N – 8) × 6 + 0.142857 MHz CATV is selected for Channel Map: 13 to 63 channels Nch center frequency for CATV 13 ≤N ≤21: 111 + (N – 13) × 6 + 0.142857 MHz N = 22: 167.142857 MHz 23 ≤N ≤63: 225 + (N – 23) × 6 + 0.142857 MHz UHF (Brazil) is selected for Channel Map: 14 to 69 channels Nch center frequency for UHF (Brazil) 473 + (N – 14) × 6 + 0.142857 MHz
	Offset Frequency	0 to 12 GHz
	Spectrum Reverse	When General or IF Band is selected for Channel Map: Can be selected from Normal or Reverse.
Level	Setting Mode	Reference setting: Inputs the reference level. Adjust range: The MS8901A measures input power for all bandwidth to determine the reference level. Refer to MER: The MS8901A measures MER at the Adjust Range execution and sets reference level so that the measured result becomes optimal.
	Reference Setting Range	–26 to +10 dBm (Preamplifier: Off) –46 to –10 dBm (Preamplifier: On)
Signal Information	Mode	Mode1, Mode2, Mode3
	Guard Interval	1/4, 1/8, 1/16, 1/32
	Modulation System	64QAM, 16QAM, QPSK, DQPSK, 64QAM (PR), 16QAM (PR), QPSK (PR), DQPSK (PR) PR: Partial reception
	System	TV: Fixed input mode. Performs measurement with user setting values (frequency, channel, level, spectrum reverse.) TV-Auto Select: RF/IF input auto switching mode. Measurement for user setting value and IF (37.15 MHz, spectrum reverse) input signal; whichever has the higher level.
Modulation Analysis	When an OFDM modulation signal conforming to ISDB-T is input for a waveform	
	Equalizer Switch Function	Switches operation mode corresponding to the signal frequency response. Standard: MX890120A/A1/A2 compatible mode Advanced: Field use mode
	Reception Segment Switch Function	Switches the number of segments to be analyzed. 13 Seg: Receives and analyzes all segments. 1 Seg: Receives and analyzes one segment. Note that the following parameters are not measured (can be selected) when 1 Seg is set: • Mode 1 GI: All • Mode 2 GI: 1/16 and 1/32 • Mode 3 GI: 1/32
	Frequency Range	32 MHz to 1000 MHz
	Frequency Lock Range	±99 kHz
	Level Range	–26 to +10 dBm (Preamplifier: Off), –46 to –10 dBm (Preamplifier: On)
	Frequency Measurement Accuracy	• When mode: Mode3, guard interval: 1/8, segmentation offset: 512, modulation system for all segments of Layers_A to _C: 64QAM, average count: 5, 13 segments; ±0.3 Hz + (reference frequency accuracy × measurement frequency) • When mode: Mode1, guard interval: 1/4, segmentation offset: 128, modulation system for all segments of Layers_A to _C: DQPSK, average count: 5, 13 segments; ±1.6 Hz + (reference frequency accuracy × measurement frequency) • When option: The MS8901A-53 or the MS8901A-73 is installed, when mode: Mode3, guard interval: 1/8, segmentation offset: 512, modulation system for all segments of Layer_ A to _C: 64QAM, average count: 5, ±0.15 Hz + (reference frequency accuracy × measurement frequency) When average count: 40 in the above condition ±0.1 Hz + (reference frequency accuracy × measurement frequency)

Continued on next page

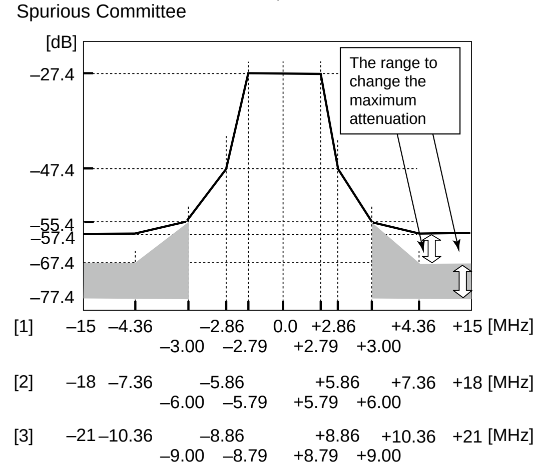
<table>
<tr><td rowspan="8">Modulation Analysis</td><td>MER Measurement Item</td><td>Conventional (overall), Layer_A, Layer_B, Layer_C, TMCC, AC1, AC2</td></tr>
<tr><td>Residual MER</td><td>Conventional value when mode: Mode3, guard interval: 1/8, segmentation offset: 512, modulation system for all segments of Layer_ A to C: 64QAM, level: –20 dBm, Preamplifier: Off, average count: 10, 13 segments;
≥44 dB (37.15 MHz, typ.)
≥42 dB (500 MHz, typ.)</td></tr>
<tr><td>Constellation</td><td>Layer_A (64QAM, 16QAM, QPSK, DQPSK)
Layer_B (64QAM, 16QAM, QPSK, DQPSK)
Layer_C (64QAM, 16QAM, QPSK, DQPSK)
TMCC (DBPSK)
AC1 (DBPSK)
AC2 (DBPSK)
Marker function: I and Q values at the marker can be read.
Note that these specifications apply when Standard is selected for the Equalizer switch function.
When Advanced is selected for the Equalizer switch function, both ends of the frequency bandwidth are displayed as invalid values.</td></tr>
<tr><td>Frequency Response</td><td>Displays assuming the average level of 5.57 MHz bandwidth is 0 dB.
Level axis: ±2, ±5, ±10, ±20, ±50 dB
Marker function: Relative level and frequency at the marker can be read.
Correction: Frequency characteristic calibration can be performed using external signal source.
Display range: Depends on the reception segment switch function settings:
13 Seg: 5.57 MHz band (13 Segments)
1 Seg: 0.43 MHz band (1 Segment)
Note that these specifications apply when Standard is selected for the Equalizer switch function.
When Advanced is selected for the Equalizer switch function, both ends of the frequency bandwidth are displayed as invalid values.</td></tr>
<tr><td>Segmentation Offset</td><td>Specifies a position where analysis data is obtained within guard interval. The end of the guard interval is 0.
<table>
<tr><th>Guard interval / Mode</th><th>1/4</th><th>1/8</th><th>1/16</th><th>1/62</th></tr>
<tr><td>Mode1</td><td>0 to 512</td><td>0 to 256</td><td>0 to 128</td><td>0 to 64</td></tr>
<tr><td>Mode2</td><td>0 to 1024</td><td>0 to 512</td><td>0 to 256</td><td>0 to 128</td></tr>
<tr><td>Mode3</td><td>0 to 2048</td><td>0 to 1024</td><td>0 to 512</td><td>0 to 256</td></tr>
</table></td></tr>
<tr><td>Signal Parameter Auto Detection</td><td>Analyzes the signal input by user control (panel operation or remote control) to automatically detect the parameters required for modulation analysis.
Frequency lock range: ±99 kHz (typ.)
Mode, GI, TMCC information auto detection:
Analyzes the signal input by user control to automatically detect and set the mode, guard interval and TMCC
information.
TMCC information auto detection:
Analyzes the signal input by user control to automatically detect and set the TMCC information.</td></tr>
<tr><td>Sub-carrier MER</td><td>Displays MER of all sub-carriers, which exist in the bandwidth.
MER axis: 20, 30, 40, 50, and 60 dB
Magnify Window: Enables to enlarge the selected segment
Worst Envelope Line: Displays the worst value of the sub-carrier MER as the line graph. Non-display or display can be selected.
Maker Function: Enables to read MER and frequency with maker can select the current value or the worst value
Peak Display: Enables to read the MER and frequency of the worst value. Can set the full screen, enlarged screen and non-display.
Threshold Setting: Recognizes the sub-carrier worse than the threshold value set by MER
Setting Range: 0 to 30 dB (based on the Conventional MER value)
Display Range: there are two settings of the reception segment switching function
13 Seg: 5.57 MHz bandwidth (13 Segments)
1 Seg: 0.43 MHz bandwidth (1 Segment)
All the above are based on the condition when Standard is selected with Equalizer switching function.
When Advanced is selected with the equalizer switching function, both ends of the frequency bandwidth are displayed as invalid</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="11">C/N</td><td colspan="2">For CW (continuous wave)</td></tr>
<tr><td>Frequency Range</td><td>32 MHz to 1000 MHz (except IF Band)</td></tr>
<tr><td>Offset Frequency</td><td>100 Hz to 10 MHz</td></tr>
<tr><td>C/N Value</td><td>–140 to –40 dBc/Hz</td></tr>
<tr><td>Residual C/N</td><td>500 MHz, –10 dBm; ≤95 dBc/Hz (1 kHz offset), ≤108 dBc/Hz (10 kHz offset), ≤118 dBc/Hz (100 kHz offset)</td></tr>
<tr><td>Frequency Measurement Accuracy</td><td>Input level: –20 to +10 dBm (Preamplifier: Off) or –40 to –10 dBm (Preamplifier: On),
for input signal of ±1 kHz from the set frequency, average count: 5
±0.1 Hz + (Reference frequency accuracy × Measurement frequency)</td></tr>
<tr><td>Display Resolution</td><td>0.01 Hz</td></tr>
<tr><td>Marker Function</td><td>Offset frequency and C/N value at the marker can be read.</td></tr>
<tr><td>Level Range</td><td>–20 to +10 dBm (Preamplifier: Off), –40 to –10 dBm (Preamplifier: On)</td></tr>
<tr><td>C/N Integration Function</td><td>Calculates C/N integral value for the specified range.
C/N integral display range: –99.9 to 0 dBc
C/N integral setting range: 100 Hz to 10 MHz, 1 Hz steps
The frequencies of the integral start/stop points must be different.</td></tr>
</table>

Continued on next page

<table>
<tr><td rowspan="21">Spectrum Mask</td><td colspan="2">Measurement can be set with two methods</td></tr>
<tr><td colspan="2">Type A: Only 1 channel is fixed for the measurement channel numbers</td></tr>
<tr><td>Frequency</td><td>32 MHz to 2990 MHz (except IF Band)</td></tr>
<tr><td>Mask Type</td><td>Transmission, User-1, User-2</td></tr>
<tr><td>Mask Break Point</td><td>Transmission: Conforms to the transmission spectrum mask described in the “ARIB STD B31” (version 1.5).



Notes: [1] When Channel Map is set to other than General (except IF Band)
[2] When Channel Map is set to General</td></tr>
<tr><td>Pass/Fail Judgment</td><td>Performs Pass/Fail judgment. Judged as “Fail” when the spectrum waveform exceeds the mask line.
0 dB line is not included in the criteria.</td></tr>
<tr><td>Marker Function</td><td>Normal marker: Waveform frequency and relative level at the marker can be read.
Delta marker: Frequency difference and relative level difference between any two points can be read.</td></tr>
<tr><td>Occupied Frequency Bandwidth Measurement</td><td>Measures the bandwidth, where 99% of total power of 20 MHz span is included.
1 kHz resolution.</td></tr>
<tr><td>Level Range</td><td>When frequency is from 32 MHz to 1000 MHz:
–22 to +10 dBm (Preamplifier: Off) (Frequency: 32 MHz to 1000 MHz)
–42 to –10 dBm (Preamplifier: On) (Frequency: 32 MHz to 1000 MHz)</td></tr>
<tr><td>Spectrum mask line recall</td><td>Recalls the spectrum mask line by using a remote control command.</td></tr>
<tr><td colspan="2">Type B: Channel number for measurement is three at maximum.
Frequency measurement width (Span) is 30 MHz (±15 MHz) at 1 channel measurement</td></tr>
<tr><td>Frequency</td><td>32 MHz to 2985 MHz (except IF Band) at 1 channel measurement However, when several waves are measured, the frequency range for measurement should not exceed over 3 GHz.</td></tr>
<tr><td>Mask Type</td><td>Transmission, User-1, User-2</td></tr>
<tr><td>Frequency Channel</td><td>1 to 3 channel. However, several waves are limited to the adjacent continuous wave.</td></tr>
<tr><td>Station Power</td><td>Selection of station power: High/Low/30 dB Mask
• High: When the average power of the transmission or relay station is more than 2.5 W
• Low: When the average power of the transmission or relay station is less than or equal to 2.5 W
• 30 dB Mask: When the average power of the transmission or relay station is less than 0.25 W.</td></tr>
<tr><td>Average Power Setting Range (Average Power)</td><td>0.25 W to 2.5 W
Only when the station power is selected to Low
0.025 W to 0.249 W
Only when the station power is 30 dB Mask</td></tr>
<tr><td>Mask Break Point</td><td>Transmission: Conforms to the transmission spectrum mask described in the Investigation Report from Spurious Committee



Notes: [1] When the number of Channel is set to 1: Center frequency = Set frequency
[2] When the number of Channel is set to 2: Center frequency = Set frequency + 3 MHz
[3] When the number of Channel is set to 3: Center frequency = Set frequency + 6 MHz
User-1, User-2: Any arbitrary breakpoint can be set up to 50 points</td></tr>
</table>

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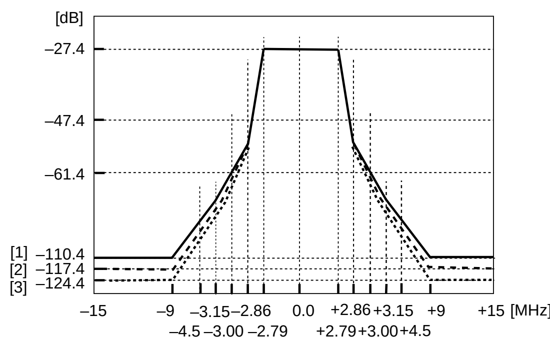
Spectrum Mask	Maximum Attenuation	When station power is high: –77.4 dB When station power is low: 0.25 W <P ≤2.5 W: – (73.4 + 10 logP) dB, P: ≤0.25 W (–67.4 dB) The value is gained, depending on the Average Power P [W]. When station power is 30 dB Mask, depending on the Average Power P [W]: 0.025 W ≤P <0.25 W: – (73.4 + 10 logP) dB P ≤0.025 W: –57.4 dB
	Frequency Measurement width (Span)	Channel Number = 1: 30 (±15) MHz Channel Number = 2: 36 (±18) MHz Channel Number = 3: 42 (±21) MHz
	Pass/Fail Judgment	Performs Pass/Fail judgment. Judged as “Fail” when the spectrum waveform exceeds the mask line. –27.4 dB line is not included in the criteria.
	Marker Function	Normal marker: Reads the frequency and relative level of the wave with marker Delta marker: Reads the difference of frequency and that of relative level between arbitrary 2 points
	Occupied Frequency Bandwidth Measurement	Measures the bandwidth occupying 99% within the whole bandwidth power of 30 MHz span. Display: Only at 1 channel measurement Resolution: 1 kHz Display: Only at 1 channel measurement
	Level Range	–22 to +10 dBm (Preamplifier: Off) (Frequency: 32 MHz to 1000 MHz) –42 to –10 dBm (Preamplifier: On) (Frequency: 32 MHz to 1000 MHz)
	Mask Line Recall	Recalls the spectrum mask line by using a remote control command.
	Brazil: Channel number for measurement is fixed to 1 channel.	
	Frequency	32 MHz to 2985 MHz (other than IF Band)
	Mask Type	Transmission, User-1, User-2
	Station Power	Selects the station power: Critical/Sub-Critical/Non-Critical.
	Mask Break Point	Transmission: Conforms to “ABNT NBR 15601: 2007.”  Notes: [1] When Station Power is Non Critical: The maximum attenuation = –110.4 dB [2] When Station Power is Sub Critical: The maximum attenuation = –117.4 dB [3] When Station Power is Critical: The maximum attenuation = –124.4 dB User-1, User-2: Up to 50 break points can be set.
	Marker Function	Normal marker: Reads the frequency and relative level of the waveform with marker. Delta marker: Reads the difference of frequency and relative level difference between any 2 points.. Marker trace: Reads a mask line.
	Pass/Fail Judgment	Performs pass-fail judgment. Judged as “Fail” when the spectrum waveform exceeds the mask line. –27.4 dB line is not included in the criteria.
	Level Range	–22 to +10 dBm (Preamplifier: Off) (Frequency: 32 MHz to 1000 MHz) –42 to –10 dBm (Preamplifier: On) (Frequency: 32 MHz to 1000 MHz)
	Mask Line Recall	Recalls the spectrum mask line by using a remote control command.
	Filter Characteristics File Selection	Default, User-1, User-2, User-3
Frequency Counter	For CW (continuous wave)	
	Frequency Range	3.9 MHz to 1000 MHz
	Frequency Measurement Accuracy	When input level: –20 to +10 dBm (Preamplifier: Off) or –40 to –10 dBm (Preamplifier: On), for input signal of ±1 kHz from the set frequency, average count: 5; ±0.1 Hz + (Reference frequency accuracy × Measurement frequency)
	Display Resolution	0.01 Hz
Storage Mode	For modulation analysis, C/N and frequency counter	
	Normal	Displays measured results every time.
	Average	Displays average for the set number of measured results. However, overwrites every 5 times for constellation. Average count: 2 to 100 Display method Every: Displays every measured result being averaged. Once: Updates display after averaging the set number of measured results.
	Max. Hold	Displays the maximum value among the measured results up to the latest one. However, the minimum value is displayed for the MER value. Frequency is determined by the absolute value of the difference. Constellation display is overwritten every 5 times. The display of the sub-carrier MER waveform is same as Normal.
	Overwrite	Waveform display is overwritten without clearing the past measured results. Numeric values are displayed each time same as Normal display.

Continued on next page

Storage Mode	Moving Average	Displays the moving average for the set number of measured results. However, overwrites every 5 times for constellation. Invalid during C/N measurement. Average count: 2 to 100 Display method Every: Displays every measured result being averaged. Once: Updates display after averaging the set number of measured results.
RF/IF Auto Switch Mode	Measurement Target	User setting value (RF) and preset value (IF)
	Preset Value	As IF, Channel Map is 37.15 MHz when General is set, spectrum reverse
	User Setting Items	RF: Channel Map/frequency/offset frequency/reference setting IF: Reference setting
	Measurement Target Display	RF: RF measurement, IF: IF measurement No Measure: Not measured
	Switch Status Display	(No display): Normal, Signal Loss: No signal, Signal Abnormal: Signal error
	Storage Status Display	(No display): Normal, Changed: Input is switched when storage mode is set to Average or Moving Average.

MP8931A Bit Error Rate Tester

MP8931A is the bit error measurement tool, equipped with conventional NRZ I/F, DVB-ASI and DVB-SPI, both of which are dedicated I/F for digital broadcasting.

- Clock frequency: 1 kHz to 155 MHz
- Pseudo-random (PN9/15/23) and ALL0/1, 1010 fixed pattern measurement
- MP8931A includes conventional NRZ I/F (TTL-Clock/Data/Enable) as standard equipment, as well as DVB-ASI* and DVB-SPI*, both of which are for digital broadcasting.
- Selectable error rate measurement part in an DVB I/F data packet is possible
- Error insertion
- GPIB/RS-232C I/F
- Small design (thin case)

* DVB-ASI: Digital Video Broadcasting - Asynchronous Serial Interface
DVB-SPI: Digital Video Broadcasting - Synchronous Parallel Interface

Remote Control
GPIB

Specifications

MP8931A Bit Error Rate Tester

Interface	NRZ, DVB-SPI, DVB-ASI
Remote Interface	GPIB, RS-232C
Internal Clock Frequency	1 kHz to 155 MHz
External Clock Input	1 kHz to 155 MHz, TTL/ECL, 75Ω/1 MΩ (NRZ, DVB-SPI)
Test Patterns	PN9, PN9_INV, PN15, PN15_INV, PN23, PN23_INV, ALL"0", ALL"1", "1010" Synchronization establish condition NRZ: 50 bits + N bits (N: number of stages, "0" when fixed), when normal DVB-SPI, SVB-ASI: 8 (8 + N) bits, when normal Synchronization loss condition: when 6 error bits of 64 bits detected.
Error Insertion	Nothing, Manual, Rate (10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7})
Measurement Time/Bit Setting	Measurement time (0 to 59 sec, 0 to 59 min, 0 to 999 h), Bit setting (10^{-3} to 10^{-15}), Manual, Repeat
Auto Sync	On/Off
DVB Interface Packet	204: (1) + 187 + (16) byte 188: (1) + 187 byte 204: (1 + 3) + 184 + (16) byte 188: (1 + 3) + 184 byte 204: (1) + 203 byte 204: (1 + 3) + 200 byte (DVB-ASI, DVB-SPI)
Through-put Setting	1 MHz to 27 MHz (DVB-ASI)
LEDs	Counting, Sync Loss, Signal Loss, Errors
Display Indication	(1) Switch between "Error rate" and "Number of errors/total count" (2) Over Flow display (3) Error display (4) Passed (elapsed) time/left (remaining) time display (5) Current/Last display
Display Control	Display-off, Bright control
Setting Data Auto-saving	Auto-saving the latest parameters which are set before power-off and Auto-setting on the next power-on.
Output Monitorable/disable	Output terminal, setting the able/disable of output
Dimension and Mass	426 (W) × 88 (H) × 451 (D) mm, ≤15 kg
Power Supply	85 V(ac) to 250 V(ac), 47.5 Hz to 63 Hz, ≤50 VA
Operating Temperature	0° to 50°C
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• MS8901A Digital Broadcast Signal Analyzer

Model/Order No.	Name	
	Main frame	
MS8901A	Digital Broadcast Signal Analyzer	
	Standard accessories	
	Power Code:	1 pc
J0996B	RS232C Cable:	1 pc
F0014	Fuse, 6.3 A:	1 pc
B0329G	Front Cover for 3/4 MW 4U:	1 pc
MA1621A	50Ω to 75Ω Impedance Transformer:	1 pc
W1717AE	MS8901A Operation Manual Vol. 1 (Basic Operation):	1 copy
W1782AE	MS8901A Operation Manual Vol. 2 (Panel Operation):	1 copy
W1783AE	MS8901A Operation Manual Vol. 3 (Programming):	1 copy
MX268001A	File Transfer Utility:	1 pc
	Options	
MS8901A-01	Precision Frequency Reference (Aging Rate: 5×10^{-10}/day)	
MS8901A-02	Narrow Resolution Bandwidths (FFT) (1 Hz to 1 kHz)	
MS8901A-04	Digital Resolution Bandwidth (10 Hz to 1 MHz, RMS Detection Function)	
MS8901A-09	Ethernet Interface (10BASE-T)	
MS8901A-18	Low IF/IQ Unbalanced Input	
MS8901A-21	Power Meter	
MS8901A-34	4 GHz LO Output	
MS8901A-41	Power Meter Retrofit	
MS8901A-46	Auto Power Recovery	
MS8901A-47	Rack-mount (IEC) without Handles	
MS8901A-48	Rack-mount (JIS) without Handles	
MS8901A-53	High Accuracy Modulation Frequency Measurement (Option 73 retrofit)	
MU890100A	ISDB-T Demodulation Unit*1	
	Measurement software	
MX890110A	ISDB-T Field Test Software (Attached to J1032 UHF Band Pass Filter)	
MX890120B	ISDB-T Signal Analysis Software	
	Application parts	
J0576D	Coaxial Cord, 2 m (N-P/ 5D-2W/ N-P)	
J0127C	Coaxial Cord, 0.5 m (BNC-P, RG-58A/U, BNC-P)	
J0127A	Coaxial Cord, 1 m (BNC-P, RG-58A/ U, BNC-P)	
J0007	408JE-104 GPIB Cable (1 m)	
J0008	GPIB Cable, 2 m	
J1032	UHF Bandwidth Pass Filter (460 MHz to 600 MHz)	
MP59B	50Ω Coaxial Switching Unit (DC to 3 GHz, Manual Switch)	
MP520C	CM Directional Coupler (25 MHz to 500 MHz, 50Ω)	
MP520D	CM Directional Coupler (100 MHz to 1700 MHz, 50Ω)	
MP721A	Fixed Attenuator (3 dB)	
MP721B	Fixed Attenuator (6 dB)	
MP721C	Fixed Attenuator (10 dB)	
MP721D	Fixed Attenuator (20 dB)	
MP721E	Fixed Attenuator (30 dB)	
MP534A	Dipole Antenna (25 MHz to 520 MHz)	
MP651A	Dipole Antenna (470 MHz to 1700 MHz)	
MP635A	Log Periodic Antenna (80 MHz to 1000 MHz)	
MP666A	Log Periodic Antenna (200 MHz to 2000 MHz)	
MB9A	Tripod (for MP666A, MP651A/B, MP534A/B)	
MB19A	Tripod (for MP635A, MP666A, with pole)	
B0452A	Hard Carrying Case with Caster	
MA4701A	Power Sensor (10 MHz to 18 GHz, –30 to +20 dBm, N connector)	
MA4703A	Power Sensor (50 MHz to 26.5 GHz, –30 to +20 dBm, SMA connector)	
MA4705A	Power Sensor (50 MHz to 32 GHz, –30 to +20 dBm, SMA connector)	
J0370A	Sensor Connecting Code, 1.5 m	

*1: MX890110A is necessary.

• MX890110A ISDB-T Field Test Software

Model/Order No.	Name	
	Measurement software	
MX890110A	ISDB-T Field Test Software	
	Standard accessories	
J1032	UHF Band Pass Filter (460 MHz to 600 MHz):	1 pc
J0576E	Coaxial Cord, 30 cm (N-P/5D2W/N-P):	1 pc
Z0808	ANR-CFX00T64 (P) (Memory Card)*2:	1 pc
W1718AE	MX890110A Operation Manual:	1 copy
	Option	
MU890100A	ISDB-T Demodulation Unit*1	

• MX890120B ISDB-T Signal Analysis Software

Model/Order No.	Name	
	Measurement software	
MX890120B	ISDB-T Signal Analysis Software	
	Standard accessories	
Z0808	ANR-CFX00T64 (P) (Memory Card)*2:	1 pc
W2312AE	MX890120B Operation Manual:	1 copy
	Option	
MX890110A	ISDB-T Field Test Software*3	

*1: MX890110A is necessary.
*2: Means ATA memory card, CompactFlash card or gettable memory card with a minimum size of 20 MB.
*3: This software can be used at the same time with MX890120B.

• MP8931A Bit Error Rate Tester

Model/Order No.	Name	
	Main frame	
MP8931A	Bit Error Rate Tester	
	Standard accessories	
	Power Cord:	1 pc
F0012	Fuse, 3.15 A:	1 pc
W2249AE	MP8931A Operation Manual:	1 copy
	Application parts	
B0329A	Protective Cover	
J1011	D-Sub 25 Cable	
J0026A	Coaxial Cord, 1 m	
J0007	GPIB Cable (408JE-104), 1 m	
J0008	GPIB Cable (408JE-102), 2 m	
J1256A	RS-232C Cable, 1.5 m	

HIGH PERFORMANCE HANDHELD SPECTRUM MASTER™

MS2720T

9 kHz to 9 GHz/13 GHz/20 GHz/32 GHz/43 GHz

Remote Control

Ethernet | USB

Taking the World's First 32 GHz and 43 GHz Handheld Spectrum Analyzers to the Next Level of Performance

NEW

From Anritsu, the inventor of the handheld spectrum analyzer first introduced in 1999, we are proud to introduce our 7th generation Spectrum Master MS2720T. The MS2720T represents the highest performance handheld spectrum analyzers available in the world as Anritsu pushes the envelope closer to benchtop quality. This generation introduces a touch screen, full-band tracking generators to 20 GHz, and best-in-class performance for dynamic range, DANL, phase noise, and sweep speed.

Spectrum and Interference Analyzer Highlights

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I, Field Strength, Spectral Emissions
- Measure Interference: Spectrogram, Signal Strength, RSSI
- Dynamic Range: > 106 dB in 1 Hz RBW
- DANL: –163 dBm in 1 Hz RBW
- Phase Noise: –112 dBc/Hz @ 10 kHz offset at 1 GHz
- Resolution Bandwidth (RBW): 1 Hz to 10 MHz
- Full-band Tracking Generators: 9, 13, 20 GHz
- Full-band Preamplifiers: included at no charge
- Channel Scanner: scan up to 20 channels at once
- Burst Detect™ Sweep Mode: Sweep 1000x in 15 MHz span
- Coverage Mapping: plot RSSI on on-screen map
- Interference Mapping: on-screen mapping with triangulation
- Operation to +55°C: full performance on AC or battery

Capabilities and Functional Highlights

- GSM/GPRS/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- LTE FDD/TDD
- CDMA/EV-DO
- WiMAX Fixed/Mobile
- Zero-span IF Output
- I/Q Waveform Capture
- Gated Sweep
- AM/FM/PM Demodulator
- High Accuracy Power Meter up to 26 GHz USB Sensors
- Remote Access Tool
- Three Hour Battery

Spectrum Analyzer Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) Apply when using internal reference and performance sweep mode; 3) Subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Measurements	Smart Measurements	Field Strength (dBm/m^2, dBW/m^2, V/m, A/m, Watt/m^2, Watt/cm^2, or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (AM, wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask)
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Frequency Offset, Signal Standard, Channel #
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/RBW Ratio
Sweep Functions	Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
	Sweep Mode	Fast (100x Performance), Performance, No FFT, Burst Detect (1000x Fast in 15 MHz span)
	Detection	Peak, RMS/Avg, Negative, Sample, Quasi-peak
	Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold%, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1-6 markers frequency and amplitude, plus delta markers frequency offset and amplitude
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
Frequency	MS2720T-0709	9 kHz to 9 GHz
	MS2720T-0713	9 kHz to 13 GHz
	MS2720T-0720	9 kHz to 20 GHz
	MS2720T-0732	9 kHz to 32 GHz
	MS2720T-0743	9 kHz to 43 GHz
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1.0 ppm/10 years Accuracy: ±0.3 ppm (25°C ±25°C) + aging
	Auto-sensing External Frequency Reference (MHz)	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608
	Sweep Time	10 µs to 600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1–3 sequence ±10% (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 10 MHz in 1–3 sequence (–3 dB bandwidth)
	RBW with Quasi-Peak Detection	200 Hz, 9 KHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
	VBW/Average Type	Linear/Log

Continued on next page

Spectral Purity	SSB Phase Noise at 1 GHz		9 GHz Instrument		13 GHz to 43 GHz Instruments	
		Offset	Maximum	Typical	Maximum	Typical
		10 kHz 100 kHz 1 MHz 10 MHz	–108 dBc/Hz –110 dBc/Hz –118 dBc/Hz –129 dBc/Hz	–112 dBc/Hz –115 dBc/Hz –123 dBc/Hz –133 dBc/Hz	–102 dBc/Hz –106 dBc/Hz –111 dBc/Hz –123 dBc/Hz	–106 dBc/Hz –110 dBc/Hz –116 dBc/Hz –129 dBc/Hz
Amplitude Ranges	Dynamic Range	>106 dB minimum at 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW				
	Measurement Range	DANL to +30 dBm				
	Display Range	1 dB to 15 dB/div in 1 dB steps, ten divisions displayed				
	Reference Level Range	–120 to +30 dBm				
	Attenuator Resolution	0 dB to 65 dB, 5 dB steps				
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW				
	Maximum Continuous Input	+30 dBm Peak typical, ±50 VDC (≥ 10 dB Attenuation) +23 dBm Peak typical, ±50 VDC (< 10 dB Attenuation) +13 dBm Peak typical, ±50 VDC (Preamp = ON)				
Amplitude Accuracy			+20° to +30°C (after 30 minute warm-up)		–10° to +55°C (after 60 minute warm-up)	
			Maximum	Typical	Maximum	Typical
	9 GHz Instrument	100 kHz to 7 GHz >7 GHz to 9 GHz	±1.3 dB ±1.8 dB	±0.5 dB ±0.5 dB	±2.3 dB ±2.8 dB	±0.5 dB ±0.5 dB
	13 GHz to 20 GHz Instruments	100 kHz to 9 GHz >9 GHz to 18 GHz	±1.3 dB ±2.3 dB	±0.5 dB ±0.5 dB	±2.3 dB ±3.3 dB	±0.5 dB ±0.5 dB
	32 GHz to 43 GHz Instruments	>100 kHz to 9 GHz >9 GHz to 40 GHz	±1.3 dB ±2.3 dB	±0.5 dB ±0.5 dB	±2.3 dB ±3.3 dB	±0.5 dB ±0.5 dB
Displayed Average Noise Level (DANL)	(RMS detection, VBW/Avg type = Log, Ref Level = –20 dBm for Preamp Off and –50 dBm for Preamp On, Performance Sweep Mode)					
			Preamp = Off		Preamp = On	
			Maximum	Typical	Maximum	Typical
	9 GHz Instrument	10 MHz to 3 GHz >3 GHz to 8 GHz	–146 dBm –140 dBm	–149 dBm –143 dBm	–160 dBm –152 dBm	–163 dBm –155 dBm
	13 GHz to 43 GHz Instruments	10 MHz to 4 GHz >4 GHz to 9 GHz >9 GHz to 13 GHz	–145 dBm –142 dBm –136 dBm	–148 dBm –145 dBm –139 dBm	–161 dBm –159 dBm –156 dBm	–164 dBm –162 dBm –159 dBm
	20 GHz Instrument	>13 GHz to 20 GHz	–138 dBm	–141 dBm	–157 dBm	–160 dBm
	32 GHz to 43 GHz Instruments	>13 GHz to 32 GHz >32 GHz to 40 GHz	–135 dBm –127 dBm	–138 dBm –130 dBm	–154 dBm –148 dBm	–157 dBm –151 dBm
Spurs			(RF input terminated, 0 dB input attenuation)			
			Preamp = Off		Preamp = On	
	Residual Spurs	<13 GHz 13 GHz to 20 GHz >20 GHz to 32 GHz >32 GHz to 43 GHz	–90 dBm, maximum –85 dBm, maximum –80 dBm, maximum –80 dBm, maximum		–100 dBm, maximum –100 dBm, maximum –100 dBm, maximum –95 dBm, maximum	
	Input-Related Spurs	–60 dBc, –70 dBc typical (0 dB attenuation, –30 dBm input, span < 1.7 GHz)				
Third-Order Intercept (TOI)	(–20 dBm tones 100 kHz apart, 0 dB Attenuation Preamp OFF)					
	2.4 GHz		+14 dBm minimum			
	50 MHz to 20 GHz		+20 dBm typical			
	>20 GHz to 32 GHz		+15 dBm typical			
	>32 GHz to 20 GHz		+20 dBm typical			
P1dB	<4 GHz		5 dBm typical			
	4 GHz to 20 GHz		12 dBm typical			
	>20 GHz to 32 GHz		7 dBm typical			
	>32 GHz to 43 GHz		12 dBm typical			
Second Harmonic Distortion			(0 dB input attenuation, –30 dBm input)			
	50 MHz		–54 dBc maximum			
VSWR			(>10 dB input attenuation)			
	<9 GHz Instruments	<4 GHz	1:5:1 typical			
		4 GHz to 8 GHz	1.8:1 typical			
	13 GHz to 43 GHz Instruments	<20 GHz	1.5:1 typical			
		20 GHz to 43 GHz	2.0:1 typical			

• Tracking Generator (Options 809, 813, and 820)

Setup Parameters	Frequency	Center/Start/Stop, Span, Signal Standard, Channel #, Frequency Step/Offset, Channel Offset			
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Units, Pre-Amp, Detection			
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span			
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/Average Type (Linear/Log), RBW/VBW Ratio, Span/RBW Ratio			
	Generator	On/Off, Output Power, Mode (CW/Tracking), Settings, Transmission Measurement			
	Tracking Generator Settings	External Gain/Loss, Power Statistics (On/Off)			
	Transmission Measurement Settings	Normalize (Off/On), Scale, Reference Position and Amplitude, Transmission Statistics and Offset			
	Maximum Continuous Input	+23 dBm, ±50 VDC			
Frequency	Frequency Range	MS2720T-0809	100 kHz to 9 GHz		
		MS2720T-0813	100 kHz to 13 GHz		
		MS2720T-0820	100 kHz to 20 GHz		
	Frequency Accuracy	Aging: ±1 ppm/10 year			
		Accuracy: ±0.3 ppm (25°C ±25°C) + aging			
Output Power	100 kHz to 20 GHz	–40 to 0 dBm			
	Step Size	0.1 dB nominal			
	Dynamic Range	9 GHz Instrument	>110 dB typical 100 kHz to 7 GHz		
			>100 dB typical >7 GHz to 9 GHz		
		13 GHz and 20 GHz Instruments	>100 dB typical 100 kHz to 12 GHz		
			>80 dB typical >12 GHz to 20 GHz		
Level Accuracy		(At least 30 minute warm-up after 1 hour non-operating at 15° to 35°C ambient, excludes load VSWR effects)			
	Frequency Range	20° to 30°C (after 30 minute warm-up)		0° to 50°C (after 60 minute warm-up)	
		Maximum	Typical	Maximum	Typical
	100 kHz to 9 GHz	±1.5 dB	±0.5 dB	±2.0 dB	±1.0 dB
	>9 GHz to 13 GHz	±1.6 dB	±1.0 dB	±2.1 dB	±1.5 dB
	>13 GHz to 18 GHz	±2.0 dB	±1.0 dB	±2.5 dB	±1.5 dB
VSWR	100 kHz to 5 GHz	2:1 typical			
	>5 GHz to 20 GHz	4:1 typical			

• High Accuracy Power Meter (Option 19) (Requires external USB Power Sensor)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale			
Average	# of Running Averages, Max Hold			
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)			
Limits	Limit On/Off, Limit Upper/Lower			
Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108A/18A/26A
Description	High Accuracy RF Power Sensor	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz
Connector	Type N(m), 50Ω	Type N(f), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω (8/18 GHz) Type K(m), 50Ω (26 GHz)
Dynamic Range	–30 to +20 dBm (0.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 μW to 200 mW)	–40 to +20 dBm (0.1 μW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB[*1]	±0.17 dB[*2]	±0.16 dB[*1]	±0.18 dB[*3]
Data sheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504

∗1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
∗2: Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
∗3: Expanded uncertainty with K=2 for power measurements of a CW signal greater than –20 dBm with zero mismatch

• Interference Analyzer (Option 25)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram	Collect data up to 72 hours
	Signal Strength	Gives visual and aural indication of signal strength
	Received Signal Strength Indicator (RSSI)	Collect data up to 72 hours
	Signal ID	ID up to 12 FM, GSM, W-CDMA, CDMA or Wi-Fi signals based on RF bandwidth
	Interference Mapping	Draw bearing of signal strength from GPS location on on-screen map
	Application Options	Impedance (50Ω, 75Ω, Other)

• Channel Scanner (Option 27)

General	Number of Channels	1 to 20 Channels (Power Levels)
	Measurements	Graph/Table, Max Hold (On/5 s/Off), Frequency/Channel, Current/Maximum, Dual Color
	Scanner	Scan Channels, Scan Frequencies, Scan Custom List, Scan Script Master™
	Amplitude	Reference Level, Scale
	Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
	Frequency Range	9 kHz to 9, 13, 20, 32, or 43 GHz
	Frequency Accuracy	±10 Hz + time base error
	Measurement Range	–110 to +30 dBm
	Application Options	Impedance (50Ω, 75Ω, Other)

• Coverage Mapping (Option 431)

Measurements	Indoor	Mapping RSSI, ACPR
	Outdoor Mapping	RSSI, ACPR
Setup Parameters	Mode	Spectrum Analyzer
	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/VBW Ratio
	Measurement Setup	ACPR, RSSI
	Point Distance/Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

• GPS Receiver (Option 31)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
	Note: Anritsu 2000-1528-R GPS antenna requires +5 VDC Anritsu 2000-1652-R GPS antenna requires +3.3 VDC or +5 VDC
GPS Time/Location Indicator	Time, Latitude, Longitude, and Altitude on display Time, Latitude, Longitude, and Altitude with trace storage
High Frequency Accuracy	<±25 ppb with GPS On, 3 minutes after satellite lock in selected mode (GPS Antenna connected) <±50 ppb for 3 days after GPS lock, 0° to 50°C ambient temperature (GPS Antenna disconnected)
Connector	SMA, female

• Gated Sweep (Option 90)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 to 65 ms typical) Gate Length (1 µs to 65 ms typical) Zero Span Time

• Zero Span IF Output (Option 89)

Mode	Spectrum Analyzer/Span/Zero Span
Center Frequency	140 MHz
Output Level	–25 dBm typical
Reference Level	–57 to +30 dBm (Preamp Off) –87 to –40 dBm (Preamp On)
IF Bandwidths	Up to 30 MHz (3 dB bandwidth)
RF Attenuation	Auto
Connector	BNC female

• I/Q Waveform Capture (Option 24)

Mode	Spectrum Analyzer
Capture Mode	Single or Continuous
Trigger	Free Run, External (Rising/Falling), Delay
Maximum Capture Length	800 ms
Maximum Sample Rate	40 MHz
Maximum Signal Bandwidth	32 MHz

• Secure Data (Option 7)

Set at Factory	Save measurement files on external USB flash drive only Internal memory is permanently disabled

• AM/FM/PM Signal Analyzer (Option 509)

Measurements							
Display Type	RF Spectrum (AM/FM/PM)	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*M Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*

*: Requires sine wave modulation

Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq
	Amplitude Setup	Scale, Power Offset, Adjust Range
	Measurements	Demod Type (AM, FM, PM), IFBW, Auto IFBW RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average
	Marker	Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table
RF and Modulation Measurements	AM	Modulation Rate: ±1 Hz (< 100 Hz), ±2% (>100 Hz) Depth: ±5% for (Modulation rates 10 Hz to 100 kHz)
	FM	Modulation Rate: ±1 Hz (< 100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (100 Hz to 100 kHz)**
	PM	Modulation Rate: ±1 Hz (< 100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz)**
	IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz, 70 kHz, 140 kHz
	RBW/VBW	30
	Span/RBW	100
	Sweep Time	50 µs to 50 ms (Audio Waveform)

**: IFBW must be greater than 95% occupied BW

• GSM/GPRS/EDGE Measurements (Option 880)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) RF Summary	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC) Modulation Summary	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	View Pass/Fail Limits All, RF, Demod Available Measurements Channel Power Occupied Bandwidth Burst Power Average Burst power Frequency Error Phase Error EVM Origin Offset C/I Magnitude Error Script Master™

Setup Parameters	GSM/EDGE Select	Auto, GSM, EDGE	
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel	
	Amplitude	Power Offset, Auto Range, Adjust Range	
	Sweep	Single/Continuous, Trigger Sweep	
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory	
	Measurement Summary Screen	Overall Measurements, RF Measurements, Modulation Measurements	
RF Measurements	Frequency Error	±10 Hz + time base error, 99% confidence level	
	Occupied Bandwidth	Bandwidth within which lies 99% of the power transmitted on a single channel	
	Burst Power Error	±1.5 dB, ±1 dB typical, (–50 to +20 dBm)	
Demodulation Measurements	GSMK Modulation Quality (RMS Phase)	Measurement Accuracy	±1 °
		Residual Error (GSMK)	1 °
	8 PSK Modulation Quality (EVM)	Measurement Accuracy	±1.5%
		Residual Error (8 PSK) 2	.5%

• W-CDMA/HSPA+ Measurements (Option 881)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Band Spectrum Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single carrier ACLR Multi-carrier ACLR	Code Domain Power Graph P-CPICH Power Channel Power Noise Floor EVM Carrier Feed Through Peak Code Domain Error Carrier Frequency Frequency Error Control Channel Power Abs/Rel/Delta Power CPICH, P-CCPCH S-CCPCH, PICH P-SCH, S-SCH HSPA+ Power vs. Time Constellation Code Domain Power Table Code, Status EVM, Modulation Type Power, Code Utilization Power Amplifier Capacity Codogram Modulation Summary	Scrambling Code Scanner (Six) Scrambling Codes CPICH Ec/Io Ec Pilot Dominance OTA Total Power Multipath Scanner (Six) Six Multipaths Tau Distance RSCP Relative Power Multipath Power	View Pass/Fail Limits All, RF, Demod Available Measurements Max Output Power Frequency Error EVM CPICH Occupied Bandwidth Spectral Mask ACLR PCDE P-CCPCH S-CCPCH Code Spread 3 PICH Code 128 Test Models 1 (16), (32), (64) 2 3 (16), (32) 4 (+CPICH), (-CIPCH) 5 (2 HS), (4 HS), (8 HS)

Setup Parameters	Scrambling Code, Threshold	Auto, Manual
	User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
	Maximum Spreading Factor	256, 512
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Marker	Six Markers, Table On/Off
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
RF Measurements	RF Channel Power Accuracy	±1.25 dB, ±0.7 dB typical, (temperature range 15° to 35°C)
	Occupied Bandwidth Accuracy	±100 kHz
	Adjacent Channel Leakage Ratio (ACLR)	–54 dB/–59 dB ±0.8 dB @ 5 MHz/10 MHz offset, typical, 824 MHz to 894 MHz, 1710 MHz to 2170 MHz –54 dB/–57 dB ±1.0 dB @ 5 MHz/10 MHz offset, typical, 2300 MHz to 2700 MHz
Demodulation Measurements	W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
	HSPA+ Modulations	QPSK, 16 QAM, 64 QAM
	Frequency Error	±10 Hz + time base error, 99% confidence level
	EVM Accuracy	±2.5%, 6% ≤ EVM ≤ 25%
	Residual EVM	2.5% typical
	Code Domain Power	±0.5 dB for code channel power >–25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
	CPICH (dBm) Accuracy	±0.8 dB typical
Over-the-Air (OTA) Measurements	Scrambling Code Scanner	Six strongest Scrambling Codes
	Multipath Scanner	Multipath power of six signals relative to strongest pilot

• TD-SCDMA/HSPA+ Measurements (Option 882)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error (QPSK/8 PSK/16 QAM/64 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error CDP Marker Modulation Summary	Code Scan (32) Scrambling Code Group Tau Ec/Io DwPTS Power Pilot Dominance Tau Scan (Six) Sync-DL# Tau Ec/Io DwPTS Power Pilot Dominance Record Run/Hold	View Pass/Fail Limits All, RF, Demod Available Measurements Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Noise Floor

Setup Parameters	Slot Selection	Auto, 0-6
	Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
	SYNC-DL Code	Auto, 0-31
	Scrambling/Midamble Code	Auto, 0-127
	Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
	Measurement Speed	Fast, Normal, Slow
	User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
	Demodulation Type	Auto, QPSK, 8 PSK, 16 QAM, 64 QAM
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Sweep	Hold/Run, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements	RF Channel Power Accuracy (RRC)	±1.5 dB, ±1.0 dB typical, (slot power –40 dBm to +10 dBm)
	Frequency Error	±10 Hz + time base error, in the presence of a downlink slot
Demodulation Measurements	Supported Modulation	QPSK, 8 PSK, 16 QAM, 64 QAM
	Residual EVM (rms)	3% typical, P-CCPH Slot Power > –50 dBm
	PN Offset	Within 1 × 64 chips
	Pilot Power Accuracy	±1.0 dB typical
	Timing Error (Tau) for Dominant SYNC-DL	±0.2 μs (external trigger)
	Spreading Factor	1, 16
Over-the-Air (OTA) Measurements	Code Scanner	32 Sync Codes and associated Scrambling Code Groups
	Tau Scanner	Six strongest Sync Codes
	Auto Save	Yes
	GPS Tagging and Logging	Yes

• LTE FDD/TDD Measurements (Option 883)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth ACPR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization% Channel Power, Cell ID OSTP, EVM Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH Total Power (Table View) Modulation Results Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1 or 2) Modulation Summary	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power SS, P-SS, S-SS Power PBCH Power PCFICH Power Cell, Group, Sector ID

Setup Parameters	Frequency	E-UTRA Bands 1 - 5, 7 - 14, 17 - 21, 24 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
	Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous
	EVM Mode	Auto, PBCH only, Max Hold
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
LTE FDD RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +10 dBm)
LTE FDD Modulation Measurements	RS Power Accuracy	±1.0 dB typical, (RF input –50 to +10 dBm)
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Residual EVM (rms)	2.0% typical (E-UTRA Test Model 3.1, RF Input –50 to +10 dBm)
LTE FDD Over-the-Air (OTA) Measurements	Scanner	Six strongest signals if present Auto Save – Sync Signal power and Modulation Results with GPS information
	Tx Test	Scanner – Three strongest signals if present RS Power – Strongest signal
	Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: *.kml, *.mtd (tab delimited)

• **LTE FDD/TDD Measurements (Option 883)** (continued)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Frame View Sub-Frame View Total Frame Power DwPTS Power Transmit Off Power Cell ID Timing Error ACLR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization% Channel Power, Cell ID Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH Total Power (Table View) Modulation Results Antenna Icons Detects active antennas (1 or 2) Modulation Summary	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power SS, P-SS, S-SS Power PBCH Power PCFICH Power Cell, Group, Sector ID Frame Power DWPTS Power Transmit Off Power Timing

Setup Parameters	Frequency	E-UTRA bands 33 - 43 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
	Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous
	EVM Mode	Auto, PBCH only, Max Hold
	Trigger	No Trigger/Ext Trigger, Rising/Falling
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
LTE TDD RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –30 to +10 dBm)
LTE TDD Modulation Measurements	RS Power Accuracy	±1.0 dB typical, (RF input –50 to +10 dBm)
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Residual EVM (rms)	2.0% typical (E-UTRA Test Model 3.1, RF Input –30 to +10 dBm)
Over-the-Air (OTA) Measurements	Scanner	Six strongest signals if present Auto Save – Sync Signal power and Modulation Results with GPS information
	Tx Test	Scanner – Three strongest signals if present RS Power – Strongest signal
	Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: *.kml, *.mtd (tab delimited)

• CDMA/EV-DO Measurements (Option 884)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Multi-carrier ACPR RF Summary	Code Domain Power Graph Pilot Power Channel Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Frequency Error Abs/Rel/ Power Pilot Page Sync Q Page Code Domain Power Table Code Status Power Multiple Codes Code Utilization Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power Limit Test – 10 Tests Averaged Rho Adjusted Rho Multipath Pilot Dominance Pilot Power Pass/Fail Status	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Mask Test Frequency Error Channel Frequency Frequency error Pilot Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Code Utilization Measured PN Pilot Dominance

CDMA Setup Parameters	PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
	Walsh Codes	64, 128
	Measurement Speed	Fast, Normal, Slow
	External Trigger Polarity	Rising, Falling
	Number of Carriers	1 to 5
	Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
CDMA RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
CDMA Demodulation Measurements	Frequency Error	±10 Hz + time base error, 99% confidence level (in slow mode)
	Rho Accuracy	±0.005, for Rho >0.9
	Residual Rho	>0.995, typical, >0.99 maximum, (RF input –50 to +20 dBm)
	PN Offset	1 × 64 chips
	Pilot Power Accuracy	±1.0 dB typical, relative to channel power
	Tau	±0.5 µs typical, ±1.0 µs maximum
CDMA Over-the-Air (OTA) Measurements	Pilot Scanner	Nine strongest pilots
	Multipath Scanner	Multipath power of six signals relative to strongest pilot
	Limit Test	Average of ten tests compared to limit

• **CDMA/EV-DO Measurements (Option 884)** (continued)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail

Channel Spectrum
  Channel Power
  Occupied Bandwidth
  Peak-to-Average Power
Power vs. Time
  Pilot & MAC Power
  Channel Power
  Frequency Error
  Idle Activity
  On/Off Ratio
Spectral Emission Mask
Multi-carrier ACPR
RF Summary
	MAC Code Domain Power Graph
	  Pilot & MAC Power
	  Channel Power
	  Frequency Error
	  Rho Pilot
	  Rho Overall
	  Data Modulation
	  Noise Floor
	MAC Code Domain Power Table
	  Code
	  Status
	  Power
	  Code Utilization
	Data Code Domain Power
	  Active Data Power
	  Data Modulation
	  Rho Pilot
	  Rho Overall
	  Maximum Data CDP
	  Minimum Data CDP
	Modulation Summary
		Pilot Scanner (Nine)
		  PN
		  E_c/I_o
		  Tau
		  Pilot Power
		  Channel Power
		  Pilot Dominance
		Mulitpath Scanner (Six)
		  E_c/I_o
		  Tau
		  Channel Power
		  Multipath Power
			View Pass/Fail Limits
			  All, RF, Modulation
			Available Measurements
			  Channel Power
			  Occupied Bandwidth
			  Peak-to-Average Power
			  Carrier Frequency
			  Frequency Error
			  Spectral Mask
			  Noise Floor
			  Pilot Power
			  RMS Phase Error
			  Tau
			  Code Utilization
			  Measured PN
			  Pilot Dominance

Setup Parameters	PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
	Walsh Codes	64, 128
	Measurement	Speed Fast, Normal, Slow
	External Trigger Polarity	Rising, Falling
	Slot Type	Auto, Active, Idle
	Number of Carriers	1 to 5
	Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
EV-DO RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
EV-DO Demodulation Measurements	EV-DO Compatibility	Rev 0 and Rev A
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Rho Accuracy	±0.01, for Rho >0.9
	Residual Rho	>0.995 typical, >0.99, maximum (RF input –50 to +20 dBm)
	PN Offset	Within 1 × 64 chips
	Pilot Power Accuracy	±1.0 dB typical, relative to channel power
	Tau	±0.5 μs typical, ±1.0 μs maximum
EV-DO Over-the-Air (OTA) Measurements	Pilot Scanner	Nine strongest pilots
	Multipath Scanner	Multipath power of six signals relative to strongest pilot

• **WiMAX Fixed/Mobile Measurements (Option 885)**

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID Sector ID (Mobile) Modulation Summary	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Base Station ID

Setup Parameters	Bandwidth (MHz)	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00
	Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
	Span (MHz)	5, 10, 15, 20
	Frame Length (ms)	2.5, 5.0, 10.0
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
WiMAX Fixed RF Measurements (temperature range 15° to 35°C)	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
WiMAX Fixed Demodulation Measurements (temperature range 15° to 35°C)	Frequency Error	0.07 ppm + time base error, 99% confidence level
	Residual EVM (rms)	3% typical, 3.5% maximum (RF Input –50 to +20 dBm)

• **WiMAX* Fixed/Mobile Measurements (Option 885)** (continued)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power Uplink Burst Power ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID DL-MAP (Tree View) Modulation Summary	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Downlink Burst Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID

Setup Parameters	Zone Type	PUSC
	DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
	Bandwidths (MHz)	3.50, 5.00, 7.00, 8.75, 10.00
	Cyclic Prefix Ratio (CP)	1/8
	Span (MHz)	5, 10, 20, 30
	Frame Lengths (ms)	5, 10
	Demodulation	Auto, Manual, FCH
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
WiMAX Mobile RF Measurements (temperature range 15° to 35°C)	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
WiMAX Mobile Demodulation Measurements (temperature range 15° to 35°C)	Frequency Error	0.02 ppm + time base error, 99% confidence level
	Residual EVM (rms)	2.5% typical, 3.0% maximum (RF Input –50 to +20 dBm)
WiMAX Mobile Over-the-Air (OTA) Measurements	Channel Power Monitor	Over time (one week), measurement time interval 1 s to 60 s
	Preamble Scanner	Six Strongest Preambles
	Auto Save	Yes
	GPS Tagging and Logging	Yes

*: Mobile WiMAX conforms to IEEE Std. 802.16e-2005, WiMAX Forum® Air Interface - Mobile System Profile - Release 1.0 Certified, System Profiles according to WMF-T24-001-R010v07.

General Specifications

Setup Parameters	System	Status (Temperature, Battery Info, S/N, Firmware Version, Installed Options) Self Test, Application Self Test, GPS (see Option 31) Name, Date and Time, Ethernet Configuration, Volume
	System Options	Display (Brightness, Blank, Default, Black & White, Night Vision, High Contrast, Invert Black & White) Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, User Defined) Reset (Factory Defaults, Master Reset, Update Firmware) Share Center Frequency and Power (All Modes are Not Shared) Power-On (via Power Switch or when DC is Applied)
	File	Save As, Save Meas, Save, Save On Event, Recall Meas, Recall, Copy, Delete
	Save/Recall	Setups, Measurements, Screen Shots JPEG (save only)
	Delete	By File Type, All, Selected
	Internal Trace/Setup Memory	>13,000 traces
	External Trace/Setup Memory	Limited by size of USB Flash Drive
Connectors	RF In	9 GHz to 20 GHz Instruments: Type N, female, 50Ω 32 GHz to 43 GHz Instruments: Ruggedized Type K, male
	RF Out	9 GHz to 20 GHz Instruments: Type N, female, 50Ω
	GPS	SMA Female
	External Power	5.5 mm barrel connector, 12 to 14.5 VDC, < 5.0 A
	LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
	USB Interface	Two Type A, Connect Flash Drive and Power Sensor; 5-pin mini-B, Connect to PC for data transfer
	Headset Jack	3.5 mm 3-wire headset jack
	External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm
	External Reference Out	BNC, female, 50Ω, 10 MHz
	External Trigger	BNC, female, 50Ω, Maximum Input +5 VDC
	IF Out	BNC, female, 50Ω, 140 MHz
Display and Keyboard	Display	8.4" Touch Screen, 800 x 600 Resolution
	Keyboard	Backlit (Red for Night Vision, White for all other display modes)
Battery	Type, Operation	Li-Ion, 3 hour operation, typical
Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC
	Australia and New Zealand	C-tick N274
	Interference, Emissions, Immunity	EN 61326-1, EN 55011, EN 61000-4-2/3/4/5/11
Safety	Safety Class	EN 61010-1 Class 1, Pollution Degree 2
	Product Safety	IEC 60950-1 when used with Anritsu Company supplied Power Supply
Environmental	Temperature	–10° to +55°C (Operating), –51° to +71°C (Storage)
	Maximum Humidity	85% RH, non-condensing
	Vibration, Shock, Temperature, Humidity	MIL-PRF-28800F Class 2
	Altitude	4600 m, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3
Dimensions and Mass	Dimensions	315 × 211 × 77 mm, (12.4 × 8.3 × 3.0 in)
	Mass	3.7 kg to 4.4 kg (8.1 lb to 9.8 lb) depending on Frequency Option and Tracking Generator

Master Software Tools (for your PC)

Database Management	Full Trace Retrieval	Retrieve all traces from instrument into one PC directory
	Trace Catalog	Index all traces into one catalog
	Trace Rename Utility	Rename measurement traces
	Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
Data Analysis	Trace Math and Smoothing	Compare multiple traces
	Measurement Calculator	Translate into other units
Report Generation	Report Generator	Includes GPS, power level, and calibration status along with measurements
	Edit Graph	Change scale, limit lines, and markers
	Report Format	Create reports in HTML for PDF format
	Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
	Notes	Annotate measurements
Mapping (GPS Required)	Spectrum Analyzer Mode	MapInfo, MapPoint
	Mobile WiMAX OTA Option	Google Earth, Google Maps, MapInfo
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
	Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
	Folder Spectrogram – 3D View	View Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	Traces	Add, delete, and modify limit lines and markers
	Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
	Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
	Languages	Add one language or modify non-English language menus
	Mobile WiMAX	DL-MAP Parameters
	Display	Modify display settings
Connectivity	Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
	Download	Download measurements and live traces to PC for storage and analysis
	Upload	Upload measurements from PC to instrument
	Remote Access Tool	Remote control and monitoring of instrument (via Ethernet port) over the Internet

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MS2720T	Spectrum Master (Requires Option 709, 713, 720, 732, or 743)
	Freqeuncy Options
MS2720T-0709	Frequency Range 9 kHz to 9 GHz
MS2720T-0713	Frequency Range 9 kHz to 13 GHz
MS2720T-0720	Frequency Range 9 kHz to 20 GHz
MS2720T-0732	Frequency Range 9 kHz to 32 GHz
MS2720T-0743	Frequency Range 9 kHz to 43 GHz
	Tracking Generator Options
MS2720T-0809	9 GHz Tracking Generator (Requires Option 709)
MS2720T-0813	13 GHz Tracking Generator (Requires Option 713)
MS2720T-0820	20 GHz Tracking Generator (Requires Option 720)
	Spectrum Analyzer Options
MS2720T-0025	Interference Analyzer (Option 31 is recommended)
MS2720T-0027	Channel Scanner
MS2720T-0431	Coverage Mapping (Requires Option 31 for full functionality)
MS2720T-0509	AM/FM/PM Measurements (Option 431 required for full functionality)
MS2720T-0024	I/Q Waveform Capture (Requires Option 9)
MS2720T-0089	Zero-Span IF Output
MS2720T-0090	Gated Sweep
	Power Meter Option
MS2720T-0019	High Accuracy Power Meter (Requires USB Power Sensor, sold separately)

Model/Order No.	Name
	Wireless Measurement Options
MS2720T-0009	Demodulation Hardware
MS2720T-0880	GSM/GPRS/EDGE Measurements (Requires Option 9)
MS2720T-0881	W-CDMA/HSPA+ Measurements (Requires Option 9, Option 31 recommended)
MS2720T-0882	TD-SCDMA/HSPA+ Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0883	LTE FDD/TDD Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0884	CDMA/EV-DO Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0885	WiMAX Fixed/Mobile Measurements (Requires Option 9, Option 31 required for full functionality)
	General Options
MS2720T-0007	Secure Data Operation
MS2720T-0031	GPS Receiver (Requires GPS Antenna, sold separately) - 2000-1528-R GPS Antenna, SMA(m) with 5 m (15 ft) cable, requires 5 VDC - 2000-1652-R GPS Antenna, SMA(m) with 0.3 m (1 ft) cable, requires 3.3 VDC or 5 VDC
MS2720T-0098	Standard Calibration (ANSI Z540-1-1994)
MS2720T-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)

Continued on next page

Model/Order No.	Name
	Power Sensors
	(for complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 250 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
	Manuals
	(soft copy included on Handheld Instruments Documentation Disc and at www.anritsu.com)
10920-00060	Handheld Instruments Documentation Disc
10580-00340	Spectrum Master User Guide (Hard copy included)
10580-00349	Spectrum Analyzer Measurement Guide
10580-00339	Tracking Generator Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+, LTE, TD-LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00341	Spectrum Master Programming Manual
10580-00342	Spectrum Master Maintenance Manual
	Troubleshooting Guides
	(soft copy at www.anritsu.com)
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00566	LTE eNodeB
11410-00615	TD-LTE eNodeB
11410-00463	W-CDMA/HSPA+ Base Stations
11410-00465	TD-SCDMA/HSPA+ Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00469	Mobile WiMAX Base Stations
11410-00470	Fixed WiMAX Base Stations
	Standard Accessories (included with instrument)
10920-00060	Handheld Instruments Documentation Disc
10580-00340	Spectrum Master User Guide (includes GPS Receiver)
2300-498	Master Software Tools (MST) Disc
2000-1685-R	Soft Carrying Case
633-75	High Capacity Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Cigarette Lighter 12 VDC Adapter
2000-1371-R	Ethernet Cable, 7 ft/213 cm
3-2000-1498	USB A-mini B Cable, 10 ft/305 cm
11410-00646	MS2720T Spectrum Master Technical Data Sheet
	One Year Warranty
	(Including battery, firmware, and software)
	Certificate of Calibration and Conformance
	Optional Accessories
	GPS Antennas
2000-1528-R	GPS Antenna, SMA(m) with 5 m (15 ft) cable, requires 5 VDC
2000-1652-R	GPS Antenna, SMA(m) with 0.3 m (1 ft) cable, requires 3.3 VDC or 5 VDC
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd gain, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd gain, Yagi
2000-1677-R	300 MHz to 3000 MHz, SMA(m), 50Ω, 3 m cable (9.8 ft) 0 to 6 dBi gain @ 950 MHz, log periodic
2000-1617	600 MHz to 21 GHz, N(f), 5 to 8 dBi gain to 12 GHz, 0 to 6 dBi gain to 21 GHz, log periodic

Model/Order No.	Name
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1487	VHF/UHF, Telescopic Whip antenna, straight or 90°, BNC(m), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
	Mag Mount Broadband Antenna
2000-1647-R	Cable 1: 698–1200 MHz 2 dBi peak gain, 1700–2700 MHz 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 2: 3000–6000 MHz 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50Ω, 10 ft
2000-1645-R	694-894 MHz 3 dBi peak gain 1700-2700 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
2000-1646-R	750-1250 MHz 3 dBi peak gain, 1650-2000 MHz 5 dBi peak gain, 2100-2700 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
2000-1648-R	1700-6000 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50Ω
1030-179-R	777 MHz to 787 MHz, N(m) to N(f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50Ω
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-417-R	N(m) to QMA(f), DC to 6 GHz, 50Ω
1091-418-R	N(m) to QMA(m), DC to 18 GHz, 50Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50Ω
510-90-R	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN(m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN(f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50Ω, w/ Reinforced Grip
71693-R	Ruggedized K(f) to Type N(f)
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Miscellaneous Accessories
2000-1374	External Dual Charger for Li-Ion Batteries
633-75	High Capacity Battery Pack, 7500 mAh
66864	Rack Mount Kit, Master Platform
2000-1689	EMI Near Field Probe Kit
2000-1653	Anti-glare Screen Cover (package of 2)
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

HIGH PERFORMANCE HANDHELD SPECTRUM ANALYZER
MS2721B
9 kHz to 7.1 GHz

Remote Control
Ethernet | USB

The Most Advanced Ultra-portable Spectrum Analyzer on the Market, Featuring Unparalleled Performance at a Modest Price

Continuous frequency coverage from 9 kHz to 7.1 GHz gives the wireless professional the performance needed for the most demanding measurements in harsh RF and physical environments. Whether you need spectrum monitoring, AM and FM broadcast proofing, WiFi and WiFi5 installation and testing, RF and microwave signal measurements or cellular signal measurements, the Spectrum Master family is the tool to make your job easier and more productive. Includes quasi-peak detector and CISPR bandwidths.

High Performance Highlights
- 9 kHz to 7.1 GHz Input
- 1 Hz to 3 MHz RBW Range
- Very Low Phase Noise (–100 dBc/Hz Maximum at 10 kHz offset, 100 kHz to 7.1 GHz)
- Built-in AM/FM/SSB Demodulator
- Built-in Preamplifier
- 65 dB Step Attenuator
- True RMS Detection
- 2+ Hours of Battery Life
- 3.1 kg (<6.9 lbs)
- 3G Modulation Cellular Measurement options
- GPS Receiver option
- Tracking Generator option
- Includes Quasi-peak detector and CISPR bandwidths
- WiMAX Measurement options

Features
Functions
- Multiple Marker: Display up to six markers on screen. Each marker includes a delta marker, effectively allowing up to 12 markers on screen. The user may also set marker 1 to be the reference for 6 delta markers.
- Marker Table: Display a table of up to six marker frequency and amplitude values plus delta marker frequency offset and amplitude.

Upper/Lower Limit
- Fixed and segmented: Each upper and lower limit can be made up of between one and 40 segments. One-button creation of a spectrum envelope and saveable limit lines.

Smart Measurements
- Occupied Bandwidth: Measures 99% to 1% power channel of a signal.
- Channel Power: Measures the total power in a specified bandwidth.
- C/I: Measures carrier to interference ratio.
- ACPR: Measures power levels in the channels immediately above and below the center channel.
- Field Strength: Uses antenna calibration tables to measure dBm/meter^2, dBmV/meter^2, W/meter and V/meter.

Specifications

Frequency	Frequency Range	9 kHz to 7.1 GHz
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1 ppm per 10 years Accuracy: ±0.3 ppm (25°C ±25°C) + aging
	Frequency Span	10 Hz to 7.1 GHz Plus 0 Hz (zero span)
	Span Accuracy	Same as frequency reference accuracy
	Sweep Time	10 μs to 600 seconds in zero span, autoset in non-zero span
	Sweep Time Accuracy	±2% in zero span
	Sweep Trigger	Free run, Single, Video, External
	Resolution Bandwidth	1 Hz to 3 MHz in 1-3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)
	Video Bandwidth	1 Hz to 3 MHz in 1-3 sequence (–3 dB bandwidth)
	SSB Phase Noise	–100 dBc/Hz Max. (10, 20 and 30 kHz offset) –102 dBc/Hz Max. (100 kHz)
Amplitude	Measurement Range	DANL to +30 dBm
	Display Range	1 to 15 dB/div in 1 dB steps. Ten divisions displayed.
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBμV Linear Scale Modes: nV, μV, mV, V, kV, nW, μW, mW, W, kW
	Attenuator Range	0 to 65 dB
	Attenuator Resolution	5 dB steps
	Absolute Amplitude Accuracy	Power levels: ≥–50 dBm, ≤35 dB Input attenuation ±1.5 dB (9 kHz to 10 MHz) ±1.25 dB (>10 MHz to 4 GHz) ±1.75 dB (>4 GHz to 7.1 GHz) 40 to 55 dB Input attenuation ±1.5 dB (9 kHz to 10 MHz) ±1.75 dB (>10 MHz to 6.5 GHz) ±2 dB (>6.5 GHz to 7.1 GHz) 60 to 65 dB Input attenuation ±1.5 dB (9 kHz to 10 MHz) ±1.75 dB (>10 MHz to 6.5 GHz) ±3 dB (>6.5 GHz to 7.1 GHz) Preamplifier On, 0 or 10 dB Input attenuation ±1.5 dB (9 kHz to 4 GHz) ±1.75 dB (>4 GHz to 7.1 GHz)
	Second Harmonic Distortion (0 dB input attenuation, –30 dBm input)	0.05 GHz to 1.4 GHz, –50 dBc >1.4 GHz to 2 GHz, –70 dBc >2 GHz, –80 dBc
	Third Order Intercept (TOI) (preamplifier off)	Frequency Min. 600 MHz +7 dBm 3.5 GHz +9 dBm Frequency / Typical 50 MHz to 300 MHz / >8 dBm >300 MHz to 2.2 GHz / >10 dBm >2.2 GHz to 2.8 GHz / >15 dBm >2.8 GHz to 4.0 GHz / >10 dBm >4.0 GHz to 7.1 GHz / >13 dBm 0 dB attenuation, –20 dBm reference level, –20 dBm tones, spaced 100 kHz
	Displayed Average Noise Level: DANL in 1 Hz RBW	Test conditions (for all models): Input attenuation: 0 dB, RMS detection, Reference level = –20 dBm for preamplifier off and –50 dBm for preamplifier on. Note: Discrete spurious signals are not included in the measurement of DANL as they are covered by the residual spurious specification.
		Preamplifier On –163 dBm (Typical), –161 dBm (Max.), 10 MHz to 1 GHz –160 dBm (Typical), –159 dBm (Max.) >1 GHz to 2.2 GHz –156 dBm (Typical), –153 dBm (Max.) >2.2 GHz to 2.8 GHz –160 dBm (Typical), –159 dBm (Max.), >2.8 GHz to 4.0 GHz –158 dBm (Typical), –154 dBm (Max.), >4.0 GHz to 7.1 GHz Preamplifier Off –140 dBm (Typical), –137 dBm (Max.), 10 MHz to 1 GHz –136 dBm (Typical), –133 dBm (Max.), >1 GHz to 2.2 GHz –130 dBm (Typical), –126 dBm (Max.), >2.2 GHz to 2.8 GHz –139 dBm (Typical), –136 dBm (Max.), >2.8 GHz to 4.0 GHz –131 dBm (Typical), –127 dBm (Max.), >4.0 GHz to 7.1 GHz

Continued on next page

Amplitude	Noise Figure (derived from DANL measurement)	0 dB attenuation, 23°C: Preamplifier On Frequency / Typical 10 MHz to 1 GHz: 11 dB >1 GHz to 2.2 GHz: 14 dB >2.2 GHz to 2.8 GHz: 18 dB >2.8 GHz to 4.0 GHz: 14 dB >4.0 GHz to 7.1 GHz: 16 dB
	Input-related Spurious –30 dBm input, 0 dB RF attenuation, span <1.7 GHz	–60 dBc Max., (<–70 dBc typical)
	Residual Spurious, Preamplifier Off (RF input terminated, 0 dB RF attenuation)	–90 dBm Max.*2, 100 kHz to <3200 MHz –84 dBm Max.*2, 3200 MHz to 7100 MHz Exceptions*2: Frequency / Spurious Level 250, 300, and 350 MHz: –85 dBm Max. to 4010 MHz: –80 dBm Max. (–90 dBm typical) to 5084 MHz: –70 dBm Max. (–83 dBm typical) to 5894 MHz: –75 dBm Max. (–87 dBm typical) to 7028 MHz: –80 dBm Max. (–92 dBm typical)
	Residual Spurious, Preamplifier On (RF input terminated, 0 dB RF attenuation)	–100 dBm Max.

Options Specifications

• I/Q Demodulation Hardware (Option 9)
Hardware required to demodulate 3G, 4G and WiMAX signals

• High Accuracy Power Meter (Option 19)
(Requires external USB Power Sensor)

• Tracking Generator (Option 20)

Frequency Range	450 kHz to 7.1 GHz (usable to 100 kHz)
Power Output	–40 to 0 dBm
Connector	Type N female, 50Ω
Step Size	0.1 dB
Level Accuracy (15° to 35°C)	±1.5 dB Max. (450 kHz to 7.1 GHz, 15° to 35°C)

• Interference Analyzer (Option 25)

Signal Strength	Gives visual and aural indication of signal strength
RSSI	Collect data up to one week
Spectrogram	Collect data up to one week

• Channel Scanner (Option 27)

Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Number of Channels	1 to 20 (Power Levels)

• GPS (Option 31)

GPS Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
GPS High Frequency Accuracy when GPS Antenna is Connected	<±25 ppb with GPS On, 3 minutes after satellite lock in selected mode
Internal High Accuracy, when GPS Antenna is not Connected	<±50 ppb for 3 days, 0° to 50°C ambient temperature
Connector	BNC, female, reverse polarity

• W-CDMA/HSDPA OTA (Option 35)

Resolution	0.1 dB

• GSM/GPRS/EDGE RF Measurements (Option 40)

Occupied Bandwidth	Bandwidth within which 99% of the power transmitted on a single channel lies
Burst Power	±1 dB typical for –50 to +20 dBm (±1.5 dB Max.)
Frequency Error	±10 Hz + time base error, 99% confidence level

• GSM/GPRS/EDGE Demodulator (Option 41)

GSMK Modulation Quality	(RMS Phase) Measurement Accuracy: ±1 deg Residual Error (GSMK): 1 deg
8PSK Modulation Quality	(EVM) Measurement Accuracy: ±1.5% Residual Error (8PSK): 2.5%
	(EVM) Measurement Accuracy: ±1.5% Residual Error (8PSK): 2.5%

• **W-CDMA/HSDPA RF Measurements (Option 44)**

Frequency Ranges	824 MHz to 894 MHz 1710 MHz to 2170 MHz 2300 MHz to 2700 MHz
RF Channel Power (temperature range 15° to 35°C)	±0.7 dB typical (±1.25 dB Max.)
Occupied Bandwidth Accuracy	±100 kHz
Residual Adjacent Channel Leakage Ratio (ACLR)*3 (824 MHz to 894 MHz, 1710 MHz to 2170 MHz)	–54 dB typical at 5 MHz offset –59 dB typical at 10 MHz offset
Leakage Ratio (ACLR)*3 (2300 MHz to 2700 MHz)	–54 dB typical at 5 MHz offset –57 dB typical at 10 MHz offset
ACLR Accuracy (Single channel active) (824 MHz to 894 MHz, 1710 MHz to 2170 MHz)	±0.8 dB for ACLR ≥–45 dB at 5 MHz offset ±0.8 dB for ACLR ≥–50 dB at 10 MHz offset
ACLR Accuracy (Single channel active) (2300 MHz to 2700 MHz)	±1.0 dB for ACLR ≥–45 dB at 5 MHz offset ±1.0 dB for ACLR ≥–50 dB at 10 MHz offset
Frequency Error: ±10 Hz + Time Base Error, 99% confidence level	±10 Hz + Time Base Error, 99% confidence level

• **W-CDMA Demodulation and W-CDMA/HSDPA Demodulator (Options 45 and 65)**

EVM Accuracy*3 (824 MHz to 894 MHz, 1710 MHz to 2170 MHz)	(3GPP Test Model 4) ±2.5%; ≤EVM ≤25% (3GPP Test Model 5) ±2.5%; ≤EVM ≤20% (2300 MHz to 2700 MHz)
EVM Accuracy*3	±2.5% for 6 ≤EVM ≤20%
Residual EVM	2.5% typical
Code Domain Power	±0.5 dB for code channel power >–25 dB 16, 32, 64 DCPH (test model 1) 16, 32 DCPH (test model 2, 3)
CPICH (dBm) Accuracy	±0.8 dB typical
Scrambling Code	3 seconds

• **Fixed WiMAX RF Measurements (Option 46)**

Channel Power Accuracy*3	±1 dB Typical for +20 to –50 dBm (±1.5 dB Max.)

• **Fixed WiMAX RF Measurements (Option 46)**

Residual EVM (rms)	3% for +20 to –50 dBm (3.5% Max.)
Frequency Error	±10 Hz + time base error, 99% confidence level

∗1: Excludes mismatch errors.
Excludes noise, zero set, zero drift for levels <–20 dBm.
Excludes digital modulation uncertainty between +17 and +20 dBm.
∗2: After 30 min warm-up
∗3: Depends on reference level, input signal level and single channel conditions

General

RF Input VSWR	2.0:1 maximum, 1.5:1 typical (≥10 dB attenuation)
Maximum Continuous Input	(≥10 dB attenuation), +30 dBm
Input Damage Level*	≥10 dB attenuation, >+43 dBm, ±50 Vdc <10 dB attenuation, >+23 dBm, ±50 Vdc ∗ Input protection relay opens at >30 dBm with ≥10 dB input attenuation and at approximately 10 to 23 dBm with <10 dB attenuation.
ESD Damage Level	≥10 dB attenuation, >10 kV
External Reference Frequencies	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13 and 19.6608 MHz at –10 to +10 dBm
Display	Bright daylight-viewable color transmissive LCD: Full SVGA, 8 in.
Languages	Built-in English, Spanish, Italian, French, German, Japanese, Korean, and Chinese. The instrument also has the capability to have two customized languages installed from Master Software Tools.
Marker Modes	6 Markers, 9 Modes: Normal, Delta, Marker to Peak, Marker to Center, Marker to Reference Level, Next Peak Left, Next Peak Right, All Markers Off, Noise Marker, Frequency Counter Marker (1 Hz resolution), Markers Tracking or Fixed, Marker 1 reference for all deltas.
Sweeps	Full span, Zero span, Span Up/Span Down
Detection	Peak, Negative, Sample, RMS, Quasi-peak
Memory	Trace and Setup storage is limited only by the capacity of the installed external storage (CF or USB flash drive). For a 256 MB card, storage is greater than 13000 spectrum analyzer traces and over 10000 setups.
Traces	Displayed Traces: Three Traces with trace overlay. Trace A is always the live data; Traces B and C can be either stored data or traces which have been mathematically manipulated. Also Traces B and C can show Max. hold or min hold.
Interfaces	Type N female RF connector for Spectrum Analyzer input Type N female RF connector for optional Tracking Generator Reverse polarity BNC jack for optional GPS antenna connector BNC female connectors for ext. reference and ext. trigger 5-pin Mini-B USB 2.0 for data transfer to a PC USB 2.0 Host connector used with High Accuracy Power Meter and USB Flash Drives RJ45 connector for Ethernet 10/100BASE-T 2.5 mm 3-wire headset connector
Dimensions and Mass	313 (W) × 211 (H) × 77 (D) mm (12W × 8H × 3D in.) 3.1 kg (<6.9 lbs.) typical
Environmental	MIL-PRF-28800F class 2
Operating	–10° to +55°C, humidity 85% or less
Storage	–51° to +71°C
Altitude	4600 m, operating and non-operating
Safety	Conforms to EN 61010-1 for Class 1 portable equipment
Electromagnetic Compatibility	Meets European Community requirements for CE marking.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MS2721B	Handheld Spectrum Analyzer (9 kHz to 7.1 GHz)
	Options
MS2721B-009	I/Q Demodulation Hardware
MS2721B-019	High Accuracy Power Meter
MS2721B-020	Tracking Generator
MS2721B-025	Interference Analyzer
MS2721B-027	Channel Scanner
MS2721B-031	GPS (includes GPS antenna)
MS2721B-033	cdmaOne and CDMA2000 1xRTT Over the Air (OTA) (requires Opt. 009, 031)
MS2721B-034	CDMA2000 1xEV-DO Over-the-Air Measurements (requires Opt. 009, 031)
MS2721B-035	W-CDMA/HSDPA OTA (requires Opt. 009 and 031)
MS2721B-037	IEEE 802.16 Mobile WiMAX Over-the-Air Measurements (requires Opt. 009)
MS2721B-038	TD-SCDMA/HSDPA Over-the-Air Measurements (requires Opt. 009)
MS2721B-040	GSM/GPRS/EDGE RF Measurement (requires Opt. 009)
MS2721B-041	GSM/GPRS/EDGE Demod (requires Opt. 009)
MS2721B-042	cdmaOne/CDMA2000 1X RF Measurements (requires Opt. 009)
MS2721B-043	cdmaOne/CDMA2000 1X Demodulation (requires Opt. 009)
MS2721B-044	W-CDMA/HSDPA RF Measurement (requires Opt. 009)
MS2721B-045	W-CDMA Demodulation (requires Opt. 009)
MS2721B-046	IEEE 802.16 Fixed WiMAX RF Measurements (requires Opt. 009)
MS2721B-047	IEEE 802.16 Fixed WiMAX Demodulation (requires Opt. 009)
MS2721B-060	TD-SCDMA/HSDPA Measurements (requires Opt. 009)
MS2721B-061	TD-SCDMA/HSDPA Demodulation (requires Opt. 009)
MS2721B-062	CDMA2000 1xEV-DO RF Measurements (requires Opt. 009)
MS2721B-063	CDMA2000 1xEV-DO Demodulation (requires Opt. 009)
MS2721B-065	W-CDMA/HSDPA Demod (requires Opt. 009)
MS2721B-066	IEEE 802.16 Mobile WiMAX RF Measurements (requires Opt. 009)
MS2721B-067	IEEE 802.16 Mobile WiMAX Demodulation (requires Opt. 009)
MS2721B-090	Gated Sweep
MS2721B-0541	LTE RF Measurements (requires Opt. 009)
MS2721B-0542	LTE Modulation Measurements (requires Opt. 009)
MS2721B-0546	LTE Over-the-Air Measurements (requires Opt. 009)
MS2721B-0098	Standard Calibration to Z540
MS2721B-0099	Premium Calibration to Z540 plus test data
	Standard accessories
10580-00207	Spectrum Master User Guide (includes Bias-Tee and GPS Receiver)
65729	Soft Carrying Case
40-187-R	AC – DC Adapter
806-141-R	Automotive Cigarette Lighter/12 Volt DC Adapter
2300-498	CD-ROM Containing Master Software Tools
2000-1371-R	Automotive Cigarette Lighter 12 Volt DC Adapter
633-44	Rechargeable battery, Li-Ion
1091-27-R	Type-N male to SMA female adapter
1091-172	Type-N male to BNC female adapter
2000-1520-R	2 GB USB Memory Device
3-2000-1498	USB A-mini B Cable, 10 feet/305 cm
	One Year Warranty

Model/Order No.	Name
	Optional accessories
1030-105-R	Band Pass Filters, 890 MHz to 915 MHz, N(m) to N(f), 50Ω
1030-106-R	Band Pass Filters, 1710 MHz to 1790 MHz, N(m) to N(f), 50Ω
1030-107-R	Band Pass Filters, 1910 MHz to 1990 MHz, N(m) to N(f), 50Ω
1030-109-R	Band Pass Filters, 824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	Band Pass Filters, 880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-111-R	Band Pass Filters, 1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-112-R	Band Pass Filters, 2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-114-R	Band Pass Filters, 806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
760-243-R	Transit Case
	Anritsu Master Software Tools, User/Measurement Guide
10580-00175	Anritsu HHSA User's Guide
10580-00176	Anritsu HHSA Programming Manual
10580-00177	Anritsu HHSA Maintenance Manual
2000-1411-R	Portable Yagi Antenna, 10 dBd, N(f) 822 MHz to 900 MHz
2000-1412-R	Portable Yagi Antenna, 10 dBd, N(f) 885 MHz to 975 MHz
2000-1413-R	Portable Yagi Antenna, 10 dBd, N(f) 1.71 GHz to 1.88 GHz
2000-1414-R	Portable Yagi Antenna, 9.3 dBd, N(f) 1.85 GHz to 1.99 GHz
2000-1415-R	Portable Yagi Antenna, 10 dBd, N(f) 2.4 GHz to 2.5 GHz
2000-1416-R	Portable Yagi Antenna, 10 dBd, N(f) 1.92 GHz to 2.23 GHz
2000-1030	Portable antenna, SMA(m) 1.71 GHz to 1.88 GHz, 50Ω
2000-1031	Portable antenna, SMA(m) 1.85 GHz to 1.99 GHz, 50Ω
2000-1032	Portable antenna, SMA(m) 2.4 GHz to 2.5 GHz, 50Ω
2000-1035	Portable antenna, SMA(m) 896 MHz to 941 MHz, 50Ω
2000-1200	Portable antenna, SMA(m) 806 MHz to 869 MHz, 50Ω
2000-1361	Portable Antenna, SMA(m) 5725 MHz to 5825 MHz, 50Ω
2000-1473	Portable Antenna, SMA(m) 870 MHz to 960 MHz, 50Ω
2000-1474	Portable Antenna, SMA(m) 2.4 GHz to 2.5 GHz, 50Ω
2000-1475	Portable Antenna, SMA(m) 2.11 GHz to 2.17 GHz, 50Ω
61532	Antenna Kit: 2000-1030, 2000-1031, 2000-1032, 2000-1035, 2000-1200, and 2000-1361

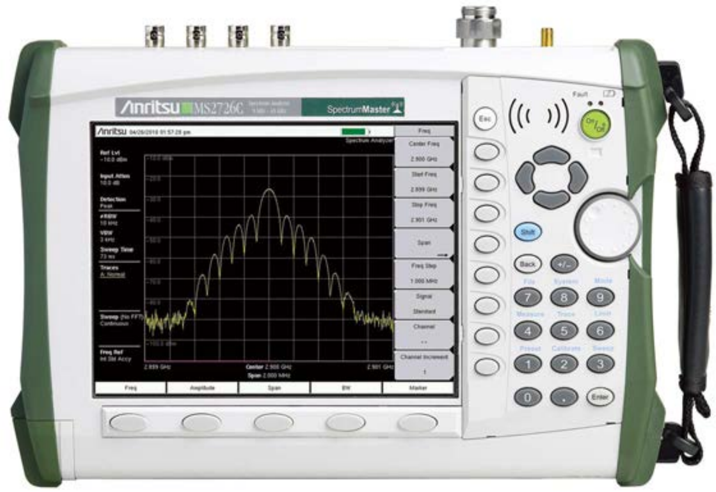
HIGH PERFORMANCE HANDHELD SPECTRUM MASTER

MS2722C/MS2723C/MS2724C/MS2725C/MS2726C

9 kHz to 43 GHz

Remote Control
Ethernet | USB

The Most Advanced Ultra-portable Spectrum Analyzer on the Market, Featuring Unparalleled Performance at a Modest Price



Anritsu's high performance handheld spectrum analyzer provides the wireless professional the performance needed for the most demanding measurements in harsh RF and physical environments. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or Wi-Fi and wireless network measurements, the Spectrum Master is the ideal instrument to making fast and reliable measurements.

Spectrum and Interference Analyzer Highlights

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI
- Dynamic Range: > 104 dB in 1 Hz RBW
- DANL: –160 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz @ 10 kHz offset at 1 GHz
- Frequency Accuracy: ±25 ppb with GPS On
- 1 Hz to 10 MHz Resolution Bandwidth (RBW)
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 40 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete

Capabilities and Functional Highlights

- LTE, GSM/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- CDMA, EV-DO
- WiMAX - Fixed/Mobile
- AM/FM/SSB Demodulator
- Zero span IF Output
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter
- 4, 6, 8, 18, 26 GHz USB Sensors
- Channel Scanner
- 8.4-inch Display
- <5 minutes warm-up time
- 2.5 hours battery operation time
- Ethernet/USB Data Transfer
- MST Remote Access Tool

Specifications

Model		MS2722C	MS2723C	MS2724C	MS2725C	MS2726C
Measurements	Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m^2 or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask)				
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #				
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection				
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span				
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW				
	File	Save, Recall, Delete, Directory Management				
	Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event				
	Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All				
	Delete	Selected File, All Measurements, All Mode Files, All Content				
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy				
	Application Options	Impedance (50Ω, 75Ω, Other)				
Sweep Functions	Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type				
	Sweep Mode	Fast, Performance, No FFT				
	Detection	Peak, RMS/Avg, Negative, Sample, Quasi-peak				
	Triggers	Free Run, External, Video, Delay, Level, Slope, Hysteresis, Holdoff, Force Trigger Once				
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations				
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)				
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold				
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale				
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off				
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker				
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level				
	Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude				
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit				
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right				
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1				
	Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope				
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall				
Frequency	Frequency Range	9 kHz to 9 GHz (usable to 0 Hz), Preamp 100 kHz to 9 GHz	9 kHz to 13 GHz (usable to 0 Hz), Preamp 100 kHz to 13 GHz	9 kHz to 20 GHz (usable to 0 Hz), Preamp 100 kHz to 20 GHz	9 kHz to 32 GHz (usable to 0 Hz), Preamp 100 kHz to 32 GHz	9 kHz to 43 GHz (usable to 0 Hz), Preamp 100 kHz to 43 GHz
	Tuning Resolution	1 Hz				
	Frequency Reference	Aging: ±1.0 ppm/10 years Accuracy: ±0.3 ppm (25°C ±25°C) + aging				
	External Reference Frequencies	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608 MHz				
	Frequency Span	10 Hz to 9 GHz including zero span	10 Hz to 13 GHz including zero span	10 Hz to 20 GHz including zero span	10 Hz to 32 GHz including zero span	10 Hz to 43 GHz including zero span
	Sweep Time	10 µs to 600 seconds in zero span				
	Sweep Time Accuracy	±2% in zero span				
Bandwidth (Performance Sweep Mode)	Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1–3 sequence ±10% (–3 dB bandwidth)				
	Video Bandwidth (VBW)	1 Hz to 10 MHz in 1–3 sequence (–3 dB bandwidth)				
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)				
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1				
Spectral Purity	SSB Phase Noise at 1 GHz	–100 dBc/Hz @ 10 kHz offset from carrier (–104 dBc/Hz typical) –102 dBc/Hz @ 100 kHz offset from carrier (–107 dBc/Hz typical) –107 dBc/Hz @ 1 MHz offset from carrier (–114 dBc/Hz typical) –120 dBc/Hz @ 10 MHz offset from carrier (–129 dBc/Hz typical)				

Continued on next page

Model		MS2722C	MS2723C	MS2724C	MS2725C	MS2726C
Amplitude Ranges	Dynamic Range	> 104 dB @ 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW				
	Measurement Range	DANL to +30 dBm				
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed				
	Reference Level Range	–120 to +30 dBm				
	Attenuator Resolution	0 to 65 dB, 5 dB steps				
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW				
	Maximum Continuous Input	+30 dBm Peak, ±50 VDC (≥10 dB Attn) +23 dBm Peak, ±50 VDC (<10 dB Attn) +13 dBm Peak, ±50 VDC (Preamp On)				
Amplitude Accuracy (single sine wave input <Ref level, and >DANL, auto attenuation, Performance Sweep Mode)	+20° to +30°C after 30-minute warm-up	Typical: ±0.5 dB, 100 kHz to 9 GHz Maximum: ±1.3 dB, 100 kHz to 9 GHz	Typical: ±0.5 dB, 100 kHz to 13 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz	Typical: ±0.5 dB, 100 kHz to 20 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz, Add ±1.0 dB, 13 GHz to 20 GHz	Typical: ±0.5 dB, 100 kHz to 32 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz, Add ±1.0 dB, 13 GHz to 32 GHz	Typical: ±0.5 dB, 100 kHz to 40 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz, Add ±1.0 dB, 13 GHz to 40 GHz
	–10° to +40°C after 60-minute warm-up	Add ±1.0 dB, 100 kHz to 9 GHz	Add ±1.0 dB, 100 kHz to 13 GHz	Add ±1.0 dB, 100 kHz to 20 GHz	Add ±1.0 dB, 100 kHz to 32 GHz	Add ±1.0 dB, 100 kHz to 32 GHz Add ±2.0 dB, 32 GHz to 40 GHz
Displayed Average Noise Level (RMS detection, VBW/Avg type = Log., Ref Level = –20 dBm for preamp Off and –50 dBm for preamp On, Performance Sweep Mode)	(DANL in 1 Hz RBW, 0 dB attenuation) Preamp Off					
	10 MHz to 4 GHz	–141 dBm	–141 dBm	–141 dBm	–141 dBm	–141 dBm
	>4 GHz to 9 GHz	–134 dBm	–134 dBm	–134 dBm	–134 dBm	–134 dBm
	>9 GHz to 13 GHz	–	–129 dBm	–129 dBm	–129 dBm	–129 dBm
	>13 GHz to 20 GHz	–	–	–123 dBm	–123 dBm	–123 dBm
	>20 GHz to 32 GHz	–	–	–	–134 dBm	–134 dBm
	>32 GHz to 40 GHz	–	–	–	–	–127 dBm
	(DANL in 1 Hz RBW, 0 dB attenuation) Preamp On					
	10 MHz to 4 GHz	–160 dBm	–160 dBm	–160 dBm	–160 dBm	–160 dBm
	>4 GHz to 9 GHz	–156 dBm	–156 dBm	–156 dBm	–156 dBm	–156 dBm
	>9 GHz to 13 GHz	–	–152 dBm	–152 dBm	–152 dBm	–152 dBm
	>13 GHz to 20 GHz	–	–	–145 dBm	–145 dBm	–145 dBm
	>20 GHz to 32 GHz	–	–	–	–154 dBm	–154 dBm
	>32 GHz to 40 GHz	–	–	–	–	–147 dBm
Spurious	Residual Spurious (RF input terminated, 0 dB input attenuation)	Preamp Off –90 dBm 9 kHz to 9 GHz Preamp On –100 dBm 1 MHz to 9 GHz	Preamp Off –90 dBm 9 kHz to 13 GHz Preamp On –100 dBm 1 MHz to 13 GHz	Preamp Off –90 dBm 9 kHz to 13 GHz, –85 dBm 13 GHz to 20 GHz Preamp On –100 dBm 1 MHz to 20 GHz	Preamp Off –90 dBm 9 kHz to 13 GHz, –85 dBm 13 GHz to 20 GHz, –80 dBm 20 GHz to 32 GHz Preamp On –100 dBm 1 MHz to 32 GHz	Preamp Off –90 dBm 9 kHz to 13 GHz, –85 dBm 13 GHz to 20 GHz, –80 dBm 20 GHz to 43 GHz Preamp On –100 dBm 1 MHz to 32 GHz, –95 dBm 32 GHz to 43 GHz
	Input-Related Spurious	(0 dB attenuation, –30 dBm input, span <1.7 GHz) –60 dBc, –70 dBc typical				
Third-Order Intercept (TOI) (–20 dBm tones 100 kHz apart, –20 dBm Ref level, 0 dB input attenuation, preamp Off)	2.4 GHz	+15 dBm	+15 dBm	+15 dBm	+15 dBm	+15 dBm
	50 MHz to 9 GHz	+20 dBm typical	+20 dBm typical	+20 dBm typical	+20 dBm typical	+20 dBm typical
	50 MHz to 13 GHz	–				
	50 MHz to 20 GHz	–	–			
	20 MHz to 32 GHz	–	–	–	+15 dBm typical	+15 dBm typical
	32 GHz to 43 GHz	–	–	–	–	+20 dBm typical
P1dB	<4 GHz	+5 dBm typical				
	4 GHz to 9 GHz	+12 dBm typical	+12 dBm typical	+12 dBm typical	+12 dBm typical	+12 dBm typical
	4 GHz to 13 GHz	–				
	4 GHz to 20 GHz	–	–			
	20 GHz to 32 GHz	–	–	–	+7 dBm typical	+7 dBm typical
	32 GHz to 43 GHz	–	–	–	–	+12 dBm typical
Second Harmonic Distortion	50 MHz	–54 dBc				
	<4 GHz	–60 dBc typical				
	>4 GHz	–75 dBc typical				
VSWR	>10 dB input attenuation					
	<9 GHz	1:5:1 typical	–	–	–	–
	<13 GHz	–	1:5:1 typical	–	–	–
	<20 GHz	–	–	1:5:1 typical	1:5:1 typical	1:5:1 typical
	<20 GHz to 32 GHz	–	–	–	2.0:1 typical	2.0:1 typical
	<20 GHz to 43 GHz	–	–	–	–	

• GPS Receiver Option (Option 0031)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, Signal Analyzers
when GPS Antenna is connected	<±25 ppb with GPS On, 3 minutes after satellite lock in selected mode
GPS Lock – after antenna is disconnected	<±50 ppb for 3 days, 0° to 50°C ambient temperature
Connector	SMA, Female

• Secure Data Option (Option 0007)

For highly secure data handling requirements, this software option prevents the storing of measurement setup or data information onto any internal file storage location. Instead, setup and measurement information is stored ONLY to the external USB memory location.

A simple factory preset prepares the Spectrum Master for transportation while the USB memory remains behind in the secure environment. The Spectrum Master cannot be switched between secure and non-secure operation by the user once configured for secure data operation.

• High Accuracy Power Meter (Option 0019) (Requires external USB Power Sensor(s))

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108/18/26A
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz (MA24108A) 10 MHz to 18 GHz (MA24118A) 10 MHz to 26 GHz (MA24126A)
Connector	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω (MA24108/18A) Type K(m), 50Ω (MA24126A)
Dynamic Range	–30 to +20 dBm (0.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurands	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB*1	±0.17 dB*2	±0.16 dB*1	±0.18 dB*3
Datasheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504

*1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

• Interference Analyzer (Option 0025)

Measurements	Spectrum Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I) Spectrogram (Collect data up to 72 hours) Signal Strength (Gives visual and aural indication of signal strength) Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength Signal ID (up to 12 signals) Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) >10 dB Interference Mapping Save current point location and direction Save/Recall points/map Delete last saved point Delete all points Speaker on/off Volume Reset Max/Min hold
Application Options	Impedance (50Ω, 75Ω, Other)

• Channel Scanner (Option 0027)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Custom List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	9 kHz to 43 GHz
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +30 dBm
Application Options	Impedance (50Ω, 75Ω, Other)

• Zero Span IF Output (Option 0089)

Mode	Spectrum Analyzer/Span/Zero Span
Center Frequency	140 MHz
Output Level	–40 to –20 dBm typical
	For a signal at Reference Level: –43 to +30 dBm (Preamp Off) or –60 to –40 dBm (Preamp On)
IF Bandwidths	Up to 30 MHz (3 dB bandwidth)
RF Attenuation	Auto
Connector	BNC female

• GSM/EDGE Signal Analyzers (Options 0040, 0041)

Measurements			
RF (Option 0040)	Demodulation (Option 0041)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC)	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC)	RF Measurements and Demodulation can be made OTA. There are no additional OTA Measurements.	Measurements Channel Power Occupied Bandwidth Burst Power Average Burst power Frequency Error Phase Error EVM Origin Offset C/I Magnitude Error Script Master™

Setup Parameters	
GSM/EDGE Select	Auto, GSM, EDGE
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screen	Overall Measurements
RF Measurements (Option 0040)	
Frequency Error	±10 Hz + time base error, 99% confidence level
Occupied Bandwidth	Bandwidth within which 99% of the power transmitted on a single channel lies
Burst Power Error	±1.5 dB, ±1 dB typical, (–50 to +20 dBm)
Demodulation (Option 0041)	
GSMK Modulation Quality (RMS Phase) Measurement Accuracy	±1 deg.
Residual Error (GSMK)	1 deg.
8 PSK Modulation Quality (EVM) Measurement Accuracy	±1.5%
Residual Error (8 PSK)	2.5%

• W-CDMA/HSPA+ Signal Analyzers (Options 0044, 0045 or 0065, 0035)

Measurements			
RF (Option 0044)	Demodulation (Option 0045 or 0065)	Over-the-Air (OTA) (Option 0035)	Pass/Fail (User Editable)
Band Spectrum Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single carrier ACLR Multi-carrier ACLR RF Summary	Code Domain Power Graph P-CPICH Power Channel Power Noise Floor EVM Carrier Feed Through Peak Code Domain Error Carrier Frequency Frequency Error Control Channel Power Abs/Rel/Delta Power CPICH, P-CCPCH S-CCPCH, PICH P-SCH, S-SCH HSDPA Power vs. Time Constellation Code Domain Power Table Code, Status EVM, Modulation Type Power, Code Utilization Power Amplifier Capacity Codogram Modulation Summary	Scrambling Code Scanner (Six) Scrambling Codes CPICH E_C/I_O E_C Pilot Dominance OTA Total Power Multipath Scanner (Six) Six Multipaths Tau Distance RSCP Relative Power Multipath Power	Measurements Max Output Power Frequency Error EVM CPICH Occupied Bandwidth Spectral Mask ACLR PCDE P-CCPCH S-CCPCH Code Spread 3 PICH Code 128 Script Master™ Test Models 1 (16), (32), (64) 2 3 (16), (32) 4 (+CPICH), (-CIPCH) 5 (2 HS), (4 HS), (8 HS)

Setup Parameters	
Scrambling Code, Threshold	Auto, Manual
User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
Maximum Spreading Factor	256, 512
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Marker	Six Markers, Table On/Off
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0044)	
RF Channel Power Accuracy	±1.25 dB, ±0.7 dB typical, (temperature range 15° to 35°C)
Occupied Bandwidth Accuracy	±100 kHz
Adjacent Channel Leakage Ratio (ACLR)	–54 dB/–59 dB ±0.8 dB @ 5 MHz/10 MHz offset, typical, Bands I – VI, VIII – XIV, XVII –54 dB/–57 dB ±1.0 dB @ 5 MHz/10 MHz offset, typical, Band VII
Demodulation (Option 0045 for W-CDMA only or 0065 for W-CDMA and HSDPA)	
W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
HSDPA Modulations	QPSK, 16QAM, 64QAM
EVM Accuracy	±2.5%, 6% ≤EVM ≤ 25%
Residual EVM	2.5% typical
Code Domain Power	±0.5 dB for code channel power >–25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
CPICH (dBm) Accuracy	±0.8 dB typical
Over-the-Air (OTA) Measurements (Option 0035)	
Scrambling Code Scanner	Six strongest Scrambling Codes
Multipath Scanner	Multipath power of six signals relative to strongest pilot

• CDMA Signal Analyzers (Option 0042, 0043, 0033)

Measurements			
RF (Option 0042)	Demodulation (Option 0043)	Over-the-Air (OTA) (Option 0033)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Multi-carrier ACPR RF Summary	Code Domain Power Graph Pilot Power Channel Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Frequency Error Abs/Rel/Power Pilot Page Sync Q Page Code Domain Power Table Code Status Power Multiple Codes Code Utilization Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power Limit Test – 10 Tests Averaged Rho Adjusted Rho Multipath Pilot Dominance Pilot Power Pass/Fail Status	Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Mask Test Frequency Error Channel Frequency Frequency error Pilot Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Code Utilization Measured PN Pilot Dominance Multipath Power

Setup Parameters	
PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Number of Carriers	1 to 5
Carrier Bandwidth	1.23, 1.24, 1.25 MHz
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0042)	
RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
Demodulation (Option 0043)	
Frequency Error	±10 Hz + time base error, 99% confidence level (in slow mode)
Rho Accuracy	±0.005, for Rho >0.9
Residual Rho	>0.995, typical, >0.99 maximum, (RF input –50 to +20 dBm)
PN Offset	1 × 64 chips
Pilot Power Accuracy	±1.0 dB typical, relative to channel power
Tau	±0.5 µs typical, ±1.0 µs maximum
Over-the-Air (OTA) Measurements (Option 0033)	
Pilot Scanner	Nine strongest pilots
Multipath Scanner	Multipath power of six signals relative to strongest pilot
Limit Test	Average of ten tests compared to limit

• EV-DO Signal Analyzers (Option 0062, 0063, 0034)

Measurements			
RF (Option 0062)	Demodulation (Option 0063)	Over-the-Air (OTA) (Option 0034)	Pass/Fail (User Editable)

Channel Spectrum
  Channel Power
  Occupied Bandwidth
  Peak-to-Average Power
Power vs. Time
  Pilot & MAC Power
  Channel Power
  Frequency Error
  Idle Activity
  On/Off Ratio
Spectral Emission Mask
Multi-carrier ACPR
RF Summary
	MAC Code Domain Power Graph
	  Pilot & MAC Power
	  Channel Power
	  Frequency Error
	  Rho Pilot
	  Rho Overall
	  Data Modulation
	  Noise Floor
	MAC Code Domain Power Table
	  Code
	  Status
	  Power
	  Code Utilization
	Data Code Domain Power
	  Active Data Power
	  Data Modulation
	  Rho Pilot
	  Rho Overall
	  Maximum Data CDP
	  Minimum Data CDP
	Modulation Summary
		Pilot Scanner (Nine)
		PN
		  E_C/I_O
		  Tau
		  Pilot Power
		  Channel Power
		  Pilot Dominance
		Mulitpath Scanner (Six)
		  E_C/I_O
		  Tau
		  Channel Power
		  Multipath Power
			Measurements
			  Channel Power
			  Occupied Bandwidth
			  Peak-to-Average Power
			  Carrier Frequency
			  Frequency Error
			  Spectral Mask
			  Noise Floor
			  Pilot Power
			  RMS Phase Error
			  Tau
			  Code Utilization
			  Measured PN
			  Pilot Dominance
			  Mulitpath Power

Setup Parameters	
PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Slot Type	Auto, Active, Idle
Number of Carriers	1 to 5
Carrier Bandwidth	1.23, 1.24, 1.25 MHz
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0062)	
RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
Demodulation (Option 0063)	
EV-DO Compatibility	Rev 0 and Rev A
Frequency Error	±20 Hz + time base error, 99% confidence level
Rho Accuracy	±0.01, for Rho >0.9
Residual Rho	>0.995 typical, >0.99, maximum (RF input –50 to +20 dBm)
PN Offset	Within 1 × 64 chips
Pilot Power Accuracy	±1.0 dB typical, relative to channel power
Tau	±0.5 µs typical, ±1.0 µs maximum
Over-the-Air (OTA) Measurements (Option 0034)	
Pilot Scanner	Nine strongest pilots
Multipath Scanner	Multipath power of six signals relative to strongest pilot

• LTE Signal Analyzers (Options 0541, 0542, 0543, 0546)

Measurements			
RF (Option 0541)	Modulation (Option 0542)	Over-the-Air (OTA) (Option 0546)	Pass/Fail (User Editable)

Channel Spectrum
  Channel Power
  Occupied Bandwidth
ACPR
RF Summary
	Constellation
	  Reference Signal Power
	  Sync Signal Power
	  EVM
	  Frequency Error
	  Carrier Frequency
	  Cell ID
	  Sector ID
	  Group ID
	Control Channel Power
	RS
	  P-SS
	  S-SS
	  PBCH
	  PCFICH
	  Modulation Summary
		Synch Signal Power
		(Six Strongest)
		  Power
		  Cell ID
		  Sector ID
		  Group ID
		Dominance
			Pass Fail All
			Pass/Fail RF
			Pass Fail Demod
			Measurements
			Channel Power
			  Occupied Bandwidth
			  ACLR
			  Frequency Error
			  Carrier Frequency
			  Dominance
			  EVM (peak)
			  EVM (rms)
			  RS Power
			  SS Power
			  P-SS Power
			  S-SS Power
			  PBCH Power
			  PCFICH Power
			  Cell ID
			  Group ID
			  Sector ID

Setup Parameters	
Bandwidth	10 MHz
Span	1.4, 3, 5, 10, 15, 20, 30 MHz
Frame Length	2.5, 5.0, 10.0 msec
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0541)	
RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +10 dBm)
Modulation (Option 0542)	
Frequency Error	±10 Hz + time base error, 99% confidence level
Residual EVM (rms)	2.5% typical (E-UTRA Test Model 3.1) (RF Input –50 to +10 dBm)
Bandwidth = 15 MHz, 20 MHz (Option 0543) (Requires Option 0541 or 0542)	
Bandwidths	15 MHz, 20 MHz
Over-the-Air (OTA) Measurements (Option 0546)	
Scanner	Six strongest Sync Signals
Auto Save	Yes
GPS Tagging and Logging	Yes

• Fixed and Mobile WiMAX Signal Analyzers (Options 0046, 0047, 0066, 0067, 0037)

Measurements			
RF (Option 0046 - Fixed) (Option 0066 - Mobile)	Demodulation (Option 0047 - Fixed) (Option 0067 - Mobile)	Over-the-Air (OTA) (Option 0037 - Mobile)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power (Mobile) Uplink Burst Power (Mobile) Data Burst Power (Fixed) Crest Factor (Fixed) ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR (Mobile) Base Station ID Sector ID (Mobile) DL-MAP (Tree View) (Mobile) Modulation Summary	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID	Pass Fail All Pass/Fail RF Pass Fail Demod Measurements Channel Power Occupied Bandwidth Downlink Bust Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID (Mobile)

Setup Parameters	
Fixed WiMAX Bandwidth	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00 MHz
Fixed WiMAX Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
Fixed WiMAX Span	5, 10, 15, 20 MHz
Fixed WiMAX Frame Length	2.5 msec, 5.0 msec, 10.0 msec
Mobile WiMAX Zone Type	PUSC
Mobile WiMAX DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
Mobile WiMAX Bandwidths	3.50, 5.00, 7.00, 8.75, 10.00 MHz
Mobile WiMAX Cyclic Prefix Ratio (CP)	1/8
Mobile WiMAX Span	5, 10, 20, 30 MHz
Mobile WiMAX Frame Lengths	5 msec, 10 msec
Mobile WiMAX Demodulation	Auto, Manual, FCH
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0046 – Fixed, Option 0066 – Mobile)	
RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
Demodulated Signal Analyzer (Option 0047 – Fixed, Option 0067 – Mobile)	
Frequency Error	±10 Hz + time base error, 99% confidence level
Fixed WiMAX Residual EVM (rms)	3% typical, 3.5% maximum (RF Input –50 to +20 dBm)
Mobile WiMAX Residual EVM (rms)	2.5% typical, 3.0% maximum, (RF Input –50 to +20 dBm)
Over-the-Air (OTA) Measurements (Option 0037)	
Channel Power Monitor	Over time (one week), measurement time interval 1 to 60 sec
Preamble Scanner	Six Strongest Preambles
Auto Save	Yes
GPS Tagging and Logging	Yes

- **TD-SCDMA/HSPA+ Signal Analyzers (Options 0060, 0061, 0038)**

Measurements			
RF (Option 0060)	Demodulation (Option 0061)	Over-the-Air (OTA) (Option 0038)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error (QPSK/8 PSK/16 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error CDP Marker Modulation Summary	Code Scan (32) Scrambling Code Group Tau E_C/I_O Pilot Dominance Tau Scan (Six) Sync-DL# Tau E_C/I_O DwPTS Power Pilot Dominance Record Run/Hold	Pass Fail All Pass/Fail RF Pass Fail Demod Measurements Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Carrier Feedthrough Noise Floor

Setup Parameters	
Slot Selection	Auto, 0-6
Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
SYNC-DL Code	Auto, 0-31
Scrambling/Midamble Code	Auto, 0-127
Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
Measurement Speed	Fast, Normal, Slow
User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
Demodulation Type	Auto, QPSK, 8 PSK, 16 QAM
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Hold/Run, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0060)	
RF Channel Power Accuracy (RRC)	±1.5 dB, ±1.0 dB typical, (slot power –40 to +10 dBm)
Frequency Error	±20 Hz + time base error, in the presence of a downlink slot
Demodulation (Option 0061)	
Supported Modulation	QPSK, 8 PSK, 16QAM, MBMS
Residual EVM (rms)	3% typical, P-CCPH slot power >–50 dBm
PN Offset	Within 1 × 64 chips
Pilot Power Accuracy	±1.0 dB typical
Timing Error (Tau) for Dominant SYNC-DL	±0.2 µs (external trigger)
Spreading Factor	1, 16
Over-the-Air (OTA) Measurements (Option 0038)	
Code Scanner	32 Sync Codes and associated Scrambling Code Groups
Tau Scanner	Six strongest Sync Codes
Auto Save	Yes
GPS Tagging and Logging	Yes

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) Apply when using internal reference and performance sweep mode; 3) Subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters	
System	Status (Temperature, Battery Info, S/N, Firmware Ver, IP Address, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
System Options	Name, Date and Time, Ethernet Configuration, Display, Volume Display (Brightness, Default Colors, Black and White, Night Vision, High Contrast) Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Share Center Frequency and Power Offset between Modes Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Internal Trace/Setup Memory	>13,000 traces
External Trace/Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	
RF In	Type K, male, 50Ω, Maximum Input +30 dBm, ±50 VDC
GPS	SMA Female
External Power	5.5 mm barrel connector, 12 to 15 VDC, <5.0 Amps
LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset Jack	2.5 mm 3-wire headset connector
External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm
External Reference Out	BNC, female, 50Ω, 10 MHz
External Trigger	BNC, female, 50Ω, Maximum Input ±5 VDC
IF Out	BNC, female, 50Ω, 140 MHz
Display	
Size	8.4-inch
Resolution	800 × 600
Battery	
Type	Li-Ion
Battery Operation	3 hours, typical (MS2722C, MS2723C, MS2724C) 2.5 hours, typical (MS2725C, MS2726C)
Electromagnetic Compatibility	
European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-3/-4/-5/-6/-11
Safety	
Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	
Temperature	–10° to +55°C (Operating), –51° to +71°C (Storage)
Maximum Humidity	85%
Shock	MIL-PRF-28800F Class 2
Altitude	4600 meters, operating and non-operating
Dimensions and Mass	
Dimensions	315 × 211 × 77 mm, (12.4 × 8.3 × 3.0 in)
Mass	3.5 kg, (7.8 lbs) (MS2722C, MS2723C, MS2724C) 3.8 kg, (8.5 lbs) (MS2725C, MS2726C)

Master Software Tools (for your PC)

Database Management	
Full Trace Retrieval	Retrieve all traces from instrument into one PC directory
Trace Catalog	Index all traces into one catalog
Trace Rename Utility	Rename measurement traces
Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
DAT File Converter	Converts HHST files to MST file format and vice-versa
Data Analysis	
Trace Math and Smoothing	Compare multiple traces
Data Converter	Convert from/to Return Loss/VSWR/Cable Loss/ DTF and also into Smith Charts
Measurement Calculator	Translates into other units
Report Generation	
Report Generator	Includes GPS, power level, and calibration status along with measurements
Edit Graph	Change scale, limit lines, and markers
Report Format	Create reports in HTML for PDF format
Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
Notes	Annotate measurements
Mapping (GPS Required)	
Spectrum Analyzer Mode	MapInfo, MapPoint
Mobile WiMAX OTA Option	Google Earth, Google Maps, MapInfo
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	
Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	
Traces	Add, delete, and modify limit lines and markers
Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
Product Updates	Auto-checks Anritsu website for latest revision firmware
Firmware Upload	Upload new firmware into the instrument
Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
VSG Pattern Converter	Import user-defined patterns (ASCII text or MATLAB file format required)
Languages	Add up to two languages or modify non-English language menus
Mobile WiMAX	DL-MAP Parameters
Display	Modify display settings
Script Master™	
Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
GSM/GPRS/EDGE or W-CDMA/HSDPA Mode	Automate Signal Analysis testing requirements with annotated how-to pictures
Connectivity	
Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
Download	Download measurements and live traces to PC for storage and analysis
Upload	Upload measurements from PC to instrument
Firmware Updates	Product Update: download latest firmware version
Remote Access Tool	Remote control and monitoring of instrument (via Ethernet port) over the Internet

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MS2722C	Spectrum Analyzer (9 kHz to 9 GHz)
MS2723C	Spectrum Analyzer (9 kHz to 13 GHz)
MS2724C	Spectrum Analyzer (9 kHz to 20 GHz)
MS2725C	Spectrum Analyzer (9 kHz to 32 GHz)
MS2726C	Spectrum Analyzer (9 kHz to 43 GHz)
	Options
MS272xC-0007	Secure Data Operation
MS272xC-0009	I/Q Demodulation Hardware
MS272xC-0019	High-Accuracy Power Meter
MS272xC-0024	IQ Waveform Capture
MS272xC-0025	Interference Analyzer
MS272xC-0027	Channel Scanner
MS272xC-0031	GPS Receiver (requires Antenna P/N 2000-1528-R)
MS272xC-0033	CDMA Over-the-Air (OTA) Measurements*2
MS272xC-0034	EV-DO Over-the-Air (OTA) Measurements*2
MS272xC-0035	W-CDMA/HSPA+ Over-the-Air (OTA) Measurements*2
MS272xC-0037	IEEE 802.16 Mobile WiMAX Over-the-Air (OTA) Measurements*1
MS272xC-0038	TD-SCDMA/HSPA+ Over-the-Air (OTA) Measurements*1
MS272xC-0040	GSM/EDGE RF Measurements*1
MS272xC-0041	GSM/EDGE Demodulation*1
MS272xC-0042	CDMA RF Measurements*1
MS272xC-0043	CDMA Demodulation*1
MS272xC-0044	W-CDMA/HSPA+ RF Measurements*1
MS272xC-0045	W-CDMA Demodulation*1
MS272xC-0046	IEEE 802.16 Fixed WiMAX RF Measurements*1
MS272xC-0047	IEEE 802.16 Fixed WiMAX Demodulation*1
MS272xC-0060	TD-SCDMA/HSPA+ Measurements*1
MS272xC-0061	TD-SCDMA/HSPA+ Demodulation*1
MS272xC-0062	EV-DO RF Measurements*1
MS272xC-0063	EV-DO Demodulation*1
MS272xC-0065	W-CDMA/HSPA+ Demodulation*1
MS272xC-0066	IEEE 802.16 Mobile WiMAX RF Measurements*1
MS272xC-0067	IEEE 802.16 Mobile WiMAX Demodulation*1
MS272xC-0089	Zero-Span IF Output
MS272xC-0090	Gated Sweep
MS272xC-0098	Standard Calibration (ANSI Z540-1-1994)
MS272xC-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)
MS272xC-0431	Coverage Mapping (requires Option 0031)
MS272xC-0541	LTE RF Measurements*1
MS272xC-0542	LTE Modulation Measurements*1
MS272xC-0543	LTE BW = 15 MHz, 20 MHz (requires Option 0541 or 0542)
MS272xC-0546	LTE Over-the-Air (OTA) Measurements*1
MS272xC-0551	TD-LTE RF Measurements*1
MS272xC-0552	TD-LTE Modulation Measurements*1
MS272xC-0556	TD-LTE Over-the-Air Measurements*1 (recommend Option 0031)
	Power Sensors (for complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, 150 W
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
	Manuals (soft copy available at www.anritsu.com)
10580-00277	Spectrum Master User Guide (hard copy included) - Bias-Tee, GPS Receiver
10580-00244	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, IF Output
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00278	Programming Manual
10580-00279	Maintenance Manual

Model/Order No.	Name
	Troubleshooting Guides (soft copy included on MST CD and at www.anritsu.com)
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00566	LTE eNodeB Testing
11410-00463	W-CDMA/HSDPA Base Stations
11410-00465	TD-SCDMA/HSDPA Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations
	Standard Accessories (included with instrument)
10580-00277	Spectrum Master User Guide (includes Bias-Tee and GPS Receiver)
2300-498	MST CD: Master Software Tools, User/Measurement Guides, Programming Manual, Troubleshooting Guides, Application Notes
2000-1685-R	Soft Carrying Case
633-44	Rechargeable Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Cigarette Lighter 12 Volt DC Adapter
2000-1371-R	Ethernet Cable, 7 feet/213 cm
3-2000-1498	USB A-mini B Cable, 10 feet/305 cm
11410-00529	MS2722C Spectrum Master Technical Data Sheet
11410-00524	MS2723C Spectrum Master Technical Data Sheet
11410-00525	MS2724C Spectrum Master Technical Data Sheet
11410-00526	MS2725C Spectrum Master Technical Data Sheet
11410-00527	MS2726C Spectrum Master Technical Data Sheet
	One Year Warranty (including battery, firmware, and software)
	Certificate of Calibration and Conformance
	Optional Accessories
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21000 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic
2000-1659-R	698 MHz to 787 MHz, 8 dBd gain
2000-1660-R	1425 MHz to 1535 MHz, 12 dBd gain
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1487	VHF/UHF, Telescopic Whip antenna, straight or 90°, BNC(m), 50Ω

Continued on next page

*1: Requires Option 0009
*2: Requires Option 0009, and Option 0031

Model/Order No.	Name
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50Ω
1030-179-R	777 MHz to 787 MHz, N(m) to N(f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50Ω, w/ Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA(m) (requires 5 Vdc)
2000-1374	External Charger for Li-Ion Batteries
2000-1652-R	GPS Antenna, SMA(m) with 1 foot cable, requires 5 Vdc
633-75	High Capacity Battery Pack, 7000 mAh
66864	Rack Mount Kit, Master Platform
	Backpack and Transit Case
67135	Anritsu Backpack (for Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

SPECTRUM MASTER

MS2711E MS2712E MS2713E

9 kHz to 3 GHz | 9 kHz to 4 GHz | 9 kHz to 6 GHz

Remote Control
USB

Compact Handheld Spectrum Analyzer

The wireless communications market is rapidly growing as the telecommunications sectors continue to evolve. Whether you are installing, troubleshooting, or solving problems for public safety providers, or wireless service providers, Anritsu has a solution. Anritsu's new Spectrum Master has been designed for technicians, installers, field radio frequency (RF) engineers, and contractors who struggle with both keeping track of the growing number of interfering signals and assessing signal quality on a wide range of increasingly complex signals. Easy-to-use, integrated and high performing, the Spectrum Master helps users address those challenges and more. Its feature-rich and compact design helps users comply to regulatory requirements, manage and maximize efficiency, improve system up-time, and increase revenue – all in a rugged and field-proven device designed to withstand even the most punishing conditions. This next generation of Anritsu's best-in-class Spectrum Master series is ideal for spectrum monitoring, interference analysis, RF and microwave measurements, field strength measurements, transmitter spectrum analysis, electromagnetic field strength, signal strength mapping, and overall field analysis of cellular 2G/3G/4G, land mobile radio, Wi-Fi, and broadcast signals.

Designed for Field Use

The Spectrum Master was designed specifically for field environments. Weighing less than 3.45 kg, it is small and compact and easy to carry. Its field replaceable Li-Ion battery typically lasts for more than 3 hours, and a new bright 8.4-inch color display provides visibility even in broad daylight. With an operating temperature range from –10° to +55°C, a rugged case and splash proof design, the Spectrum Master works in the most extreme weather conditions with guaranteed performance anywhere and anytime.

Integrated Solution

The Spectrum Master is a multifunctional instrument that eliminates the need for you to carry and learn multiple instruments. It can be configured to across a broad range of parameters, including a 3 GHz, 4 GHz or 6 GHz spectrum analyzer, an interference analyzer, 2-port transmission measurement with built-in 32 V bias-tee, channel scanner, power meter, high accuracy power meter, and GPS receiver for time/location stamping and accuracy enhancements.

Easy-to-Use

The Spectrum Master leverages the user interface from Anritsu's popular MS2721B analyzer, giving users intuitive spectrum analyzer menus. A touchscreen keypad combination provides you with an intuitive menu-driven interface designed to give a familiar menu structure with quick access to popular measurements.

Key Facts

- 9 kHz to 3 GHz (MS2711E)
- 9 kHz to 4 GHz (MS2712E)
- 9 kHz to 6 GHz (MS2713E)
- One-button measurements: ACPR, Channel Power, Field Strength, Occupied BW, AM/FM/SSB Demod
- Interference Analyzer: Interference Mapping, Spectrogram, Signal Strength, RSSI, Signal ID
- Coverage Mapping (Indoor and Outdoor GPS Mapping)
- DANL: >–162 dBm typical (normalized to 1 Hz)
- Dynamic Range: >95 dB (>85 dB for MS2711E)
- <Phase Noise: –100 dBc/Hz @ 10 kHz offset (–90 dBc/Hz for MS2711E)
- Frequency Accuracy: <±50 ppb with GPS On
- Detection methods: Peak, RMS, Negative, Sample, Quasi-peak
- Save-on-event: automatically saves a sweep when crossing a limit line or at the end of the sweep
- Gated sweep: view pulsed or burst signals only when they are on, or off
- Three hours of battery life
- Touch-screen display
- USB port
- 8.4-inch touchscreen TFT display
- Lightweight: <3.45 kg

Functions and Description

- Spectrum Analyzer, 100 kHz to 3 GHz/4 GHz/6 GHz
  – Locates and identifies various signals over a wide frequency range. Detects signals as low as –152 dBm with phase noise better than –100 dBc/Hz (–110 dBc/Hz typical).
- Interference Analyzer (Option 25)
  – Includes everything you need to monitor, identify, and locate interference using the spectrogram display, Mapping, RSSI, Signal ID, and signal strength meter.
- GPS receiver (Option 31)
  – Provides location and UTC time information. Also improves the accuracy of the reference oscillator.

- 2-port Transmission Measurement (Option 21)
  – Offers high and low power settings for both active and passive measurements. Better than 80 dB dynamic range.
- Bias-Tee (Option 10)*
  – Possesses a built-in 32 V bias-tee that can be turned on as needed and applied to the RF In port.
- High Accuracy Power Meter (Option 19)
  – Connects high accuracy 4, 6, 8, and 18 GHz USB power sensors with better than ±0.16 dB accuracy.
- Power Meter (Option 29)
  – Makes channelized transmitter power measurements.
- Channel Scanner (Option 27)
  – Measures the power of multiple transmitted signals. Scans up to 1200 channels using Script Master.
- CW Signal Generator (Option 28)*
  – Provides CW source to test low noise amplifiers and repeaters. (Needs external CW generator kit.)
- Gated Sweep (Option 90)*
  – Views pulsed or burst signals such as WiMAX, GSM, and TD-SCDMA only when they are on.

*: Indicates option not available in the MS2711E

Specifications

- **Spectrum Analyzer**

Frequency	Frequency Range	9 kHz to 3 GHz (MS2711E), 9 kHz to 4 GHz (MS2712E), 9 kHz to 6 GHz (MS2713E) (usable to 0 Hz)			
	Maximum Continuous Input	+26 dBm			
	Tuning Resolution	1 Hz			
	Frequency Reference	Aging: ±1.0 ppm/year			
	Frequency Span	Accuracy: ±1.5 ppm (25°C ±25°C) + aging, <±50 ppb with GPS On 10 Hz to 4 GHz including zero span (MS2712E), 10 Hz to 6 GHz including zero span (MS2713E)			
	Sweep Time	Minimum 100 ms, 10 µs to 600 seconds in zero span			
	Sweep Time Accuracy	±2% in zero span			
Bandwidth	Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero span) (–3 dB bandwidth) (100 Hz to 3 MHz for MS2711E)			
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable) (10 Hz to 3 MHz for MS2711E)			
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)			
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1			
Spectral Purity	SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz (typical, 10 kHz offset) –105 dBc/Hz, –112 dBc/Hz (typical, 100 kHz offset) –115 dBc/Hz, –121 dBc/Hz (typical, 1 MHz offset)			
Amplitude Ranges	Dynamic Range	>102 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW, (–85 dB for the MS2711E)			
	Measurement Range	DANL to +26 dBm			
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed			
	Reference Level Range	–120 to +30 dBm			
	Attenuator Range	0 to 55 dB, 5.0 dB steps			
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW			
Amplitude Accuracy	9 kHz to 100 kHz	±2.0 dB typical			
	100 kHz to 4.0 GHz	±1.25 dB, ±0.5 dB typical			
	>4.0 GHz to 6 GHz	±1.50 dB, ±0.5 dB typical			
Displayed Average Noise Level (DANL)	RBW Normalized to 1 Hz, 0 dB attenuation				
		Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
		Maximum	Typical	Maximum	Typical
	10 MHz to 2.4 GHz	–141 dBm	146 dBm	–157 dBm	–162 dBm
	>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
	>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
	>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
Spurs	Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
	Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
	Exceptions, typical	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input <–68 dBc @ F1 – 280 MHz with F1 Input <–70 dBc @ F1 + 190 MHz with F1 Input <–52 dBc @ 7349 – 2F2 MHz, with F2 Input, where F2 <2424.5 MHz			
Third-Order Intercept (TOI)		Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)			
	800 MHz	+16 dBm			
	2400 MHz	+20 dBm			
	200 MHz to 2200 MHz	+25 dBm, typical			
	>2.2 GHz to 5.0 GHz	+28 dBm, typical			
	>5.0 GHz to 6.0 GHz	+33 dBm, typical			
Second Harmonic Distortion		Preamp Off, 0 dB input attenuation, –30 dBm input			
	50 MHz	–56 dBc			
	>50 MHz to 200 MHz	–60 dBc, typical			
	>200 MHz to 3000 MHz	–70 dBc, typical			
VSWR		2:1, typical			

• 2-Port Transmission Measurement (Option 0021)

Frequency	Frequency Range	2 MHz to 3 GHz (MS2711E), 2 MHz to 4 GHz (MS2712E), 2 MHz to 6 GHz (MS2713E)
	Frequency Resolution	10 Hz
Output Power	High	0 dBm, typical
	Low	–30 dBm, typical
Dynamic Range	2 MHz to 4 GHz	80 dB
	>4 GHz to 6 GHz	70 dB
Application Options		Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• Bias-Tee (Option 0010)

Setup	On/Off, Voltage, Current (Low/High)
Voltage Range	+12 V to +32 V
Current (Low/High)	250 mA/450 mA, 1 A surge for 100 ms
Resolution	0.1 V

• GPS Receiver (Option 0031) (Antenna sold separately, P/N 2000-1528-R)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Generator
When GPS Antenna is connected	<±50 ppb with GPS On, 3 minutes after satellite lock in selected mode
Connector	SMA, female

• Power Meter (Option 0029)

Frequency Range	10 MHz to 4 GHz (MS2712E), 10 MHz to 6 GHz (MS2713E)
Span	1 kHz to 100 MHz
Display Range	–140 to +30 dBm, ≤40 dB span
Measurement Range	–120 to +26 dBm
Offset Range	0 to +100 dB
VSWR	2:1 typical
Maximum Power	+26 dBm without attenuator
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50Ω, 75Ω, Other)

• High Accuracy Power Meter (Option 0019) (Requires external USB Power Sensor(s)

Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108A	MA24118A
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz	10 MHz to 18 GHz
Connector	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω
Dynamic Range	–30 to +20 dBm (.001 to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 μW to 200 mW)	–40 to +20 dBm (0.1 μW to 100 mW)	–40 to +20 dBm (0.1 μW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB*1	±0.17 dB*2	±0.16 dB*1	±0.18 dB*3	±0.18 dB*3
Datasheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504	11410-00504

*1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

• Interference Analyzer (Option 0025)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram (Collect data up to one week)	
	Signal Strength (Gives visual and aural indication of signal strength)	
	Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength	
	Signal ID (up to 12 signals)	Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) >10 dB
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)	

• Channel Scanner (Option 0027) (Option 0027 not offered in the MS2711E)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Freq/Channel, Current/Max, Single/Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	100 kHz to 4 GHz (MS2712E), 100 kHz to 6 GHz (MS2713E)
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• CW Signal Generator (Option 0028) (Requires CW Signal Generator Kit, P/N 69793) (Option 0028 not offered in the MS2711E)

Setup Parameters	Frequency	Frequency, Signal Standard, Channel Number, Display Setup Help
	Amplitude	Power Level (Low/High), Offset (dB)
	Frequency Range	25 MHz to 2 GHz typical
	Output Power	High 0 dBm typical, Low –30 dBm typical Attenuator (included in kit 69793): 0 to 90 dB in 1 dB steps

• Gated Sweep (Option 0090) (MS2712E, MS2713E) (Requires CW Signal Generator Kit, P/N 69793) (Option 0090 not offered in the MS2711E)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 to 65 ms typical) Gate Length (1 μs to 65 ms typical) Zero Span Time

• Coverage Mapping (Options 0431) (Option 0431 not offered in the MS2711E)

Measurements	Indoor Mapping RSSI ACPR	Outdoor Mapping RSSI ACPR

Setup Parameters	Frequency	Center/Start/Stop, Span, Freq. Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
	Measurement Setup	ACPR, RSSI
	Point Distance/ Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
	System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Internal Trace/Setup Memory	2,000 traces, 2,000 Setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	RF Out	Type N, female, 50Ω (Reflection In) (Option 21 only)
	RF Out Damage Level	23 dBm, ±50 VDC (Option 21 only)
	RF In	Type N, female, 50Ω
	RF In Damage Level	+33 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation)
	GPS	SMA(f)
	External Power	5.5 mm barrel connector, 12.5 to 15 VDC, <4.0 Amps
	USB Interface (2)	Type A, Connect USB Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Headset Jack	3.5 mm mini-phone plug
	External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm 1 MHz, 5 MHz, 10 MHz, 13 MHz
	External Trigger/Clock Recovery	BNC, female, 50Ω, Maximum Input ±50 VDC
Display	Type	Resistive Touchscreen
	Size	8.4-inch daylight viewable color LCD
	Resolution	800 × 600
Battery	Type	Li-Ion
	Battery Operation	3.0 hours, typical
Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
	Australia and New Zealand	C-tick N274
	Interference	EN 61326-1
	Emissions	EN 55011
	Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11
Safety	Safety Class	EN 61010-1 Class 1
	Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	Temperature	–10° to +55°C (Operating), –40°C to +71°C (Storage)
	Maximum Humidity	95% RH (non-condensing) at 40°C
	Shock	MIL-PRF-28800F Class 2
	Altitude	4600 meters, operating and non-operating
Dimensions and Mass	Dimensions	273 × 199 × 91 mm, (10.7 × 7.8 × 3.6 in)
	Mass	3.45 kg, (7.6 lbs)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MS2711E	Spectrum Analyzer (9 kHz to 3 GHz)
MS2712E	Spectrum Analyzer (9 kHz to 4 GHz)
MS2713E	Spectrum Analyzer (9 kHz to 6 GHz)
	MS2711E Options
MS2711E-0019	High-Accuracy Power Meter (requires External Power Sensor)
MS2711E-0021	Transmission Measurement
MS2711E-0025	Interference Analyzer
MS2711E-0027	Channel Scanner
MS2711E-0029	Power Meter
MS2711E-0010	Bias T
MS2711E-0098	Standard Calibration
MS2711E-0099	Premium Calibration
	MS2712E Options
MS2712E-0021	2-Port Transmission Measurement
MS2712E-0010	Bias-Tee
MS2712E-0031	GPS Receiver (requires Antenna P/N 2000-1528-R)
MS2712E-0019	High-Accuracy Power Meter (requires External Power Sensor)
MS2712E-0029	Power Meter
MS2712E-0025	Interference Analyzer (Option 0031 recommended)
MS2712E-0027	Channel Scanner
MS2712E-0431	Coverage Mapping (requires Option 0031)
MS2712E-0090	Gated Sweep
MS2712E-0028	C/W Signal Generator (requires Option 0021) (requires CW Signal Generator Kit, P/N 69793)
MS2712E-0509	AM/FM/PM Analyzer
MS2712E-0009	20 MHz BW Demod
MS2712E-0040	GSM/EDGE RF Measurements (requires Option 0009)
MS2712E-0041	GSM/EDGE Demodulation (requires Option 0009)
MS2712E-0044	W-CDMA/HSPA+ RF Measurements (requires Option 0009)
MS2712E-0045	W-CDMA Demodulation (requires Option 0009)
MS2712E-0065	W-CDMA/HSPA+ Demodulation (requires Option 0009)
MS2712E-0035	W-CDMA/HSPA+ Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2712E-0520	P25 Analyzer Measurements (requires Option 0009)
MS2712E-0522	P25 Coverage Measurements (requires Option 0009)
MS2712E-0530	NXDN Analyzer Measurements (requires Option 0009)
MS2712E-0532	NXDN Coverage Measurements (requires Option 0009)
MS2712E-0541	LTE RF Measurements (requires Option 0009 and Option 0031)
MS2712E-0542	LTE Modulation Quality (requires Option 0009 and Option 0031)
MS2712E-0546	LTE Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2712E-0060	TD-SCDMA/HSPA+ Measurements (requires Option 0009)
MS2712E-0061	TD-SCDMA/HSPA+ Demodulation (requires Option 0009)
MS2712E-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (requires Option 0009)
MS2712E-0042	CDMA RF Measurements (requires Option 0009)
MS2712E-0043	CDMA Demodulation (requires Option 0009)
MS2712E-0033	CDMA Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2712E-0062	1xEV-DO RF Measurements (requires Option 0009)
MS2712E-0063	1xEV-DO Demodulation (requires Option 0009)
MS2712E-0034	1xEV-DO Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2712E-0046	Fixed WiMAX RF Measurements (requires Option 0009)
MS2712E-0047	Fixed WiMAX Demodulation (requires Option 0009)
MS2712E-0066	Mobile WiMAX RF Measurements (requires Option 0009)
MS2712E-0067	Mobile WiMAX Demodulation (requires Option 0009)
MS2712E-0037	Mobile WiMAX Over-the-Air Measurements (requires Option 0009)
MS2712E-0030	ISDB-T Digital Video Measurements (requires Option 0009)
MS2712E-0032	ISDB-T SFN Measurements (requires Option 0009)
MS2712E-0411	Ethernet Connectivity
MS2712E-0098	Standard Calibration (ANSI 2540-1-1994)
MS2712E-0099	Premium Calibration to Z540 plus test data

Model/Order No.	Name
	MS2713E Options
MS2713E-0021	2-Port Transmission Measurement
MS2713E-0010	Bias-Tee
MS2713E-0031	GPS Receiver (Requires Antenna P/N 2000-1528-R)
MS2713E-0019	High-Accuracy Power Meter (requires External Power Sensor)
MS2713E-0029	Power Meter
MS2713E-0025	Interference Analyzer (Option 0031 recommended)
MS2713E-0027	Channel Scanner
MS2713E-0431	Coverage Mapping (requires Option 0031)
MS2713E-0090	Gated Sweep
MS2713E-0028	C/W Signal Generator (requires Option 0021) (requires CW Signal Generator Kit, P/N 69793)
MS2713E-0509	AM/FM/PM Analyzer
MS2713E-0009	20 MHz BW Demod
MS2713E-0040	GSM/EDGE RF Measurements (requires Option 0009)
MS2713E-0041	GSM/EDGE Demodulation (requires Option 0009)
MS2713E-0044	W-CDMA/HSPA+ RF Measurements (requires Option 0009)
MS2713E-0045	W-CDMA Demodulation (requires Option 0009)
MS2713E-0065	W-CDMA/HSPA+ Demodulation (requires Option 0009)
MS2713E-0035	W-CDMA/HSPA+ Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2713E-0520	P25 Analyzer Measurements (requires Option 0009)
MS2713E-0522	P25 Coverage Measurements (requires Option 0009)
MS2713E-0530	NXDN Analyzer Measurements (requires Option 0009)
MS2713E-0532	NXDN Coverage Measurements (requires Option 0009)
MS2713E-0541	LTE RF Measurements (requires Option 0009 and Option 0031)
MS2713E-0542	LTE Modulation Quality (requires Option 0009 and Option 0031)
MS2713E-0546	LTE Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2713E-0060	TD-SCDMA/HSPA+ Measurements (requires Option 0009)
MS2713E-0061	TD-SCDMA/HSPA+ Demodulation (requires Option 0009)
MS2713E-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (requires Option 0009)
MS2713E-0042	CDMA RF Measurements (requires Option 0009)
MS2713E-0043	CDMA Demodulation (requires Option 0009)
MS2713E-0033	CDMA Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2713E-0062	1xEV-DO RF Measurements (requires Option 0009)
MS2713E-0063	1xEV-DO Demodulation (requires Option 0009)
MS2713E-0034	1xEV-DO Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2713E-0046	Fixed WiMAX RF Measurements (requires Option 0009)
MS2713E-0047	Fixed WiMAX Demodulation (requires Option 0009)
MS2713E-0066	Mobile WiMAX RF Measurements (requires Option 0009)
MS2713E-0067	Mobile WiMAX Demodulation (requires Option 0009)
MS2713E-0037	Mobile WiMAX Over-the-Air Measurements (requires Option 0009)
MS2713E-0030	ISDB-T Digital Video Measurements (requires Option 0009)
MS2713E-0032	ISDB-T SFN Measurements (requires Option 0009)
MS2713E-0411	Ethernet Connectivity
MS2713E-0098	Standard Calibration (ANSI 2540-1-1994)
MS2713E-0099	Premium Calibration to Z540 plus test data
	Power Sensors (for complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm

Continued on next page

Model/Order No.	Name
	Manuals (soft copy included on MST CD and at www.us.anritsu.com)
10580-00251	Spectrum Master User Guide (hard copy included) - Bias-Tee, GPS Receiver
10580-00242	2-Port Transmission Measurement - Bias-Tee
10580-00231	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, CW Signal Generator
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00237	Digital TV Measurement Guide - DVB-T/H, ISDB-T
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00243	P25 and NXDN Measurement Guide
10580-00256	Programming Manual
	Standard Accessories (included with instrument)
10580-00251	Spectrum Master User Guide (includes Bias-Tee, GPS Receiver)
2000-1654-R	Soft Carrying Case
2300-498	MST CD: Master Software Tools, User/Measurement Guides, Programming Manual, Troubleshooting Guides, Application Notes
633-44	Rechargeable Li-Ion Battery
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 VDC Adapter
3-2000-1498	USB A/5-pin mini-B Cable, 10 feet/305 cm
11410-00511	Spectrum Master™ MS2712E, MS2713E Technical Data Sheet
	One Year Warranty (including battery, firmware, and software)
	Certificate of Calibration and Conformance
11410-00597	Spectrum Master MS2711E Technical Data Sheet
	Optional Accessories
	Directional Antennas
2000-1411-R	822 MHz to 900 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi
2000-1677-R	300 MHz to 3 GHz, SMA(m), log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1750 MHz to 1850 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi

Model/Order No.	Name
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) - SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) - SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) - SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) - SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) - SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) - SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) - SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) - SMA(f), 50Ω
1030-149-R	High Pass, 150 MHz, N(m) to N(f), 50Ω
1030-150-R	High Pass, 400 MHz, N(m) to N(f), 50Ω
1030-151-R	High Pass, 700 MHz, N(m) to N(f), 50Ω
1030-152-R	Low Pass, 200 MHz, N(m) to N(f), 50Ω
1030-153-R	Low Pass, 550 MHz, N(m) to N(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) - N(f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50Ω
1030-179-R	777 MHz to 797 MHz, N(m) to N(f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m)-N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) - N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) - N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) - N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) - N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) - N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) - N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) - N(f)
	Adapters
1091-26-R	SMA(m) - N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) - N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) - N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) - N(f), DC to 18 GHz, 50Ω
1091-172-R	BNC(f) - N(m), DC to 1.3 GHz, 50Ω
510-102-R	N(m) - N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) - N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) - N(f), DC to 18 GHz, 50Ω
	Backpack and Transit Case
67135	Anritsu Backpack (for Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA(m); 15 ft cable
2000-1652-R	GPS Antenna, SMA(m) with 1 ft. cable
2000-1374	External Charger for Li-Ion Batteries
2000-1653	Protective Screen Cover
806-245-R	Calibration Accessory for use with Option 20 Tracking Generator
2000-1371-R	Ethernet Cable, 7 feet/213 cm
2000-1689	EMI Near Field Probe Kit
3-806-152	Cat 5e Crossover Patch Cable, 7 feet/213 cm
2300-517	Phase Noise Measurement Software (requires Ethernet Option 0411)
633-75	8000 mAh High-capacity Battery Pack

CELL MASTER

MT8212E/MT8213E

Cable & Antenna Analyzer: 2 MHz to 4 GHz/6 GHz, Spectrum Analyzer: 9 kHz to 4 GHz/6 GHz

Remote Control
USB

Compact Handheld Base Station Analyzer

Anritsu introduces its latest generation compact handheld Base Station Analyzer for installation and maintenance of wireless networks. Designed as a lightweight base station tester meeting virtually all testing needs by an RF technician. The Cell Master features Signal Analyzer options for 2G, 3G and 4G cellular networks including LTE and WiMAX, and for digital broadcast.

Cable and Antenna Analyzer Highlights

- Measurements: RL, VSWR, Cable Loss, DTF, Phase
- 2-port Transmission Measurement: High/Low Power
- Sweep Speed: 1 msec/data point, typical
- Display: Single or Dual Measurement Touchscreen
- Calibration: OSL, InstaCal™, and Flex Cal™
- Bias-Tee: 32 V internal

Spectrum and Interference Analyzer Highlights

- Measurements: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Interference Mapping
- Dynamic Range: >102 dB in 1 Hz RBW
- DANL: –162 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: ±50 ppb with GPS On

Capabilities and Functional Highlights

- GSM/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- CDMA, EV-DO
- WiMAX – Fixed/Mobile
- CW Signal Generator
- Gated Sweep
- GPS tagging of stored traces
- Touchscreen keyboard
- Internal Power Meter
- High Accuracy Power Meter
- Channel Scanner
- E1, T1, T3 Backhaul Analyzer
- <5 minutes warm-up time
- 3 hours battery operation time
- USB Data Transfer
- Master Software Tools
- LTE FDD/TDD (20 MHz B/W)
- ISDB-T, ISDB-T SFN
- DVB-T/H, DVB-T/H SFN
- Interference Analyzer
- Built-in Bias-Tee
- USB Power Sensors, 4 GHz to 26 GHz
- Coverage Mapping

Cable and Antenna Analyzer Specifications

Measurements	Measurements	VSWR Return Loss Cable Loss Distance-to-Fault (DTF) Return Loss Distance-to-Fault (DTF) VSWR 1-port Phase Smith Chart
Setup Parameters	Measurement Display	Single/Dual Measurement Display with independent markers
	Frequency	Start/Stop, Signal Standard, Start Cal
	DTF	Start/Stop, DTF Aid, Units (m/ft), Cable Loss, Propagation Velocity, Cable, Windowing
	Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Top, Bottom Auto Scale, Full Scale
	Sweep	Run/Hold, Single/Continuous, RF Immunity (High/Low), Data Points, Averaging/Smoothing, Output Power (High/Low)
	Data Points	137, 275, 551, 1102, 2204
	Markers	Markers 1-6 (On/Off), Delta Makers 1-6 (On/Off), Marker to Peak/Valley, Marker Table
	Traces	Recall, Copy to Display Memory, No Trace Math, Trace ± Memory, Trace Overlay
	Limit Line	On/Off, Single Limit, Multi-segment (41), Limit Alarm, Clear
	Calibration	Start Cal, Cal Type (Standard/FlexCal™)
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Frequency	Frequency Range	2 MHz to 4 GHz (MT8212E), 2 MHz to 6 GHz (MT8213E)
	Frequency Accuracy	≤±2.5 ppm @ 25°C
	Frequency Resolution	1 kHz (RF immunity low) 100 kHz (RF immunity high)
Output Power	High	0 dBm, typical
	Low	–30 dBm, typical
Interference Immunity	On-Channel	+17 dBm @ >1.0 MHz from carrier frequency
	On-Frequency	0 dBm within ±10 kHz of the carrier frequency
Measurement Speed	Return Loss	≤1.00 msec/data point, RF immunity low, typical
Distance-to-Fault	Distance-to-Fault	≤1.25 msec/data point, RF immunity low, typical
Return Loss	Measurement Range	0 to 60 dB
	Resolution	0.01 dB
VSWR	Measurement Range	1:1 to 65:1
	Resolution	0.01
Cable Loss	Measurement Range	0 to 30 dB
	Resolution	0.01 dB
Distance-to-Fault	Vertical Range Return Loss	0 to 60 dB
	Vertical Range VSWR	1:1 to 65:1
	Fault Resolution (meters)	$(1.5 \times 10^8 \times vp)/\Delta F$ (vp = velocity propagation constant, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters)	0 to (Data Points – 1) × Fault Resolution, to a maximum of 1500 meters (4921 ft)
1-Port Phase	Measurement Range	–180° to +180°
	Resolution	0.01°
Smith Chart	Resolution	0.01, 50Ω/75Ω Selectable
Measurement Accuracy	Corrected Directivity	>42 dB, OSL Calibration >38 dB, InstaCal™ Calibration

Spectrum Analyzer Specifications

Measurements	Smart Measurement	Field Strength (uses antenna calibration tables to measure dBm/m^2 or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (wide/narrow FM, USB and LSB), (audio out only) C/I (carrier-to-interference ratio) Coverage Mapping (requires Option 0431)
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/WBW, Span/RBW
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
	Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)
Sweep Functions	Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type, Gated Sweep (see Option 0090)
	Detection	Peak, RMS, Negative, Sample, Quasi-peak
	Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1-6 markers frequency and amplitude plus delta markers frequency amplitude and offset
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Points (41 max), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
Frequency	Frequency Range	9 kHz to 4 GHz (MT8212E), 9 kHz to 6 GHz (MT8213E)
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1.0 ppm/year Accuracy: ±1.5 ppm (25°C ±25°C) + aging, <±50 ppb with GPS On
	Frequency Span	10 Hz to 4 GHz including zero span (MT8212E) 10 Hz to 6 GHz including zero span (MT8213E)
	Sweep Time	Minimum 100 ms, 10 μs to 600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	1 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (-6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz (typical, 10 kHz offset) –105 dBc/Hz, –112 dBc/Hz (typical, 100 kHz offset) –115 dBc/Hz, –121 dBc/Hz (typical, 1 MHz offset)
Amplitude Ranges	Dynamic Range	>102 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW
	Measurement Range	DANL to +26 dBm
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
	Reference Level Range	–120 to +30 dBm
	Maximum Continuous Input	+30 dBm
	Attenuator Resolution	0 to 55 dB in 5 dB steps
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBmV, dBW, dBmW, dBmW, dBA, dBmA, dBmA Linear Scale Modes: nV, mV, mV, V, kV, nW, mW, mW, W, kW, nA, mA, mA, A
Amplitude Accuracy	9 kHz to 100 kHz	±2.00 dB typical
	100 kHz to 4 GHz	±1.25 dB, ±0.5 dB typical
	>4 GHz to 6 GHz	±1.50 dB, ±0.5 dB typical

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Displayed Average Noise Level (DANL)	RBW Normalized to 1 Hz, 0 dB attenuation				
		Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
		Maximum	Typical	Maximum	Typical
	10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
	>2.4 GHz to 4 GHz	–136 dBm	–141 dBm	–154 dBm	–159 dBm
	>4 GHz to 5 GHz	–133 dBm	–138 dBm	–154 dBm	–155 dBm
	>5 GHz to 6 GHz	–125 dBm	–131 dBm	–146 dBm	–150 dBm
	(RBW = 10 Hz, 0 dB attenuation)				
	10 MHz to 2.4 GHz	–131 dBm	–136 dBm	–147 dBm	–152 dBm
	>2.4 GHz to 4 GHz	–126 dBm	–131 dBm	–144 dBm	–149 dBm
	>4 GHz to 5 GHz	–123 dBm	–128 dBm	–144 dBm	–145 dBm
	>5 GHz to 6 GHz	–115 dBm	–121 dBm	–136 dBm	–140 dBm
Spurs	Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
	Input-Related Spurious	–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
	Exceptions, typical	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input <–68 dBc @ F1 – 280 MHz with F1 Input <–70 dBc @ F1 + 190 MHz with F1 Input <–52 dBc @ 7349-2F2 MHz, with F2 Input, where F2 <2424.5 MHz <–55 dBc @ 190.5 ± F1/2 MHz, with F1 Input, where F1 <1 GHz			
Third-Order Intercept (TOI)	Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)				
	800 MHz	+16 dBm			
	2400 MHz	+20 dBm			
	200 MHz to 2200 MHz	+25 dBm, typical			
	>2.2 GHz to 5.0 GHz	+28 dBm, typical			
	>5.0 GHz to 6.0 GHz	+33 dBm, typical			
Second Harmonic Distortion	Preamp Off, 0 dB input attenuation, –30 dBm input				
	50 MHz	–56 dBc			
	>50 MHz to 200 MHz	–60 dBc, typical			
	>200 MHz to 3000 MHz	–70 dBc, typical			
VSWR		2:1, typical			

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
	System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Internal Trace/Setup Memory	2,000 traces, 2,000 setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	RF Out	Type N, female, 50Ω (Reflection In)
	RF Out Damage Level	23 dBm, ±50 VDC
	RF In	Type N, female, 50Ω
	RF Input Damage Level	+35 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation)
	GPS	SMA female
	T1	Bantam Jacks
	T3	BNC Connectors
	E1	RJ48C
	External Power	5.5 mm barrel connector, 12.5 VDC to 15 VDC, <4.0 Amps
	USB Interface (2)	Type A (Connect USB Flash Drive and Power Sensor)
	USB Interface	5-pin mini-B, Connect to PC for data transfer and/or remote control
	Headset Jack	3.5 mm mini-phone plug
	External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm 1 MHz, 5 MHz, 10 MHz, 13 MHz
	External Trigger/Clock Recovery	BNC, female, 50Ω, Maximum Input ±50 VDC
Display	Type	Resistive Touchscreen
	Size	8.4-inch daylight viewable color LCD
	Resolution	800 × 600
Battery	Type	Li-Ion
	Battery Operation	3 hours, typical

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Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 2004/108/EC Low Voltage Directive 2006/95/EC
	Australia and New Zealand	C-tick N274
	Interference	EN 61326-1
	Emissions	EN 55011
	Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11
Safety	Safety Class	EN 61010-1 Class 1
	Product Safety	IEC 60950-1 when used with Anritsu Company supplied Power Supply
Environmental	Temperature	–10°C to +55°C (Operating), –40°C to +71°C (Storage)
	Maximum Humidity	95% RH (none condensing) at 40°C
	Shock	MIL-PRF-28800F Class 2
	Altitude	4600 meters, operating and non-operating
Dimensions and Mass	Dimensions	273 × 199 × 91 mm, (10.7 × 7.8 × 3.6 in)
	Mass	3.71 kg, (8.2 lbs)
ESD	RF Port Center Pin	Withstands up to ±15 kV

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MT8212E	Cable and Antenna Analyzer (2 MHz to 4 GHz) Spectrum Analyzer (9 kHz to 4 GHz) Power Meter (10 MHz to 4 GHz)
	Options
MT8212E-0021	2-port Transmission Measurement
MT8212E-0010	High-Voltage Variable Bias-Tee
MT8212E-0031	GPS Receiver (requires Antenna P/N 2000-1528-R or 2000-1652-R)
MT8212E-0019	High-accuracy Power Meter[*3]
MT8212E-0025	Interference Analysis[*1]
MT8212E-0027	Channel Scanner
MT8212E-0431	Coverage Mapping[*1]
MT8212E-0090	Gated Sweep
MT8212E-0028	C/W Signal Generator (requires CW Signal Generator Kit, P/N 69793)
MT8212E-0040	GSM/EDGE RF Measurements
MT8212E-0041	GSM/EDGE Demodulation
MT8212E-0044	W-CDMA/HSPA+ RF Measurements
MT8212E-0065	W-CDMA/HSPA+ Demodulation
MT8212E-0035	W-CDMA/HSPA+ Over-the-Air Measurements
MT8212E-0060	TD-SCDMA/HSPA+ RF Measurements
MT8212E-0061	TD-SCDMA/HSPA+ Demodulation
MT8212E-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (option 0031 is recommended)
MT8212E-0551	TD-LTE RF Measurements
MT8212E-0552	TD-LTE Modulation Measurements
MT8212E-0556	TD-LTE OTA Measurements[*1]
MT8212E-0541	LTE RF Measurements
MT8212E-0542	LTE Modulation Measurements
MT8212E-0546	LTE Over-the-Air Measurements (option 0031 is recommended)
MT8212E-0042	CDMA RF Measurements
MT8212E-0043	CDMA Demodulation
MT8212E-0033	CDMA Over-the-Air Measurements[*1]
MT8212E-0062	EV-DO RF Measurements
MT8212E-0063	EV-DO Demodulation
MT8212E-0034	EV-DO Over-the-Air Measurements[*1]
MT8212E-0046	Fixed WiMAX RF Measurements
MT8212E-0047	Fixed WiMAX Demodulation
MT8212E-0066	Mobile WiMAX RF Measurements
MT8212E-0067	Mobile WiMAX Demodulation
MT8212E-0037	Mobile WiMAX Over-the-Air Measurements (option 0031 is recommended)
MT8212E-0030	ISDB-T Digital Video Measurements
MT8212E-0032	ISDB-T SFN Measurements
MT8212E-0079	ISDB-T BER Measurements
MT8212E-0064	DVB-T/H Digital Video Measurements
MT8212E-0078	DVB-T/H SFN Measurements
MT8212E-0057	DVB-T/H BER Measurements
MT8212E-0051	T1 Analyzer[*2]
MT8212E-0052	E1 Analyzer[*2]
MT8212E-0053	T3/T1 Analyzer[*2]
MT8212E-0098	Standard Calibration (ANSI Z540-1-1994)
MT8212E-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)

Model/Order No.	Name
	Main frame
MT8213E	Cable and Antenna Analyzer (2 MHz to 6 GHz) Spectrum Analyzer (9 kHz to 6 GHz) Power Meter (10 MHz to 6 GHz)
	Options
MT8213E-0021	2-port Transmission Measurement
MT8213E-0010	High-Voltage Variable Bias-Tee
MT8213E-0031	GPS Receiver (requires Antenna P/N 2000-1528-R or 2000-1652-R)
MT8213E-0019	High-accuracy Power Meter[*3]
MT8213E-0025	Interference Analysis[*1]
MT8213E-0027	Channel Scanner
MT8213E-0431	Coverage Mapping[*1]
MT8213E-0090	Gated Sweep
MT8213E-0028	C/W Signal Generator (requires CW Signal Generator Kit, P/N 69793)
MT8213E-0040	GSM/EDGE RF Measurements
MT8213E-0041	GSM/EDGE Demodulation
MT8213E-0044	W-CDMA/HSPA+ RF Measurements
MT8213E-0065	W-CDMA/HSPA+ Demodulation
MT8213E-0035	W-CDMA/HSPA+ Over-the-Air Measurements
MT8213E-0060	TD-SCDMA/HSPA+ RF Measurements
MT8213E-0061	TD-SCDMA/HSPA+ Demodulation
MT8213E-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (option 0031 is recommended)
MT8213E-0551	TD-LTE RF Measurements
MT8213E-0552	TD-LTE Modulation Measurements
MT8213E-0556	TD-LTE OTA Measurements[*1]
MT8213E-0541	LTE RF Measurements
MT8213E-0542	LTE Modulation Measurements
MT8213E-0546	LTE Over-the-Air Measurements (option 0031 is recommended)
MT8213E-0042	CDMA RF Measurements
MT8213E-0043	CDMA Demodulation
MT8213E-0033	CDMA Over-the-Air Measurements[*1]
MT8213E-0062	EV-DO RF Measurements
MT8213E-0063	EV-DO Demodulation
MT8213E-0034	EV-DO Over-the-Air Measurements[*1]
MT8213E-0046	Fixed WiMAX RF Measurements
MT8213E-0047	Fixed WiMAX Demodulation
MT8213E-0066	Mobile WiMAX RF Measurements
MT8213E-0067	Mobile WiMAX Demodulation
MT8213E-0037	Mobile WiMAX Over-the-Air Measurements (option 0031 is recommended)
MT8213E-0030	ISDB-T Digital Video Measurements
MT8213E-0032	ISDB-T SFN Measurements
MT8213E-0079	ISDB-T BER Measurements
MT8213E-0064	DVB-T/H Digital Video Measurements
MT8213E-0078	DVB-T/H SFN Measurements
MT8213E-0057	DVB-T/H BER Measurements
MT8213E-0051	T1 Analyzer[*2]
MT8213E-0052	E1 Analyzer[*2]
MT8213E-0053	T3/T1 Analyzer[*2]
MT8213E-0098	Standard Calibration (ANSI Z540-1-1994)
MT8213E-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)

*1: Requires GPS Receiver Option 0031
*2: Mutually exclusive
*3: Requires External Power Sensor

Continued on next page

Model/Order No.	Name
	Power Sensors
	(for complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline High Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
	Manuals
	(soft copy included on MST CD and at www.us.anritsu.com)
10580-00250	Cell Master Instrument User Guide (hard copy included) - Bias-Tee, GPS Receiver
10580-00241	Cable and Antenna Analyzer Measurement Guide
10580-00242	2-Port Transmission Measurement - Bias-Tee
10580-00231	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, CW Signal Generator, AM/FM/PM Analyzer, Interference Mapping, Coverage Mapping
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00237	Digital TV Measurement Guide - DVB-T/H, ISDB-T
10580-00238	Backhaul Analyzer Measurement Guide - T1, E1, T3/T1
10580-00215	ODTF-1 Optical Distance-to-Fault Module
10580-00256	Programming Manual
	Troubleshooting Guides
	(soft copy included on MST CD and at www.us.anritsu.com)
11410-00472	Interference
11410-00473	Cable, Antenna and Components
11410-00551	Spectrum Analyzers
11410-00566	LTE eNodeB Base Stations
11410-00552	T1/DS1 Backhaul Testing
11410-00553	E1 Backhaul Testing
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00463	W-CDMA/HSDPA Base Stations
11410-00465	TD-SCDMA/HSDPA Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations
	Standard Accessories
	(included with instrument)
10580-00250	Cell Master User Guide (includes Bias-Tee, GPS Receiver)
200-1654-R	Soft Carrying Case
2300-498	MST CD: Master Software Tools, User/Measurement Guides, Programming Manual, Troubleshooting Guides, Application Notes
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) DVD Disc
2300-539	easyTest Tools CD Disc
633-44	Rechargeable Li-Ion Battery
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 VDC Adapter
3-2000-1498	USB A/5-pin mini-B Cable, 10 feet/305 cm
11410-00485	Cell Master™ MT8212E Technical Data Sheet
	One Year Warranty (including battery, firmware, and software)
	Certificate of Calibration and Conformance

Model/Order No.	Name
	Optional Accessories
	Calibration Components, 50Ω
ICN50B	InstaCal™ Calibration Module, 38 dB, 2 MHz to 6.0 GHz, N(m), 50Ω
OSLN50-1	Precision Open/Short/Load, N(m), 42 dB, 6.0 GHz, 50Ω
OSLNF50-1	Precision Open/Short/Load, N(f), 42 dB, 6.0 GHz, 50Ω
2000-1618-R	Precision Open/Short/Load, 7/16 DIN(m), DC to 4.0 GHz 50Ω
2000-1619-R	Precision Open/Short/Load, 7/16 DIN(f), DC to 4.0 GHz 50Ω
22N50	Open/Short, N(m), DC to 18 GHz, 50Ω
22NF50	Open/Short, N(f), DC to 18 GHz, 50Ω
SM/PL-1	Precision Load, N(m), 42 dB, 6.0 GHz
SM/PLNF-1	Precision Load, N(f), 42 dB, 6.0 GHz
	Calibration Components, 75Ω
22N75	Open/Short, N(m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N(f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N(m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N(f), DC to 3 GHz, 75Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω
	Phase-Stable Test Port Cables, Armored w/ Reinforced Grip
	(ideal for contractors and other rugged applications)
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - N(f), 50Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - N(f), 50Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
	Interchangeable Adaptor Phase Stable Test port Cables, Armored w/ Reinforced Grip
	(recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the Reinforced grip series cables. Now you can also change the adaptor interface on the grip to four different connector types)
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50Ω
	Phase-Stable Test Port Cables, Armored
	(ideal for use with tightly spaced connectors and other general use applications)
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) - N(f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) - N(m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) - N(f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) - N(m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N(m) - N(f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N(m) - N(m), 50Ω
	Adapters
1091-26-R	SMA(m) - N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) - N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) - N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) - N(f), DC to 18 GHz, 50Ω
1091-172-R	BNC(f) - N(m), DC to 1.3 GHz, 50Ω
510-90-R	7/16 DIN(f) - N(m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN(f) - N(f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN(m) - N(m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN(m) - N(f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN(m) - 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN(f) - 7/16 DIN (f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) - 7/16 DIN(f), DC to 6 GHz, 50Ω, w/Reinforced Grip
510-102-R	N(m) - N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) - N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) - N(f), DC to 18 GHz, 50Ω
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA(m)
69793	CW Signal Generator Kit
2000-1652-R	GPS Antenna, SMA(m)
2000-1374	External Charger for Li-Ion Batteries
2000-1689	EMI Near Field Probe Kit
2300-532	Map Master CD
633-75	8000 mAh High-capacity Battery Pack
2000-1653	Anti-glare Screen Cover (package of 2)
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

Continued on next page

Model/Order No.	Name
	Directional Antennas
2000-1411-R	822 MHz to 900 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1617	600 MHz to 21 GHz
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi
2000-1677-R	300 MHz to 3 GHz, SMA(m), log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
	Mag Mount Broadband Antennas
2000-1647-R	Cable 1: 698 MHz to 1200 MHz 2 dBi peak gain, 1700 MHz to 2700 MHz 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50Ω, 10 ft
2000-1645-R	694 MHz to 894 MHz 3 dBi peak gain, 1700 MHz to 2700 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
2000-1646-R	750 MHz to 1250 MHz 3 dBi peak gain, 1650 MHz to 2000 MHz 5 dBi peak gain, 2100 MHz to 2700 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
2000-1648-R	1700 MHz to 6000 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
	Filters
1030-114-R	806 MHz to 869 MHz, N(m) - SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) - SMA (f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) - SMA (f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) - SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) - SMA (f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) - SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) - SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) - SMA (f), 50Ω
1030-149-R	High Pass, 150 MHz, N(m) to N(f), 50Ω
1030-150-R	High Pass, 400 MHz, N(m) to N(f), 50Ω
1030-151-R	High Pass, 700 MHz, N(m) to N(f), 50Ω
1030-152-R	Low Pass, 200 MHz, N(m) to N(f), 50Ω
1030-153-R	Low Pass, 550 MHz, N(m) to N(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) - N(f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50Ω
1030-179-R	777 MHz to 797 MHz, N(m) to N(f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) - N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) - N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) - N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) - N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) - N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) - N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) - N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) - N(f)
	T1/E1 Extender Cables
806-16-R	Bantam Plug to Bantam Plug
3-806-116	Bantam Plug to BNC
3-806-117	Bantam " Y " Plug to RJ48
3-806-169	72 inch (1.8 m) BNC to BNC, 75 1/2 RG59 Type Coax Cable
806-176-R	Bantam Plug to Alligator Clips

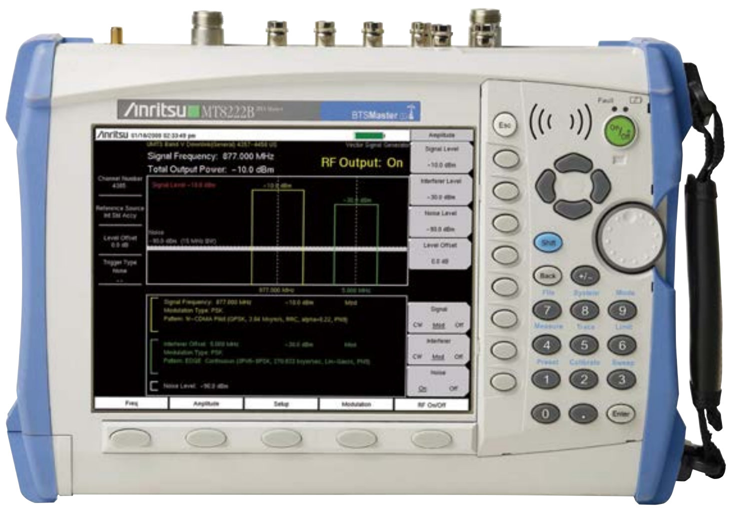
BTS MASTER

MT8221B/MT8222B

Cable & Antenna Analyzer: 400 MHz to 4.0 GHz/6.0 GHz, Spectrum Analyzer: 150 kHz to 7.1 GHz, Power Meter: 10 MHz to 7.1 GHz

Remote Control
Ethernet | USB

High Performance Handheld Base Station Analyzer



Anritsu introduces its next generation high performance handheld Base Station Analyzer for installation and maintenance of wireless networks. The BTS Master features the latest support for HSPA+ and LTE and is a future-proof platform with 20 MHz demodulation bandwidth and a Vector Signal Generator for receiver testing.

Cable and Antenna Analyzer Highlights

- Measurements: RL, VSWR, Cable Loss, DTF, Phase, Gain
- 2-port Gain Measurement Uncertainty: <0.45 dB
- 2-port Dynamic Range: >80 dB
- RF Immunity: +17 dBm on-channel, +10 dBm on-frequency
- Calibration: OSL and FlexCal™
- Bias-Tee: 32 V internal

Spectrum and Interference Analyzer Highlights

- Measurements: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID
- Dynamic Range: >95 dB in 1 Hz RBW
- DANL: –163 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz @ 10 kHz offset
- Frequency Accuracy: <±25 ppb with GPS On

Capabilities and Functional Highlights

- LTE and TD-LTE
- GSM/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- CDMA, EV-DO
- WiMAX - Fixed/Mobile
- Vector Signal Generator
- Zero-span IF Output
- Gated Sweep
- GPS tagging of stored traces
- Internal Preamplifier standard
- Internal Power Meter
- High Accuracy Power Meter
- USB Power Sensors, 4 GHz to 26 GHz
- Channel Scanner
- Line Sweep Tools
- Backhaul Analyzers, E1, T1, T3
- <5 minutes warm-up time
- 2.5 hours battery operation time
- Ethernet/USB Data Transfer
- MST Remote Access Tool

Cable and Antenna Analyzer Specifications

Measurements	Measurements	VSWR Return Loss Cable Loss Distance-to-Fault (DTF) Return Loss Distance-to-Fault (DTF) VSWR
	Others	1-port Phase 2-port Phase 2-port Gain Smith Chart
Setup Parameters	Frequency	Start/Stop, Signal Standard, Start Cal
	DTF	Start/Stop, DTF Aid, Units (m/ft), Cable Loss, Propagation Velocity, Cable, Windowing
	Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Top, Bottom Auto Scale, Full Scale
	Sweep	Run/Hold, Single/Continuous, RF Immunity (High/Low), Data Points, Averaging/Smoothing, Output Power (High/Low)
	Data Points	137, 275, 551
	Markers	Markers 1 to 6 each with a Delta Marker, Marker to Peak/Valley, Marker Table (On/Off)
	Traces	Recall, Copy to Display Memory, No Trace Math, Trace ± Memory, Trace Overlay (On/Off)
	Limit Line	On/Off, Single Limit, Multi-segment (41), Limit Alarm, Clear
	Limit Line Edit	Frequency, Amplitude, Add Point, Delete Point, Next Point Left/Right, Move Limit
	Calibration	Start Cal, 1/2-port, Low/High Power, Standard/FlexCal™, DUT Connector, Configure DUT
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)
Frequency	Frequency Range	400 MHz to 4 GHz (MT8221B), 400 MHz to 6 GHz (MT8222B)
	Frequency Accuracy	±3.0 ppm
	Frequency Resolution	1 kHz (RF immunity low) 100 kHz (RF immunity high)
Output Power	High	–7 dBm, typical, 1 or 2-port
	Low	–40 dBm, typical, 2-port
Dynamic Range	400 MHz to 3.0 GHz	80 dB
	>3.0 GHz to 4.0 GHz	70 dB
Interference Immunity	On-Channel	+17 dBm @ >1.0 MHz from carrier frequency
	On-Frequency	+10 dBm within ±10 kHz from the carrier frequency
Measurement Speed	Return Loss	≤4.5 msec/data point, RF immunity low, typical
	Distance-to-Fault	≤4.5 msec/data point, RF immunity low, typical
Return Loss	Measurement Range	0 to 60 dB
	Resolution	0.01 dB
VSWR	Measurement Range	1:1 to 65:1
	Resolution	0.01
Cable Loss	Measurement Range	0 to 30 dB
	Resolution	0.01 dB
2-Port Gain	Measurement Range	–120 to +100 dB
	Resolution	0.01 dB
Distance-to-Fault	Vertical Range Return Loss	0 to 60 dB
	Vertical Range VSWR	1 to 65
	Fault Resolution (meters)	$(1.5 \times 10^8 \times vp)/\Delta F$ (vp = velocity propagation constant, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters)	0 to (Data Points – 1) × Fault Resolution, to a maximum of 1500 meters (4921 ft)
Phase (1 and 2-Port)	Measurement Range	–180° to +180°
	Resolution	0.01°
Smith Chart	Resolution	0.01
Measurement Accuracy	Corrected Directivity	>42 dB

Spectrum Analyzer Specifications

Measurements	Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m² or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask)
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/WBW, Span/RBW
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
	Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)
Sweep Functions	Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type, Gated Sweep (see Option 0090)
	Detection	Peak, RMS, Negative, Sample, Quasi-peak
	Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold
	Trace C Operations	A → B, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1 to 6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1 to 6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
Frequency	Frequency Range	150 kHz to 7.1 GHz (usable to 0 Hz)
	Maximum Continuous Input	+30 dBm
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1.0 ppm/10 years
	Frequency Span	Accuracy: ±0.3 ppm (25°C ±25°C) + aging 10 Hz to 7.1 GHz including zero span
	Sweep Time	Minimum 100 ms, 10 µs to 600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	1 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero span) (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	SSB Phase Noise	–100 dBc/Hz @ 10, 20 and 30 kHz offset from carrier –102 dBc/Hz @ 100 kHz offset from carrier
Amplitude Ranges	Dynamic Range	>95 dB (600 MHz, 3.5 GHz), 2/3 (TOI-DANL) in 1 Hz RBW
	Measurement Range	DANL to +30 dBm
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
	Reference Level Range	–120 to +30 dBm
	Attenuator Resolution	0 to 65 dB, 5.0 dB steps
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW

Continued on next page

Amplitude Accuracy (Power level >–50 dBm)	(Input attenuation)	Preamp Off (≤35 dB)	Preamp Off (40 to 55 dB)	Preamp Off (60 to 65 dB)	Preamp On (0 or 10 dB)
	150 kHz to ≤10 MHz	±1.50 dB	±1.50 dB	±1.50 dB	
	150 kHz to 4.0 GHz				±1.50 dB
	>10 MHz to 4.0 GHz	±1.25 dB	±1.75 dB	±1.75 dB	
	>4.0 GHz to 6.5 GHz		±1.75 dB	±1.75 dB	
	>4.0 GHz to 7.1 GHz	±1.75 dB			±1.75 dB
	>6.5 GHz to 7.1 GHz		±2.00 dB	±3.00 dB	
Displayed Average Noise Level (DANL)	(DANL in 1 Hz RBW, 0 dB attenuation)	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
		Maximum	Typical	Maximum	Typical
	3 MHz to 1 GHz	–137 dBm	–150 dBm	–161 dBm	–163 dBm
	>1.0 GHz to 2.2 GHz	–133 dBm	–147 dBm	–159 dBm	–160 dBm
	>2.2 GHz to 4.0 GHz	–133 dBm	–143 dBm	–156 dBm	–159 dBm
	>4.0 GHz to 7.1 GHz	–130 dBm	–138 dBm	–154 dBm	–156 dBm
Spurious	Residual Spurious	Preamp Off (RF input terminated, 0 dB input attenuation) –90 dBm, 150 kHz to 3.2 GHz –84 dBm, >3.2 GHz to 7.1 GHz			
	Exceptions	–70 dBm @ 3200 MHz Preamp On (RF input terminated, 0 dB input attenuation) –100 dBm. 10 MHz to 7.1 GHz			
	Exceptions	–95 dBm @ 50, 100, 150 MHz			
	Input-Related Spurious	(0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz) –60 dBc, –70 dBc typical			
	Exceptions	–40 dBc, –60 dBc typical @ 1672 MHz			
Third-Order Intercept (TOI)		Preamp Off			
	600 MHz	+8 dBm typical			
	3.5 GHz	+9 dBm typical			
Second Harmonic Distortion	Preamp Off	–50 dBc maximum			
		–70 dBc typical			
VSWR	<4.0 GHz	1:5:1 typical			
	4.0 GHz to 7.1 GHz	1.8:1 typical			

Power Meter Specifications

Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Full Band
Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	Acquisition Fast/Med/Slow, # of Running Averages
Limits	Limit On/Off, Limit Upper/Lower
Frequency Range	10 MHz to 7.1 GHz
Span	1 kHz to 100 MHz
Display Range	–140 to +30 dBm, ≤40 dB span
Measurement Range	–120 to +30 dBm
Offset Range	0 to +100 dB
VSWR	1.5:1 typical
Maximum Power	+30 dBm without attenuator
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50Ω, 75Ω, Other)

Vector Signal Generator Option (Option 0023) Specifications

Setup Parameters	Frequency	Frequency, Signal Standard, Channel Number, Interferer Offset					
	Amplitude	Signal/Interferer/Noise Level in dBm, Level Offset, Signal (CW/Modulated/Off), Interferer (CW/Modulated/Off), Noise (On/Off)					
	Trigger (for modulated signals)	Type (None/Positive/Negative), Delay, Manual, Pattern Manager					
	Pattern Manager	Add, Erase					
	Modulation	Signal Pattern Select, Interferer Pattern Select, Edit					
	Modulation Edit	Analog, Digital, Custom, Spectrum Inversion (Normal/Reverse)					
	RF	On/Off					
	Active Pattern Memory	256 MB					
	Frequency Range	400 MHz to 6 GHz					
	Frequency Resolution	1 Hz					
	Frequency Accuracy	±0.3 ppm (25°C ±25°C) + aging					
	Output Power	–124 to 0 dBm, CW –124 to –8 dBm, Modulated/Noise/Multicarrier					
	Step Size	0.1 dB nominal					
	Bandwidth	1 signal to 10 MHz or 2 signals to 5 MHz each + AWGN					
	Waveform Addition	Desired Signal + Interfering Signal + AWGN					
Level Accuracy, Single Channel	At least 30 minutes warm-up after 1 hour non-operating at 15° to 35°C ambient, excludes load VSWR effects						
		(400 MHz to 2.0 GHz)		(>2.0 to 4.0 GHz)		(>4.0 to 6.0 GHz)	
	VSG Output Power	CW Mode	W-CDMA	CW Mode	W-CDMA	CW Mode	W-CDMA
	–46 to 0 dBm	±1.0 dB		±1.2 dB		±1.2 dB	
	–46 to –8 dBm		±1.4 dB		±1.4 dB		±1.8 dB
	–84 to <–46 dBm	±1.1 dB	±1.4 dB	±1.3 dB	±1.4 dB	±1.3 dB	±2.0 dB
	–104 to <–84 dBm	±1.4 dB	±1.5 dB	±1.4 dB	±1.5 dB	±1.4 dB	±2.0 dB
	–124 to <–104 dBm	±1.7 dB	±1.7 dB	±1.7 dB	±1.7 dB	±1.7 dB	±2.4 dB
Standard Signal Patterns	AM (Frequency/Depth)	400 Hz/5%, 1 kHz/10%, 3 kHz/20%, 5 kHz/30%, 10 kHz/50%, 15 kHz/70%, 20 kHz/90%					
	FM (Rate/Deviation)	1 kHz/100 Hz, 5 kHz/500 Hz, 10 kHz/1 kHz, 50 kHz/5 kHz, 100/10 kHz, 500 kHz/50 kHz, 500 kHz/100 kHz, 500 kHz/500 kHz					
	Pulsed CW (Duty Cycle/Period)	50%/0.1 msec (10 kHz), 50%/1 msec (1 kHz), 50%/2.5 msec (400 Hz)					
	EDGE – Continuous	3Pi/8-8PSK, 270.833 ksym/sec, Linearized Gaussian filtered, Data = PN9					
	W-CDMA Pilot	QPSK, 3.84 Msym/s, RRC filtered, alpha = 0.22, Data = PN9					
	DECT 16 QAM – Continuous	1.152 Msym/s, RRC filtered, alpha = 0.5, Data = PN9					
	DECT 64 QAM – Continuous	16 QAM, 6.84 Msym/s. RRC filtered, alpha = 0.15, Data = PN9					
	DVB-C	1.152 Msym/s, RRC filtered, alpha = 0.5, Data = PN9					
	J.83C Digital Cable	16 QAM, 5 Msym/s, RRC filtered, alpha = 0.13					
	64 QAM – US Digital Cable	5.056941 Msym/s, RRC filtered, alpha = 0.18					
User-defined Signal Patterns	Input Waveform for MST Pattern Converter	ASCII Text or MATLAB® file format					
	Number of Waveforms	≤1000					
	Sampling Rate	Bandwidth		Time		Length	
	12.500 MHz	10.0 MHz		≤4 seconds		N × 8 samples	
	6.250 MHz	5.0 MHz		≤8 seconds		N × 4 samples	
	1.625 MHz	1.2 MHz		≤32 seconds		N × 4 samples	

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
	System Options	Name, Date and Time, Ethernet Configuration, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Internal Trace/Setup Memory	>30,000 traces
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	RF Out	Type N, female, 50Ω, Maximum Input +23 dBm, ±50 VDC, (Reflection In)
	RF In	Type N, female, 50Ω, Maximum Input +30 dBm, ±50 VDC
	GPS	SMA. female
	T1	Bantam Jacks (Option 0051)
	T3	BNC (Option 0053)
	E1	RJ48C and BNC (Option 0052)
	External Power	5.5 mm barrel connector, 12 VDC to 15 VDC, <5.0 Amps
	LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
	USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Headset Jack	2.5 mm barrel connector
	External Reference In	BNC, female, 50Ω, Maximum Input +10 dB
	Reference Out	BNC, female, 50Ω, 10 MHz
	External Trigger In/Clock Recovery	BNC, female, 50Ω, Maximum Input ±5 VDC
	IF Out	BNC, female, 50Ω, 140 MHz
Display	Size	8.4-inch
	Resolution	800 × 600
Battery	Type	Li-Ion
	Battery Operation	2.5 hours, typical
Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
	Australia and New Zealand	C-tick N274
	Interference	EN 61326-1
	Emissions	EN 55011
	Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11
Safety	Safety Class	EN 61010-1 Class 1
	Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	Temperature	–10° to +55°C (Operating), –51° to +71°C (Storage)
	Maximum Humidity	85%
	Shock	MIL-PRF-28800F Class 2
	Altitude	4600 meters, operating and non-operating
Dimensions and Mass	Dimensions	315 × 211 × 94 mm, (12.4 × 8.3 × 3.7 in)
	Mass	4.9 kg (10.7 lbs)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MT8221B	**Main frame** Cable and Antenna Analyzer, 400 MHz to 4 GHz Spectrum Analyzer, 150 kHz to 7.1 GHz Power Meter, 150 kHz to 7.1 GHz
	Options
MT8221B-0010	High Voltage Variable Bias Tee
MT8221B-0031	GPS Receiver (requires Antenna P/N 2000-1528-R or 2000-1652-R)
MT8221B-0019	High-Accuracy Power Meter (Requires External Power Sensor)
MT8221B-0025	Interference Analysis
MT8221B-0027	Channel Scanner
MT8221B-0089	Zero-Span IF Output
MT8221B-0090	Gated Sweep
MT8221B-0023	Vector Signal Generator
MT8221B-0024	IQ Waveform Capture
MT8221B-0040	GSM/EDGE RF Measurements
MT8221B-0041	GSM/EDGE Demodulation
MT8221B-0044	W-CDMA/HSPA+ RF Measurements
MT8221B-0065	W-CDMA/HSPA+ Demodulation
MT8221B-0035	W-CDMA/HSPA+ Over-the-Air Measurements
MT8221B-0060	TD-SCDMA/HSPA+ Measurements
MT8221B-0061	TD-SCDMA/HSPA+ Demodulation
MT8221B-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (option 0031 is recommended)
MT8221B-0541	LTE RF Measurements
MT8221B-0542	LTE Modulation Measurements
MT8221B-0546	LTE Over-the-Air Measurements (option 0031 is recommended)
MT8221B-0543	15 & 20 MHz LTE Modulation Measurements
MT8221B-0551	TD-LTE RF Measurements
MT8221B-0552	TD-LTE Modulation Measurements
MT8221B-0556	TD-LTE OTA Measurements (Option 31 is recommended)
MT8221B-0042	CDMA RF Measurements
MT8221B-0043	CDMA Demodulation
MT8221B-0033	CDMA Over-the-Air Measurements*
MT8221B-0062	1xEV-DO RF Measurements
MT8221B-0063	1xEV-DO Demodulation
MT8221B-0034	1xEV-DO Over-the-Air Measurements*
MT8221B-0046	Fixed WiMAX RF Measurements
MT8221B-0047	Fixed WiMAX Demodulation
MT8221B-0066	Mobile WiMAX RF Measurements
MT8221B-0067	Mobile WiMAX Demodulation
MT8221B-0037	Mobile WiMAX Over-the-Air Measurements (option 0031 is recommended)
MT8221B-0431	Coverage Mapping*
MT8221B-0051	T1 Analyzer (mutually exclusive with Options 0052, 0053)
MT8221B-0052	E1 Analyzer (mutually exclusive with Options 0051, 0053)
MT8221B-0053	T3/T1 Analyzer (mutually exclusive with Options 0051, 0052)
MT8221B-0098	Standard Calibration to Z540
MT8221B-0099	Premium Calibration to Z540 plus test data

Model/Order No.	Name
MT8222B	**Main frame** Cable and Antenna Analyzer, 400 MHz to 6 GHz Spectrum Analyzer, 150 kHz to 7.1 GHz Power Meter, 150 kHz to 7.1 GHz
	Options
MT8222B-0010	High Voltage Variable Bias Tee
MT8222B-0031	GPS Receiver (requires Antenna P/N 2000-1528-R or 2000-1652-R)
MT8222B-0019	High-Accuracy Power Meter (Requires External Power Sensor)
MT8222B-0025	Interference Analysis
MT8222B-0027	Channel Scanner
MT8222B-0089	Zero-Span IF Output
MT8222B-0090	Gated Sweep
MT8222B-0023	Vector Signal Generator
MT8222B-0024	IQ Waveform Capture
MT8222B-0040	GSM/EDGE RF Measurements
MT8222B-0041	GSM/EDGE Demodulation
MT8222B-0044	W-CDMA/HSPA+ RF Measurements
MT8222B-0065	W-CDMA/HSPA+ Demodulation
MT8222B-0035	W-CDMA/HSPA+ Over-the-Air Measurements*
MT8222B-0060	TD-SCDMA/HSPA+ Measurements
MT8222B-0061	TD-SCDMA/HSPA+ Demodulation
MT8222B-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (option 0031 is recommended)
MT8222B-0541	LTE RF Measurements (BW: ≤10 MHz)
MT8222B-0542	LTE Modulation Measurements (BW: ≤10 MHz)
MT8222B-0546	LTE Over-the-Air Measurements (option 0031 is recommended)
MT8222B-0543	15 & 20 MHz LTE Modulation Measurements
MT8222B-0551	TD-LTE RF Measurements
MT8222B-0552	TD-LTE Modulation Measurements
MT8222B-0556	TD-LTE OTA Measurements (Option 31 is recommended)
MT8222B-0042	CDMA RF Measurements
MT8222B-0043	CDMA Demodulation
MT8222B-0033	CDMA Over-the-Air Measurements*
MT8222B-0062	1xEV-DO RF Measurements
MT8222B-0063	1xEV-DO Demodulation
MT8222B-0034	1xEV-DO Over-the-Air Measurements*
MT8222B-0046	Fixed WiMAX RF Measurements
MT8222B-0047	Fixed WiMAX Demodulation
MT8222B-0066	Mobile WiMAX RF Measurements
MT8222B-0067	Mobile WiMAX Demodulation
MT8222B-0037	Mobile WiMAX Over-the-Air Measurements (option 0031 is recommended)
MT8222B-0431	Coverage Mapping*
MT8222B-0051	T1 Analyzer (mutually exclusive with Options 0052, 0053)
MT8222B-0052	E1 Analyzer (mutually exclusive with Options 0051, 0053)
MT8222B-0053	T3/T1 Analyzer (mutually exclusive with Options 0051, 0052)
MT8222B-0098	Standard Calibration to ISO/IEC 17025:2005
MT8222B-0099	Premium Calibration to ISO/IEC 17025:2005 plus test data

*: Requires GPS Receiver Option 0031

Continued on next page

Model/Order No.	Name
	Power Sensors
	(For complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline High Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
	Manuals
	(soft copy included on MST CD and at www.us.anritsu.com)
10920-00060	Handheld Instruments Documentation Disc
10580-00207	BTS Master User Guide (Hard copy included) - Bias-Tee, GPS Receiver
10580-00230	Cable and Antenna Analyzer Measurement Guide
10580-00244	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, IF Output, Gated Sweep
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00232	Vector Signal Generator Measurement Guide
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00238	Backhaul Analyzer Measurement Guide - T1, E1, T3/T1
10580-00208	Programming Manual
10580-00209	Maintenance Manual
	Troubleshooting Guides
	(soft copy included on MST CD and at www.us.anritsu.com)
11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00463	W-CDMA/HSDPA Base Stations
11410-00465	TD-SCDMA/HSDPA Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations
11410-00473	Cable, Antenna and Components
11410-00551	Spectrum Analyzers
11410-00566	LTE eNodeB Base Stations
11410-00552	T1/DS1 Backhaul Testing
11410-00553	E1 Backhaul Testing
	Standard Accessories
	(included with instrument)
10580-00207	BTS Master User Guide (includes Bias-Tee and GPS Receiver)
65681	Soft Carrying Case
2300-498	MST CD: Master Software Tools, User/Measurement Guides, Programming Manual, Troubleshooting Guides, Application Notes
10920-00060	Handheld Instruments Documentation Disc
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) DVD Disc
633-44	Rechargeable Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Cigarette Lighter 12 Volt DC Adapter
3-806-152	Cat 5e Crossover Patch Cable, 7 feet/213 cm
2000-1371-R	Ethernet Cable, 7 feet/213 cm
3-2000-1498	USB A-mini B Cable, 10 feet/305 cm
1091-27-R	Type-N male to SMA female adapter
1091-172-R	Type-N male to BNC female adapter
11410-00442	BTS Master™ MT8221B Technical Data Sheet
	One Year Warranty (Including battery, firmware, and software)
	Certificate of Calibration and Conformance

Model/Order No.	Name
	Optional Accessories
	Calibration Components, 50Ω
OSLN50-1	Precision Open/Short/Load, N(m), 42 dB, 6.0 GHz, 50Ω
OSLNF50-1	Precision Open/Short/Load, N(f), 42 dB, 6.0 GHz, 50Ω
2000-1618-R	Precision Open/Short/Load, 7/16 DIN(m), DC to 6.0 GHz 50Ω
2000-1619-R	Precision Open/Short/Load, 7/16 DIN(f), DC to 6.0 GHz 50Ω
22N50	Open/Short, N(m), DC to 18 GHz, 50Ω
22NF50	Open/Short, N(f), DC to 18 GHz, 50Ω
SM/PL-1	Precision Load, N(m), 42 dB, 6.0 GHz
SM/PLNF-1	Precision Load, N(f), 42 dB, 6.0 GHz
	Calibration Components, 75Ω
22N75	Open/Short, N(m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N(f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N(m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N(f), DC to 3 GHz, 75Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω
	Phase-Stable Test Port Cables, Armored w/ Reinforced Grip
	(ideal for contractors and other rugged applications)
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - N(f), 50Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - N(f), 50Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
	InterChangeable Adaptor Phase Stable Test Port Cables, Armored w/Reinforced Grip
	(recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the Reinforced grip series cables. Now you can also change the adaptor interface on the grip to four different connector types)
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50Ω
	Phase-Stable Test Port Cables, Armored
	(ideal for use with tightly spaced connectors and other general use applications)
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) - N(f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) - N(m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) - N(f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) - N(m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N(m) - N(f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N(m) - N(m), 50Ω
	Adapters
1091-26-R	SMA(m) - N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) - N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) - N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) - N(f), DC to 18 GHz, 50Ω
1091-172-R	BNC(f) - N(m), DC to 1.3 GHz, 50Ω
510-90-R	7/16 DIN(f) - N(m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN(f) - N(f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN(m) - N(m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN(m) - N(f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN(m) - 7/16 DIN(m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN(f) - 7/16 DIN(f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) - 7/16 DIN(f), DC to 6 GHz, 50Ω, w/ Reinforced Grip
510-102-R	N(m) - N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) - N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) - N(f), DC to 18 GHz, 50Ω
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA(m)
2000-1652-R	GPS Antenna, SMA(m)
2000-1374	External Charger for Li-Ion Batteries
633-75	High-capacity Li-Ion Battery Back
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

Continued on next page

Model/Order No.	Name
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1659-R	698 to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 to 1535 MHz, N(f), 12 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21 GHz, N(f), 5 to 8 dBi to 12 GHz, 0 to 6 dBi to 21 GHz, log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
	Mag Mount Broadband Antenna
2000-1647-R	Cable 1: 698 MHz to 1200 MHz, 2 dBi peak gain, 1700 MHz to 2700 MHz, 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50Ω, 10 ft
2000-1645-R	694 MHz to 894 MHz, 3 dBi peak gain, 1700 MHz to 2700 MHz, 3 dBi peak gain, N(m), 50Ω, 10 ft
2000-1646-R	750 MHz to 1250 MHz, 3 dBi peak gain, 1650 MHz to 2000 MHz, 5 dBi peak gain, 2100 MHz to 2700 MHz, 3 dBi peak gain, N(m), 50Ω, 10 ft
2000-1648-R	1700 MHz to 6000 MHz, 3 dBi peak gain, N(m), 50Ω, 10 ft
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) - SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) - SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) - SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) - SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) - SMA(f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) - N(f), 50Ω
1030-179-R	777 MHz to 787 MHz, N(m) - N(f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) - N(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) - SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) - SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) - SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) - N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) - N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) - N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) - N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) - N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) - N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) - N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) - N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) - N(f)
	T1/E1 Extender Cables
806-16-R	Bantam Plug to Bantam Plug
3-806-116	Bantam Plug to BNC
3-806-117	Bantam " Y " Plug to RJ48
3-806-169	72 inch (1.8 m) BNC to BNC, 75 1/2 RG59 Type Coax Cable
806-176-R	Bantam Plug to Alligator Clips

Bluetooth TEST SET

MT8852B

2.4 GHz Reference *Bluetooth* Transceiver

Remote Control
GPIB

Test Bluetooth Modules and Products with a Bluetooth Interface

The Anritsu MT8852B *Bluetooth* Test Set is the market leading RF measuring instrument for design proving and production test of a wide range of products that integrate *Bluetooth* technology, including phones, headsets, computers, audio-visual and gaming products as well as modules. In production, a single key press initiates a measurement script that tests a device in less than 10 seconds.
8 *Bluetooth* Basic Rate and 6 *Bluetooth* EDR transmitter and receiver test cases are supported in the MT8852B *Bluetooth* Test Set. EDR test cases supported include Relative Transmit Power, Carrier Frequency Stability/Modulation Accuracy, Differential Phase Encoding, Sensitivity, and BER Floor Performance.
The introduction of the new *Bluetooth* low energy specification opens up a whole new range of applications including sports and fitness monitoring and health and wellbeing sensors. The new MT8852B low energy measurement option adds 6 low energy test cases to the standard product. These new test cases can be run as part of a test script so that test program creation is simplified and test times are minimized.
For audio measurement, the MT8852B supports all three codec air interfaces (µ-law, A-law and CVSD) on up to three SCO audio channels. It offers comprehensive testing facilities integrated within a *Bluetooth* wireless technology test set. Rear-panel jack-plug connectors provide analog inputs and outputs for all three audio channels.
The Adaptive Frequency Hopping (AFH) option facilitates analysis of interference from, and co-existence with, interfering signals such as WLAN. This option provides graphical displays of FER and masked channels when interfering signals are introduced, allowing optimization of hardware designs.

- Compliant with *Bluetooth* 1.2, 2.0 and 2.1, 3.0+HS and 4.0 core specification
- Measurements performed as defined in the *Bluetooth* RF Test Specification
- Qualified by *Bluetooth* SIG for RF measurements
- 8 Basic Rate and 6 EDR transmitter and receiver test cases.
- Enhanced Power Control (EPC) measurement included as standard
- Initialization and control of test devices through USB and UART HCI control port
- Option for *Bluetooth* low energy measurements
- Built in support for *Bluetooth* low energy 2-Wire control interface
- Single script runs Basic Rate, EDR and low energy tests
- Tests RF performance of *Bluetooth* modules in under 10 seconds
- BR/EDR/low energy dirty transmitter for receiver sensitivity test cases
- Audio testing capability. 3 SCO channels with CVSD, u-Law and A-Law air interface.
- Tests through antenna interface or cable connection
- Easy operation: one touch testing with RUN key
- Pre-programmed or user-defined test scripts
- BlueSuite Pro3 software provides graphical traces of modulation, power ramp, individual channel measurements, and receiver sensitivity search
- BlueTest 2 and CombiTest software for automated high volume production line testing
- Adaptive Frequency Hopping software option for *Bluetooth* 1.2 device testing

MT8852B is the Master, establishing the link by Paging the EUT. The EUT BT address can be entered manually or through the GPIB port. If the EUT BT address is not known, you can use Inquiry or read the address directly through the EUT HCI interface (RS-232 or USB). Test Mode is then activated in the EUT and RF measurements performed. When the EUT is in Test Mode, the MT8852B has complete control over its operation. The EUT can be put into loopback or TX test mode, frequency hopping can be disabled or the EUT sent to defined TX and RX frequencies as required by the test specification. The MT8852B runs a selected test script. A test script comprises of all (or a user selected subset) of the available RF measurements. The user can modify the measurements by editing test frequencies, number of bits/packets tested, hopping On or Off, and Pass/Fail limits. Pre programmed “Full” and “Quick Test” scripts plus user-defined scripts are selectable. Script results can be viewed on the screen and accessed over the GPIB. In addition any individual measurement can be run continuously.

Features

- **Compliant with *Bluetooth* 1.2, 2.0 and 2.1, 3.0+HS and 4.0 core specification**

MT8852B is fully compliant with the *Bluetooth* core specifications 1.2, 2.0, 2.1 (EDR), 3.0 + HS and 4.0. All supported RF test cases can be used to confirm a product meets the exact requirements of the radio specification.

- **One Touch Testing**

Once the MT8852B has been configured, each device is tested with a single keystroke. Press RUN to initiate a link, activate Test Mode, perform the measurements and report the results.

• Single Script Runs 8 Standard Rate, 6 EDR Test Cases and 6 Low Energy (with option) Test Cases

Built in test scripts simplify product verification and production test. All the test cases commonly used in a production environment for standard rate and EDR products are supported. The Quick Test script performs a rapid test on *Bluetooth* EDR devices in under 10 seconds.

• Editing Tests

Test scripts can be customized to specific requirements. Each test can be enabled or disabled and within any test, parameters such as hopping can be enabled or disabled, the number of measured packets defined and the specific frequencies of testing set up.

• Signal Generator and Transmitter Analyzer Modes for Protocol Free Applications

For protocol free measurements, MT8852B can be used as a fixed frequency signal source and transmitter analyzer. This is ideal for R&D applications and crystal tuning before full testing.

• Full Implementation of Standard Rate and EDR Dirty Transmitter for Sig Core Specification Compliant Measurements

The MT8852B applies full implementation of the standard rate and EDR dirty transmitter to comply with the *Bluetooth* specification. This is essential to test the performance of devices in real world conditions with degraded test signals.

• Audio Test Capability; 3 SCO Channels.

Measurements on *Bluetooth* modules and products that support SCO audio channels are supported. Up to 3 audio channels can be tested and all 3 air interfaces (CVSD, μ-Law and A-Law) are supported for a comprehensive test solution air interface

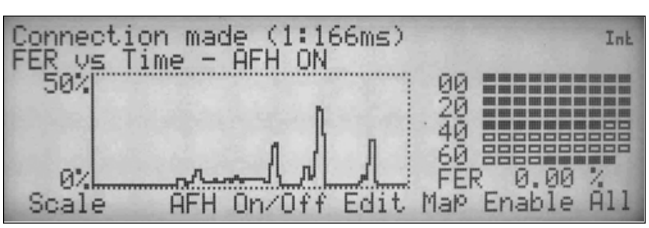
• Backward Compatible with MT8850A and MT8852A Test Sets

The GPIB command set for MT8852B is built on the legacy MT8850A and MT8852A command set. Existing test programs can be used with MT8852B.

Use MT8852B-15 AFH Option to:

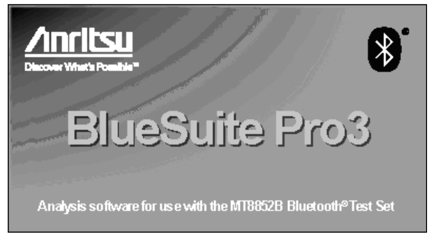
- Connect to an EUT using the *Bluetooth* 1.2 specification Faster Connection and display the connection time in milliseconds.
- Display the EUT *Bluetooth* 1.2 Supported Features map, including AFH capabilities.
- Read the EUT Local Assessment Scheme in the presence of an external interfering signal (e.g. WLAN).
- Manually define additional channels to mask in the MT8852B Pseudo Local Assessment Map.
- Display a graph of channel utilization against time to measure the speed with which an EUT masks channels when an interfering source is activated.
- Display a graph of Frame Error Rate (FER) against time to validate that an EUT identifies all "Bad" channels and maintains a zero or low FER.
- Establish an audio SCO link so that the audio quality can be monitored in the presence of interfering signals, and ensure that the AFH functionality maintains a high quality audio path.

This screen presents a graph with 1 second resolution of the FER of the *Bluetooth* link with AFH enabled. When an interfering source such as a 802.11 WLAN access point is activated, the FER can be seen to increase immediately. As the EUT's local assessment scheme identifies the "bad" channels and reports its assessment to the MT8852B, the FER will decrease as the channels are removed from the hopping plan.



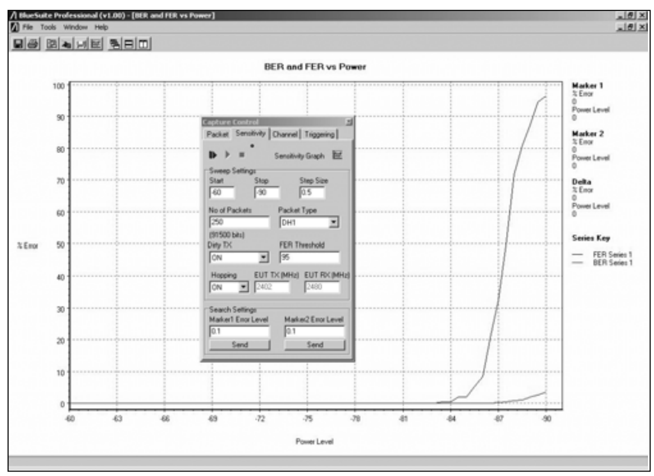
Frame Error Rate against time with AFH active

BlueSuite Pro software displays; modulation, power burst profile, IQ diagrams and sensitivity searches, graphically on PC monitor.



BlueSuite Pro is a comprehensive software tool that enables a greater understanding of all aspects of a device's RF characteristics. Running on a standard PC, BlueSuite Pro interfaces to the MT8852B through a GPIB interface. Use BlueSuite Pro to;

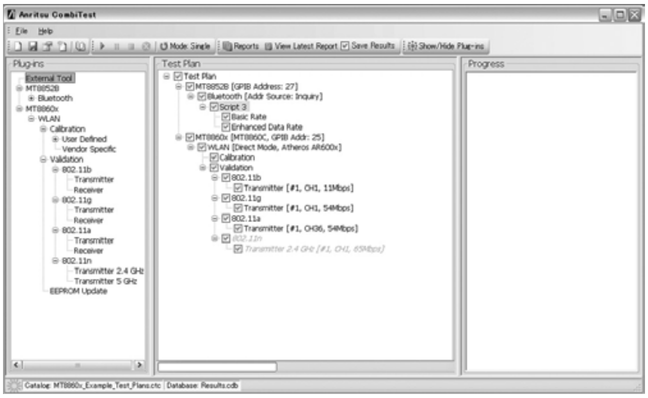
- Monitor the real-time state of the EUT through the display of frequency deviation, power burst, IQ constellation and vector graphs.
- Configure and run sensitivity sweeps and display the results graphically.
- Configure and run measurement sweeps for seven different tests and display the results graphically for each of the 79 *Bluetooth* channels.
- Configure and run audio tests and display the results graphically.
- Configure and run a power control test and display the results graphically.
- Read and write script and limit settings to and from the MT8852B.
- Edit and run a complete test script and generate a detailed report of the results.
- Step through individual connection and test mode controls to determine the cause of problems otherwise difficult to isolate.



Automatic sensitivity search measurements display the FER/BER performance of an EUT with decreasing power into the receiver. Tests can be performed on all supported standard rate and EDR packet types

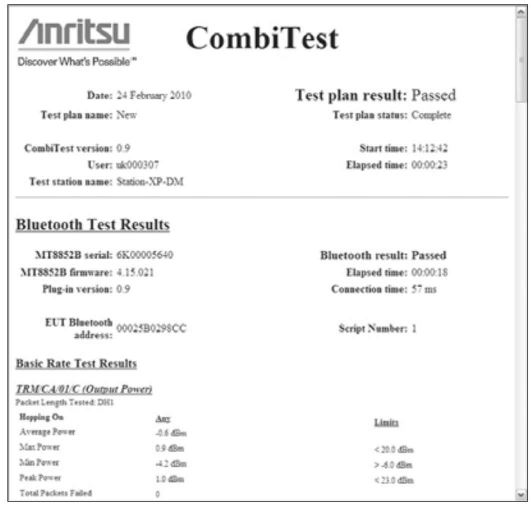
CombiTest is a new PC application that improves production line efficiency. CombiTest is a tool that facilitates the development and running of test plans for combo modules that include *Bluetooth* and 802.11 technology.

CombiTest is a software application used to remotely control Anritsu WLAN and *Bluetooth* test sets using a user-configured test plan of measurements. It is ideal for creating design-verification or production test plans for the new generation of wireless combo modules including 802.11 and *Bluetooth* radios. CombiTest allows users to install plug-ins as required for each test instrument.



CombiTest features:

- Plug-ins for the Anritsu MT8860x WLAN Test Set and the Anritsu MT8852B *Bluetooth* Test Set
- WLAN Network and Direct modes supported
- *Bluetooth* test mode measurements
- Rapid creation and execution of test plans
- Control packages available for leading WLAN chipsets
- Calibration, validation, and EEPROM programming of modules
- Run an entire test plan or just the selected components
- Detailed report of test results with database of previous tests
- CombiTest application source code available on request



CombiTest reports clearly present full set up and results details of each device tested. Results are automatically archived into a database.

Specifications

Basic Rate Measurements	All measurements made in compliance with *Bluetooth* core specifications 3.0 + HS Test Suite Structure (TSS) and Test Purposes (TP) Specification 1.2/2.0/2.0 + EDR/2.1/2.1 + EDR/3.0/3.0 + HS
Output Power	TRM/CA/01/C
Measurement Configuration	Hopping: OFF or ON – measure at Defined, All, or Any frequencies Loopback or TX mode Payload: PRBS 9 Packet type: DH1, DH3, DH5
Displayed Results	Average power Peak power
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	+22 to –50 dBm average power (+23 dBm peak power)
Resolution	0.1 dB
Accuracy	+20 to –35 dBm, ±1 dB +22 to +20 dBm, ±1.5 dB
Power Control	TRM/CA/03/C
Measurement Configuration	Hopping: OFF Loopback or TX mode Payload: PRBS 9 Packet type: DH1, DH3, DH5
Displayed Results	Maximum power Minimum power Maximum step size Minimum step size Power at each power step
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	+22 to –35 dBm average power (+23 dBm peak power)
Resolution	0.1 dB
Accuracy	+20 to –35 dBm, ±1 dB +22 to +20 dBm, ±1.5 dB

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Enhanced Power Control	TRM/CA/14/C
Measurement Configuration	Measurement configuration Hopping: OFF Loopback or TX mode Payload: PRBS9 Packet type: DH1, 2DH1, 3DH1
Displayed Results	Maximum power for each packet type Minimum power for each packet type Maximum power step for each packet type Minimum power step for each packet type Maximum power difference at any step between DHn and 2DHn or 3DHn packets
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	+22 to –35 dBm average power (+23 dBm peak power)
Resolution	0.1 dB
Accuracy	+20 to –35 dBm, ±1.0 dB +22 to +20 dBm, ±1.5 dB
Initial Carrier Frequency Tolerance	TRM/CA/08/C
Measurement Configuration	Hopping: OFF or ON – measure at Defined, All, or Any frequencies Loopback or TX mode Payload: PRBS 9 Packet type: DH1
Displayed Results	Average initial frequency error Maximum positive frequency error Maximum negative frequency error
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
RF Input Measurement Range	+20 to –35 dBm
Initial Frequency Error Measurement Range	0 Hz to ±150 kHz
Frequency Resolution	1 kHz
Accuracy	500 Hz ± Frequency Standard
Carrier Frequency Drift	TRM/CA/09/C
Measurement Configuration	Hopping: OFF or ON – measure at Defined, All, or Any frequencies Loopback or TX mode Payload: 10101010 Packet type: DH1, DH3, DH5
Displayed Results	Carrier frequency drift Drift rate
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
RF Input Measurement Range	+20 to –35 dBm
Frequency Drift Measurement Range	0 Hz to 200 kHz, and >2000/50 μs
Frequency Resolution	1 kHz
Sensitivity - Single Slot Packets	RCV/CA/01/C
Measurement Configuration	Hopping: OFF or ON, user selectable Loopback only Payload: PRBS9 Packet type: DH1 Dirty transmitter (as defined in the RF test spec): ON or OFF, user defined
Displayed Results	BER (percentage) Total number of bit errors and FER
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Number of Measured Bits	1 to 10,000 packets (216 to 2,160,000 bits)
Output Power Range	0 to –90 dBm, resolution 0.1 dB
Output Power Accuracy	±1 dB, 0 to –80 dBm
BER/FER Measurement Range	0.000% to 100%
BER/FER Resolution	0.001%
Sensitivity - Multi Slot Packets	RCV/CA/02/C
Measurement Configuration	Hopping: OFF or ON, user selectable Loopback only Payload: PRBS 9 Packet type: DH3, DH5 Dirty transmitter (as defined in RF test spec): ON or OFF, user defined
Displayed Results	BER (percentage) Total number of bit errors and FER
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Number of Measured Bits	1 to 10,000 packets (for DH3, 1,464 to 14,640,000 bits), (for DH5, 2,712 to 27,120,000 bits)
Output Power Range	0 to –90 dBm, 0.1 dB resolution
Output Power Accuracy	±1 dB, 0 to –80 dBm
BER/FER Measurement Range	0.000% to 100%
BER/FER Resolution	0.001%

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Modulation Characteristics	TRM/CA/07/C
Measurement Configuration	Hopping: OFF Loopback or TX mode Payload: 11110000 and 10101010 Packet type: DH1, DH3, DH5
Displayed Results	Frequency deviation Δf1max Δf2max Δf1avg Δf2avg and Δf2avg/Δf1avg plus % of Δf2max <115 kHz
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
RF Input Measurement Range	+20 to –35 dBm
Deviation Measurement Range	0 Hz to 350 kHz peak
Deviation Resolution	1 kHz
Accuracy	1% for modulation index = 0.32
Maximum Input Level	RCV/CA/06/C
Measurement Configuration	Hopping: OFF Loopback only Payload: PRBS 9 Packet type: DH1
Displayed Results	BER (percentage) Total number of bit errors and FER
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Number of Measured Bits	1 to 10,000 packets (216 – 2,160,000 bits)
Output Power Range	0 to –90 dBm, resolution 0.1 dB
Output Power Accuracy	±1 dB, 0 to –80 dBm
EDR Measurements	
EDR Relative Transmit Power	TRM/CA/10/C
Measurement Configuration	Hopping: Off and On – measure at Defined, All, or Any frequencies Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5 Loopback or TX mode EUT power level: Max and Min
Displayed Results	Max differential power (from all packets) Min differential power (from all packets) Average differential power (over all packets)
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	+20 to –35 dBm average power (+23 dBm peak power)
Relative Power Resolution	0.01 dB, GFSK to π/4DQPSK and 8DPSK
Relative Power Accuracy	Relative power measurement accuracy between GFSK and π/4DQPSK or 8DPSK, 0.2 dB typical for a power difference of <6 dB
Relative Power Measurement Range	Relative power measurement range between GFSK and π/4DQPSK or 8DPSK, $(P_{GFSK} - 8\text{ dB}) < P_{DPSK} < (P_{GFSK} + 4\text{ dB})$
EDR Carrier Frequency Stability and Modulation Accuracy	TRM/CA/11/C
Measurement Configuration	Hopping: Off and On – measure at Defined, All, or Any frequencies Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5 Loopback or TX mode EUT power level: Max and Min
Displayed Results	Initial frequency error ω_i Frequency error ω_o Frequency error $\omega_i + \omega_o$ RMS DEVM (block with greatest DEVM value displayed) Peak DEVM 99% DEVM Average RMS DEVM (average DEVM for all blocks measured)
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Carrier Frequency Stability Measurement Range	0 Hz to ±100 kHz
Carrier Frequency Stability Accuracy	500 Hz ±Frequency Standard
Carrier Frequency Stability Resolution	1 kHz
RMS DEVM Range	30% π/4DQPSK, 20% 8DPSK
RMS DEVM Resolution	0.1% π/4DQPSK and 8DPSK
Peak DEVM Range	0 to 50% π/4DQPSK, 0 to 30% 8DPSK
Peak DEVM Resolution	0.1% π/4DQPSK and 8DPSK
EDR Differential Phase Encoding	TRM/CA/12/C
Measurement Configuration	Hopping: OFF and ON, user selectable Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5. Number of test packets: default 100 TX mode only
Displayed Results	Number of packets received Number of packets with payload data errors Percentage of errored packets
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined

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EDR Sensitivity	RCV/CA/07/C
Measurement Configuration	Hopping: OFF and ON, user selectable Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5. Bit threshold control: Threshold 1, 1.6 million bits, Threshold 2, 16 million bits (user editable) Loopback only Dirty transmitter (as defined in RF test spec): ON or OFF, user selectable
Displayed Results	Overall BER (displayed in exponential format) Number of bits in error Number of packets sent by test set Number of packets received in error by EUT
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	0 to –90 dBm, resolution 0.1 dB
Output Power Accuracy	±1 dB, 0 to –80 dBm
EDR BER Floor Performance	RCV/CA/08/C
Measurement Configuration	Hopping: OFF and ON, user selectable Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5 Bit threshold control: Threshold 1, 8 million bits, Threshold 2, 160 million bits (user editable) Loopback only
Displayed Results	Overall BER (displayed in exponential format) Number of bits in error Number of packets sent by test set Number of packets received in error by EUT
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	0 to –90 dBm, resolution 0.1 dB
Output Power Accuracy	±1 dB, 0 to –80 dBm
EDR Maximum Input Level	RCV/CA/10/C
Measurement Configuration	Hopping: OFF and ON, user selectable Modulations: π/4DQPSK and 8DPSK Packet type: 2-DH1, 3, 5 and 3-DH1, 3, 5 Number of bits: default 1.6 million (user editable) Loopback only
Displayed Results	Overall BER (displayed in exponential format) Number of bits in error Number of packets sent by test set Number of packets received in error by EUT
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	0 to –90 dBm, resolution 0.1 dB
Output Power Accuracy	±1 dB, 0 to –80 dBm
Low Energy Measurements	BLE measurements made in compliance with *Bluetooth* RF test specification RF_PHY.TS/4.0.0
BLE Output Power	TRM-LE/CA/01/C and TRM-LE/CA/02/C
Measurement Configuration	DUT configured to transmit Test Reference Packets. Packet payload: PRBS9
Displayed Results	Average power Peak to average power
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	+22 to –50 dBm average power (+23 dBm peak power)
Resolution	0.1 dB
Accuracy	+20 to –35 dBm, ±1.0 dB +22 to +20 dBm, ±1.5 dB
BLE Modulation Characteristics	TRM-LE/CA/05/C
Measurement Configuration	DUT configured to transmit Test Reference Packets. Packet payload: 11110000 and 10101010
Displayed Results	Frequency deviation Δf1max Δf2max Δf1avg Δf2avg, Δf2avg / Δf1 avg ratio, %Δf2max, > 185 kHz
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	RF input: +20 to –35 dBm Deviation: 0 Hz to 500 kHz peak
Resolution	Deviation: 1 kHz
Accuracy	1% for modulation index 0.5
BLE Carrier Frequency Offset and Drift	TRM-LE/CA/06/C and TRM-LE/CA/07/C
Measurement Configuration	DUT configured to transmit Test Reference Packets. Packet payload: 10101010
Displayed Results	Carrier frequency error Frequency drift Drift rate
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Measurement Range	RF input: +20 to –35 dBm Frequency: 500 kHz
Frequency Resolution	1 kHz
Accuracy	500 Hz ± Frequency standard

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BLE Receiver Sensitivity	RCV-LE/CA/01/C and RCV-LE/CA/02/C
Measurement Configuration	DUT configured to receive Test Reference Packets. Packet payload: PRBS9 Full support of Dirty Transmitter as defined in test specification
Displayed Results	Receiver PER. Requires DUT to support HCI UART or USB or 2-Wire interface for automated PER results.
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	0 to –90 dBm, resolution 0.1 dB
Output Power Accuracy	± 1 dB, 0 to –80 dBm
BLE Maximum Input Signal Level	RCV-LE/CA/06/C
Measurement Configuration	DUT configured to receive Test Reference Packets. Packet payload: PRBS9
Displayed Results	Receiver PER. Requires DUT to support HCI UART or USB or 2-Wire interface for automated PER results.
Number of Measurement Frequencies	Three, default to RF Test Specification or user defined
Output Power Range	0 to –90 dBm, resolution 0.1 dB
Output Power Accuracy	± 1 dB, 0 to –80 dBm
BLE PER Report Integrity	RCV-LE/CA/07/C
Measurement Configuration	DUT configured to receive Test Reference Packets. Packet payload: PRBS9 CRC corruption: Alternate packets Number of test packets: Random [100 ≤ RND ≤ 1500]
Displayed Results	Receiver PER. Requires DUT to support HCI UART or USB or 2-Wire interface for automated PER results.
Number of Measurement Frequencies	One, default to RF Test Specification or user defined
Output Power Range	0 to –90 dBm, resolution 0.1 dB
Output Power Accuracy	± 1 dBm (0 to –80 dBm)
MT8852B Signal Generator	
Frequency	
Frequency Range	2.40 GHz to 2.5 GHz
Frequency Resolution	1 kHz
Frequency Accuracy	As frequency standard ±500 Hz
Level	
Amplitude Range	0 to –90 dBm
Amplitude Accuracy	±1 dB (0 to –80 dBm)
Amplitude Resolution	±0.1 dB
Output Impedance	50Ω (nominal)
Output VSWR	1.5:1 (typically 1.3) Adjacent channels 3 or higher –40 dBc
GFSK Modulation	
Modulation Index	Variable, 0.25 to 0.50 (125 kHz to 250 kHz)
Modulation Index Resolution	0.01
Modulation Index Accuracy	1% for Modulation Index = 0.32
Baseband Filter	BT = 0.5
π/4DQPSK Modulation	
Modulation Index Accuracy	<5% RMS DEVM
Baseband Filter	BT = 0.4
8DPSK Modulation	
Modulation Index Accuracy	<5% RMS DEVM
Baseband Filter	BT = 0.4
MT8852B Measuring Receiver	
Frequency	
Frequency Range	2.40 GHz to 2.5 GHz
Frequency Resolution	1 kHz
Frequency Accuracy	As frequency standard ±500 Hz
Level	
Range	+22 to –55 dBm average power
Power Measurement Accuracy	±1 dB (+20 to –35 dBm)
Input VSWR	1.5:1
Damage Level	+25 dBm
Resolution	0.1 dB
GFSK Modulation	
Deviation Measurement Range	0 to 350 kHz peak
Accuracy	1% for Modulation Index = 0.32
EUT Control Interface	
RS-232 HCI commands	The EUT control interface provides RS-232 HCI commands to the EUT through a standard RS-232 interface. The interface meets the requirements of the *Bluetooth* specification for HCI UART transport layer. A RS-232 cable is supplied.
USB HCI commands	The EUT control interface provides USB HCI commands to the EUT through a standard USB interface. The interface meets the requirements of the *Bluetooth* specification section H: 2. A USB cable is supplied.
2-Wire control	For test control of *Bluetooth* low energy devices the EUT control interface supports the 2-Wire specification

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Audio Specifications	
Number of SCO Channels Supported	3
Codec Air Interfaces Supported	CVSD, A-Law, μ-Law
Frequency Response	(–3 dB) measured CODEC in to CODEC out: 160 Hz –3.5 kHz. Measured with 50Ω source impedance and 10 MΩ load impedance
Maximum Input/Output Signal Level	3.4 V_{pk-pk} = 1.2V RMS
Distortion/Noise	A law: typical –37 dB at 1 kHz, 1 V RMS μ law: typical –37 dB at 1 kHz, 1 V RMS CVSD: typical –30 dB at 300 Hz, 1 V RMS
Input/Output Connectors	3.5 mm audio jack plugs (one for each SCO channel)
Input Impedance	20 kΩ
Minimum Output Load	600Ω
Internal Audio Source	1 kHz fixed frequency
AFH (Option 15)	Supported in ACL and SCO connections
Displays	Active channel vs. time, FER vs. time
Other Features	ACL connection timer, resolution 1 ms
Frequency Standard	
Frequency	10 MHz
Temperature Stability	±0.5 ppm, –10° to +85°C
Aging (1st year)	±1.0 ppm
Aging (over 10 years)	±2.5 ppm, including year 1
Rear Panel Connectors	
External Frequency Standard Input	Rear panel BNC socket, 50Ω 1 volt
Output 1	TTL output for TX ON, TX DATA, RX DATA, and correlator
Output 2	TTL output for RX ON, TX DATA, RX DATA, and correlator
Input 1	For service use only
GPIB	
IEE 488.2	Offers full instrument control as standard
RS-232	
RS-232	Offers full instrument control as standard
General	
Power Supply	85 V(ac) to 264 V(ac)
Frequency	47 Hz to 63 Hz
Power	150 VA Max
Environmental	
Operating temperature	+5° to +40°C
Operating humidity	20% to 75%
Safety	Complies with IEC 61010-1
EMC	Conforms to the protection requirements of EEC Council Directive 89/336/EEC
Size and Weight	
Dimensions	216.5 × 88 × 380 mm
Weight	<3.45 kg

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MT8852B	*Bluetooth* Test Set with EDR and Audio
MT8852B-040	*Bluetooth* Test Set with no EDR and no Audio
MT8852B-041	*Bluetooth* Test Set with no EDR and with Audio
MT8852B-042	*Bluetooth* Test Set with EDR and no Audio
MT8852B-043	*Bluetooth* Low Energy Measurements Only
	Included accessories
	MT8852B Operation Manual
	MT8852B Remote Programming Manual
	BlueSuite Software (standard version)
	RS 232 HCI Control Interface Lead
	USB HCI Control Interface Lead
	RS 232 Cable for Firmware Updates
	Power Cord for Destination Country
	Certificate of Calibration
	3.5 mm Jack Plugs (Qty 3) Audio Versions only
	BlueTest2 Software

Model/Order No.	Name
	Options and accessories
2400-82	Rack Mount Kit
MT8852B-014	Headset and Hands-free Profile Emulator Software
MT8852B-015	Adaptive Frequency Hopping Option
MT8852B-017	IQ Data Output
MT8852B-027	*Bluetooth* Low Energy Measurements
MT8852B-319	Retrofit Audio to MT8852B
MT8852B-325	Retrofit EDR to MT8852B
MT8852B-330	Retrofit Basic Rate Measurements to MT8852B-043
MT8852B-098	Standard Calibration to ANSI/NCSL Z540
MT8852B-099	Premium Calibration to ANSI/NCSL Z540 (Test report and uncertainty data included)
MX885201B	BlueSuite Pro3 Software Application
2000-1613-R	*Bluetooth* Antenna and Adaptor
D41310	Soft Carry Bag

Bluetooth AUDIO TEST SET

MT8855A

20 Hz to 20 kHz

Remote Control
USB

For Rapid Audio Measurements on Products Running Bluetooth Audio Profiles

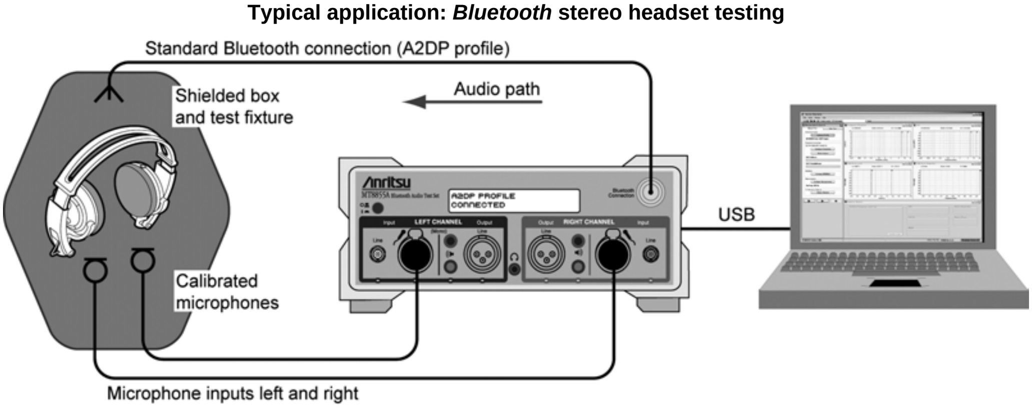
The MT8855A is the world's first test set designed specifically to perform high-quality audio measurements on products using the *Bluetooth* Advanced Audio Distribution Profile (A2DP), the Headset profile, or the Hands-Free profile.
The MT8855A is the ideal instrument for both design validation and manufacturing test. Typical *Bluetooth* products that can be tested with the MT8855A include stereo and mono headsets, mobile phones, digital music players, integrated and accessory car kits, and desktop speakers. Accessory microphones and speakers connect directly to the MT8855A's audio inputs and outputs to enable the development of a complete test system. Module testing is also facilitated using direct connection to the RF and audio connectors.
After establishing a *Bluetooth* connection with the DUT, the MT8855A's integrated audio generators and analyzers are used to perform measurements including level, frequency response, and THD+N.

Features

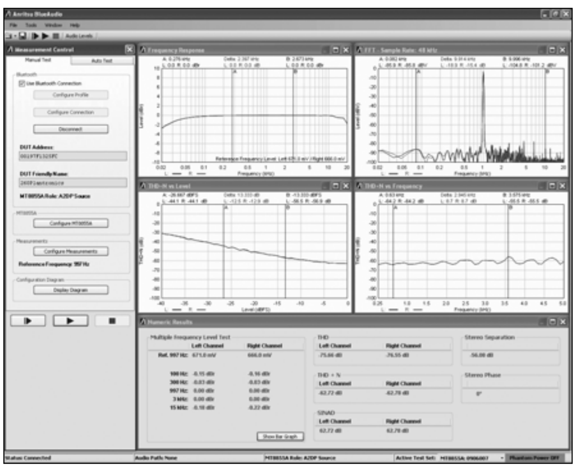
- 20 Hz to 20 kHz frequency coverage
- THD, THD+N, SINAD distortion measurements
- Stereo phase and stereo separation
- Graphical measurements of frequency response, plus THD+N vs. level and frequency
- Audio FFT analyzer aides fault finding
- A2DP profile support for stereo headset testing
- Headset and Hands-Free profile support for mono headsets
- PC-installed user interface: BlueAudio
- Manual mode for R&D applications
- Auto mode runs user defined test plans for production testing
- Audio generator: common stereo tone frequency, or mono
- Two audio analyzers: stereo left / right or mono
- Direct connection of accessory microphones and speakers
- Built-in speakers
- Under 10 seconds test time for typical headset
- Independent audio generator and analyzer for non *Bluetooth* applications
- Included documentation and programming examples show how to use the MT8855A Class Library to create user test programs
- Pass Through mode: supports use of external audio sources and analyzers
- SCO/eSCO connections for testing modules without profile support
- PESQ/MOS measurement option

Stereo headsets running the A2DP or Hands-Free profile are now a common wireless device for use with mobile phones and digital music players. Ensuring the HiFi-quality audio that users have come to expect from these headsets places demands on the manufacturer for performance and reliability. The MT8855A is the ideal test solution to meet these demands by allowing rapid characterization of the audio performance of the fully assembled product.

Typical application: *Bluetooth* stereo headset testing



For headset speaker testing, a test fixture that couples the headset speakers to the test system's microphones is integrated into a shielded enclosure. The MT8855A's built-in microphone power supply allows for direct connection of the accessory microphone without the need for additional amplifiers or power supplies.
A frequency response curve supplied with the microphone, corrects headset speaker measurements, specifically to provide accurate audio level measurements. The response of the DUT can also be compared with a stored "Golden Trace" for comparative measurements. These tests validate the performance of headset DAC, amplifiers, and speaker cones.
The BlueAudio software displays the left and/or right channel frequency response as detected by the microphones. Additional measurements of THD+N, stereo separation and stereo phase can be displayed simultaneously. Typically these measurements are performed on a 997 Hz tone.
The total test time for a 5 point frequency response plus 997 Hz THD+N, stereo separation, and stereo phase (including inquiry and connection time) is typically less than 10 seconds.
To test the headset microphone and audio input stages, the MT8855A plays an audio test signal through the accessory speaker coupled to the target microphone. Speaker frequency correction curves can again be applied to eliminate the response of the speaker from the results of measurements.
The MT8855A decodes the audio tone received over the *Bluetooth* connection and processes it to generate the audio measurement results. The recovered tone can be routed to the integrated speakers or to a headphone jack plug for use in rapid functional testing.



BlueAudio Manual Test screen showing measurement control window with graphic and numeric measurement results.

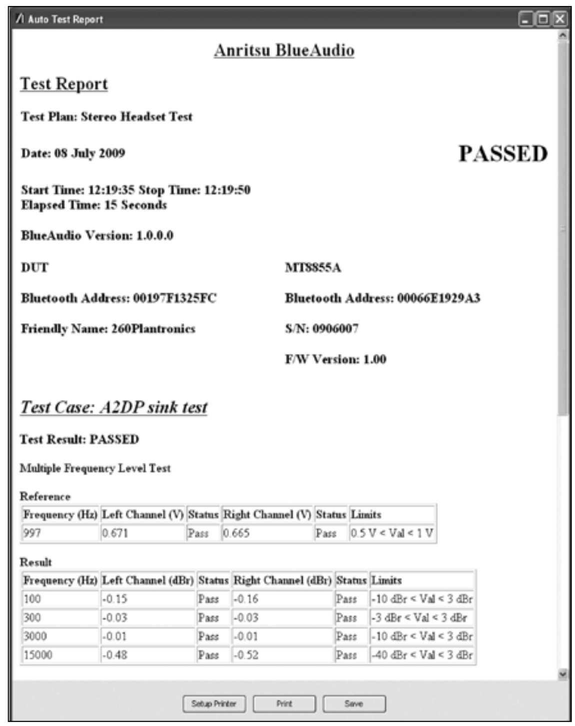
BlueAudio

The BlueAudio software, supplied with each MT8855A, is installed on a PC that connects to the MT8855A using a standard USB cable. BlueAudio serves as the MT8855A's front panel and is used to configure the instrument and display graphical and numeric measurement results. It communicates with the MT8855A by means of the class library dll file.
Configuring the MT8855A for testing is a simple, four-step process.

1. Define the *Bluetooth* profile and the role of the MT8855A, e.g., A2DP Source.
2. Define the *Bluetooth* connection process, e.g., Inquiry with Authentication.
3. Select the audio inputs and outputs, e.g., microphone input and speaker output.
4. Select the measurements to be performed, e.g., THD+N and frequency response.

BlueAudio displays both numeric and graphical results. For high volume production testing, the numeric results provide a comprehensive overview of the device's performance. A 5 frequency level test can be defined, in addition to distortion (THD+N, THD, SINAD), stereo phase and separation results.

During design validation, the graphical traces provide addition detail and device characterisation to assist with fault diagnostics. An audio FFT analyzer displays the full spectrum of the audio signal being analyzed. Harmonics and spurious are easily identified and the presence of any audio warping can be seen by monitoring the fundamental frequency tone.
A frequency response curve with up to 201 data points can be configured to get a true representation of the test device's characteristics.
Resonances are clearly displayed and switching to a logarithmic frequency scale reveals detail in the critical low frequency region. Complex limit lines can be generated for automated Pass/Fail judgement, or alternatively the live trace can be compared with a stored "Golden Trace".
THD+N can be viewed as a function of frequency and level. This provides, in clear graphical format, a comprehensive view of the characteristics of a DUT under a full range of operating conditions.
The BlueAudio software also includes an "Auto Test" mode that enables the user to define a sequence of tests and run these automatically as a "Test Plan". Each Test Plan may include multiple profiles and measurements, and the results of measurement are saved in a database for analysis and review. The Auto Test mode has been developed to offer high-volume manufacturers a fully-functional production test program that runs a test plan and saves results in the shortest possible time.



Auto Test Report

Anritsu BlueAudio

Test Report

Test Plan: Stereo Headset Test

Date: 08 July 2009 PASSED

Start Time: 12:19:35 Stop Time: 12:19:50
Elapsed Time: 15 Seconds

BlueAudio Version: 1.0.0.0

DUT MT8855A

Bluetooth Address: 00197F1325FC Bluetooth Address: 00066E1929A3

Friendly Name: 260Plantronics S/N: 0906007

F/W Version: 1.00

Test Case: A2DP sink test

Test Result: PASSED

Multiple Frequency Level Test

Reference

Frequency (Hz)	Left Channel (V)	Status	Right Channel (V)	Status	Limits
997	0.671	Pass	0.665	Pass	0.5 V < Val < 1 V

Result

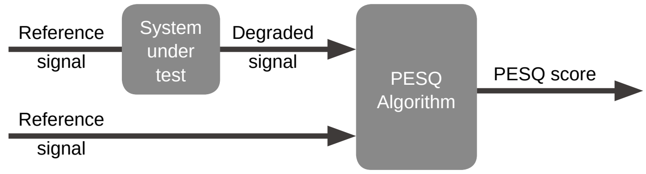
Frequency (Hz)	Left Channel (dBr)	Status	Right Channel (dBr)	Status	Limits
100	-0.15	Pass	-0.16	Pass	-10 dBr < Val < 3 dBr
300	-0.03	Pass	-0.03	Pass	-3 dBr < Val < 3 dBr
3000	-0.01	Pass	-0.01	Pass	-10 dBr < Val < 3 dBr
15000	-0.48	Pass	-0.52	Pass	-40 dBr < Val < 3 dBr

Setup Printer Print Save

Example Auto Test measurement report from BlueAudio.

PESQ/MOS Measurements Option

PESQ (Perceptual Evaluation of Speech Quality) is an objective measurement of voice quality used in telecommunications systems. PESQ has been used in traditional telephone networks, VoIP, and cellular phone systems for many years and has now been adopted by Anritsu as a solution for *Bluetooth* audio applications. As illustrated below, a reference audio signal is passed through the system under test and the degradation in the audio signal is measured by an algorithm. The PESQ algorithm was developed by KPN Research (Netherlands) and British Telecommunications (UK). It was approved by the ITU in 2001 and adopted as ITU-T recommendation P862. PESQ measurements have largely replaced Mean Opinion Score (MOS) measurements that were based on subjective scores given by a panel of listeners. A PESQ score can be converted to a MOS score using a formula supplied by the ITU.



Specifications

RF	
RF Connections	Type N (f), Impedance 50 Ohms
RF Level	Support for both cable connections and over-air connections. Setting 1: Nominally –5 dBm for over-air connections Setting 2: Nominally –40 dBm for cable connections
Radio RF Performance	Compliant with requirements of core specification 1.2, 2.0, 2.1 + EDR for initial frequency, modulation, drift, and sensitivity test cases.
System Modes	
Bluetooth Audio Measurements	Creates a Bluetooth connection to DUT and uses internal audio generator and analyzer for measurements
Bluetooth Pass Through	Creates a Bluetooth connection to the DUT, external audio source and analyzer routed through instrument line input and output.
Analogue Audio Measurements	Audio measurements using internal audio generator and analyzer with no Bluetooth connection.
Profiles	
Profiles	Headset, Hands-Free (Gateway and Device), A2DP (sink and source), AVRCP For DUTs that do not support HSP, HFP, A2DP profiles, a basic SCO/eSCO connection can be established for audio testing.
Supported Codecs	CVSD, SBC, μ-Law, A-Law
Audio Generators	
Audio Generators	2 linked for left and right channels
Freq Range	20 Hz to 20 kHz
Freq Resolution	1 Hz
Freq Accuracy	0.1 Hz at 997 Hz. 100 ppm across full frequency range
Line Output	
Line Output Connectors	XLR, one each for left and right (usable for both balanced and unbalanced)
Line Output Level	Voltage range: 1 mV to 2 V RMS into 600 Ohms or greater Plus tone off mode
Line Output Resolution	1 mV
Line Output Level Accuracy	±0.1 dB at 997 Hz into 600 Ohms or greater for voltage range 100 mV to 2 V ±0.5 dB at 997 Hz into 600 Ohms or greater for voltages <100 mV
Line Output Flatness	±0.5 dB at 20 Hz to 20 kHz relative to 997 Hz for voltage range 100 mV to 2 V ±1 dB from 20 Hz to 20 kHz relative to 997 Hz for voltages <100 mV
Line Output Distortion	≤–87 dB THD+N at 997 Hz at 200 mV to 2 V output into 600 Ohm load
Output Impedance	Impedance: <120 Ohm
Speaker Output	
Speaker Output Connector	4 mm socket left and right outputs
Speaker Output Level	2 × 1 Watt into 8 Ohm Suitable for speakers with impedance in range 4 Ohm to 32 Ohm
Speaker Output Resolution	10 mV
Speaker Output Accuracy	±0.2 dB at 997 Hz into 8 Ohms, 100 uW to 1 W
Speaker Output Flatness	±1.0 dB from 20 Hz to 20 kHz at 100 mW relative to 997 Hz
Speaker Output Distortion	<–50 dB THD+N at 997 Hz at 100 mW
Speaker Output Impedance	<1 Ohm (nominal value 0.1 Ohm at room temperature)
Audio Analyzer	
Audio Analyzer	For left and right channels
Freq Range	20 Hz to 20 kHz

Continued on next page

Line Input	
Line Input Connection	BNC Impedance: 100k Ohms Input level: 10 mV to 4 V Measurement resolution: 1 mV
Measurements for Line Input	Level: Input levels 20 mV to 4 V: ±0.5 dB over 20 Hz to 20 kHz ±0.1 dB at 997 Hz Input levels 10 mV to 19 mV: ±1 dB over 20 Hz to 20 kHz ±0.2 dB at 997 Hz THD+N: Input level 1 V at 997 Hz: ±0.5 dB over range –80 to –20 dB Input levels 100 mV to 4 V at 997 Hz: ±1.0 dB over range –80 to –20 dB THD: Input levels 100 mV to 4 V at 997 Hz: ±0.5 dB over range –80 to –20 dB Stereo Separation: ±1.0 dB at input level 1 V at 997 Hz over dynamic range of 80 dB Stereo Phase: Mic input –90 to +270 ±1 degree ±1 sample at 997 Hz for input of 10 mV or greater, with signal to noise ratio of 30 dB or greater
Microphone Input	
Microphone Input Connection	XLR Impedance: 2 k Ohms nominal Input level: 1 mV to 200 mV Measurement resolution: 0.1 mV Balanced Internal 48 V phantom power supply for accessory microphone. Compliant with EN61938: 1997.
Measurements for Microphone Input	Level accuracy: Input levels 10 mV to 200 mV: ±0.2 dB at 997 Hz ±0.5 dB, 100 Hz to 20 kHz –3 dB at 20 Hz Level accuracy: Input levels 2 mV to 9.9 mV: ±0.5 dB at 997 Hz ±1 dB, 100 Hz to 20 kHz –3 dB at 20 Hz THD+N: For input levels 10 mV to 100 mV: ±0.5 dB, –65 to –20 dB THD: For input levels 10 mV to 100 mV: ±0.5 dB, –65 to –20 dB Stereo Separation: Accuracy: ±1 dB at input level 10 mV at 997 Hz and 20 kHz over dynamic range of 60 dB Stereo Phase: Mic input –90 to +270 ±1 degree ±1 sample at 997 Hz for input of 10 mV or greater, having signal to noise ratio of 30 dB or greater
Other Audio Outputs	
Built-in Speakers	2 integrated speakers
Headphone Connector	3.5 mm stereo output for connection of standard headphones. Connection of a headset automatically mutes the internal speakers.
Bluetooth Digital Output Level	
Level of Sinusoidal Test Signal Relative to Maximum Peak Sinusoid	0 dBFS to –40 dBFS
BlueAudio PC Application	
BlueAudio Software	PC GUI application in VB.NET. Configures MT8855A hardware and displays results graphically and numerically. BlueAudio contains a Manual Mode in which individual tests are configured and run, and an Auto Test mode in which a test plan is generated and executed, with results automatically displayed in a report and saved to a database.
BlueAudio Display Windows	Measurement control: • Bluetooth profile • Bluetooth connection • Input/Output configuration • Measurement configuration Results: Left/Right channel results displayed simultaneously. • Numeric – Level (5 frequency level measurements) – THD+N – THD (up to max. 20 harmonics for 1 kHz tone, or less) – SINAD – Stereo separation – Stereo phase – PESQ/MOS (requires option) • Graphical – Freq response – FFT – THD+N vs. level – THD+N vs. Freq
PC Requirements	The BlueAudio application runs on Windows XP and Vista operating systems. The application supports English, Chinese, Japanese operating systems. BlueAudio runs through a USB connection to the MT8855A.

Continued on next page

PESQ and MOS Option	
Option-032 PESQ/MOS	Performs PESQ (Perceptual Evaluation of Speech Quality) and MOS (Mean Opinion Score) measurements on reference audio signals. Reference audio signals can be: user created, downloaded from the ITU web site or MT8855A-033 ASTS files. PESQ/MOS measurements are supported on HSP/HFP profiles with MT8855A role defined as Audio Gateway and SCO/eSCO connections. Anritsu licence the PESQ measurement algorithm from Psytechnics Limited. The PESQ measurement conforms to ITU-T P.862.
Option-033 ASTS Reference Audio Signals	Artificial Speech-like Test Stimulus (ASTS) are audio files that have been specially formulated for use in PESQ measurements. They contain a full range of British and American English phonetic sounds in short, 10 second files. Male and female voices supplied.
User Programming Interface	
API Interface to MT8855A Class Library	Documentation and programming examples that explain how to use the MT8855A Class Library to create user test programs.
BlueStart	A sample open source program developed in Visual Basic 2005 with comprehensive comments.
General	
General	Power supply: 85 V(ac) to 264 V(ac) Frequency: 47 Hz to 63 Hz Power: 50 Watt max, 25 Watt typical Dimensions: 230 (W) × 110 (H) × 387 (D) mm Weight: 3.5 kg Operating temperature range: +5° to +40°C Operating humidity: <75% non condensing Safety: Complies with BS EN 61010-1 (Equivalent to IEC 61010-1). EMC: Conforms to the protection requirements of EEC Council Directive EN61326: 2006.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Power meter models
MT8855A	*Bluetooth* Audio Test Set
MT8855A-032	PESQ/MOS Measurement Option
MT8855A-033	Artificial Speech-like Test Stimulus (ASTS) Audio Files Option
	Included accessories
13000-00280	Operation Manual (Printed)
2300-295	CD with BlueAudio Software and PDF Operation Manual
2000-1611-R	USB Cable for Connection of MT8855A to PC
553-525-R	XLR (f) to BNC (f) Adaptor (Qty. 2) for Line Out Socket
553-526-R	BNC (m) to Phono (f) (Qty. 4)
	Optional accessories
2400-84-R	Rack Mount Kit
2000-1607-R	Standard Microphone (including interface cable) (typical frequency response calibration data)
2000-1608-R	Calibrated Microphone (including interface cable) (individually calibrated frequency response data)
2000-1612-R	Test Speaker
2000-1613-R	2.4 GHz Antenna and Adaptor
MT8855A-098	Standard Calibration to ANSI/NCSLI Z540-1 (Certificate of calibration only)
MT8855A-099	Premium Calibration to ANSI/NCSLI Z540-1 (Certificate of calibration with test report and uncertainty data included)
D41310	Soft carry case

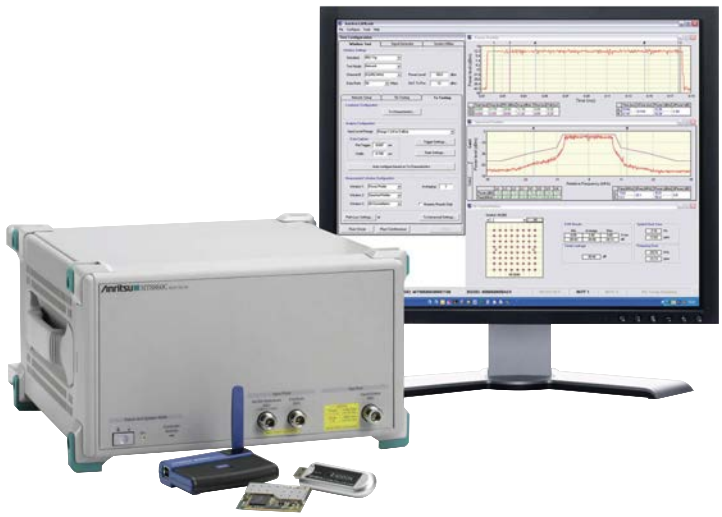
WLAN TEST SET

MT8860C

2412 MHz to 2484 MHz and 5150 MHz to 5825 MHz 802.11b/g/a frequency bands

Remote Control
GPIB | Ethernet

One Test Set, Two Modes of Testing



The MT8860C is an integrated one-box test set dedicated to testing 802.11 WLAN devices. It provides a high-speed measurement solution that is ideally suited for design proving and production testing. The MT8860C replaces existing test systems that typically utilize power meters, spectrum analyzers and gold radios with external attenuators. The end result is a test instrument that is easier to integrate into production, provides traceable and repeatable measurements and offers a universal solution for all WLAN chip sets. By being simpler to maintain and calibrate, the MT8860C also reduces test system costs, increases production throughput and delivers the most flexible WLAN test system.
The MT8860C provides two modes of operation: Network and Direct. In "Network" mode, standard WLAN signaling is used to test both the transmitter and receiver of the device under test (DUT). In "Direct" mode, the MT8860C tests the DUT receiver by automatically creating and transmitting WLAN packets, and measures the DUT transmitter by using its built-in transmitter analyzer. In Direct mode, the DUT must be controlled by the test mode software utility from the chipset vendor.
The user interface is implemented through the supplied LANLook software package. LANLook runs on a standard PC and uses a conventional Windows®-based interface for both instrument configuration and control. Measurement results are displayed in clear numerical and graphical formats. LANLook communicates with the MT8860C using remote commands that are sent via a GPIB or Ethernet interface.

Key Features

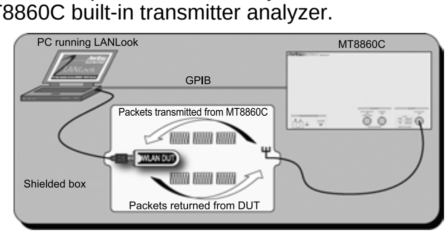
- Integrated test set for validating the RF performance of 802.11b/g/a/n devices operating in the 2.4 GHz and 5 GHz frequency bands
- "Network" mode allows devices to be tested in a connection using standard WLAN signalling.
- "Direct" mode allows WLAN devices to be tested with the support of control software from the chipset vendor
- Built-in reference radio for calibrated Packet Error Rate (PER) measurements
- Built-in TX Analyzer providing high-speed measurements including power, spectral mask and modulation accuracy (EVM)
- Dedicated WLAN signal generator for 802.11b/g/a
- Supports GPIB and Ethernet remote interfaces
- Validated for CTIA and Wi-Fi Alliance CWG Certification testing
- LANLook software for instrument configuration and results display
- CombiTest software for automated production test requirements including 802.11 (with MT8860C) and 802.11/*Bluetooth* (with MT8860C + MT8852B) combo modules.

Network Mode Measurements

Network mode greatly simplifies the measurement set-up and allows any WLAN device to be tested in a mode that closely reflects its native operation. The MT8860C built-in reference radio simulates both an Access Point (AP) or client device/station (STA), and using standard protocol messaging, establishes a network connection with the DUT. Once a connection is made, both the transmitter and receiver of the DUT can be tested without the need for control software from the chipset vendor.

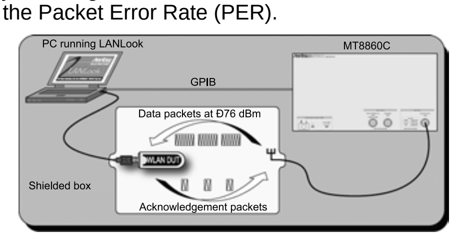
Network Mode Transmitter Testing

When testing the transmitter characteristics of a WLAN device, the MT8860C uses a "Packet Loopback" technique whereby packets containing a control message are transmitted by the MT8860C to the DUT. The control message instructs the DUT to re-transmit the data received. The packets returned by the DUT are then captured by the MT8860C built-in transmitter analyzer.



Network Mode Receiver Testing

For receiver sensitivity testing, the MT8860C transmits packets at power levels down to –100 dBm. For each packet correctly received, the DUT responds by transmitting an acknowledgement (ACK) packet. By counting the number of ACKs, the MT8860C is able to calculate the Packet Error Rate (PER).



The use of a reference radio allows testing to be performed at different data rates with real-time configuration of the packet structure, including MAC address and payload length.

Direct Mode Measurements

In Direct mode, the MT8860C acts as a transmitter analyzer and WLAN signal source. This mode of operation is most similar to the test method that uses spectrum analyzers, power meters and gold radios for device testing.
Control software supplied by the chipset vendor is used to configure the DUT via a host processor interface. Testing of the WLAN transmitter and receiver is performed by the MT8860C without a network connection being established.

Direct Mode Transmitter Testing

The WLAN device is configured to continuously transmit packets. The MT8860C built-in transmitter analyzer is configured to trigger on the incoming packets and performs all the selected transmitter measurements in parallel.

Direct Mode Receiver Testing

When testing the Rx sensitivity of a device in Direct mode, the MT8860C is configured to transmit a specified number of data packets. After the final packet has been transmitted, a basedband register (internal to the DUT) is read. This register contains the number of packets received without error.
The PER is then calculated from the number of packets sent by the MT8860C and the number received without error.

MT8860C Software Support

Two PC based software programs are supplied as standard with the MT8860C WLAN Test Set - LANLook and CombiTest.
LANLook provides an ideal user-interface for development engineers validating the performance of WLAN devices. All aspects of the MT8860C can be configured and controlled using LANLook. Transmitter and Receiver measurements can be performed and the resultant data can then be read back and displayed in both graphical and numeric formats. LANLook is written in Visual BasicR and full source code is provided allowing users to customize the software to exactly match their own unique requirements.
CombiTest is the ideal PC software program for testing large numbers of WLAN devices quickly, easily and repeatedly in either a production or R&D environment. CombiTest allows a user to predefine a test plan of measurements, and to use all or part of this as required to perform both Tx and Rx testing on 802.11b, 802.11g, 802.11a and 802.11n devices. CombiTest can also be used to control an MT8852B *Bluetooth* test set for testing combo devices that support *Bluetooth*/WLAN radios.
For WLAN testing, CombiTest allows all combinations of channel number and data rate to be tested using a user-defined sequence of transmitter and receiver measurement scripts. A channel number and data rate are specified for each measurement script. One or more measurements can be selected, and for each measurement pass/fail limits can be defined. Graphical data can also be requested where applicable.
CombiTest is designed to support the full test and measurement capabilities of MT8860C. Consequently, test plans can be created for use in both “Network” and “Direct” modes of operation. With “Network” mode selected, protocol-based messaging is used by the MT8860C to dynamically configure the DUT. As a result, test plans can be created that proceed to completion without manual intervention. When “Direct” mode is selected, protocol-based messaging is not used. Instead, the DUT must be configured using chipset vendor control software - with configuration commands being sent to the DUT via a host processor interface rather than over the radio layer. In order to provide a fully automated solution, the control software and related configuration commands must be supported within CombiTest.
CombiTest provides a DUT control interface that allows Dynamic Link Library (DLL) files to be “registered” with CombiTest. Each DLL file contains the configuration commands required for a particular chipset. Once a DUT control DLL is registered, it can be selected as part of the overall test mode setup. When a test plan is executed, the DUT is dynamically configured using commands sent via the host processor interface. As a result, no external control is required and the test plan can proceed to completion. In partnership with a number of tier 1 WLAN chipset vendors, a library of DUT control DLL packages for use with CombiTest has been developed. For latest information regarding available control DLL packages, please e-mail wlan.support@anritsu.com.

Supported Measurements

802.11b (DSSS data rates – 1, 2, 5.5 and 11 Mbps)

IEEE802.11-2007 Reference	Test Parameter	Limit
18.4.7.1	Transmit power levels	Follows national regulatory domain requirements
18.4.7.2	Transmit power level control	Required for radios >100 mW
18.4.7.3	Transmit spectrum mask	Defined limit mask
18.4.7.4	Transmit center frequency tolerance	±25 ppm
18.4.7.5	Chip clock frequency tolerance	±25 ppm
18.4.7.6	Transmit power-on and power-down ramp	<2 µs
18.4.7.7	RF carrier suppression	–15 dB, unscrambled 1010 payload
18.4.7.8	Transmit modulation accuracy	<0.35 EVM peak, DQSK modulation
18.4.8.1	Receiver minimum input sensitivity	PER <8%, –76 dBm input level, 11 Mbps
18.4.8.2	Receiver maximum input level	PER <8%, –10 dBm input level, 11 Mbps
18.4.8.3	Receiver adjacent channel rejection*	>35 dB, PER <8%, 25 MHz separation, 11 Mbps

802.11g & 802.11a
(OFDM data rates – 6, 9, 12, 18, 24, 36, 48 and 54 Mbps)

IEEE802.11-2007 Reference	Test Parameter	Limit
19.4.7.1 (17.3.9.1)	Transmitter power levels	Follows national regulatory domain requirements
19.5.4 (17.3.9.2)	Transmit spectrum mask	Defined limit mask
19.4.7.2 (17.3.9.4)	Transmit center frequency tolerance	±25 ppm (802.11g); ±20 ppm (802.11a)
19.4.7.3 (17.3.9.5)	Symbol clock frequency tolerance	±25 ppm (802.11g); ±20 ppm (802.11a)
19.4.7 (17.3.9.6.1)	Transmit center frequency leakage	No greater than –15 dB relative to overall transmitted power
19.4.7 (17.3.9.6.2)	Transmitter spectral flatness	±2 dB maximum deviation, subcarrier 1 to 16; +2 to –4 dB, subcarrier 17 to 26
19.7.2.7 (17.3.9.6.3)	Transmitter constellation error	No greater than –25 dB RMS EVM, 54 Mbps
19.5.1 (17.3.10.1)	Receiver minimum input sensitivity	PER <10%, –65 dBm input, 54 Mbps
19.5.2 (17.3.10.2)	Receiver adjacent channel rejection*	No less than –1 dB, PER <10%, 54 Mbps
17.3.10.3	Receiver non-adjacent channel rejection*	No less than 15 dB, PER <10%, 54 Mbps
19.5.3 (17.3.10.4)	Receiver maximum input level	PER <10%, –20 dBm input

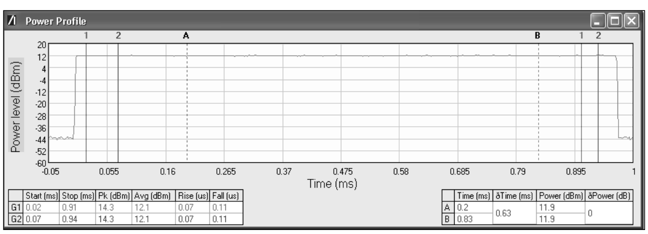
IEEE802.11-2007 supersedes IEEE802.11b-1999, IEEE802.11g-2003 and IEEE802.11a-1999

802.11n

IEEE Std 802.11n-2009 Reference	Test Parameter	Limit
20.3.21.1	Transmit spectrum mask	Defined limit mask based on channel bandwidth
20.3.21.2	Transmitter spectral flatness	Defined limits based on channel bandwidth
20.3.21.3	Transmit power	Follows regional and national regulatory domain requirements
20.3.21.4	Transmit center frequency tolerance	± 20 ppm maximum (5 GHz band) ±25 ppm maximum (2.4 GHz band)
20.3.21.6	Symbol clock frequency tolerance	±20 ppm maximum (5 GHz band) ±25 ppm maximum (2.4 GHz band)
20.3.21.7.2	Transmitter center frequency leakage	No greater than –15 dB relative to overall transmitted power (20 MHz channel bandwidth) No greater than –20 dB relative to overall transmitted power (40 Hz channel bandwidth)
20.3.21.7.3	Transmitter constellation error	No greater than –28 dB (3.98%RMS), 64-QAM with 5/6 coding rate
20.3.22.1	Receiver minimum input sensitivity	<10% PER, –64 dBm, MCS 7, 20 MHz channel bandwidth
20.3.22.2*	Receiver adjacent channel rejection	–2 dB for <10% PER, MCS 7
20.3.22.3*	Receiver non-adjacent channel rejection	14 dB for <10% PER, MCS 7
20.3.22.4	Receiver maximum input level	<10% for –30 dBm input at the receiver, all MCS settings.

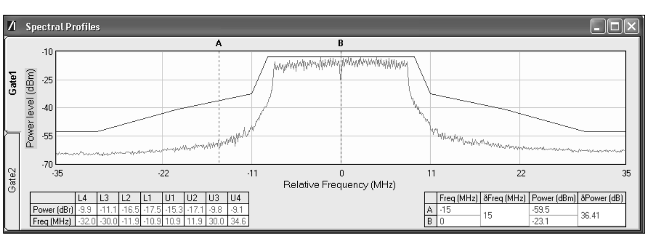
*: Additional signal source required

Example Measurements



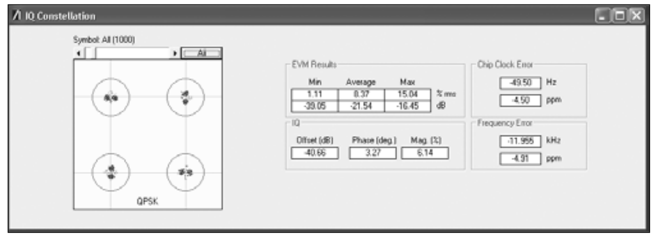
Power burst profile

Power measurements are displayed against time. Measurement triggers initiate the capture of up to 6 ms of data. Two gates are used to measure peak and average power in any defined section of the trace. This enables the measurement of power in the preamble and payload independently. Power burst Rise and Fall time are also measured and the trace can be configured to display either maximum and minimum power values or average power. When analyzing 802.11g or 802.11a OFDM signals, peak and crest factor measurements can be displayed.



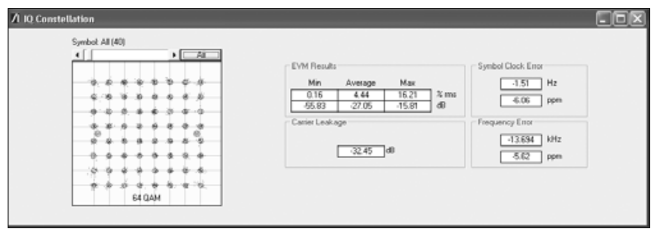
Spectral profiles

The MT8860C automatically applies the correct spectrum mask limits for either 802.11b, 802.11g or 802.11a transmitters with a results table that displays the pass/fail status of each of the mask elements. The measurement gates in the power profile display are used to define the time period over which the spectrum is calculated. As a result, two spectral displays are provided - one for each measurement gate. These can be used to view the spectrum of clearly defined sections of the power burst. Numeric displays of occupied bandwidth and carrier suppression (DSSS modulation only) are also available.



EVM (802.11b/g DSSS)

The MT8860C measures the EVM of DSSS modulated carriers. The IEEE 802.11b standard requires that the peak EVM of 1000 chips does not exceed 35%. The MT8860C measures minimum, average and maximum EVM in terms of %rms and relative dB. In addition to EVM, measurements of IQ offset, rms phase and amplitude error, chip clock error and center frequency error are performed.
A graphical display of the IQ constellation diagram is provided.

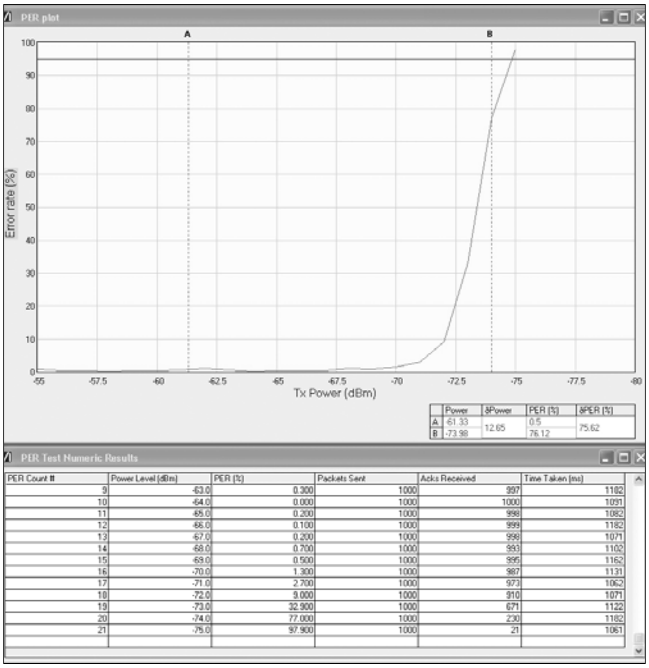


EVM (802.11g OFDM)

The MT8860C measures the EVM of 802.11g and 802.11a OFDM modulated carriers. Numeric results are given for EVM. Furthermore, graphical displays of the IQ constellation diagram, EVM against subcarrier and EVM against symbol are provided. As a result, detailed analysis of the modulation distortion can be performed. In addition to the EVM results, measurements of carrier leakage, symbol clock error and center frequency error are performed.
The MT8860C has a residual EVM figure of <2% and a measurement refresh rate of typically 300 ms.

Receiver PER
(Automated Measurements in Network Mode Only)

In Network mode, the MT8860C has the unique ability to perform automated sensitivity search measurements on any 802.11b/g/a device without the need for proprietary chipset vendor control software. This provides a convenient test solution that can quickly analyze the performance of a device at each data rate and validate conformance with the 802.11 minimum receiver sensitivity test specification. The number of packets to be transmitted at each power level can be defined along with start and stop search levels and step size for a fully flexible solution. Results can be saved in both graphical and tabular numeric formats for later analysis.



As well as sensitivity search measurements, the MT8860C is able to perform strife testing of DUTs by continuously running a fixed level sensitivity test and displaying the results graphically against time. This is a powerful tool to validate a DUT ability to maintain good receiver sensitivity under a variety of conditions such as external interferers and extreme temperatures.

Specifications

• MT8860C WLAN Test Set

Wireless Test Mode		Standards supported: IEEE Std 802.11b-1999 IEEE Std 802.11g-2003 IEEE Std 802.11a-1999 (Option 14) IEEE Std 802.11n-2009 (Option 17) IEEE Std 802.11-2007	
Supported Channels			
802.11b/802.11g (DSSS)		Channels 1 to 14 (2412 MHz to 2484 MHz)	
802.11g (OFDM)		Channels 1 to 13 (2412 MHz to 2472 MHz)	
802.11a		Channels 36, 40, 44, 48 (5150 MHz to 5250 MHz) Channels 52, 56, 60 ,64 (5250 MHz to 5350 MHz) Channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140 (5470 MHz to 5725 MHz) Channels 149, 153, 157, 161,165 (5725 MHz to 5825 MHz)	
802.11n (20 MHz channel bandwidth)	Frequency Band		
	2.4 GHz	Channels 1 to 13 (2412 MHz to 2472 MHz)	
	5 GHz	Channels 36, 40, 44, 48 (5150 MHz to 5250 MHz) Channels 52, 56, 60 ,64 (5250 MHz to 5350 MHz) Channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140 (5470 MHz to 5725 MHz) Channels 149, 153, 157, 161,165 (5725 MHz to 5825 MHz)	
802.11n (40 MHz channel bandwidth)	Frequency Band	40 MHz channels are specified in the format (Primary Channel, Secondary), where Secondary = ±1	
		Secondary = +1	Secondary = –1
	2.4 GHz	Primary Channels 1 to 9	Primary Channels 5 to 13
	5 GHz	Primary Channels 36, 44 Primary Channels 52, 60 Primary Channels 100, 108, 116, 124, 132 Primary Channels 149, 157	Primary Channels 40, 48 Primary Channels 56, 64 Primary Channels 104, 112, 120, 128, 136 Primary Channels 153, 161
Data Rates and Modulation			
802.11b/802.11g (DSSS)		1 Mbps 11-chip Barker DBPSK 2 Mbps 11-chip Barker DQPSK 5.5 Mbps CCK DQPSK 11 Mbps CCK DQPSK	
802.11g (OFDM) 802.11a		6, 9, 12, 18, 24, 36, 48, 54 Mbps OFDM (BPSK, QPSK, 16-QAM, 64-QAM)	
802.11n (non-HT)		PPDU Types: 20 MHz, 40 MHz Upper, 40 MHz Lower, 40 MHz Duplicate 1 Mbps 11-chip Barker DBPSK 2 Mbps 11-chip Barker DQPSK 5.5 Mbps CCK DQPSK 11 Mbps CCK DQPSK 6, 9, 12, 18, 24, 36, 48, 54 Mbps OFDM (BPSK, QPSK, 16-QAM, 64-QAM)	

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802.11n (HT)	PPDU HT Formats: HT-Mixed Mode, (HT-Greenfield: Tx test only) PPDU Types: 20 MHz, 40 MHz, (40 MHz Upper, 40 MHz Lower: Tx test only), 40 MHz Duplicate Modulation & Coding Scheme: MCS Index 0 to 7 and MCS 32 (Duplicate) Guard Interval HT-Mixed Mode: Long (800 ns), Short (400 ns) HTGreenfield: Long (800 ns) only Data Rates 20 MHz channel b/w: 6.5, 7.2, 13, 14.4, 19.5, 21.7, 26, 28.9, 39, 43.3, 52, 57.8, 58.5, 65, 72.2 Mbps 40 MHz channel b/w: 6, 6.7, 13.5, 15, 27, 30, 40.5, 54, 60, 81, 90, 108, 120, 121.5, 135, 150 Mbps Modulation: OFDM (BPSK, QPSK, 16-QAM, 64-QAM)
Operating Modes	Two modes of operation are supported; Network Mode and Direct Mode
Network Mode (802.11b, 802.11g, 802.11a only)	In Network mode, standard protocol messaging is used to establish a network connection between the MT8860C and a WLAN device. Once a connection is made, the receiver and transmitter characteristics of the device under test (DUT) can be tested
Receiver Measurements	Packet Error Rate (PER) at defined level Frame Reception Rate (FRR) at defined level
Unicast Packet Type	The MT8860C transmits data packets containing the MAC address of the DUT and automatically calculates the PER or FRR based on the number of acknowledgement (ACK) packets it receives in response from the DUT. PER (%) = [1 - (ACKs received from DUT/data packets transmitted by MT8860C)] × 100 FRR (%) = (ACKs received from DUT/data packets transmitted by MT8860C) × 100
Broadcast Packet Type	MT8860C transmits data packets containing the broadcast address (FFFFFFFFFFFF). The PER/FRR is calculated externally and requires access to the DUT receive frame registers. These are normally available from the DUT client software under “Advanced Information”. PER (%) = [1 - (good packets reported by DUT/data packets transmitted by MT8860C)] × 100 FRR (%) = (good packets reported by DUT/data packets transmitted by MT8860C) × 100
Transmitter Measurements	
Data Frame Type	The MT8860C transmits ICMP echo request packets and then analyzes the echo reply packets returned by the DUT in response Supported Measurements: All transmitter measurements stated in the 802.11b and 802.11g/802.11a sections are supported (see below)
ACK Frame Type	The MT8860C transmits Unicast packets and then analyzes the ACK packets returned by the DUT in response. This testing methodology is specified by the CTIA/Wi-Fi Alliance in the CWG Test Plan that is used to evaluate the RF Performance of Wi-Fi Mobile Supported Measurements: ACK frames have a short time duration, As a result, analysis is limited to the following measurements; (802.11b/802.11g DSSS): Average, Peak and Crest Factor Power Power-On and Power-Down Ramp Spectrum Mask/Mask Segment Occupied Bandwidth (OBW), Power Spectral Density (PSD) RF Carrier Suppression (802.11g OFDM/802.11a): Average, Peak and Crest Factor Power Power-On and Power-Down Ramp CCDF
Network Mode Configuration Settings	
MT8860C Role (Connection Type)	Infrastructure and Ad-Hoc
Infrastructure	Supports Access Point and Client (STA) modes
Ad-Hoc	Supports creating and joining a network
SSID (Network Name)	Supported in Access Point and Ad-Hoc creation modes (32 characters maximum)
Beacon Configuration	The MT8860C periodically transmits beacon management frames so that a connection can be established and maintained with a DUT. The following beacon parameters can be adjusted; Beacon Interval: 20 to 1000 (default 200) Operational Rate Set: All Rates, Multiple Rates, Single Rate, User-defined DSSS Preamble Format: Long, Short NOTE: The Beacon Interval represents a number of time units (TU), with 1 TU being equal to 1024 µs In addition, the following Information Elements can included in the beacon (and other) management frames; ERP Information Element Country Information Element: The parameters regional code, first channel number, number of channels and maximum transmit power level can be specified Vendor Specific Information Element: Up to 32 characters can be specified in the contents field
IP Properties	The IP settings of the DUT can be assigned manually or automatically via DHCP
Direct Mode (802.11b, 802.11g, 802.11a, 802.11n)	In Direct mode, the DUT is controlled directly by using the appropriate chipset vendor control software
Receiver Measurements	The MT8860C transmits a defined number of packets to the DUT. Chipset vendor control software is required to read the DUT receiver packet count register
Transmitter Measurements	The DUT is configured for continuous transmission using chipset vendor control software. The MT8860C acts as a transmitter analyzer for measurements on the packets received. All transmitter measurements stated in the 802.11b, 802.11g/802.11a and 802.11n sections are supported (see below)

• 802.11b Measurements

The following applies to data rates of 1, 2, 5.5 and 11 Mbps that use DSSS modulation

Transmit Power Levels	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.7.1)
Definition	Average, peak and crest factor power measurements derived from gate 1 or 2
Damage Level	>+27 dBm
Dynamic Range	Low Noise Mode: +24 to –50 dBm average power (+27 dBm peak) Low ACP Mode: +20 to –50 dBm average power (+23 dBm peak)
Accuracy (CW)	Data Frame Type: ±0.6 dB (+24 to –30 dBm), ±1.0 dB (–30 to –50 dBm) ACK Frame Type: ±0.8 dB (+24 to –30 dBm), ±1.2 dB (–30 to –50 dBm)
Resolution	dBm to 2 decimal places
Capture Width	10 µs to 5.95 ms
Time Resolution	0.1 µs marker resolution with 10 µs time window
Transmit Power Level Control	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.7.2)
Definition	Peak and Average Power specification as for 18.4.7.1
Transmit Spectrum Mask	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.7.3)
Definition	Spectrum measurement derived from gate 1 or 2
Gate Width	From gate 1 or 2, 50 µs to 5.95 ms
Frequency Span	70 MHz (fc ±35 MHz)
Flatness over Frequency Span	±1 dB
Linearity	±0.8 dB (50 dB dynamic range CW measurements)
Resolution	dBr to 1 decimal place
Range (modulated carrier power)	Low Noise Mode: +24 to –40 dBm Low ACP Mode: +20 to –40 dBm
Dynamic Range	>50 dB (usable dynamic range with Dither Mode set to ON)
Receiver Resolution Bandwidth	Equivalent to 100 kHz Gaussian
Noise Floor (for all supported channels)	–110 dBm (with Input Level Range 3L selected)
Spurious Specification (for all supported channels)	<–52 dBc (with Dither Mode set to ON)
Measurement Configuration	
Dither Mode	OFF: Default mode ON: Additional Signal processing removes spurs from the spectral measurement
RF Optimization Mode	User selection of Low Noise or Low ACP (default Low Noise)
Transmit Center Frequency Tolerance	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.7.4)
Definition	Average Frequency of the DSSS carrier signal
Data Output Format	Hz and ppm
Accuracy	±1 kHz ± reference frequency oscillator error (ppm) for measurement gate >1 ms
Resolution	Hz to 2 decimal places, ppm to 2 decimal places
Chip Clock Frequency Tolerance	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.7.5)
Definition	Frequency error relative to 11MHz chip clock. Measurement averaged over a fully coded DSSS packet with minimum payload length of 3,300 chips (300 µs)
Data Output Format	Hz and ppm
Range	±50 ppm
Resolution	Hz to 2 decimal places, ppm to 2 decimal places
Analysis Length	3,300 to 30,250 chips (default 5,500 chips)
Transmit Power-On & Power-Down Ramp	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.7.6)
Definition	Time for the burst to transition from 10 to 90% or 90 to 10% of linear power
Resolution	0.1 µs
Data Outputs	10%, 90% and delta values
RF Carrier Suppression	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.7.7)
Definition	Relative level of the carrier to highest sideband for a 10101010 test pattern, scrambler disabled, data rate 2 Mbps
Range	As spectral mask range
Dynamic Range	As spectral mask dynamic range
Flatness	As spectral mask flatness
Linearity	As spectral mask linearity
Resolution	As spectral mask resolution
Transmit Modulation Accuracy	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.7.8)
Definition	Peak and Average Error Vector Magnitude measurement performed for DBPSK and DQPSK modulated packets. Measurement averaged over a fully coded DSSS packet with minimum payload length of 220 chips (20 µs)
Measurement Accuracy	<10% residual RMS EVM; +24 to –45 dBm
Modulation Setting	Data rate 1, 2, 5.5 or 11 Mbps
Displayed Measurement Range	1 to 100% dependent on modulation

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Measurement Configuration	
EVM Calculation Method	rms Error Vector: The EVM measurement is performed using the 'classic' definition for EVM (rms Error Vector) and is calculated using chips that are transmitted during the PSDU (payload) of the packet 11b Modulation Accuracy: The EVM measurement is performed using the definition in 18.4.7.8 and is calculated over 1,000 chips that are transmitted during the PLCP preamble and header
RX Filter Selection	Selectable between; None Gaussian, BT 0.3 to 1.0 (default 0.5), resolution 0.1 Root Raised Cosine, α 0.30 to 1.00 (default 0.35), resolution 0.01
Analysis Length	220 to 11,000 chips (default 1,000 chips)
Receiver Minimum Input Sensitivity	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.8.1)
Definition	Packet Error Rate (PER) at defined power level
Power Range	See Reference Radio Transmitter section
Mode	Network: MT8860C forms a connection with the DUT. Unicast and Broadcast Packets supported Direct: MT8860C transmits defined number of packets
Data Packet Structure	Complies with 802.11 specifications for MAC header formatting, scrambling, encoding, interleaving and calculation of the appropriate CRC/FCS checksum
Number of Transmitted Packets	1 to 10,000 (default 500)
Payload Length	60 to 1,500 bytes (default 1,024 bytes)
Preamble Format	Long or Short
Payload	All 0's, 0101, Counting, PN7, 1010, Random (Payload data scrambled over the air)
Data Rates	1, 2, 5.5 or 11 Mbps
Network Mode Settings	
Inter-packet Interval	0 to 65535 ms
Inter-packet Resolution	1 ms
DUT TX Power Level	–30 to +30 dBm This is the expected power level of the ACK packet transmitted by the DUT in response to a correctly received Unicast packet. This value is used by the MT8860C to calculate the amount of return path attenuation required to prevent MT8860C reference radio receiver saturation
Direct Mode Settings	
Inter-packet Spacing	0 to 200 slots (default 5 slots)
Inter-packet Resolution	20 µs
DUT MAC Address Range	00-00-00-00-00-00 to FF-FF-FF-FF-FF-FF
Receiver Maximum Input Level	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.8.2)
Definition	Receiver PER specification as for 18.4.8.1 (above)
Receiver Adjacent Channel Rejection	IEEE Std 802.11b-1999/IEEE Std 802.11-2007 (18.4.8.3)
Definition	Adjacent Channel measurements made with external modulated signal source (e.g. MG3700A) using Interferer input port
Additional TX Measurements	
Occupied Bandwidth (OBW)	Measures the frequency range within which the specified percentage power is contained
Occupied Bandwidth Percentage	1 to 99%
Power Spectral Density (PSD)	As per ETSI EN 300-328 (4.3.2/5.7.3). The maximum power measured in a 1 MHz bandwidth within the occupied bandwidth of the signal
Additional RX Measurements	
Frame Reception Rate (FRR)	As defined in the CTIA/Wi-Fi Alliance CWG RF Test Plan FRR (%) = (ACKs received from DUT/data packets transmitted by MT8860C) × 100 Specification as for 18.4.8.1 (above)

• 802.11g Measurements/802.11a Measurements

The following applies to data rates 6, 9, 12, 18, 24, 36, 48 and 54 Mbps that use OFDM modulation
(For DSSS data rates, please refer to the 802.11b measurement section above)

Transmit Power Levels	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.4.7.1) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.9.1)
Definition	Average, peak and crest factor power measurements on OFDM modulated signals on the supported channels
Damage Level	>+27 dBm
Dynamic Range	+18 to –50 dBm average power (+27 dBm peak)
Accuracy (CW)	Data Frame Type: ±0.6 dB (+18 to –30 dBm), ±1.0 dB (–30 to –50 dBm) ACK Frame Type: ±0.8 dB (+18 to –30 dBm), ±1.2 dB (–30 to –50 dBm)
Resolution	dBm to 2 decimal places
Capture Width	10 µs to 5.95 ms
Time Resolution	0.1 µs marker resolution with 10 µs time window
Transmit Spectrum Mask	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.5.4) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.9.2)
Definition	Display of Spectrum measurement derived from gate 1 or 2
Gate Width	From gate 1 or 2, 50 µs to 5.95 ms
Frequency Span	70 MHz (fc ±35 MHz)
Flatness over Frequency Span	±1 dB
Linearity	±0.8 dB (50 dB dynamic range CW measurements)
Resolution	dBr to 1 decimal place
Range (modulated carrier power)	+18 to –40 dBm
Dynamic Range	(Usable dynamic range for signals with 8 dB crest factor and Dither Mode set to ON) ±11 MHz from fc; 30 dB (typical 46 dB) ±20 MHz from fc; 40 dB (typical 48 dB) ±30 MHz from fc; 43 dB (typical 50 dB)
Receiver Resolution Bandwidth	Equivalent to 100 kHz Gaussian
Noise Floor (for all supported channels) 802.11g 802.11a	(With Input Level Range 3L selected) –110 dBm –105 dBm
Spurious Specification (for all supported channels) 802.11g 802.11a	(With Dither Mode ON) <–45 dBc <–43 dBc
Measurement Configuration	
Dither Mode	OFF: Default mode ON: Additional Signal processing removes spurs from the spectral measurement
Transmit Center Frequency Tolerance	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.4.7.2) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.9.4)
Definition	Average Frequency of the OFDM carrier signal
Data Output Format	Hz and ppm
Accuracy	±1 kHz ± reference frequency oscillator error (ppm) for measurement gate >1 ms
Resolution	Hz to 2 decimal places, ppm to 2 decimal places
Symbol Clock Frequency Tolerance	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.4.7.3) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.9.5)
Definition	Frequency error relative to 250 kHz symbol clock as per 19.4.7.3 /17.2.9.5. Measurement averaged over a fully coded OFDM packet with minimum payload length of 16 symbols (64 µs)
Data Output Format	Hz and ppm
Range	±40 ppm
Resolution	Hz to 2 decimal places, ppm to 2 decimal places
Analysis Length	16 to 500 symbols (default 55 symbols)
Transmitter Center Frequency Leakage	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.4.7) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.9.6.1)
Definition	Measurement of the leakage of the center carrier
Data Output Format	dB
Resolution	dB to 2 decimal places
Transmitter Spectral Flatness	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.4.7) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.9.6.2)
Definition	Graphical display of RF sub-carrier power level Display includes limit lines (as per 17.2.9.6.2) Overall Pass/ Fail status indicated For measurement failure, a numeric measurement result of the failing subcarrier(s) is reported
Unit of Measurement	dBr

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Transmitter Modulation Accuracy	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.7.2.7) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.9.6.3)
Definition	Peak and Average EVM. Measurement averaged over a fully coded OFDM packet with minimum payload length of 16 symbols (64 µs)
Measurement Accuracy 802.11g 802.11a	(54 Mbps, +18 to –45 dBm) <2% residual RMS EVM <2.3% residual RMS EVM (typical <2%)
Modulation Setting	Data rates 6, 9, 12, 18, 24, 36, 48 or 54 Mbps
Data Output Format	Peak and Average EVM pilots only, dB or percentage Peak and Average EVM on each sub carrier (frequency domain), % vs sub-carrier –26 to +26 EVM vs Symbol (time domain), % vs symbol number, 1 to specified analysis length
Measurement Configuration	
Analysis Length	16 to 500 symbols (default 40 symbols)
OFDM Pilot Tracking	User selection of Phase tracking only or Phase and Amplitude tracking (default Phase tracking only)
Channel Estimation	User selection of Long Training Sequence or Full Packet (default Long Training Sequence)
Receiver Minimum Input Sensitivity	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.5.1) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.10.1)
Definition	Packet Error Rate (PER) at defined power level
Power Range	See Reference Radio Transmitter section
Mode	Network: MT8860C forms a connection with the DUT. Unicast and Broadcast Packets supported Direct: MT8860C transmits defined number of packets
Data Packet Structure	Adheres to relevant 802.11 specifications for MAC header formatting, scrambling, encoding, interleaving and calculation of the appropriate CRC/FCS checksum
Number of Transmitted packets	1 to 10,000 (default 500)
Payload Length	60 to 1,500 bytes (default 1,024 bytes)
Payload	All 0's, 0101, Counting, PN7, 1010, Random (Payload data is scrambled over the air)
Data Rates	6, 9, 12, 18, 24, 36, 48 or 54 Mbps
Network Mode Settings	
Inter-packet Interval	0 to 65535 ms
Inter-packet Resolution	1 ms
DUT TX Power Level	–30 to +30 dBm This is the expected power level of the ACK packet transmitted by the DUT in response to a correctly received Unicast packet. This value is used by the MT8860C to calculate the amount of return path attenuation required to prevent MT8860C reference radio receiver saturation.
Direct Mode Settings	
Inter-packet Spacing	0 to 200 slots (default 5 slots)
Inter-packet Resolution	9 µs
DUT MAC Address	Range 00-00-00-00-00-00 to FF-FF-FF-FF-FF-FF
Receiver Adjacent Channel Rejection	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.5.2) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.10.2)
Definition	Adjacent Channel measurements made with external modulated signal source (e.g. MG3700A) using Interferer input port
Receiver Maximum Input Level	IEEE Std 802.11g-2003/IEEE Std 802.11-2007 (19.5.3) IEEE Std 802.11a-1999/IEEE Std 802.11-2007 (17.3.10.4)
Definition	Receiver PER specification as for 19.5.1 (above)
Additional TX Measurements	
CCDF	CCDF defined as percentage of samples against dB, where percentage of samples is normalized to the average power in the gate, and dB is defined as the relative value of samples greater than the average
Measurement Scales	Y-axis, Log scale, fixed values of 100, 10, 1, 0.1, 0.01% X-axis, dB scale, fixed values of 0 to 12 dB
Occupied Bandwidth (OBW)	Measures the frequency range within which the specified percentage power is contained
Occupied Bandwidth Percentage	1 to 99%
Power Spectral Density (PSD)	As per ETSI EN 300-328 (4.3.2/5.7.3). The maximum power measured in a 1 MHz bandwidth within the occupied bandwidth of the signal
Additional RX Measurements	
Frame Reception Rate (FRR)	As defined in the CTIA/Wi-Fi Alliance CWG RF Test Plan FRR (%) = (ACKs received from DUT/data packets transmitted by MT8860C) × 100 Specification as for 19.5.1 (above)

• 802.11n Measurements

The following applies to the 11n High Throughput (HT) modes that use OFDM modulation
(For non-HT modes, please refer to the 802.11b, 802.11g, 802.11a measurement sections above)

Transmit Power Levels	IEEE Std 802.11n-2009 (20.3.21.3)
Definition	Average, peak and crest factor power measurements on HT OFDM modulated signals on the supported channels
Damage Level	>+27 dBm
Dynamic Range	20 MHz channel b/w: +18 to –50 dBm average power (+27 dBm peak) 40 MHz channel b/w: +16 to –50 dBm average power (+27 dBm peak)
Accuracy (CW)	±0.6 dB (+18 to –30 dBm) ±1.0 dB (–30 to –50 dBm)
Resolution	dBm to 2 decimal places
Capture Width	10 µs to 5.95 ms
Time Resolution	0.1 µs marker resolution with 10 µs time window
Transmit Spectrum Mask	IEEE Std 802.11n-2009 (20.3.21.1)
Definition	Display of Spectrum measurement derived from gate 1 or 2
Gate Width	From gate 1 or 2, 50 µs to 5.95 ms
Frequency Span	20 MHz channel b/w: 70 MHz (fc ±35 MHz) 40 MHz channel b/w: 130 MHz (fc ±65 MHz)
Flatness over Frequency Span	±1 dB
Linearity	±0.8 dB (50 dB dynamic range CW measurements)
Resolution	dBr to 1 decimal place
Range (modulated carrier power)	20 MHz channel b/w: +18 to –40 dBm 40 MHz channel b/w: +16 to –40 dBm
Dynamic Range	20 MHz channel b/w: (For signals with 8 dB crest factor and Dither Mode set to ON) ±11 MHz from fc; 30 dB (typical 46 dB) ±20 MHz from fc; 40 dB (typical 48 dB) ±30 MHz from fc; 43 dB (typical 50 dB) 40 MHz channel b/w: (For signals with 10 dB crest factor and Dither Mode set to ON) ±60 MHz from fc; 43 dB (typical 48 dB)
Receiver Resolution Bandwidth	Equivalent to 100 kHz Gaussian
Noise Floor (for all supported channels)	2.4 GHz frequency band: (With Input Level Range 3L selected) –110 dBm 5 GHz frequency band: (With Input Level Range 3L selected) –105 dBm
Spurious Specification (for all supported channels)	2.4 GHz frequency band: (With Dither Mode ON) 20 MHz channel b/w: <–45 dBc 40 MHz channel b/w: ± (25 MHz to 40 MHz); <–30 dBc ± (40 MHz to 50 MHz); <–40 dBc ± (50 MHz to 60 MHz); <–45 dBc ± (60 MHz to 65 MHz); <–48 dBc 5 GHz frequency band: (With Dither Mode ON) 20 MHz channel b/w: <–43 dBc 40 MHz channel b/w: ± (25 MHz to 40 MHz); <–30 dBc ± (40 MHz to 50 MHz); <–40 dBc ± (50 MHz to 60 MHz); <–45 dBc ± (60 MHz to 65 MHz); <–48 dBc
Measurement Configuration	
Dither Mode	OFF: Default mode ON: Additional Signal processing removes spurs from the spectral measurement
Transmit Center Frequency Tolerance	IEEE Std 802.11n-2009 (20.3.21.4)
Definition	Average Frequency of the HT OFDM carrier signal
Data Output Format	Hz and ppm
Accuracy	±1 kHz ± reference frequency oscillator error (ppm) for measurement gate >1 ms
Resolution	Hz to 2 decimal places, ppm to 2 decimal places
Symbol Clock Frequency Tolerance	IEEE Std 802.11n-2009 (20.3.21.6)
Definition	Frequency error relative to 250 kHz symbol clock as per 20.3.21.6. Measurement averaged over a fully coded HT OFDM packet with minimum payload length of 16 symbols (64 µs)
Data Output Format	Hz and ppm
Range	±40 ppm
Resolution	Hz to 2 decimal places, ppm to 2 decimal places
Analysis Length	16 to 500 symbols (default 55 symbols)
Transmitter Center Frequency Leakage	IEEE Std 802.11n-2009 (20.3.21.7.2)
Definition	Measurement of the leakage of the center carrier
Data Output Format	dB
Resolution	dB to 2 decimal places

Continued on next page

Transmitter Spectral Flatness	IEEE Std 802.11n-2009 (20.3.21.2)
Definition	Graphical display of RF sub-carrier power level Display includes limit lines (as per 20.3.21.2) Overall Pass/ Fail status indicated For measurement failure, a numeric measurement result of the failing subcarrier(s) is reported
Unit of Measurement	dBr
Transmitter Modulation Accuracy	IEEE Std 802.11n-2009 (20.3.21.7.3/20.3.21.7.4)
Definition	Peak and Average EVM. Measurement averaged over a fully coded HT OFDM packet with minimum payload length of 16 symbols (64 µs)
Measurement Accuracy	2.4 GHz frequency band 20 MHz channel b/w: (72.2 Mbps, +18 to –45 dBm) <2% residual RMS EVM 40 MHz channel b/w: (150 Mbps, +16 to –45 dBm) <2% residual RMS EVM 5 GHz frequency band 20 MHz channel b/w: (72.2 Mbps, +18 to –45 dBm) <2.3% residual RMS EVM (typical <2%) 40 MHz channel b/w: (150 Mbps, +16 to –45 dBm) <2.3% residual RMS EVM (typical <2%)
Modulation Settings	PPDU Format: HT-Mixed Mode, HT-Greenfield PPDU Type: 20 MHz, 40 MHz, 40 MHz Upper, 40 MHz Lower, 40 MHz Duplicate Modulation & Coding Scheme: MCS Index 0 to 7 and MCS 32 (Duplicate) Guard Interval HT-Mixed Mode: Long (800 ns), Short (400 ns) HT-Greenfield: Long (800 ns) only
Data Output Format	Peak and Average EVM pilots only, dB or percentage Peak and Average EVM on each sub carrier (frequency domain), % vs sub-carrier –26 to +26 EVM vs Symbol (time domain), % vs symbol number, 1 to specified analysis length
Measurement Configuration	
Analysis Length	16 to 500 symbols (default 40 symbols)
OFDM Pilot Tracking	User selection of Phase tracking only or Phase and Amplitude tracking (default Phase tracking only)
Channel Estimation	User selection of Long Training Sequence or Full Packet (default Long Training Sequence)
Receiver Minimum Input Sensitivity	IEEE Std 802.11n-2009 (20.3.22.1)
Definition	Packet Error Rate (PER) at defined power level
Power Range	–20 to –100 dBm at MT8860C test port
Mode	Direct: MT8860C transmits defined number of packets
Data Packet Structure	Complies with 802.11 specifications for MAC header formatting, scrambling, encoding, interleaving and calculation of the appropriate CRC/FCS checksum
Number of Transmitted Packets	1 to 10,000 (default 500)
Payload Length	50 to 1772 bytes
Data Rates	20 MHz channel b/w: 6.5, 7.2, 13, 14.4, 19.5, 21.7, 26, 28.9, 39, 43.3, 52, 57.8, 58.5, 65, 72.2 Mbps 40 MHz channel b/w: 6, 6.7, 13.5, 15, 27, 30, 40.5, 54, 60, 81, 90, 108, 120, 121.5, 135, 150 Mbps
Direct Mode Settings	
Inter-packet Spacing	10 µs to 1000 µs
DUT MAC Address range	Valid Unicast MAC address only. Broadcast and Multicast MAC addresses not supported.
Receiver Adjacent Channel Rejection Receiver Non-adjacent Channel Rejection	IEEE Std 802.11n-2009 (20.3.22.2) IEEE Std 802.11n-2009 (20.3.22.3)
Definition	Adjacent Channel measurements made with external modulation signal source (e.g., MG3700A) using external interferer port
Receiver Maximum Input Level	IEEE Std 802.11n-2009 (20.3.22.4)
Definition	Receiver PER specification as for 20.3.22.1 (above)
Additional TX Measurements	
CCDF	CCDF defined as percentage of samples against dB, where percentage of samples is normalized to the average power in the gate, and dB is defined as the relative value of samples greater than the average
Measurement Scales	Y-axis, Log scale, fixed values of 100, 10, 1, 0.1, 0.01% X-axis, dB scale, fixed values of 0 to 12 dB
Occupied Bandwidth (OBW)	Measures the frequency range within which the specified percentage power is contained
Occupied Bandwidth Percentage	1 to 99%
Power Spectral Density (PSD)	As per ETSI EN 300-328 (4.3.2/5.7.3). The maximum power measured in a 1 MHz bandwidth within the occupied bandwidth of the signal
TX Measurement Controls	
Averaging	1 to 1,000 (default 1)
Triggers	4 trigger sources are available; Free Run, RF, Video and External In Network Mode operation, the RF trigger (rising edge) must be selected
Free Run	Continuous unsynchronised
RF Edge	RF triggering on rising or falling edge, detected at RF input User set level
RF Edge Dynamic Range	+18 to –40 dBm average power with Input Level Range set to AUTO
Video	Video triggering on rising or falling edge, detected at IF

Continued on next page

Video Trigger Dynamic Range	(+18 to –50 dBm average power with Input Level Range set to AUTO) Triggers at –10 dB below average power level (DSSS data rates) Triggers at –20 dB below average power level (OFDM data rates)
External	TTL input, BNC on Rear Panel
Measurement Gates	Two gates for Power, Spectrum, Frequency and CCDF measurements. Gate positions set directly by remote command
Settable Gate Range	10 µs to 5.95 ms
TX Analysis auto-configure function	Using this function, the following parameters are automatically configured by the MT8860C; Input Level Range Pre-trigger Capture Width Trigger settings Measurement Gate settings
Reference Radio Transmitter (802.11b, 802.11g, 802.11a only)	Network and Direct Modes
Supported Channels	802.11b/802.11g (DSSS): Channels 1 to 14 (2412 MHz to 2484 MHz) 802.11g (OFDM): Channels 1 to 13 (2412 MHz to 2472 MHz) 802.11a: Channels 36, 40, 44, 48 (5150 MHz to 5250 MHz) Channels 52, 56, 60 ,64 (5250 MHz to 5350 MHz) Channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140 (5470 MHz to 5725 MHz) Channels 149, 153, 157, 161, 165 (5725 MHz to 5825 MHz)
Output Power (for supported channels)	802.11b/802.11g: –3 to –100 dBm (settable to 0 dBm but performance unwarranted) 802.11a: –8 to –100 dBm (settable to 0 dBm but performance unwarranted)
Power Accuracy (for supported channels, CW, 18° to 28°C)	802.11 b/802.11g: ±1.0 dB (–3 to –90 dBm), ±2.0 dB typical (<–90 to –100 dBm) 802.11a: ±1.0 dB (–8 to –90 dBm), ±2.0 dB typical (<–90 to –100 dBm)
Settable Resolution	0.1 dB
Output Impedance	50 <2:1 VSWR
Frequency Accuracy	±20 ppm
Modulation Accuracy (for supported channels, unless stated)	802.11b/802.11g (DSSS): <10% RMS EVM; 11 Mbps, <–20 dBm (channels 1 to 13) 802.11g (OFDM): <5.6% RMS EVM; 54 Mbps, <–20 dBm (nominal <4%) Nominally <5.6% RMS EVM, 54 Mbps, <–3 to –20 dBm 802.11a: <5.6% RMS EVM; 54 Mbps, <–20 dBm
Reference Radio Receiver (802.11b, 802.11g, 802.11a only)	Network Mode only
Supported Channels	See Reference Radio Transmitter Section (above)
Maximum Safe Input	+27 dBm Peak Power
Damage Level	+32 dBm peak power (excluding range 3, +18 dBm)
Input VSWR (for supported channels)	802.11b/802.11g: Nominally <1.5:1 802.11a: Nominally <1.6:1
Minimum Receive Sensitivity (for <1% PER)	802.11b/802.11g: –50 dBm (1 Mbps), –45 dBm (11 Mbps), –50 dBm (6 Mbps), –30 dBm (54 Mbps) 802.11a: –50 dBm (6 Mbps), –27 dBm (54 Mbps)
Signal Generator Mode (802.11b, 802.11g, 802.11a only)	In this mode, MT8860C can be configured to transmit a continuous RF signal at the Test Port NOTE: Transmitter measurements are not supported. For receiver testing, chipset vendor control software is required to directly configure the device under test (DUT) and read the receiver packet count register
Transmit Modes	CW (single carrier) Continuous Framed (dynamic duty cycle) Continuous Modulated (100% duty cycle) Carrier Suppression (100% duty cycle, 0101 payload, scrambler disabled)
Supported Channels	See Reference Radio Transmitter Section (above)
Data Rates and Modulation	Applicable when the transit mode is set to Continuous Framed or Continuous Modulated
802.11b/802.11g (DSSS)	1 Mbps 11-chip Barker DBPSK 2 Mbps 11-chip Barker DQPSK 5.5 Mbps CCK DQPSK 11 Mbps CCK DQPSK
802.11g (OFDM) 802.11a	6, 9, 12, 18, 24, 36, 48, 54 Mbps OFDM (BPSK, QPSK, 16-QAM, 64-QAM)
Data Packet Structure (Continuous Framed and Continuous Modulated)	Adheres to relevant 802.11 specifications for MAC header formatting, scrambling, encoding, interleaving and calculation of the appropriate CRC/FCS checksum
Payload Length	60 to 1,500 bytes (default 1,024 bytes)
Payload	All 0's, 0101, Counting, PN7, 1010, Random (Payload data is scrambled over the air)
Inter-packet Spacing (Continuous Framed)	0 to 200 slots (default 5 slots)
Inter-packet Resolution	802.11b/802.11g (DSSS): 20 µs 802.11g (OFDM)/802.11a: 9 µs
DUT MAC Address Range	00-00-00-00-00-00 to FF-FF-FF-FF-FF-FF
Output Power (for supported channels)	See Reference Radio Transmitter Section (above)
Power Accuracy (for supported channels, CW, 18° to 28°C)	See Reference Radio Transmitter Section (above)
Settable Resolution	See Reference Radio Transmitter Section (above)
Output Impedance	See Reference Radio Transmitter Section (above)
Frequency Accuracy	See Reference Radio Transmitter Section (above)
Modulation Accuracy (for supported channels, unless stated)	See Reference Radio Transmitter Section (above)

- **General**

Path Loss Table	Compensation for cable and system loss can be specified for each supported channel. Independent values can be specified for the TX and RX paths. When the path loss table is enabled, the TX and RX path loss values for the selected channel are applied to both the measurement results and MT8860C transmitted power level.
Reference Frequency Oscillator	10 MHz TCXO fitted as standard
Frequency	10 MHz
Aging	<±1 ppm/year, <±2.5 ppm /10 years
Drift (Temperature Coefficient)	<±0.5 ppm, 0° to +45°C
Inputs & Outputs	
Front Panel Inputs & Outputs	
Test Port In/Out (for supported channels)	Provides connection to DUT, N-type (f), 50Ω nominal Maximum Input Power: +27 dBm Peak (Input Level Ranges 1, 1L, 2, 2L) +18 dBm Peak (Input Level Ranges 3, 3L) VSWR: Nominally <1.5:1 (2.4 GHz frequency band) Nominally <1.6:1 (5 GHz frequency band)
Interferer Input (for supported channels)	Provides input for external signal source (e.g. MG3700A), N-type (f) Maximum Input Power: +27 dBm VSWR: Nominally <1.5:1 (2.4 GHz frequency band) Nominally <1.6:1 (5 GHz frequency band) Loss to Test Port In/Out (using supplied test data): Nominally 22 dB ±1 dB (2.4 GHz frequency band) Nominally 24 dB ±1 dB (5 GHz frequency band)
WLAN Reference Input	Allows an external reference radio to be used for DUT receiver measurements using only the leveling loop and attenuator of MT8860C. In this mode, no measurements are supported by MT8860C. For correct leveling operation, the external radio must transmit a signal with the following characteristics; Packet duration: >110 µs Input Level Range: +12 to +18 dBm average power Maximum Input Power: +27 dBm
Rear Panel Inputs & Outputs	
GPIB	All MT8860C parameters (except the supply switch) are remotely programmable. The GPIB is designed in accordance with IEEE 488.2
Ethernet RJ45	Allows MT8860C to be remotely programmed by a LAN-connected computer. The following LAN interface protocols and related [port numbers] are supported; VXI-11 using VISA Sockets LAN [5025] TELNET [5024] File Transfer Protocol (FTP) [23]
10 MHz Out	As Reference Frequency Oscillator specification, TTL
10 MHz In	TTL
Digital Inputs	BNC, TTL
Input 1	BNC, TTL input for the external trigger source
Input 2	BNC, TTL input TX signal for External Reference radio. The TX signal must be the same length as the transmission from the external WLAN radio
Digital Outputs	
Output 1	BNC, TTL compatible The user can select between one of the following; 1. The TX trigger signal from the internal reference radio 2. The trigger signal from the MT8860C when the signal trigger is set to RF 3. The trigger signal from the MT8860C when the signal trigger is set to Video (default setting)
Output 2	BNC, TTL compatible The user can select between one of the following; 1. The TX trigger signal from the internal reference radio (default setting) 2. The trigger signal from the MT8860C when the signal trigger is set to RF 3. The trigger signal from the MT8860C when the signal trigger is set to Video
Power Requirements	
AC Supply	85 V(ac) to 264 V(ac)
Frequency	47 Hz to 63 Hz
Power	100 VA
Dimensions and Weight	
Dimensions (D × W × L)	180 × 320 × 350 mm
Weight	<10 kg
Rated Range of Use	
Operating Temperature Range	+5° to +40°C
Operating Humidity	<75% non condensing
Conditions of Storage	
Temperature	–20° to +70°C
Safety	Conforms with the product safety standard BS EN 61010-1 (Equivalent to IEC 61010-1) for class 1 portable equipment, for use in a Pollution Degree 2 environment. The instrument is designed to be operated from an Installation Category 2 supply
Electromagnetic Compatibility (EMC)	Conforms to the protection requirements of EN61326; RF emission and immunity class A

• MN8861A Receiver Accessory for MT8860C

Supported Channels 802.11n HT 2.4 GHz (20 MHz channel bandwidth)	Channels: 1 - 13 (2412 MHz to 2472 MHz)	
Supported Channels 802.11n HT 5 GHz (20 MHz channel bandwidth)	Channels: 36, 40, 44, 48 (5150 MHz to 5250 MHz) Channels: 52, 56, 60, 64 (5250 MHz to 5350 MHz) Channels: 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140 (5470 MHz to 5725 MHz) Channels: 149, 153, 157, 161, 165 (5725 MHz to 5825 MHz)	
Supported Channels 802.11n HT 2.4 GHz (40 MHz channel bandwidth)	Secondary = +1 Primary = 1 - 9	Secondary = –1 Primary = 9 - 13
Supported Channels 802.11n HT 5 GHz (40 MHz channel bandwidth)	Secondary = +1 Primary = 36, 44, 52, 60, 100, 108, 116, 124, 132, 149, 157	Secondary = –1 Primary = 40, 48, 56, 64, 104, 112, 120, 128, 136, 153, 161
PPDU HT Format	HT-Mixed Mode	
PPDU Types	20 MHz, 40 MHz, 40 MHz Duplicate	
Modulation and Coding Scheme	MCS index 0 - 7 and MCS 32 (Duplicate)	
Guard Interval	Long (800 ns), Short (400 ns)	
Data Rates (20 MHz channel b/w)	6.5, 7.2, 13, 14.4, 19.5, 21.7, 26, 28.9, 39, 43.3, 52, 57.8, 58.5, 65, 72.2 Mbps	
Data Rates (40 MHz channel b/w)	6, 6.7, 13.5, 15, 27, 30, 40.5, 54, 60, 81, 90, 108, 120, 121.5, 135, 150 Mbps	
Modulation	OFDM (BPSK, QPSK, 16-QAM, 64 QAM)	
Packet Spacing	10 µs to 1000 µs	
Number of Packets	1 to 10000	
Output Power 2.4 GHz (supported channels) MT8860C output	–20 to –100 dBm (settable to –3 dBm, unwarranted)	
Output Power 5 GHz (supported channels) MT8860C output	–20 to –100 dBm (settable to –8 dBm, unwarranted)	
Power Accuracy (supported channels)	±1.0 dB (–20 to –90 dBm, CW, 18° to 28°C) 2.4 GHz ±1.0 dB (–20 to –90 dBm, CW, 18° to 28°C) 5 GHz ±2.0 dB typical (<–90 to –100 dBm, CW, 18° to 28°C)	
Settable Resolution	0.1 dB	
Radio Specification	Complies with IEEE Std 802.11n-2009 radio specification for transmit spectral mask, modulation accuracy, and spectral flatness.	
MN8861A Supplementary Specification		
Connectors	Test Port N (m)	
Digital Interface Tx On Line	BNC TTL output connectors to Digital In 2 on MT8860C Active High for the length of the packet	
Control Interface	USB	
General		
Power Supply (supplied)	85 V(ac) to 264 V(ac)	
Frequency	47 Hz to 63 Hz	
Power	<20 VA	
Dimensions and Weight		
Dimensions	115 (W) × 85 (H) × 72 (D) mm	
Weight	<0.6 kg	
Operating Temperature Range	+5° to +40°C	
Operating Humidity	<75% non-condensing	
Safety	Complies to BS EN 61010-1 (equivalent to IEC 61010-1)	
EMC	Conforms to the protection requirements of EEC Council Directive 89/336/EEC	

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MT8860C	WLAN Test Set with 802.11b/g Measurements
	Standard accessories
	Power Cable
	Ethernet Cable
	Cat 5E Cross-over Patch Cable
	N-type Termination Plug (6 GHz, 50Ω) fitted to the WLAN Reference Input
	MT8860C WLAN Test Set Operation Manual (printed copy)
	MT8860C WLAN Test Set Remote Programming Manual (printed copy)
	Product CD Containing;
	• LANLook Software
	• Source Code for LANLook
	• Ethernet Communicator Software
	• Source Code for Ethernet Communicator
	• National Instruments VISA Run-Time Engine
	• CombiTest MT8860x Plug-in Operation Manual (pdf)
	• MT8860C WLAN Test Set Operation Manual (pdf)
	• MT8860C WLAN Test Set Remote Programming Manual (pdf)
	Options
MT8860C-001	Rack Mount Kit (CANNOT be ordered with option 2)
MT8860C-014	802.11a Transmitter and Receiver Measurements
MT8860C-114	Retrofit 802.11a Transmitter and Receiver Measurements
MT8860C-017	802.11n Transmitter and Receiver Measurements (Requires MN8861A Receiver Accessory for 802.11n receiver measurement support, sold separately)
MN8861A	Receiver Accessory for MT8860C
MT8860C-117	Retrofit, 802.11n Transmitter and Receiver Measurements (Requires MN8861A Receiver Accessory for 802.11n receiver measurement support, sold separately)
MT8860C-098	Standard Calibration to ISO 17025 and ANSI/NCSLI Z540-1 (Certificate of calibration only)
MT8860C-099	Premium Calibration to ISO 17025 and ANSI/NCSLI Z540-1 (Certificate of calibration with test report and uncertainty data included)
	Accessories
2000-1613-R	*Bluetooth*/Dual Band WLAN Antenna and Adapter
2000-1548-R	N-type Termination Plug (6 GHz, 50Ω)
2100-2	GPIB Cable, 2 m
2000-1371-R	Ethernet Cable
3-806-152	Cat 5E Cross-over Patch Cable
B0329G	Protective Cover (CANNOT be ordered with option 1 or option 2)
13000-00258	MT8860C WLAN Test Set Operation Manual
13000-00259	MT8860C WLAN Test Set Remote Programming Manual

PIM MASTER™ PASSIVE INTERMODULATION ANALYZER
MW82119A

LTE 700 MHz, Cellular 850 MHz, E-GSM 900 MHz, DCS 1800 MHz, PCS 1900 MHz, PCS/AWS 1900 MHz/2100 MHz

Remote Control
Ethernet | USB

Featuring Distance-to-PIM™ (DTP) The Fastest Way to Pinpoint the Source of PIM

NEW

Anritsu Company introduces the first battery-operated high power Passive Intermodulation (PIM) testing solution for the major wireless standards in use around the world. PIM is a form of interference generated by passive components that are normally thought of as linear such as connectors, cable assemblies, filters and antennas. However, when subject to high RF power levels found in cellular systems, these devices can generate spurious signals that increase the receiver noise floor and reduce site performance.

The PIM Master accurately measures PIM performance by injecting two CW test tones into the antenna feed network and recording the magnitude of the 3rd, 5th, or 7th order intermodulation products falling in the receive band of the system. The MW82119A is able to perform the following measurements enabling test technicians to quickly find and eliminate PIM problems found at the cell site:

- PIM versus Time
- Swept PIM
- Distance-to-PIM™ (DTP)

The PIM Master's small size and light weight combined with battery operation make it the ideal solution for verifying performance at difficult to access sites such as Remote Radio Head (RRH) installations or indoor Distributed Antenna Systems (DAS). Performing a PIM test at these sites often involves a tower climb or carrying the equipment up a ladder or through small access ports to reach the required point of test. The enhanced portability of the MW82119A enables high power PIM testing where required without heavy lifting and without long extension cords.

The PIM Master includes Anritsu's patented Distance-to-PIM™ (DTP) technology for accurately determining the location of PIM faults both inside the feed system as well as beyond the antenna. This technology becomes critically important for fault finding DAS installations due to the complexity of the feed system and large number of RF interconnects. Without DTP, finding and eliminating PIM requires a process of elimination involving the movement of low PIM loads in the network until the PIM problem disappears. This process is not only time consuming, but it also means that good connections may be opened (and potentially damaged) in the process of locating PIM problems. Distance-to-PIM allows technicians to quickly and efficiently locate PIM sources at a site resulting in quicker site repairs and lower cost.

As with all Anritsu Handheld products, the MW82119A has been designed and tested to rigorous standards for shock, vibration and temperature extremes to ensure reliable service in an outdoor environment.

2 × 40 W Test Capability

Even though the package is small and it is battery operated, the MW82119A is a high performance PIM test solution allowing operators to adjust output power from 25 dBm (0.3 Watts) for indoor DAS testing to 46 dBm (40 Watts) for macro site testing. In both indoor and outdoor systems, PIM interference is highly dependent on the power level being transmitted by that system. By matching the PIM test power level more closely to the actual power level used at the site, operators will gain a clearer understanding of the true interference generated by both the RF infrastructure and the environment where the antenna is placed.

Overview

• Distance-to-PIM™ (DTP)

Distance-to-PIM (DTP) is similar to Distance-to-Fault (DTF), which Anritsu introduced in the Site Master™ in 1997 for identifying the location of impedance mismatches in a feed line. DTP quickly and accurately identifies the location of PIM faults inside the feed system as well as beyond the antenna. This capability eliminates the guesswork involved in isolating PIM sources and speeds site repairs.

Up to 6 markers can be activated in Distance-to-PIM to identify the magnitude and distance to PIM faults found in the system. Using Anritsu's familiar Line Sweep Tools (LST) application, operators can overlay multiple DTP measurements to identify what has changed since the last visit. This enables the ability to see growing PIM problems and take corrective action before they impact network performance.

• PIM vs. Time

The PIM Master includes a PIM versus Time measurement that tracks not only the instantaneous PIM level but also records the maximum PIM level experienced throughout a fixed frequency PIM test. The two test frequencies, transmit power level, intermodulation order (3rd, 5th or 7th) and test duration can be easily adjusted by the user to meet the test requirements.

This mode is useful for dynamic PIM tests as it not only captures the peak PIM value for pass / fail determination but also provides a visual indication of the stability of the system under test. When a limit line is entered in this mode, the color of the PIM magnitude changes to red when the value has exceeded the limit value. The peak value will remain red indicating a failure even if the PIM level returns to a passing level after the dynamic stress has been removed.

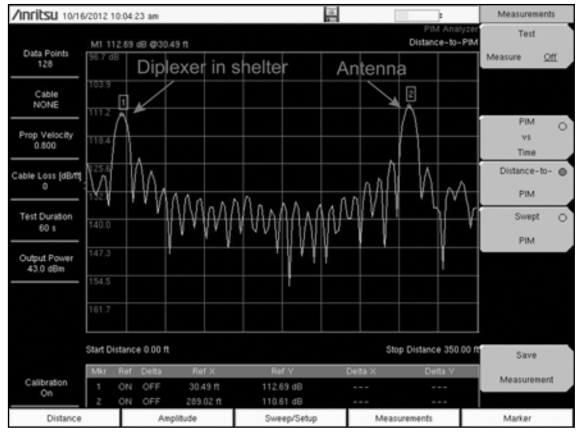
• Swept PIM

When making a Swept PIM measurement, the PIM Master is able to evaluate changes in PIM magnitude versus Intermodulation (IM) frequency. This test is conducted by holding one transmit tone fixed while varying the frequency of the second transmit tone, causing the IM product to "sweep" across a range of frequencies in the receive band of the system. The magnitude of the PIM generated versus frequency is displayed and can be compared to a user-selected pass / fail limit.

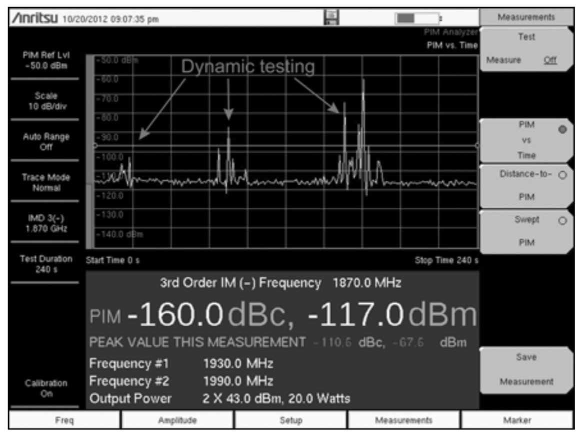
PIM measurements are the vector sum of all PIM signals generated on a line at the IM frequency being tested. When multiple PIM sources exist, it is possible for the signals to combine out of phase at a particular test frequency indicating a passing result when the individual PIM levels are actually failures. A swept PIM test varies the IM frequency over a range of frequencies providing the user a clearer picture of the true PIM performance of the system. It is worth mentioning that Distance-to-PIM measurements provide the same function as they also evaluate a range of frequencies rather than a single IM frequency.

• Easy to View Display

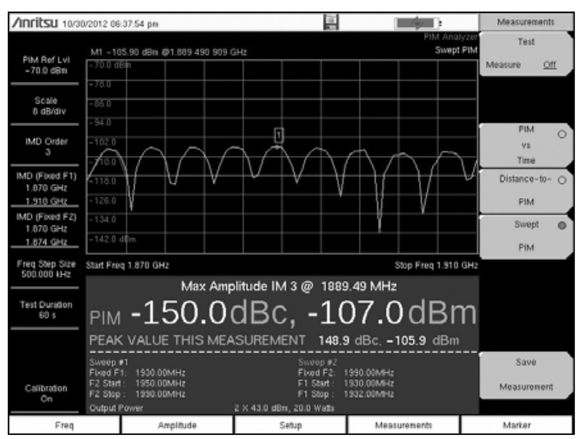
The PIM Master uses the same large, field proven, color touch screen displays found in other Anritsu Handheld products. Five different screen settings are available to enhance visibility in the environment where the test will be performed. This includes a Black & White setting to improve readability in direct sunlight as well as a Night Vision setting to reduce screen brightness for nighttime operation.



Distance-to-PIM (DTP)
PIM Level (dBm) vs. Distance (meter)



PIM vs. Time
PIM Level (dBm) vs. Time (second)



Swept PIM
PIM Level (dBm) vs. Frequency (MHz)

PIM Report Generation and Certified Training

• Line Sweep Tools for Cable, Antenna, and PIM Analyses

Line Sweep Tools (LST) is a post processing tool to manage and archive measured data from Anritsu's cable & antenna analyzers as well as PIM analyzers. Measured PIM results from different frequency band PIM Analyzers as well as measured data from your SiteMaster™ can be combined together into a single, unified site report.
In one report an operator can have all of the information needed to verify the integrity of an antenna system with the measurements of:

- PIM
- Distance-to-PIM (DTP)
- Return Loss
- Insertion Loss
- Distance-to-Fault (DTF)

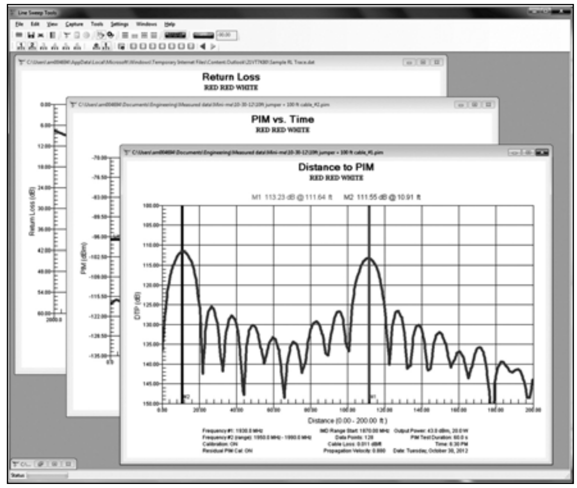
Contractors, technicians, and engineers can be more productive with one cohesive tool to learn and use in managing antenna line quality measurements.
PIM Master™ Certified PIM Measurement Training Course
Specialized PIM Master™ passive intermodulation measurement training is an intense one-day instructor led training course that focuses on making PIM measurements (theory and lab). This is modeled on our successful Site Master™ Certified Line Sweep course.

- Brief Course Outline
  - Definition and Description
  - How PIM differs from Return Loss
  - Why is PIM a problem
  - How to test for PIM
  - PIM testing process
  - Hints for successful testing
  - Assessing results
- Labs
  - Hooking up the equipment and confirming proper operation
  - Measuring known good and bad devices
  - Device measurement practice
- Exams
  - Theory and safety
  - Hands-on practical
- Certification (after passing exams)
  - Certificate of Completion
  - Wallet-sized photo ID

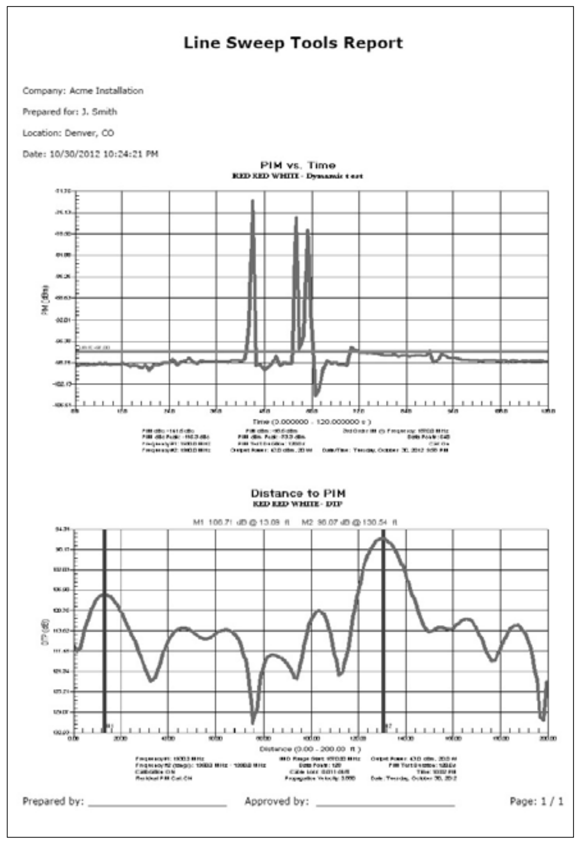
Students will learn technical aspects of PIM measurements, how to set up a PIM measurement, useful examples of what works and what doesn't, interpreting results, and locating the PIM.

• Customer Support

Like all Anritsu products, the PIM Master has a range of support products, services and training allowing you to maximize your return-on-investment.
With Anritsu's design know-how and demanding production testing and performance verification you can count on the PIM Master to give you years of reliable, dependable service.



Line Sweep Tools (LST) utilized for report generation on a PIM trace



Test Report generated using Line Sweep Tools (LST)

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications subject to change without notice; 3) Typical performance is the measured performance of an average unit; 4) Recommended calibration cycle is 12 months.

Measurements	PIM and PIM vs. Time	3rd, 5th, and 7th order intermodulation product when in receive band (user selectable)	
	Distance-to-PIM	Distance and relative magnitude of mutiple PIM sources	
	Swept PIM	3rd, 5th, and 7th order intermodulation product when in receive band (user selectable)	
Instrument Setup Parameters	Frequency	Carrier F1, Carrier F2, Intermodulation Order (3rd, 5th, 7th)	
	Amplitude	Ref Value, Scale, Auto Range (On/Off), Amplitude Tone (On/Off)	
	Setup	Output Power, Test Duration (1 s to 3,600 s)	
	Limit Lines	Limit (Upper/Lower), On/Off, Limit Move, Limit Alarm (On/Off)	
	GPS	On/Off, 3.3 V/5.0 V	
	DTP	Cable Velocity, Distance	
PIM Measurement Ranges	RF Test Power	Two CW tones 25 to 46 dBm, 0.1 dBm steps	
	Transmit Frequency Range	Option 700	Tx: 734 MHz to 734.5 MHz, 745 MHz to 766 MHz Rx(L): 698 MHz to 722 MHz, Rx(U): 779.5 MHz to 804.5 MHz
		Option 850	Tx: 869 MHz to 871.5 MHz, 881.5 MHz to 894 MHz Rx: 824 MHz to 849 MHz
		Option 900	Tx: 927 MHz to 937.5 MHz, 951.5 MHz to 960 MHz Rx: 880 MHz to 915 MHz
		Option 180	Tx: 1805 MHz to 1837.5 MHz, 1857.5 MHz to 1880 MHz Rx: 1710 MHz to 1785 MHz
		Option 190	x: 1930 MHz to 1932.5 MHz, 1950 MHz to 1990 MHz Rx: 1870 MHz to 1910 MHz
		Option 192	Tx: 1930 MHz to 1935 MHz, F2: 2110 MHz to 2155 MHz Rx: 1710 MHz to 1750 MHz
	Residual PIM Performance	<–117 dBm, <–125 dBm typical (2x 43 dBm test tones)	
	PIM Measurement Range	–70 to –130 dBm	
PIM Master Connectors	Test Port	7/16 DIN, female, 50Ω	
	Dual USB Type A	2x Type A (connect USB Flash Drive and USB Power Sensor)	
	USB Mini-B	1x Mini-B (connect to PC for data transfer)	
	GPS	SMA, female (with GPS option only)	
	External Power	2.1 mm × 5.5 mm barrel connector, 12 to 15 VDC, <5.0 A	
Display	Size	213 mm (8.4 in) touch screen	
	Resolution	800 × 600	
Battery	Type	Li-Ion	
	Battery Operation	2.5 hours, typical	
Power	Emergency Stop	Red push button	
	AC/DC Adapter	Input: 100 VAC to 240 VAC, 50/60 Hz , Output: 12 VDC	
Electromagnetic Compatibility	Australia and New Zealand	C-tick N274	
	Interference	EN 61326-1:2006	
	Emissions	EN 55011:2007	
	Immunity	EN 61000-4-2/-3/-4-4/-4-5/-4-6/-4-11	
	European Union	CE Mark, EMC Directive 2004/108/EC	
Safety	Safety Class	2006/95/EC, EN 61010-1 Class 1	
	Product Safety	IEC 60950-1 when used with Anritsu Company supplied Power cable	
Environmental	Temperature	–10° to +55°C (Operating), –51° to +71°C (Storage)	
	Relative Humidity	5% to 95% at +40°C, Non-condensing	
	Shock	MIL-PRF-28800F Class 2	
	Altitude	4600 meters, operating and non-operating	
Dimensions and Mass	Dimensions	350 × 314 × 152 mm (13.8 × 12.4 × 6.0 in)	
	Mass	9.0 kg to 12.2 kg (20 lb to 27 lb)	

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MW82119A	PIM Master™ Passive Intermodulation Analyzer
	Frequency Options (Must order one)
MW82119A-0700	LTE 700 MHz
MW82119A-0850	Cellular 850 MHz
MW82119A-0900	E-GSM 900 MHz
MW82119A-0180	DCS 1800 MHz
MW82119A-0190	PCS 1900 MHz
MW82119A-0192	PCS/AWS 1900/2100 MHz
	Other Options
MW82119A-0019	High Accuracy Power Meter (requires USB power sensor)
MW82119A-0031	GPS Receiver (requires GPS antenna)
MW82119A-0098	Standard Calibration to ISO 17025 and/or Z540.1
MW82119A-0099	Premium Calibration to ISO 17025 and/or Z540.1 plus test data
	Standard Accessories (included with PIM Master)
2000-1712-R	Soft Carrying Case
2000-1714-R	Shoulder Strap
1091-387-R	Adapter, 7/16 DIN(f) to 7/16 DIN(m), 50Ω (Connector Saver)
10920-00060	Handheld Instruments Documentation Disc
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) DVD Disc
10580-00285	User Guide
633-75	High-capacity Li-Ion Battery Pack
40-187-R	AC/DC Power Supply (Country dependent)
	AC Power Cable
806-141-R	Automotive Cigarette Lighter 12 VDC Adapter
2000-1371-R	Ethernet Cable, 7 ft/213 cm
3-2000-1498	USB A-mini B Cable, 10 ft/305 cm
11410-00679	PIM Master Product Brochure
	One Year Warranty (Including battery, firmware, and software)
	Certificate of Calibration

Model/Order No.	Name
	Accessory Kits
2000-1716-R	PIM Master Accessory Kit with 2.75 m Armored PIM Test Cable and Hard Case
	PIM accessory kit includes:
16DD50-2.75-R	Armored PIM Test Cable, 2.75 m, 45 MHz to 3000 MHz, 7/16 DIN(m), 50Ω
2000-1724-R	Low PIM Termination, 700 MHz to 2600 MHz, 40 W CW, 7/16 DIN(m), 7/16 DIN(f), 50Ω
1091-390-R	PIM Standard, -80 dBm ±3 dB @ 1775 MHz, 20 W, 7/16 DIN(m) to 7/16 DIN(f), 50Ω
1091-403-R	PIM Standard, -80 dBm ±3 dB @ 910 MHz, 20 W, 7/16 DIN(m) to 7/16 DIN(f), 50Ω
1091-386-R	Adapter, 7/16 DIN(f) to N(f), 50Ω
1091-389-R	Adapter, 7/16 DIN(f) to N(m), 50Ω
1091-387-R	Adapter, 7/16 DIN(f) to 7/16 DIN(m), 50Ω
1091-388-R	Adapter, 7/16 DIN(f) to 7/16 DIN(f), 50Ω
1091-385-R	Adapter, 7/16 DIN(m) to 7/16 DIN(m), 50Ω
760-260-R	Hard Case
01-510	Crescent Wrench
01-512-R	1" Torque Wrench
01-513-R	1¼" Torque Wrench
971-9-R	Isopropyl Alcohol Wipes (50 pieces)
971-10-R	Tapered Cotton Swab (100 pieces)
971-11-R	Duster (10 oz. spray can) (blow away microscopic contaminants)
	Optional Accessories
760-259-R	MW82119A Transit Case
67135	Backpack for Accessories
2000-1374	Dual Battery Charger
16DD50-4.0-R	Armored PIM Test Cable, 4 m, 45 MHz to 3000 MHz, 7/16 DIN(m), 50Ω
2000-1528-R	GPS Antenna, SMA(m) with 15 ft cable
2000-1652-R	GPS Antenna, SMA(m) with 1 ft cable
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24105A	Inline High Power Sensor, 350 MHz to 4 GHz, +3 dBm to +51.76 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
10580-00315	Certified PIM Master™ PIM Measurement Training Course

PIM MASTER™ HIGH-PERFORMANCE PASSIVE INTERMODULATION ANALYZER

MW8208A MW8209A MW8219A

Cellular Band 850 MHz E-GSM Band 900 MHz PCS/AWS Bands 1900 MHz/2100 MHz

Remote Control
GPIB

Featuring Distance-to-PIM™ (DTP)
The Fastest Way to Pinpoint the Source of PIM

NEW
MW8208A

Anritsu Company introduces its first generation high performance PIM testing solution for the Cellular, E-GSM, PCS, and AWS, frequency bands. Anritsu has developed the PIM Master to verify if receiver interference at a cell site is due to an intermodulation product of two or more transmit frequencies, also known as passive intermodulation (PIM).
The PIM Master generates two high power tones in the transmit band of a base station and Anritsu's family of handheld RF instruments' PIM Analyzer measures the 3rd, 5th, or 7th order intermodulation products in the receive band coming back down the same cable. And the GPS option will record the location of the measurement.

Anritsu's handheld instruments supporting the PIM Master include:
- Site Master™ S332E, S362E
- Spectrum Master™ MS271xE, MS2721B
- Cell Master™ MT8212E, MT8213E
- BTS Master™ MT8221B, MT8222B

PIM Testing

The current standard of PIM testing offers a well-known system of two primary carriers and a calculated PIM frequency, which is monitored via a spectrum analyzer. This provides a measurement of the overall linearity of the antenna system and the surrounding environment.
As more power goes up the antenna lines a coaxial connection is more likely to cause a fault on a tower. Traffic through the site plays a big part – a relatively quiet site will not usually see the same performance problems that a busy site will see.
The main reason we use a PIM test is that it is the most comprehensive measure of electrical connection quality that is commercially available.

PIM Testing versus Line Sweeping

A PIM test cannot, however, measure VSWR. This means the test set will not see an open or short condition, unless the fault displays non-linear behavior. A return loss figure that is failing will not be determined with a PIM test measurement.
Components deteriorate as they age due to a number of issues, including poor mechanical design, poor installation, and moisture ingress (which is the most significant).

On-site faults can mostly be categorized into two main types: linearity related and impedance related.
PIM testing measurements reflect the overall linearity of an antenna feed line and Line Sweep measurements reflect the overall impedance matching of all of the components in an antenna feed line. Both tests need to be performed to ensure the overall quality of an antenna feed line. Passing one type of test (PIM or Line Sweep) does not guarantee the other test will pass.

Symptoms of PIM problems

Many symptoms could be indicators of PIM problems.

These include:
- Receiver desensitization (raised noise floor)
- Rx Diversity alarms
- Spectral re-growth in the transmitter mask
- Excessive dropped/blocked calls
- Cell site coverage shrinking
- Complaints of interference from neighboring cell site owners

40 W 1900 MHz/2100 MHz Residual PIM Measurement with GPS tagging Listen to relative PIM level with audible tone Save/Recall Setups for standardized testing

Where is the PIM?

Anritsu labs has invented and succeeded in developing a patent pending technology that pinpoints PIM faults called Distance-to-PIM™ (DTP). No more wasting time rappelling down towers trying to locate PIM, no more wondering if the PIM is coming from the antenna system or the surrounding environment.
The Distance-to-PIM test is simple, immediate, and accurate. DTP informs the technician of the distance and relative magnitude of all the PIM sources simultaneously, both inside the antenna system and beyond the antenna.
DTP is similar to Distance-to-Fault (DTF), which Anritsu introduced in the Site Master™ in 1997, displaying distance versus impedance changes. DTP utilizes algorithms much like DTF to show distance versus the magnitude of non-linear faults.
DTP is an option available on the PIM Master.

Distance-to-PIM lab results

DTP has been tested extensively in our development lab with very positive results as shown on the left. DTP shows the location for PIM problems within the antenna system, as well as distance to external PIM sources outside the antenna system. This is an incredible step forward in improving the quality of information received from the on-site PIM test.
The Distance-to-PIM test offers far more insight than traditional PIM testing. This information can speed up repairs, control repair costs, and help plan budgets accurately. Comparison of PIM values over time can show if a device is deteriorating with age. This permits fault correction before a failure causes dropped or blocked calls.

2 × 40 Watt PIM Testing

PIM problems can be intermittent and power sensitive. This is often the case when PIM problems are just beginning to show up. This can be due to light corrosion, high traffic loading, or changing weather conditions activating environmental diodes. Using higher power levels can often force otherwise intermittent failures to become visible. Higher power levels may be required to find faults in a multicarrier antenna system and to discover microscopic arcing in connectors.
In many cases PIM faults cannot be discovered with just 2 × 20 Watts of power. With the ability to test at 40 Watts, one can spot serious problems that cannot be seen on a 20 Watt PIM tester.

Storing and Recalling Setups and Measurements

When saving files many choices are available. One can save and recall:

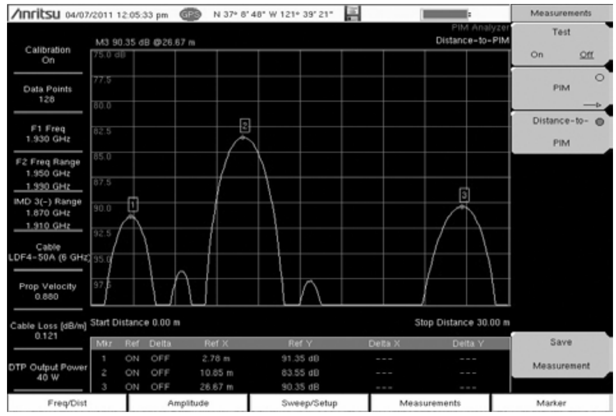
- Set-up file
- Measurement file
- Jpeg screen shot (save only)

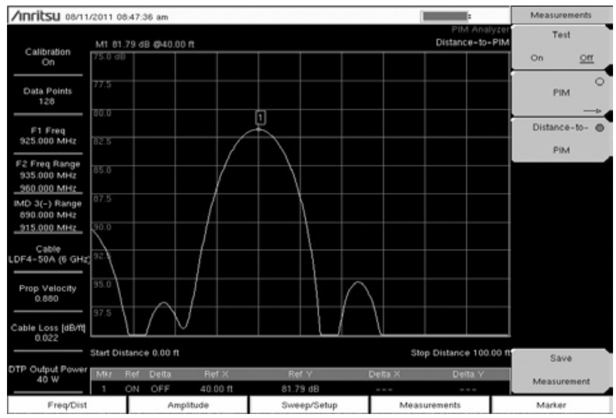
Saving and recalling setups makes it quicker to run the same tests over and over again at different sites. Saving and recalling a measurement becomes a reference measurement at a site when you return to see if there has been any deterioration since the last time the site was tested.

Run Line Sweep Tests on the same instruments

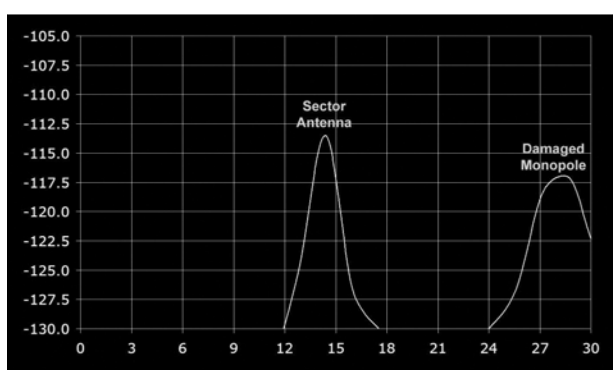
Since both PIM measurements and Line Sweep measurements can be made on the same instruments (Site, Cell, or BTS Masters) one can efficiently make Line Sweep measurements at the same time. Now all PIM measurements and Line Sweep measurements are stored together on the same instrument. An installation contractor or technician only has to learn how to use one instrument to make all related antenna measurements for linearity and impedance testing.

Distance-to-PIM™ (DTP) Plots
PIM Level (dB) vs. Distance (meters or feet)

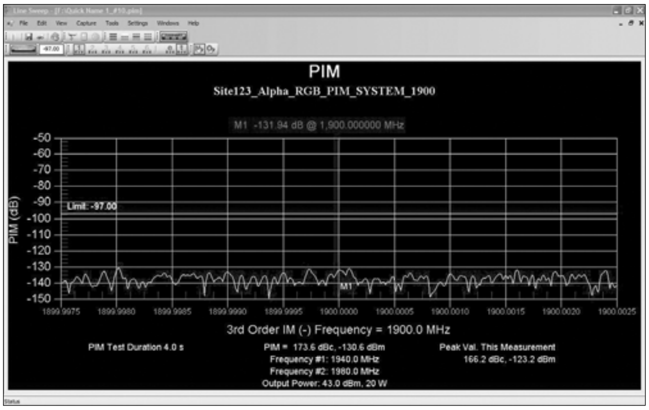




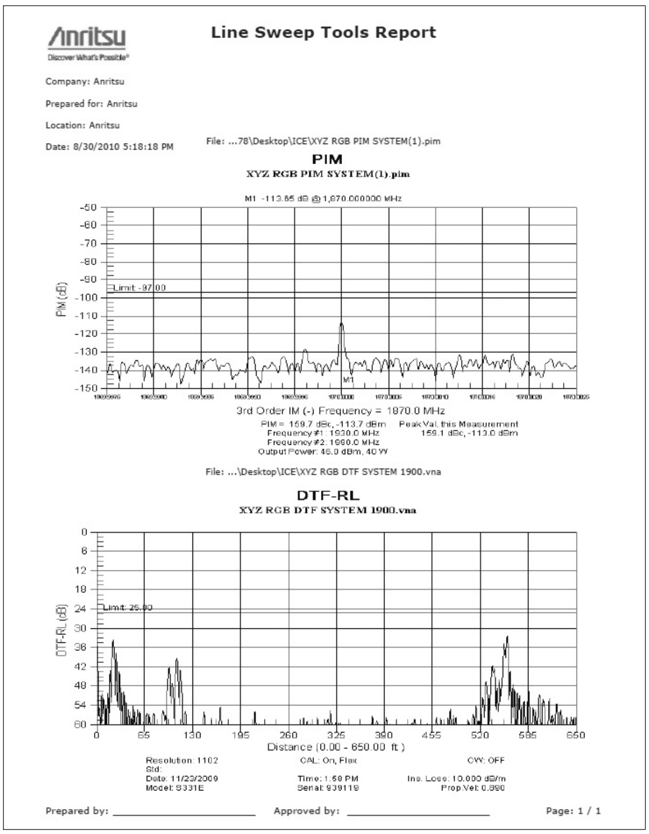
Locating PIM sources (1900/2100 and 900 MHz respectively)



Locating external PIM occurrences beyond the antenna



PC Line Sweep Tool utilized for report generation on a PIM trace



Line Sweep Tools Report with Limit Lines

Line Sweep Tools for Cable, Antenna, and PIM Analysis

Anritsu's Line Sweep Tools is a new generation post processing tool to manage, archive and report on all cable, antenna, and PIM analyzer sweeps. In one tool all measurements can be incorporated into one unified report per antenna system.
Now in one integrated report an operator can have all of the information on the integrity of an antenna system with the measurements of:

- PIM
- Return Loss
- Insertion Loss
- Distance-to-Fault

Contractors, technicians, and engineers can be more productive with one cohesive tool to learn and use in managing antenna line quality measurements.

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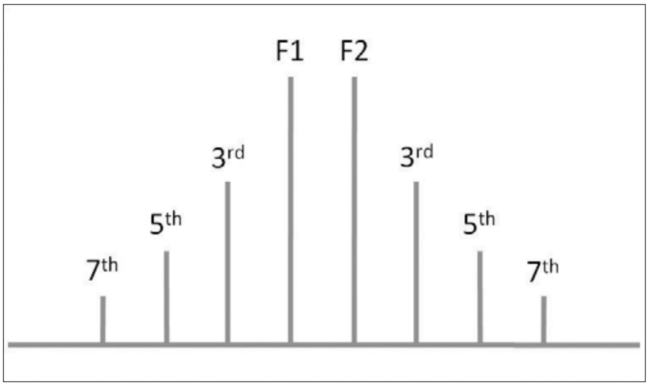
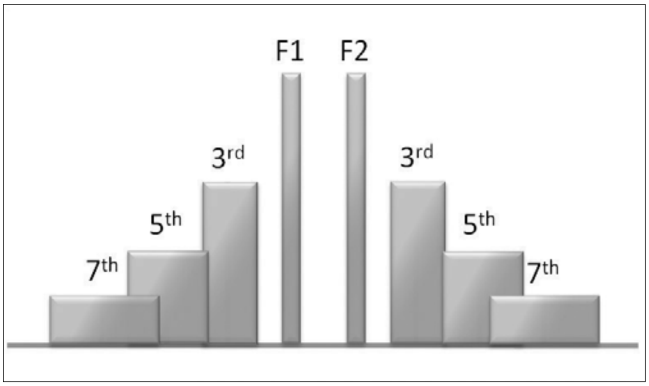
Anritsu Line Sweep Tool for report generation
A full line of PIM testing accessories
Extended warranty
PIM Certified Technician Training Course
Made in the USA

With Anritsu's design know-how and demanding production testing and performance verification you can count on the PIM Master to give you years of reliable dependable service.



Carriers F1 and F2 with 3rd through 7th order products



PIM Bandwidth increases with the order of the product

Corrosion (rust) in view of the antenna can cause PIM

Rusty rooftops and fences can be prime sources of PIM

What is PIM?

PIM is a form of intermodulation distortion that occurs in passive components normally thought of as linear, such as filters, combiners, surge protectors, cables, connectors, and antennas. However, when subject to the high RF powers found in cellular systems, these devices can generate spurious signals.

PIM shows up as a set of unwanted signals created by the mixing of two or more strong RF signals in a non-linear device, such as in a loose or corroded connector, or in nearby rust. Other names for PIM include the "diode effect" and the "rusty bolt effect."

This pair of formulas can predict PIM frequencies for two carriers:

$$IM_{n+m} = nF1 - mF2$$
$$IM_{n+m} = nF2 - mF1$$

F1 and F2 are the Tx carrier frequencies and the constants n and m are positive integers. When referring to PIM products, the sum of n + m is called the product order, so if m is 2 and n is 1, the result (2 + 1 = 3) is referred to as a third order product or IM3.

Typically, the third order product is the strongest causing the most harm when they fall into the Rx band. Because PIM amplitude becomes lower as the order increases, higher order products typically are not strong enough to cause direct frequency problems, but they usually assist in raising the adjacent noise floor.

Once this raised noise floor crosses into the Rx band, it then has an open door (and sometimes gain via an LNA) into the BTS.

It is important to recognize that intermodulation created from modulated signals occupies more bandwidth than the fundamentals. PIM products can be very wide band, covering wide swaths of frequencies.

Why has PIM become an issue recently?

The introduction of high-speed data within mobile communications devices has increased the network traffic within a cellular system to the degree that it is greatly affecting network performance.

As extra cellular transmitters and modulation formats are commissioned into service in new or existing sites, the statistical performance can appear to change dramatically. Ultimately, this can result in poor site/sector performance and reduced coverage, and this is why testing for PIM is now required in the field.

PIM has come to the forefront of network problems recently due to a variety of reasons which can be any combination of the following:

- Higher RF power
  - Multiband systems on the same antenna lines
  - Fully loaded multicarrier systems
  - High density/traffic sites – heavily loaded
- Wideband receive filters
- Duplex antenna lines
- Wider bandwidth signals up to 5, 10, and 20 MHz
- Aging infrastructure – primarily connectors corroding and loosening
- Environmental diodes created by corrosion in the surrounding area
- Intermittent environmental diodes due to wet and dry conditions
- Neighboring cell sites generating PIM

An on site PIM test is a comprehensive measure of linearity and construction quality. For more information about PIM testing refer to our whitepaper "Troubleshooting Passive Intermodulation Problems in the Field" document number 11410-00586.

PIM Master™ Specifications

General Specifications: All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Measurements	PIM	3rd, 5th, and 7th order intermodulation product in receive band (user selectable)
	Noise Floor	Rx noise floor of base station
	Distance-to-PIM	Distance and magnitude of multiple PIM sources (Option 0420)
Instrument Setup Parameters	Instruments Supported	Site Master™ S332E, S362E, Spectrum Master™ MS2712E, MS2713E, Cell Master™ MT8212E, MT8213E, BTS Master™ MT8221B, MT8222A, MT8222B
	Frequency	Carrier F1, Carrier F2, Intermod Order (3rd, 5th, 7th), Span
	Amplitude	Ref Value, Scale, Ref Level Offset, Auto Range (On/Off), Amplitude Tone (On/Off)
	Setup	Output Power, Test Duration (1 s to 60 s), Normal → A, Max Hold → A, Display Type (Trace, Bar)
	Parameter Setup	F1, F2, Power
	Limit Lines	Limit (Upper/Lower), On/Off, Limit Move, Limit Alarm (On/Off)
	GPS	On/Off, 3.3 V/5.0 V
	DTP	Cable Velocity, Distance, Calibrate
	Measurements	PIM Test (Measure/Off) Measure Noise Floor, Save Measurement
PIM Measurement Ranges	RF Test Power	Two CW tones of 20, 30, or 40 Watts (≈ 43, 45, 46 dBm) (user selectable)
	Transmit Frequency Range	MW8208A – 869 MHz to 894 MHz
		MW8219A – 1930 MHz to 1990 MHz, 2110 MHz to 2155 MHz
		MW8209A – 925 MHz to 960 MHz
	3rd, 5th, and 7th Order Frequency Ranges	MW8208A – 824 MHz to 849 MHz
		MW8219A – 1710 MHz to 1755 MHz, 1850 MHz to 1910 MHz
		MW8209A – 880 MHz to 915 MHz
	Residual PIM Performance	< –112 dBm/–155 dBc typical
	Measurable PIM order	3rd, 5th, and 7th order intermodulation product (if in band)
	Distance-to-PIM	Distance and magnitude of multiple PIM sources (Option 0420)
PIM Master Connectors	Test Port	7/16 DIN, female, 50Ω
	RF Out	Type N, female, 50Ω (connect to RF In on instrument)
	10 MHz Out	BNC, female, 50Ω, 10 MHz (connect to Ext. Ref. In on instrument)
	USB Interface	Type B (connect to USB Type A port on instrument)
	AC Power	IEC60320 C14
Power	Emergency Stop	Red push button
	AC Power	90 VAC to 240 VAC, 50 Hz/60 Hz
Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 2004/108/EC
	Australia and New Zealand	C-tick N274
	Interference	EN 61326-1:2006
	Emissions	EN 55011:2007
	Immunity	EN 61000-4-2/-3/-4-4/-4-5/-4-6/-4-11
Safety	Safety Class	2006/95/EC, EN 61010-1 Class 1
	Product Safety	IEC 60950-1 when used with Company supplied Power cable
Environmental	Temperature	–10° to +55°C (Operating), –51° to +71°C (Storage)
	Maximum Humidity	95%
	Shock	MIL-PRF-28800F Class 2
	Altitude	4600 meters, operating and non-operating
Dimensions and Mass	Dimensions	300 × 425 × 500 mm (12 × 17 × 20 in)
	Mass	27 kg (59 lbs)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

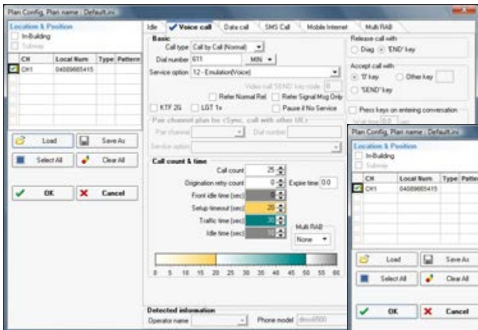
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MW8208A	PIM Master™ Passive Intermodulation Analyzer (requires S332E, S362E, MS2712E, MS2713E, MT8212E, MT8213E, MT8221B or MT8222B) 900 MHz Tx Frequency Band
	Options
MW8208A-0425	Large Wheel Option (as shown in photo)
MW8208A-0098	Standard Calibration to Z540
MW8209A	PIM Master™ Passive Intermodulation Analyzer (requires S332E, S362E, MS2712E, MS2713E, MT8212E, MT8213E, MT8221B or MT8222A/B) 900 MHz Tx Frequency Band
	Options
MW8209A-0425	Large Wheel Option (as shown in photo)
MW8209A-0098	Standard Calibration to Z540
MW8219A	PIM Master™ Passive Intermodulation Analyzer (requires S332E, S362E, MS2712E, MS2713E, MT8212E, MT8213E, MT8221B or MT8222A/B) 1900/2100 MHz Tx Frequency Band
	Options
MW8219A-0425	Large Wheel Option (as shown in photo)
MW8219A-0098	Standard Calibration to Z540

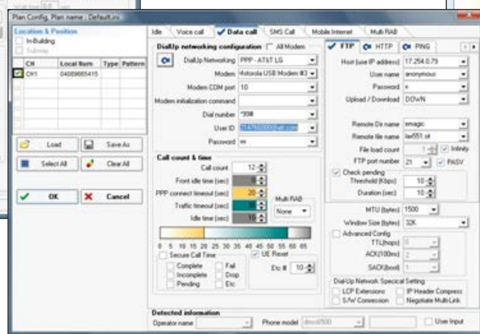
Model/Order No.	Name
	Standard Accessories (included with PIM Master)
10580-00280	PIM Master™ User Guide
11410-00546	PIM Master Product Brochure
2000-1635-R	Interface Cable (USB, RF, REF)
	Country dependent AC Power Cable
	Optional Accessories
10580-00315	Certified PIM Master™ PIM Measurement Training Course
2000-1637-R	PIM Master Accessory Kit with Torque Wrench
MA82103A	Low PIM Load, 700 MHz to 2200 MHz
1091-390-R	PIM Standard, –80 dBm @ 2 × 20 watts
1091-386-R	Adapter, 7/16 DIN(f) to N(f), 50Ω
1091-389-R	Adapter, 7/16 DIN(f) to N(m), 50Ω
1091-387-R	Adapter, 7/16 DIN(f) to 7/16 DIN(m), 50Ω
1091-388-R	Adapter, 7/16 DIN(f) to 7/16 DIN(f), 50Ω
1091-385-R	Adapter, 7/16 DIN(m) to 7/16 DIN(m), 50Ω
1091-403-R	PIM Standard, –80 dBm ±3 dB @ 910 MHz, 2 × 20 W
16DD50-2.75-R	Armored PIM Test Cable, 2.75 m, 45 MHz to 3000 MHz, 7/16 DIN(m), 50Ω
01-512-R	1" 25 N-m Torque Wrench
01-513-R	1¼" 25 N-m Torque Wrench
67135	Anritsu Backpack (For Handheld Products)
01-510	Crescent Wrench

LINK MASTER™ AIR INTERFACE LOGGING AND ANALYSIS TOOLS
ML8725A/ML8726A

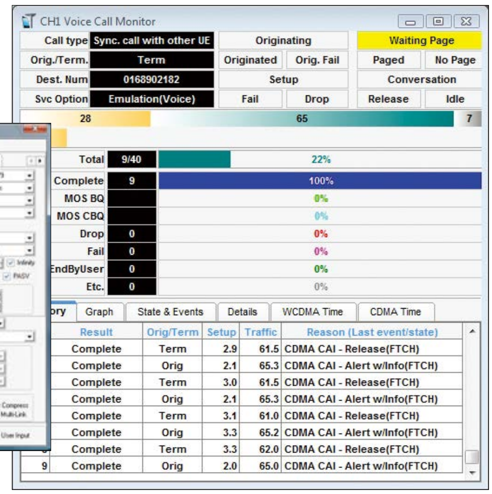
Air Interface Optimization Tools Featuring a Complete LTE Drive Test Solution



Link Master LML Voice Call Configuration



Link Master LML Data Call Configuration



Link Master LML Voice Call Monitor

Air Interface Optimization Tools

Link Master is a family of PC-based air interface drive test and analysis tools which measures network performance and identifies opportunities for optimization. Link Master is designed for wireless operators that need to plan, implement and optimize, 2G, 3G, and 4G networks including HSPA and LTE.

Discovering opportunities for optimizing network performance is effortlessly visualized with comprehensive analysis tools including:

- Real-time mapping with trace lines to the serving cell sector
- Simple multi-floor in-building network characterization
- Full playback capability
- One-click synchronization

Link Master tools provides the data and information necessary for maximizing wireless network performance with:

- Subscriber UE network dependent performance data
- Receiver independent network performance data
- Layer 1 Measurements and Layer 3 Signaling: OTA, RRC, NAS

Drive test multiple technologies and networks simultaneously on one platform with multiple call types and users:

- LTE, W-CDMA/HSPA, GSM/EDGE, CDMA/EV-DO
- Voice, Video, Data, SMS, MMS, FTP, HTTP, PING, E-mail
- Six UEs and two Receivers

The Link Master family of optimization tools consists of:

- **Link Master LML** – Air Interface Logging Tools

Link Master LML logs air interface data taken during a drive test from multiple UEs or receivers on a PC.

- **Link Master LMA** – Air Interface Analysis Tools

Link Master LMA provides in-depth analysis of the post processed log data on a PC.

Maximize KPIs, Reduce Churn

It is critical in today's competitive environment to meet key performance indicators (KPIs) for minimum dropped and blocked calls and to maximize data throughput for the demanding subscriber. Optimizing the network will eliminate network performance as a reason for churn.

Link Master air interface family of optimization tools provides the necessary measurement tools to determine your KPIs and the analysis tools allowing you to easily identify where you can boost your network performance.

Whether you are planning, implementing, or optimizing an outdoor network or a multi-story in-building network with microcells, picocells, or femtocells, the Link Master platform is the one solution for your air interface optimization requirements.

Link Master LML

Air Interface Logging Tools

Link Master LML gives the operator many choices on call set-ups and real-time analysis. With up to six UEs or receiver devices on multiple networks on multiple call types, virtually every scenario can de drive tested. And a simple user interface enables walk testing multi-story office buildings.

Voice Call Configuration

- Auto-Dial with periodic, continuous, and mobile terminated call
- Save configuration settings and share common files with your team
- Idle-mode and manual measurements
- Call Quality (QoS) measurements

Data Call Configuration

- FTP download/upload, HTTP Download, Ping Test, SMS, Email, UDP
- Save configuration settings and share common files with your team
- Test the multiple layers of your network with RF performance data simultaneous with user access and network configuration settings

Voice Call Monitor

- Display call scenario history with summary
- Monitor the call scenario test during your data acquisition
- View call history and event timing

Data Call Monitor

- Display data call history with graph
- Monitor data session activity
- Summarize throughput results for each transfer and compare tests within a session
- Monitor low level events through an integrated ftp client perspective

Layer-3 Capture

- User selectable message filter to identify specific classes to view
- Decode each message for deep analysis in the field

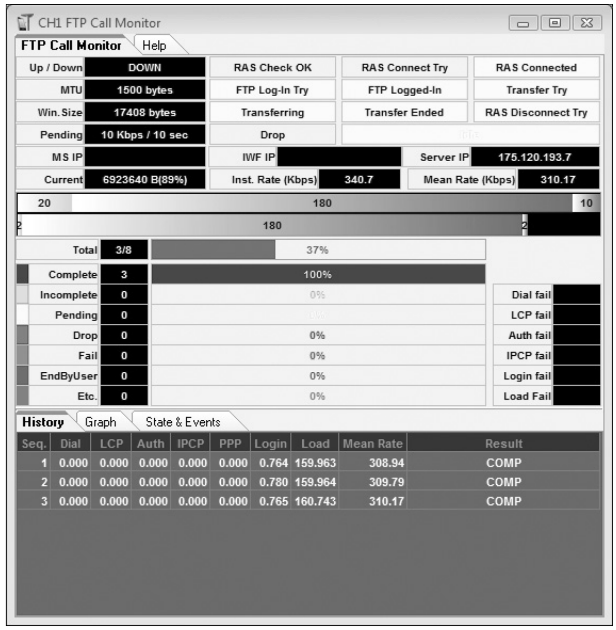
Integrated Mapping with Trace Line

- Load cell site table and monitor your serving sector while you drive
- Select from a wide range of parameters and plot your data on the map during your data collection period
- Look for excessive handoffs and for logical serving sectors, quickly identify neighbor list configuration or sector coverage problems

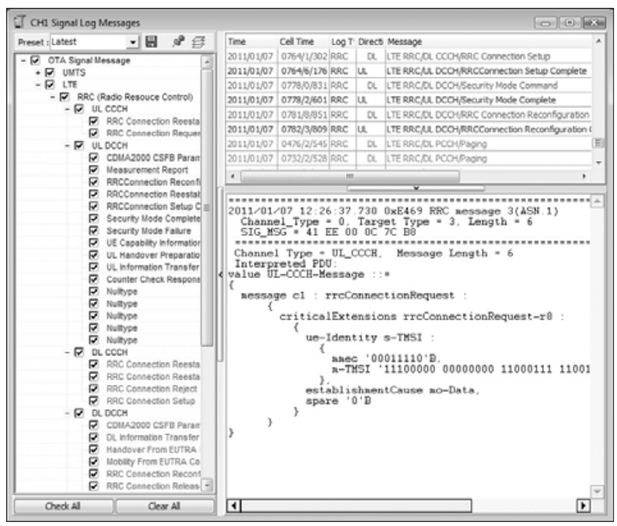
Full Replay

- Load your log file and step through the drive to identify problems
- Replay the log in slow motion or fast motion

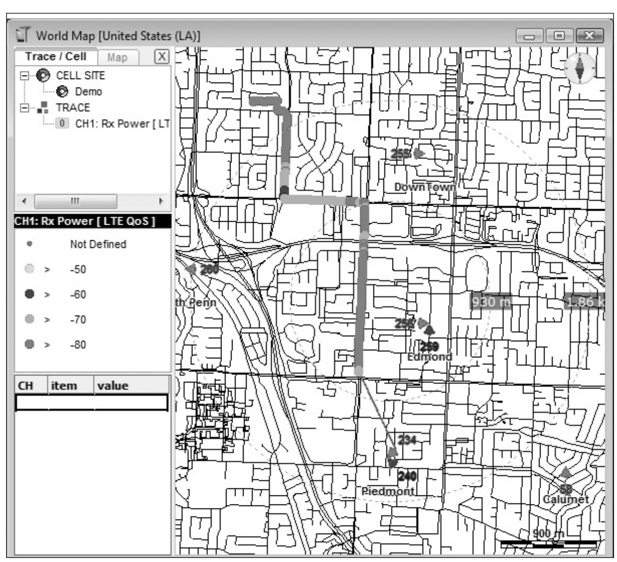
Jump to specific time periods for event analysis



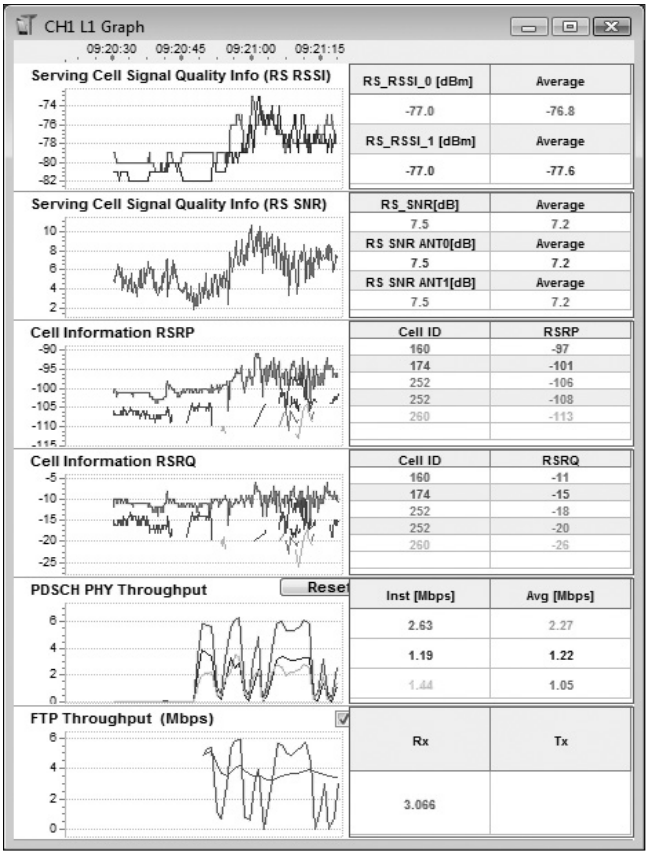
Link Master LML Data Call Monitor



Link Master LML Layer 3 Capture



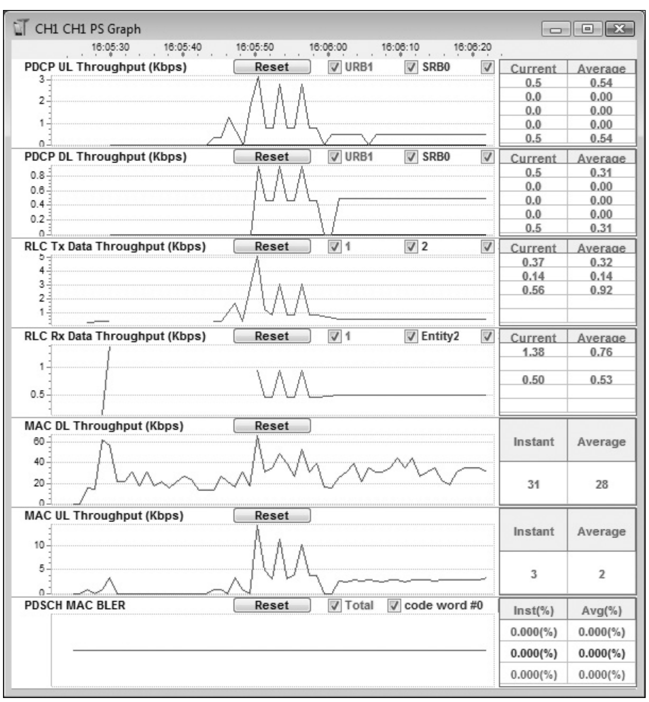
Link Master LML Integrated Mapping with Trace Line



Layer 1 graph is fully configurable to select the specific parameters that the user wishes to view

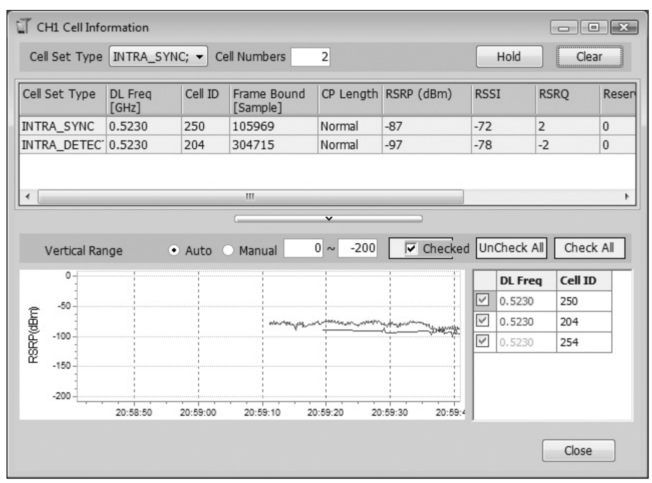
Layer 1 Measurements
Serving Cell RSSI
Serving Cell SNR
Cell RSRP
Cell RSRQ
Path Profile
Tx Power
Tx Power/RB
Wideband CQI Information
Rank Information
Channel Information
CFI Information
DLACK Detection Rate
PDCCH Detection Rate R1
PBCH BLER
PDSCH PHY Throughput
PDSCH BLER
PDSCH Scheduled Throughput
PDCCH SER
PDSCH SER
PUSCH PHY Throughput
AGC Report
(Filtered Power to Set-Point)
AGC Report (DAC Index)
AGC Report (Measured Power)
AFC Report
System Bandwidth Information
FTP Application Throughput

Views
Layer 1 Graphs
Neighbor Cell Information
AGC Symbol Distribution
Symbol Constellation
Channel Information
LLR Information
Path Profile Information
PRACH Information
Timing Adjustment
Sub Band CQI information
PDCP UL/DL Throughput graph
RLC UL/DL Throughput graph
MAC UL/DL Throughput graph
PDSCH MAC BLER
MAC Statistics
RLC Statistics
PDCP Statistics
RRC information/Statistics
NAS information/Statistics



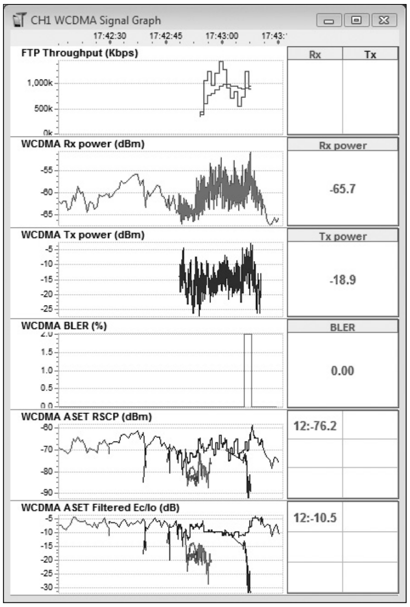
LTE Ch1 Packet Graph

Monitor the Application layer throughput and the Physical Channel simultaneously to identify potential network problems



LTE Cell Information

W-CDMA/HSPA



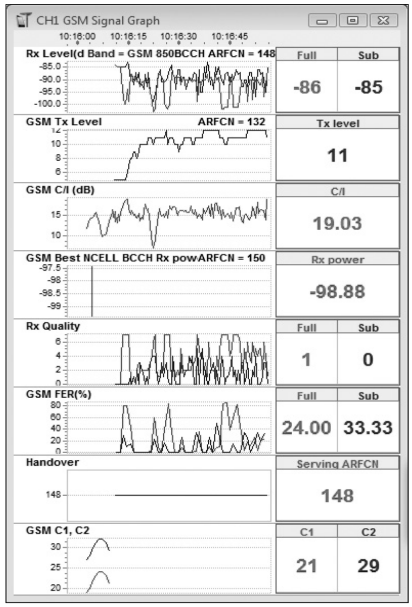
Layer 1 Measurements

FTP Throughput
PPP Throughput
Physical Throughput
RLC Throughput
RLC Error Ratio
Tx Power
Tx State
Tx Power
BLER (%)
Estimated SIR
Power Control
DRX Mode
RSCP
Active Set RSCP
Ec/No
Active Set Ec/No
Finger Combined
Handover State
Spreading Factor

Views

System Status
Cell Information
RRC & L1 State
Physical Channel
Signal Graph
TA Graph
Finger
Scrambling Code Graph
RLC Statistics and Logical Channels
Compressed Mode GSM Measurements
System Information Block Summary

GSM/EDGE



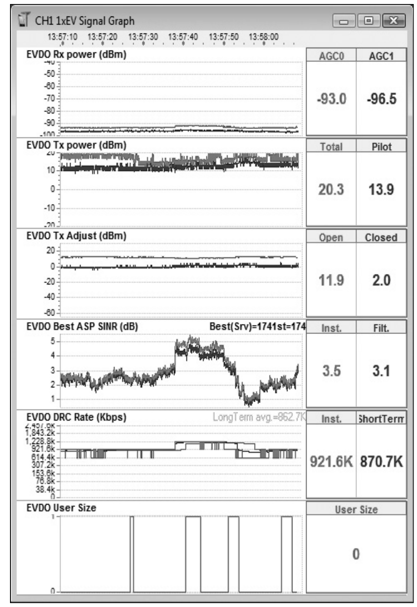
Layer 1 Measurements

GSM Rx Power
GSM Tx Level
GSM C/I
GSM Timing Advance
Best Neighbor Cell BCCH Rx power
DTX
Radio Link Timeout Counter
Downlink Signaling Counter
Rx Quality
Rx Level
MS Eval TA
Network Assigned TA
GSM FER (%)
SNDCP Throughput
LLC Throughput
RLC Throughput
GPRS CS
EDGE MCS
GPRS Timeslot Number
GMSK BEP
8PSK BEP
Handover History
GSM C1, C2

Views

Power Scan
FCCH & SCH decode
Paging Summary Data
Summarized Layer 3
Neighbor Cell Metrics
Service Cell Parameters
RLC Statistics
LLC Statistics
SNDCP Statistics
MAC Parameters
CELL Information
Surround Cell List
Temporary Block Flow (Radio Link/MAC)

CDMA/EV-DO



Layer 1 Measurements

FTP Throughput
PPP Throughput
Physical Throughput
EV-DO RFP Throughput
Rx Power
Tx Power
Tx Adjust
Best ASP SINR
DRC Rate
PER
ASP History
DRC Lock
Best ASP Index
User Size
Fwd/Rev Traffic Rate
ARQ Effective Receive Rate
RPC History
DRC/Pilot Ratio
ACK/Pilot Ratio
Data/Pilot Ratio
Max Tx Power RRI
PPP vs. DRC
RAB
RRI

Views

System Status
Active Set Configuration
QPCH Info
Finger Placement
Temporal Analyzer
PN Graph
EV-DO AT Status
System Determination Status
TA Graph
Forward/Reverse Link Statistics
RLP Statistics
DRC Channel Info
EV-DO Rev. A Forward/Reverse Link Metrics
EV-DO Rev. A Forward/Reverse RLP Statistics

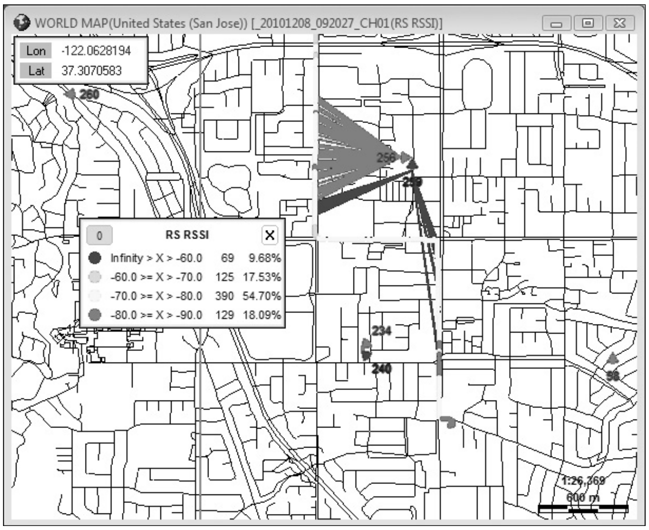
Link Master LMA

Air Interface Analysis Tools

Link Master LMA post processing tools provides analysis of the data collected via the Link Master LML air interface logging tools.
Quick analysis and fast response times to queries are achieved through the highly efficient database engine. User definable filters or threshold limits narrow the analysis to focus in on network performance areas of interest.
In depth analysis can isolate individual or multiple test UEs and the issues involved as well as tracking and recording their log files.
Report generation is quick and easy with one-click standardized reporting. And a forms driven report generator tool makes it fast to create user definable reports.

Key Features

- Outdoor and In-Building Analysis
- Function Analysis: call events, signal strength, neighbor information, pilot information, etc.
- QoE Analysis: voice, video, data quality, etc.
- User selectable UI displays: map, time graph, table, statistic chart, correlation graph, etc.
- User-definable database query filters for focused data analysis
- Full drive test replay
- One-click synchronization
- Multiple data and image export file formats
- One-click comprehensive standardized report generation
- Forms driven user defined report generation



Easily View the Sector Serving Area

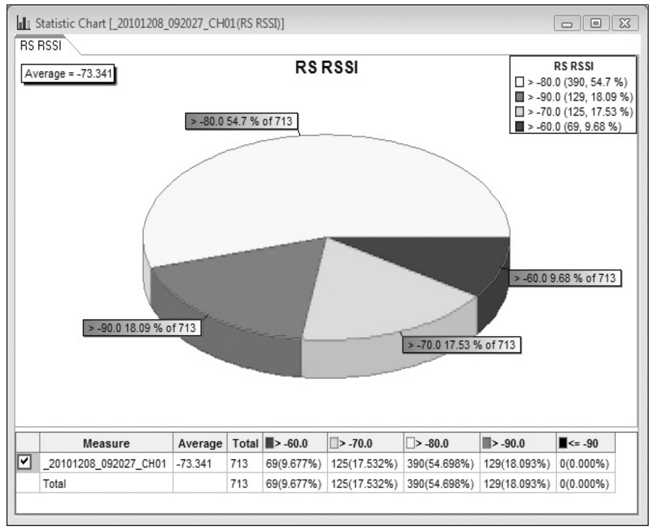
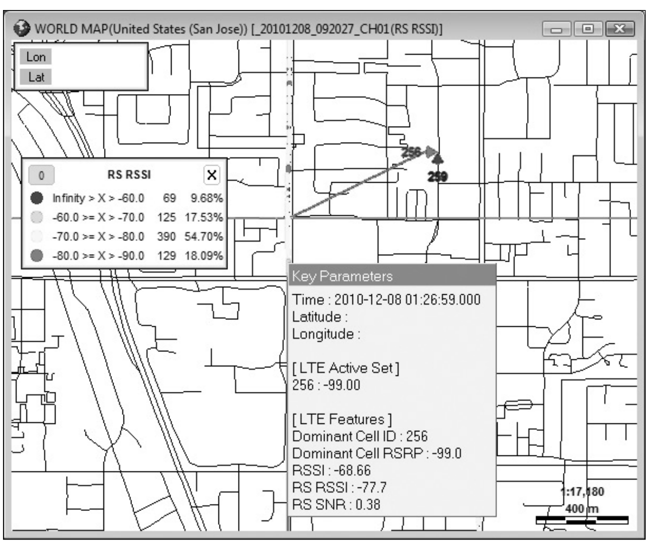
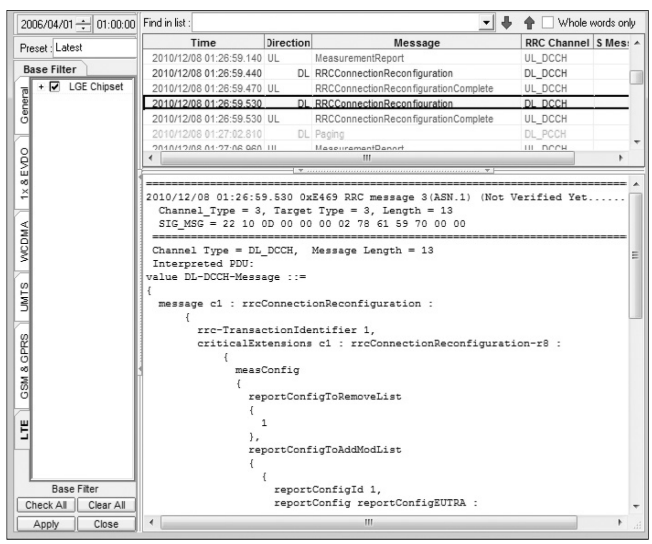


Chart Statistic of Key Parameters



One-click Synchronization Map View



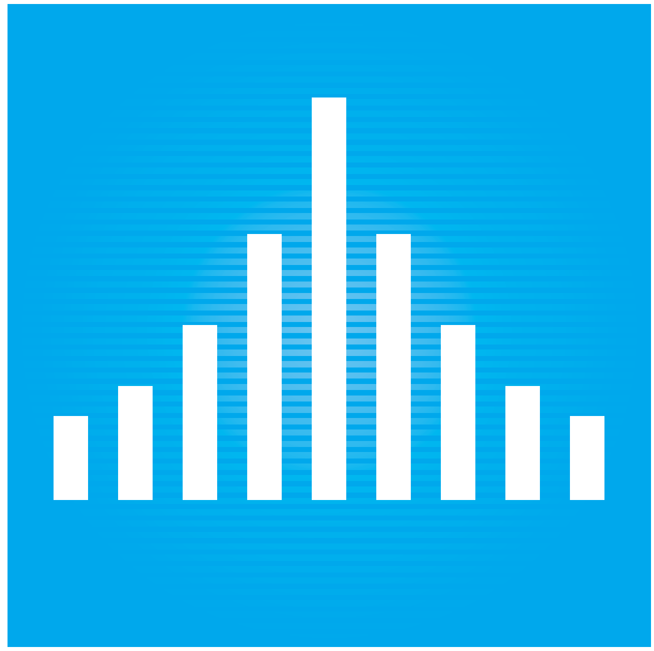
One-click Synchronization Log View

Ordering Information (North America Sales Only)

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
ML8725A	**Link Master LML Logging Tools** Link Master LML Logging Tools (includes 1 to 2 UE support)
 ML8725A-0010 ML8725A-0011 ML8725A-0012 ML8725A-0013	*Utilizing UEs with Qualcomm or CT (LG LTE) chipsets* LTE UE Measurements CDMA/EV-DO UE Measurements W-CDMA/HSPA/GSM/EDGE UE Measurements W-CDMA/HSDPA/GSM/EDGE UE Measurements
  ML8725A-0050 ML8725A-0051 ML8725A-0052 ML8725A-0053 ML8725A-0060 ML8725A-0061 ML8725A-0070	*Utilizing up to two Scanning Receivers or Anritsu Handheld Analyzers* LTE Receiver Measurements CDMA/EV-DO Receiver Measurements W-CDMA/HSPA/GSM/EDGE Receiver Measurements W-CDMA/HSPA Receiver Measurements 3 to 4 UE support 5 to 6 UE support In-building Network Measurements
 ML8725A-0080 ML8725A-0081 ML8725A-0090	*North America only* LML USB Hardware License Key LML Software License Key per PC – renews every six months LML Software Updates – 1 Year Support
ML8726A	**Link Master LMA Analysis Tools** Link Master LMA Analysis Tools (includes In-building Network Analysis Tools)
ML8726A-0010 ML8726A-0011 ML8726A-0012 ML8726A-0013	LTE Analysis Tools CDMA/EV-DO Analysis Tools W-CDMA/HSPA/GSM/EDGE Analysis Tools W-CDMA/HSDPA/GSM/EDGE Analysis Tools
 ML8726A-0080 ML8726A-0081 ML8726A-0090	*North America only* LMA USB Hardware License Key LMA Software License Key per PC – renews every six months LMA Software Updates – 1 Year Support

Model/Order No.	Name
	PC and Hardware Requirements CPU: Pentium IV, 1.8 GHz or higher RAM: 2 GB or higher OS: Windows XP Display: 1024 × 768 resolution USB ports: For GPS, UEs, receivers, and USB license key if used Disk Space: 30 GB UE Chipsets: Qualcomm, GCT (LG LTE) High Performance: PCTel™ SeeGull LX and EX Scanning Receivers Scanning Receivers: (Single or multi-band technology support) Anritsu Handheld Analyzers: BTS Master™, Cell Master™, LMR Master™, and Spectrum Master™ LTE, W-CDMA/HSPA, CDMA, EV-DO OTA Measurements (Single carrier and single technology support)
  2000-1647-R 2000-1645-R 2000-1646-R 2000-1648-R	**Receiver Accessories** **Mag Mount Broadband Antennas** Cable 1: 698 MHz to 1200 MHz 2 dBi peak gain, 1700 MHz to 2700 MHz 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50Ω, 10 ft 694 MHz to 894 MHz 3 dBi peak gain, 1700 MHz to 2700 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft 750 MHz to 1250 MHz 3 dBi peak gain, 1650 MHz to 2000 MHz 5 dBi peak gain, 2100 MHz to 2700 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft 1700 MHz to 6000 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft



SIGNAL ANALYZERS/ SPECTRUM ANALYZERS

Selection Guide 464
Signal Analyzers....................................... 465, 496, 524
Spectrum Analyzer 551
High Performance Handheld Spectrum Master ... 558, 587
Spectrum Master 575
High Performance Handheld Spectrum Analyzer 582
VNA Master 603, 618
Sweep Master Web-Based Line Sweep and
Document Tracking Tools 631

Selection Guide

Model	Measurement Frequency Range	Measurement Level Range (dBm)	Resolution Bandwidth	C/N (dBc/Hz)	RF-band Harmonic Distortion (dBc)*4	Third Order Intercept Point (TOI) (dBm)	Counter	Measure	Zone Marker	AM/FM Demodulation Mode	QP Detection	High-speed Time Domain	Gate	Tracking Generator	Remote Control	PTA	Features
MS2690A	50 Hz to 6.0 GHz	–155 to +30	30 Hz to 3 MHz, 50 kHz 5, 10, 20, 31.25 MHz (SPA mode) 1 Hz to 10 MHz*1 (VSA mode)	–116*1	–75	+22	✓	✓	✓	–	–	✓	✓	–	GPIB Ethernet USB	Windows XP Embedded	Portable
MS2691A	50 Hz to 13.5 GHz																
MS2692A	50 Hz to 26.5 GHz																
MS2830A-040/041/043	9 kHz to 3.6 GHz 9 kHz to 6 GHz 9 kHz to 13.5 GHz	–151 to +30	1 Hz to 31.25 MHz*1, 50 kHz	–115 –133 (Opt.)*1	–65	+15	✓	✓	✓	–	Opt.	✓	✓	–	GPIB Ethernet USB	Windows XP Embedded	
MS2830A-044/045	9 kHz to 26.5 GHz 9 kHz to 43 GHz 18 GHz to 110 GHz (with external mixer)	–150 to +30	1 Hz to 31.25 MHz*1, 50 kHz	–115*1	–65	+15	✓	✓	✓	–	Opt.	✓	✓	–	GPIB Ethernet USB	Windows XP Embedded	
MS2687B	9 kHz to 30 GHz 18 GHz to 110 GHz (with external mixer)	–124 to +30	300 Hz to 3 MHz, 5, 10, 20 MHz 1 Hz to 1 MHz (Opt.)	–108*2	–70	+12.5	✓	✓	✓	–	–	✓	✓	–	GPIB RS-232C Ethernet (Opt.)	–	
MS2711E	9 kHz to 3 GHz	–152 to +26	100 Hz to 3 MHz	–100*2	–70	+28	✓	✓	–	✓	✓	–	–	✓	USB	–	Handheld (<3.5 kg)
MS2712E	9 kHz to 4 GHz	–152 to +26	10 Hz to 3 MHz	–100*2	–70	+28	✓	✓	–	✓	✓	–	–	✓	Ethernet USB	–	Handheld (<3.5 kg)
MS2713E	9 kHz to 6 GHz	–152 to +26	10 Hz to 3 MHz	–100*2	–70	+33	✓	✓	–	✓	✓	–	–	✓	Ethernet USB	–	
MS2721B	9 kHz to 7.1 GHz	–161 to +30	1 Hz to 3 MHz	–100*2	–80	+13	✓	✓	–	✓	✓	–	✓	✓	Ethernet USB	–	Handheld (<3.1 kg)
MS2722C	9 kHz to 9 GHz	–160 to +30	1 Hz to 10 MHz	–100*2	–75	+20	✓	✓	–	✓	✓	–	✓	–	Ethernet USB	–	Handheld (<3.8 kg)
MS2723C	9 kHz to 13 GHz																
MS2724C	9 kHz to 20 GHz																
MS2725C	9 kHz to 32 GHz																
MS2726C	9 kHz to 43 GHz																

*1: 100 kHz offset
*2: 10 kHz offset
*3: 30 kHz offset
*4: –30 dBm

SIGNAL ANALYZER

MS2690A, MS2691A, MS2692A

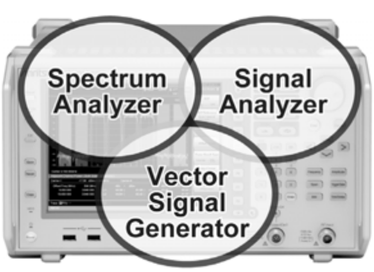
50 Hz to 6.0 GHz | 50 Hz to 13.5 GHz | 50 Hz to 26.5 GHz

Remote Control
GPIB | Ethernet | USB

Signal Analyzer Solving Next-Generation Wireless Communications Issues

Excellent Eco Product

The MS2690A/MS2691A/MS2692A (MS269xA) Signal Analyzer has the excellent general level accuracy, dynamic range and performance of a high-end spectrum analyzer.
Its easy operability and built-in functions are perfect for tests of Tx characteristics. Not only can it capture wideband signals but FFT technology supports multifunction signal analyses in both the time and frequency domains. Behavior in the time domain that cannot be handled by a sweep type spectrum analyzer can be checked in the frequency domain. A wide frequency can be analyzed using sweep type spectrum analysis functions while detailed signal analysis of a specific frequency band is supported too. Moreover, the built-in signal generator function outputs both continuous wave (CW) and modulated signals for use as a reference signal source when testing Tx characteristics of parts and as a signal source for evaluating Rx characteristics.
Wireless communications are tending toward use of higher frequencies above 3 GHz and wider bandwidths. However, general-purpose spectrum analyzers suffer from a degraded noise floor above 3 GHz due to the 3-GHz baseband, so they cannot be used to verify the true product performance. Because the MS269xA baseband can be extended up to 6 GHz it offers excellent level accuracy and modulation precision at frequencies from 50 Hz to 6 GHz. Adding the full line of versatile analysis software options eliminates the need for an external PC at wireless modulation analysis. Moreover, installing a preselector bypass option (MS2692A-067) enables use of the signal analyzer and modulation analysis functions up to 26.5 GHz (MS2692A).
Waveform creation software generates modulation signal patterns for all common wireless technologies to output signals for the vector signal generator function.
The high-performance, multi-function MS269xA Signal Analyzer supports better analysis than more expensive standalone spectrum analyzers.



Key Features

- **Basic Performance/Functions**
  - **Frequency Range**
    MS2690A: 50 Hz to 6.0 GHz
    MS2691A: 50 Hz to 13.5 GHz
    MS2692A: 50 Hz to 26.5 GHz
  - **Total Level Accuracy: ±0.3 dB (typ.)**
  - **Dynamic Range[*1]: 177 dB**
    TOI[*2]: ≥+22 dBm
    DANL[*3]: –155 dBm/Hz
  - **Improved Level Linearity**
  - **Internal Reference Oscillator**
    Pre-installed Reference Oscillator
    Aging Rate: $\pm 1 \times 10^{-8}$/day
    Start-up Characteristics: $\pm 5 \times 10^{-8}$ (5 minutes after power-on)
    Rubidium Reference Oscillator (Opt. 001)
    Aging Rate: $\pm 1 \times 10^{-10}$/month
    Start-up Characteristics: $\pm 1 \times 10^{-9}$ (7 minutes after power-on)
  - **Versatile Built-in Functions**

[Standard]

Channel Power	Occupied Bandwidth
Adjacent Channel Leakage Power	Spectrum Emission Mask[*4]
Spurious Emission[*4]	Burst Average Power
Frequency Counter[*4]	AM Depth[*5]
FM Deviation[*5]	Multi-marker & Marker List
Highest 10 Markers	Limit Line[*4]
2-tone 3rd-order Intermodulation Distortion[*4]	
Phase Noise	Power Meter[*6]

[Option]
Noise Figure[*7]

*1: Difference between TOI and DANL as simple guide
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)
*4: Spectrum Analyzer Functions
*5: Signal Analyzer Functions
*6: Use USB Power Sensors
*7: Noise Figure Measurement Function (Requires Opt. 017)
[Use Noise Sources (Noisecom, NC346 series)]

- **Signal Analyzer Functions**
  - **Analysis Bandwidth**
    Standard: 31.25 MHz max.
    (50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
    Opt. 004: 125 MHz max.
    (200 MHz max. sampling rate = 5 ns resolution, ADC resolution 12 bits)
    Opt. 077: 62.5 MHz max.
    (100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
    Opt. 078*8, *9: 125 MHz max.
    (200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)
  - **Capture Function**
    Saves analysis Span × Time signal to internal memory and writes to hard disk.
    Up to 100 Msamples per measurement can be saved to internal memory.
  - **Replay Function**
    Reads saved data and replays using signal analyzer function.
  - **Measurement with Sub-trace Display**
    Splits screen and confirms both main and sub-traces at same time to check errors.
    Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
    Sub: Power vs. Time, Spectrogram

- **Supports 125 MHz Wideband Measurements up to 26.5 GHz**
  Opt. 067 Microwave Preselector Bypass*10
  Opt. 078 Analysis Bandwidth Extension to 125 MHz*8
  Bypassing preselector improves RF frequency characteristics and in-band frequency characteristics. Supports modulation analysis and signal analyzer measurements for signals up to 26.5 GHz.

*8: Requires MS269xA-077
*9: Combining with MX269028A-002 wireless LAN IEEE802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE802.11ac. See measurement software catalog for more details.
*10: Opt. 067 can be installed in MS2692A

- **Vector Signal Generator (Opt. 020)**
  - **Frequency Range: 125 MHz to 6 GHz**
  - **Pre-installed Baseband Generator**
    Vector Modulation Bandwidth: 120 MHz
    Sampling Clock: 20 kHz to 160 MHz
  - **Level Accuracy: ±0.5 dB**
  - **Large-capacity Memory: 1 GB = 256 Msamples**
  - **Internal AWGN Generator**
  - **Internal BER Measurement Function**
    Bit Rate: 100 bps to 10 Mbps
    Input Level: TTL

Basic Performance

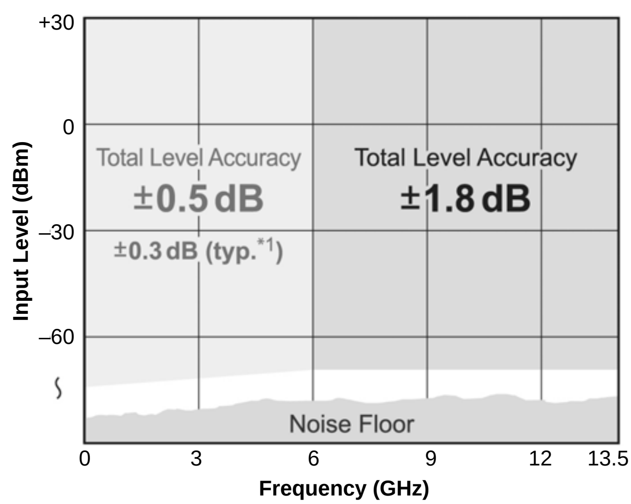
- **Excellent Total Level Accuracy: ±0.3 dB (typ.) (Common to both Spectrum Analyzer and Signal Analyzer Functions)**

With a 6-GHz basic band and level calibration over a wide frequency range, the MS269xA has excellent total level accuracy.
The Absolute Amplitude Accuracy specification described in catalogs of other spectrum analyzers ignores the important frequency characteristics, linearity, and attenuator switching errors. In contrast, the MS269xA Level Calibration technology assures excellent level accuracy over a wide frequency range from 50 Hz to 6 GHz even under measurement conditions including the above three errors. The level accuracy is assured even when the frequency and attenuator are switched.

Advantage of 6 GHz Basic Band
Conventional spectrum analyzers have a degraded noise floor above 3 GHz because they use a preselector at the 3-GHz basic band, which causes lowered measurement accuracy. The MS269xA basic band of 6 GHz eliminates the degraded noise floor and improves measurement accuracy.

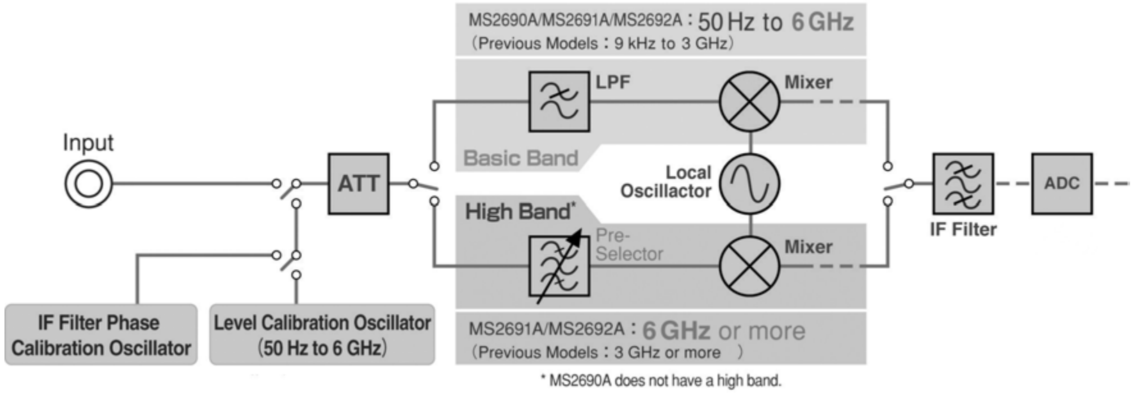
Advantage of MS269xA Level Accuracy Technology
Conventional spectrum analyzers perform level calibration at just one frequency point, which causes errors when the frequency changes.
The MS269xA has two built-in signal generators for level calibration over a wide frequency range from 50 kHz to 6 GHz, minimizing measurement errors in this frequency range.

The MS269xA total level accuracy includes:
- **Frequency characteristics**
- **Linearity**
- **Attenuator switching error**



Note: Eliminates effect of noise floor
Used only when Uncal does not occur
*1: Excluding Guard Band

MS269xA Block Diagram



Preselector

The MS269xA has a basic band that goes to 6 GHz without a preselector. Most spectrum analyzers may use a preselector in the high band to clean-up images but it is extremely difficult to stabilize the amplitude and frequency characteristics of the preselector. This instability is the main cause of degraded level accuracy and modulation precision in measuring instruments.
Additionally, the preselector passband frequency can cause limitations at analysis bandwidths. No preselector means greater measurement accuracy.

MS2692A-067* **Microwave Preselector Bypass**

Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics.
When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.

∗: Opt. 067 can be installed in MS2692A.

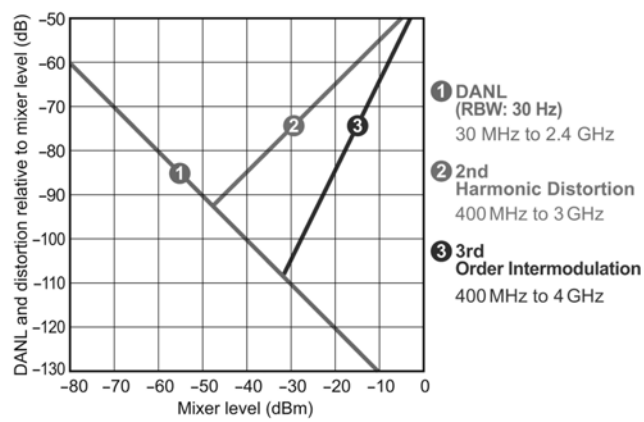
- **Top Class Dynamic Range**
  - **Dynamic Range*1: 177 dB**
  - **TOI*2: ≥+22 dBm (700 MHz to 4 GHz)**
  - **DANL*3: –155 dBm/Hz (30 MHz to 2.4 GHz)**

∗1: Difference between TOI and DANL as simple guide.
∗2: TOI (Third Order Intercept)
∗3: DANL (Displayed Average Noise Level)

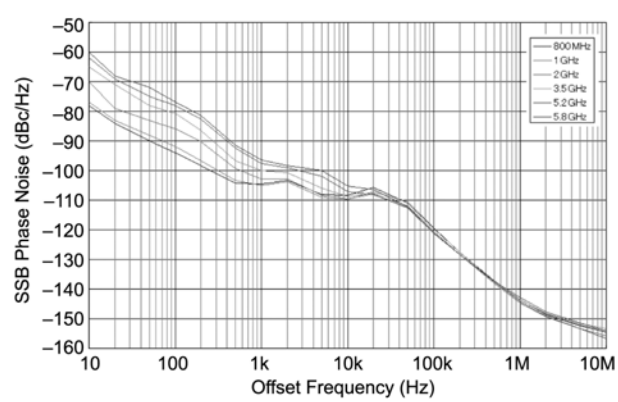
Dynamic range is a key specification for spectrum analyzers.
Low displayed average noise level (DANL) as well as high TOI are important too.
Low TOI may cause distortion with high-level carrier signals. Inserting an attenuator can lower the carrier level but this has the effect of lowering the level of weak spurious, making it hard to measure.

The MS269xA has an excellent dynamic range supporting true performance measurements of devices, such as base stations, requiring wideband measuring instruments.
For example, the 3GPP category-B spurious measurement specification requires a measuring instrument with severe dynamic range specifications. If the measurement is within the MS269xA dynamic range, measurement jigs such as filters and amplifiers are unnecessary and troublesome calibration is omitted, helping simplify setup and cut costs.

Distortion Characteristics (Spectrum Analyzer)



Example: SSB Phase Noise
(Spectrum Analyzer/Signal Analyzer Common)



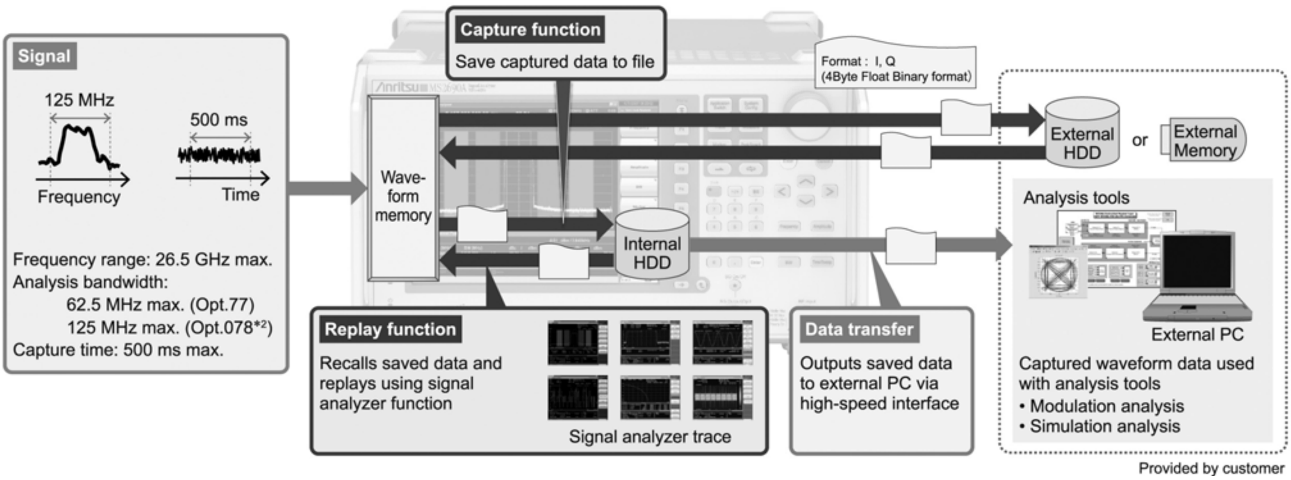
• Supports 125 MHz Wideband Measurements up to 26.5 GHz

MS2692A-067 Microwave Preselector Bypass*1 + MS2692A-078 Analysis Bandwidth Extension to 125 MHz*2

*1: Can be installed in MS2692A.

*2: Require MS2692A-077.

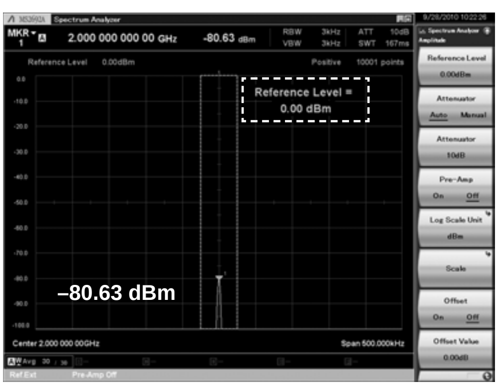
Supports wideband analysis with high frequencies for satellite communications
  Microwave preselector bypass frequency range: 6 GHz to 26.5 GHz (MS2692A)
Installing the microwave preselector bypass supports signal analyzer measurement functions in the above frequency range.

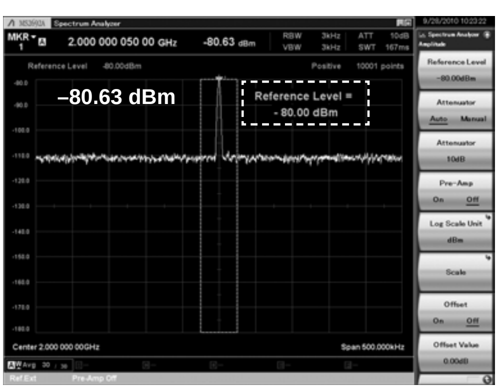


• Improved Level Linearity

Conventional spectrum analyzers use an analog IF and log amp to achieve good level accuracy at points near the log scale reference level, but the accuracy degrades at points that are further away. The MS269xA uses a digital IF instead of a log amp, which supports measurements with excellent accuracy at any point.

Example: Level Stability by Switching Reference Level

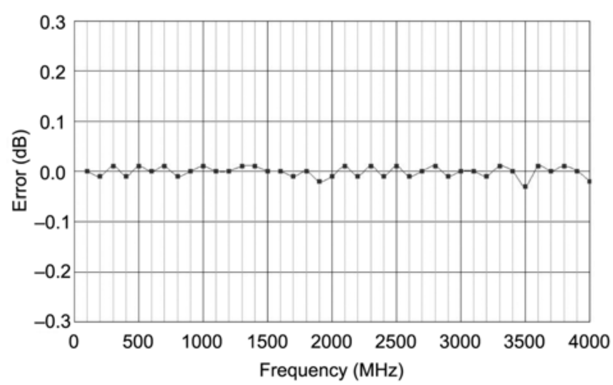




• Dual Sweep Speed: Normal/Fast

When sweep time is set to [Auto], Normal (normal sweep) or Fast mode (high-speed sweep) can be set. The Fast mode sweeps six times faster than the Normal mode.

Example of Sweep Mode Switch Error: (CW –10 dBm input)
Level Error when Switching from Normal to Fast



• Resolution Bandwidth (RBW)

- **Setting Range (Spectrum Analyzer):**
  30 Hz to 3 MHz (1-3 sequence),
  50 kHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz*1
- **Setting Range (Spectrum trace in signal analyzer mode):**
  1 Hz to 1 MHz (1-3 sequence), 3 MHz*2, *3, 10 MHz*3

When monitoring two adjacent signals, the frequency resolution can be increased by reducing the resolution bandwidth (RBW).
This also has the effect of reducing the noise level.
Conversely, to confirm level variations of 20-MHz band signals such as LTE and WiMAX, set the RBW to 31.25 MHz.

*1: Instead of Gaussian filter, 31.25 MHz RBW uses filter with flat top characteristics above 31.25 MHz.
*2: With Opt. 077 installed and bandwidth setting ≥50 MHz
*3: With Opt. 004 or Opt. 077+078 installed and bandwidth setting ≥50 MHz

• Trigger Function

Trigger sweep executes sweeping using the specified trigger condition as the start point. In particular, "SG Marker" starts analyzer measurement in synchrony with the signal output by installing Opt. 020. Using this function supports simple synchronized measurement even when evaluating signals with large level variation over time, such as modulation signals.

- Video trigger:
  Trigger sweeping starts in synchronization with the rise or fall of the waveform. A trigger level indicator showing the trigger level is displayed on the screen.
- Wide IF video trigger:
  An IF signal with a wide passing band of about 50 MHz is detected, and sweeping starts in synchronization with either the rise or fall of the detected signal.
- External trigger:
  Sweeping starts in synchronization with the rise or fall of the signal input via the Trigger Input connector.
- SG Marker trigger (Requires Opt. 020):
  Sweeping starts in synchronization with the rise or fall of the marker signal output of Opt. 020. This function supports measurement in synchronization with the output signal of Opt. 020.

• Gate Sweep

Gate sweep executes sweeping only for the length of time specified by the gate length, starting from when the trigger condition is met. A delay time until sweeping starts after the trigger condition is met can be set using trigger delay.

- The gate source can be selected from the following
  - Wide IF video trigger
  - External trigger
  - SG marker trigger (Requires Opt. 020)
- Setting range and resolution for gate delay
  - Setting range: 0 to 1 s
  - Resolution: 20 ns
- Setting range and resolution for gate length
  - Setting range: 50 us to 1 s
  - Resolution: 20 ns

• Three Built-in External Interfaces

The built-in Gigabit Ethernet, USB2.0, and GPIB interfaces support remote operation.

- GPIB: IEEE488.2, Rear panel, IEEE488 bus connector
  Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
- Ethernet: 10/100/1000BASE-T, Rear panel, RJ-45
- USB (B): USB2.0, Rear panel, USB-B connector

• Saving Measurement Results

Measurement results can be saved to internal hard disk or external USB memory. Screen dumps and trace data can be saved too.

- Screen dump file type
  - BMP
  - PNG
- The color of the screen hard copy can be set as follows:
  - Normal (same as screen display)
  - Reverse
  - Monochrome
  - Reversed Monochrome

Signal Analyzer: Basic Performance/Functions

• Wide bandwidth × High Accuracy FFT Analysis

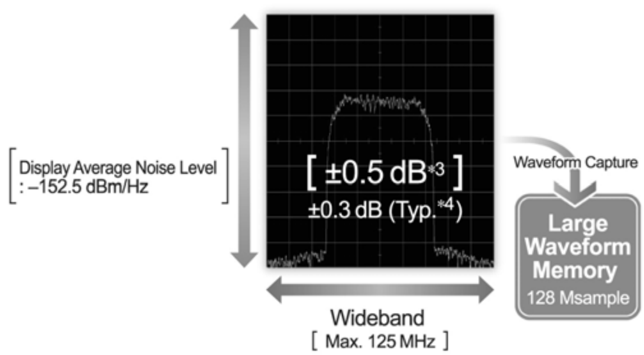
Standard: 31.25 MHz max.
(Sampling rate 50 MHz max = Resolution 20 ns, ADC resolution 16 bits)

Opt. 004: 125 MHz max.
(Sampling rate 200 MHz max = Resolution 5 ns, ADC resolution 12 bits)

Opt. 077: 62.5 MHz max.
(Sampling rate 100 MHz max = Resolution 10 ns, ADC resolution 14 bits)

Opt. 078*1, *2: 125 MHz max.
(Sampling rate 200 MHz max = Resolution 5 ns, ADC resolution 14 bits)

Based on the excellent level accuracy and wide dynamic range of the MS269xA, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.



*1: Requires Opt. 077
*2: Combining with MX269028A-002 wireless LAN IEEE802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE802.11ac.
See measurement software catalog for more details.
*3: 50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal
*4: Excluding Guard Band

• Excellent Frequency Characteristics in Analysis Bandwidth

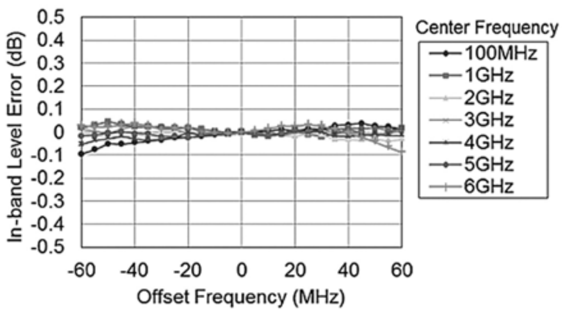
The Signal Analyzer Extra Band Cal function using the built-in oscillator for calibration supports analysis bandwidth calibration at the set frequency.
The excellent in-band frequency characteristics support wideband modulation analysis with less error.

Extra Band Cal Frequency Range

Span ≤ 31.25 MHz (Standard): 30 MHz to 6 GHz
Span > 31.25 MHz (Opt. 004/077/078): 100 MHz to 6 GHz

*:Setting center frequency after Extra Band Cal, requires re-execution of Extra Band Cal.

Example of frequency characteristics in analysis bandwidth after Extra Band Cal
(With Opt. 078, Reference Level: –10 dBm, Input attenuator: 10 dB, Preamp: Off, Span: 125 MHz)



• Save Signals in Internal Memory

Max. Capture Time: 0.5 s to 2000 s
Max. Number of Samples: 100 Msamples

The "Analysis bandwidth × Analysis time" signal is held in internal memory and saved to hard disk.
Up to 100 Msamples of data can be saved to memory for one measurement. The frequency span determines the sampling rate. The following chart shows the maximum capture time per frequency span.

Span	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	20 kHz	2000 s	40M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz*	100 MHz	500 ms	50M
62.5 MHz*	100 MHz	500 ms	50M
100 MHz*	200 MHz	500 ms	100M
125 MHz*	200 MHz	500 ms	100M

*: With MS269xA-004: 50/100/125 MHz
With MS269xA-077: 50/62.5 MHz
With MS269xA-077/078: 50/62.5/100/125 MHz

• Replay Function for Comparison Evaluation

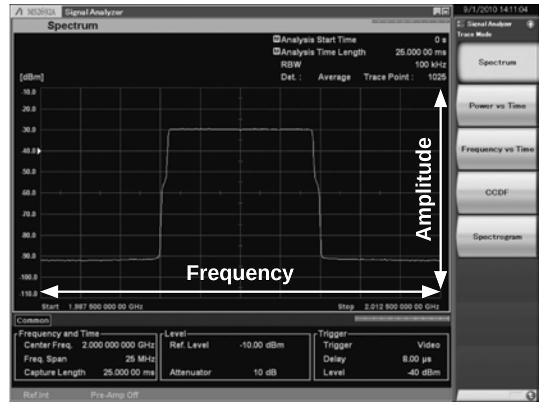
This function reads saved data and replays it using the signal analyzer measurement function.

Examples:
1. Data sharing between separate R&D and manufacturing
2. Later laboratory bench-top analysis of on-site signals
3. Save data at shipment and re-verify if problem occurs

Signal Analyzer: Trace

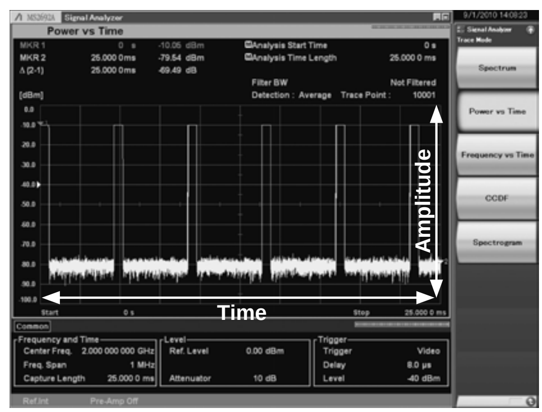
• Spectrum

The Spectrum trace displays a graph with amplitude on the y-axis and frequency on the x-axis. The captured IQ data is FFT processed (fast Fourier transformed) and converted from the time domain to the frequency domain for display as a spectrum.



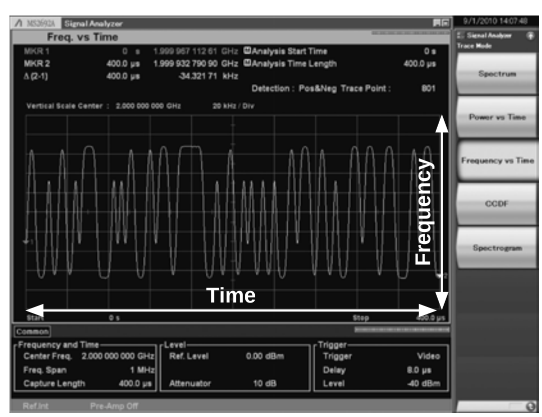
• Power vs. Time

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.



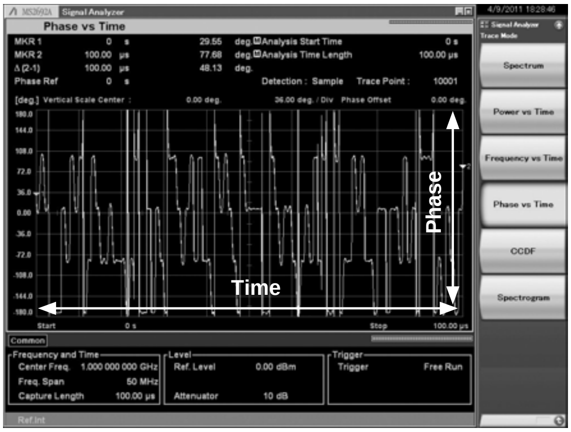
• Frequency vs. Time

The Frequency vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.



• Phase vs. Time

The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.

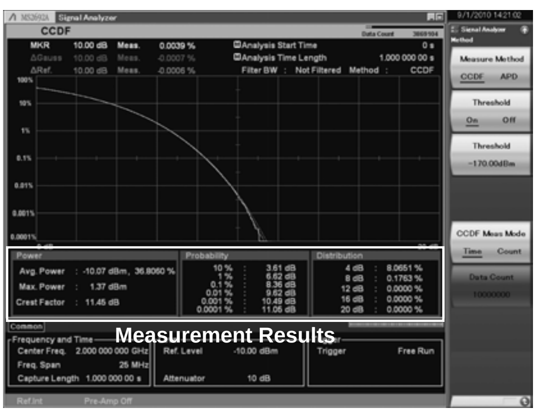


• CCDF[*1]/APD[*2]

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

∗1: CCDF (Complementary Cumulative Distribution Function)

∗2: APD (Amplitude Probability Density)



Measurement Results

- ■ CCDF: The CCDF display indicates the cumulative distribution of transient power variations compared to average power.
- ■ APD: The APD display indicates the probability distribution of transient power fluctuations compared to average power.

• Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum. It is useful for monitoring frequency hopping and transient signals.

• No Trace

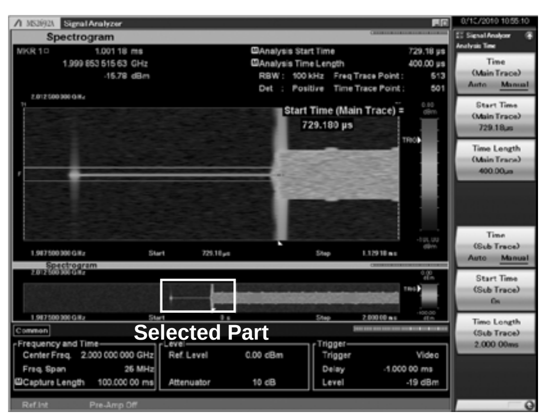
No Trace mode does not execute signal analysis. Therefore, “IQ data output” and “IQ data readout using remote commands” can be executed quickly without the need to wait for completion of analysis.

• Measurement with Sub-trace Display

This function splits the screen into top and bottom halves; simultaneous display of the sub-trace supports easy monitoring of fault locations and transient phenomena.

Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
Sub: Power vs. Time, Spectrogram

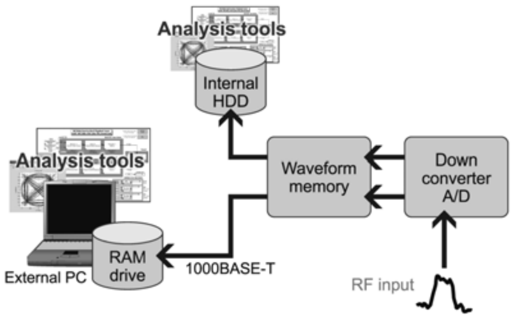
The part of a previously captured long-term signal to be monitored can be selected on the sub-trace to display the problem part only on the main trace.



Signal Analyzer: Applications

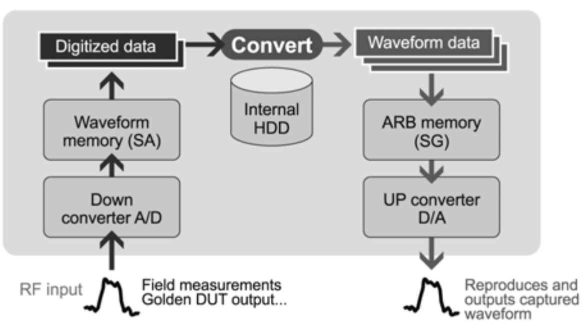
• Captured Waveforms Analysis using Commercial Analysis Tools

Other digitizers may exhibit severe degradation of the RF channel during capture, requiring troublesome calibration of the captured data when using analysis tools.
The MS269xA uses high-performance RF and two built-in calibration oscillators to minimize the degradation and eliminate the need for calibration before using analysis tools.
The waveform data are saved to the internal hard disk and can be output to an external PC via a high-speed interface, such as the 1000BASE-T LAN port.



• Captured Waveform Output from Vector Signal Generator Option

Waveforms captured using the digitizing function can be regenerated by using with the optional MS269xA-020 Vector Signal Generator. Signals captured in the field can be returned to the lab for analysis by replaying the signal using the Signal Generator. Signals captured from known good devices can provide a stable reference to increase debugging efficiency and test reliability.



Versatile Built-in Functions

• Useful for Tx Characteristics Evaluation

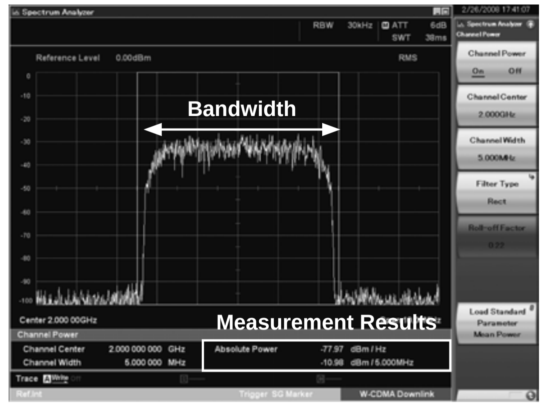
The MS269xA is fully loaded with all the functions required for evaluating Tx characteristics. Tests can be performed simply and in accordance with standards using functions tailored to measurement contents.

Measure Function	SPA*1	VSA*2
Channel Power	√	√
Occupied Bandwidth	√	√
Adjacent Channel Leakage Power	√	√
Spectrum Emission Mask	√	
Burst Average Power	√	√
Spurious Emission	√	
AM Depth		√
FM Deviation		√
Multi-marker & Marker List	√	√
Highest 10 Markers	√	√
Limit Line	√	
Frequency Counter	√	
2-tone 3rd-order Intermodulation Distortion	√	
Phase Noise	Independent function	
Power Meter	Independent function*3	
Noise Figure	Opt.017*4	

*1: SPA (Spectrum Analyzer)
*2: VSA (Vector Signal Analyzer)
*3: Use USB Power Sensors
*4: Use Noise Sources (Noisecom, NC346 series)

• Channel Power SPA VSA

This function measures channel bandwidth power. Three types of filters (Rect, Nyquist, Root Nyquist) can be selected.
Pre-installed templates for each standard support easy parameter setting.

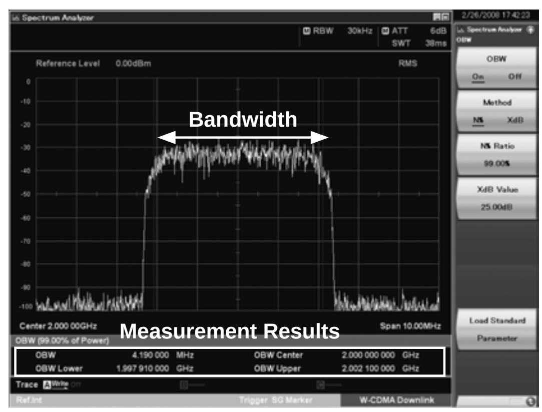


Measurement Results

- Absolute power per Hz in channel band
- Total power in channel band

• Occupied Bandwidth SPA VSA

Occupied bandwidth is measured by selecting either the N% or X-dB mode. Pre-installed templates for each standard support easy parameter setting.

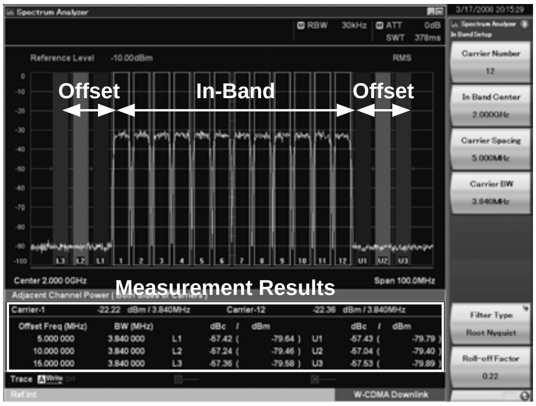


Measurement Results

- Bandwidth for specified conditions

• Adjacent Channel Leakage Power SPA VSA

This function measures carrier adjacent channel (offset) power (In-Band).
1 to 12 carriers can be set and switched instantaneously on-screen. True ACLR performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.

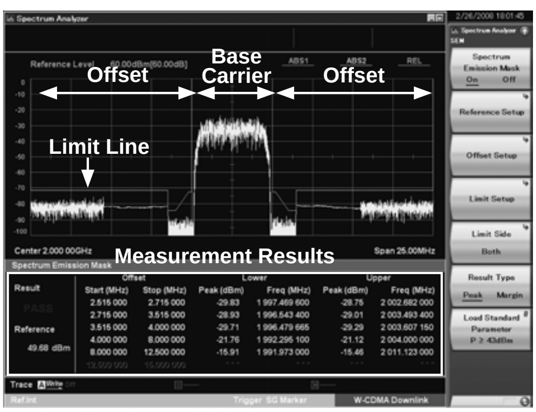


Measurement Results

- Absolute power of Offset channel
- Relative values in relation to reference power selected in ACP reference

• Spectrum Emission Mask SPA

This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.

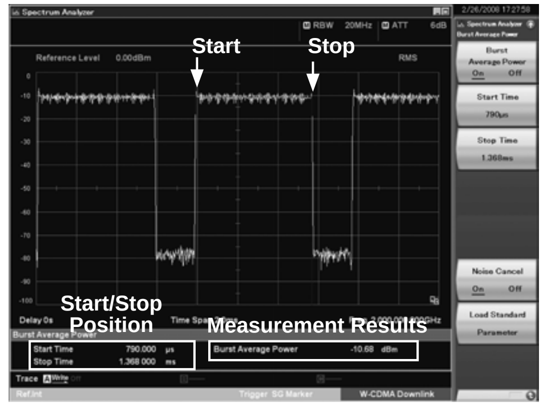


Measurement Results

- Peak power (or margin) at offset
- Each peak frequency

• Burst Average Power SPA VSA

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.

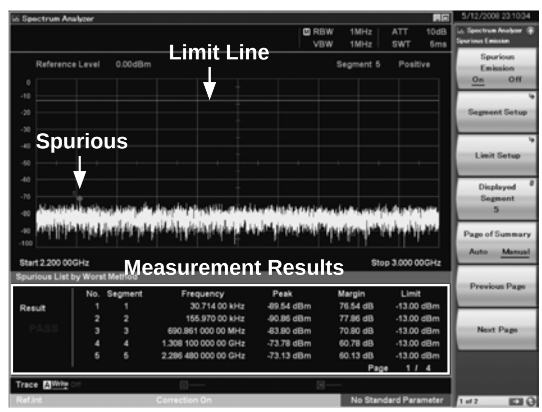


Measurement Results

- Average power of specified range

• Spurious Emission SPA

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. In particular, all tests can be completed up to the final stage without an external PC because the zero-span capture function described in the technology compliance test is built-in.

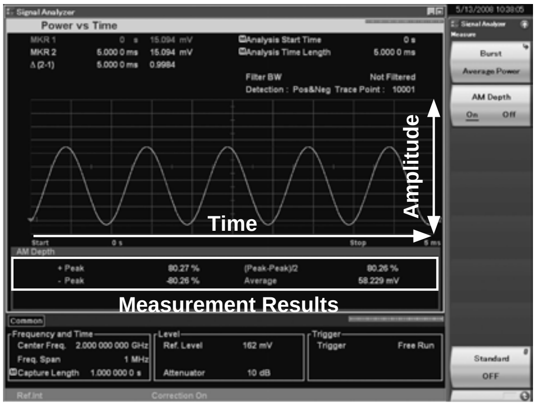


Measurement Results

- Each segment peak power and margin
- Each peak frequency

• AM Depth VSA

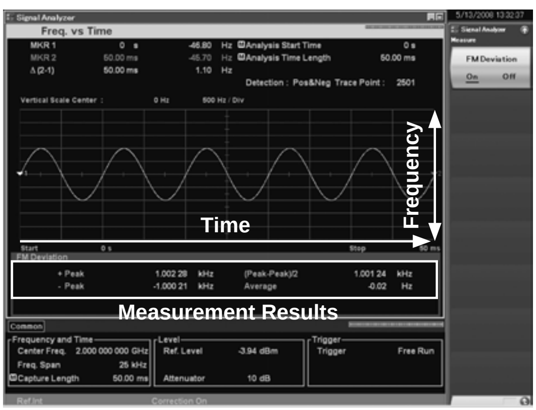
The Power vs. Time trace measurement function is used to confirm AM depth.
It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.



Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

• FM Deviation VSA

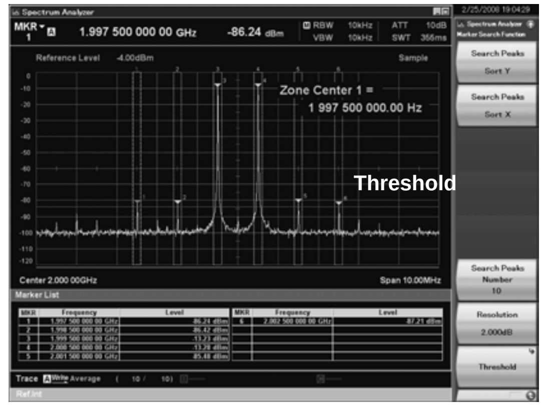
The Frequency vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.



Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

• Multi-marker & Marker List SPA VSA

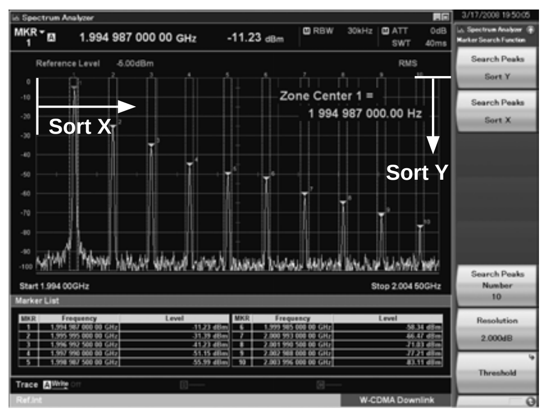
Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.



Measurement Results
- Marker point frequency
- Marker point power
- Absolute power per Hz in marker bandwidth
- Total power in marker bandwidth
- Difference between any markers

• Highest 10 Markers SPA VSA

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.

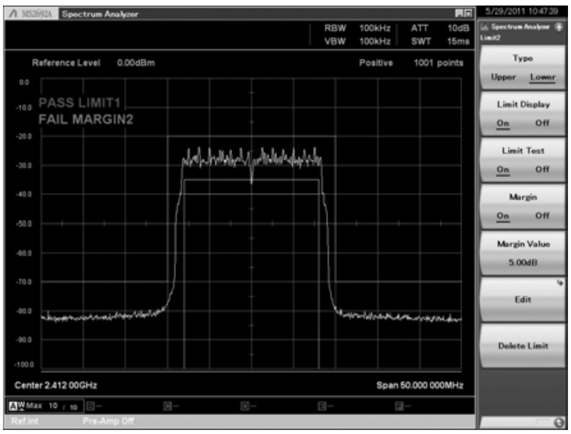


Measurement Results
- Peak Search Y:
  Sets up to 10 markers in order of peak level
- Peak Search X:
  Sets up to 10 markers in order of frequency (time) level

• Limit Line SPA

At the spectrum display (frequency domain), two limit lines are set and evaluation is performed based on these set lines. Either Upper Limit or Lower Limit can be selected. The line settings set the frequency/level of the crossover point sequentially from the lowest frequency. Up to 100 crossover points can be set. (In the diagram below, Limit1 is 6 points and Limit2 is 4 points.) In addition, when a margin is set at each of Limit1/2, evaluation can be performed using the lines, taking into account the margins. Once Limit1/2 has been set, the level direction can be fine-adjusted by the margin setting.

Line: Limit1, Limit2
Judgment type: Upper Limit, Lower Limit
Crossover (point): 1 to 100
Margin: Limit1, 2 + Display margin line

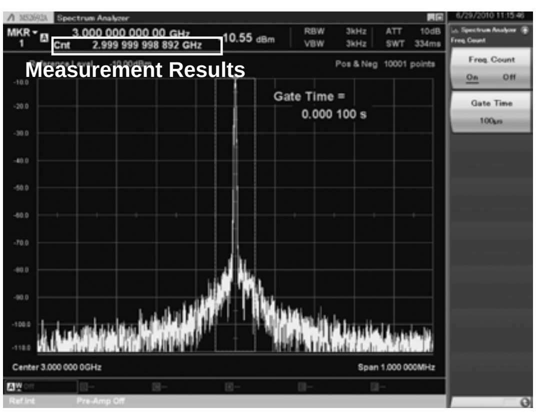


Measurement Results

■ Evaluation: PASS, FAIL

• Frequency Counter SPA

This function of the marker functions is used to measure CW frequencies.
Gate Time sets the measurement target time.



Measurement Results

■ Marker point frequency

• 2-tone 3rd-order Intermodulation Distortion SPA

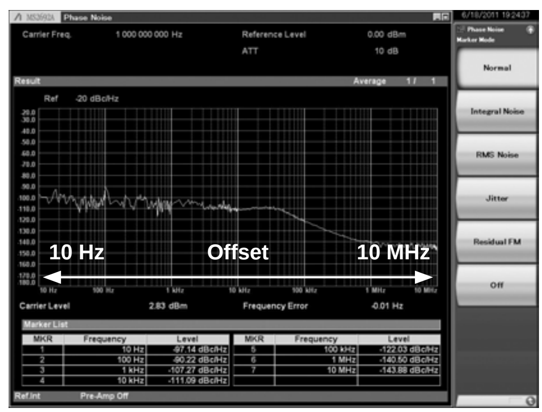
By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.

Measurement Results

■ TOI: [dBm]
■ Amplitude: [dBc]

• Phase Noise

This function measures phase noise in the 10 Hz to 10 MHz frequency offset range.

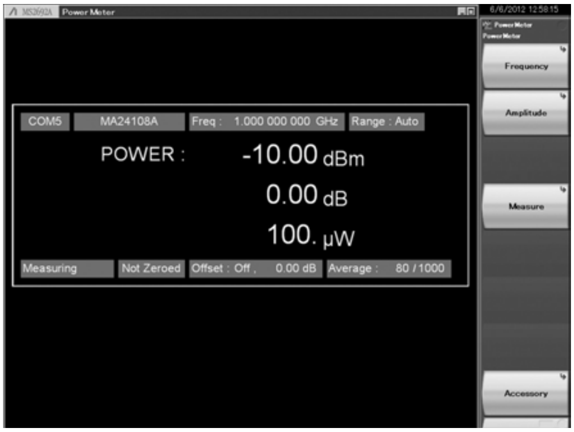


Measurement Results

■ Carrier level
■ Error between set frequency and carrier frequency
■ Marker point phase noise level

• Power Meter

Power meter function can connect a USB power sensor to the MS2830A and read the measurement values.



Measurement Results

■ Power: [dBm], [W]
■ Relative power: [dB]

Compatible USB power sensors.

Model	Frequency Range	Resolution	Dynamic Range
MA24104A	600 MHz to 4 GHz	1 kHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	1 kHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	100 kHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	100 kHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	100 kHz	–40 to +20 dBm

• Noise Figure Measurement (Opt. 017)

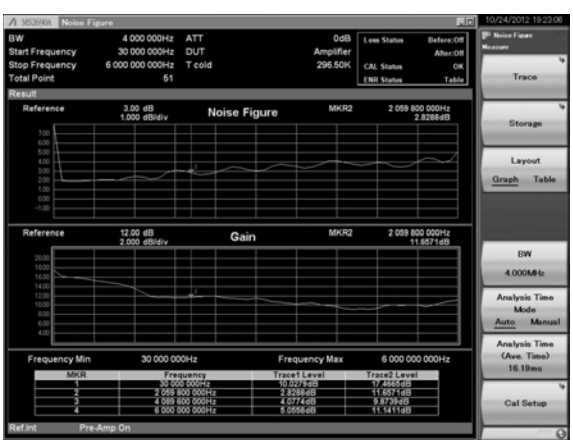
Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source*.

Frequency Mode: Fixed/List/Sweep
DUT Mode: Amplifier
Screen Layout: Graph/Table

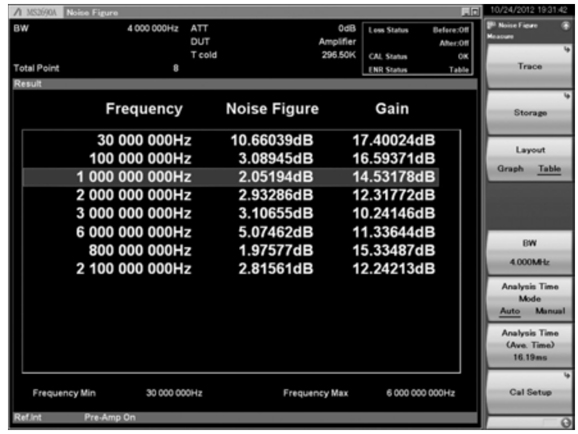
Measurement Results Display

■ Graph/List/Spot

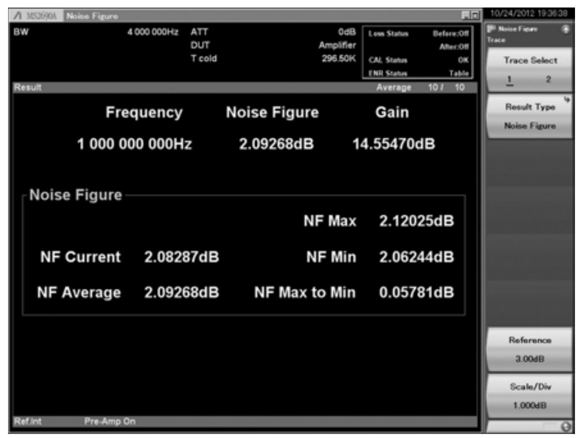
Displays measurement results for each trace (Trace1/Trace2).
• Noise Figure (NF) [dB]
• Noise Factor (F) [Linear]
• Gain
• Y-Factor: Power ratio when Noise Source is turned ON/OFF
• T effective: Effective noise temperature
• P Hot: Power measured when Noise Source is On.
• P Cold: Power measured when Noise Source is Off.



Measurement Result: Example of Graph display (Frequency Mode: Sweep, Screen Layout: Graph)



Measurement Result: Example of List display (Frequency Mode: List, Screen Layout: List)



Measurement Result: Example of Spot display (Frequency Mode: Fixed)

*: Supports noise sources from Noisecom NC346 series.
See the MS2690A/MS2691A/MS2692A catalog for more details.

Vector Signal Generator (Opt. 020)
Basic Performance

The MS269xA-020 Vector Signal Generator option covers the frequency range from 125 MHz to 6 GHz; it has a wide vector modulation bandwidth of 120 MHz as well as a large built-in memory for storing 256 Msamples. Its level accuracy is at least as good as a dedicated signal generator and the ACLR performance is ideal for Tx tests of devices such as amplifiers and Rx tests of base stations. The all-in-one analyzer and signal generator supports simple configuration of space-saving measurement systems as well as easy signal analysis matching the output timing from the signal generator option.

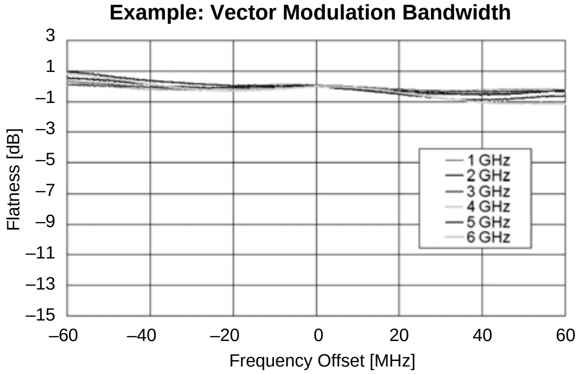
- **Frequency Range**
  - **Frequency Range: 125 MHz to 6 GHz**
  - **Resolution: 0.01 Hz step**

The Vector Signal Generator (Opt. 020) frequency range is 125 MHz to 6 GHz, covering the key wireless communication range.

- **Internal Baseband Generator**
  - **Vector Modulation Bandwidth: 120 MHz**
  - **Sampling Clock: 20 kHz to 160 MHz**

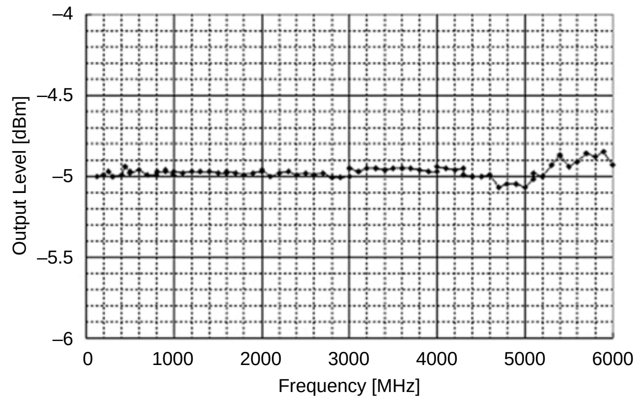
The wideband 120-MHz vector modulation bandwidth is achieved using the Opt. 020 baseband signal generator.
The sampling clock supports up to 160 MHz.

Example: Vector Modulation Bandwidth

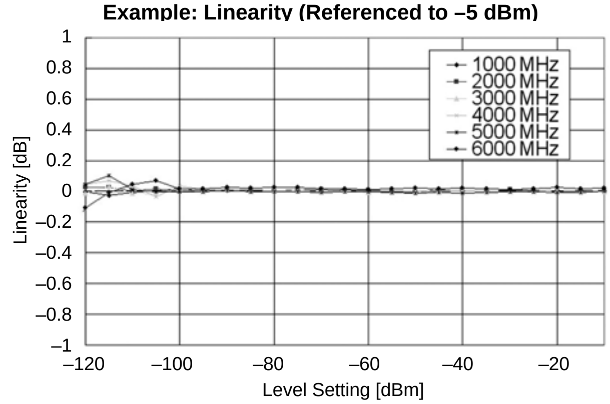


- **Level Accuracy ±0.5 dB**
  - **Output Level Accuracy (CW):**
    ±0.5 dB (–120 dBm ≤ Level ≤ +5 dBm, Frequency ≤ 3 GHz)
    ±0.8 dB (–110 dBm ≤ Level ≤ +5 dBm, Frequency > 3 GHz)

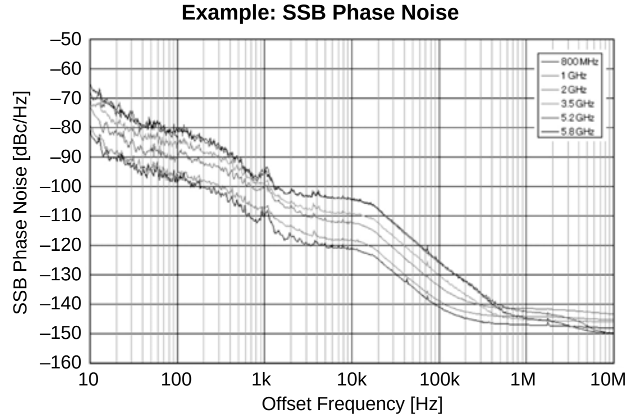
Example: Frequency Characteristics (Referenced to –5 dBm)



Example: Linearity (Referenced to –5 dBm)



Example: SSB Phase Noise



• Large-capacity Memory

1 GB = 256 Msamples/channel

The MS269xA-020 arbitrary waveform memory can save 256 Msamples/channel as well as multiple waveform patterns at the same time. Waveform patterns in memory can be output instantaneously by switching without need to recall from hard disk.

• Internal AWGN Generator

Absolute CN Ratio: ≤40 dB

This functions adds AWGN (Additive White Gaussian Noise) to the wanted waveform in memory. It is ideal for Tx dynamic range tests.

AWGN band set automatically to sampling clock of wanted signal.

Example: When wanted signal conditions are:
- W-CDMA
- Bandwidth = 3.84 MHz
- Over sampling = × 4

• Internal BER Measurement Function

Input Bit Rate: 100 bps to 10 Mbps

Input Level: TTL Level

Input Signal: Data, Clock, Enable

Connector: Rear panel, Aux connector*

Adding the MS269xA-020 Vector Signal Generator option includes a built-in BER tester for measurements up to 10 Mbps. It supports Rx sensitivity tests by inputting the receiver-demodulated Data/Clock/Enable to the back of the MS269xA.

∗: Requires J1373A AUX Conversion Adapter (sold separately)

• Versatile Multiple Waveform Generation

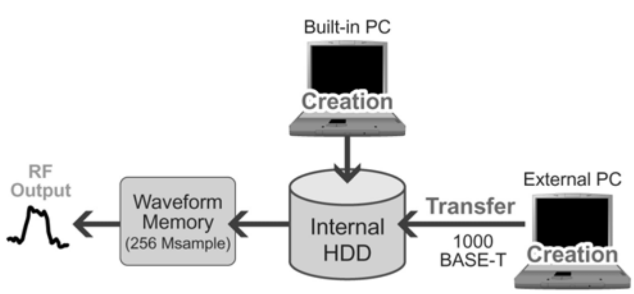
Any type of waveform can be generated using the MS269xA-020 Signal Generator option. In addition to using C and simulation tools, Anritsu's IQproducer can be run on a PC to edit waveform parameters and output waveforms.

Creating Waveform Using IQproducer

IQproducer is PC software that is used to edit parameters and create any waveform pattern. It can be installed either on an external PC or in the MS269xA main frame.
- HSDPA/HSUPA IQproducer
- TDMA IQproducer
- Multi-carrier IQproducer
- Mobile WiMAX IQproducer
- LTE IQproducer
- XG-PHS IQproducer
- LTE TDD IQproducer
- WLAN IQproducer
- TD-SCDMA IQproducer

Creating Any Waveform

IQ Data created using the MS269xA digitize function or by simulation tools or in C can be converted to a waveform pattern using the SG option and output.



• Useful IQproducer Waveform Generation Software

IQproducer is application software for a PC for editing, creating and transferring waveform patterns using the MS269xA-020 arbitrary waveform generation option.
It has the following three main functions.

- **Parameter Editing:**
  Function for easily editing parameters matching each communication method
- **Simulation:**
  Function for checking generated waveform pattern before transfer to CCDF and FFT graphs
- **Conversion:**
  Function for converting ASCII format waveform patterns created by simulation software, files captured using digitizing function, and MG3700A waveform patterns, into files that can be used by MS269xA-020

Excellent Expandability Platform (Hardware)

The versatility of the MS269xA series is tailored easily to the application by installing modules in expansion slots.

• Basic Function and Performance Upgrades

• MS2690A/MS2691A/MS2692A-001
Rubidium Reference Oscillator

This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of $\pm 1 \times 10^{-9}$ at 7 minutes after power-on.

Aging Rate: $\pm 1 \times 10^{-10}$/month
Start-up Characteristics: $\pm 1 \times 10^{-9}$ (7 minutes after power-on)

• MS2691A/MS2692A-003
Preselector Extended Lower Limit (3 GHz)

This option extends the lower limit of the preselector from 5.9 GHz to 3 GHz. It can only be installed in the MS2691A/MS2692A.

• MS2690A/MS2691A/MS2692A-008 6 GHz Preamplifier

This option increases the sensitivity of the spectrum/signal analyzer functions and is used for examining low-level signals such as interference waveforms.

Frequency range: 100 kHz to 6 GHz
Gain: 14 dB (≤3 GHz)
13 dB (3 GHz < Frequency ≤ 4 GHz)
11 dB (4 GHz < Frequency ≤ 5 GHz)
10 dB (5 GHz < Frequency ≤ 6 GHz)

• MS2692A-067 Microwave Preselector Bypass

Bypassing the preselector used for the microwave band improves RF frequency characteristics and in-band frequency characteristics.

∗: Cannot be installed simultaneously with MS2692A-003/004/008

• Signal Analyzer Function and Performance Upgrade

• MS2690A/MS2691A/MS2692A-004
Wideband Analysis Hardware

This option expands the analysis bandwidth to 125 MHz.

• MS2690A/MS2691A/MS2692A-077
Analysis Bandwidth Extension to 62.5 MHz

This option expands the analysis bandwidth to 62.5 MHz.

• MS2690A/MS2691A/MS2692A-078*1, *2
Analysis Bandwidth Extension to 125 MHz

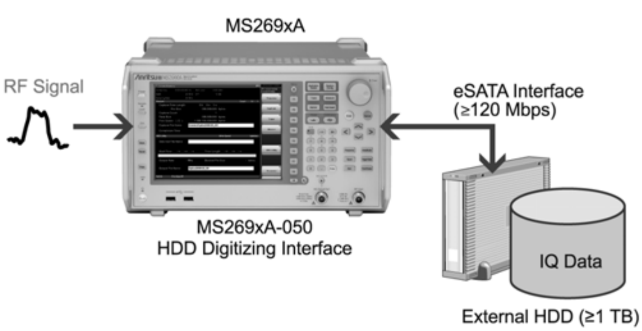
This option expands the analysis bandwidth to 125 MHz.

∗1: Requires Opt. 077
∗2: Combining with MX269028A-002 wireless LAN IEEE802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE802.11ac. See measurement software catalog for more details

Usage Example: Record Noise and Replay
When the Vector Signal Generator (Opt. 020) generates a signal based on the data captured by the signal analyzer, a signal that mimics the captured signal can be output*1.
For example, a variety of noise sources can be captured and edited using one MS269xA to evaluate the noise tolerance of a product. In some cases, it is not possible to capture minute level fluctuations with a resolution of 20 ns*2, depending on the noise components. In these circumstances, a signal very close to the actual noise can be captured and replayed by setting the resolution to 5 ns*3.
(At signal generation, the setting range of the pattern sampling rate must be within the 160 MHz upper limit of the vector signal generator sampling rate.)

∗1: Capture time depends on memory capacity.
∗2: Sampling rate of 50 MHz at 31.25 MHz FFT band
∗3: Sampling rate of 200 MHz at 125 MHz FFT band

- **Expansion Functions**
  - **MS2690A/MS2691A/MS2692A-017**
    Noise Figure Measurement Function
    Adds noise figure measurement function.
    Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.
  - **MS2690A/MS2691A/MS2692A-020**
    Vector Signal Generator
    This option is a high-performance waveform generator covering a frequency range of 125 MHz to 6 GHz with a 120 MHz wideband vector modulation band and built-in 256 Msample waveform memory.
  - **MS2690A/MS2691A/MS2692A-040**
    Baseband Interface Unit
    The MS269xA is an all-in-one solution supporting DigRF 3G RFIC Tx/Rx measurements using a combination of the MS269xA-020 Vector Signal Generator, MX269040A RF UMTS Measurement Software, and MX269041A DigRF 2.5G/3G Digital I/F Control Software.
    ∗: See each catalog for details.
  - **MS2690A/MS2691A/MS2692A-050**
    HDD Digitizing Interface
    Installing the MS269xA-050 HDD Digitizing Interface option captures up to 4 hours of 20 MHz wideband RF signals.
    It is convenient for troubleshooting uncommon faults.



  - **MS2690A/MS2691A/MS2692A-313**
    Removable HDD
    The MS269xA-313 Removable HDD is useful when a user takes the instrument to an outside company for calibration but wants to protect the security of data in the instrument, such as measurement results, data and main frame settings. In this case, the user removes the regular MS269xA hard disk and replaces it with this product.

Trademarks:
- WiMAX® is a trademark or registered trademark of WiMAX Forum.
- CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).
- IQproducer™ is a registered trademark of Anritsu Corporation.

Future-proof Platform (Software)

Adding measurement software options to the signal analyzer assures that the modulation analysis and other functions will support all common current and future communications systems.

- **Measurement Software**

Communications Systems	Name	Model
Mobile WiMAX	Mobile WiMAX Measurement Software	MX269010A
W-CDMA/HSPA/ HSPA Evolution	W-CDMA/HSPA Downlink Measurement Software	MX269011A
	W-CDMA/HSPA Uplink Measurement Software	MX269012A
W-CDMA/HSPA	W-CDMA BS Measurement Software	MX269030A
GSM/EDGE	GSM/EDGE Measurement Software	MX269013A
EDGE Evolution	EDGE Evolution Measurement Software	MX269013A-001
ETC/DSRC	ETC/DSRC Measurement Software	MX269014A
TD-SCDMA	TD-SCDMA Measurement Software	MX269015A
Next-generation PHS (XGP)	XG-PHS Measurement Software	MX269016A
Multi-TDMA systems	Vector Modulation Analysis Software	MX269017A
3GPP LTE (FDD)	LTE Downlink Measurement Software	MX269020A
	LTE-Advanced FDD Downlink Measurement Software	MX269020A-001*1
	LTE Uplink Measurement Software	MX269021A
3GPP LTE (TDD)	LTE TDD Downlink Measurement Software	MX269022A
	LTE TDD Uplink Measurement Software	MX269023A
CDMA2000	CDMA2000 Forward Link Measurement Software	MX269024A
1xEV-DO	EV-DO Forward Link Measurement Software	MX269026A
WLAN	WLAN (802.11) Measurement Software (Supports IEEE802.11n/11a/11b/11g/11j/11p)	MX269028A
	802.11ac (160 MHz) Measurement Software (for MS269xA)	MX269028A-002*2
MediaFLO	Measurement Software for MediaFLO	MX269036A

∗1: Requires MX269020A.
∗2: Only for MS269xA. Requires MX269028A.
Combining with the MS269xA-078 Analysis Bandwidth Extension to 125 MHz supports modulation analysis up to 160-MHz bandwidth signals of the IEEE802.11ac.
∗: See each measurement software catalog for more details.

Adding a license for the IQproducer waveform generation software to the vector signal generator option supports easy generation of test patterns for all common communications systems worldwide.

- **IQproducer License for MS269xA-020 VSG**

Waveforms generated by IQproducer can be downloaded to the MS269xA main frame in which the MS269xA-020 Vector Signal Generator is installed, but the following licenses (option) are required to output the signal.

- MX269901A HSDPA/HSUPA IQproducer
- MX269902A TDMA IQproducer
- MX269904A Multi-Carrier IQproducer
- MX269905A Mobile WiMAX IQproducer
- MX269908A LTE IQproducer
- MX269908A-001*1 LTE-Advanced FDD Option
- MX269909A XG-PHS IQproducer
- MX269910A LTE TDD IQproducer
- MX269911A WLAN IQproducer
- MX269911A-001*2 802.11ac (80 MHz) Option
- MX269912A TD-SCDMA IQproducer

∗1: Requires MX269908A.
∗2: Requires MX269911A.

● Waveform Patterns for MS269xA-020 VSG

Various waveforms with preset parameters matching each communication method are provided. The MS269xA-020 Vector Signal Generator option outputs RF signals.
Pre-installed reference waveforms are saved on the MS269xA hard disk for free use.

Pre-installed Patterns

- W-CDMA
- HSDPA (Test Model5)
- CDMA2000 1xEV-DO
- CDMA2000
- GSM/EDGE
- Digital Broadcasting (ISDB-T/CS/BS/CATV)
- WLAN (IEEE802.11a/b/g)
- *Bluetooth*

Specifications

The specification is the value after a 30-minute warm-up at a constant ambient temperature.
Typical values are only for reference and are not guaranteed specifications.

● Vector Signal Analysis Function/Spectrum Analyzer Function Common

Frequency

Frequency Range	50 Hz to 6.0 GHz (MS2690A) 50 Hz to 13.5 GHz (MS2691A) 50 Hz to 26.5 GHz (MS2692A)
Frequency Bands	(see table below)
Preselector Range	5.9 GHz to 13.5 GHz (Frequency band mode: Normal) (MS2691A) 5.9 GHz to 26.5 GHz (Frequency band mode: Normal) (MS2692A) 3.0 GHz to 13.5 GHz (Frequency band mode: Spurious) (MS2691A) 3.0 GHz to 26.5 GHz (Frequency band mode: Spurious) (MS2692A)
Frequency Setting Range	0 Hz to 6.0 GHz (MS2690A) 0 Hz to 13.5 GHz (MS2691A) 0 Hz to 26.5 GHz (MS2692A) Setting resolution: 1 Hz
Internal Reference Oscillator	Start-up characteristics (23˚C, referenced to frequency at 24 h after power-on): ±5 × 10^{-7} (2 minutes after power-on), ±5 × 10^{-8} (5 minutes after power-on) Aging rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day Temperature characteristics: ±2 × 10^{-8} (5˚ to 45˚C) with MS269xA-001 Rubidium Reference Oscillator Start-up characteristics (23˚C, referenced to frequency at 24 h after power-on): ±1 × 10^{-9} (7 minutes after power-on) Aging rate: ±1 × 10^{-10}/month Temperature characteristics: ±1 × 10^{-9} (5˚ to 45˚C)
SSB Phase Noise	18˚ to 28˚C, 2 GHz (see table below)

Frequency Bands:

Frequency	Band	Mixer harmonic order (N)	
50 Hz ≤ Frequency ≤ 6.0 GHz	0	1	
3.0 GHz ≤ Frequency ≤ 6.0 GHz	1 – L	1	(with MS2691A-003/MS2692A-003, MS2691A/MS2692A)
5.9 GHz ≤ Frequency ≤ 8.0 GHz	1–	1	(MS2691A/MS2692A)
7.9 GHz ≤ Frequency ≤ 13.5 GHz	1+	1	(MS2691A/MS2692A)
13.4 GHz ≤ Frequency ≤ 20.0 GHz	2–	2	(MS2692A)
19.9 GHz ≤ Frequency ≤ 26.5 GHz	2+	2	(MS2692A)

SSB Phase Noise:

Frequency Offset	Max.
100 kHz	–116 dBc/Hz
1 MHz	–137 dBc/Hz

Amplitude

Measurement Range	without MS269xA-008, or Preamp: Off DANL to +30 dBm with MS269xA-008, Preamp: On DANL to +10 dBm
Max. Input Level	without MS269xA-008, or Preamp: Off CW Average power: +30 dBm (Input attenuator: ≥10 dB) DC Voltage: 0 Vdc with MS269xA-008, Preamp: On CW Average power: +10 dBm (Input attenuator: 0 dB) DC Voltage: 0 Vdc
Input Attenuator	0 to 60 dB, 2 dB steps
Input Attenuator Switching Error	Referenced to 10 dB input attenuator without MS269xA-008, or Preamp: Off Frequency band mode: Normal ±0.2 dB (≤6.0 GHz, 10 to 60 dB) ±0.75 dB (>6.0 GHz, 10 to 60 dB) Frequency band mode: Spurious ±0.2 dB (<3.0 GHz, 10 to 60 dB) ±0.75 dB (≥3.0 GHz, 10 to 60 dB) with MS269xA-008, Preamp: On Frequency band mode: Normal ±0.65 dB (≤6.0 GHz, 10 to 60 dB)

Reference Level

Setting Range	Log scale: –120 to +50 dBm, or Equivalent level Linear scale: 22.4 µV to 70.7 V, or Equivalent level Setting resolution: 0.01 dB, or Equivalent level
Units	Log scale: dBm, dBµV, dBmV, dBµV (emf), dBµV/m, V, W Linear scale: V
Linearity Error	Excluding the noise floor effect without MS269xA-008, or Preamp: Off ±0.07 dB (Mixer input level: ≤–20 dBm) ±0.10 dB (Mixer input level: ≤–10 dBm) Frequency band mode: Normal, Mixer input level: ≤0 dBm ±0.15 dB (≤6.0 GHz) ±0.50 dB (>6.0 GHz) (MS2691A) ±0.60 dB (>6.0 GHz) (MS2692A) Frequency band mode: Spurious, Mixer input level: ≤0 dBm ±0.15 dB (<3.0 GHz) ±0.50 dB (≥3.0 GHz) (MS2691A) ±0.60 dB (≥3.0 GHz) (MS2692A) with MS269xA-008, Preamp: On ±0.07 dB (Preamp input level: ≤–40 dBm) ±0.10 dB (Preamp input level: ≤–30 dBm) Frequency band mode: Normal ±0.50 dB (Preamp input level: ≤–20 dBm, ≤6.0 GHz)
RF Frequency Characteristics	18˚ to 28˚C, after CAL, Input attenuator: 10 dB without MS269xA-008, or Preamp: Off ±0.35 dB (9 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (9 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) without MS2692A-067, or Microwave Preselector Bypass: Off, after Preselector tuning ±1.50 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal) (3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious) ±2.50 dB (13.5 GHz < Frequency ≤ 26.5 GHz) with MS269xA-008, Preamp: On ±0.65 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
1 dB Gain Compression	without MS269xA-008, or Preamp: Off, Mixer input level ≥+3 dBm (100 MHz ≤ Frequency < 400 MHz) ≥+7 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) ≥+3 dBm (3.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Spurious) (MS2691A) (6.0 GHz < Frequency ≤ 13.5 GHz) (MS2691A) ≥0 dBm (3.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Spurious) (MS2692A) (6.0 GHz < Frequency ≤ 26.5 GHz) (MS2692A) with MS269xA-008, Preamp: On, Preamp input level ≥–20 dBm (100 MHz ≤ Frequency < 400 MHz) ≥–15 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)

Spurious Response

<table>
<tr><td>2nd Harmonic Distortion</td><td>
without MS269xA-008, or Preamp: Off, Mixer input level: –30 dBm
<table>
<tr><td>Harmonic (dBc)</td><td>SHI (dBm)</td><td></td></tr>
<tr><td>≤–60</td><td>≥+30</td><td>(10 MHz ≤ Frequency ≤ 400 MHz)</td></tr>
<tr><td>≤–75</td><td>≥+45</td><td>(400 MHz < Frequency ≤ 3.0 GHz)</td></tr>
</table>
without MS2692A-067, Mixer input level: –10 dBm
<table>
<tr><td>Harmonic (dBc)</td><td>SHI (dBm)</td><td></td></tr>
<tr><td>≤–90</td><td>≥+80</td><td>(>3.0 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–90</td><td>≥+80</td><td>(≥1.5 GHz, Frequency band mode: Spurious)</td></tr>
</table>
with MS2692A-067, Microwave Preselector Bypass: Off, Mixer input level: –10 dBm
<table>
<tr><td>Harmonic (dBc)</td><td>SHI (dBm)</td><td></td></tr>
<tr><td>≤–70</td><td>≥+60</td><td>(3 GHz < Frequency ≤ 13.25 GHz)</td></tr>
</table>
with MS269xA-008, Preamp: On, Preamp input level: –45 dBm
<table>
<tr><td>Harmonic (dBc)</td><td>SHI (dBm)</td><td></td></tr>
<tr><td>≤–50</td><td>≥+5</td><td>(10 Hz ≤ Frequency ≤ 400 MHz)</td></tr>
<tr><td>≤–55</td><td>≥+10</td><td>(400 MHz < Frequency ≤ 3.0 GHz)</td></tr>
</table>
</td></tr>
<tr><td>Residual Response</td><td>Frequency: ≥1 MHz, Input attenuator: 0 dB, 50Ω terminated
Signal Analyzer: with MS269xA-004 or 077/078, Except bandwidth setting: >31.25 MHz
≤–100 dBm</td></tr>
</table>

Connector

RF Input	Front panel, N-J, 50Ω (nominal) 18˚ to 28˚C, Input attenuator: ≥10 dB VSWR:≤1.2 (nominal, 40 MHz ≤ Frequency ≤ 3.0 GHz) ≤1.5 (nominal, 3.0 GHz < Frequency ≤ 6.0 GHz) ≤2.0 (nominal, 6.0 GHz < Frequency ≤ 26.5 GHz)
IF Output	Rear panel, BNC-J, 50Ω (nominal) Frequency:875 MHz (Signal Analyzer, without MS269xA-004/077/078, or Bandwidth: ≤31.25 MHz) 900 MHz (Signal Analyzer, with MS269xA-004 or 077/078, Bandwidth: >31.25 MHz) 874.988 MHz (Spectrum Analyzer) Gain: 0 dB (nominal) (Referenced to RF input level, RF frequency: 1 GHz, Input attenuator: 0 dB) IF Bandwidth: 120 MHz (nominal)
External Reference Input	Rear panel, BNC-J, 50Ω (nominal) Frequency: 10 MHz,13 MHz Operation range: ±1 ppm Input level: –15 dBm ≤ Level ≤ +20 dBm, 50Ω (AC coupling)
Reference Signal Output	Rear panel, BNC-J, 50Ω (nominal) Frequency: 10 MHz Output level: ≥0 dBm (AC coupling)
Sweep Status Output	Rear panel, BNC-J Output level: TTL Level (High level at sweeping or waveform capture)
Trigger Input	Rear panel, BNC-J Input level: TTL Level
Noise Source Drive	This is available when the Option 017/117 is installed. Supply(+28 V) of the Noise Source Drive. Rear Panel, BNC-J Output Voltage: 28 ±0.5 V, Pulsed
External Reference	Control from external controller (Excluding power-on) Ethernet 10/100/1000BASE-T, Rear panel, RJ-45 GPIB:IEEE488.2, Rear panel, IEEE488 bus connector Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2 USB (B): USB2.0, Rear panel, USB-B connector
USB	USB2.0 Supporting waveform hard copy to external device, and saving main frame settings USB-A connector (Front panel: 2 ports, Rear panel: 2 ports)
Monitor Output	Rear panel, VGA compatible, mini D-Sub 15 pin
Aux	When using MS269xA-020 trigger input/output Rear panel, 68 pins (DX10BM-68S equivalent)
Display	XGA-color LCD (1024 × 768 resolution), 8.4 inch (213 mm)

General Specifications

Dimensions and Mass	340 (W) × 200 (H) × 350 (D) mm (Excluding projections), ≤13.5 kg (Excluding options)
Power Supply	100 V(ac) to 120 V(ac), 200 V(ac) to 240 V(ac) (–15/+10%, 250 V max.), 50 Hz/60 Hz (±5%) ≤260 VA (Excluding options), ≤440 VA (Including all options, max.)
Temperature Range	Operating: +5˚ to +45˚C, Storage: –20˚ to +60˚C
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

● Spectrum Analyzer Function

Frequency

Span	Range:0 Hz, 300 Hz to 6.0 GHz (MS2690A) 0 Hz, 300 Hz to 13.5 GHz (MS2691A) 0 Hz, 300 Hz to 26.5 GHz (MS2692A) Resolution: 2 Hz Accuracy: ±0.2% (Number of Trace points: 10001)
Display Frequency Accuracy	± [Display frequency × Reference oscillator accuracy + Span frequency × Span accuracy + RBW × 0.05 + 2 × N + Span frequency/(Number of trace points – 1)] Hz N: Mixer harmonic order
Resolution Bandwidth (RBW)	Setting range:30 Hz to 3 MHz (1-3 sequence), 50 kHz, 5, 10, 20, 31.25 MHz ∗31.25 MHz: Can be set when Span: 0 Hz only Selectivity (–60 dB/–3 dB): 4.5:1 (Nominal, 30 Hz to 10 MHz)
Video Bandwidth (VBW)	Setting range: 1 Hz to 10 MHz (1-3 sequence), 5 kHz, Off VBW mode: Video Average, Power Average

Amplitude

Display Average Noise Level (DANL)

18˚ to 28˚C, Detector: Sample, VBW: 1 Hz (Video Average), Input attenuator: 0 dB

without MS269xA-008, 6.0 GHz ≤ Frequency ≤ 26.5 GHz: without MS2692A-067

Frequency	Max.	Frequency band mode
100 kHz	–135.0 [dBm/Hz]	
1 MHz	–145.0 [dBm/Hz]	
30 MHz ≤ Frequency < 2.4 GHz	–155.0 [dBm/Hz]	
2.4 GHz ≤ Frequency < 3.0 GHz	–153.0 [dBm/Hz]	
3.0 GHz ≤ Frequency < 4.0 GHz	–153.0 [dBm/Hz]	Normal
4.0 GHz ≤ Frequency < 6.0 GHz	–152.0 [dBm/Hz]	Normal
6.0 GHz ≤ Frequency < 10.0 GHz	–151.0 [dBm/Hz]	Normal
10.0 GHz ≤ Frequency ≤ 13.5 GHz	–150.0 [dBm/Hz]	Normal
13.5 GHz < Frequency ≤ 20.0 GHz	–147.0 [dBm/Hz]	Normal
20.0 GHz < Frequency ≤ 26.5 GHz	–143.0 [dBm/Hz]	Normal

with MS269xA-008, Preamp: On

Frequency	Max.	Frequency band mode
100 kHz	–150.0 [dBm/Hz]	
1 MHz	–159.0 [dBm/Hz]	
30 MHz ≤ Frequency < 2.4 GHz	–166.0 [dBm/Hz]	
2.4 GHz ≤ Frequency < 3.0 GHz	–165.0 [dBm/Hz]	
3.0 GHz ≤ Frequency < 4.0 GHz	–164.0 [dBm/Hz]	Normal
4.0 GHz ≤ Frequency < 5.0 GHz	–161.0 [dBm/Hz]	Normal
5.0 GHz ≤ Frequency ≤ 6.0 GHz	–159.0 [dBm/Hz]	Normal

with MS269xA-008, Preamp: Off

Frequency	Max.	Frequency band mode
100 kHz	–135.0 [dBm/Hz]	
1 MHz	–145.0 [dBm/Hz]	
30 MHz ≤ Frequency < 2.4 GHz	–153.0 [dBm/Hz]	
2.4 GHz ≤ Frequency < 3.0 GHz	–152.0 [dBm/Hz]	
3.0 GHz ≤ Frequency < 4.0 GHz	–151.0 [dBm/Hz]	Normal
4.0 GHz ≤ Frequency < 5.0 GHz	–150.0 [dBm/Hz]	Normal
5.0 GHz ≤ Frequency < 6.0 GHz	–149.0 [dBm/Hz]	Normal

Total Level Accuracy*

*: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.

18˚ to 28˚C, after CAL, Input attenuator: ≥10 dB, Auto Sweep Time Select: Normal, RBW: ≤1 MHz,
Detection: Positive, CW, Excluding the noise floor effect

without MS269xA-008, Preamp: Off
Mixer input level: ≤0 dBm,
±0.5 dB (50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
(50 Hz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
after Preselector tuning
±1.8 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal)
(3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious)
±3.0 dB (13.5 GHz < Frequency ≤ 26.5 GHz)

with MS269xA-008, Preamp: On
Preamp input level: ≤–20 dBm
±1.0 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
(100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)

Spurious Response

2-tone 3rd-order Intermodulation Distortion

18˚ to 28˚C, ≥300 kHz separation

without MS269xA-008, or Preamp: Off
with MS2692A-067, Microwave Preselector Bypass: Off
Mixer input level: –15 dBm (per waveform)
≤–60 dBc (TOI: +15 dBm) (30 MHz ≤ Frequency < 400 MHz)
≤–66 dBc (TOI: +18 dBm) (400 MHz ≤ Frequency < 700 MHz)
≤–74 dBc (TOI: +22 dBm) (700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal)
(700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
≤–66 dBc (TOI: +18 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
≤–45 dBc (TOI: +7.5 dBm) (6.0 GHz < Frequency ≤ 26.5 GHz, Frequency band mode: Normal)
(3.0 GHz ≤ Frequency ≤ 26.5 GHz, Frequency band mode: Spurious)

with MS269xA-008, Preamp: On
Preamp input level: –45 dBm (per waveform)
≤–73 dBc (TOI: –8.5 dBm) (30 MHz ≤ Frequency < 400 MHz)
≤–78 dBc (TOI: –6 dBm) (400 MHz ≤ Frequency < 700 MHz)
≤–81 dBc (TOI: –4.5 dBm) (700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal)
(700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
≤–78 dBc (TOI: –6 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

Image Response

without MS2692A-067
≤–70 dBc (Frequency ≤ 13.5 GHz)
≤–65 dBc (13.5 GHz < Frequency ≤ 26.5 GHz)

Sweep

Sweep Mode	Single, Continuous
Sweep Time	Setting range: 2 ms to 1000 s (Span: ≥300 Hz), 1 µs to 1000 s (Span: 0 Hz)

Waveform Display

Detector	Pos&Neg, Positive Peak, Sample, Negative Peak, RMS
Number of Trace Points	1001, 2001, 5001, 10001 (Span: >500 MHz) 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001(100 MHz < Span ≤ 500 MHz) (300 Hz ≤ Span ≤ 100 MHz, Sweep time: >10 s) 11, 21, 41, 51, 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001(300 Hz ≤ Span ≤ 100 MHz, Sweep time: ≤10 s) (Span: 0 Hz, Sweep time: ≤10 s) 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001 (Span: 0 Hz, Sweep time: >10 s)
Scale	Log display: 10 div/12 div, 0.1 to 20 dB/div (1-2-5 sequence) Lin display: 10 div, 1 to 10%/div (1-2-5 sequence)
Trigger Function	Trigger mode:Free Run (Trig Off), Video, Wide IF, External (TTL) SG Marker (with MS269xA-020), BBIF (with MS269xA-040)
Gate Function	Gate mode:Off, Wide IF, External SG Marker (with MS269xA-020), BBIF (with MS269xA-040)

Measurement Functions

Adjacent Channel Leakage Power (ACP)		Reference: Span Total, Carrier Total, Both side of Carrier, Carrier Select Adjacent channel specification: 3 channels × 2 (Normal Mode), 8 channels × 2 (Advanced Mode)
Burst Average Power		In time domain, displays average power in specified time
Channel Power		Absolute value measurement: dBm, dBm/Hz
Occupied Bandwidth (OBW)		N% of Power, X-dB Down
Spectrum Emission Mask		Pass/Fail evaluation at Peak/Margin measurement
Spurious Emission		Pass/Fail evaluation at Worst/Peaks measurement
Frequency Counter	Accuracy	Span: ≤1 MHz, RBW: 1 kHz, S/N: ≥50 dB, Gate time: ≥100 ms, ± (Marker frequency × Frequency reference accuracy + (0.01 × N/Gate Time[s]) Hz) N: Mixer harmonic order
	Gate Time Range	100 µs to 1 s
2-tone 3rd-order Intermodulation Distortion		Measures IM3 and TOI from two-tone signal.

• Vector Signal Analysis Function

Common

Trace Mode	Spectrum, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Spectrogram, No Trace
Bandwidth	without MS269xA-004 Specified analysis bandwidth from center frequency 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz with MS269xA-004 Adds the 50, 100, and 125 MHz bandwidths to the standard analysis bandwidths. with MS269xA-077 Adds the 50 MHz, 62.5 MHz bandwidths to the standard analysis bandwidths. with MS269xA-077/078 Adds the 50, 62.5, 100, and 125 MHz bandwidths to the standard analysis bandwidths.
Sampling Rate	Auto-setting depending on RBW without MS269xA-004, or Bandwidth: ≤31.25 MHz 2 kHz to 50 MHz (1-2-5 sequence) with MS269xA-004, Bandwidth: >31.25 MHz 100 MHz, 200 MHz with MS269xA-077, Bandwidth: >31.25 MHz 100 MHz with MS269xA-077/078, Bandwidth: >31.25 MHz 100 MHz, 200 MHz
Capture Time	Set length of capture time without MS269xA-004, or Bandwidth: ≤31.25 MHz Min. capture time length: 2 µs to 50 ms (determined depending on analysis bandwidth) Max. capture time length: 2 to 2000 s (determined depending on analysis bandwidth) Setting mode: Auto, Manual with MS269xA-004, Bandwidth: >31.25 MHz Min. capture time length: 500 ns to 1 µs (determined depending on analysis bandwidth) Max. capture time length: 500 ms with MS269xA-077, Bandwidth: >31.25 MHz Min. capture time length: 1 µs (determined depending on analysis bandwidth) Max. capture time length: 500 ms with MS269xA-077/078, Bandwidth: >31.25 MHz Min. capture time length: 500 ns to 1 µs (determined depending on analysis bandwidth) Max. capture time length: 500 ms
Trigger	Trigger mode:Free Run (Trig Off), Video, Wide IF Video, External (TTL) SG Marker (with MS269xA-020), BBIF (with MS269xA-040)
ADC Resolution	16 bits

Spectrum Display Function

Function Outline	Displays any time length in captured waveform data and spectrum in frequency range
Analysis Time Range	Analysis start time: Set analysis start time point from waveform data header Analysis time length: Set analysis time length Setting mode: Auto, Manual
Frequency	Set center frequency and Span in frequency range of waveform data
Frequency Setting Range	without MS269xA-004, or Bandwidth: ≤31.25 MHz 0 Hz to 6.0 GHz (MS2690A), 0 Hz to 13.5 GHz (MS2691A), 0 Hz to 26.5 GHz (MS2692A) with MS269xA-004, Bandwidth: >31.25 MHz 100 MHz to 6.0 GHz with MS269xA-077, or with MS269xA-077/078, without MS2692A-067, Bandwidth: >31.25 MHz 100 MHz to 6.0 GHz with MS269xA-077, or with MS269xA-077/078, with MS2692A-067, Bandwidth: >31.25 MHz 100 MHz to 26.5 GHz
Resolution Bandwidth (RBW)	without MS269xA-004, or Bandwidth: ≤31.25 MHz Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS269xA-004, Bandwidth: >31.25 MHz Setting range: 3 kHz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS269xA-077, Bandwidth: >31.25 MHz Setting range: 3 kHz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS269xA-077/078, Bandwidth: >31.25 MHz Setting range: 3 kHz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)
Total Level Accuracy* *: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.	18˚ to 28˚C, after CAL, Input attenuator: ≥10 dB, Center frequency, CW, RBW: Auto, Time Detection: Average, Marker Result: Integration or Peak (Accuracy), Excluding the noise floor effect Mixer input level: ≤0 dBm without MS269xA-004, or Bandwidth: ≤31.25 MHz without MS269xA-008, or Preamp: Off ±0.5 dB (50 Hz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (50 Hz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) after Preselector tuning ±1.8 dB (6.0 GHz < Frequency ≤ 13.5 GHz, Frequency band mode: Normal) (3.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Spurious) ±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz) with MS269xA-004, Bandwidth: >31.25 MHz without MS269xA-008, or Preamp: Off ±0.5 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) with MS269xA-077, or with MS269xA-077/078, Bandwidth: >31.25 MHz without MS269xA-008, or Preamp: Off ±0.5 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) with MS269xA-077, or with MS269xA-077/078 with MS2692A-067, Microwave Preselector Bypass: On, Bandwidth: >31.25 MHz ±1.8 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Normal) ±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz) Preamp input level: ≤–20 dBm without MS269xA-004, or Bandwidth: ≤31.25 MHz with MS269xA-008, Preamp: On ±1.0 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) (100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious) with MS269xA-004, Bandwidth: >31.25 MHz with MS269xA-008, Preamp: On ±1.0 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal) with MS269xA-077, or with MS269xA-077/078, Bandwidth: >31.25 MHz with MS269xA-008, Preamp: On ±1.0 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)

Continued on next page

<table>
<tr><td>Display Average Noise Level (DANL)</td><td>
18˚ to 28˚C, Input attenuator: 0 dB
without MS269xA-008, 6.0 GHz ≤ Frequency ≤ 26.5 GHz: without MS2692A-067
<table>
<tr><th>Frequency</th><th>Max.</th><th>Frequency band mode</th></tr>
<tr><td>100 kHz</td><td>–132.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–142.5 [dBm/Hz]</td><td></td></tr>
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<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–150.5 [dBm/Hz]</td><td>Normal</td></tr>
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</table>
with MS269xA-008, Preamp: Off
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</table>
</td></tr>
<tr><td>Adjacent Channel Leakage Power Measurement (ACP)</td><td>Reference: Span Total, Carrier Total, Both Sides of Carriers, Carrier Select
Adjacent channel specification: 3 channels × 2</td></tr>
<tr><td>Channel Power</td><td>Absolute value measurement: dBm, dBm/Hz</td></tr>
<tr><td>Occupied Bandwidth (OBW)</td><td>N% of Power, × dB Down</td></tr>
</table>

Power vs. Time Display Function

Function Outline	Displays variation in power of captured waveform with time
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Resolution Bandwidth	Filter type: Rect, Gaussian, Nyquist, Root Nyquist, Off, (Default: Off) Roll-off ratio: 0.01 to 1 (Set for Nyquist, Root Nyquist) Filter frequency offset: Set center frequency of filter in wavelength data frequency band
AM Depth (Peak to Peak Measurement)	Measures with AM depth or marker function +Peak, –Peak, (P-P)/2, Average
Burst Average Power	Measures average power of burst signal

Frequency vs. Time Display Function

Function Outline	Displays variation in frequency of input signal with time from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Operation Level Range	–17 to +30 dBm (Input attenuator: ≥10 dB)
Frequency (Vertical axis)	Sets center frequency and Span in waveform data frequency range Display frequency range: 1/25, 1/10, 1/5, 1/2 of RBW Input frequency range: 10 MHz to 6 GHz
Display Frequency Accuracy	Input level: –17 to +30 dBm (Span: ≤31.25 MHz, Scale: Span/25) CW input: ± (Reference oscillator accuracy × Center frequency + Display frequency range × 0.01) Hz
FM Deviation (Peak to Peak Measurement)	Measures with FM deviation or marker function +Peak, –Peak, (P-P)/2, Average

Phase vs. Time Display Function

Function Outline	Displays phase time fluctuation of input signal from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Phase (Vertical axis)	Display mode: Wrap, Unwrap Display phase range: 0.01 deg./div to 200 Gdeg./div Offset: –100 deg. to +100 Mdeg.

CCDF/APD Display Function

Function Outline	Displays CCDF and APD of waveform data captures for fixed time
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Display	Displays CCDF or APD as graph Histogram resolution: 0.01 dB Numeric display: Average Power, Max Power, Crest Factor
Resolution Bandwidth (RBW)	Filter type: Rectangle, Off, (Default: Off) Filter frequency offset: Sets filter center frequency in waveform data frequency band

Spectrogram Display Function

Function Outline	Displays spectrogram for time period in captured waveform data
Analysis Time Range	Analysis start time: Sets position of analysis start after waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Settable as center frequency and span frequency of waveform data
Resolution Bandwidth (RBW)	Setting range: 1 Hz to 1 MHz (1-3 sequence) Selection (–60/–3 dB): 4.5: 1 (nominal)

Digitize Function

Function Outline	Outputs captured waveform data to internal hard disk or external device
Waveform Data	Format: I, Q (32 bit Float Binary format) Level: Sets 0 dBm input to $\sqrt{(I^2 + Q^2)} = 1$ Level accuracy: Same as Total level accuracy of Signal Analyzer
External Output	Output to external PC via Ethernet

Replay Function

Function Outline	Captured waveforms can be replayed again by using the VSA function to read saved digitize data
Measurable Waveform Data Condition	Format: I, Q (Binary format) Combination of Span, Sampling rate, and Minimum Capture Sample:

Span	Sampling Rate	Minimum Capture Sample
1 kHz	2 kHz	74000 (37 s)
2.5 kHz	5 kHz	160000 (32 s)
5 kHz	10 kHz	310000 (31 s)
10 kHz	20 kHz	610000 (30.5 s)
25 kHz	50 kHz	730000 (14.6 s)
50 kHz	100 kHz	730000 (7.3 s)
100 kHz	200 kHz	730000 (3.65 s)
250 kHz	500 kHz	730000 (1.46 s)
500 kHz	1 MHz	730000 (730 ms)
1 MHz	2 MHz	730000 (365 ms)
2.5 MHz	5 MHz	730000 (146 ms)
5 MHz	10 MHz	730000 (73 ms)
10 MHz	20 MHz	730000 (36.5 ms)
18.6 MHz	20 MHz	730000 (36.5 ms)
20 MHz	25 MHz	730000 (29.2 ms)
25 MHz	50 MHz	730000 (14.6 ms)
31.25 MHz	50 MHz	730000 (14.6 ms)
50 MHz	100 MHz	730000 (7.3 ms)
62.5 MHz	100 MHz	730000 (7.3 ms)
100 MHz	200 MHz	730000 (3.65 ms)
125 MHz	200 MHz	730000 (3.65 ms)

• MS2690A/MS2691A/MS2692A-001 Rubidium Reference Oscillator

Function Outline	Generates 10 MHz reference signal with higher frequency stability

• MS2691A/MS2692A-003 Extension of Preselector Lower Limit to 3 GHz

Cannot be installed simultaneously MS2692A-003 and MS2692A-067.

Function Outline	Extends lower limit of preselector to 3 GHz

• MS2690A/MS2691A/MS2692A-004 Wideband Analysis Hardware

Cannot be installed simultaneously MS2692A-004 and MS2692A-067.

Common

Bandwidth	This option adds the 50, 100, and 125 MHz bandwidths to the standard analysis bandwidths (1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz).
Sampling Rate	Bandwidth: >31.25 MHz Auto-setting depending on RBW 100 MHz, 200 MHz
Capture Time	Bandwidth: >31.25 MHz Capture Time Length: Set length of capture time Max. Capture Time Length: 500 ns to 1 µs (determined depending on analysis bandwidth) Min. Capture Time Length: 500 ms
Resolution Bandwidth (RBW)	Bandwidth: >31.25 MHz Setting Range: 3 kHz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–30 dB): 4.5:1 (nominal)
ADC Resolution	12 bits
Frequency	Setting Range: 100 MHz to 6.0 GHz (Bandwidth: >31.25 MHz)

Amplitude

<table>
<tr><td>Display Average Noise Level (DANL)</td><td>18˚ to 28˚C, Input attenuator: 0 dB, Frequency band mode: Normal
without MS269xA-008, or Preamp: Off
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<tr><td>Frequency</td><td>Max.</td></tr>
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<tr><td>2.4 GHz ≤ Frequency < 4.0 GHz</td><td>–141.0 [dBm/Hz]</td></tr>
<tr><td>4.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–139.0 [dBm/Hz]</td></tr>
</table>
with MS269xA-008, Preamp: On
<table>
<tr><td>Frequency</td><td>Max.</td></tr>
<tr><td>100 MHz ≤ Frequency < 2.4 GHz</td><td>–156.0 [dBm/Hz]</td></tr>
<tr><td>2.4 GHz ≤ Frequency < 4.0 GHz</td><td>–154.0 [dBm/Hz]</td></tr>
<tr><td>4.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–150.0 [dBm/Hz]</td></tr>
</table></td></tr>
<tr><td>Total Level Accuracy*
*: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.</td><td>18˚ to 28˚C, After CAL, Input attenuator: ≥10 dB, Center frequency, CW, RBW: Auto, Time Detection: Average, Marker Result: Integration or Peak (Accuracy), Excluding the noise floor effect, Bandwidth: >31.25 MHz
without MS269xA-008, or Preamp: Off, Mixer input level: ≤0 dBm
±0.5 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
with MS269xA-008, Preamp: On, Preamp input level: ≤–20 dBm
±1.0 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>Linearity Error</td><td>Frequency band mode: Normal, Excluding the noise floor effect
without MS269xA-008, or Preamp: Off
±0.07 dB (Mixer input level: ≤–20 dBm)
±0.10 dB (Mixer input level: ≤–10 dBm)
±0.30 dB (Mixer input level: ≤0 dBm)
with MS269xA-008, Preamp: On
±0.07 dB (Mixer input level: ≤–40 dBm)
±0.10 dB (Mixer input level: ≤–30 dBm)
±0.50 dB (Mixer input level: ≤–20 dBm)</td></tr>
<tr><td>RF Frequency Characteristics</td><td>18˚ to 28˚C, After CAL, Input attenuator: ≥10 dB
without MS269xA-008, or Preamp: Off
±0.35 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
with MS269xA-008, Preamp: On
±0.65 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)</td></tr>
</table>

Note: There is a chance of a sampling error of 0.084 ppm or less when setting the 50 MHz/100 MHz/125 MHz bandwidth for Wideband Analysis Hardware operation. Very occasionally, you may observe a noise spike for about 10 ns when measuring with the Power vs. Time screen of the Vector Signal Analyzer.

• MS2690A/MS2691A/MS2692A-008 6 GHz Preamplifier
Cannot be installed simultaneously MS2692A-008 and MS2692A-067.

Frequency

Range	100 kHz to 6 GHz

Amplitude

<table>
<tr><td>Measurement Range</td><td>Display average noise level to +10 dBm</td></tr>
<tr><td>Max. Input Level</td><td>CW Average power: +10 dBm (Input attenuator: 0 dB)
DC Voltage: 0 Vdc</td></tr>
<tr><td>Gain</td><td>14 dB (Frequency ≤ 3.0 GHz), 13 dB (3.0 GHz < Frequency ≤ 4.0 GHz), 11 dB (4.0 GHz < Frequency ≤ 5.0 GHz),
10 dB (5.0 GHz < Frequency ≤ 6.0 GHz)</td></tr>
<tr><td>Noise Factor</td><td>7.0 dB (Frequency ≤ 3.0 GHz), 8.5 dB (3.0 GHz < Frequency ≤ 4.0 GHz), 9.5 dB (4.0 GHz < Frequency ≤ 6.0 GHz)</td></tr>
<tr><td>Display Average Noise Level (DANL)</td><td>Spectrum analyzer function: 18˚ to 28˚C, Input attenuator: 0 dB, Detector: sample, VBW: 1 Hz (Video average)
Vector signal analysis function: 18˚ to 28˚C, Input attenuator: 0 dB
Preamp: On
<table>
<tr><th>Frequency</th><th>Max. (Spectrum analyzer function)</th><th>Max. (Vector signal analysis function)</th><th>Frequency band mode</th></tr>
<tr><td>100 kHz</td><td>–150.0 [dBm/Hz]</td><td>–147.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–159.0 [dBm/Hz]</td><td>–156.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–166.0 [dBm/Hz]</td><td>–163.5 [dBm/Hz]</td><td></td></tr>
<tr><td>2.4 GHz ≤ Frequency < 3.0 GHz</td><td>–165.0 [dBm/Hz]</td><td>–162.5 [dBm/Hz]</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–164.0 [dBm/Hz]</td><td>–161.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>4.0 GHz ≤ Frequency < 5.0 GHz</td><td>–161.0 [dBm/Hz]</td><td>–158.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>5.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–159.0 [dBm/Hz]</td><td>–156.5 [dBm/Hz]</td><td>Normal</td></tr>
</table>
Preamp: Off
<table>
<tr><th>Frequency</th><th>Max. (Spectrum analyzer function)</th><th>Max. (Vector signal analysis function)</th><th>Frequency band mode</th></tr>
<tr><td>100 kHz</td><td>–135.0 [dBm/Hz]</td><td>–132.5 [dBm/Hz]</td><td></td></tr>
<tr><td>1 MHz</td><td>–145.0 [dBm/Hz]</td><td>–142.5 [dBm/Hz]</td><td></td></tr>
<tr><td>30 MHz ≤ Frequency < 2.4 GHz</td><td>–153.0 [dBm/Hz]</td><td>–150.5 [dBm/Hz]</td><td></td></tr>
<tr><td>2.4 GHz ≤ Frequency < 3.0 GHz</td><td>–152.0 [dBm/Hz]</td><td>–149.5 [dBm/Hz]</td><td></td></tr>
<tr><td>3.0 GHz ≤ Frequency < 4.0 GHz</td><td>–151.0 [dBm/Hz]</td><td>–148.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>4.0 GHz ≤ Frequency < 5.0 GHz</td><td>–150.0 [dBm/Hz]</td><td>–147.5 [dBm/Hz]</td><td>Normal</td></tr>
<tr><td>5.0 GHz ≤ Frequency < 6.0 GHz</td><td>–149.0 [dBm/Hz]</td><td>–146.5 [dBm/Hz]</td><td>Normal</td></tr>
</table></td></tr>
<tr><td>Input Attenuator Switching Error</td><td>Frequency band mode: Normal
±0.65 dB (≤6.0 GHz, 10 to 60 dB)</td></tr>
</table>

Reference Level

<table>
<tr><td>RF Frequency Characteristics</td><td>18˚ to 28˚C, After CAL, Input attenuator: 10 dB
±0.65 dB (100 kHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
(100 kHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>Linearity Error</td><td>Excluding the noise floor effect
±0.07 dB (Preamp input level*: ≤–40 dBm)
±0.10 dB (Preamp input level*: ≤–30 dBm)
Frequency band mode: Normal
±0.5 dB (Preamp input level*: ≤–20 dBm, frequency: ≤6.0 GHz)</td></tr>
<tr><td>1 dB Gain Compression</td><td>Preamp input level*
≥–20 dBm (100 MHz ≤ Frequency < 400 MHz)
≥–15 dBm (400 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
(400 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)</td></tr>
</table>

Spurious Response

<table>
<tr><td>2nd Harmonic Distortion</td><td>Preamp input level*: –45 dBm
Harmonic SHI
≤–50 dBc ≤+5 dBm (10 MHz ≤ Frequency ≤ 400 MHz)
≤–55 dBc ≤+10 dBm (400 MHz < Frequency ≤ 3.0 GHz)</td></tr>
<tr><td>2-tone 3rd-order Intermodulation Distortion</td><td>18˚ to 28˚C, Preamp input level*: –45 dBm (per waveform), ≥300 kHz separation
≤–73 dBc (TOI: –8.5 dBm) (30 MHz ≤ Frequency < 400 MHz)
≤–78 dBc (TOI: –6 dBm) (400 MHz ≤ Frequency < 700 MHz)
≤–81 dBc (TOI: –4.5 dBm)(700 MHz ≤ Frequency < 4.0 GHz, Frequency band mode: Normal)
(700 MHz ≤ Frequency < 3.0 GHz, Frequency band mode: Spurious)
≤–78 dBc (TOI: –6 dBm) (4.0 GHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)</td></tr>
</table>

*: Preamp input level = RF input level – Input attenuator setting value

• MS2690A/MS2691A/MS2692A-017 Noise Figure Measurement Function*

Frequency

Frequency Range	MS2690A: 30 MHz to 6 GHz MS2691A: 30 MHz to 6 GHz MS2692A: 30 MHz to 6 GHz
Frequency Setting Range	MS2690A: 10 MHz to 6 GHz MS2691A: 10 MHz to 13.5 GHz MS2692A: 10 MHz to 26.5 GHz

NF Measurement

Measurement Range	Within the frequency range (Attenuator = 0 dB, Pre-Amp = On) – 20 to +40 dB
Instrument Uncertainty	Within the measurement range ENR: 4 to 7 dB ±0.02 dB ENR: 12 to 17 dB ±0.025 dB ENR: 20 to 22 dB ±0.03 dB

GAIN Measurement

Measurement Range	Within the frequency range –20 to +40 dB
Instrument Uncertainty	Within the measurement range ≤0.07

Resolution Bandwidth

Setting Range	100 kHz to 8 MHz

Connector

Noise Source	Connector: Rear Panel, BNC-J Output Voltage: 28 ±0.5 V, Pulsed

*: Recommending the NC346 Series noise sources by Noisecom company

• MS2690A/MS2691A/MS2692A-020 Vector Signal Generator

Frequency

Range	125 MHz to 6 GHz
Resolution	0.01 Hz steps

Output Level

Setting range	–140 to +10 dBm (CW), –140 to 0 dBm (Modulation)
Units	dBm, dBμV (Terminated, Open)
Resolution	0.01 dB
Level Accuracy	18˚ to 28˚C, CW Output level: p –120 ≤ p ≤ +5 dBm ±0.5 dB (≤3.0 GHz) –110 ≤ p ≤ +5 dBm ±0.8 dB (>3.0 GHz) –127 ≤ p < –120 dBm ±0.7 dB (≤3.0 GHz) –127 ≤ p ≤ –110 dBm ±2.5 dB (typ.) (>3.0 GHz) –136 ≤ p < –127 dBm ±1.5 dB (typ.) (≤3.0 GHz)
Linearity	18˚ to 28˚C, CW, Referenced to –5 dBm output Output level: p –120 ≤ p ≤ –5 dBm ±0.2 dB (typ.) (≤3.0 GHz) –110 ≤ p ≤ –5 dBm ±0.3 dB (typ.) (>3.0 GHz)
Connector	N-J connector, 50Ω [Front panel, SG Output (Opt.)]
VSWR	CW: ≤–5 dBm, Modulation: ≤–15 dBm 1.3 (≤3.0 GHz) 1.9 (>3.0 GHz)
Max. Reverse Input	1 W peak (≥300 MHz), 0.25 W peak (<300 MHz)

Signal Purity

Harmonic Spurious	Output level: ≤+5 dBm, CW, Output frequency: ≥300 MHz ≤–30 dBc
Non-harmonic Spurious	Output level: ≤+5 dBm, CW, Offset: ≥15 kHz (from Output frequency) <–68 dBc (125 MHz ≤ Frequency ≤ 500 MHz) <–62 dBc (500 MHz < Frequency ≤ 1.0 GHz) <–56 dBc (1.0 GHz < Frequency ≤ 2.0 GHz) <–50 dBc (2.0 GHz < Frequency ≤ 6.0 GHz)

Vector Modulation

18˚ to 28˚C, SG Level Auto CAL: On

Vector Accuracy	W-CDMA (DL1code) Output level: ≤–5 dBm, Output frequency: 800 MHz to 2700 MHz ≤2% (rms)
Carrier Leak	Output frequency: ≥300 MHz ≤–40 dBc
Image Rejection	Output frequency: ≥300 MHz, Using 10 MHz max. sine wave ≤–40 dBc
ACLR	Output level: ≤–5 dBm, Using W-CDMA (Test Model 1 64DPCH) signal, 300 MHz ≤ Output frequency ≤ 2.4 GHz ≤–64 dBc/3.84 MHz (5 MHz offset), ≤–67 dBc/3.84 MHz (10 MHz offset)
CW and Level Error at Vector Modulation	AWGN signal with bandwidth of 5 MHz, Output frequency: ≥300 MHz ±0.2 dB (Output level: ≤–15 dBm) ±0.4 dB (typ., –15 dBm < Output level: ≤–5 dBm)
Spectrum Inversion	Supported

Pulse Modulation

On/Off ratio	≥60 dB
Rising/Falling Edge Time	≤90 ns (10 to 90%)
Pulse Repetition Frequency	DC to 1 MHz (Duty 50%)
External Panel Modulation Signal Input	AUX connector (Rear panel), 600Ω, 0 to 5 V, Threshold value: approx. 1 V

Arbitrary Waveform Generator

Waveform Resolution	14 bits
Marker Output	Three signals (three signals in waveform pattern, or real-time three signals generation), TTL, polarity inversion function
Internal Baseband Reference Clock	Range: 20 kHz to 160 MHz Resolution: 0.001 Hz
External Baseband Reference Clock	Range: 20 kHz to 40 MHz Division, Multiplier function: 1, 2, 4, 8, 16, 1/2, 1/4, 1/8, 1/16 of input signal Input connector: AUX connector (Rear panel), 0.7 Vp-p min. (AC/50Ω), or TTL
Waveform Memory	Memory: 256 Msamples
AWGN Addition Function	CN Ratio absolute value: ≤40 dB

BER Measurement

Connector	AUX connector (Rear panel)
Input Level	TTL Level
Input Signal	Data, Clock, Enable
Input Bit Rate	100 bps to 10 Mbps
Measured Patterns	PN9, PN11, PN15, PN20, PN23, ALL0, ALL1, 01 Repeat PN9Fix, PN11Fix, PN15Fix, PN20Fix, PN23Fix, User Define
Synchronization Establishing Condition	PN Signal: PN stage × 2 bit error free At PNFix Signal:0 PN stage × 2 bit error free, PN signal and sync establishment, establish sync with PNFix signal at PN stage error free from PNFix signal header bit ALL0, ALL1, 01 Repeat: 10 bit error free User Define: 8 to 1024 bits (variable) error free, Select header bit used at sync detection
Re-synchronization Judgment Condition	x/y y = Measured bit count: Select from 500, 5000, 50000 x = y bit error bit count: Setting range 1 to y/2
Measured Bit Count	$\leq 2^{32} - 1$ bits
Measured Error Bit Count	$\leq 2^{31} - 1$ bits
Measurement End Conditions	Measured bit count, Measured error bit count
Auto Re-synchronization Function	On/Off
Operation at Resync.	Select from Count Clear, and Count Keep
Measurement Mode	Single, Endless, Continuous
Display	Status, Error, Error Rate, Error Count, Sync Loss Count, Measured bit count
Polarity Inversion Function	Data, Clock, Enable polarity inversion
Clear Measurement Function	Clear measured value saved at sync during BER measurement, and select measurement from 0

• MS2690A/MS2691A/MS2692A-050 HDD Digitizing Interface

<table>
<tr><td rowspan="4">Bandwidth, Sampling Rate, Recorded Data Format</td><td>Bandwidth</td><td>Sampling Rate</td><td>Recorded Data Format</td></tr>
<tr><td>100, 250, 500 kHz, 1, 2.5, 5 MHz</td><td>200, 500 kHz, 1, 2, 5, 10 MHz</td><td>Floating Decimal Format</td></tr>
<tr><td>10 MHz, 18.6 MHz</td><td>20 MHz</td><td rowspan="2">Fixed Decimal Format
(16 bits)</td></tr>
<tr><td>20 MHz</td><td>25 MHz</td></tr>
<tr><td>Recording Time</td><td colspan="3">5 seconds to 4 hours</td></tr>
<tr><td>Number of Recorded File</td><td colspan="3">1000 files max.</td></tr>
<tr><td>Resample Function</td><td colspan="3">Convert by resampling at data retrieval, Setting range: Sampling rate/2 to Sampling rate</td></tr>
<tr><td>Trigger Function</td><td colspan="3">Video, Wide IF Video, External, SG Marker</td></tr>
<tr><td>Count Mode</td><td colspan="3">Capturing times: 1 to 20 times</td></tr>
<tr><td>Interface</td><td colspan="3">Connector: External Serial ATA Connector
Data rate: 1.5 Gbps
Hot Plug: Not supported (The main frame and external HDD must be off when connecting/disconnecting connectors.)</td></tr>
</table>

• MS2692A-067 Microwave Preselector Bypass

Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics.
When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.
Microwave Preselector Bypass: On (with MS2692A-067), Microwave Preselector Bypass: Off (with special directions)

Cannot install simultaneously with MS2692A-003, MS2692A-004, or MS2692A-008.

Frequency

Frequency Range	6.0 GHz to 26.5 GHz

Amplitude

RF Frequency Characteristics	18° to 28°C, after CAL, Input attenuator: 10 dB, Microwave Preselector Bypass: On ±1.0 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz) ±1.5 dB (13.5 GHz < Frequency ≤ 26.5 GHz) ∗ with MS2692A-067, Microwave Preselector Bypass: Off, see Signal Analyzer/Spectrum Analyzer (RF Frequency Characteristics)
Displayed Average Noise Level (DANL)	18° to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB Microwave Preselector Bypass: On or Off –146 dBm/Hz (6.0 GHz ≤ Frequency < 10.0 GHz) –145 dBm/Hz (10.0 GHz ≤ Frequency ≤ 13.5 GHz) –142 dBm/Hz (13.5 GHz < Frequency ≤ 20.0 GHz) –138 dBm/Hz (20.0 GHz < Frequency ≤ 26.5 GHz)
Image Responses	Microwave Preselector Bypass: Off ≤–60 dBc (6.0 GHz ≤ Frequency ≤ 26.5 GHz)

• MS2690A/MS2691A/MS2692A-077 Analysis Bandwidth Extension to 62.5 MHz
MS2690A/MS2691A/MS2692A-078 Analysis Bandwidth Extension to 125 MHz (Requires Opt. 077)

Common

Bandwidth	with MS269xA-077 Adds the 50 MHz, 62.5 MHz bandwidths to the standard analysis bandwidths. with MS269xA-077/078 Adds the 50, 62.5, 100, and 125 MHz bandwidths to the standard analysis bandwidths.
Sampling Rate	Auto-setting depending on RBW with MS269xA-077, Bandwidth: >31.25 MHz 100 MHz with MS269xA-077/078, Bandwidth: >31.25 MHz 100 MHz, 200 MHz
Capture Time	Set length of capture time with MS269xA-077, Bandwidth: >31.25 MHz Min. capture time length: 1 µs (determined depending on analysis bandwidth) Max. capture time length: 500 ms with MS269xA-077/078, Bandwidth: >31.25 MHz Min. capture time length: 500 ns to 1 µs (determined depending on analysis bandwidth) Max. capture time length: 500 ms
Resolution Bandwidth (RBW)	with MS269xA-077, Bandwidth: >31.25 MHz Setting range: 3 kHz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS269xA-077/078, Bandwidth: >31.25 MHz Setting range: 3 kHz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)
ADC Resolution	with MS269xA-077/078, Bandwidth: >31.25 MHz 14 bits
Frequency	without MS2692A-067, Bandwidth: >31.25 MHz 100 MHz to 6.0 GHz with MS2692A-067, Bandwidth: >31.25 MHz 100 MHz to 26.5 GHz

Amplitude

<table>
<tr><td>Display Average Noise Level (DANL)</td><td>18˚ to 28˚C, Input attenuator: 0 dB
without MS269xA-008, or Preamp: Off, Frequency band mode: Normal
<table>
<tr><th>Frequency</th><th>Max.</th></tr>
<tr><td>100 MHz ≤ Frequency < 2.2 GHz</td><td>–147.0 [dBm/Hz]</td></tr>
<tr><td>2.2 GHz ≤ Frequency < 4.0 GHz</td><td>–145.0 [dBm/Hz]</td></tr>
<tr><td>4.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–143.0 [dBm/Hz]</td></tr>
</table>
with MS269xA-008, Preamp: On, Frequency band mode: Normal
<table>
<tr><th>Frequency</th><th>Max.</th></tr>
<tr><td>100 MHz ≤ Frequency < 2.2 GHz</td><td>–160.0 [dBm/Hz]</td></tr>
<tr><td>2.2 GHz ≤ Frequency < 4.0 GHz</td><td>–158.0 [dBm/Hz]</td></tr>
<tr><td>4.0 GHz ≤ Frequency ≤ 6.0 GHz</td><td>–154.0 [dBm/Hz]</td></tr>
</table>
with MS2692A-067, Microwave Preselector Bypass: On
<table>
<tr><th>Frequency</th><th>Max.</th></tr>
<tr><td>6.0 GHz < Frequency < 10.0 GHz</td><td>–140.0 [dBm/Hz]</td></tr>
<tr><td>10.0 GHz ≤ Frequency ≤ 13.5 GHz</td><td>–136.0 [dBm/Hz]</td></tr>
<tr><td>13.5 GHz < Frequency ≤ 20.0 GHz</td><td>–133.0 [dBm/Hz]</td></tr>
<tr><td>20.0 GHz < Frequency ≤ 26.5 GHz</td><td>–129.0 [dBm/Hz]</td></tr>
</table></td></tr>
<tr><td>Total Level Accuracy*
*: The Total level accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.</td><td>18˚ to 28˚C, after CAL, Input attenuator: ≥10 dB, Center frequency, CW, RBW: Auto, Time Detection: Average, Marker Result: Integration or Peak (Accuracy), Excluding the noise floor effect
without MS269xA-008, or Preamp: Off, Mixer input level: ≤0 dBm, Bandwidth: >31.25 MHz
±0.5 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
with MS269xA-008, Preamp: On, Preamp input level: ≤–20 dBm, Bandwidth: >31.25 MHz
±1.0 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
with MS269xA-077, or MS269xA-077/078, Bandwidth: >31.25 MHz
with MS2692A-067, Microwave Preselector Bypass: On
±1.8 dB (6.0 GHz ≤ Frequency ≤ 13.5 GHz, Frequency band mode: Normal)
±3.0 dB (13.5 GHz ≤ Frequency ≤ 26.5 GHz)</td></tr>
<tr><td>Linearity Error</td><td>Excluding the noise floor effect
without MS269xA-008, or Preamp: Off, Frequency band mode: Normal
±0.07 dB (Mixer input level: ≤–20 dBm)
±0.10 dB (Mixer input level: ≤–10 dBm)
±0.30 dB (Mixer input level: ≤0 dBm, Frequency: ≤6.0 GHz)
with MS269xA-008, Preamp: On, Frequency band mode: Normal
±0.07 dB (Mixer input level: ≤–40 dBm)
±0.10 dB (Mixer input level: ≤–30 dBm)
±0.50 dB (Mixer input level: ≤–20 dBm)
with MS2692A-067, Microwave Preselector Bypass: On
±0.60 dB (Mixer input level: ≤0 dBm, Frequency: > 6.0 GHz)</td></tr>
<tr><td>RF Frequency Characteristics</td><td>18˚ to 28˚C, After CAL, Input attenuator: 10 dB
without MS269xA-008, or Preamp: Off
±0.35 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
with MS269xA-008, Preamp: On
±0.65 dB (100 MHz ≤ Frequency ≤ 6.0 GHz, Frequency band mode: Normal)
with MS2692A-067, Microwave Preselector Bypass: On
±1.0 dB (6.0 GHz < Frequency ≤ 13.5 GHz)
±1.5 dB (13.5 GHz < Frequency ≤ 26.5 GHz)</td></tr>
</table>

Note: Amplitude errors may occur in digitized IQ data at a probability of 0.0001 ppm or less. (AD converter maker nominal specifications) when the Analysis Bandwidth Extension 62.5 MHz/125 MHz option operates at the 50 MHz/62.5 MHz/100 MHz/125 MHz bandwidth setting.

Typical (typ): Performance not warranted. Must products meet typical performance.
Nominal: Values not warranted. Included to facilitate application of product.
Example: Performance not warranted. Data actually measured by randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MS2690A	Signal Analyzer (50 Hz to 6.0 GHz)
MS2691A	Signal Analyzer (50 Hz to 13.5 GHz)
MS2692A	Signal Analyzer (50 Hz to 26.5 GHz)
	Standard accessories
	Power Cord :1 pc
P0031A	USB Memory (>1 GB USB2.0 Flash Driver) :1 pc
Z0541A	USB Mouse :1 pc
	Install CD-ROM (Application software, instruction manual CD-ROM) :1 pc
	Options
MS2690A-001	Rubidium Reference Oscillator (Aging rate ±1 × 10^{-10}/month)
MS2690A-004	Wideband Analysis Hardware (Extends the Analysis Bandwidth to 125 MHz)
MS2690A-008	6 GHz Preamplifier (100 kHz to 6 GHz)
MS2690A-017	Noise Figure Measurement Function
MS2690A-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2690A-040	Baseband Interface Unit
MS2690A-050	HDD Digitizing Interface
MS2690A-077	Analysis Bandwidth Extension to 62.5 MHz
MS2690A-078[*2]	Analysis Bandwidth Extension to 125 MHz (Requires MS2690A-077)
MS2690A-313	Removable HDD
MS2691A-001	Rubidium Reference Oscillator (Aging rate ±1 × 10^{-10}/month)
MS2691A-003	Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of preselector to 3 GHz)
MS2691A-004	Wideband Analysis Hardware (Extends the Analysis Bandwidth to 125 MHz)
MS2691A-008	6 GHz Preamplifier (100 kHz to 6 GHz)
MS2691A-017	Noise Figure Measurement Function
MS2691A-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2691A-040	Baseband Interface Unit
MS2691A-050	HDD Digitizing Interface
MS2691A-077	Analysis Bandwidth Extension to 62.5 MHz
MS2691A-078[*2]	Analysis Bandwidth Extension to 125 MHz (Requires MS2691A-077)
MS2691A-313	Removable HDD
MS2692A-001	Rubidium Reference Oscillator (Aging rate ±1 × 10^{-10}/month)
MS2692A-003	Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of preselector to 3 GHz)
MS2692A-004	Wideband Analysis Hardware (Extends the Analysis Bandwidth to 125 MHz)
MS2692A-008	6 GHz Preamplifier (100 kHz to 6 GHz)
MS2692A-017	Noise Figure Measurement Function
MS2692A-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2692A-040	Baseband Interface Unit
MS2692A-050	HDD Digitizing Interface
MS2692A-067[*1]	Microwave Preselector Bypass
MS2692A-077	Analysis Bandwidth Extension to 62.5 MHz
MS2692A-078[*2]	Analysis Bandwidth Extension to 125 MHz (Requires MS2692A-077)
MS2692A-313	Removable HDD
	Retrofit Options
MS2690A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 × 10^{-10}/month)
MS2690A-104	Wideband Analysis Hardware Retrofit (Extends the Analysis Bandwidth to 125 MHz)
MS2690A-108	6 GHz Preamplifier Retrofit (100 kHz to 6 GHz)
MS2690A-117	Noise Figure Measurement Function Retrofit
MS2690A-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2690A-140	Baseband Interface Unit Retrofit
MS2690A-150	HDD Digitizing Interface Retrofit
MS2690A-177	Analysis Bandwidth Extension to 62.5 MHz Retrofit
MS2690A-178[*2]	Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2690A-077/177)

*1: Cannot be installed simultaneously with MS2692A-003/103/004/104/008/108

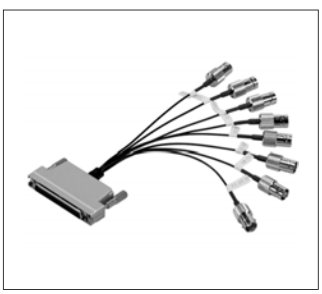
*2: Combining the MS269xA-078 Analysis Bandwidth Extension to 125 MHz and MX269028A-002 wireless LAN IEEE802.11ac (160 MHz) measurement software (only for MS269xA) supports modulation analysis up to 160-MHz bandwidth signals of the IEEE802.11ac. See measurement software catalog for more details.

Model/Order No.	Name
MS2691A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 × 10^{-10}/month)
MS2691A-103	Extension of Preselector Lower Limit to 3 GHz Retrofit (Extends lower limit of pre-selector to 3 GHz)
MS2691A-104	Wideband Analysis Hardware Retrofit (Extends the Analysis Bandwidth to 125 MHz)
MS2691A-108	6 GHz Preamplifier Retrofit (100 kHz to 6 GHz)
MS2691A-117	Noise Figure Measurement Function Retrofit
MS2691A-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2691A-140	Baseband Interface Unit Retrofit
MS2691A-150	HDD Digitizing Interface Retrofit
MS2691A-177	Analysis Bandwidth Extension to 62.5 MHz Retrofit
MS2691A-178[*2]	Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2691A-077/177)
MS2692A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 × 10^{-10}/month)
MS2692A-103	Extension of Preselector Lower Limit to 3 GHz Retrofit (Extends lower limit of pre-selector to 3 GHz)
MS2692A-104	Wideband Analysis Hardware Retrofit (Extends the Analysis Bandwidth to 125 MHz)
MS2692A-108	6 GHz Preamplifier Retrofit (100 kHz to 6 GHz)
MS2692A-117	Noise Figure Measurement Function Retrofit
MS2692A-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2692A-140	Baseband Interface Unit Retrofit
MS2692A-150	HDD Digitizing Interface Retrofit
MS2692A-167[*1]	Microwave Preselector Bypass Retrofit
MS2692A-177	Analysis Bandwidth Extension to 62.5 MHz Retrofit
MS2692A-178[*2]	Analysis Bandwidth Extension to 125 MHz Retrofit (Requires MS2692A-077/177)
	Software options
	CD-ROM with License and Operation manuals
MX269010A	Mobile WiMAX Measurement Software
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software
MX269013A	GSM/EDGE Measurement Software
MX269013A-001	EDGE Evolution Measurement Software (Requires MX269013A)
MX269014A	ETC/DSRC Measurement Software
MX269015A	TD-SCDMA Measurement Software
MX269016A	XG-PHS Measurement Software
MX269017A	Vector Modulation Analysis Software
MX269020A	LTE Downlink Measurement Software
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)
MX269021A	LTE Uplink Measurement Software
MX269022A	LTE TDD Downlink Measurement Software
MX269023A	LTE TDD Uplink Measurement Software
MX269024A	CDMA2000 Forward Link Measurement Software
MX269026A	EV-DO Forward Link Measurement Software
MX269028A	WLAN (802.11) Measurement Software
MX269028A-002[*2]	802.11ac (160 MHz) Measurement Software (For MS269xA. Requires MX269028A)
MX269030A	W-CDMA BS Measurement Software
MX269036A	Measurement Software for MediaFLO
MX269040A	UMTS Measurement Software for RF Device Test
MX269041A	Digital I/F Control Software for DigRF2.5G/3G
MX269901A	HSDPA/HSUPA IQproducer
MX269902A	TDMA IQproducer
MX269904A	Multi-Carrier IQproducer
MX269905A	Mobile WiMAX IQproducer
MX269908A	LTE IQproducer
MX269908A-001	LTE-Advanced FDD Option (Requires MX269908A)
MX269909A	XG-PHS IQproducer
MX269910A	LTE TDD IQproducer
MX269911A	WLAN IQproducer
MX269911A-001	802.11ac (80 MHz) Option (Requires MX269911A)
MX269912A	TD-SCDMA IQproducer
	Warranty service
MS2690A-ES210	2 Years Extended Warranty Service
MS2690A-ES310	3 Years Extended Warranty Service
MS2690A-ES510	5 Years Extended Warranty Service
MS2691A-ES210	2 Years Extended Warranty Service
MS2691A-ES310	3 Years Extended Warranty Service
MS2691A-ES510	5 Years Extended Warranty Service
MS2692A-ES210	2 Years Extended Warranty Service
MS2692A-ES310	3 Years Extended Warranty Service
MS2692A-ES510	5 Years Extended Warranty Service

Continued on next page

Model/Order No.	Name
	Application parts
	Following operation manuals provided as hard copy
W2850AE	MS2690A/MS2691A/MS2692A Operation Manual (Main frame Operation)
W2851AE	MS2690A/MS2691A/MS2692A Operation Manual (Main frame Remote Control)
W2852AE	MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Remote Control)
W2854AE	MS2690A/MS2691A/MS2692A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A Operation Manual (Spectrum Analyzer Function Remote Control)
W2856AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Operation)
W2857AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Remote Control)
W2914AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (IQproducer)
W2929AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Standard Waveform Pattern)
W3130AE	MS2690A/MS2691A/MS2692A-040 Operation Manual (Operation)
W3117AE	Phase Noise Measurement Function Operation Manual (Operation)
W3118AE	Phase Noise Measurement Function Operation Manual (Remote control)
W3655AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Noise Figure Measurement Function Remote control)
W2919AE	MX269010A Operation Manual (Operation)
W2954AE	MX269010A Operation Manual (Remote Control)
W3098AE	MX269011A Operation Manual (Operation)
W3099AE	MX269011A Operation Manual (Remote control)
W3060AE	MX269012A Operation Manual (Operation)
W3061AE	MX269012A Operation Manual (Remote control)
W3100AE	MX269013A Operation Manual (Operation)
W3101AE	MX269013A Operation Manual (Remote control)
W3031AE	MX269014A Operation Manual (Operation)
W3032AE	MX269014A Operation Manual (Remote control)
W3044AE	MX269015A Operation Manual (Operation)
W3045AE	MX269015A Operation Manual (Remote control)
W3157AE	MX269016A Operation Manual (Operation)
W3158AE	MX269016A Operation Manual (Remote control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote control)
W3014AE	MX269020A Operation Manual (Operation)
W3064AE	MX269020A Operation Manual (Remote control)
W3015AE	MX269021A Operation Manual (Operation)
W3065AE	MX269021A Operation Manual (Remote control)
W3209AE	MX269022A Operation Manual (Operation)
W3210AE	MX269022A Operation Manual (Remote control)
W3521AE	MX269023A Operation Manual (Operation)
W3522AE	MX269023A Operation Manual (Remote Control)
W3201AE	MX269024A Operation Manual (Operation)
W3202AE	MX269024A Operation Manual (Remote control)
W3203AE	MX269026A Operation Manual (Operation)
W3204AE	MX269026A Operation Manual (Remote control)
W3528AE	MX269028A Operation Manual (Operation)
W3529AE	MX269028A Operation Manual (Remote Control)
W2860AE	MX269030A Operation Manual (Operation)
W2861AE	MX269030A Operation Manual (Remote control)
W3313AE	MX269036A Operation Manual (Operation)
W3314AE	MX269036A Operation Manual (Remote control)

Model/Order No.	Name
W3003AE	MX269040A Operation Manual (W-CDMA Operation)
W3004AE	MX269040A Operation Manual (GSM/EDGE Operation)
W3005AE	MX269040A Operation Manual (Remote control)
W3006AE	MX269041A Operation Manual (BBIF Operation)
W3007AE	MX269041A Operation Manual (BBIF Remote control)
W3008AE	MX269041A Operation Manual (IQ Pattern/DUT Control Producer)
W3016AE	MX269041A Operation Manual (RF device test integrated software)
W3108AE	MX269050A Operation Manual (Operation)
W3109AE	MX269050A Operation Manual (Remote control)
W2915AE	MX269901A Operation Manual
W2916AE	MX269902A Operation Manual
W2917AE	MX269904A Operation Manual
W2918AE	MX269905A Operation Manual
W3023AE	MX269908A Operation Manual
W3153AE	MX269909A Operation Manual
W3221AE	MX269910A Operation Manual
W3488AE	MX269911A Operation Manual
W3582AE	MX269912A Operation Manual
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max)
MA1612A	Four-Port Junction Pad (5 MHz to 3 GHz, N-J)
MP752A	Termination (DC to 12.4 GHz, 50Ω, N-P)
MA2512A	Band Pass Filter (for W-CDMA, 1.92 to 2.17 GHz)
J0576B	Coaxial Cord (N-P · 5D-2W · N-P), 1 m
J0576D	Coaxial Cord (N-P · 5D-2W · N-P), 2 m
J0127A	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 1 m
J0127B	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 2 m
J0127C	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 0.5 m
J0322A	Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 0.5 m (DC to 18 GHz)
J0322B	Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 1 m (DC to 18 GHz)
J0322C	Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 1.5 m (DC to 18 GHz)
J0322D	Coaxial Cord (SMA-P · 50Ω SUCOFLEX104 · SMA-P), 2 m (DC to 18 GHz)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1554A	DC Block, SMA type (MODEL 7006) (9 kHz to 26.5 GHz, SMA-P · SMA-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adapter (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
J0911	Coaxial Cord, 1.0 M (for 40 GHz) (DC to 40 GHz, approx. 1 m) (SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cord, 0.5 M (for 40 GHz) (DC to 40 GHz, approx. 0.5 m) (SF102A, 11K254/K254/0.5M)
41KC-3	Fixed Attenuator, 3 dB (DC to 40 GHz, 3 dB)
J1261A	Ethernet Cable (Shield type, straight), 1 m
J1261B	Ethernet Cable (Shield type, straight), 3 m
J1261C	Ethernet Cable (Shield type, cross), 1 m
J1261D	Ethernet Cable (Shield type, cross), 3 m
J0008	GPIB Connection Cable, 2.0 m
J1373A	AUX Conversion Adapter (AUX → BNC, for vector signal generator option)
B0597A	Rack Mount Kit (EIA)
B0589A	Carrying Case (Hard type, with casters)
B0633A	Carrying Case (Soft type)
Z1082A	10/13 MHz Reference Signal Input
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B Cable)
Z1037A	Installation Kit (required when retrofitting options or installing software)



J1373A
AUX Conversion Adapter

MA24106A
USB Power Sensor

B0589A
Carrying Case (Hard type)

B0633A
Carrying Case (Soft type)

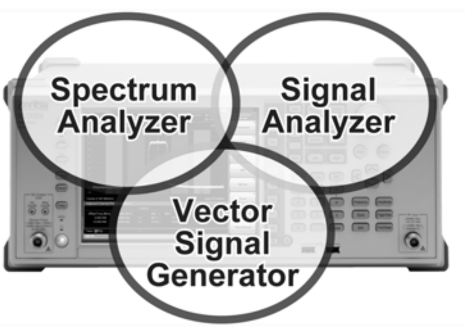
Anritsu

SIGNAL ANALYZER
MS2830A
9 kHz to 3.6 GHz/6.0 GHz/13.5 GHz

Remote Control
GPIB | Ethernet | USB

[High Speed + High Performance] × [Low Cost] + Eco-friendly

The MS2830A is a high-speed, high-performance, cost-effective Spectrum Analyzer/Signal Analyzer.
Not only can it capture wideband signals but FFT technology supports multifunction signal analyses in both the time and frequency domains. Behavior in the time domain that cannot be handled by a sweep type spectrum analyzer can be checked in the frequency domain. A wide frequency can be analyzed using sweep type spectrum analysis functions while detailed signal analysis of a specific frequency band is supported too.
Moreover, the built-in signal generator function outputs both continuous wave (CW) and modulated signals for use as a reference signal source when testing Tx characteristics of parts and as a signal source for evaluating Rx characteristics.



Key Features

- **Basic Performance/Functions**
  - **Frequency Range**
    MS2830A-040: 9 kHz to 3.6 GHz
    MS2830A-041: 9 kHz to 6.0 GHz
    MS2830A-043: 9 kHz to 13.5 GHz
  - **Total Level Accuracy: ±0.3 dB (typ.)**
  - **Dynamic Range*1: 168 dB**
    TOI*2: ≥+15 dBm
    DANL*3: –153 dBm/Hz
  - **Improved Level Linearity**
  - **Internal Reference Oscillator**
    Pre-installed Reference Oscillator
      Aging Rate: ±1 × 10^{-6}/year, ±1 × 10^{-7}/day
      Start-up Characteristics: ±5 × 10^{-7} (5 minutes after power-on)
    Rubidium Reference Oscillator (Opt. 001)
      Aging Rate: ±1 × 10^{-10}/month
      Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)
    High Stability Reference Oscillator (Opt. 002)
      Aging Rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
      Start-up Characteristics: ±5 × 10^{-8} (5 minutes after power-on)
  - **Versatile Built-in Functions**

Channel Power	Occupied Bandwidth
Adjacent Channel Leakage Power	Spectrum Emission Mask*4
Spurious Emission*4	Burst Average Power
Frequency Counter*4	AM Depth*5
FM Deviation*5	Multi-marker & Marker List
Highest 10 Markers	Limit Line*4
2-tone 3rd-order Intermodulation Distortion*4	
Power Meter*6	Phase Noise*7
Noise Figure*8	

  - **Low-power-consumption**
    MS2830A-040: 110 VA (nominal)
    MS2830A-041: 110 VA (nominal)
    MS2830A-043: 130 VA (nominal)

*1: Difference between TOI and DANL as simple guide
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)
*4: Spectrum Analyzer Functions
*5: Signal Analyzer Functions (Requires Opt. 005/006/077/078)
*6: Power Meter Function (Use USB Power Sensors)
*7: Phase Noise Measurement Function (Requires Opt. 010)
*8: Noise Figure Measurement Function (Requires Opt. 017)
[Use Noise Sources (Noisecom, NC346 series)]

- **Signal Analyzer Functions (Opt. 005/006/077/078)**
  - **Analysis Bandwidth**
    Opt. 006: 10 MHz max.
    (20 MHz max. sampling rate = 50 ns resolution, ADC resolution 16 bits)
    Opt. 005*9: 31.25 MHz max
    (50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
    Opt. 077*10: 62.5 MHz max.
    (100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
    Opt. 078*11: 125 MHz max
    (200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The MS2690A/91A/92A Signal Analyzer series is recommended for other measurement purposes.

*9: Requires Opt. 006
*10: Requires Opt. 005 and Opt. 006
*11: Requires Opt. 005, Opt. 006 and Opt. 077

  - **Capture Function**
    Saves analysis Span × Time signal to internal memory and writes to hard disk.
    Up to 100 Msamples per measurement can be saved to internal memory.
  - **Replay Function**
    Reads saved data and replays using signal analyzer function.
  - **Measurement with Sub-trace Display**
    Splits screen and confirms both main and sub-traces at same time to check errors.
    Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
    Sub: Power vs. Time, Spectrogram

- **Vector Signal Generator (Opt. 020/021)**
  - **Frequency Range**
    Opt. 020: 250 kHz to 3.6 GHz
    Opt. 021: 250 kHz to 6 GHz
  - **Pre-installed Baseband Generator**
    Vector Modulation Bandwidth: 120 MHz
    Sampling Clock: 20 kHz to 160 MHz
  - **Level Accuracy: ±0.5 dB (typ.)**
  - **Large-capacity Memory**
    256 MB = 64 Msamples
    1 GB = 256 Msamples (Opt. 027)
  - **Internal AWGN Generator (Opt. 028)**

Basic Performance

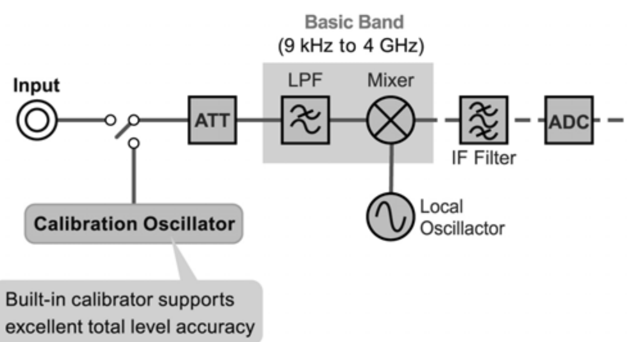
- **Excellent Total Level Accuracy: ±0.3 dB (typ.) (Common to both Spectrum Analyzer and Signal Analyzer Performances)**

With a level calibration over a wide frequency range, the MS2830A has excellent total level accuracy.
The Absolute Amplitude Accuracy specification described in catalogs of other spectrum analyzers ignores the important frequency characteristics, linearity, and attenuator switching errors. In contrast, the MS2830A Level Calibration technology assures excellent level accuracy over a wide frequency range from 300 kHz to 4 GHz even under measurement conditions including the above three errors. The level accuracy is assured even when the frequency and attenuator are switched.

The MS2830A total level accuracy includes:
- **Frequency characteristics**
- **Linearity**
- **Attenuator switching error**

Advantage of MS2830A Level Accuracy Technology
Conventional spectrum analyzers perform level calibration at just one frequency point, which causes errors when the frequency changes.
The MS2830A has two built-in signal generators for level calibration over a wide frequency range from 300 kHz to 4 GHz, minimizing measurement errors in this frequency range.

MS2830A Block Diagram

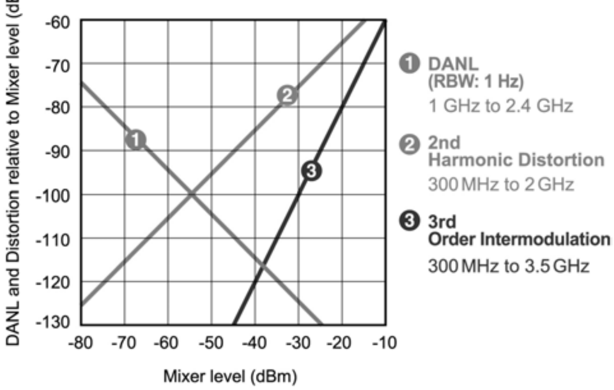


- **Wide Dynamic Range**
  Dynamic Range*1: 168 dB
  TOI*2: ≥+15 dBm (300 MHz to 3.5 GHz)
  DANL*3: –153 dBm/Hz (30 MHz to 1 GHz)

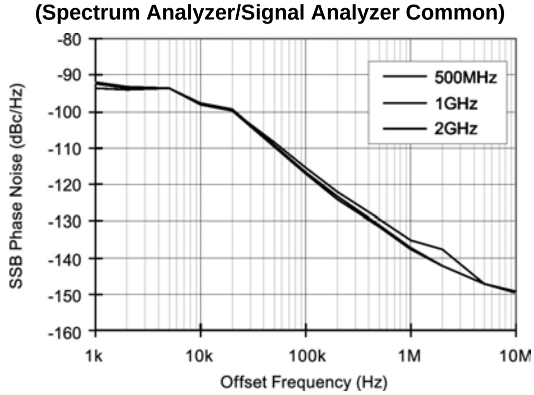
*1: Difference between TOI and DANL as simple guide.
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)

Dynamic range is a key specification for spectrum analyzers.
Low displayed average noise level (DANL) as well as high TOI are important too.
Low TOI may cause distortion with high-level carrier signals.
Inserting an attenuator can lower the carrier level but this has the effect of lowering the level of weak spurious, making it hard to measure.
The MS2830A has an excellent dynamic range supporting true performance measurements of devices, such as base stations, requiring wideband measuring instruments.

Distortion Characteristics (Spectrum Analyzer)
MS2830A-040/041/043



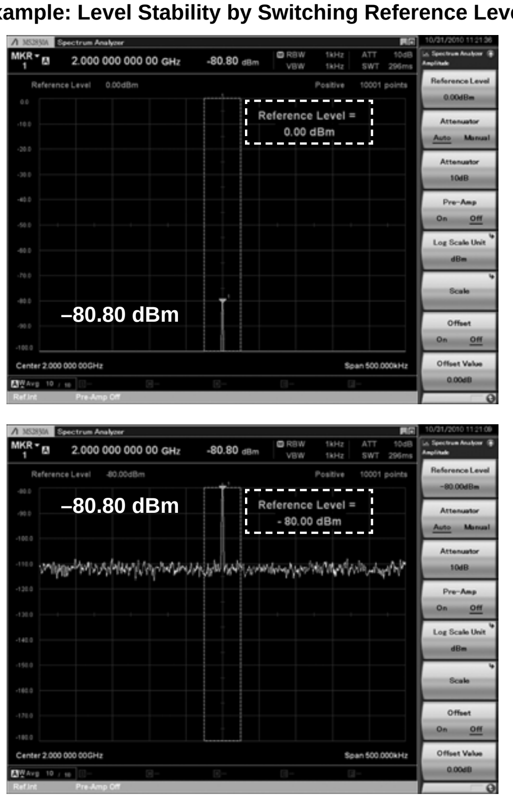
Example: SSB Phase Noise
(Spectrum Analyzer/Signal Analyzer Common)



- **Improved Level Linearity**

Conventional spectrum analyzers use an analog IF and log amp to achieve good level accuracy at points near the log scale reference level, but the accuracy degrades at points that are further away. The MS2830A uses a digital IF instead of a log amp, which supports measurements with excellent accuracy at any point.

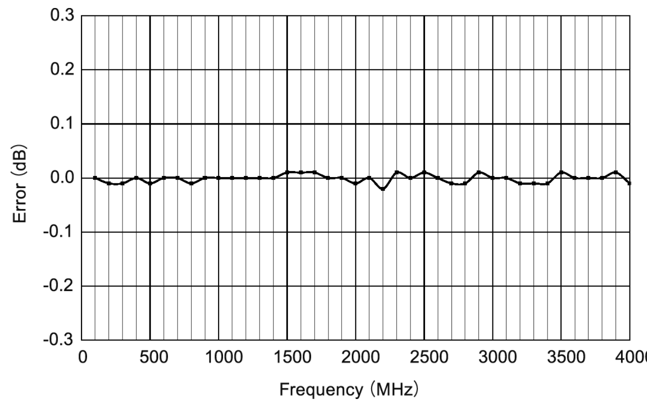
Example: Level Stability by Switching Reference Level



- **Dual Sweep Speed: Normal/Fast**

When sweep time is set to [Auto], Normal (normal sweep) or Fast mode (high-speed sweep) can be set. The Fast mode sweeps six times faster than the Normal mode.

Example of Sweep Mode Switch Error: (CW –10 dBm input)
Level Error when Switching from Normal to Fast



- **Low Consumption Power, Excellent Eco Product**

The MS2830A meets Anritsu “Excellent eco products” standard for environment-friendly products. It cuts consumed power by 50% compared to conventional models.

Power Consumption:
≤350 VA (including all options)
110 VA (nominal, with Opt. 040, 3.6 GHz*1)
110 VA (nominal, with Opt. 041, 6 GHz*1)
130 VA (nominal, with Opt. 043, 13.5 GHz*1)

*1: One of the Opt. 040, 041 or 043. Excludes other options.

- **Resolution Bandwidth (RBW)**

Setting Range

Spectrum Analyzer:
1 Hz to 3 MHz (1-3 sequence),
50 kHz, 5 MHz, 10 MHz, 20 MHz*2, 31.25 MHz*2, *3,
200 Hz (6 dB)*4, 9 kHz (6 dB)*4, 120 kHz (6 dB)*4,
1 MHz (Impulse)*4

Spectrum trace in signal analyzer mode:
1 Hz to 1 MHz (1-3 sequence)*5
1 Hz to 3 MHz (1-3 sequence)*6
1 Hz to 10 MHz (1-3 sequence)*7

When monitoring two adjacent signals, the frequency resolution can be increased by reducing the resolution bandwidth (RBW).
This also has the effect of reducing the noise level.
Conversely, to confirm level variations of 20-MHz band signals such as LTE and WiMAX, set the RBW to 31.25 MHz.

*2: Can be set when with Opt. 005.
*3: Instead of Gaussian filter, 31.25 MHz RBW uses filter with flat top characteristics above 31.25 MHz.
*4: When Opt. 016 installed.
*5: Without Opt. 077/078, or Bandwidth: ≤31.25 MHz.
*6: With Opt. 077, Bandwidth: >31.25 MHz.
*7: With Opt. 078, Bandwidth: >31.25 MHz.

• Gate Sweep

Gate sweep executes sweeping only for the length of time specified by the gate length, starting from when the trigger condition is met. A delay time until sweeping starts after the trigger condition is met can be set using trigger delay.

- The gate source can be selected from the following
  - Wide IF video trigger
  - External trigger
  - Frame trigger
  - SG marker trigger (Requires Opt. 020/021)
- Setting range and resolution for gate delay
  - Setting range: 0 to 1 s
  - Resolution: 20 ns
- Setting range and resolution for gate length
  - Setting range: 50 µs to 1 s
  - Resolution: 20 ns

• Trigger Function

Trigger sweep executes sweeping using the specified trigger condition as the start point. In particular, "SG Marker" starts analyzer measurement in synchrony with the signal output by installing Opt. 020/021. Using this function supports simple synchronized measurement even when evaluating signals with large level variation over time, such as modulation signals.

- Video trigger:
  Trigger sweeping starts in synchronization with the rise or fall of the waveform. A trigger level indicator showing the trigger level is displayed on the screen.
- Wide IF video trigger:
  An IF signal with a wide passing band of about 5 MHz is detected, and sweeping starts in synchronization with either the rise or fall of the detected signal.
- External trigger:
  Sweeping starts in synchronization with the rise or fall of the signal input via the Trigger Input connector.
- Frame trigger:
  An equipment-internal trigger signal is used to generate a trigger and start the sweep. The generation period (Period) and offset time (Offset) for the trigger signal can be set. It is also possible to resynchronize the trigger signal with either the Wide IF Video signal or an external trigger.
- SG Marker trigger (Requires Opt. 020/021):
  Sweeping starts in synchronization with the rise or fall of the marker signal output of Opt. 020/021. This function supports measurement in synchronization with the output signal of Opt. 020/021.

• Three Built-in External Interfaces

The built-in Gigabit Ethernet, USB2.0, and GPIB interfaces support remote operation.

- GPIB: IEEE488.2, Rear panel, IEEE488 bus connector
  Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
- Ethernet: 10/100/1000BASE-T, Rear panel, RJ-45
- USB (B): USB2.0, Rear panel, USB-B connector

• Saving Measurement Results

Measurement results can be saved to internal hard disk or external USB memory. Screen dumps and trace data can be saved too.

- Screen dump file type
  - BMP
  - PNG
- The color of the screen hard copy can be set as follows:
  - Normal (same as screen display)
  - Reverse
  - Monochrome
  - Reversed Monochrome

Signal Analyzer: Basic Performance/Functions

• Wide bandwidth × High Accuracy FFT Analysis

Opt. 006: 10 MHz max.
(20 MHz max. sampling rate = 50 ns resolution, ADC resolution 16 bits)

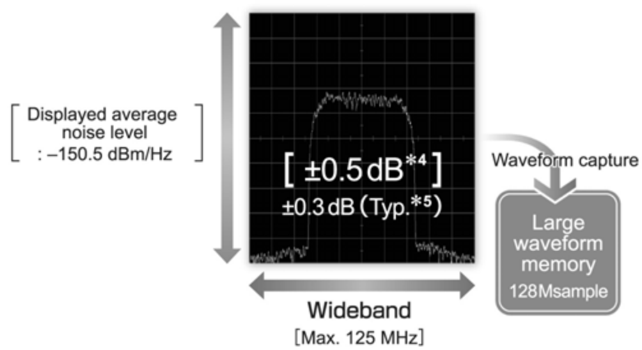
Opt. 005*1: 31.25 MHz max.
(50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)

Opt. 077*2: 62.5 MHz max.
(100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)

Opt. 078*3: 125 MHz max.
(200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The MS2690A/91A/92A Signal Analyzer series is recommended for other measurement purposes.

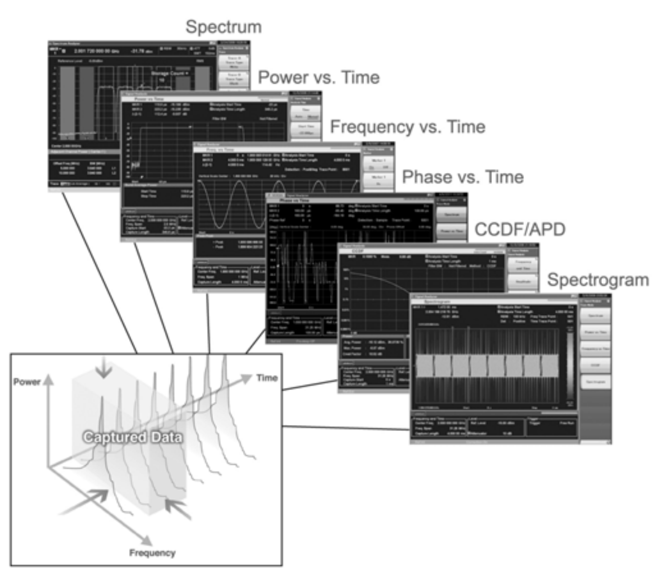
Based on the excellent level accuracy and wide dynamic range of the MS2830A, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.



*1: Requires Opt. 006.
*2: Requires Opt. 005 and Opt. 006.
*3: Requires Opt. 005, Opt. 006 and Opt. 077.
*4: 300 kHz ≤ f < 4 GHz, Frequency band mode Normal.
*5: Excluding Guard Band.

• Vector Signal Analysis (VSA) Function

Seamless signal capture and VSA analysis in multiple domains make it easy to evaluate burst-signal responses and capture degraded spectrum transients, etc., which cannot be checked by conventional sweep spectrum analyzers. This greatly improves design verification and troubleshooting efficiency.



- **Save Signals in Internal Memory**

Max. Capture Time: 0.5 s to 2000 s
Max. Number of Samples: 100 Msamples

The “Analysis bandwidth × Analysis time” signal is held in internal memory and saved to hard disk.
Up to 100 Msamples of data can be saved to memory for one measurement. The frequency span determines the sampling rate.
The following chart shows the maximum capture time per frequency span.

Span*	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	20 kHz	2000 s	40M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz	100 MHz	500 ms	50M
62.5 MHz	100 MHz	500 ms	50M
100 MHz	200 MHz	500 ms	100M
125 MHz	200 MHz	500 ms	100M

*:With Opt. 006: 1 kHz to 10 MHz
With Opt. 005/006: 1 kHz to 31.25 MHz
With Opt. 005/006/077: 1 kHz to 62.5 MHz
With Opt. 005/006/077/078: 1 kHz to 125 MHz

- **Replay Function for Comparison Evaluation**

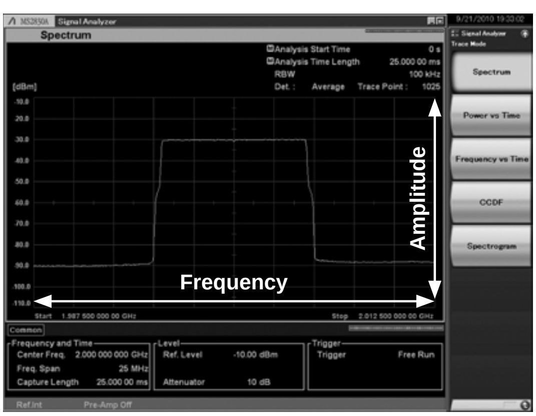
This function reads saved data and replays it using the signal analyzer measurement function.

Examples:
1. Data sharing between separate R&D and manufacturing
2. Later laboratory bench-top analysis of on-site signals
3. Save data at shipment and re-verify if problem occurs

Signal Analyzer: Trace

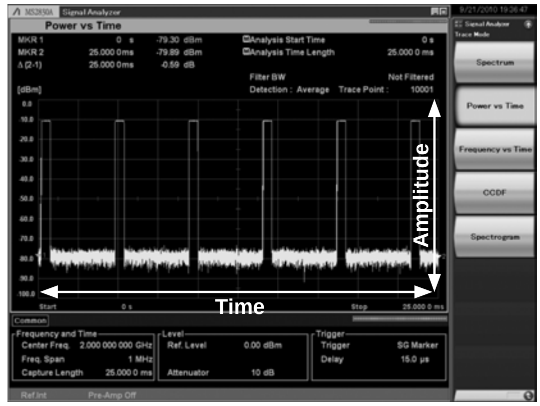
- **Spectrum**

The Spectrum trace displays a graph with amplitude on the y-axis and frequency on the x-axis. The captured IQ data is FFT processed (fast Fourier transformed) and converted from the time domain to the frequency domain for display as a spectrum.



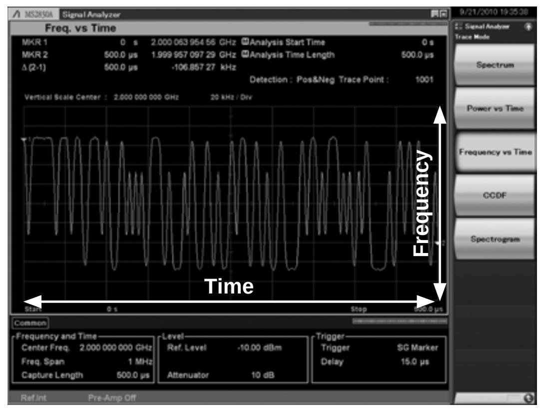
- **Power vs. Time**

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.



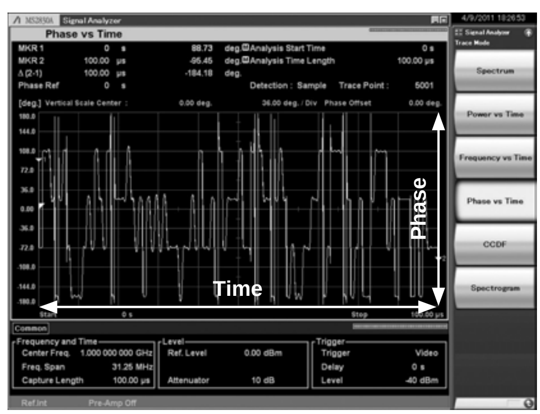
- **Frequency vs. Time**

The Frequency vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.



- **Phase vs. Time**

The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.



• CCDF[*1]/APD[*2]

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

∗1: CCDF (Complementary Cumulative Distribution Function)
∗2: APD (Amplitude Probability Density)

Measurement Results

- CCDF: The CCDF display indicates the cumulative distribution of transient power variations compared to average power.
- APD: The APD display indicates the probability distribution of transient power fluctuations compared to average power.

• Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum. It is useful for monitoring frequency hopping and transient signals.

• No Trace

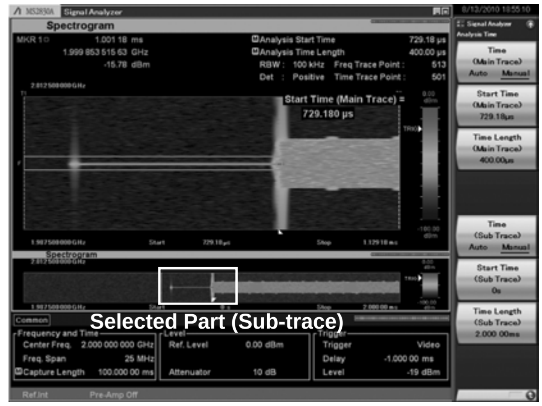
No Trace mode does not execute signal analysis. Therefore, “IQ data output” and “IQ data readout using remote commands” can be executed quickly without the need to wait for completion of analysis.

• Measurement with Sub-trace Display

This function splits the screen into top and bottom halves; simultaneous display of the sub-trace supports easy monitoring of fault locations and transient phenomena.

Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
Sub: Power vs. Time, Spectrogram

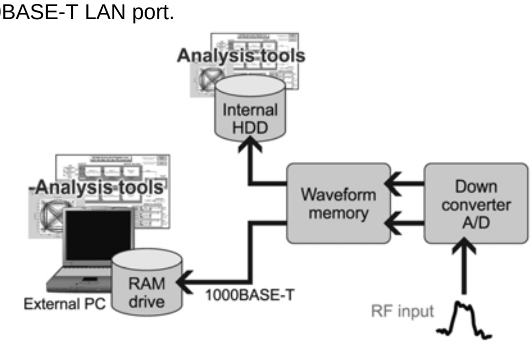
The part of a previously captured long-term signal to be monitored can be selected on the sub-trace to display the problem part only on the main trace.



Signal Analyzer: Applications

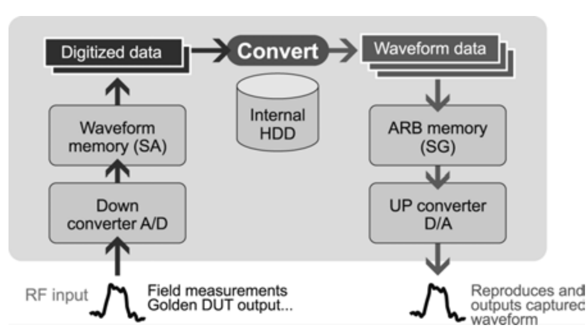
• Captured Waveforms Analysis using Commercial Analysis Tools

Other digitizers may exhibit severe degradation of the RF channel during capture, requiring troublesome calibration of the captured data when using analysis tools.
The MS2830A uses high-performance RF and two built-in calibration oscillators to minimize the degradation and eliminate the need for calibration before using analysis tools.
The waveform data are saved to the internal hard disk and can be output to an external PC via a high-speed interface, such as the 1000BASE-T LAN port.



• Captured Waveform Output from Vector Signal Generator Option

Waveforms captured using the digitizing function can be regenerated by using with the optional MS2830A-020/021 Vector Signal Generator. Signals captured in the field can be returned to the lab for analysis by replaying the signal using the Signal Generator.
Signals captured from known good devices can provide a stable reference to increase debugging efficiency and test reliability.



Versatile Built-in Functions

• Useful for Tx Characteristics Evaluation

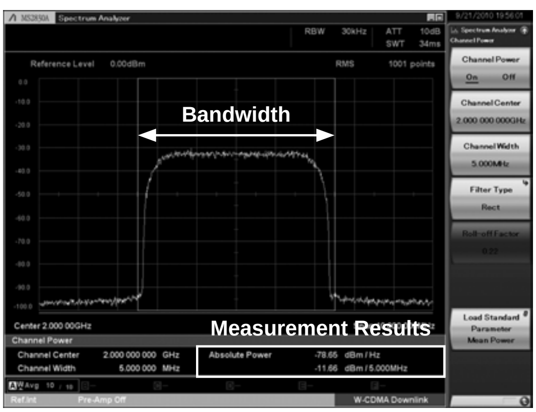
The MS2830A is fully loaded with all the functions required for evaluating Tx characteristics. Tests can be performed simply and in accordance with standards using functions tailored to measurement contents.

Measure Function	SPA*1	VSA*2
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
2-tone 3rd-order Intermodulation Distortion	✓	
Power Meter	Independent function*3	
Phase Noise	Opt. 010	
Noise Figure	Opt.017*4	

*1: SPA (Spectrum Analyzer)
*2: VSA (Vector Signal Analyzer), Requires Opt. 005/006/077/078
*3: Use USB Power Sensors
*4: Use Noise Sources (Noisecom, NC346 series)

• Channel Power SPA VSA

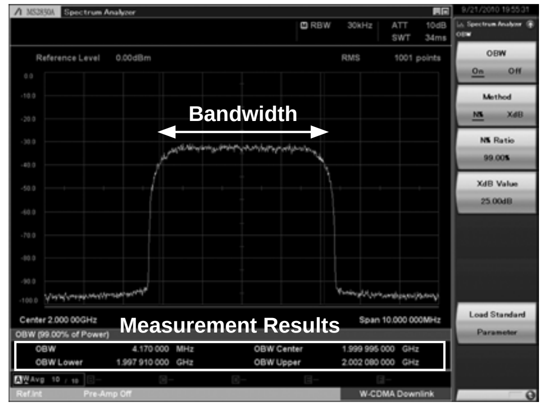
This function measures channel bandwidth power. Three types of filters (Rect, Nyquist, Root Nyquist) can be selected.
Pre-installed templates for each standard support easy parameter setting.



Measurement Results
- Absolute power per Hz in channel band
- Total power in channel band

• Occupied Bandwidth SPA VSA

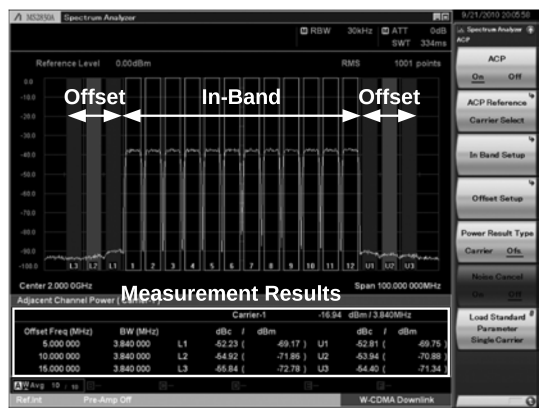
Occupied bandwidth is measured by selecting either the N% or X-dB mode.
Pre-installed templates for each standard support easy parameter setting.



Measurement Results
- Bandwidth for specified conditions

• Adjacent Channel Leakage Power SPA VSA

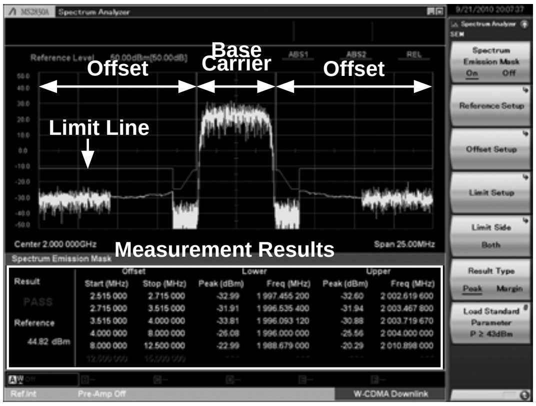
This function measures carrier adjacent channel (offset) power (In-Band).
1 to 12 carriers can be set and switched instantaneously on-screen.
True ACLR performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.



Measurement Results
- Absolute power of Offset channel
- Relative values in relation to reference power selected in ACP reference

• Spectrum Emission Mask SPA

This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.



Measurement Results

- Peak power (or margin) at offset
- Each peak frequency

• Burst Average Power SPA VSA

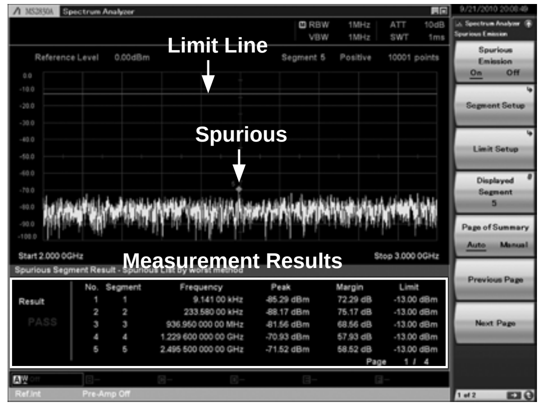
The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result. Pre-installed templates for each standard support easy parameter setting.

Measurement Results

- Average power of specified range

• Spurious Emission SPA

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. In particular, all tests can be completed up to the final stage without an external PC because the zero-span capture function described in the technology compliance test is built-in.

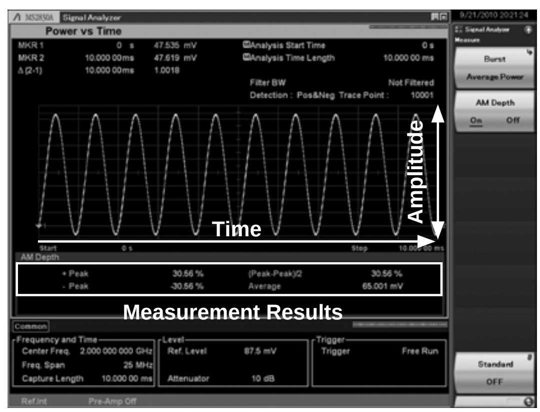


Measurement Results

- Each segment peak power and margin
- Each peak frequency

• AM Depth VSA

The Power vs. Time trace measurement function is used to confirm AM depth.
It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.

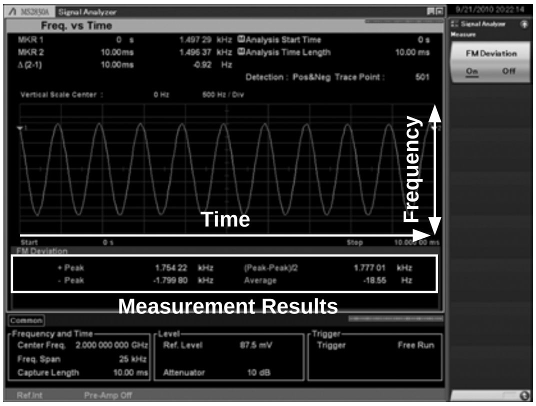


Measurement Results

- +Peak, –Peak, (Peak-Peak)/2, Average

• FM Deviation VSA

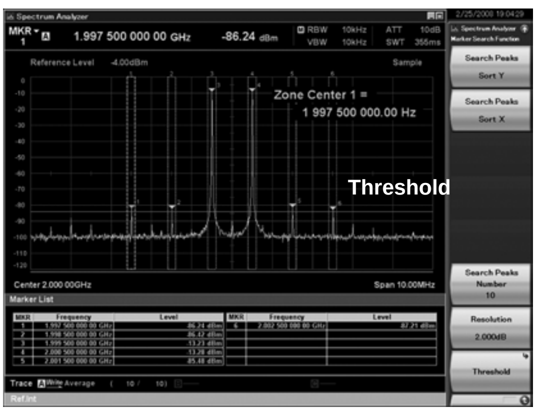
The Frequency vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.



Measurement Results
- +Peak, –Peak, (Peak-Peak)/2, Average

• Multi-marker & Marker List SPA VSA

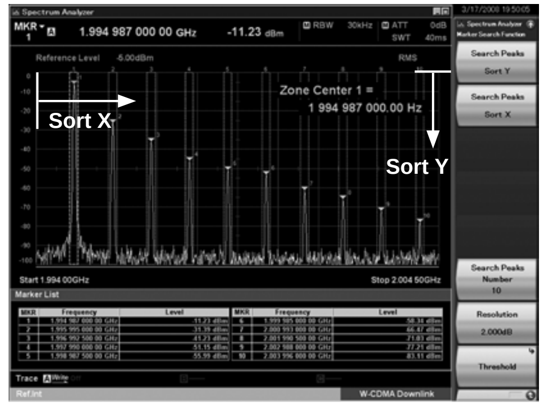
Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.



Measurement Results
- Marker point frequency
- Marker point power
- Absolute power per Hz in marker bandwidth
- Total power in marker bandwidth
- Difference between any markers

• Highest 10 Markers SPA VSA

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.

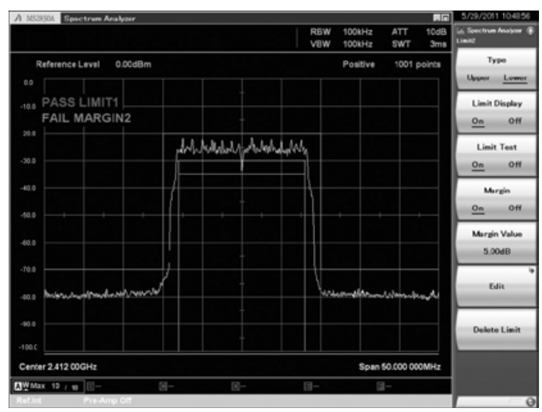


Measurement Results
- Peak Search Y:
  Sets up to 10 markers in order of peak level
- Peak Search X:
  Sets up to 10 markers in order of frequency (time) level

• Limit Line SPA

At the spectrum display (frequency domain), two limit lines are set and evaluation is performed based on these set lines. Either Upper Limit or Lower Limit can be selected. The line settings set the frequency/level of the crossover point sequentially from the lowest frequency. Up to 100 crossover points can be set. (In the diagram below, Limit1 is 6 points and Limit2 is 4 points.) In addition, when a margin is set at each of Limit1/2, evaluation can be performed using the lines, taking into account the margins. Once Limit1/2 has been set, the level direction can be fine-adjusted by the margin setting.

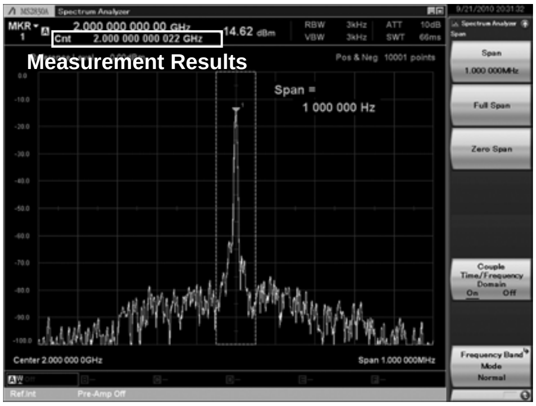
Line: Limit1, Limit2
Judgment type: Upper Limit, Lower Limit
Crossover (point): 1 to 100
Margin: Limit1, 2 + Display margin line



Measurement Results
- Evaluation: PASS, FAIL

• Frequency Counter SPA

This function of the marker functions is used to measure CW frequencies. Gate Time sets the measurement target time.



Measurement Results

- Marker point frequency

• 2-tone 3rd-order Intermodulation Distortion SPA

By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.

Measurement Results

- TOI: [dBm]
- Amplitude: [dBc]

• Power Meter

Power meter function can connect a USB power sensor to the MS2830A and read the measurement values.

Measurement Results

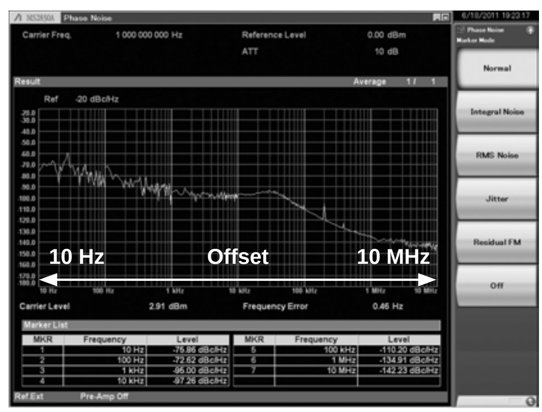
- Power: [dBm], [W]
- Relative power: [dB]

Compatible USB Power Sensors

Model	Frequency Range	Resolution	Dynamic Range
MA24104A	600 MHz to 4 GHz	1 kHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	1 kHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	100 kHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	100 kHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	100 kHz	–40 to +20 dBm

• Phase Noise (Opt. 010)

This function measures phase noise in the 10 Hz to 10 MHz frequency offset range.



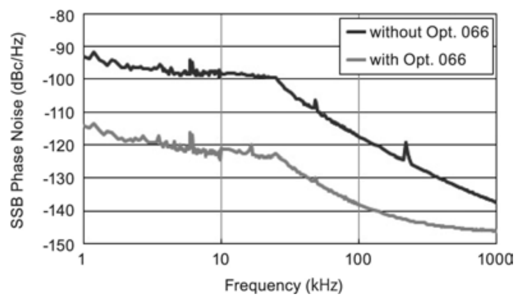
Measurement Results

- Carrier level
- Error between set frequency and carrier frequency
- Marker point phase noise level

Basic Performance Upgrade:
Low Phase Noise Performance (Opt. 066)

The MS2830A with Option 066 supports significantly improved phase noise performance, especially at carrier offsets of 1 kHz to 100 kHz.
Spectrum analyzer phase noise performance affects ACLR/MASK measurements at narrowband communications (Channel bandwidth: <100 kHz).
Add Option 066 when required by the specifications.

Center Frequency: 500 MHz



● **Noise Figure Measurement (Opt. 017)**

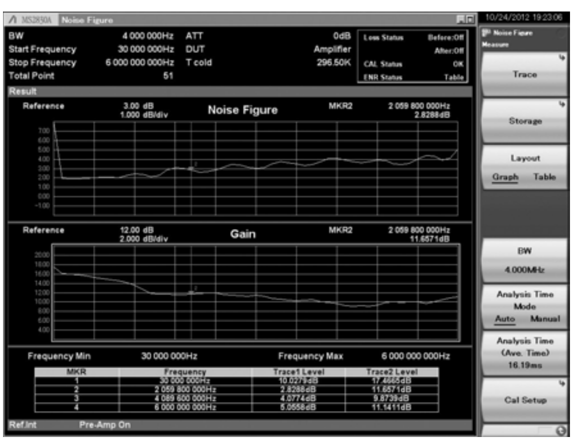
Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source*.

Frequency Mode: Fixed/List/Sweep
DUT Mode: Amplifier
Screen Layout: Graph/Table

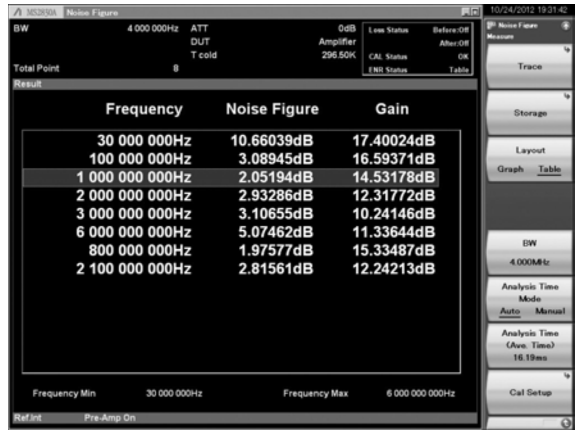
Measurement Results Display

■ Graph/List/Spot

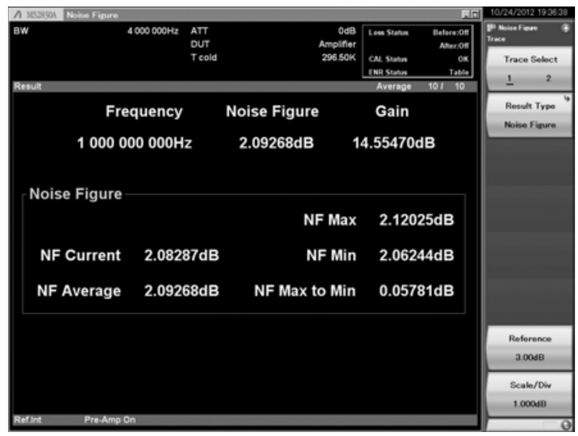
Displays measurement results for each trace (Trace1/Trace2).
• Noise Figure (NF) [dB]
• Noise Factor (F) [Linear]
• Gain
• Y-Factor: Power ratio when Noise Source is turned ON/OFF
• T effective: Effective noise temperature
• P Hot: Power measured when Noise Source is On.
• P Cold: Power measured when Noise Source is Off.



Measurement Result: Example of Graph display
(Frequency Mode: Sweep, Screen Layout: Graph)



Measurement Result: Example of List display
(Frequency Mode: List, Screen Layout: List)



Measurement Result: Example of Spot display
(Frequency Mode: Fixed)

*: Supports noise sources from Noisecom NC346 series.
See the MS2830A catalog for more details.

Vector Signal Generator (Opt. 020/021)
Basic Performance

The MS2830A-020/021 Vector Signal Generator covers the frequency range from 250 kHz to 3.6 GHz/6.0 GHz; it has a wide vector modulation bandwidth of 120 MHz as well as a large built-in memory for storing 64 Msamples/256 Msamples (with Opt. 027).
Its level accuracy is at least as good as a dedicated signal generator and the ACLR performance is ideal for Tx tests of devices such as amplifiers and Rx tests of base stations. The all-in-one analyzer and signal generator supports simple configuration of space-saving measurement systems as well as easy signal analysis matching the output timing from the signal generator option.

• Frequency Range
Frequency Range: 250 kHz to 3.6 GHz (Opt. 020)
250 kHz to 6 GHz (Opt. 021)
Resolution: 0.01 Hz step

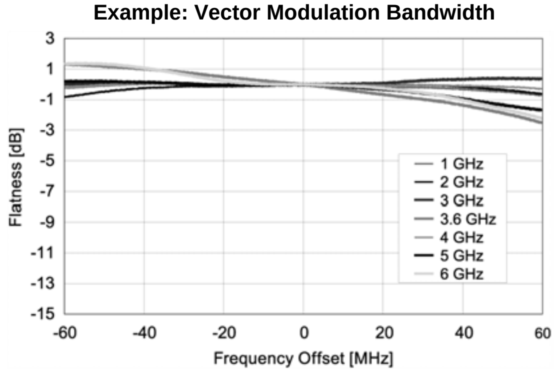
The Vector Signal Generator (Opt. 020/021) frequency range is 250 kHz to 3.6 GHz/6.0 GHz, covering the key wireless communication range.

• Output Level Range
Output Level Range:
–40 to +20 dBm (without Opt. 022, >25 MHz)
–136 to +15 dBm (with Opt. 022, >25 MHz)
Resolution: 0.01 dB step

• Internal Baseband Generator
Vector Modulation Bandwidth: 120 MHz
Sampling Clock: 20 kHz to 160 MHz

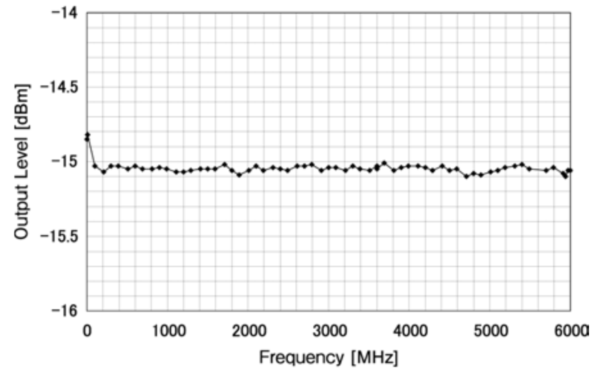
The wideband 120-MHz vector modulation bandwidth is achieved using the Opt. 020/021 baseband signal generator.
The sampling clock supports up to 160 MHz.

Example: Vector Modulation Bandwidth

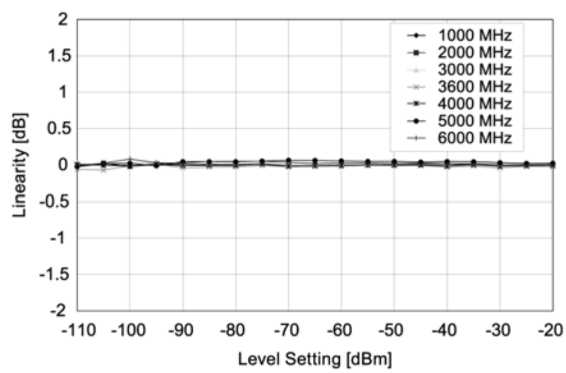


• Level Accuracy ±0.5 dB
Output Level Accuracy (CW):
±0.5 dB (typ.)
(–110 dBm ≤ Level ≤ +4 dBm,100 MHz ≤ Frequency ≤ 3.6 GHz)

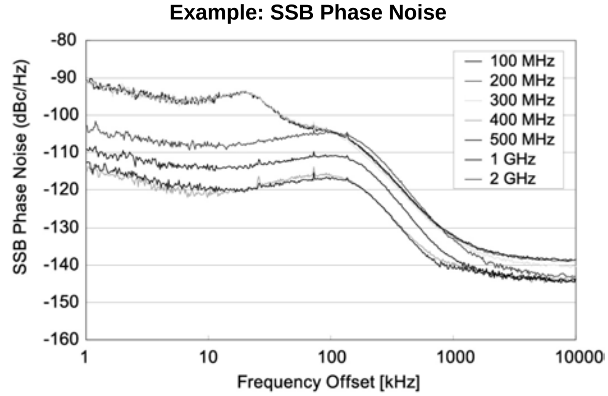
Example: Frequency Characteristics (Referenced to –15 dBm)



Example: Linearity (Referenced to –15 dBm)



Example: SSB Phase Noise



• Large-capacity Memory (Opt. 027)
256 MB = 64 Msamples/channel (without Opt. 027)
1 GB = 256 Msamples/channel (with Opt. 027)

The MS2830A-020/021 arbitrary waveform memory can save MAX. 256 Msamples/channel as well as multiple waveform patterns at the same time. Waveform patterns in memory can be output instantaneously by switching without need to recall from hard disk.

• Internal AWGN Generator (Opt. 028)
Absolute CN Ratio: ≤40 dB

This functions adds AWGN (Additive White Gaussian Noise) to the wanted waveform in memory. It is ideal for Tx dynamic range tests.

AWGN band set automatically to sampling clock of wanted signal.

Example: When wanted signal conditions are:
- W-CDMA
- Bandwidth = 3.84 MHz
- Over sampling = × 4

• Versatile Multiple Waveform Generation

Any type of waveform can be generated using the MS2830A-020/021 Signal Generator option. In addition to using C and simulation tools, Anritsu's IQproducer can be run on a PC to edit waveform parameters and output waveforms.

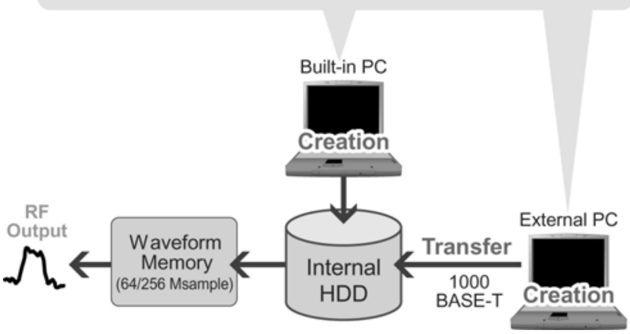
Creating Waveform Using IQproducer

IQproducer is PC software that is used to edit parameters and create any waveform pattern. It can be installed either on an external PC or in the MS2830A main frame.

- HSDPA/HSUPA IQproducer
- TDMA IQproducer
- Multi-carrier IQproducer
- Mobile WiMAX IQproducer
- LTE IQproducer
- LTE TDD IQproducer
- WLAN IQproducer
- TD-SCDMA IQproducer

Creating Any Waveform

IQ Data created using the MS2830A digitize function or by simulation tools or in C can be converted to a waveform pattern using the SG option and output.



• Useful IQproducer Waveform Generation Software

IQproducer is application software for a PC for editing, creating and transferring waveform patterns using the MS2830A-020/021 arbitrary waveform generation option.
It has the following three main functions.

- **Parameter Editing:**
  Function for easily editing parameters matching each communication method
- **Simulation:**
  Function for checking generated waveform pattern before transfer to CCDF and FFT graphs
- **Conversion:**
  Function for converting ASCII format waveform patterns created by simulation software, files captured using digitizing function, and MG3700A/MS269xA-020 waveform patterns, into files that can be used by MS2830A-020/021

Excellent Expandability Platform (Hardware)

The versatility of the MS2830A series is tailored easily to the application by installing modules in expansion slots.

• Basic Function and Performance Upgrades

• MS2830A-001/101 Rubidium Reference Oscillator/Retrofit
This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 × 10^{-9} at 7 minutes after power-on.
Aging Rate: ±1 × 10^{-10}/month
Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)

• MS2830A-002/102 High Stability Reference Oscillator/Retrofit
The 10 MHz reference oscillator improving frequency stability up to aging rate: ±1 × 10^{-8}/day
Aging Rate: ±1 × 10^{-8}/day
Start-up Characteristics: ±5 × 10^{-8} (5 minutes after power-on)

• MS2830A-008/108 Preamplifier/Retrofit
This option increases the sensitivity of the spectrum/signal analyzer functions and is used for examining low-level signals such as interference waveforms.

• MS2830A-011/111 2ndary HDD/Retrofit
Removal HDD for user data storage

• MS2830A-016/116 Precompliance EMI Function/Retrofit
This option adds an EMI measurement detection mode and RBW to the spectrum analyzer function. Both the detection mode used for CISPR standards (Quasi-Peak, CISPR-AVG, RMS-AVG) and RBW (200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Imp)) as well as conventional settings can be selected.

• MS2830A-066 Low Phase Noise Performance
Phase noise performance is increasingly important at carrier offsets of 1 kHz to 100 kHz.
Spectrum analyzer phase noise performance affects ACLR/MASK measurements at narrowband communications.
(Channel bandwidth: <100 kHz)
Add Option 066 when required by the specifications.
Frequency Range: 9 kHz to 3.7 GHz
(Frequency band mode:* Normal)
9 kHz to 3.5 GHz
(Frequency band mode:* Spurious)

*: Requires MS2830A-041/043 for setting.

Span: 300 Hz to 1 MHz (Spectrum Analyzer)
1 kHz to 31.25 MHz (Signal Analyzer)

MS2830A-066 cannot be retrofitted
MS2830A-066 sometimes cannot be installed depending on options.

Model	Case 1	Case2	Case 3
MS2830A-020/021	Yes	Yes	No
MS2830A-043	Yes	No	Yes
MS2830A-066	No	Yes	Yes

• Signal Analyzer Function and Performance Upgrade

• MS2830A-005/105
Analysis Bandwidth Extension to 31.25 MHz/Retrofit
Extends analysis bandwidth to 31.25 MHz.
*: Requires Opt. 006.

• MS2830A-006/106 Analysis Bandwidth 10 MHz/Retrofit
This option supports the VSA and digitize functions.

• MS2830A-077
Analysis Bandwidth Extension to 62.5 MHz
Extends analysis bandwidth to 62.5 MHz.
*: Retrofit not supported.
*: Requires MS2830A-005 and MS2830A-006.

• MS2830A-078
Analysis Bandwidth Extension to 125 MHz
Extends analysis bandwidth to 125 MHz.
*: Retrofit not supported.
*: Requires MS2830A-005, MS2830A-006 and MS2830A-077.

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The MS2690A/91A/92A Signal Analyzer series is recommended for other measurement purposes.

- **Expansion Functions**
  - **MS2830A-010/110 Phase Noise Measurement Function/Retrofit**
    Phase Noise Measurements
    Frequency Range: 10 MHz to main-frame upper limit frequency
    Offset Frequency Range: 10 Hz to 10 MHz
  - **MS2830A-017/117**
    Noise Figure Measurement Function/Retrofit
    Adds noise figure measurement function.
    Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.
  - **MS2830A-020/120 3.6 GHz Vector Signal Generator/Retrofit**
    Cover frequency ranging from 250 kHz to 3.6 GHz with 120 MHz wideband vector modulation bandwidth
  - **MS2830A-021/121 6 GHz Vector Signal Generator/Retrofit**
    Cover frequency ranging from 250 kHz to 6 GHz with 120 MHz wideband vector modulation bandwidth
  - **MS2830A-022/122**
    Low Power Extension for Vector Signal Generator/Retrofit
    Expands lower limit of output level from –40 to –136 dBm
    (Note: 5-dB drop in upper output level)
  - **MS2830A-027/127**
    ARB Memory Upgrade 256 Msa for Vector Signal Generator/Retrofit
    Expands ARB memory capacity from 64 Msample to 256 Msample
  - **MS2830A-028/128 AWGN/Retrofit**
    AWGN generator function
  - **MS2830A-313 Removable HDD**
    The MS2830A-313 Removable HDD is useful when a user takes the instrument to an outside company for calibration but wants to protect the security of data in the instrument, such as measurement results, data and main frame settings. In this case, the user removes the regular MS2830A hard disk and replaces it with this product.
  - **MS2830A-029**
    Analog Function Extension for Vector Signal Generator
    Adds analog signal generation function using MX269018A Analog Measurement Software to Vector Signal Generator option (Opt. 020/021). Can calibrate lower limit frequency up to 100 kHz (Opt. 020/021 lower limit frequency is 250 kHz)
    ∗: Requires MX269018A, Opt. 020 or 021, and Opt. 022
  - **MS2830A-088/188 3.6 GHz Analog Signal Generator/Retrofit**
    Outputs analog signals by combining with MX269018A Analog Measurement Software and includes low power expansion (equivalent to Opt. 022).
    Can calibrate lower limit frequency up to 100 kHz (Opt. 020/021 lower limit frequency is 250 kHz)
    ∗: Requires MX269018A
    ∗: Vector modulation signal output not supported (added by Opt. 189)
  - **MS2830A-189**
    Vector Function Extension for Analog Signal Generator Retrofit
    Installs license required for vector signal generation in existing Analog Signal Generator (Opt. 088/188).
    Use following options when ordering new Analog Signal Generator + Vector Signal Generator:
    - Opt. 020 or 021 + Opt. 022 + Opt. 029 + MS269018A + Opt. 066 + A0086A

Future-proof Platform (Software)

Adding measurement software options to the signal analyzer assures that the modulation analysis and other functions will support all common current and future communications systems.

- **Measurement Software**

Communications Systems	Name	Model	Option			
			Opt. 006	Opt. 005*1	Opt. 077*2	Opt. 078*3
Mobile WiMAX	Mobile WiMAX Measurement Software	MX269010A	✓	✓		
W-CDMA/HSPA/HSPA Evolution	W-CDMA/HSPA Downlink Measurement Software	MX269011A	✓			
	W-CDMA/HSPA Uplink Measurement Software	MX269012A	✓			
GSM/EDGE	GSM/EDGE Measurement Software	MX269013A	✓			
EDGE Evolution	EDGE Evolution Measurement Software	MX269013A-001*4	✓			
TD-SCDMA	TD-SCDMA Measurement Software	MX269015A	✓			
Multi-TDMA systems	Vector Modulation Analysis Software	MX269017A	✓	✓*5	✓*5	✓*5
Analog Wireless	Analog Measurement Software	MX269018A*6				
3GPP LTE (FDD)	LTE Downlink Measurement Software	MX269020A	✓	✓		
	LTE-Advanced FDD Downlink Measurement Software	MX269020A-001*8	✓	✓	✓*8	✓*8
	LTE Uplink Measurement Software	MX269021A	✓	✓		
3GPP LTE (TDD)	LTE TDD Downlink Measurement Software	MX269022A	✓	✓		
	LTE TDD Uplink Measurement Software	MX269023A	✓	✓		
CDMA2000	CDMA2000 Forward Link Measurement Software	MX269024A	✓			
1xEV-DO	EV-DO Forward Link Measurement Software	MX269026A	✓			
WLAN	WLAN (802.11) Measurement Software (Supports IEEE802.11n/11a/11b/11g/11j/11p)	MX269028A	✓	✓		
	802.11ac (80 MHz) Measurement Software	MX269028A-001*9	✓	✓	✓*9	✓*9
W-CDMA/HSPA	W-CDMA BS Measurement Software	MX269030A	✓			
	Wireless Network Device Test Software	MX283027A				
WLAN	WLAN Test Software	MX283027A-001*7	✓	✓		
Bluetooth	*Bluetooth* Test Software	MX283027A-002	✓			

∗1: Requires Opt. 006.
∗2: Requires Opt. 005 and Opt. 006.
∗3: Requires Opt. 005, Opt. 006 and Opt. 077.
∗4: Requires MX269013A.

*5: The Symbol Rate setting range varies as follows, depending on the option configuration.

	O-QPSK	FSK	Except FSK	
			Frame Formatted	Non-Formatted
Opt. 078, Opt. 077, Opt. 005, Opt. 006 installed	0.1 ksps to 12.5 Msps	0.1 ksps to 25 Msps	0.1 ksps to 50 Msps	0.1 ksps to 140 Msps
Opt. 077, Opt. 005, Opt. 006 installed	0.1 ksps to 6.25 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 25 Msps	0.1 ksps to 70 Msps
Opt. 005, Opt. 006 installed	0.1 ksps to 3.125 Msps	0.1 ksps to 6.25 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 35 Msps
Opt. 006 installed	0.1 ksps to 1.25 Msps	0.1 ksps to 2.5 Msps	0.1 ksps to 5 Msps	0.1 ksps to 5 Msps

*6: Requires MS2830A-066 and A0086A USB Audio.
*7: MX283027A-001 includes MX269911A WLAN IQproducer (Cannot order MX283027A-001 and MX269911A at same time).
*8:Requires MX269020A.
The LTE-Advanced Carrier Aggregation measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Model		LTE-Advanced Carrier Aggregation Signal	
Main frame	Analysis Bandwidth Extension Option Configuration	Number of Band	Number of Component Carrier
MS269xA	Opt. 078 installed	3	5
	Opt. 077installed	1	1
	Standard	1	1
MS2830A	Opt. 078 installed	1	5
	Opt. 077 installed	1	1
	Opt. 005/009 installed	1	1

*9: Requires MX269028A. The IEEE802.11ac measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Model			Bandwidth of IEEE802.11ac signal				
Main frame	Measurement software	Analysis Bandwidth Extension Option Configuration	20 MHz	40 MHz	80 MHz	160 MHz	80 MHz + 80 MHz
MS269xA	MX269028A-002 (Only for MS269xA)	Opt. 078 installed	✓	✓	✓	✓	✓*10
		Opt. 077installed	✓	✓			
		Standard	✓	✓			
MS2830A	MX269028A-001 (Only for MS2830A)	Opt. 078 installed	✓	✓	✓*11		
		Opt. 077 installed	✓	✓			
		Opt. 005/009 installed	✓	✓			

*10: Measurement required for each carrier signal (80-MHz bandwidth)
*11: Measurement is only possible when the carrier signal (80-MHz bandwidth) is input due to the effect of the image response.
See each measurement software catalog for more details.

• WiMAX® is a trademark or registered trademark of WiMAX Forum.
• CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).
• The *Bluetooth*® mark and logos are owned by Bluetooth SIG, Inc. and are used by Anritsu under license.
• IQproducer™ is a trademark of Anritsu Corporation.

Adding a license for the IQproducer waveform generation software to the vector signal generator option supports easy generation of test patterns for all common communications systems worldwide.

• IQproducer License for MS2830A-020/021 VSG

Following licenses (option) are required to download waveform pattern created with IQproducer to the MS2830A with vector signal generator option and output signals.

- MX269901A HSDPA/HSUPA IQproducer
- MX269902A TDMA IQproducer
- MX269904A Multi-carrier IQproducer
- MX269905A Mobile WiMAX IQproducer
- MX269908A LTE IQproducer
- MX269908A-001*1 LTE-Advanced FDD Option
- MX269910A LTE TDD IQproducer
- MX269911A WLAN IQproducer
- MX269911A-001*2 802.11ac (80 MHz) Option
- MX269912A TD-SCDMA IQproducer

*1: Requires MX269908A
*2: Requires MX269911A

• Waveform patterns for MS2830A-020/021 VSG

Various waveforms with preset parameters matching each communication method are provided. The MS2830A-020/021 Vector Signal Generator option outputs RF signals.
Pre-installed reference waveforms are saved on the MS2830A hard disk for free use.

Pre-installed patterns

- W-CDMA
- HSDPA (Test Model5)
- CDMA2000 1xEV-DO
- CDMA2000
- GSM/EDGE
- Digital Broadcasting (ISDB-T/CS/BS/CATV)
- WLAN (IEEE802.11a/b/g)
- *Bluetooth*

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.

The specifications are defined under the following conditions unless otherwise specified.
Auto sweep time select: Normal, Auto sweep type rules: Sweep only, Switching speed mode: Best phase noise mode,
Attenuator mode: Mechanical Attenuator Only

Nominal values indicate expected performance or describe product performance. That is not covered by the product warranty.

• Signal Analyzer/Spectrum Analyzer

Frequency

<table>
<tr><td>Frequency range</td><td>9 kHz to 3.6 GHz [MS2830A-040]
9 kHz to 6 GHz [MS2830A-041]
9 kHz to 13.5 GHz [MS2830A-043]</td></tr>
<tr><td>Frequency bands</td><td><table>
<tr><th>Frequency range</th><th>Band</th><th>Mixer harmonics order (N)</th></tr>
<tr><td>9 kHz to 4 GHz</td><td>0</td><td>1</td></tr>
<tr><td>3.5 GHz to 4.4 GHz</td><td>1</td><td>1/2</td></tr>
<tr><td>4.3 GHz to 6.1 GHz</td><td>1</td><td>1</td></tr>
<tr><td>5.9 GHz to 10.575 GHz</td><td>2</td><td>1</td></tr>
<tr><td>10.425 GHz to 13.6 GHz</td><td>2</td><td>2</td></tr>
</table></td></tr>
<tr><td>Frequency setting range</td><td>–100 MHz to 3.7 GHz [MS2830A-040]
–100 MHz to 6.1 GHz [MS2830A-041]
–100 MHz to 13.6 GHz [MS2830A-043]
Setting resolution: 1 Hz</td></tr>
<tr><td>Pre-selector range</td><td><table>
<tr><th>MS2830A-041</th><th>MS2830A-043</th><th></th></tr>
<tr><td>4 GHz to 6 GHz</td><td>4 GHz to 13.5 GHz</td><td>(Frequency band mode: Normal)</td></tr>
<tr><td>3.5 GHz to 6 GHz</td><td>3.5 GHz to 13.5 GHz</td><td>(Frequency band mode: Spurious)</td></tr>
</table></td></tr>
<tr><td>Internal reference oscillator</td><td>without MS2830A-001/002
Aging rate: $\pm1\times10^{-6}$/year, $\pm1\times10^{-7}$/day
Temperature stability: $\pm2.5\times10^{-6}$ (5° to 45°C)

with MS2830A-001
23°C, Referenced to frequency at 24-hour after power-on
Start-up characteristics: $\pm1\times10^{-9}$ (7 minutes after power-on)
Aging rate: $\pm1\times10^{-10}$/month
Temperature stability: $\pm1\times10^{-9}$ (5° to 45°C)

with MS2830A-002
23°C, Referenced to frequency at 24-hour after power-on
Start-up characteristics: $\pm5\times10^{-7}$ (2 minutes after power-on)
$\pm5\times10^{-8}$ (5 minutes after power-on)
Aging rate: $\pm1\times10^{-7}$/year, $\pm1\times10^{-8}$/day
Temperature stability: $\pm2\times10^{-8}$ (5° to 45°C)</td></tr>
<tr><td>SSB phase noise</td><td>18° to 28°C, 500 MHz, Spectrum Analyzer, Switching speed mode: Normal
–115 dBc/Hz (100 kHz offset)
–133 dBc/Hz (1 MHz offset)</td></tr>
</table>

Amplitude

<table>
<tr><td>Level measurement range</td><td>without MS2830A-008, or Preamp: Off
DANL to +30 dBm

with MS2830A-008, Preamp: On
DANL to +10 dBm</td></tr>
<tr><td>Maximum input level</td><td>without MS2830A-008, or Preamp: Off
Average total power: +30 dBm (Input attenuator: ≥10 dB)
+20 dBm (Input attenuator: 0 dB)
DC voltage: ±10 Vdc

with MS2830A-008, Preamp: On
Average total power: +10 dBm (Input attenuator: 0 dB)
DC voltage: ±10 Vdc</td></tr>
<tr><td>Input attenuator range</td><td>0 to 60 dB, 2 dB steps</td></tr>
<tr><td>Input attenuator switching uncertainty</td><td>18° to 28°C, Referenced to 10 dB

without MS2830A-008, or Preamp: Off
Frequency band mode: Normal
±0.2 dB (<4 GHz, 10 to 60 dB)
±0.75 dB (≥4 GHz, 10 to 60 dB)
Frequency band mode: Spurious
±0.2 dB (<3.5 GHz, 10 to 60 dB)
±0.75 dB (≥3.5 GHz, 10 to 60 dB)</td></tr>
</table>

Reference level

Setting range	Log scale: –120 to +50 dBm, or Equivalent level Linear scale: 22.4 µV to 70.7 V, or Equivalent level Setting resolution: 0.01 dB, or Equivalent level
Scale units	Log scale: dBm, dBµV, dBmV, dBµV (emf), dBµV/m, V, W Linear scale: V
Linearity error	Excluding the noise floor effect without MS2830A-008, or Preamp: Off ±0.07 dB (Mixer input level: ≤–20 dBm) ±0.10 dB (Mixer input level: ≤–10 dBm) with MS2830A-008, Preamp: On ±0.07 dB (Preamp input level: ≤–40 dBm) ±0.10 dB (Preamp input level: ≤–30 dBm)
RF frequency characteristics	18° to 28°C, after CAL, Input attenuator: 10 dB without MS2830A-008, or Preamp: Off ±1.0 dB (9 kHz ≤ f < 300 kHz) ±0.35 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.5 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) ±1.5 dB (6 GHz < f) with MS2830A-008, Preamp: On ±0.65 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious)
1 dB gain compression	without MS2830A-008, or Preamp: Off, at Mixer input level ≥+3 dBm (300 MHz ≤ f ≤ 6 GHz) ≥–1 dBm (6 GHz < f ≤ 13.5 GHz) with MS2830A-008, Preamp: On, at Preamp input level ≥–15 dBm (300 MHz ≤ f ≤ 6 GHz)

Spurious responses

<table>
<tr><td>Second harmonic distortion</td><td>
without MS2830A-008, or Preamp: Off
Mixer input level: –30 dBm
<table>
<tr><th>Harmonic distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–60 dBc</td><td>≥+30 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(300 MHz < f ≤ 2 GHz)</td></tr>
</table>
Mixer input level: –10 dBm
<table>
<tr><th>Harmonic distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(3 GHz < f ≤ 6.75 GHz)</td></tr>
</table>
with MS2830A-008, Preamp: On
Preamp input level: –45 dBm
<table>
<tr><th>Harmonic distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–50 dBc</td><td>≥+5 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–55 dBc</td><td>≥+10 dBm</td><td>(300 MHz < f ≤ 3 GHz)</td></tr>
</table>
SHI: Second Harmonic Intercept
</td></tr>
<tr><td>Residual responses</td><td>Frequency: ≥1 MHz, Input attenuator: 0 dB, 50Ω terminated
with MS2830A-077/078, Except bandwidth setting: >31.25 MHz
≤–100 dBm (up to 1 GHz)
≤–90 dBm (typ., 1 GHz to 6 GHz)
≤–90 dBm (nominal, 6 GHz to 13.5 GHz)</td></tr>
</table>

Connector

RF input	Connector: N-J (Front panel), 50Ω (nominal) 18° to 28°C, Input attenuator: ≥10 dB VSWR (nominal): ≤1.2 (40 MHz ≤ f ≤ 3 GHz) ≤1.5 (3 GHz < f ≤ 6 GHz) ≤1.6 (6 GHz < f ≤ 13.5 GHz)
External reference input	Connector: BNC-J (Rear panel), 50Ω (nominal) Frequency: 5, 10, 13 MHz Operating range: ±1 ppm Input level: –15 to +20 dBm, 50Ω (AC coupling)
Reference signal output	Connector: BNC-J (Rear panel), 50Ω (nominal) Frequency: 10 MHz Output level: ≥0 dBm (AC coupling)
Sweep status output	Connector: BNC-J (Rear panel) Output level: TTL level (High level at sweeping or waveform capture)
SA trigger input	Connector: BNC-J (Rear panel) Output level: TTL level

Continued on next page

Noise source drive	This is available when the Option 017/117 is installed. Supply (+28 V) of the Noise Source Drive. Rear Panel, BNC-J Output Voltage: 28 ±0.5 V, Pulsed
External controller	Control from external controller (excluding power-on/off)
Ethernet (10/100/1000BASE-T)	Connector: RJ-45 (Rear panel)
GPIB	IEEE488 bus connector (IEEE488.2, Rear panel) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
USB (B)	USB-B connector (USB2.0, Rear panel)
USB	USB-A connector (USB2.0, Front panel: 2 ports, Rear panel: 2 ports)
Monitor output	Mini D-Sub 15 pin (Compatible with VGA, Rear panel)
Aux	50 pin (Correspond to DX10A-50S, Rear panel), Using extended input/output
Display	XGA-color LCD (Resolution: 1024 × 768), 8.4 inches (Diagonal: 213 mm)

General

Dimensions and Mass	426 (W) × 177 (H) × 390 (D) mm (Exclusive of surface projection) ≤14.5 kg (with MS2830A-040/041, and MS2830A-020/021, excluding other options) ≤13.5 kg (with MS2830A-043, excluding other options)
Power supply	Power voltage: 100 V(ac) to 120 V(ac) / 200 V(ac) to 240 V(ac) (–15/+10%, Except 250 V max.) Frequency: 50 Hz/60 Hz Power consumption: ≤350 VA (including all options) 110 VA (nominal, with MS2830A-040/041, excluding other options) 130 VA (nominal, with MS2830A-043, excluding other options) 170 VA (nominal, with MS2830A-040/041, MS2830A-020/021, and MS2830A-022, excluding other options) 190 VA (nominal, with MS2830A-043, MS2830A-020/021, and MS2830A-022, excluding other options)
Temperature range	Operating: +5° to +45°C Storage: –20° to +60°C
EMC	EN61326-1, EN61000-3-2
Vibration	MIL-STD-810D
Shock	MIL-T-28800E

• Spectrum Analyzer

Frequency

Span	Range: 0 Hz, 300 Hz to 3.6 GHz [MS2830A-040] 0 Hz, 300 Hz to 6 GHz [MS2830A-041] 0 Hz, 300 Hz to 13.5 GHz [MS2830A-043] Resolution: 2 Hz Accuracy: ±0.2% (Sweep points: 10001)
Frequency readout accuracy	±(Display frequency × Frequency reference accuracy + Span frequency × Span accuracy + RBW × 0.05 + 2 × N + Span frequency/(Sweep points – 1)) Hz N: Mixer harmonic order
Resolution bandwidth (RBW)	Setting range: 1 Hz to 3 MHz (1-3 sequence), 50 kHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz 1 Hz to 10 Hz: Can not be set when Span: 0 Hz 31.25 MHz: Can be set when Span: 0 Hz only 20 MHz, 31.25 MHz: Can be set when with MS2830A-005 200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Impulse) (with MS2830A-016) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal, 1 Hz to 10 MHz)
Video bandwidth (VBW)	1 Hz to 3 kHz (1-3 sequence), 5 kHz, 10 kHz to 10 MHz (1-3 sequence), Off VBW mode: Video average, Power average

Amplitude

Displayed average noise level (DANL)	18° to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB without MS2830A-008, or Preamp: Off –134 dBm/Hz (100 kHz) –144 dBm/Hz (1 MHz) –153 dBm/Hz (30 MHz ≤ f < 1 GHz) –151 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –149 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –146 dBm/Hz (3.5 GHz < f ≤ 6 GHz), [MS2830A-041/043] –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz), [MS2830A-043] with MS2830A-008, Preamp: On –147 dBm/Hz (100 kHz, nominal) –156 dBm/Hz (1 MHz) –163 dBm/Hz (30 MHz ≤ f < 1 GHz) –162 dBm/Hz (1 GHz ≤ f < 2 GHz) –160 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –157 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –157 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –157 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043]

Continued on next page

Total absolute amplitude accuracy* *: Total absolute amplitude accuracy is found from root sum of squares (RSS) of RF frequency characteristics, Linearity error, and Input attenuator switching uncertainty.	18° to 28°C, after CAL, Auto sweep time select: Normal, 30 Hz ≤ RBW ≤ 1 MHz, Detector: Positive, CW Excluding the noise floor effect, and FFT runtime (Display: On) without MS2830A-008, or Preamp: Off Input attenuator: ≥10 dB, Mixer input level: ≤–10 dBm ±0.5 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) ±1.8 dB (6 GHz < f ≤ 13.5 GHz) with MS2830A-008, Preamp: On Input attenuator: 10 dB, Preamp input level: –30 dBm ±1.0 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious)

Spurious responses

2-tone 3rd-order intermodulation distortion	18° to 28°C, ≥300 kHz separation without MS2830A-008, or Preamp: Off Mixer input level: –15 dBm (1wave) ≤–54 dBc, TOI = +12 dBm (30 MHz ≤ f < 300 MHz) ≤–60 dBc, TOI = +15 dBm (300 MHz ≤ f < 3.5 GHz) ≤–58 dBc, TOI = +14 dBm (3.5 GHz ≤ f ≤ 6 GHz) ≤–50 dBc, TOI = +10 dBm (6 GHz < f ≤ 13.5 GHz) with MS2830A-008, Preamp: On Preamp input level: –45 dBm (1wave) ≤–73 dBc, TOI = –8.5 dBm (30 MHz ≤ f < 300 MHz) ≤–78 dBc, TOI = –6 dBm (300 MHz ≤ f ≤ 700 MHz) ≤–81 dBc, TOI = –4.5 dBm (700 MHz ≤ f < 4 GHz, Frequency band mode: Normal) (700 MHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ≤–78 dBc, TOI = –6 dBm (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) TOI: Third-order intermodulation distortion
Image responses	Frequency band mode: Normal ≤–70 dBc (10 MHz ≤ f < 4 GHz) ≤–55 dBc (4 GHz ≤ f ≤ 6 GHz) ≤–60 dBc (6 GHz < f ≤ 13.5 GHz)

Sweep

Sweep mode	Continuous, Single
Sweep time	Setting range: 1 ms to 1000 s (Span: ≥300 Hz) 1 µs to 1000 s (Span: 0 Hz)

Waveform display

Detector	Positive & Negative, Positive peak, Sample, Negative peak, RMS Quasi-Peak, CISPR-AVG, RMS-AVG (with MS2830A-016)
Sweep (trace) point	1001, 2001, 5001, 10001 (Span: >500 MHz) 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001 (100 MHz < Span ≤ 500 MHz) (300 Hz ≤ Span ≤ 100 MHz, Sweep time: > 10 s) 11, 21, 41, 51, 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001 (300 Hz ≤ Span ≤ 100 MHz, Sweep time: ≤ 10 s) (Span: 0 Hz)
Scale	Log scale: 10 div/12 div, 0.1 to 20 dB/div (1-2-5 sequence) Linear scale: 10 div, 1 to 10%/div (1-2-5 sequence)
Trigger	Free run (Trigger off), Video, Wide IF video, External, Frame SG Marker (with MS2830A-020/021)
Gate	Off, Wide IF video, External, Frame SG Marker (with MS2830A-020/021)

Measure function

Adjust channel power (ACP)		Reference: Span total, Carrier total, Both sides of carriers, Carrier select Adjust channel specifications: 3 channels × 2 (Normal mode), 8 channels × 2 (Advanced mode)
Burst average power		Displayed average power of specified interval at time domain
Channel power		Measurement of absolute values: dBm, dBm/Hz
Occupied bandwidth (OBW)		N% of power, X-dB down
Spectrum emission mask (SEM)		Decision to Pass/Fail at Peak/Margin measurement
Spurious emission		Decision to Pass/Fail at Worst/Peaks measurement
Frequency counter	Accuracy	Span: ≤1 MHz, RBW: 1 kHz, S/N: ≥50 dB, Gate time: ≥100 ms ±(Marker frequency × Frequency reference accuracy + (0.1 × N / Gate time [s] Hz) N: Mixer harmonic order
	Gate time setting	100 µs to 1 s
2-tone 3rd-order intermodulation distortion		Measures IM3 and TOI from two-tone signal.

• Signal Analyzer

Display waveform data, such as Spectrum, Power vs. Time captured at specific time

General

Trace mode	Spectrum, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Spectrogram, No Trace
Analysis bandwidth	Sets capture analysis bandwidth from center frequency 1 kHz to 10 MHz (1-2.5-5 sequence) (with MS2830A-006) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz (with MS2830A-005) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz (with MS2830A-077) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz, 100 MHz, 125 MHz (with MS2830A-078)
Sampling rate	Auto setting by conditions of analysis bandwidth 2 kHz to 20 MHz (1-2-5 sequence) (with MS2830A-006) 2 kHz to 50 MHz (1-2-5 sequence) (with MS2830A-005) 2 kHz to 100 MHz (1-2-5 sequence) (with MS2830A-077) 2 kHz to 200 MHz (1-2-5 sequence) (with MS2830A-078)
Capture time	without MS2830A-077/078, or ≤31.25 MHz bandwidth Setting capture time length Minimum capture time length: 2 μs to 50 ms (Determined according to analysis bandwidth) Maximum capture time length: 2 s to 2000 s (Determined according to analysis bandwidth) Setting mode: Auto, Manual with MS2830A-077, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 1 μs Maximum capture time length: 500 ms Setting mode: Auto, Manual with MS2830A-078, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 500 ns to 1 μs (Determined according to analysis bandwidth) Maximum capture time length: 500 ms Setting mode: Auto, Manual
Trigger	Free run (Trigger off), Video, Wide IF video, Frame, External (TTL) SG Marker (with MS2830A-020/021)
ADC resolution	without MS2830A-077/078, or ≤31.25 MHz bandwidth 16 bits

Spectrum displayed function

Function outline	Displayed spectrum of any time length and frequency range within captured waveform data
Analysis time length	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Can be set Center frequency and Span at frequency range in waveform data
Frequency setting	without MS2830A-077/078, or ≤31.25 MHz bandwidth 0 MHz to 3.6 GHz [MS2830A-040] 0 MHz to 6 GHz [MS2830A-041] 0 MHz to 13.5 GHz [MS2830A-043] with MS2830A-077/078, >31.25 MHz bandwidth 300 MHz to 3.6 GHz [MS2830A-040] 300 MHz to 6 GHz [MS2830A-041] 300 MHz to 13.5 GHz [MS2830A-043]
Resolution bandwidth (RBW)	without MS2830A-077/078, or ≤31.25 MHz bandwidth Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS2830A-077, >31.25 MHz bandwidth Setting range: 1 Hz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS2830A-078, >31.25 MHz bandwidth Setting range: 1 Hz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)
Total absolute amplitude accuracy* *: Total absolute amplitude accuracy is found from root sum of squares (RSS) of RF frequency characteristics, Linearity error, and Input attenuator switching uncertainty.	18° to 28°C, after CAL, Input attenuator: ≥10 dB, RBW: Auto, Time detection: Average, Marker result: Integration or Peak (Accuracy), Center frequency, CW Excluding the noise floor effect without MS2830A-008, or Preamp: Off Input attenuator: ≥10 dB, Mixer input level: ≤–10 dBm ±0.5 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) ±1.8 dB (6 GHz < f ≤ 13.5 GHz) with MS2830A-008, Preamp: On Input attenuator: 10 dB, Preamp input level: ≤–30 dBm ±1.0 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious)

Continued on next page

In-band frequency characteristics	18° to 28°C, Referenced to level at center frequency, Center frequency: ±10 MHz without MS2830A-077/078, or ≤31.25 MHz bandwidth ±0.31 dB (30 MHz ≤ f ≤ 4 GHz, Frequency band mode: Normal) (30 MHz ≤ f < 3.5 GHz, Frequency band mode: Spurious)
Displayed average noise level (DANL)	18° to 28°C, Input attenuator: 0 dB without MS2830A-008, or Preamp: Off –131.5 dBm/Hz (100 kHz) –141.5 dBm/Hz (1 MHz) –150.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –148.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –146.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –143.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –139.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] with MS2830A-008, Preamp: On –144.5 dBm/Hz (100 kHz, nominal) –153.5 dBm/Hz (1 MHz) –160.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –159.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –157.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –154.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –154.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –154.5 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043]
Adjacent channel power (ACP)	Reference: Span total, Carrier total, Both sides of carriers, Carrier select Adjacent channel specifications: 3 channels × 2
Channel power	Measurement of absolute values: dBm, dBm/Hz
Occupied bandwidth (OBW)	N% of Power, X-dB Down

Power vs. Time displayed function

Function outline	Displayed time changes of power for captured waveform data
Analysis time range	Analysis start time: Sets analysis start time position from beginning of waveform data Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Resolution bandwidth	Filter type: Rect, Gaussian, Nyquist, Root Nyquist, Off, (Default: Off) Roll-off ratio: 0.01 to 1 (Set for Nyquist, Root Nyquist) Filter frequency offset: Set center frequency of filter in wavelength data frequency band
AM depth (Peak to Peak measurement)	Measures with AM depth or marker function +Peak, –Peak, (P-P)/2, Average
Burst average power	Measures average power of burst signal

Frequency vs. Time displayed function

Function outline	Displayed frequency time fluctuations of input signal from captured waveform data
Analysis time range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Operating level range	–17 to +30 dBm (Input attenuator: ≥10 dB)
Frequency (Vertical axis)	Can be set Center frequency and Span at frequency range in waveform data Displayed frequency range: Selectable 1/25, 1/10, 1/5, 1/2 of analysis bandwidth Input frequency range: 10 MHz to 6 GHz
Frequency readout accuracy	Input level: –17 to +30 dBm, Span: ≤31.25 MHz, Scale: Span/25, CW input ± (Reference oscillator accuracy × Center frequency + Displayed frequency range × 0.01) Hz
FM deviation (Peak to Peak measurement)	Measures FM deviation or marker function +Peak, –Peak, (P-P)/2, Average

Phase vs. Time displayed function

Function outline	Displayed phase time fluctuation of input signal from captured waveform data
Analysis time range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Phase (Vertical axis)	Display mode: Wrap, Unwrap Displayed phase range: 0.01 deg./div to 200 Gdeg./div Offset: –100 deg. to +100 Mdeg.

CCDF/APD displayed function

Function outline	Displayed CCDF and APD of waveform date within a given length of time
Analysis time range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Display	Displayed CCDF or APD as graphs Histogram resolution: 0.01 dB Value: Average power, Max. power, Crest factor
Resolution bandwidth	Filter type: Rectangle, Off, (Default: Off) Filter frequency offset: Sets filter center frequency in frequency band of waveform data

Spectrogram displayed function

Function outline	Displayed spectrogram for arbitrary time length in captured waveform data
Analysis time range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Can be set Center frequency and Span at frequency range in waveform data
Resolution bandwidth (RBW)	Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)

Digitize function

Function outline	Captured waveform data saved to internal HDD or output to external devices
Waveform data	Format: I, Q (each 32 bit, Float binary type) Level: 0 dBm input is $\sqrt{(I^2 + Q^2)} = 1$ Level accuracy: Same as signal analyzer absolute amplitude accuracy
External output	Can be output to external PC via Ethernet

Replay function

Function outline	Captured waveforms can be replayed again by using the VSA function to read saved digitize data
Conditions for measurable waveform data	Format: I, Q (binary format) Combination of Span, Sampling rate, and Minimum capture sample

Span	Sampling rate	Minimum capture sample
1 kHz	2 kHz	74000 (37 s)
2.5 kHz	5 kHz	160000 (32 s)
5 kHz	10 kHz	310000 (31 s)
10 kHz	25 kHz	610000 (30.5 s)
25 kHz	50 kHz	730000 (14.6 s)
50 kHz	100 kHz	730000 (7.3 s)
100 kHz	200 kHz	730000 (3.65 s)
250 kHz	500 kHz	730000 (1.46 s)
500 kHz	1 MHz	730000 (730 ms)
1 MHz	2 MHz	730000 (365 ms)
2.5 MHz	5 MHz	730000 (146 ms)
5 MHz	10 MHz	730000 (73 ms)
10 MHz	20 MHz	730000 (36.5 ms)
18.6 MHz	20 MHz	730000 (36.5 ms)
20 MHz	25 MHz	730000 (29.2 ms)
25 MHz	50 MHz	730000 (14.6 ms)
31.25 MHz	50 MHz	730000 (14.6 ms)
50 MHz	100 MHz	730000 (7.3 ms)
62.5 MHz	100 MHz	730000 (7.3 ms)
100 MHz	200 MHz	730000 (3.65 ms)
125 MHz	200 MHz	730000 (3.65 ms)

• MS2830A-017 Noise Figure Measurement Function*

Frequency

Frequency range	MS2830A-040: 30 MHz to 3.6 GHz MS2830A-041: 30 MHz to 6 GHz MS2830A-043: 30 MHz to 6 GHz
Frequency setting range	MS2830A-040: 10 MHz to 3.6 GHz MS2830A-041: 10 MHz to 6 GHz MS2830A-043: 10 MHz to 13.5 GHz

NF measurement

Measurement range	Within the frequency range (Attenuator = 0 dB, Pre-Amp = On) – 20 to +40 dB
Instrument uncertainty	Within the measurement range ENR: 4 to 7 dB ±0.02 dB ENR: 12 to 17 dB ±0.025 dB ENR: 20 to 22 dB ±0.03 dB

GAIN measurement

Measurement range	Within the frequency range –20 to +40 dB
Instrument uncertainty	Within the measurement range ≤0.07

Resolution bandwidth

Setting range	100 kHz to 8 MHz

Connector

Noise source	Connector: Rear Panel, BNC-J Output Voltage: 28 ±0.5 V, Pulsed

*: Recommending the NC346 Series noise sources by Noisecom company

• MS2830A-020 3.6 GHz Vector Signal Generator/MS2830A-021 6 GHz Vector Signal Generator

∗: Use the MS2830A-021 for frequencies higher than 3.6 GHz.

The specifications of the MS2830A-020/021 are defined under the following conditions unless otherwise specified.

CW	Pulse modulation: Off
Modulation	after CAL Waveform pattern RMS value: At RMSw (linear value) and each combination less than following ranges: RMSnom = 20 • log (RMSw/4628) [16-bit data] RMSnom = 20 • log (RMSw/2314) [15-bit data] RMSnom = 20 • log (RMSw/1157) [14-bit data] –3.00 dB ≤ RMSnom ≤ +3.00 dB Pulse modulation: Off

Frequency

Range	250 kHz to 3.6 GHz [MS2830A-020] 250 kHz to 6 GHz [MS2830A-021]
Resolution	0.01 Hz steps

Output level

<table>
<tr><td>Setting range</td><td>without MS2830A-022
–40 to +20 dBm (>25 MHz), –40 to +2 dBm (≤25 MHz)
with MS2830A-022
–136 to +15 dBm (>25 MHz), –136 to –3 dBm (≤25 MHz)</td></tr>
<tr><td>Units</td><td>dBm, dBμV (terminated, open)</td></tr>
<tr><td>Resolution</td><td>0.01 dB</td></tr>
<tr><td>Output level accuracy</td><td>18° to 28°C, CW
without MS2830A-022
<table>
<tr><td></td><td>Output level [p] (dBm)</td></tr>
<tr><td>±0.5 dB (typ., ≤25 MHz)</td><td>–40 ≤ p ≤ +2</td></tr>
<tr><td>±0.5 dB (typ., 25 MHz < f ≤ 375 MHz)</td><td>–40 ≤ p ≤ +9</td></tr>
<tr><td>±0.5 dB (375 MHz ≤ f ≤ 3.6 GHz)</td><td>–40 ≤ p ≤ +9</td></tr>
<tr><td>±0.8 dB (>3.6 GHz)</td><td>–40 ≤ p ≤ +4</td></tr>
</table>
with MS2830A-022
<table>
<tr><td></td><td>Output level [p] (dBm)</td></tr>
<tr><td>±1.0 dB (typ., ≤25 MHz)</td><td>–110 ≤ p ≤ –3</td></tr>
<tr><td>±1.0 dB (typ., 25 MHz < f < 100 MHz)</td><td>–110 ≤ p ≤ +4</td></tr>
<tr><td>±0.5 dB (typ., 100 MHz ≤ f < 375 GHz)</td><td>–110 ≤ p ≤ +4</td></tr>
<tr><td>±0.5 dB (375 MHz ≤ f ≤ 3.6 GHz)</td><td>–110 ≤ p ≤ +4</td></tr>
<tr><td>±0.8 dB (>3.6 GHz)</td><td>–110 ≤ p ≤ –1</td></tr>
<tr><td>±1.0 dB (100 MHz ≤ f ≤ 3.6 GHz)</td><td>–120 ≤ p < –110</td></tr>
<tr><td>±1.0 dB (typ., 100 MHz ≤ f ≤ 3.6 GHz)</td><td>–127 ≤ p < –120</td></tr>
<tr><td>±2.5 dB (typ., >3.6 GHz)</td><td>–127 ≤ p < –110</td></tr>
</table></td></tr>
<tr><td>Output level linearity</td><td>18° to 28°C, CW
without MS2830A-022, Referenced to –10 dBm output
<table>
<tr><td></td><td>Output level [p] (dBm)</td></tr>
<tr><td>±0.2 dB (typ., ≤3.6 GHz)</td><td>–40 ≤ p ≤ –10</td></tr>
<tr><td>±0.3 dB (typ., >3.6 GHz)</td><td>–40 ≤ p ≤ –10</td></tr>
</table>
with MS2830A-022, Referenced to –15 dBm output
<table>
<tr><td></td><td>Output level [p] (dBm)</td></tr>
<tr><td>±0.2 dB (typ., ≤3.6 GHz)</td><td>–110 ≤ p ≤ –15</td></tr>
<tr><td>±0.3 dB (typ., >3.6 GHz)</td><td>–110 ≤ p ≤ –15</td></tr>
</table></td></tr>
</table>

Output connector

Connector	N-J connector, 50Ω (Front panel, SG output)
VSWR	18° to 28°C without MS2830A-022, Output level ≤–10 dBm 1.5 (≤3.6 GHz), 2.0 (>3.6 GHz) with MS2830A-022, Output level: ≤–15 dBm 1.3 (≤3.6 GHz), 1.9 (>3.6 GHz)
Max. reverse input	0 Vdc (max.) without MS2830A-022 +12 dBm (<20 MHz), +24 dBm (≥20 MHz) with MS2830A-022 +18 dBm (<20 MHz), +30 dBm (≥20 MHz)

Signal purity

Harmonic spurious	Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022), CW <–30 dBc (≥1 MHz)
Non-harmonic spurious	Offset from output frequency: ≥15 kHz Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022), CW <–46 dBc (100 MHz ≤ f ≤ 3 GHz) <–40 dBc (3 GHz < f ≤ 6 GHz)

Vector modulation

<table>
<tr><td>Vector accuracy</td><td>18° to 28°C, Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022)
W-CDMA (DL 1 code), Output frequency: 800 MHz to 2.7 GHz
LTE-DL (20 MHz), Output frequency: 600 MHz to 2.7 GHz
  ≤1.4% (rms)</td></tr>
<tr><td>Carrier leak</td><td>18° to 28°C, RMS: 0 dB
  ≤–40 dBc (375 MHz ≤ f ≤ 2.4 GHz)</td></tr>
<tr><td>Image rejection</td><td>18° to 28°C, use sine wave <10 MHz
  ≤–40 dBc</td></tr>
<tr><td>ACLR</td><td>18° to 28°C, W-CDMA (Test Model 1 64DPCH)
Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022)
<table>
<tr><td></td><td>5 MHz offset</td><td>10 MHz offset</td></tr>
<tr><td>375 MHz ≤ f ≤ 2.4 GHz</td><td>≤–64 dBc/3.84 MHz</td><td>≤–67 dBc/3.84 MHz</td></tr>
<tr><td>2.4 GHz < f ≤ 3.6 GHz</td><td>≤–59 dBc/3.84 MHz</td><td>≤–63 dBc/3.84 MHz</td></tr>
<tr><td>3.6 GHz < f ≤ 6 GHz</td><td>≤–56 dBc/3.84 MHz</td><td>≤–60 dBc/3.84 MHz</td></tr>
</table></td></tr>
<tr><td>CW and level error at vector modulation</td><td>18° to 28°C, Bandwidth: 5 MHz (AWGN), Output frequency: ≥100 MHz
Output level: ≤0 dBm (without MS2830A-022), ≤–5 dBm (with MS2830A-022)
  ±0.2 dB</td></tr>
</table>

Pulse modulation

On/Off ratio	>60 dB (≤3 GHz) >40 dB (3 GHz < f ≤ 6 GHz)
Rising/Falling edge time	≤90 ns (10% to 90%)
Pulse repetition frequency	DC to 1 MHz (Duty: 50%)
External panel modulation signal input	Aux connector (Rear panel), TTL H: Signal On, L: Signal Off

Arbitrary waveform generator

Waveform resolution	14/15/16 bits
Marker output	14 bits: Three signals in waveform pattern, or real-time three-signal generation 15 bits: One signal in waveform pattern, or real-time three-signal generation 16 bits: Real-time three-signal generation Switching positive and negative logic pulse outputs
Internal baseband reference clock	Range: 20 kHz to 160 MHz Resolution: 0.001 Hz
External baseband reference clock	Range: 20 kHz to 40 MHz Division, multiplier function: Internally generate 1, 2, 4, 8, 16, 1/2, 1/4, 1/8 and 1/16 times input signals and use as DAC sampling clock Input connector: Aux connector (Rear panel) Input level ≥0.7 Vp-p, 50Ω (AC coupling)

Waveform memory	Memory: 64 Msamples (without MS2830A-027)
	  256 Msamples (with MS2830A-027)
	File (Package) open count: Max. package count: 100
	  Max. patterns per package: 1000
	  However, 4096 patterns in total and 128 samples minimum per pattern
	SG Trigger input: Synchronize with trigger signals and start waveform pattern output. Switch start trigger/frame trigger
	Start trigger: To start waveform output
	Frame trigger: To output signals at burst timing
	  To output data for burst length at frame trigger timing and wait for next frame trigger.

Input connector	Function switch: Common start/frame trigger connector. Switch to use. Connector: BNC-J connector (Rear panel) Input level: TTL Logic: Select rise/fall polarity

AWGN addition function

CN Ratio absolute value	≤40 dB (with MS2830A-028)

• MS2830A-066 Low Phase Noise Performance

Signal Analyzer/Spectrum Analyzer

Frequency range	9 kHz to 3.7 GHz 9 kHz to 3.5 GHz (Frequency band mode: Spurious)
Span	300 Hz to 1 MHz (Spectrum Analyzer) 1 kHz to 31.25 MHz (Signal Analyzer)
SSB phase noise	18° to 28°C 500 MHz, Spectrum Analyzer, Switching speed mode: Normal mode –115 dBc/Hz (100 kHz offset) –133 dBc/Hz (1 MHz offset) with MS2830A-066, MS2830A-066: On Center frequency: 500 MHz, Span: ≤1 MHz (Spectrum Analyzer) –109 dBc/Hz (1 kHz offset) –118 dBc/Hz (10 kHz offset) –133 dBc/Hz (100 kHz offset) –148 dBc/Hz (1 MHz offset, nominal) Center frequency: 220 MHz, Span: ≤500 kHz (Spectrum Analyzer) –122 dBc/Hz (25 kHz offset)

Spectrum Analyzer

Displayed average noise level (DANL)	18° to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB with MS2830A-066, without MS2830A-008, or Preamp: Off –133 dBm/Hz (100 kHz) –143 dBm/Hz (1 MHz) –152 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 6 GHz), [MS2830A-041/043] –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz), [MS2830A-043] with MS2830A-066, MS2830A-008, Preamp: On –146 dBm/Hz (100 kHz, nominal) –155 dBm/Hz (1 MHz) –162 dBm/Hz (30 MHz ≤ f < 1 GHz) –161 dBm/Hz (1 GHz ≤ f < 2 GHz) –158 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –154 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –154 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –154 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043]
Image responses	with MS2830A-066 MS2830A-066: On, Center frequency: ≤3.6 GHz, Span: ≤1 MHz (Spectrum Analyzer) Image responses (Input signal + 150 MHz): ≤–10 dBc (110 MHz ≤ f < 3.6 GHz)
Multiple responses	with MS2830A-066 MS2830A-066: On, Center frequency: ≤3.6 GHz, Span: ≤1 MHz (Spectrum Analyzer), Mixer input level: –15 dBm ≤10 dBc (nominal)

Signal Analyzer

Displayed average noise level (DANL)	18° to 28°C, Input attenuator: 0 dB with MS2830A-066, without MS2830A-008, or Preamp: Off –130.5 dBm/Hz (100 kHz) –140.5 dBm/Hz (1 MHz) –149.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –147.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –144.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –141.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –139.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] with MS2830A-066, MS2830A-008, Preamp: On –143.5 dBm/Hz (100 kHz, nominal) –152.5 dBm/Hz (1 MHz) –159.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –158.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –155.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –151.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Normal) [MS2830A-041/043] –151.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz, Frequency band mode: Spurious) [MS2830A-041/043] –151.5 dBm/Hz (4 GHz < f ≤ 6 GHz) [MS2830A-041/043]

• MS2830A-077 Analysis Bandwidth Extension to 62.5 MHz (Requires MS2830A-005 and MS2830A-006)
MS2830A-078 Analysis Bandwidth Extension to 125 MHz (Requires MS2830A-005, MS2830A-006 and MS2830A-077)

An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The MS2690A/91A/92A Signal Analyzer series is recommended for other measurement purposes.

General

Analysis bandwidth	Sets capture analysis bandwidth from center frequency 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz (with MS2830A-077) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz, 100 MHz, 125 MHz (with MS2830A-078)
Sampling rate	Auto setting by conditions of analysis bandwidth 2 kHz to 100 MHz (1-2-5 sequence) (with MS2830A-077) 2 kHz to 200 MHz (1-2-5 sequence) (with MS2830A-078)
Capture time	with MS2830A-077, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 1 μs Maximum capture time length: 500 ms Setting mode: Auto, Manual with MS2830A-078, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 500 ns to 1 μs (Determined according to analysis bandwidth) Maximum capture time length: 500 ms Setting mode: Auto, Manual
ADC resolution	with MS2830A-077/078, >31.25 MHz bandwidth 14 bits

Frequency

Frequency setting	with MS2830A-077/078, >31.25 MHz bandwidth 300 MHz to 3.6 GHz [MS2830A-040] 300 MHz to 6 GHz [MS2830A-041] 300 MHz to 13.5 GHz [MS2830A-043]
Resolution bandwidth (RBW)	with MS2830A-077, >31.25 MHz bandwidth Setting range: 1 Hz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS2830A-078, >31.25 MHz bandwidth Setting range: 1 Hz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)

Amplitude

Displayed average noise level (DANL)	18° to 28°C, Input attenuator: 0 dB With MS2830A-077, or 078, > 31.25 MHz bandwidth without MS2830A-066, MS2830A-008, or with MS2830A-008, Preamp: Off –146.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –144.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –142.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –139.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –135.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] without MS2830A-066, with MS2830A-008, Preamp: On –156.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –155.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –153.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –150.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] with MS2830A-066, without MS2830A-008, or Preamp: Off –143.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –141.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –138.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –135.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043] –135.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) [MS2830A-043] with MS2830A-066, MS2830A-008, Preamp: On –153.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –152.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –149.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –145.5 dBm/Hz (3.5 GHz < f ≤ 6 GHz) [MS2830A-041/043]
Image Response	with MS2830A-077/078, >31.25 MHz bandwidth Image Response (Occurs at frequency 200 MHz away): 0 dBc (nominal, 300 MHz < f ≤ 13.5 GHz)
Linearity error	Excluding the noise floor effect without MS2830A-008, or Preamp: Off ±0.07 dB (Mixer input level: ≤–20 dBm) ±0.10 dB (Mixer input level: ≤–10 dBm) with MS2830A-008, Preamp: On ±0.07 dB (Preamp input level: ≤–40 dBm) ±0.10 dB (Preamp input level: ≤–30 dBm)
RF frequency characteristics	18° to 28°C, after CAL, Input attenuator: 10 dB, Frequency band mode: Normal without MS2830A-008, or Preamp: Off ±0.35 dB (300 MHz ≤ f < 4 GHz) ±1.5 dB (4 GHz ≤ f ≤ 6 GHz) ±1.5 dB (6 GHz < f) with MS2830A-008, Preamp: On ±0.65 dB (300 MHz ≤ f < 4 GHz) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No	Name
	Main frame
MS2830A	Signal Analyzer
	Standard accessories
	Power Cord: 1 pc
P0031A	USB Memory (≥256 MB, USB2.0 Flash Driver): 1 pc
Z0541A	USB Mouse: 1 pc
	Install CD-ROM (Application software, instruction manual CD-ROM): 1 pc
	Options
MS2830A-040	3.6 GHz Signal Analyzer
MS2830A-041	6 GHz Signal Analyzer
MS2830A-043	13.5 GHz Signal Analyzer
MS2830A-001	Rubidium Reference Oscillator
MS2830A-002	High Stability Reference Oscillator
MS2830A-005*1	Analysis Bandwidth Extension to 31.25 MHz (Requires MS2830A-006)
MS2830A-006	Analysis Bandwidth 10 MHz
MS2830A-008	Preamplifier
MS2830A-010	Phase Noise Measurement Function
MS2830A-011	2ndary HDD
MS2830A-016	Precompliance EMI Function
MS2830A-017	Noise Figure Measurement Function
MS2830A-066*2	Low Phase Noise Performance
MS2830A-077*3	Analysis Bandwidth Extension to 62.5 MHz
MS2830A-078*4	Analysis Bandwidth Extension to 125 MHz
MS2830A-313	Removable HDD
MS2830A-020	3.6 GHz Vector Signal Generator
MS2830A-021	6 GHz Vector Signal Generator
MS2830A-022	Low Power Extension for Vector Signal Generator
MS2830A-027	ARB Memory Upgrade 256 Msa for Vector Signal Generator
MS2830A-028	AWGN
MS2830A-029*5	Analog Function Extension for Vector Signal Generator
MS2830A-088	3.6 GHz Analog Signal Generator
	Retrofit options
MS2830A-101	Rubidium Reference Oscillator Retrofit
MS2830A-102	High Stability Reference Oscillator Retrofit
MS2830A-105*1	Analysis Bandwidth Extension to 31.25 MHz Retrofit (Requires MS2830A-006)
MS2830A-106	Analysis Bandwidth 10 MHz Retrofit
MS2830A-117	Noise Figure Measurement Function Retrofit
MS2830A-108	Preamplifier Retrofit
MS2830A-110	Phase Noise Measurement Function Retrofit
MS2830A-111	2ndary HDD Retrofit
MS2830A-116	Precompliance EMI Function Retrofit
MS2830A-120	3.6 GHz Vector Signal Generator Retrofit
MS2830A-121	6 GHz Vector Signal Generator Retrofit
MS2830A-122	Low Power Extension for Vector Signal Generator Retrofit
MS2830A-127	ARB Memory Upgrade 256 Msa for Vector Signal Generator Retrofit
MS2830A-128	AWGN Retrofit
MS2830A-188	3.6 GHz Analog Signal Generator Retrofit
MS2830A-189	Vector Function Extension for Analog Signal Generator Retrofit

∗1: Requires MS2830A-006/106.
∗2: Retrofit not supported.
MS2830A-066 sometimes cannot be installed depending on options.

Model	Case 1	Case2	Case 3
MS2830A-020/021	Yes	Yes	No
MS2830A-043	Yes	No	Yes
MS2830A-066	No	Yes	Yes

∗3: Retrofit not supported. Requires MS2830A-005 and MS2830A-006.
∗4: Retrofit not supported. Requires MS2830A-005, MS2830A-006 and MS2830A-077.
∗5: Retrofit not supported.

Model/Order No	Name
	Software options
	CD-ROM with License and Operation manuals
MX269010A	Mobile WiMAX Measurement Software
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software
MX269013A	GSM/EDGE Measurement Software
MX269013A-001	EDGE Evolution Measurement Software (Requires MX269013A)
MX269015A	TD-SCDMA Measurement Software
MX269017A	Vector Modulation Analysis Software
MX269018A	Analog Measurement Software (Requires MS2830A-066 and A0086A USB Audio)
MX269020A	LTE Downlink Measurement Software
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)
MX269021A	LTE Uplink Measurement Software
MX269022A	LTE TDD Downlink Measurement Software
MX269023A	LTE TDD Uplink Measurement Software
MX269024A	CDMA2000 Forward Link Measurement Software
MX269026A	EV-DO Forward Link Measurement Software
MX269028A	WLAN (802.11) Measurement Software
MX269028A-001	802.11ac (80 MHz) Measurement Software (For MS2830A. Requires MX269028A.)
MX269030A	W-CDMA BS Measurement Software
MX283027A	Wireless Network Device Test Software
MX283027A-001	WLAN Test Software (Requires MX283027A)
MX283027A-002	*Bluetooth* Test Software (Requires MX283027A)
MX269901A	HSDPA/HSUPA IQproducer
MX269902A	TDMA IQproducer
MX269904A	Multi-Carrier IQproducer
MX269905A	Mobile WiMAX IQproducer
MX269908A	LTE IQproducer
MX269908A-001	LTE-Advanced FDD Option (Requires MX269908A)
MX269910A	LTE TDD IQproducer
MX269911A	WLAN IQproducer
MX269911A-001	802.11ac (80 MHz) Option (Requires MX269911A)
MX269912A	TD-SCDMA IQproducer
	Warranty service
MS2830A-ES210	2 years Extended Warranty Service
MS2830A-ES310	3 years Extended Warranty Service
MS2830A-ES510	5 years Extended Warranty Service

Continued on next page

Model/Order No	Name
	Application parts
	Following operation manuals provided as hard copy
W3334AE	MS2830A Operation Manual (Mainframe Operation)
W2851AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Mainframe Remote Control)
W3335AE	MS2830A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Signal Analyzer Function Remote Control)
W3336AE	MS2830A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Spectrum Analyzer Function Remote Control)
W3117AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Phase Noise Measurement Function Operation)
W3118AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Phase Noise Measurement Function Remote Control)
W3655AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Noise Figure Measurement Function Remote control)
W3337AE	MS2830A Option 020/021 Operation Manual (Operation)
W3338AE	MS2830A Option 020/021 Operation Manual (Remote Control)
W2914AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (IQproducer)
W2929AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Standard Waveform Pattern)
W2919AE	MX269010A Operation Manual (Operation)
W2954AE	MX269010A Operation Manual (Remote Control)
W3098AE	MX269011A Operation Manual (Operation)
W3099AE	MX269011A Operation Manual (Remote Control)
W3060AE	MX269012A Operation Manual (Operation)
W3061AE	MX269012A Operation Manual (Remote Control)
W3100AE	MX269013A Operation Manual (Operation)
W3101AE	MX269013A Operation Manual (Remote Control)
W3044AE	MX269015A Operation Manual (Operation)
W3045AE	MX269015A Operation Manual (Remote Control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote Control)
W3555AE	MX269018A Operation Manual (Operation)
W3556AE	MX269018A Operation Manual (Remote Control)
W3014AE	MX269020A Operation Manual (Operation)
W3064AE	MX269020A Operation Manual (Remote Control)
W3015AE	MX269021A Operation Manual (Operation)
W3065AE	MX269021A Operation Manual (Remote Control)
W3209AE	MX269022A Operation Manual (Operation)
W3210AE	MX269022A Operation Manual (Remote Control)
W3521AE	MX269023A Operation Manual (Operation)
W3522AE	MX269023A Operation Manual (Remote Control)
W3201AE	MX269024A Operation Manual (Operation)
W3202AE	MX269024A Operation Manual (Remote Control)
W3203AE	MX269026A Operation Manual (Operation)
W3204AE	MX269026A Operation Manual (Remote Control)
W3528AE	MX269028A Operation Manual (Operation)
W3529AE	MX269028A Operation Manual (Remote Control)
W2860AE	MX269030A Operation Manual (Operation)
W2861AE	MX269030A Operation Manual (Remote Control)
W3471AE	MX283027A Operation Manual (Operation)
W3473AE	MX283027A-001 Operation Manual (Operation)
W3474AE	MX283027A-001 Operation Manual (Remote Control)
W3516AE	MX283027A-002 Operation Manual (Operation)
W3517AE	MX283027A-002 Operation Manual (Remote Control)
W2915AE	MX269901A Operation Manual
W2916AE	MX269902A Operation Manual
W2917AE	MX269904A Operation Manual
W2918AE	MX269905A Operation Manual
W3023AE	MX269908A Operation Manual
W3221AE	MX269910A Operation Manual
W3488AE	MX269911A Operation Manual
W3582AE	MX269912A Operation Manual

Model/Order No	Name
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max.)
MA1612A	Four-port Junction Pad (5 MHz to 3 GHz, N-J)
MP752A	Termination (DC to 12.4 GHz, 50Ω, N-P)
J0576B	Coaxial Cord, 1 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2 m (BNC-P · RG58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322B	Coaxial Cord, 1 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322C	Coaxial Cord, 1.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322D	Coaxial Cord, 2 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1554A	DC Block, SMA type (MODEL 7006) (9 kHz to 26.5 GHz, SMA-P · SMA-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adaptor (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
34AKNF50	Ruggedized K-to-Type N Adapter (DC to 20 GHz, 50Ω, Ruggedized K-M · N-F, SWR: 1.5 (max.), Insertion Loss: 0.4 dB (max.))
J0911	Coaxial Cable, 1.0 m for 40 GHz (DC to 40 GHz, approx. 1 m, SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cable, 0.5 m for 40 GHz (DC to 40 GHz, approx. 0.5 m, SF102A, 11K254/K254/0.5M)
41KC-3	Fixed Attenuator (DC to 40 GHz, 3 dB)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Cross, 1 m)
J1261D	Ethernet Cable (Shield type, Cross, 3 m)
J0008	GPIB Cable, 2.0 m
J1487A	AUX Conversion Adaptor (AUX → BNC, for Vector Signal Generator option)
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636A	Carrying Case (Hard type, with casters)
B0645A	Soft Carrying Case
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B Cable)
Z0975A	Keyboard (USB)
Z1345A	Installation Kit (required when retrofitting options or installing software)

SIGNAL ANALYZER

MS2830A Microwave

9 kHz to 26.5 GHz/43 GHz (18 GHz to 110 GHz)

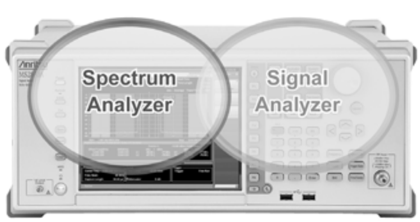
Remote Control
GPIB | Ethernet | USB

[High Speed + High Performance] × [Low Cost] + Eco-friendly

Excellent Eco Product

The MS2830A-044/045 Signal Analyzer includes a spectrum analyzer function for measuring up to 110 GHz using an external mixer based on the 26.5 GHz/43 GHz upper frequency limit.
It supports measurements of Tx characteristics, including adjacent channel leakage power, spectrum mask, and frequency counter, as well as spurious measurements requiring a wide dynamic range. Installing the bandwidth analysis option up to 125 MHz adds signal analyzer functions for checking phenomena that are hard to check using a spectrum analyzer, such as frequency vs. time, phase vs. time, spectrogram, and CCDF. In addition, optional measurement software supports modulation analysis. Moreover, installing a preselector bypass option enables use of the signal analyzer and modulation analysis functions up to 26.5 GHz/43 GHz (MS2830A-044/045). Finally, it can be customized to support a range of application-specific measurements.

- Installing a microwave-band preamp supports measurement of weaker signals.
- Using the 1st local signal output as an external mixer supports measurement of high-frequency signals up to 110 GHz.
- Using the 1st IF signal output as a down converter supports analysis in combination with external equipment.



Key Features

Basic Performance/Functions

- **Frequency Range**
  MS2830A-044: 9 kHz to 26.5 GHz
  MS2830A-045: 9 kHz to 43 GHz
- **Measures up to 110 GHz using External Mixer**
  Frequency Range: 26.5 GHz to 110 GHz
  Built-in connector to connect external mixer (MS2830A-044/045)
  - Connector: SMA-J, 50Ω
  - Local Signal Output: 5 GHz to 10 GHz
  - IF Signal Frequency: 1875 MHz
- **Excellent Dynamic Range*1:**
  159 dB (at 25 GHz)
  TOI*2: ≥+13 dBm, DANL*3: –146 dBm/Hz
  157 dB (nominal, at 40 GHz)
  TOI: ≥+13 dBm nominal, DANL: –144 dBm/Hz
- **Preamp up to 43 GHz**
  → Opt. 068/168: Microwave Preamplifier
  DANL*3: –156 dBm/Hz (at 25 GHz)*4, –150 dBm/Hz (at 40 GHz)*4
- **Total Level Accuracy:**
  ±0.5 dB (300 kHz ≤ f < 4 GHz), ±3.0 dB (13.8 GHz < f ≤ 40 GHz)
- **Used as Wideband Down Converter**
  Built-in IF Output Function (MS2830A-044/045)
  - Connector: SMA-J, 50Ω
  - IF Output Frequency: 1875 MHz
  - IF Output Bandwidth: 1 GHz (3 dB Bandwidth, nominal)*5
  - Gain: –10 dB (nominal)
- **Improved Level Linearity**
- **Reference Oscillator**
  Pre-installed Reference Oscillator
  Aging Rate: ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
  Start-up Characteristics: ±5 × 10^{-8} (5 minutes after power-on)
  Rubidium Reference Oscillator (Opt. 001)
  Aging Rate: ±1 × 10^{-10}/month
  Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)

*1: Difference between TOI and DANL as simple guide
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)
*4: Spectrum Analyzer Functions
*5: When using external mixer bands, or using internal micro frequency bands (Band; 3 to 9) with Microwave Preselector Bypass option: On

- **Versatile Built-in Functions**

- Channel Power	- Occupied Bandwidth
- Adjacent Channel Leakage Power	- Spectrum Emission Mask*1
- Spurious Emission*1	- Burst Average Power
- Frequency Counter*1	- AM Depth*2
- FM Deviation*2	- Multi-marker & Marker List
- Highest 10 Markers	- Limit Line*1
- 2-tone 3rd-order Intermodulation Distortion*1	
- Power Meter*3	- Phase Noise*4
- Noise Figure*5	

- **Low-power Consumption**
  MS2830A-044/045: 190 VA (nominal)

*1: Spectrum Analyzer Functions
*2: Signal Analyzer functions (requires Opt. 005/006/009/077/078)
*3: Power Meter Function (use USB power sensors)
*4: Phase Noise Measurement Function (requires Opt. 010)
*5: Noise Figure Measurement Function (Requires Opt. 017)
[Use Noise Sources (Noisecom, NC346 series)]

Signal Analyzer Functions

- **Analysis Bandwidth**
  Opt. 006: 10 MHz max.
  (20 MHz max. sampling rate = 50 ns resolution, ADC resolution 16 bits)
  Opt. 005*6, Opt. 009*7: 31.25 MHz max.
  (50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)
  Opt. 077*8: 62.5 MHz max.
  (100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)
  Opt. 078*9: 125 MHz max.
  (200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The MS2690A/91A/92A Signal Analyzer series is recommended for other measurement purposes.

- **Capture Function**
  Saves analysis Span × Time signal to internal memory and writes to hard disk. Up to 100 Msamples per measurement saved to internal memory.
  Example: Span 1 MHz: Max. capture time 50 s
  Span 10 MHz: Max. capture time 5 s
- **Replay Function**
  Reads saved data and replays using signal analyzer function.
  Example:
  1. Data sharing between R&D and manufacturing
  2. Later laboratory bench-top analysis of on-site signals
- **Measurement with Sub-trace Display**
  Split screen displaying both main and sub-traces at same time to check errors
  Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
  Sub: Power vs. Time, Spectrogram
- **Supports 125 MHz Wideband Measurements up to 43 GHz**
  → Opt. 067: Microwave Preselector Bypass
  → Opt. 078*9:Analysis Bandwidth Extension to 125 MHz
  Bypassing preselector improves RF frequency characteristics and in-band frequency characteristics. Supports modulation analysis and signal analyzer measurements for signals up to 43 GHz.

*6: Opt. 005 can be installed in MS2830A-044. Requires Opt. 006.
*7: Opt. 009 can be installed in MS2830A-045. Requires Opt. 006.
Cannot be set the RBW to more than 10 MHz in spectrum analyzer function.
*8: Requires Opt. 006 and Opt. 005 (for MS2830A-044).
Requires Opt. 006 and Opt. 009 (for MS2830A-045).
*9: Requires Opt. 006, Opt. 005 and Opt. 077 (for MS2830A-044).
Requires Opt. 006, Opt. 009 and Opt. 077 (for MS2830A-045).

Basic Performance

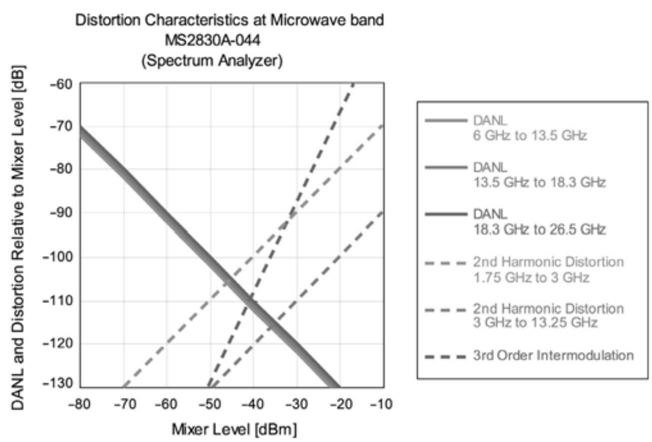
- **Dynamic Range*1**

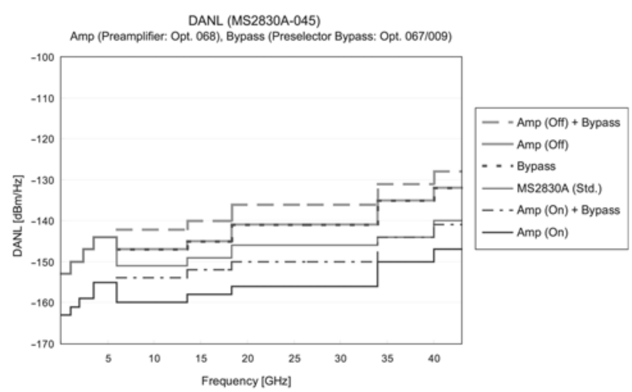
159 dB (at 25 GHz)
TOI*2: ≥+13 dBm (6 GHz < f ≤ 26.5 GHz)
DANL*3: –146 dBm/Hz (18.3 GHz < f ≤ 34 GHz)
157 dB (nominal, at 40 GHz)
TOI: ≥+13 dBm (nominal, 26.5 GHz < f ≤ 40 GHz)
DANL: –144 dBm/Hz (34 GHz < f ≤ 40 GHz)

*1: Difference between TOI and DANL as simple guide
*2: TOI (Third Order Intercept)
*3: DANL (Displayed Average Noise Level)

Dynamic range is a key specification for spectrum analyzers. Low displayed average noise level (DANL) as well as high TOI are important too. Low TOI may cause distortion with high-level carrier signals. Inserting an attenuator can lower the carrier level but this has the effect of lowering the level of weak spurious, making it hard to measure.
The MS2830A has an excellent dynamic range supporting true performance measurements of devices, such as base stations, requiring wideband measuring instruments.

Distortion Characteristics (Spectrum Analyzer)





- **Total Level Accuracy**

  ±0.5 dB (300 kHz ≤ f <4 GHz)
  ±1.8 dB (4 GHz ≤ f ≤ 13.8 GHz)
  ±3.0 dB (13.8 GHz < f ≤ 40 GHz)

The absolute level accuracy in most spectrum analyzer catalogs does not include frequency characteristics, linearity, and attenuator switching error.
However, the MS2830A Total Level Accuracy in the catalog includes the above three errors.
Even when changing the frequency and attenuator, stable measurement is assured in the specified error range.

> The MS2830A total level accuracy includes:
> - **Frequency characteristics**
> - **Linearity**
> - **Attenuator switching error**

- **Preamp up to 43 GHz (Opt. 068 Microwave Preamplifier)**

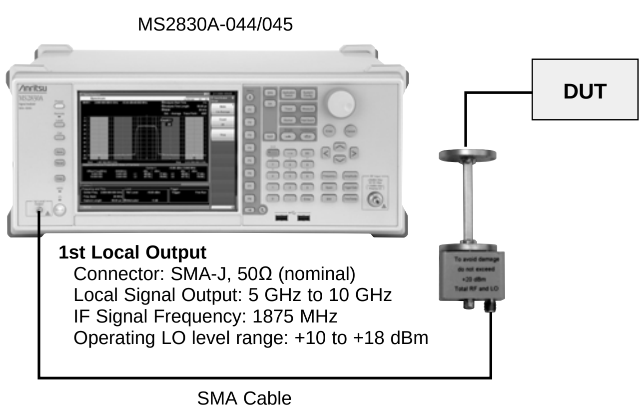
  DANL: –156 dBm/Hz (at 25 GHz)
  –150 dBm/Hz (at 40 GHz)

Installing the Microwave Preamplifier (Opt. 068) amplifies signals before the mixer to improve the spectrum analyzer and signal analyzer sensitivity. This is recommended when measuring low-level signals, such as noise and interference signals.

Frequency range: 100 kHz to 26.5 GHz (MS2830A-044)
100 kHz to 43 GHz (MS2830A-045)
∗: Simultaneous installation with Opt. 008 not supported

- **Measures up to 110 GHz using External Mixer**

The MA2740A series of external mixers supports spectrum measurements up to 110 GHz with high-sensitivity and less Lo-order harmonics because output of local signals from 5 GHz to 10 GHz is supported.



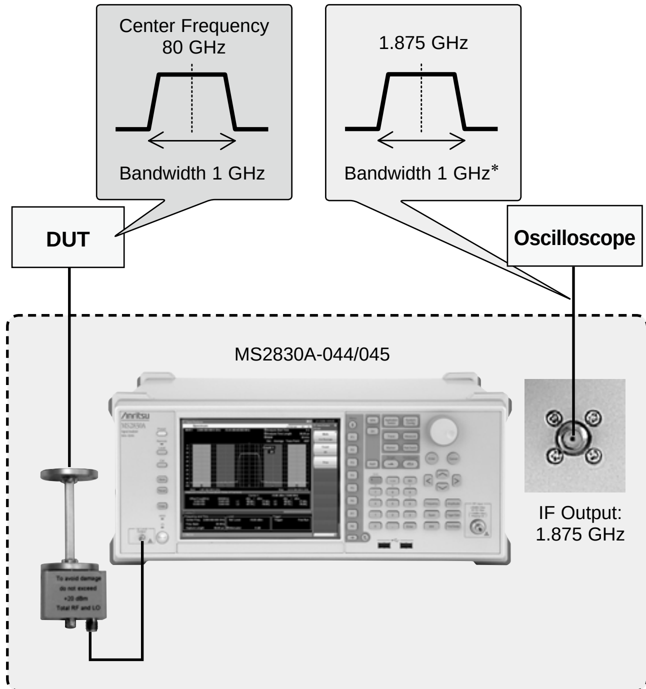
External mixer (MA2740A Series)

Model Name	Frequency Range	LO Order Harmonics
MA2740A	18 GHz to 26.5 GHz	3
MA2741A	26.5 GHz to 40 GHz	4
MA2742A	33 GHz to 50 GHz	5
MA2743A	40 GHz to 60 GHz	6
MA2744A	50 GHz to 75 GHz	8
MA2745A	60 GHz to 90 GHz	9
MA2746A	75 GHz to 110 GHz	11

- **Used as Wideband Down Converter**
  IF Output Frequency 1.875 GHz

Since IF Out supports a high frequency of 1.875 GHz, 1 GHz* wideband signals can be down converted. This can be used for down converting when performing modulation analysis by digitizing with an oscilloscope, etc.

Measurement image:
Down convert signals with 80 GHz center frequency and 1 GHz* bandwidth to 1.875 GHz



∗: When using external mixer bands, or using internal micro frequency bands (Band 3 to 9) with Microwave Preselector Bypass option: On

- **Supports 125 MHz Wideband Measurements up to 43 GHz**

  Opt. 067 Microwave Preselector Bypass + Opt. 078* Analysis Bandwidth Extension to 125 MHz

∗: Requires Opt. 006, Opt. 005 and Opt. 077 (for MS2830A-044).
Requires Opt. 006, Opt. 009 and Opt. 077 (for MS2830A-045).

Supports wideband analysis with high frequencies

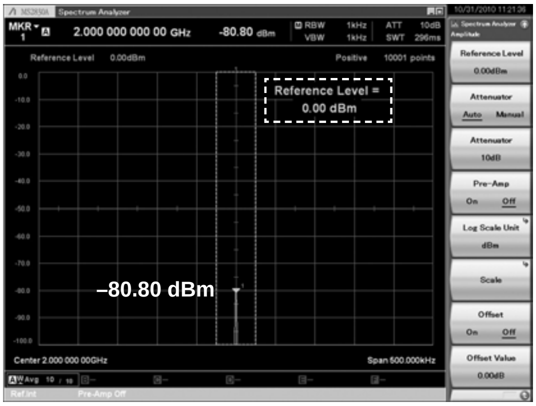
Frequency range: 4 GHz to 26.5 GHz (MS2830A-044, Frequency band mode: Normal)
4 GHz to 43 GHz (MS2830A-045, Frequency band mode: Normal)

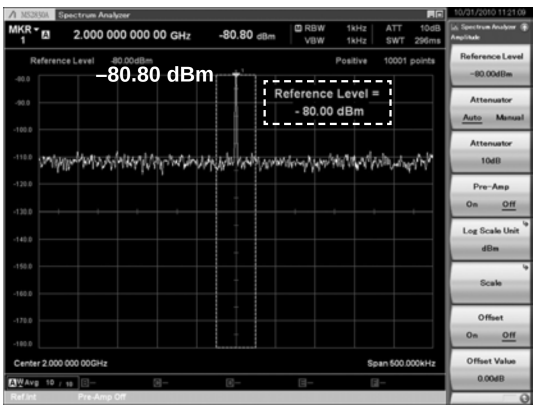
Installing the Microwave Preselector Bypass supports signal analyzer measurement functions in the above frequency range. Adding the measurement software permits modulation analysis and is very useful for designing and inspecting high-frequency devices.

• Improved Level Linearity

Conventional spectrum analyzers use an analog IF and log amp to achieve good level accuracy at points near the log scale reference level, but the accuracy degrades at points that are further away. The MS2830A uses a digital IF instead of a log amp, which supports measurements with excellent accuracy at any point.

Example: Level Stability by Switching Reference Level

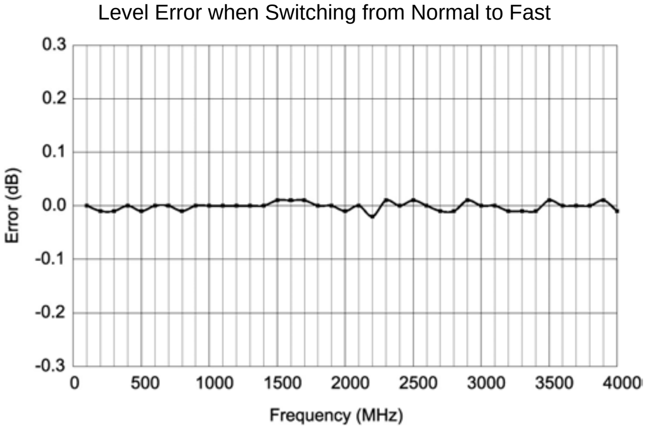




• Dual Sweep Speed: Normal/Fast

When sweep time is set to [Auto], Normal (normal sweep) or Fast mode (high-speed sweep) can be set. The Fast mode sweeps six times faster than the Normal mode.

Example of Sweep Mode Switch Error: (CW –10 dBm input)
Level Error when Switching from Normal to Fast



• Low Consumption Power, Excellent Eco Product

The MS2830A meets Anritsu "Excellent eco products" standard for environment-friendly products. It cuts consumed power by 50% compared to conventional models.

Power Consumption:
≤350 VA (including all options)
190 VA (nominal, MS2830A-044 only, 26.5 GHz*1)
190 VA (nominal, MS2830A-045 only, 43 GHz*1)
*1: Excluding other options

• Resolution Bandwidth (RBW)

Setting Range

Spectrum Analyzer:
1 Hz to 3 MHz (1-3 sequence),
50 kHz, 5 MHz, 10 MHz, 20 MHz*2, 31.25 MHz*2, *3,
200 Hz (6 dB)*4, 9 kHz (6 dB)*4, 120 kHz (6 dB)*4,
1 MHz (Impulse)*4

Spectrum trace in signal analyzer mode:
1 Hz to 1 MHz (1-3 sequence)*5
1 Hz to 3 MHz (1-3 sequence)*6
1 Hz to 10 MHz (1-3 sequence)*7

When monitoring two adjacent signals, the frequency resolution can be increased by reducing the resolution bandwidth (RBW).
This also has the effect of reducing the noise level.
Conversely, to confirm level variations of 20-MHz band signals such as LTE, set the RBW to 31.25 MHz.

*2: Can be set when with Opt. 005. Can not be set when with Opt. 009.
*3: Instead of Gaussian filter, 31.25 MHz RBW uses filter with flat top characteristics above 31.25 MHz.
*4: When Opt. 016 installed.
*5: Without Opt. 077/078, or Bandwidth: ≤31.25 MHz
*6: With Opt. 077, Bandwidth: >31.25 MHz
*7: With Opt. 078, Bandwidth: >31.25 MHz

• Gate Sweep

Gate sweep executes sweeping only for the length of time specified by the gate length, starting from when the trigger condition is met. A delay time until sweeping starts after the trigger condition is met can be set using trigger delay.

- The gate source can be selected from the following
  - Wide IF video trigger
  - External trigger
  - Frame trigger
- Setting range and resolution for gate delay
  - Setting range: 0 to 1 s
  - Resolution: 20 ns
- Setting range and resolution for gate length
  - Setting range: 50 µs to 1 s
  - Resolution: 20 ns

• Trigger Function

Trigger sweep executes sweeping using the specified trigger condition as the start point.

- Video trigger:
  Trigger sweeping starts in synchronization with the rise or fall of the waveform. A trigger level indicator showing the trigger level is displayed on the screen.
- Wide IF video trigger:
  An IF signal with a wide passing band of about 5 MHz is detected, and sweeping starts in synchronization with either the rise or fall of the detected signal.
- External trigger:
  Sweeping starts in synchronization with the rise or fall of the signal input via the Trigger Input connector.
- Frame trigger:
  An equipment-internal trigger signal is used to generate a trigger and start the sweep. The generation period (Period) and offset time (Offset) for the trigger signal can be set. It is also possible to resynchronize the trigger signal with either the Wide IF Video signal or an external trigger.

• Three Built-in External Interfaces
The built-in Gigabit Ethernet, USB2.0, and GPIB interfaces support remote operation.

- GPIB: IEEE488.2, Rear panel, IEEE488 bus connector
  Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
- Ethernet: 10/100/1000BASE-T, Rear panel, RJ-45
- USB (B): USB2.0, Rear panel, USB-B connector

• Saving Measurement Results
Measurement results can be saved to internal hard disk or external USB memory. Screen dumps and trace data can be saved too.

- Screen dump file type
  - BMP
  - PNG
- The color of the screen hard copy can be set as follows:
  - Normal (same as screen display)
  - Reverse
  - Monochrome
  - Reversed Monochrome

Signal Analyzer: Basic Performance/Functions

• Wide Bandwidth × High Accuracy FFT Analysis

Analysis Bandwidth

Opt. 006: 10 MHz max.
(20 MHz max. sampling rate = 50 ns resolution, ADC resolution 16 bits)

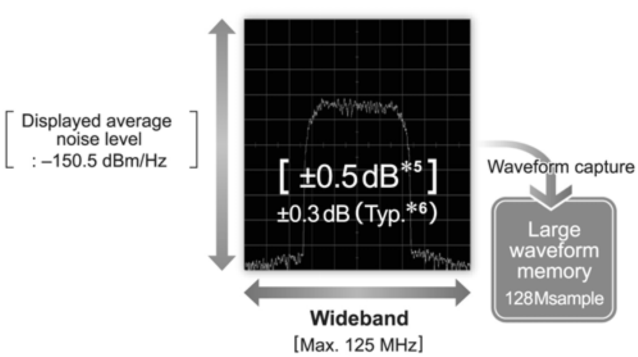
Opt. 005*1, Opt. 009*2: 31.25 MHz max.
(50 MHz max. sampling rate = 20 ns resolution, ADC resolution 16 bits)

Opt. 077*3: 62.5 MHz max.
(100 MHz max. sampling rate = 10 ns resolution, ADC resolution 14 bits)

Opt. 078*4: 125 MHz max.
(200 MHz max. sampling rate = 5 ns resolution, ADC resolution 14 bits)

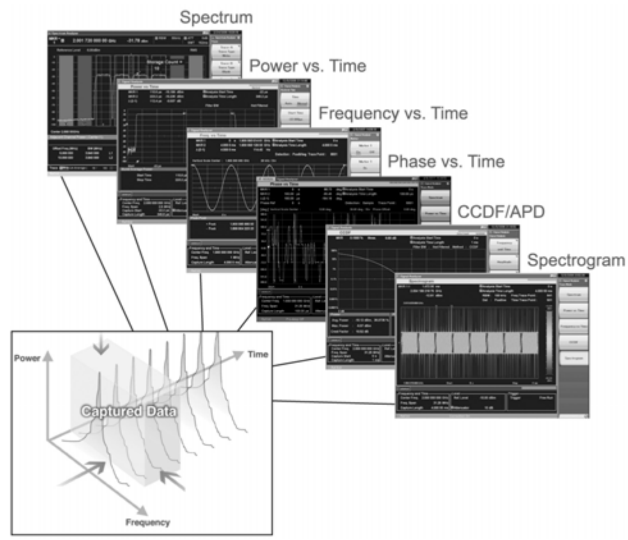
Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The MS2690A/91A/92A Signal Analyzer series is recommended for other measurement purposes.

Based on the excellent level accuracy and wide dynamic range of the MS2830A, a signal with an FFT analysis bandwidth of up to 125 MHz can be captured with a level accuracy of ±0.3 dB.



*1: Opt. 005 can be installed in MS2830A-044. Requires Opt. 006.
*2: Opt. 009 can be installed in MS2830A-045. Requires Opt. 006.
*3: Requires Opt. 006 and Opt. 005 (for MS2830A-044).
Requires Opt. 006 and Opt. 009 (for MS2830A-045).
*4: Requires Opt. 006, Opt. 005 and Opt. 077 (for MS2830A-044).
Requires Opt. 006, Opt. 009 and Opt. 077 (for MS2830A-045).
*5: 300 kHz ≤ f < 4 GHz, Frequency band mode Normal.
*6: Excluding Guard Band

• Vector Signal Analysis (VSA) Function
Seamless signal capture and VSA analysis in multiple domains make it easy to evaluate burst-signal responses and capture degraded spectrum transients, etc., which cannot be checked by conventional sweep spectrum analyzers. This greatly improves design verification and troubleshooting efficiency.



• Save Signals in Internal Memory
Max. Capture Time: 0.5 s to 2000 s
Max. Number of Samples: 100 Msamples

The "Analysis bandwidth × Analysis time" signal is held in internal memory and saved to hard disk.
Up to 100 Msamples of data can be saved to memory for one measurement. The frequency span determines the sampling rate.
The following chart shows the maximum capture time per frequency span.

Span*	Sampling Rate	Capture Time	Max. Sampling Data
1 kHz	2 kHz	2000 s	4M
2.5 kHz	5 kHz	2000 s	10M
5 kHz	10 kHz	2000 s	20M
10 kHz	20 kHz	2000 s	40M
25 kHz	50 kHz	2000 s	100M
50 kHz	100 kHz	1000 s	100M
100 kHz	200 kHz	500 s	100M
250 kHz	500 kHz	200 s	100M
500 kHz	1 MHz	100 s	100M
1 MHz	2 MHz	50 s	100M
2.5 MHz	5 MHz	20 s	100M
5 MHz	10 MHz	10 s	100M
10 MHz	20 MHz	5 s	100M
25 MHz	50 MHz	2 s	100M
31.25 MHz	50 MHz	2 s	100M
50 MHz	100 MHz	500 ms	50M
62.5 MHz	100 MHz	500 ms	50M
100 MHz	200 MHz	500 ms	100M
125 MHz	200 MHz	500 ms	100M

*: With Opt. 006: 1 kHz to 10 MHz
With Opt. 005/006 (for MS2830A-044) or
Opt. 006/009 (for MS2830A-045): 1 kHz to 31.25 MHz
With Opt. 005/006/077 (for MS2830A-044) or
Opt. 006/009/077 (for MS2830A-045): 1 kHz to 62.5 MHz
With Opt. 005/006/077/078 (for MS2830A-044) or
Opt. 006/009/077/078 (for MS2830A-045): 1 kHz to 125 MHz

• Replay Function for Comparison Evaluation
This function reads saved data and replays it using the signal analyzer measurement function.

Examples:
1. Data sharing between separate R&D and manufacturing
2. Later laboratory bench-top analysis of on-site signals
3. Save data at shipment and re-verify if problem occurs

Signal Analyzer: Trace

• Spectrum

The Spectrum trace displays a graph with amplitude on the y-axis and frequency on the x-axis. The captured IQ data is FFT processed (fast Fourier transformed) and converted from the time domain to the frequency domain for display as a spectrum.

• Power vs. Time

The Power vs. Time trace displays a graph with amplitude on the y-axis and time on the x-axis to confirm changes in power with time of measured signals.

• Frequency vs. Time

The Frequency vs. Time trace displays a graph with frequency on the y-axis and time on the x-axis to confirm time variation of the measured signal frequency.

• Phase vs. Time

The Phase vs. Time trace displays a graph with phase on the y-axis and time on the x-axis to confirm time variation of the measured signal phase.

• CCDF*1/APD*2

The CCDF trace displays the power variation probability on the y-axis and power variation on the y-axis to confirm the CCDF and APD of measured signals.

*1: CCDF (Complementary Cumulative Distribution Function)
*2: APD (Amplitude Probability Density)

Measurement Results

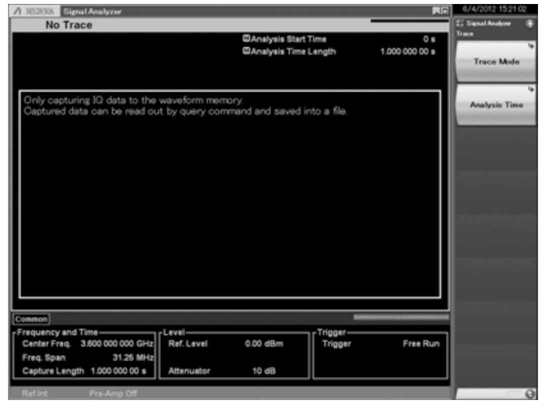
- CCDF: The CCDF display indicates the cumulative distribution of transient power variations compared to average power.
- APD: The APD display indicates the probability distribution of transient power fluctuations compared to average power.

• Spectrogram

The Spectrogram trace displays the level as color with frequency on the y-axis and time on the x-axis. The captured IQ data is FFT processed to confirm time variations in the continuous spectrum.
It is useful for monitoring frequency hopping and transient signals.

• No Trace

No Trace mode does not execute signal analysis. Therefore, “IQ data output” and “IQ data readout using remote commands” can be executed quickly without the need to wait for completion of analysis.

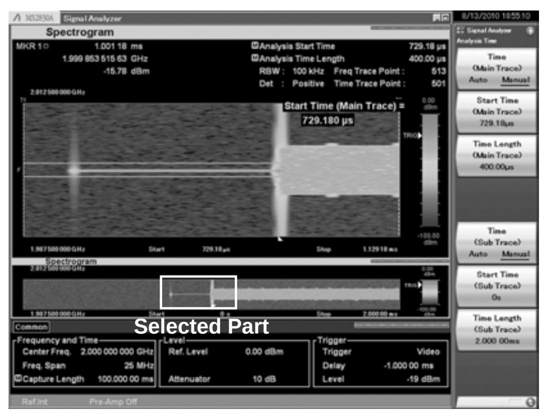


• Measurement with Sub-trace Display

This function splits the screen into top and bottom halves; simultaneous display of the sub-trace supports easy monitoring of fault locations and transient phenomena.

Main: Spectrum, Frequency vs. Time, Power vs. Time, Phase vs. Time, CCDF/APD, Spectrogram
Sub: Power vs. Time, Spectrogram

The part of a previously captured long-term signal to be monitored can be selected on the sub-trace to display the problem part only on the main trace.



Versatile Built-in Functions

• Useful for Tx Characteristics Evaluation

The MS2830A is fully loaded with all the functions required for evaluating Tx characteristics. Tests can be performed simply and in accordance with standards using functions tailored to measurement contents.

Measure Function	SPA*1	VSA*2
Channel Power	✓	✓
Occupied Bandwidth	✓	✓
Adjacent Channel Leakage Power	✓	✓
Spectrum Emission Mask	✓	
Burst Average Power	✓	✓
Spurious Emission	✓	
AM Depth		✓
FM Deviation		✓
Multi-marker & Marker List	✓	✓
Highest 10 Markers	✓	✓
Limit Line	✓	
Frequency Counter	✓	
2-tone 3rd-order Intermodulation Distortion	✓	
Power Meter	Independent function*3	
Phase Noise	Opt. 010	
Noise Figure	Opt. 017*4	

*1: SPA (Spectrum Analyzer)
*2: VSA (Vector Signal Analyzer), requires Opt. 005/006/009/077/078
*3: Use USB Power Sensors
*4: Use Noise Sources (Noisecom, NC346 series)

• Channel Power SPA VSA

This function measures channel bandwidth power. Three types of filters (Rect, Nyquist, Root Nyquist) can be selected.
Pre-installed templates for each standard support easy parameter setting.

Measurement Results

■ Absolute power per Hz in channel band
■ Total power in channel band

• Occupied Bandwidth SPA VSA

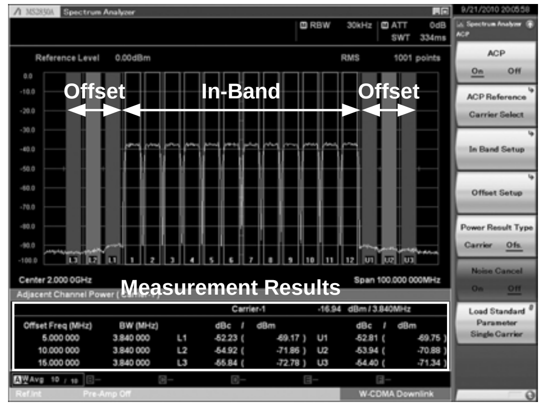
Occupied bandwidth is measured by selecting either the N% or X-dB mode.
Pre-installed templates for each standard support easy parameter setting.

Measurement Results

■ Bandwidth for specified conditions

• Adjacent Channel Leakage Power SPA VSA

This function measures carrier adjacent channel (offset) power (In-Band).
1 to 12 carriers can be set and switched instantaneously on-screen.
True ACLR performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.

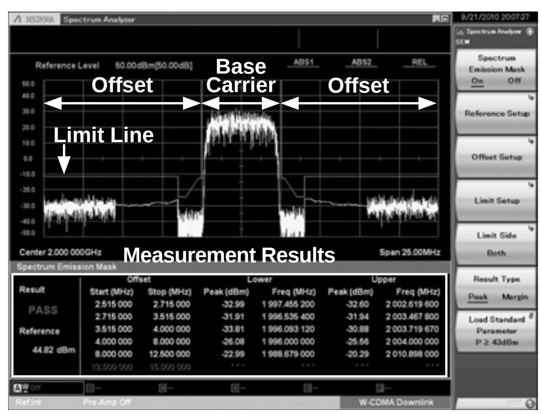


Measurement Results

■ Absolute power of Offset channel
■ Relative values in relation to reference power selected in ACP reference

• Spectrum Emission Mask SPA

This function splits the offset part into up to 12 segments; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. Pre-installed templates for each standard support easy parameter setting.

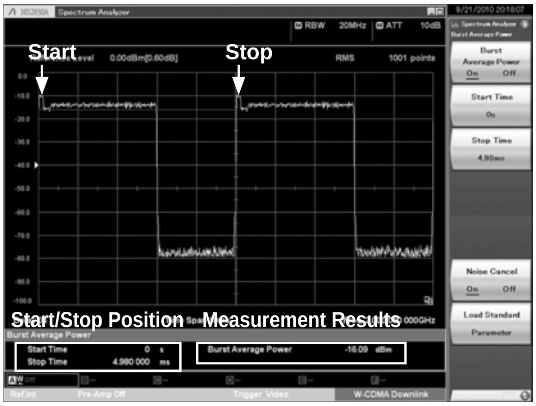


Measurement Results

■ Peak power (or margin) at offset
■ Each peak frequency

• Burst Average Power SPA VSA

The average power for the range specified by two markers is displayed in the time domain. Measurement only requires setting the measurement start and stop positions on the screen. True performance is measured using the noise cancellation function to subtract main-frame noise from the measurement result.
Pre-installed templates for each standard support easy parameter setting.

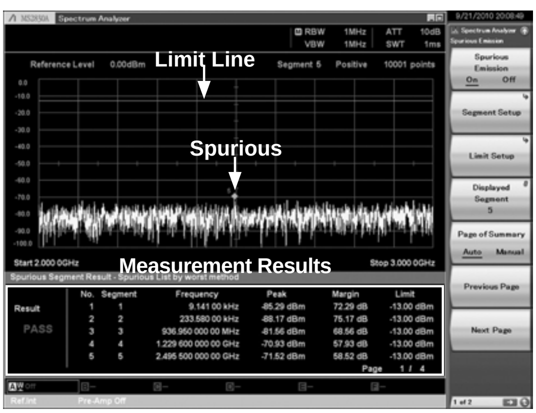


Measurement Results

■ Average power of specified range

• Spurious Emission SPA

This function splits the frequency range into up to 20 segments for sweeping; the measurement parameters and limit lines can be specified to measure the peak power and margin for each segment. The results are tabulated below the trace and marked PASS/FAIL. In particular, all tests can be completed up to the final stage without an external PC because the zero-span capture function described in the technology compliance test is built-in.



Measurement Results

■ Each segment peak power and margin
■ Each peak frequency

• AM Depth VSA

The Power vs. Time trace measurement function is used to confirm AM depth.
It measures the measured signal AM based on trace data at the displayed marker. When marker is Off, the whole range is measured.

Measurement Results

■ +Peak, –Peak, (Peak-Peak)/2, Average

• FM Deviation VSA

The Freq. vs. Time trace measurement is used to confirm the FM deviation. It measures the maximum and minimum frequencies from trace data in the marker range. When marker is Off, the whole range is measured.

Measurement Results

■ +Peak, –Peak, (Peak-Peak)/2, Average

• Multi-marker & Marker List SPA VSA

Up to 10 markers can be set for this function. Markers may be either a spot or a zone. Using a zone marker, the peak of a signal with an unstable variable frequency can be tracked and measured. Not only can the 10 markers be listed below the trace but the differences between markers can be calculated and displayed using the delta setting.

Measurement Results

■ Marker point frequency
■ Marker point power
■ Absolute power per Hz in marker bandwidth
■ Total power in marker bandwidth
■ Difference between any markers

• Highest 10 Markers SPA VSA

This function sets the threshold level and auto-detects peaks in the X (frequency) and Y (level/time) directions.

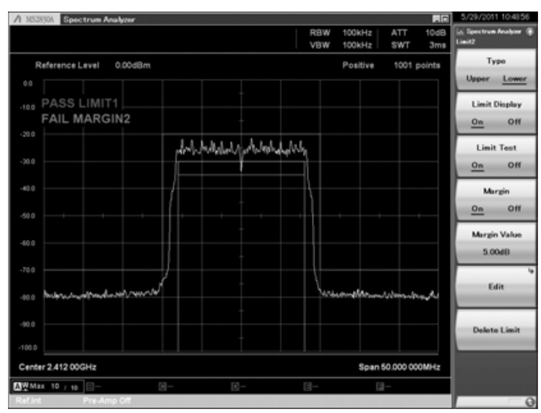
Measurement Results

■ Peak Search Y:
Sets up to 10 markers in order of peak level
■ Peak Search X:
Sets up to 10 markers in order of frequency (time) level

• Limit Line SPA

At the spectrum display (frequency domain), two limit lines are set and evaluation is performed based on these set lines. Either Upper Limit or Lower Limit can be selected. The line settings set the frequency/level of the crossover point sequentially from the lowest frequency. Up to 100 crossover points can be set. (In the diagram below, Limit1 is 6 points and Limit2 is 4 points.) In addition, when a margin is set at each of Limit1/2, evaluation can be performed using the lines, taking into account the margins. Once Limit1/2 has been set, the level direction can be fine-adjusted by the margin setting.

Line: Limit1, Limit2
Judgment type: Upper Limit, Lower Limit
Crossover (point): 1 to 100
Margin: Limit1, 2 + Display margin line



Measurement Results

■ Evaluation: PASS, FAIL

• Frequency Counter SPA

This function of the marker functions is used to measure CW frequencies.
Gate Time sets the measurement target time.

Measurement Results

■ Marker point frequency

• 2-tone 3rd-order Intermodulation Distortion SPA

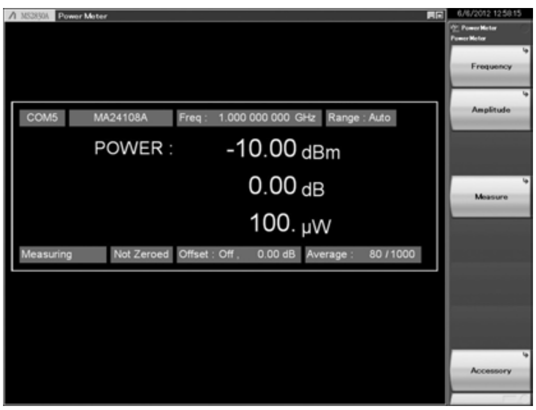
By inputting two different frequency CW signals (desired waves), two-tone third-order intermodulation distortion is generated close to the desired waves according to non-linear characteristics of Device Under Test (DUT). Then, Third Order Intercept (TOI) is calculated from the two-tone third-order intermodulation distortion.

Measurement Results

- ■ TOI: [dBm]
- ■ Amplitude: [dBc]

• Power Meter

Power meter function can connect a USB power sensor to the MS2830A and read the measurement values.



Measurement Results

- ■ Power: [dBm], [W]
- ■ Relative power: [dB]

Compatible USB Power Sensors

Model	Frequency Range	Resolution	Dynamic Range
MA24104A	600 MHz to 4 GHz	1 kHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	1 kHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	100 kHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	100 kHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	100 kHz	–40 to +20 dBm

• Phase Noise (Opt. 010)

This function measures phase noise in the 10 Hz to 10 MHz frequency offset range.

Measurement Results

- ■ Carrier level
- ■ Error between set frequency and carrier frequency
- ■ Marker point phase noise level

• Noise Figure Measurement (Opt. 017)

Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source*.

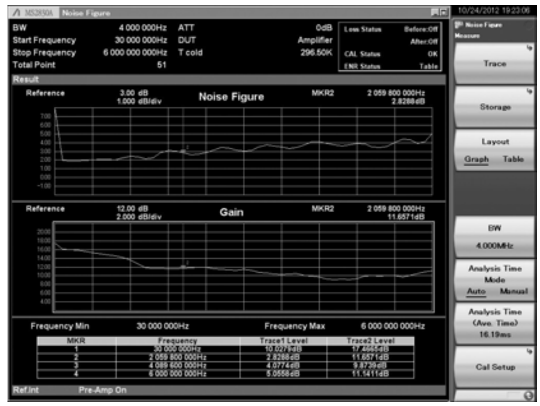
Frequency Mode: Fixed/List/Sweep
DUT Mode: Amplifier
Screen Layout: Graph/Table

Measurement Results Display

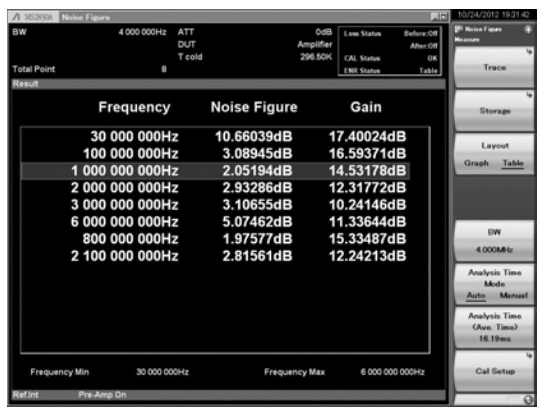
■ Graph/List/Spot

Displays measurement results for each trace (Trace1/Trace2).

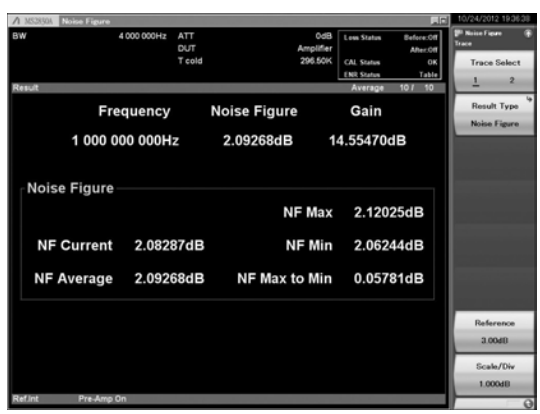
- • Noise Figure (NF) [dB]
- • Noise Factor (F) [Linear]
- • Gain
- • Y-Factor: Power ratio when Noise Source is turned ON/OFF
- • T effective: Effective noise temperature
- • P Hot: Power measured when Noise Source is On.
- • P Cold: Power measured when Noise Source is Off.



Measurement Result: Example of Graph display (Frequency Mode: Sweep, Screen Layout: Graph)



Measurement Result: Example of List display (Frequency Mode: List, Screen Layout: List)



Measurement Result: Example of Spot display (Frequency Mode: Fixed)

*: Supports noise sources from Noisecom NC346 series.
See the MS2830A catalog for more details.

Excellent Expandability Platform (Hardware)

The versatility of the MS2830A series is tailored easily to the application by installing modules in expansion slots.

• Basic Performance and Function Improvement

MS2830A-001/101 Rubidium Reference Oscillator/Retrofit

This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 × 10^{-9} at 7 minutes after power-on.

Aging Rate: ±1 × 10^{-10}/month
Start-up Characteristics: ±1 × 10^{-9} (7 minutes after power-on)

MS2830A-008/108 Preamplifier/Retrofit

This option is used to measure low-level signals, such as noise and interference signals.

Frequency Range: 100 kHz to 6 GHz

∗: Cannot be installed simultaneously with Opt. 068/168

MS2830A-011/111 2ndary HDD/Retrofit

Removable HDD for saving user data

MS2830A-016/116 Precompliance EMI Function/Retrofit

This option adds an EMI measurement detection mode and RBW to the spectrum analyzer function. Both the detection mode used for CISPR standards (Quasi-Peak, CISPR-AVG, RMS-AVG) and RBW (200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Imp)) as well as conventional settings can be selected.

MS2830A-067/167 Microwave Preselector Bypass/Retrofit

Bypassing the preselector used for the microwave band improves RF frequency characteristics and in-band frequency characteristics.

∗: Add MS2830A-067 when using the signal analyzer measurement functions at bandwidth: >31.25 MHz and frequency: >6 GHz.

MS2830A-068/168 Microwave Preamplifier/Retrofit

This option is used to measure low-level signals, such as noise and interference signals.

Frequency Range: 100 kHz to 26.5 GHz (MS2830A-044)
100 kHz to 43 GHz (MS2830A-045)

∗: Cannot be installed simultaneously with Opt. 008/108

• Signal Analyzer Function and Performance Improvement

MS2830A-005/105
Analysis Bandwidth Extension to 31.25 MHz/Retrofit

This option expands the analysis bandwidth to 31.25 MHz.

∗: Requires Opt. 006/106
Not supported by MS2830A-045 (43 GHz Signal Analyzer) – use Opt. 009

MS2830A-006/106 Analysis Bandwidth 10 MHz/Retrofit

This option supports the VSA and digitize functions.

MS2830A-009/109
Bandwidth Extension to 31.25 MHz for Millimeter-wave Retrofit

This option extends the MS2830A-045 (43 GHz Signal Analyzer) analysis bandwidth to 31.25 MHz.

∗: Requires Opt. 006/106
Dedicated option for MS2830A-045 (43 GHz Signal Analyzer)
Cannot be set the RBW to more than 10 MHz in spectrum analyzer function.

MS2830A-077 Analysis Bandwidth Extension to 62.5 MHz

This option extends the analysis bandwidth to 62.5 MHz.

∗: Retrofit not supported.
Requires Opt. 006 and Opt. 005 (for MS2830A-044).
Requires Opt. 006 and Opt. 009 (for MS2830A-045).

MS2830A-078 Analysis Bandwidth Extension to 125 MHz

This option extends the analysis bandwidth to 125 MHz.

∗: Retrofit not supported.
Requires Opt. 006, Opt. 005 and Opt. 077 (for MS2830A-044).
Requires Opt. 006, Opt. 009 and Opt. 077 (for MS2830A-045).

Note: An image response is received when setting the bandwidth to more than 31.25 MHz. This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.). The MS2690A/91A/92A Signal Analyzer series is recommended for other measurement purposes.

• Expansion Functions

MS2830A-010/110 Phase Noise Measurement Function/Retrofit

Phase Noise Measurements

Frequency Range: 10 MHz to main-frame upper limit frequency
Offset Frequency Range: 10 Hz to 10 MHz

MS2830A-017/117 Noise Figure Measurement Function/Retrofit

Adds noise figure measurement function.
Noise Figure is measured with the measurement method of Y-factor method which uses a Noise Source.

MS2830A-313 Removable HDD

The MS2830A-313 Removable HDD is useful when a user takes the instrument to an outside company for calibration but wants to protect the security of data in the instrument, such as measurement results, data and main frame settings. In this case, the user removes the regular MS2830A hard disk and replaces it with this product.

Future-proof Platform (Software)

Adding measurement software options to the signal analyzer assures that the modulation analysis and other functions will support all common current and future communications systems.

Measurement Software

Communications Systems	Name	Model	Option[*1]			
			Opt. 006	Opt. 005/009	Opt. 077	Opt. 078
Mobile WiMAX	Mobile WiMAX Measurement Software	MX269010A[*2]	✓	✓		
W-CDMA/HSPA/HSPA Evolution	W-CDMA/HSPA Downlink Measurement Software	MX269011A	✓			
	W-CDMA/HSPA Uplink Measurement Software	MX269012A	✓			
GSM/EDGE	GSM/EDGE Measurement Software	MX269013A	✓			
EDGE Evolution	EDGE Evolution Measurement Software	MX269013A-001[*3]	✓			
TD-SCDMA	TD-SCDMA Measurement Software	MX269015A	✓			
Multi-TDMA systems	Vector Modulation Analysis Software	MX269017A	✓	✓[*4]	✓[*4]	✓[*4]
3GPP LTE (FDD)	LTE Downlink Measurement Software	MX269020A	✓	✓		
	LTE-Advanced FDD Downlink Measurement Software	MX269020A-001[*5]	✓	✓[*5]	✓[*5]	✓[*5]
	LTE Uplink Measurement Software	MX269021A	✓	✓		
3GPP LTE (TDD)	LTE TDD Downlink Measurement Software	MX269022A	✓	✓		
	LTE TDD Uplink Measurement Software	MX269023A	✓	✓		
CDMA2000	CDMA2000 Forward Link Measurement Software	MX269024A	✓			
1xEV-DO	EV-DO Forward Link Measurement Software	MX269026A	✓			
WLAN	WLAN (802.11) Measurement Software (Supports IEEE802.11n/11a/11b/11g/11j/11p)	MX269028A	✓	✓		
	802.11ac (80 MHz) Measurement Software	MX269028A-001[*6]	✓	✓[*6]	✓[*6]	✓[*6]
W-CDMA/HSPA	W-CDMA BS Measurement Software	MX269030A	✓			
	Wireless Network Device Test Software	MX283027A				
WLAN	WLAN Test Software	MX283027A-001	✓	✓		
Bluetooth	*Bluetooth* Test Software	MX283027A-002	✓			

*1: 10 MHz Analysis Bandwidth MS2830A-044 + Opt. 006
MS2830A-045 + Opt. 006
31.25 MHz Analysis Bandwidth MS2830A-044 + Opt. 006 + Opt. 005 (Opt. 005 cannot be installed in MS2830A-045)
MS2830A-045 + Opt. 006 + Opt. 009 (Opt. 009 can be installed in MS2830A-045)
62.5 MHz Analysis Bandwidth MS2830A-044 + Opt. 006 + Opt. 005 + Opt. 077
MS2830A-045 + Opt. 006 + Opt. 009 + Opt. 077
125 MHz Analysis Bandwidth MS2830A-044 + Opt. 006 + Opt. 005 + Opt. 077 + Opt. 078
MS2830A-045 + Opt. 006 + Opt. 009 + Opt. 077 + Opt. 078

*2: Can not be installed in MS2830A-045

*3: Requires MX269013A.

*4: The Symbol Rate setting range varies as follows, depending on the option configuration.

	O-QPSK	FSK	Except FSK	
			Frame Formatted	Non-Formatted
Opt. 078, Opt. 077, Opt. 005/009, Opt. 006 installed	0.1 ksps to 12.5 Msps	0.1 ksps to 25 Msps	0.1 ksps to 50 Msps	0.1 ksps to 140 Msps
Opt. 077, Opt. 005/009, Opt. 006 installed	0.1 ksps to 6.25 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 25 Msps	0.1 ksps to 70 Msps
Opt. 005/009, Opt. 006 installed	0.1 ksps to 3.125 Msps	0.1 ksps to 6.25 Msps	0.1 ksps to 12.5 Msps	0.1 ksps to 35 Msps
Opt. 006 installed	0.1 ksps to 1.25 Msps	0.1 ksps to 2.5 Msps	0.1 ksps to 5 Msps	0.1 ksps to 5 Msps

*5: Requires MX269020A.
The LTE-Advanced Carrier Aggregation measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Model		LTE-Advanced Carrier Aggregation Signal	
Main frame	Analysis Bandwidth Extension Option Configuration	Number of Band	Number of Component Carrier
MS269xA	Opt. 078 installed	3	5
	Opt. 077installed	1	1
	Standard	1	1
MS2830A	Opt. 078 installed	1	5
	Opt. 077 installed	1	1
	Opt. 005/009 installed	1	1

*6: Requires MX269028A. The IEEE802.11ac measurement range varies as follows, depending on the Analysis Bandwidth Extension option configuration.

Model			Bandwidth of IEEE802.11ac signal				
Main frame	Measurement software	Analysis Bandwidth Extension Option Configuration	20 MHz	40 MHz	80 MHz	160 MHz	80 MHz + 80 MHz
MS269xA	MX269028A-002 (Only for MS269xA)	Opt. 078 installed	✓	✓	✓	✓	✓[*7]
		Opt. 077installed	✓	✓			
		Standard	✓	✓			
MS2830A	MX269028A-001 (Only for MS2830A)	Opt. 078 installed	✓	✓	✓[*8]		
		Opt. 077 installed	✓	✓			
		Opt. 005/009 installed	✓	✓			

*7: Measurement required for each carrier signal (80-MHz bandwidth)

*8: Measurement is only possible when the carrier signal (80-MHz bandwidth) is input due to the effect of the image response.

See each measurement software catalog for more details.

Specifications

The specification is the value after 30-minute warm-up at a constant ambient temperature.
The specifications are defined under the following conditions unless otherwise specified.
Auto sweep time select: Normal, Auto sweep type rules: Sweep only, Switching speed mode: Best phase noise mode
Nominal values indicate expected performance or describe product performance. That is not covered by the product warranty.
Specifications above 26.5 GHz: MS2830A-045 only.

● Signal Analyzer/Spectrum Analyzer

Frequency

<table>
<tr><td>Frequency Range</td><td>9 kHz to 26.5 GHz [MS2830A-044], 9 kHz to 43 GHz [MS2830A-045]</td></tr>
<tr><td>Frequency Bands</td><td>
<table>
<tr><th>Frequency range</th><th>Band</th><th>Mixer harmonics order (N)</th></tr>
<tr><td>9 kHz to 4 GHz</td><td>0</td><td>1</td></tr>
<tr><td>3.5 GHz to 4.4 GHz</td><td>1</td><td>1/2</td></tr>
<tr><td>4.3 GHz to 6 GHz</td><td>1</td><td>1</td></tr>
<tr><td>3.9 GHz to 8 GHz</td><td>3</td><td>1</td></tr>
<tr><td>7.9 GHz to 10.575 GHz</td><td>4</td><td>1</td></tr>
<tr><td>10.475 GHz to 12.2 GHz</td><td>5</td><td>2</td></tr>
<tr><td>12.1 GHz to 18.4 GHz</td><td>6</td><td>2</td></tr>
<tr><td>18.3 GHz to 26.6 GHz</td><td>7</td><td>4</td></tr>
<tr><td>26.5 GHz to 41.9 GHz</td><td>8</td><td>4</td></tr>
<tr><td>41.8 GHz to 43 GHz</td><td>9</td><td>8</td></tr>
</table>
</td></tr>
<tr><td>Frequency Setting Range</td><td>–100 MHz to 26.6 GHz [MS2830A-044]
–100 MHz to 43.1 GHz [MS2830A-045]
Setting resolution: 1 Hz</td></tr>
<tr><td>Pre-Selector Range</td><td>
<table>
<tr><th>MS2830A-044</th><th>MS2830A-045</th><th></th></tr>
<tr><td>4 GHz to 26.5 GHz</td><td>4 GHz to 43 GHz</td><td>(Frequency band mode: Normal)</td></tr>
<tr><td>3.5 GHz to 26.5 GHz</td><td>3.5 GHz to 43 GHz</td><td>(Frequency band mode: Spurious)</td></tr>
</table>
</td></tr>
<tr><td>Internal Reference Oscillator</td><td>with MS2830A-044/045
23°C, Referenced to frequency at 24-hour after power-on
Start-up characteristics: ±5 × 10^{-7} (2 minutes after power-on), ±5 × 10^{-8} (5 minutes after power-on)
Aging rate: ±1 × 10^{-7}/year
Temperature stability: ±2 × 10^{-8} (5° to 45°C)
with MS2830A-001
23°C, Referenced to frequency at 24-hour after power-on
Start-up characteristics: ±1 × 10^{-9} (7 minutes after power-on)
Aging rate: ±1 × 10^{-10}/month
Temperature stability: ±1 × 10^{-9} (5° to 45°C)</td></tr>
<tr><td>SSB Phase Noise</td><td>18° to 28°C, 500 MHz, Spectrum Analyzer mode, Switching Speed mode: Normal
–115 dBc/Hz (100 kHz offset)
–133 dBc/Hz (1 MHz offset)</td></tr>
</table>

Amplitude

Level Measurement Range	without MS2830A-008/068, or Preamp: Off DANL to +30 dBm with MS2830A-008/068, Preamp: On DANL to +10 dBm
Maximum Input Level	without MS2830A-008/068, or Preamp: Off Average total power: +30 dBm (Input attenuator: ≥10 dB) DC voltage: ±0 Vdc with MS2830A-008/068, Preamp: On Average total power: +10 dBm (Input attenuator: 0 dB) DC voltage: ±0 Vdc
Input Attenuator Range	with MS2830A-044 0 to 60 dB, 2 dB steps with MS2830A-045 0 to 60 dB, 10 dB steps (ATT mode: Mechanical Atten Only, or E-ATT Combined Mode, Stop Frequency: ≥6 GHz) 0 to 10 dB, 10 dB steps/10 to 40 dB, 2 dB steps/40 to 60 dB, 10 dB steps (Attenuator mode: E-ATT Combined Mode, Stop Frequency: <6 GHz)
Input Attenuator Switching Uncertainty	18° to 28°C, Referenced to 10 dB, ATT mode: Mechanical Atten Only without MS2830A-008/068, or Preamp: Off ±0.2 dB (10 to 60 dB) (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±0.75 dB (10 to 60 dB) (4 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Spurious) ±0.8 dB (10 to 60 dB) (13.8 GHz < f ≤ 26.5 GHz) ±1.0 dB (10 to 60 dB) (26.5 GHz < f ≤ 40 GHz) ±1.0 dB (10 to 60 dB) (typ., 40 GHz < f ≤ 43 GHz)

Reference Level

Setting Range	Log scale: –120 to +50 dBm, or Equivalent level Linear scale: 22.4 µV to 70.7 V, or Equivalent level Setting resolution: 0.01 dB, or Equivalent level
Scale Units	Log scale: dBm, dBµV, dBmV, dBµV (emf), dBµV/m, V, W Linear scale: V
Linearity Error	Excluding the noise floor effect, Input level: ≤–10 dB (f: <30 MHz) ±0.07 dB (Mixer input level: ≤–20 dBm) ±0.10 dB (Mixer input level: ≤–10 dBm)
RF Frequency Characteristics	18° to 28°C, after CAL, Input attenuator: 10 dB without MS2830A-008/068, or Preamp: Off without MS2830A-067, or Microwave Preselector Bypass: Off, after Preselector Auto Tune ±1.0 dB (9 kHz ≤ f < 300 kHz) ±0.35 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.5 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Spurious) ±1.5 dB (6 GHz < f ≤ 13.8 GHz) ±2.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±2.5 dB (26.5 GHz < f ≤ 40 GHz) ±2.5 dB (typ., 40 GHz < f ≤ 43 GHz) with MS2830A-008, Preamp: On ±0.65 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) with MS2830A-068, or Preamp: On without MS2830A-067, or Microwave Preselector Bypass: Off, after Preselector Auto Tune ±0.65 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Spurious) ±2.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.5 dB (26.5 GHz < f ≤ 40 GHz) ±3.5 dB (nominal, 40 GHz < f ≤ 43 GHz)
1 dB Gain Compression	without MS2830A-008/068, or Preamp: Off, at Mixer input level ≥+3 dBm (300 MHz ≤ f ≤ 4 GHz) ≥–1 dBm (4 GHz < f ≤ 13.5 GHz) ≥–1 dBm (13.5 GHz < f ≤ 26.5 GHz) ≥–1 dBm (nominal, 26.5 GHz < f ≤ 40 GHz) with MS2830A-068, Preamp: On, at Preamp input level ≥–15 dBm (300 MHz ≤ f ≤ 4 GHz) ≥–21 dBm (4 GHz < f ≤ 13.5 GHz) ≥–21 dBm (13.5 GHz < f ≤ 26.5 GHz) ≥–21 dBm (nominal, 26.5 GHz < f ≤ 40 GHz)

Spurious Responses

<table>
<tr><td>Second Harmonic Distortion</td><td>
without MS2830A-008/068, without MS2830A-067
Mixer input level: –30 dBm
<table>
<tr><th>Harmonic distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–60 dBc</td><td>≥+30 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(300 MHz < f ≤ 1 GHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(1 GHz < f ≤ 2 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(1 GHz < f < 1.75 GHz, Frequency band mode: Spurious)</td></tr>
</table>
Mixer input level: –10 dBm
<table>
<tr><th>Harmonic distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>≤–90 dBc</td><td>≥+80 dBm</td><td>(3 GHz < f ≤ 13.25 GHz)</td></tr>
<tr><td>≤–90 dBc</td><td>≥+80 dBm</td><td>(13.25 GHz < f ≤ 21.5 GHz, nominal)</td></tr>
</table>
with MS2830A-068, Preamp: Off, or with MS2830A-067, Microwave Preselector Bypass: Off
Mixer input level: –30 dBm
<table>
<tr><th>Harmonic distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–60 dBc</td><td>≥+30 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(300 MHz < f ≤ 1 GHz)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(1 GHz < f ≤ 2 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–65 dBc</td><td>≥+35 dBm</td><td>(1 GHz < f < 1.75 GHz, Frequency band mode: Spurious)</td></tr>
</table>
Mixer input level: –10 dBm
<table>
<tr><th>Harmonic distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(2 GHz < f ≤ 3 GHz, Frequency band mode: Normal)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(1.75 GHz ≤ f ≤ 3 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(2 GHz < f ≤ 3 GHz, Frequency band mode: Spurious)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(3 GHz < f ≤ 13.25 GHz)</td></tr>
<tr><td>≤–70 dBc</td><td>≥+60 dBm</td><td>(13.25 GHz < f ≤ 21.5 GHz, nominal)</td></tr>
</table>
with MS2830A-008/068, Preamp: On, with MS2830A-067, Microwave Preselector Bypass: Off
Preamp input level: –45 dBm
<table>
<tr><th>Harmonic distortion</th><th>SHI</th><th></th></tr>
<tr><td>≤–50 dBc</td><td>≥+5 dBm</td><td>(10 MHz ≤ f ≤ 300 MHz)</td></tr>
<tr><td>≤–55 dBc</td><td>≥+10 dBm</td><td>(300 MHz < f ≤ 2 GHz)</td></tr>
<tr><td>≤–45 dBc</td><td>≥0 dBm</td><td>(2 GHz < f ≤ 13.25 GHz)</td></tr>
<tr><td>≤–40 dBc</td><td>≥–5 dBm</td><td>(13.25 GHz < f < 21.5 GHz, nominal)</td></tr>
</table>
SHI: Second Harmonic Intercept
</td></tr>
<tr><td>Residual Responses</td><td>Frequency: ≥1 MHz, Input attenuator: 0 dB, 50Ω terminated
with MS2830A-077/078, except bandwidth setting: >31.25 GHz
≤–100 dBm (up to 1 GHz)
≤–90 dBm (typ., 1 GHz to 6 GHz)
≤–90 dBm (nominal, 6 GHz to 13.5 GHz)
≤–90 dBm (nominal, 13.25 GHz to 26.5 GHz)
≤–80 dBm (nominal, 26.5 GHz to 40 GHz)</td></tr>
</table>

● Spectrum Analyzer

Frequency

Span	Range: 0 Hz, 300 Hz to 26.5 GHz [MS2830A-044] 0 Hz, 300 Hz to 43 GHz [MS2830A-045] Resolution: 2 Hz Accuracy: ±0.2% (Sweep points: 10001)
Frequency Readout Accuracy	± (Display frequency × Frequency reference accuracy + Span frequency × Span accuracy + RBW × 0.05 + 2 × N + Span frequency/(Sweep points–1)) Hz N: Mixer harmonic order
Resolution Bandwidth (RBW)	Setting range: 1 Hz to 3 MHz (1-3 sequence), 50 kHz, 5 MHz, 10 MHz, 20 MHz, 31.25 MHz 1 Hz to 10 Hz: Can not be set when Span: 0 Hz 31.25 MHz: Can be set when Span: 0 Hz only 20 MHz, 31.25 MHz: Can be set when with MS2830A-005, Can not be set when with MS2830A-009 Selectivity (–60 dB/–3 dB): 4.5:1 (nominal, 1 Hz to 10 MHz)
Resolution Bandwidth (CISPR RBW)	with MS2830A-016 Setting range: 200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Impulse)
Video Bandwidth (VBW)	1 Hz to 3 kHz (1-3 sequence), 5 kHz, 10 kHz to 10 MHz (1-3 sequence), Off VBW mode: Video average, Power average

Amplitude

Displayed Average Noise Level (DANL)	18° to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB without MS2830A-067/068, Frequency band mode: Normal –134 dBm/Hz (100 kHz) –144 dBm/Hz (1 MHz) –153 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –144 dBm/Hz (4 GHz < f ≤ 6 GHz) –151 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –149 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –146 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –146 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –144 dBm/Hz (34 GHz < f ≤ 40 GHz) –140 dBm/Hz (40 GHz < f ≤ 43 GHz) without MS2830A-067, with MS2830A-068, Preamp: Off, Frequency band mode: Normal –134 dBm/Hz (100 kHz) –144 dBm/Hz (1 MHz) –153 dBm/Hz (30 MHz ≤ f < 1 GHz) –150 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –147 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –144 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –144 dBm/Hz (4 GHz < f ≤ 6 GHz) –147 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –145 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –141 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –141 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –135 dBm/Hz (34 GHz < f ≤ 40 GHz) –132 dBm/Hz (40 GHz < f ≤ 43 GHz) without MS2830A-067, or Microwave Preselector Bypass: Off with MS2830A-068, Preamp: On, Frequency band mode: Normal –147 dBm/Hz (nominal, 100 kHz) –156 dBm/Hz (1 MHz) –163 dBm/Hz (30 MHz ≤ f < 1 GHz) –161 dBm/Hz (1 GHz ≤ f < 2 GHz) –159 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –155 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –155 dBm/Hz (4 GHz < f ≤ 6 GHz) –160 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –158 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –156 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –156 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –150 dBm/Hz (34 GHz < f ≤ 40 GHz) –147 dBm/Hz (40 GHz < f ≤ 43 GHz) with MS2830A-067: See Microwave Preselector Bypass (Displayed average noise level)
Total Absolute Amplitude Accuracy* ∗: Total absolute amplitude accuracy is found from root sum of squares (RSS) of RF frequency characteristics, Linearity error, and Input attenuator switching uncertainty.	18° to 28°C, after CAL, Auto sweep time select: Normal, 30 Hz ≤ RBW ≤ 1 MHz, Detector: Positive, CW Excluding the noise floor effect, and FFT runtime (Display: On) without MS2830A-068, or Preamp: Off Input attenuator: ≥10 dB, Input level: ≤–10 dBm (f: <30 MHz), Mixer input level: ≤–10 dBm (f: ≥30 MHz) ±0.5 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ±1.8 dB (6 GHz < f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.8 GHz, Frequency band mode: Spurious) ±3.0 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.0 dB (26.5 GHz < f ≤ 40 GHz) ±3.5 dB (nominal, 40 GHz < f ≤ 43 GHz) with MS2830A-068, Preamp: On Input attenuator: 10 dB, Preamp Input level: ≤–30 dBm ±1.0 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ±2.0 dB (6 GHz < f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.8 GHz, Frequency band mode: Spurious) ±3.0 dB (13.8 GHz < f ≤ 26.5 GHz) ±4.0 dB (26.5 GHz < f ≤ 40 GHz) ±4.0 dB (nominal, 40 GHz < f ≤ 43 GHz)

Spurious Responses

2-tone 3rd-order Intermodulation Distortion	18° to 28°C, ≥300 kHz separation without MS2830A-068, or Preamp: Off, Mixer input level: –15 dBm (1wave) ≤–54 dBc, TOI = +12 dBm (30 MHz ≤ f < 300 MHz) ≤–60 dBc, TOI = +15 dBm (300 MHz ≤ f < 3.5 GHz) ≤–58 dBc, TOI = +14 dBm (3.5 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) ≤–56 dBc, TOI = +13 dBm (6 GHz < f ≤ 13.5 GHz) ≤–56 dBc, TOI = +13 dBm (13.5 GHz < f ≤ 26.5 GHz) ≤–56 dBc, TOI = +13 dBm (nominal, 26.5 GHz < f ≤ 40 GHz) with MS2830A-068, Preamp: On without MS2830A-067, Microwave Preselector Bypass: Off, Preamp input level: –45 dBm (1wave) ≤–73 dBc, TOI = –8.5 dBm (30 MHz ≤ f < 300 MHz) ≤–78 dBc, TOI = –6 dBm (300 MHz ≤ f ≤ 700 MHz) ≤–81 dBc, TOI = –4.5 dBm (700 MHz < f < 4 GHz, Frequency band mode: Normal) (700 MHz < f < 3.5 GHz, Frequency band mode: Spurious) ≤–78 dBc, TOI = –6 dBm (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ≤–70 dBc, TOI = –10 dBm (6 GHz < f ≤ 13.5 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.5 GHz, Frequency band mode: Spurious) ≤–70 dBc, TOI = –10 dBm (13.5 GHz < f ≤ 26.5 GHz) ≤–70 dBc, TOI = –10 dBm (nominal, 26.5 GHz < f ≤ 40 GHz) TOI: Third-order intermodulation distortion
Image Responses	ATT mode: M-ATT only mode, Frequency band mode: Normal without MS2830A-067 ≤–70 dBc (10 MHz ≤ f < 4 GHz) ≤–55 dBc (4 GHz ≤ f ≤ 6 GHz) ≤–70 dBc (6 GHz < f ≤ 13.5 GHz) ≤–70 dBc (13.5 GHz < f ≤ 26.5 GHz) with MS2830A-067: See Microwave Preselector Bypass (Image responses)

Sweep

Sweep Mode	Continuous, Single
Sweep Time	Setting range:1 ms to 1000 s (Span: ≥300 Hz) 1 µs to 1000 s (Span: 0 Hz)

Waveform Display

Detector	Positive & Negative, Positive peak, Sample, Negative peak, RMS
CISPR Detector	Quasi-Peak, CISPR-AVG, RMS-AVG (with MS2830A-016)
Sweep (Trace) Point	5001, 10001 (Span: >30 GHz) 1001, 2001, 5001, 10001 (500 MHz < Span ≤ 30 GHz) 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001(100 MHz < Span ≤ 500 MHz) (300 Hz ≤ Span ≤ 100 MHz, Sweep time: > 10 s) 11, 21, 41, 51, 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001(300 Hz ≤ Span ≤ 100 MHz, Sweep time: ≤ 10 s) (Span: 0 Hz)
Scale	Log scale: 10 div/12 div, 0.1 to 20 dB/div (1-2-5 sequence) Linear scale: 10 div, 1 to 10%/div (1-2-5 sequence)
Trigger	Free run (Trigger off), Video, Wide IF video, External, Frame
Gate	Off, Wide IF video, External, Frame

Measure Function

Adjust Channel Power (ACP)		Reference: Span total, Carrier total, Both sides of carriers, Carrier select Adjust channel specifications: 3 channels × 2 (Normal Mode), 8 channels × 2 (Advanced Mode)
Burst Average Power		Displayed average power of specified interval at time domain
Channel Power		Measurement of absolute values: dBm, dBm/Hz
Occupied Bandwidth (OBW)		N% of power, X-dB down
Spectrum Emission Mask (SEM)		Decision to Pass/Fail at Peak/Margin measurement
Spurious Emission		Decision to Pass/Fail at Worst/Peaks measurement
Frequency Counter	Accuracy	Span: ≤1 MHz, RBW: 1 kHz, S/N: ≥50 dB, Gate time: ≥100 ms ± (Marker frequency × Frequency reference accuracy + (0.1 × N / Gate time [s] Hz) N: Mixer harmonic order
	Gate Time Setting	100 µs to 1 s
2-tone 3rd-order Intermodulation Distortion		Measures IM3 and TOI from two-tone signal

• **Signal Analyzer**

Display waveform data, such as Spectrum, Power vs. Time captured at specific time

General

Trace Mode	Spectrum, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Spectrogram, No Trace
Analysis Bandwidth	Sets capture analysis bandwidth from center frequency 1 kHz to 10 MHz (1-2.5-5 sequence) (with MS2830A-006) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz (with MS2830A-005, or with MS2830A-009) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz (with MS2830A-077) 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz, 50 MHz, 62.5 MHz, 100 MHz, 125 MHz (with MS2830A-078) *MS2830A-005 is not available when MS2830A-045 is installed.
Sampling Rate	Auto setting by conditions of analysis bandwidth 2 kHz to 20 MHz (1-2-5 sequence) (with MS2830A-006) 2 kHz to 50 MHz (1-2-5 sequence) (with MS2830A-005, or with MS2830A-009) 2 kHz to 100 MHz (1-2-5 sequence) (with MS2830A-077) 2 kHz to 200 MHz (1-2-5 sequence) (with MS2830A-078)
Capture Time	without MS2830A-077/078, or ≤31.25 MHz bandwidth Setting capture time length Minimum capture time length: 2 µs to 50 ms (Determined according to analysis bandwidth) Maximum capture time length: 2 s to 2000 s (Determined according to analysis bandwidth) Setting mode: Auto, Manual with MS2830A-077, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 1 µs Maximum capture time length: 500 ms Setting mode: Auto, Manual with MS2830A-078, >31.25 MHz bandwidth Setting capture time length Minimum capture time length: 500 ns to 1 µs (Determined according to analysis bandwidth) Maximum capture time length: 500 ms Setting mode: Auto, Manual
Trigger	Free run (Trigger off), Video, Wide IF video, Frame, External
ADC Resolution	without MS2830A-077/078, or ≤31.25 MHz bandwidth 16 bits

Spectrum Displayed Function

Function Outline	Displayed spectrum of any time length and frequency range within captured waveform data
Analysis Time Length	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Can be set Center frequency and Span at frequency range in waveform data
Frequency Setting	without MS2830A-077/078, or ≤31.25 MHz bandwidth 0 MHz to 26.5 GHz [MS2830A-044] 0 MHz to 43 GHz [MS2830A-045] with MS2830A-077/078, without MS2830A-067, >31.25 MHz bandwidth 300 MHz to 6 GHz [MS2830A-044] 300 MHz to 6 GHz [MS2830A-045] with MS2830A-077/078, MS2830A-067, >31.25 MHz bandwidth 300 MHz to 26.5 GHz [MS2830A-044] 300 MHz to 43 GHz [MS2830A-045]
Resolution Bandwidth (RBW)	without MS2830A-077/078, or ≤31.25 MHz bandwidth Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS2830A-077, >31.25 MHz bandwidth Setting range: 1 Hz to 3 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal) with MS2830A-078, >31.25 MHz bandwidth Setting range: 1 Hz to 10 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)

Continued on next page

Total Absolute Amplitude Accuracy* *: Total absolute amplitude accuracy is found from root sum of squares (RSS) of RF frequency characteristics, Linearity error, and Input attenuator switching uncertainty.	18° to 28°C, after CAL, Input attenuator: ≥10 dB, RBW: Auto, Time detection: Average, Marker result: Integration or Peak (Accuracy), Center frequency, CW Excluding the noise floor effect without MS2830A-068, or Preamp: Off Input attenuator: ≥10 dB, Input level: ≤–10 dBm (f: <30 MHz), Mixer input level: ≤–10 dBm (f: ≥30 MHz) ±0.5 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ±1.8 dB (6 GHz < f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.8 GHz, Frequency band mode: Spurious) ±3.0 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.0 dB (26.5 GHz < f ≤ 40 GHz) ±3.5 dB (nominal, 40 GHz < f ≤ 43 GHz) with MS2830A-068, Preamp: On Input attenuator: 10 dB, Preamp Input level: ≤–30 dBm ±1.0 dB (300 kHz ≤ f < 4 GHz, Frequency band mode: Normal) (300 kHz ≤ f < 3.5 GHz, Frequency band mode: Spurious) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz, Frequency band mode: Normal) (3.5 GHz ≤ f ≤ 4 GHz, Frequency band mode: Spurious) ±2.0 dB (6 GHz < f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz < f ≤ 13.8 GHz, Frequency band mode: Spurious) ±3.0 dB (13.8 GHz < f ≤ 26.5 GHz) ±4.0 dB (26.5 GHz < f ≤ 40 GHz) ±4.0 dB (nominal, 40 GHz < f ≤ 43 GHz)
In-band Frequency Characteristics	18° to 28°C, Referenced to level at center frequency, Center frequency: ±10 MHz Without MS2830A-077/078, or ≤31.25 MHz bandwidth ±0.31 dB (30 MHz ≤ f ≤ 4 GHz, Frequency band mode: Normal) (30 MHz ≤ f < 3.5 GHz, Frequency band mode: Spurious)
Displayed Average Noise Level (DANL)	without MS2830A-067/068, Frequency band mode: Normal –131.5 dBm/Hz (100 kHz) –141.5 dBm/Hz (1 MHz) –150.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –147.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –144.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –141.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –141.5 dBm/Hz (4 GHz < f ≤ 6 GHz) –148.5 dBm/Hz (6 GHz ≤ f ≤ 13.5 GHz) –146.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –143.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –143.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –141.5 dBm/Hz (34 GHz < f ≤ 40 GHz) –137.5 dBm/Hz (40 GHz < f ≤ 43 GHz) without MS2830A-067, with MS2830A-068, Preamp: Off, Frequency band mode: Normal –131.5 dBm/Hz (100 kHz) –141.5 dBm/Hz (1 MHz) –150.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –147.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –144.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –141.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –141.5 dBm/Hz (4 GHz < f ≤ 6 GHz) –144.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –142.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –138.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –138.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –132.5 dBm/Hz (34 GHz < f ≤ 40 GHz) –129.5 dBm/Hz (40 GHz < f ≤ 43 GHz) without MS2830A-067, with MS2830A-068, Preamp: On, Frequency band mode: Normal –144.5 dBm/Hz (nominal, 100 kHz) –153.5 dBm/Hz (1 MHz) –160.5 dBm/Hz (30 MHz ≤ f < 1 GHz) –158.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –156.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –152.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –152.5 dBm/Hz (4 GHz < f ≤ 6 GHz) –157.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –155.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –153.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –153.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –147.5 dBm/Hz (34 GHz < f ≤ 40 GHz) –144.5 dBm/Hz (40 GHz < f ≤ 43 GHz) with MS2830A-067: See Microwave Preselector Bypass (Displayed average noise level)
Adjacent Channel Power (ACP)	Reference: Span total, Carrier total, Both sides of carriers, Carrier select Adjacent channel specifications: 3 channels × 2
Channel Power	Measurement of absolute values: dBm, dBm/Hz
Occupied Bandwidth (OBW)	N% of Power, X-dB Down

Power vs. Time Displayed Function

Function Outline	Displayed time changes of power for captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time position from beginning of waveform data Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Resolution Bandwidth	Filter type: Rect, Gaussian, Nyquist, Root Nyquist, Off, (Default: Off) Roll-off ratio: 0.01 to 1 (Set for Nyquist, Root Nyquist) Filter frequency offset: Set center frequency of filter in wavelength data frequency band
AM Depth (Peak to Peak measurement)	Measures with AM Depth or marker function +Peak, –Peak, (P-P)/2, Average
Burst Average Power	Measures average power of burst signal

Frequency vs. Time Displayed Function

Function Outline	Displayed frequency time fluctuations of input signal from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Operating Level Range	–17 to +30 dBm (Input attenuator: ≥10 dB)
Frequency (Vertical axis)	Can be set Center frequency and Span at frequency range in waveform data Displayed frequency range: Selectable 1/25, 1/10, 1/5, 1/2 of analysis bandwidth Input frequency range: 10 MHz to 6 GHz
Frequency Readout Accuracy	Input level: –17 to +30 dBm, Span: ≤31.25 MHz, Scale: Span/25, CW input ± (Reference oscillator accuracy × Center frequency + Displayed frequency range × 0.01) Hz
FM Deviation (Peak to Peak measurement)	Measures FM Deviation or marker function +Peak, –Peak, (P-P)/2, Average

Phase vs. Time Displayed Function

Function Outline	Displayed phase time fluctuation of input signal from captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Phase (Vertical axis)	Display mode: Wrap, Unwrap Displayed phase range: 0.01 deg./div to 200 Gdeg./div Offset: –100 deg. to +100 Mdeg.

CCDF/APD Displayed Function

Function Outline	Displayed CCDF and APD of waveform date within a given length of time
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Display	Displayed CCDF or APD as graphs Histogram resolution: 0.01 dB Value: Average power, Max. power, Crest factor
Resolution Bandwidth	Filter type: Rectangle, Off, (Default: Off) Filter frequency offset: Sets filter center frequency in frequency band of waveform data

Spectrogram Displayed Function

Function Outline	Displayed spectrogram for arbitrary time length in captured waveform data
Analysis Time Range	Analysis start time: Sets analysis start time point from waveform data header Analysis time length: Sets analysis time length Setting mode: Auto, Manual
Frequency	Can be set Center frequency and Span at frequency range in waveform data
Resolution Bandwidth (RBW)	Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity (–60 dB/–3 dB): 4.5:1 (nominal)

Digitize Function

Function Outline	Captured waveform data saved to internal HDD or output to external devices
Waveform Data	Format: I, Q (each 32 bit, Float binary type) Level: 0 dBm input is $\sqrt{(I^2 + Q^2)} = 1$ Level accuracy: Same as signal analyzer absolute amplitude accuracy
External Output	Can be output to external PC via Ethernet

Replay Function

Function Outline	Captured waveforms can be replayed again by using the VSA function to read saved digitize data
Conditions for Measurable Waveform Data	Format: I, Q (binary format) Combination of Span, Sampling rate, and Minimum capture sample

Span	Sampling rate	Minimum capture sample
1 kHz	2 kHz	74000 (37 s)
2.5 kHz	5 kHz	160000 (32 s)
5 kHz	10 kHz	310000 (31 s)
10 kHz	25 kHz	610000 (30.5 s)
25 kHz	50 kHz	730000 (14.6 s)
50 kHz	100 kHz	730000 (7.3 s)
100 kHz	200 kHz	730000 (3.65 s)
250 kHz	500 kHz	730000 (1.46 s)
500 kHz	1 MHz	730000 (730 ms)
1 MHz	2 MHz	730000 (365 ms)
2.5 MHz	5 MHz	730000 (146 ms)
5 MHz	10 MHz	730000 (73 ms)
10 MHz	20 MHz	730000 (36.5 ms)
18.6 MHz	20 MHz	730000 (36.5 ms)
20 MHz	25 MHz	730000 (29.2 ms)
25 MHz	50 MHz	730000 (14.6 ms)
31.25 MHz	50 MHz	730000 (14.6 ms)
50 MHz	100 MHz	730000 (7.3 ms)
62.5 MHz	100 MHz	730000 (7.3 ms)
100 MHz	200 MHz	730000 (3.65 ms)
125 MHz	200 MHz	730000 (3.65 ms)

• Connector

Connector

RF Input	18° to 28°C, Input attenuator: ≥10 dB with MS2830A-044 Connector: N-J (Front panel), 50Ω (nominal) VSWR :≤1.2 (nominal, 40 MHz ≤ f ≤ 3 GHz) ≤1.5 (nominal, 3 GHz < f ≤ 6 GHz) ≤1.6 (nominal, 6 GHz < f ≤ 13.5 GHz) ≤1.9 (nominal, 13.5 GHz < f ≤ 26.5 GHz) with MS2830A-045 Connector: K-J (Front panel), 50Ω (nominal) VSWR :≤1.2 (nominal, 40 MHz ≤ f ≤ 3 GHz) ≤1.3 (nominal, 3 GHz < f ≤ 6 GHz) ≤1.3 (nominal, 6 GHz < f ≤ 13.5 GHz) ≤1.4 (nominal, 13.5 GHz < f ≤ 26.5 GHz) ≤1.6 (nominal, 26.5 GHz < f ≤ 40 GHz) ≤1.6 (Reference data, 40 GHz < f ≤ 43 GHz, V-K converter mounted and included)
External Reference Input	Connector: BNC-J (Rear panel), 50Ω (nominal) Frequency: 5, 10, 13 MHz Operating range: ±1 ppm Input level: –15 to +20 dBm, 50Ω (AC coupling)
Reference Signal Output	Connector: BNC-J (Rear panel), 50Ω (nominal) Frequency: 10 MHz Output level: ≥0 dBm (AC coupling)
Sweep Status Output	Connector: BNC-J (Rear panel) Output level: TTL level (High level at sweeping or waveform capture)
SA Trigger Input	Connector: BNC-J (Rear panel) Output level: TTL level
Noise Source Drive	This is available when the Option 017/117 is installed. Supply (+28 V) of the Noise Source Drive. Rear Panel, BNC-J Output Voltage: 28 ±0.5 V, Pulsed
External Controller	Control from external controller (excluding power-on/off)
Ethernet (10/100/1000BASE-T)	Connector: RJ-45 (Rear panel)
GPIB	IEEE488 bus connector (IEEE488.2, Rear panel) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
USB (B)	USB-B connector (USB2.0, Rear panel)
USB	USB-A connector (USB2.0, Front panel: 2 ports, Rear panel: 2 ports)
Monitor Output	Mini D-Sub 15 pin (Compatible with VGA, Rear panel)
Aux	50 pin (Correspond to DX10A-50S, Rear panel), Using extended input/output
IF Output*	Connector: SMA-J (Rear panel), 50Ω (nominal) Frequency: 1875 MHz Gain: –10 dB (nominal, Input attenuator: 0 dB, Input frequency: 10 GHz)

Continued on next page

<table>
<tr><td>1st Local Output*</td><td>Connector: SMA-J (Front panel), 50Ω (nominal)
Frequency: 5 GHz to 10 GHz (Local signal output), 1875 MHz (IF signal frequency)
Gain: –10 dB (nominal, Input attenuator: 0 dB, Input frequency: 10 GHz)</td></tr>
<tr><td>Display</td><td>XGA-color LCD (Resolution: 1024 × 768), 8.4 inches (Diagonal: 213 mm)</td></tr>
<tr><td>External Mixer*</td><td>Frequency
Frequency range: 26.5 GHz to 110 GHz
Frequency bands:
<table>
<tr><th>Band</th><th>Frequency range</th><th>Mixer harmonics order (N)</th></tr>
<tr><td>A</td><td>26.5 GHz to 40 GHz</td><td>4+</td></tr>
<tr><td>Q</td><td>33 GHz to 50 GHz</td><td>5+</td></tr>
<tr><td>U</td><td>40 GHz to 60 GHz</td><td>6+</td></tr>
<tr><td>V</td><td>50 GHz to 75 GHz</td><td>8+</td></tr>
<tr><td>E</td><td>60 GHz to 90 GHz</td><td>9+</td></tr>
<tr><td>W</td><td>75 GHz to 110 GHz</td><td>11+</td></tr>
<tr><td>F</td><td>90 GHz to 140 GHz</td><td>14+</td></tr>
<tr><td>D</td><td>110 GHz to 170 GHz</td><td>17+</td></tr>
<tr><td>G</td><td>140 GHz to 220 GHz</td><td>22+</td></tr>
<tr><td>Y</td><td>170 GHz to 260 GHz</td><td>26+</td></tr>
<tr><td>J</td><td>220 GHz to 325 GHz</td><td>33+</td></tr>
</table>
Amplitude
Mixer conversion loss
Setting range: 0 to 99.9 dB
Maximum input level, Average noise level, Frequency response: Depends on External mixer
Input/Output
Applicable mixer: 2-port mixer only
Local frequency: 5 GHz to 10 GHz
IF Frequency: 1875 MHz</td></tr>
</table>

*: With MS2830A-044/045 only

● General

Dimensions and Mass	426 (W) × 177 (H) × 390 (D) mm (Exclusive of surface projection) ≤15 kg (excluding other options)
Power Supply	Power voltage: 100 V(ac) to 120 V(ac) / 200 V(ac) to 240 V(ac) Frequency: 50 Hz/60 Hz Power consumption: 190 VA (nominal, excluding other options)
Temperature Range	Operating: +5° to +45°C, Storage: –20° to +60°C
EMC	EN61326-1, EN61000-3-2

● MS2830A-001 Rubidium Reference Oscillator

Generates 10 MHz reference signal with higher frequency stability.

Frequency

Internal Reference Oscillator	See Signal Analyzer/Spectrum Analyzer (Internal reference oscillator)

● MS2830A-006 Analysis Bandwidth 10 MHz

This option adds a function to analyze 10 MHz bandwidth.

● MS2830A-005 Analysis Bandwidth Extension to 31.25 MHz

This option adds a function to analyze 31.25 MHz bandwidth. (Require Opt. 006)
MS2830A-005 is not available when MS2830A-045 is installed.

● MS2830A-009 Bandwidth Extension to 31.25 MHz for Millimeter-wave

This option adds a function to analyze 31.25 MHz bandwidth (Require Opt. 006).
MS2830A-009 is available when MS2830A-045 is installed.
Cannot be set the RBW to more than 10 MHz in spectrum analyzer function.

● MS2830A-008 Preamplifier

This option amplifies signal prior to mixer to enhance sensitivity.
Cannot install simultaneously with MS2830A-068.

Frequency

Frequency Range	100 kHz to 6 GHz

Amplitude

Level Measurement Range	See Signal Analyzer/Spectrum Analyzer (Level measurement range)
Maximum Input Level	See Signal Analyzer/Spectrum Analyzer (Maximum input level)
Displayed Average Noise Level (DANL)	See Spectrum Analyzer, Signal Analyzer (Displayed average noise level (DANL))
RF Frequency Characteristics	See Signal Analyzer/Spectrum Analyzer (RF frequency characteristics)
Input Attenuator Switching Uncertainty	See Signal Analyzer/Spectrum Analyzer (Input attenuator switching uncertainty)
Linearity Error	See Signal Analyzer/Spectrum Analyzer (Linearity error)
Second Harmonic Distortion	See Signal Analyzer/Spectrum Analyzer (Second harmonic distortion)
1 dB Gain Compression	See Signal Analyzer/Spectrum Analyzer (1 dB gain compression)
2-tone 3rd-order Intermodulation Distortion	See Spectrum Analyzer (2-tone 3rd-order intermodulation distortion)

• MS2830A-010 Phase Noise Measurement Function

Displays the phase noise characteristics on a logarithmic scale

Frequency

Frequency Range	10 MHz to Upper frequency limit
Offset Frequency Range	10 Hz to 10 MHz
Marker Mode	Normal, Integral Noise, RMS Noise, Jitter, Residual FM

• MS2830A-011 2ndary HDD

This option adds a removable HDD for storing user data.

• MS2830A-016 Precompliance EMI Function

Adds the Detection mode and the Resolution bandwidth for EMI measurement to the Spectrum Analyzer function.

Resolution Bandwidth (RBW)	Setting range: 200 Hz (6 dB), 9 kHz (6 dB), 120 kHz (6 dB), 1 MHz (Impulse)
Detector	Quasi-Peak, CISPR-AVG, RMS-AVG

• MS2830A-017 Noise Figure Measurement Function*

Frequency

Frequency Range	MS2830A-044 (MS2830A-068/168 is not installed): 30 MHz to 6 GHz MS2830A-044 (MS2830A-068/168 is installed): 30 MHz to 26.5 GHz MS2830A-045 (MS2830A-068/168 is not installed): 30 MHz to 6 GHz MS2830A-045 (MS2830A-068/168 is installed): 30 MHz to 40 GHz
Frequency Setting Range	MS2830A-044: 10 MHz to 26.5 GHz MS2830A-045: 10 MHz to 43 GHz

NF Measurement

Measurement Range	Within the frequency range (Attenuator = 0 dB, Pre-Amp = On) – 20 to +40 dB
Instrument Uncertainty	Within the measurement range ENR: 4 to 7 dB ±0.02 dB ENR: 12 to 17 dB ±0.025 dB ENR: 20 to 22 dB ±0.03 dB

GAIN Measurement

Measurement Range	Within the frequency range –20 to +40 dB
Instrument Uncertainty	Within the measurement range ≤0.07

Resolution Bandwidth

Setting Range	100 kHz to 8 MHz

Connector

Noise Source	Connector: Rear Panel, BNC-J Output Voltage: 28 ±0.5 V, Pulsed

*: Recommending the NC346 Series noise sources by Noisecom company

• MS2830A-068 Microwave Preamplifier

This option amplifies signal prior to mixer to enhance sensitivity.
Cannot install simultaneously with MS2830A-008.
When Opt. 168 is added to MS2830A (with Opt. 008), only Opt. 168 becomes available.

Frequency

Frequency Range	100 kHz to 26.5 GHz [MS2830A-044] 100 kHz to 43 GHz [MS2830A-045]

Amplitude

Level Measurement Range	See Signal Analyzer/Spectrum Analyzer (Level measurement range)
Maximum Input Level	See Signal Analyzer/Spectrum Analyzer (Maximum input level)
Displayed Average Noise Level (DANL)	See Spectrum Analyzer, Signal Analyzer (Displayed average noise level (DANL))
RF Frequency Characteristics	See Signal Analyzer/Spectrum Analyzer (RF frequency characteristics)
Input Attenuator Switching Uncertainty	See Signal Analyzer/Spectrum Analyzer (Input attenuator switching uncertainty)
Linearity Error	See Signal Analyzer/Spectrum Analyzer (Linearity error)
Second Harmonic Distortion	See Signal Analyzer/Spectrum Analyzer (Second harmonic distortion)
1 dB Gain Compression	See Signal Analyzer/Spectrum Analyzer (1 dB gain compression)
2-tone 3rd-order Intermodulation Distortion	See Spectrum Analyzer (2-tone 3rd-order intermodulation distortion)

• MS2830A-067 Microwave Preselector Bypass

Bypasses the preselector to improve the RF frequency characteristics and the in-band frequency characteristics.
Add MS2830A-067 when using the signal analyzer measurement functions at bandwidth: >31.25 MHz and frequency: >6 GHz.
When the preselector option is set to On, the image response elimination filter is bypassed.
Therefore, this function is not appropriate for spurious measurement to receive the image response.
Microwave Preselector Bypass: On (with MS2830A-067), Microwave Preselector Bypass: Off (with special directions)

Frequency

Frequency Range	4 GHz to 26.5 GHz [MS2830A-044] 4 GHz to 43 GHz [MS2830A-045]

Amplitude

Frequency Characteristics	18° to 28°C, after CAL, Input attenuator: 10 dB, Microwave Preselector Bypass: On without MS2830A-068, Preamp: Off ±1.0 dB (6 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Spurious) ±1.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±2.0 dB (26.5 GHz < f ≤ 40 GHz) ±2.0 dB (typ., 40 GHz < f ≤ 43 GHz) with MS2830A-068, Preamp: On ±1.8 dB (6 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Normal) (4 GHz ≤ f ≤ 13.8 GHz, Frequency band mode: Spurious) ±2.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.0 dB (26.5 GHz < f ≤ 40 GHz) ±3.0 dB (nominal, 40 GHz < f ≤ 43 GHz) *with MS2830A-067, Microwave Preselector Bypass: Off, see Signal Analyzer/Spectrum Analyzer (RF frequency characteristics)
Displayed Average Noise Level (DANL)	18° to 28°C, Detector: Sample, VBW: 1 Hz (Video average), Input attenuator: 0 dB without MS2830A-068, Microwave Preselector Bypass: On, Off –147 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –145 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –141 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –141 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –135 dBm/Hz (34 GHz < f ≤ 40 GHz) –132 dBm/Hz (40 GHz < f ≤ 43 GHz) with MS2830A-068, Preamp: Off, Microwave Preselector Bypass: On, Off –142 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –140 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –136 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –136 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –131 dBm/Hz (34 GHz < f ≤ 40 GHz) –128 dBm/Hz (40 GHz < f ≤ 43 GHz) with MS2830A-068, Preamp: On, Microwave Preselector Bypass: On –154 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –152 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –150 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –150 dBm/Hz (26.5 GHz < f ≤ 34 GHz) –144 dBm/Hz (34 GHz < f ≤ 40 GHz) –141 dBm/Hz (40 GHz < f ≤ 43 GHz)
Image Responses	with MS2830A-067, Microwave Preselector Bypass: Off ≤–60 dBc (6 GHz < f ≤ 13.5 GHz) ≤–60 dBc (13.5 GHz < f ≤ 26.5 GHz) with MS2830A-067, Microwave Preselector Bypass: On Generated at the frequency at the distance of 1875 MHz × 2 0 dBc (nominal, 4 GHz ≤ f ≤ 26.5 GHz) 0 dBc (nominal, 26.5 GHz < f ≤ 43 GHz)

• MS2830A-313 Removable HDD
The MS2830A-313 Removable HDD is useful when a user takes the instrument to an outside company for calibration but wants to protect the security of data in the instrument, such as measurement results, data and main frame settings. In this case, the user removes the regular MS2830A hard disk and replaces it with this product.
Insert into the HDD slot on the rear panel to use.

• MS2830A-077 Analysis Bandwidth Extension to 62.5 MHz
This option adds a function to analyze 62.5 MHz bandwidth.
MS2830A-044: Require MS2830A-006 and MS2830A-005.
MS2830A-045: Require MS2830A-006 and MS2830A-009.

• MS2830A-078 Analysis Bandwidth Extension to 125 MHz
This option adds a function to analyze 125 MHz bandwidth.
MS2830A-044: Require MS2830A-006, MS2830A-005 and MS2830A-077.
MS2830A-045: Require MS2830A-006 MS2830A-009 and MS2830A-077
An image response is received when setting the bandwidth to more than 31.25 MHz.
This can be used when not inputting a signal frequency outside the MS2830A analysis bandwidth (125 MHz max.).
The MS2690A/91A/92A Signal Analyzer series is recommended for other measurement purposes.

General

Analysis Bandwidth	See Signal Analyzer (Analysis bandwidth)
Sampling Rate	See Signal Analyzer (Sampling rate)
Capture Time	See Signal Analyzer (Capture time)
ADC Resolution	with MS2830A-077/078, >31.25 MHz bandwidth 14 bits

Frequency

Frequency Setting	See Signal Analyzer/Spectrum display function (Frequency setting)
Resolution Bandwidth (RBW)	See Signal Analyzer/Spectrum display function(Resolution bandwidth (RBW))

Amplitude

Displayed Average Noise Level (DANL)	18° to 28°C, Input attenuator: 0 dB with MS2830A-077 or 078, >31.25 MHz bandwidth without MS2830A-008/068, or with MS2830A-008/068, Preamp: Off –146.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –143.5 dBm/Hz (1 GHz ≤ f < 2.4 GHz) –140.5 dBm/Hz (2.4 GHz ≤ f ≤ 3.5 GHz) –137.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –137.5 dBm/Hz (4 GHz < f ≤ 6 GHz) with MS2830A-008/068, Preamp: ON –156.5 dBm/Hz (300 MHz ≤ f < 1 GHz) –154.5 dBm/Hz (1 GHz ≤ f < 2 GHz) –152.5 dBm/Hz (2 GHz ≤ f ≤ 3.5 GHz) –148.5 dBm/Hz (3.5 GHz < f ≤ 4 GHz) –148.5 dBm/Hz (4 GHz < f ≤ 6 GHz) 18° to 28°C, Input attenuator: 0 dB with MS2830A-077 or 078, with MS2830A-067, >31.25 MHz bandwidth without MS2830A-068 –137.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –135.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –131.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –131.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) [MS2830A-045] –125.5 dBm/Hz (34 GHz < f ≤ 40 GHz) [MS2830A-045] –122.5 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045] with MS2830A-068, Preamp: Off –132.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –130.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –126.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –126.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) [MS2830A-045] –121.5 dBm/Hz (34 GHz < f ≤ 40 GHz) [MS2830A-045] –118.5 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045] with MS2830A-068, Preamp: On –147.5 dBm/Hz (6 GHz < f ≤ 13.5 GHz) –145.5 dBm/Hz (13.5 GHz < f ≤ 18.3 GHz) –143.5 dBm/Hz (18.3 GHz < f ≤ 26.5 GHz) –143.5 dBm/Hz (26.5 GHz < f ≤ 34 GHz) [MS2830A-045] –137.5 dBm/Hz (34 GHz < f ≤ 40 GHz) [MS2830A-045] –134.5 dBm/Hz (40 GHz < f ≤ 43 GHz) [MS2830A-045]
Image Response	with MS2830A-077/078, >31.25 MHz bandwidth Image Response (Occurs at frequency 200 MHz away): 0 dBc (nominal, 300 MHz < f ≤ 43 GHz) with MS2830A-077/078, MS2830A-067, >31.25 MHz bandwidth Image Response (Occurs at frequency 1875 MHz × 2 away): 0 dBc (nominal, 6 GHz < f ≤ 43 GHz)

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RF Frequency Characteristics	18° to 28°C, after CAL, Input attenuator: 10 dB, Frequency band mode: Normal, >31.25 MHz bandwidth without MS2830A-008/068, or Preamp: Off ±0.35 dB (300 MHz ≤ f < 4 GHz) ±1.5 dB (4 GHz ≤ f ≤ 6 GHz) with MS2830A-008, Preamp: On ±0.65 dB (300 MHz ≤ f < 4 GHz) ±1.8 dB (4 GHz ≤ f ≤ 6 GHz) without MS2830A-068, or Preamp: Off with MS2830A-067, Microwave Preselector Bypass: On ±1.0 dB (6 GHz ≤ f ≤ 13.8 GHz) ±1.5 dB (13.8GHz < f ≤ 26.5 GHz) ±2.0 dB (26.5 GHz < f ≤ 40 GHz) ±2.0 dB (typ., 40 GHz < f ≤ 43 GHz) with MS2830A-068, or Preamp: On with MS2830A-067, Microwave Preselector Bypass: On ±1.8 dB (6 GHz ≤ f ≤ 13.8 GHz) ±2.5 dB (13.8 GHz < f ≤ 26.5 GHz) ±3.0 dB (26.5 GHz < f ≤ 40 GHz) ±3.0 dB (Nominal, 40 GHz < f ≤ 43 GHz)
Linearity Error	See Signal Analyzer/Spectrum Analyzer (Linearity error)

Typical (typ.): Performance not warranted. Must products meet typical performance.
Nominal: Values not warranted. Included to facilitate application of product.
Example: Performance not warranted. Data actually measured by randomly selected measuring instruments.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No	Name
	Main frame
MS2830A	Signal Analyzer
	Standard accessories
	Power Cord: 1 pc
P0031A	USB Memory (≥256 MB, USB2.0 Flash Driver): 1 pc
Z0541A	USB Mouse: 1 pc
	Install CD-ROM (Application software, instruction manual CD-ROM): 1 pc
	Options
MS2830A-044	26.5 GHz Signal Analyzer
MS2830A-045	43 GHz Signal Analyzer
MS2830A-001	Rubidium Reference Oscillator
MS2830A-005[*1]	Analysis Bandwidth Extension to 31.25 MHz
MS2830A-006	Analysis Bandwidth 10 MHz
MS2830A-008	Preamplifier
MS2830A-009[*2]	Bandwidth Extension to 31.25 MHz for Millimeter-wave
MS2830A-010	Phase Noise Measurement Function
MS2830A-011	2ndary HDD
MS2830A-016	Precompliance EMI Function
MS2830A-017	Nose Figure Measurement
MS2830A-067	Microwave Preselector Bypass
MS2830A-068	Microwave Preamplifier
MS2830A-077[*3]	Analysis Bandwidth Extension to 62.5 MHz
MS2830A-078[*4]	Analysis Bandwidth Extension to 125 MHz
MS2830A-313	Removable HDD
	Retrofit options
MS2830A-101	Rubidium Reference Oscillator Retrofit
MS2830A-105[*1]	Analysis Bandwidth Extension to 31.25 MHz Retrofit
MS2830A-106	Analysis Bandwidth 10 MHz Retrofit
MS2830A-108	Preamplifier Retrofit
MS2830A-109[*2]	Bandwidth Extension to 31.25 MHz for Millimeter-wave Retrofit
MS2830A-110	Phase Noise Measurement Function Retrofit
MS2830A-111	2ndary HDD Retrofit
MS2830A-116	Precompliance EMI Function Retrofit
MS2830A-117	Nose Figure Measurement Retrofit
MS2830A-167	Microwave Preselector Bypass Retrofit
MS2830A-168	Microwave Preamplifier Retrofit
	Software options
	CD-ROM with License and Operation manuals
MX269010A[*5]	Mobile WiMAX Measurement Software
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software
MX269013A	GSM/EDGE Measurement Software
MX269013A-001	EDGE Evolution Measurement Software (Requires MX269013A)
MX269015A	TD-SCDMA Measurement Software
MX269017A	Vector Modulation Analysis Software
MX269020A	LTE Downlink Measurement Software
MX269020A-001	LTE-Advanced FDD Downlink Measurement Software (Requires MX269020A)
MX269021A	LTE Uplink Measurement Software
MX269022A	LTE TDD Downlink Measurement Software
MX269023A	LTE TDD Uplink Measurement Software
MX269024A	CDMA2000 Forward Link Measurement Software
MX269026A	EV-DO Forward Link Measurement Software
MX269028A	WLAN (802.11) Measurement Software
MX269028A-001	802.11ac (80 MHz) Measurement Software (For MS2830A. Requires MX269028A.)
MX269030A	W-CDMA BS Measurement Software
MX283027A	Wireless Network Device Test Software
MX283027A-001	WLAN Test Software (Requires MX283027A)
MX283027A-002	*Bluetooth* Test Software (Requires MX283027A)

*1: Opt.005/105 is available when MS2830A-044 is installed.
Requires Opt.006/106.

*2: Opt.009/109 is available when MS2830A-045 is installed.
Requires Opt.006/106

*3: Retrofit not supported.
Requires Opt.006 and Opt.005 (for MS2830A-044).
Requires Opt.006 and Opt.009 (for MS2830A-045).

*4: Retrofit not supported.
Requires Opt.006, Opt.005 and Opt.077 (for MS2830A-044).
Requires Opt.006, Opt.009 and Opt.077 (for MS2830A-045).

*5: Can not be installed in MS2830A-045.

Model/Order No	Name
	– Warranty service –
MS2830A-ES210	2 years Extended Warranty Service
MS2830A-ES310	3 years Extended Warranty Service
MS2830A-ES510	5 years Extended Warranty Service
	– Application parts –
	Following operation manuals provided as hard copy
W3334AE	MS2830A Operation Manual (Mainframe Operation)
W2851AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Mainframe Remote Control)
W3335AE	MS2830A Operation Manual (Signal Analyzer Function Operation)
W2853AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Signal Analyzer Function Remote Control)
W3336AE	MS2830A Operation Manual (Spectrum Analyzer Function Operation)
W2855AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Spectrum Analyzer Function Remote Control)
W3117AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Phase Noise Measurement Function Operation)
W3118AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Phase Noise Measurement Function Remote Control)
W3655AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Noise Figure Measurement Function Operation)
W3656AE	MS2690A/MS2691A/MS2692A and MS2830A Operation Manual (Noise Figure Measurement Function Remote control)
W3098AE	MX269011A Operation Manual (Operation)
W3099AE	MX269011A Operation Manual (Remote Control)
W3060AE	MX269012A Operation Manual (Operation)
W3061AE	MX269012A Operation Manual (Remote Control)
W3100AE	MX269013A Operation Manual (Operation)
W3101AE	MX269013A Operation Manual (Remote Control)
W3044AE	MX269015A Operation Manual (Operation)
W3045AE	MX269015A Operation Manual (Remote Control)
W3305AE	MX269017A Operation Manual (Operation)
W3306AE	MX269017A Operation Manual (Remote Control)
W3014AE	MX269020A Operation Manual (Operation)
W3064AE	MX269020A Operation Manual (Remote Control)
W3015AE	MX269021A Operation Manual (Operation)
W3065AE	MX269021A Operation Manual (Remote Control)
W3209AE	MX269022A Operation Manual (Operation)
W3210AE	MX269022A Operation Manual (Remote Control)
W3521AE	MX269023A Operation Manual (Operation)
W3522AE	MX269023A Operation Manual (Remote Control)
W3201AE	MX269024A Operation Manual (Operation)
W3202AE	MX269024A Operation Manual (Remote Control)
W3203AE	MX269026A Operation Manual (Operation)
W3204AE	MX269026A Operation Manual (Remote Control)
W3528AE	MX269028A Operation Manual (Operation)
W3529AE	MX269028A Operation Manual (Remote Control)
W2860AE	MX269030A Operation Manual (Operation)
W2861AE	MX269030A Operation Manual (Remote Control)
W3471AE	MX283027A Operation Manual (Operation)
W3473AE	MX283027A-001 Operation Manual (Operation)
W3474AE	MX283027A-001 Operation Manual (Remote Control)
W3516AE	MX283027A-002 Operation Manual (Operation)
W3517AE	MX283027A-002 Operation Manual (Remote Control)

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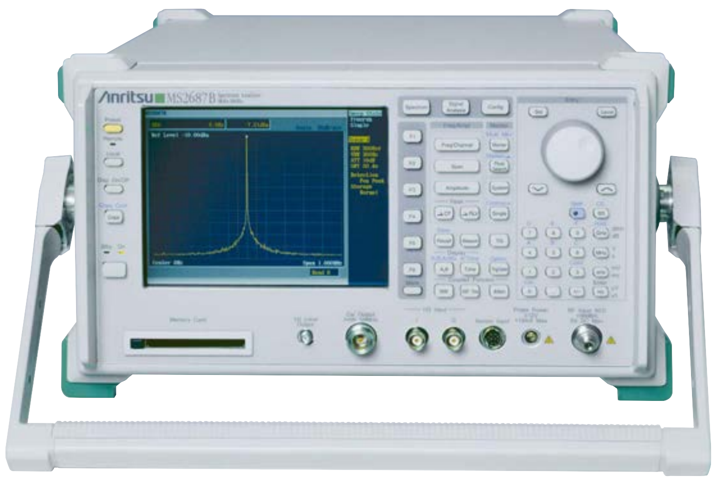
Model/Order No	Name
K240B	Power Divider (K connector, DC to 26.5 GHz, 50Ω, K-J, 1 W max.)
MA1612A	Four-port Junction Pad (5 MHz to 3 GHz, N-J)
MP752A	Termination (DC to 12.4 GHz, 50Ω, N-P)
J1359A	Coaxial Adaptor (K-P · K-J, SMA)
J0576B	Coaxial Cord, 1 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG58A/U · BNC-P)
J0127B	Coaxial Cord, 2 m (BNC-P · RG58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322B	Coaxial Cord, 1 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322C	Coaxial Cord, 1.5 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0322D	Coaxial Cord, 2 m (DC to 18 GHz), (SMA-P · 50Ω SUCOFLEX104 · SMA-P)
J0805	DC Block, N type (MODEL 7003) (10 kHz to 18 GHz, N-P · N-J)
J1554A	DC Block, SMA type (MODEL 7006) (9 kHz to 26.5 GHz, SMA-P · SMA-J)
J1555A	DC Block, SMA type (MODEL 7006-1) (9 kHz to 20 GHz, SMA-P · SMA-J)
K261	DC Block (10 kHz to 40 GHz, K-P · K-J)
J0004	Coaxial Adapter (DC to 12.4 GHz, 50Ω, N-P · SMA-J)
J1398A	N-SMA Adaptor (DC to 26.5 GHz, 50Ω, N-P · SMA-J)
34AKNF50	Ruggedized K-to-Type N Adapter (DC to 20 GHz, 50Ω, Ruggedized K-M · N-F, SWR: 1.5 (max.), Insertion Loss: 0.4 dB (max.))
J0911	Coaxial Cable, 1.0 m for 40 GHz (DC to 40 GHz, approx. 1 m, SF102A, 11K254/K254/1.0M)
J0912	Coaxial Cable, 0.5 m for 40 GHz (DC to 40 GHz, approx. 0.5 m, SF102A, 11K254/K254/0.5M)
41KC-3	Fixed Attenuator (DC to 40 GHz, 3 dB)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Cross, 1 m)
J1261D	Ethernet Cable (Shield type, Cross, 3 m)
J0008	GPIB Cable, 2.0 m
J1487A	AUX Conversion Adaptor (AUX → BNC, for Vector Signal Generator option)
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636A	Carrying Case (Hard type, with casters)
B0645A	Soft Carrying Case
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini B Cable)
Z0975A	Keyboard (USB)
Z1345A	Installation Kit (required when retrofitting options or installing software)

Anritsu

SPECTRUM ANALYZER
MS2687B
9 kHz to 30 GHz (18 GHz to 110 GHz)

Remote Control
GPIB | Ethernet OPTION

For Evaluation of IMT-2000, MMAC and Advanced Radio Communication Devices



CE

The MS2687B Spectrum Analyzer has the wide dynamic range (156 dB, typ.), wide resolution bandwidth (20 MHz) and high-speed sweep performance (20 times/s refresh rate) required for evaluating W-CDMA, GSM, W-LAN, etc., wireless systems and devices.
In addition, fast Tx measurement for each application is made easy by installing software options.

• Application Software

Communication System	Applicable Software
W-CDMA	W-CDMA Measurement Software
GSM	GSM Measurement Software
cdmaOne, CDMA2000 1X	CDMA Measurement Software
CDMA2000 1xEV-DO	CDMA2000 1xEV-DO Measurement Software
PDC/PHS/NADC (IS-136), STD-39/T79, STD-T61	π/4DQPSK Measurement Software
IEEE802.11a/11b, HiSWANa, HiperLAN2	Wireless LAN Measurement Software
TD-SCDMA	TD-SCDMA Measurement Software

Features
- Wide resolution bandwidth up to 20 MHz
- Fast data transmission speed. (GPIB transmission speed: 120 kB/s)
- Optional measurement software (sold separately) for high-speed modulation analysis
  W-CDMA: 1.5 sec, IEEE802.11a: 0.5 sec
- Optional narrow resolution bandwidth from 1 Hz
- Optional power meter that measures up to 32 GHz

Specifications
Specified values are obtained after warming up the equipment for 30 minutes at a constant ambient temperature and then performing calibration. The typical values are given for reference, and are not guaranteed.

Frequency	Frequency Range	9 kHz to 30 GHz, 18 GHz to 110 GHz (with external mixer)		
	Frequency Band	Band	Frequency range	Local harmonics order [N]
		0	9 kHz to 3.2 GHz	1
		1–	3.15 GHz to 6.3 GHz	1
		1+	6.2 GHz to 7.9 GHz	1
		2+	7.8 GHz to 15.3 GHz	2
		4+	15.2 GHz to 30 GHz	4
	Pre-selector Range	3.15 GHz to 30 GHz (band 1–, 1+, 2+, 4+)		

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Frequency	Display Frequency Accuracy	± (Display frequency × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz × N Hz) Normal marker: Same as frequency display accuracy Delta marker: Same as span accuracy ∗N: Local harmonics order
	Frequency Counter Resolution	1, 10, 100 Hz, 1 kHz (counts the received frequency at the peak point inside the zone, RBW: ≤3 MHz)
	Frequency Counter Accuracy	± (Display frequency × reference frequency accuracy + 2 × N Hz + 1 LSD) (S/N: ≥20 dB, RBW: ≤3 MHz) ∗N: Local harmonics order
	Frequency Span	Setting range: 0 Hz, and 5 kHz to 30 GHz Accuracy: ±1.0% (band 0,1), ±2.5% (band 2, 4) (at single band sweep, data point 1001)
	Resolution Bandwidth (RBW) [3 dB Bandwidth]	Setting range: 300 Hz to 3 MHz (1-3 sequence), 5, 10, 20 MHz ∗Manually settable, or automatically settable according to frequency span Accuracy: ±20% (300 Hz to 10 MHz), ±40% (20 MHz) Selectivity (60 dB: 3 dB): ≤15 : 1
	Video Bandwidth (VBW)	1 Hz to 3 MHz (1-3 sequence), Off ∗Manually settable, or automatically settable according to RBW
	Signal Purity	Sideband noise: ≤–108 dBc/Hz (1 GHz, 10 kHz offset) ≤–120 dBc/Hz (1 GHz, 100 kHz offset) Spurious resulting from local cause: ≤–65 dBc (at local harmonics order 1)
	Reference Oscillator	Frequency: 10 MHz Start-up characteristics: $\pm5 \times 10^{-8}$ (after 10 minutes warm-up, with frequency after 24 hours warm-up referenced) Aging rate: $\pm2 \times 10^{-8}$/day, $\pm1 \times 10^{-7}$/year (with frequency after 24 hours of warm-up referenced) Temperature characteristics: $\pm5 \times 10^{-8}$ (0° to 50°C, with frequency at 25°C referenced)
Amplitude	Level Measurement	Measurement range: Average noise level to +30 dBm Maximum input level: +30 dBm (Continuous average power, RF ATT: ≥10 dB) Peak pulse input: +47 dBm (pulse width: ≤1 µs, duty ratio: ≤1%, RF ATT: ≥30 dB) DC voltage: 0 V Average noise level display RBW: 300 Hz, VBW: 1 Hz, RF ATT: 0 dB, in SAMPLE detection mode ≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, band 0) ≤–120 dBm + f [GHz] dB (2.5 GHz to 3.2 GHz, band 0) ≤–115 dBm (3.15 GHz to 7.9 GHz, band 1) ≤–113 dBm (7.8 GHz to 15.3 GHz, band 2) ≤–103 dBm (15.2 GHz to 30 GHz, band 4) Residual response: RF ATT: 0 dB, input terminated at 50Ω ≤–100 dBm (1 MHz to 3.2 GHz, band 0) ≤–90 dBm (3.15 GHz to 7.8 GHz, band 1)
	Reference Level	Setting range Log scale: –100 to +40 dBm, or equivalent level Linear scale: 2.24 µV to 22.4 V Unit Log scale: dBm, dBµV, dBmV, dBµV (emf), W, V, dBµV/m Linear scale: V Reference level accuracy: ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (+0.1 to +30 dBm, –69.9 to –50 dBm), ±1.5 dB (–80 to –70 dBm) ∗After CAL, at 50 MHz, Span: 1 MHz, RF ATT, RBW, VBW, Sweep time: AUTO RBW switching uncertainty: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10 MHz, 20 MHz) ∗After CAL, with RBW 3 kHz referenced Input attenuator (RF ATT) Setting range: 0 to 70 dB (10 dB step), manually settable, or automatically settable according to reference level Switching uncertainty: ±0.3 dB (10 to 50 dB) ±0.5 dB (50 to 70 dB) ∗With 50 MHz, RF ATT: 10 dB referenced
	Frequency Response	Relative flatness: at RF ATT: 10 dB with the center point of frequency response in the band referenced ±1.0 dB (9 kHz to 3.2 GHz, band 0) ±1.5 dB (3.15 GHz to 7.9 GHz, band 1) ±3.0 dB (7.8 GHz to 15.3 GHz, band 2) ±4.0 dB (15.2 GHz to 30 GHz, band 4) ∗After pre-selector tuning for band 1, 2, and 4 Absolute flatness: at RF ATT: 10 dB with 50 MHz referenced ±5.0 dB (9 kHz to 30 GHz) ∗After pre-selector tuning for band 1, 2, and 4
	Waveform Display	Scale: 10 div (single scale) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after CAL) Log scale: ±0.4 dB (–20 to 0 dB, RBW ≤1 kHz), ±1.0 dB (–70 to 0 dB, ≤1 kHz), ±1.2 dB (–90 to 0 dB, ≤1 kHz) Linear scale: 4% of reference level Marker level resolution Log scale: 0.01 dB, Linear scale: 0.02%

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Amplitude	Spurious Response	2nd harmonic distortion: ≤–60 dBc (input frequency 10 MHz to 200 MHz) ≤–70 dBc (200 MHz to 1.6 GHz, band 0) ∗Mixer input: –30 dBm ≤–90 dBc or lower than average noise level (1.6 GHz to 15 GHz, band 1, 2, and 4) ∗Mixer input: –10 dBm 2-tone 3rd-order intermodulation distortion (Frequency difference of two signals: ≥50 kHz, Mixer input: –30 dBm): ≤–70 dBc (10 MHz to 100 MHz) ≤–85 dBc (100 MHz to 3.2 GHz, band 0) ≤–80 dBc (3.15 GHz to 7.9 GHz, band 1) ≤–75 dBc or lower than average noise level (7.8 GHz to 22.5 GHz, band 2, 4) ≤–75 dBc or lower than average noise level (22.4 GHz to 30 GHz, band 4, typ.) Image response: ≤–65 dBc (≤18 GHz) ≤–60 dBc (≤22 GHz) ≤–55 dBc (≤30 GHz) Multiple response/spurious outside the band: ≤–60 dBc (≤22 GHz) ≤–55 dBc (≤30 GHz)
	1 dB Gain Compression	≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz, band 0) ≥–5 dBm (≥3150 MHz, band 1, 2, and 4)
Frequency Sweep	Sweep Mode	Continuous, Single
	Sweep Time	Setting range: 10 ms to 1000 s ∗Manually settable, or automatically settable according to RBW and VBW Set resolution: 5 ms (5 ms to 1 s), Top three digits (≥1 s) Accuracy: ±3%
	Trigger Switch	Free run, Triggered
	Trigger Source	Wide IF video, External (TTL), External (±10 V), Line
	Gate Sweep Mode	Off, Random sweep mode Setting range Gate delay range: 0 to 65.5 ms (Resolution: 1 µs) Gate length range: 2 µs to 65.5 ms (Resolution: 1 µs) Gate end: Internal/External
	Zone Sweep	Sweeps the indicated range in the zone only.
	Tracking Sweep	Sweeps following the peak point inside the zone marker (zone sweep also available)
Time Sweep	Sweep Mode	Continuous, Single
	Sweep Time	Setting range/resolution: 1 µs to 50 µs (1-2-5 sequence), 100 µs to 4.9 ms (100 µs resolution), 5 ms to 1 s (5 ms resolution), 1 s to 1000 s (setting of top three digits) Accuracy: ±1%
	Trigger Switch	Free run, Triggered
	Trigger Source	Wide IF video, Video, External (TTL), External (±10 V), Line
	Trigger Delay	Pre-trigger (displays waveform before trigger occurrence point) Setting range: – time span to 0 s Trigger delay: Resolution: time span/500 or 100 ns, whichever is larger Post-trigger Setting range: 0 to 65.5 ms Resolution: 100 ns (sweep time: ≤4.9 ms), 1 µs (sweep time: ≥5 ms)
Functions	Number of Data Points	Selectable between 501 and 1001
	Detection Mode	NORMAL, POSITIVE PEAK, NEGATIVE PEAK, SAMPLE, AVERAGE
	Display Functions	TRACE A, TRACE B, TRACE A/BG, TRACE A/TIME Trace calculation: A → B, B → A, A ↔ B, A + B → A, A – B → A, A – B + DL → A
	Storage Functions	NORMAL, VIEW, MAX HOLD, MIN HOLD, AVERAGE, CUMULATIVE, OVER WRITE
	Marker	Signal search: AUTO TUNE, PEAK → CF, PEAK → REF, SCROLL Zone marker: NORMAL, DELTA Marker functions: MARKER → CF, MARKER → REF, MARKER → CF STEP SIZE, ∆MARKER → SPAN, ZONE → SPAN Peak search: PEAK, NEXT PEAK, MIN DIP, NEXT DIP Multi marker: 10 max. (highest 10, harmonics, manually)
	Measure	Noise power: dBm/Hz, dBm/CH, dBµV/√Hz C/N: dBc/Hz, dBc/CH Occupied bandwidth: Power N% method, X-dB down method Adjacent channel leakage power REF: Total power/Reference level/In-band level method Display: Channel designate display: 3 channels × 2, Graphic display Average power within burst signal: Average power in the designated range of time domain waveform Template comparison (at time sweep): Upper limit × 2, Lower limit × 2 MASK (at frequency sweep): Upper limit × 2, Lower limit × 2
	Correction	Frequency response can be corrected arbitrarily up to 150 points

Continued on next page

Others	Display	Color TFT-LCD, VGA 6.5-inch
	Color	Number of colors: 4096, RGB, Each 16-scale settable
	Intensity	Settable in 5 steps (display off included)
	Contents	Scale, Waveform data, Setting condition, Menu, Title
	Save/Recall	Saves and recalls setting conditions and waveform data to internal memory (max. 12) or memory card
	Hard Copy	Displayed data can be hard-copied with the printer via parallel interface (PCL level 3 or lower, or ESC/P-J83, J84 compatible models only)
	GPIB	Meets IEEE488.2. Controllable with external controller (except for power switch) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
	Parallel Interface	Centronics-compatible, Outputs print data to printer, D-Sub 25 pin connector (jack) Data line exclusive for output: 8, Control line: 4 (BUSY, DTSB, ERROR, PE)
	PC Card Interface	Saves and recalls setting condition and waveform data, ATA flash card accessible (3.3 V/5 V), Connector: Type I or Type II of PC card
	RS-232C	Controllable with external controller (except for power switch) Baud rate: 1200, 2400, 4800, 9600 bps, 19.2, 38.4, 56, 115 kbps
Input/Output Connector		Input connector: K-J Impedance: 50Ω (nominal) VSWR: ≤2.3 (typ., RF ATT: ≥10 dB) Video output: outputs analog RGB, D-Sub 15 pin connector (jack) IF output: BNC connector, 50Ω (nominal, 66 MHz/10.69 MHz) Level: –10 dBm (typ., frequency 50 MHz, display scale upper edge, 50Ω terminated) Broadband IF output: BNC connector, 50Ω (nominal, 60.69 MHz/66 MHz) Gain: 0 dB (typ., 50 MHz, RF ATT: 0 dB, for RF input level) Video output (Y): BNC connector Level: 0 to 0.5 V ± 0.1 V (typ., Log scale), 0 to 0.4 V ± 0.1 V (typ., Linear scale), (50 MHz, from upper edge to lower edge at 10 dB/div or 10%/div, 75Ω terminated) Buffered Output: BNC connector, Level: 2 to 5 V (p-p) (200Ω terminated) Sweep Output (X): BNC connector, Level: 0 to 10 V ± 0.1 V (100 kΩ termination, from the left edge to the right edge of the display scale, single band sweep) Sweep Status Output (Z): BNC connector, Level: TTL (low level at sweep) Probe source: 4 pole connector, +12 V, –12 V, ±10% each, 110 mA max. each. Trig/Gate input: BNC connector, level: ±10 V (0.1 V resolution), or TTL level External reference input: BNC connector, Frequency: 10 MHz ±10 Hz, 13 MHz ±13 Hz, Level: ≥0 dBm
Dimensions and Mass		320 (W) × 177 (H) × 411 (D) mm (handle, leg, front cover, fan cover excluded), ≤16 kg (nominal)
Power Supply		100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) (250 V max., wide range input), 47.5 Hz to 63 Hz, ≤400 VA
Temperature and Humidity		Operating: 0° to +50°C, RH ≤85% (non condensing) Storage: –20° to +60°C
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1

MS2687B Spectrum Analyzer specifications when external mixer is used.

External Mixer	Frequency Range	18 GHz to 110 GHz
	Frequency Band	(see band table below)
	Span Setting Range	0 Hz, (100 × N) Hz to each bandwidth
Amplitude	Mixer Transform Loss Setting Range	15 to 85 dB
	Maximum Input Level	Depend of external mixer
	Average Noise Level	Depend of external mixer
	Frequency Response	Depend of external mixer
Input/Output	Adaptive Mixer	Only 2 ports mixer
	Local Frequency	4 GHz to 7 GHz
	IF Frequency	460.69 MHz or 466 MHz
	Display Gain	0 ±2 dB (External mixer input level –10 dBm, Mixer transform loss 15 dB)

Frequency Band:

Band	Frequency range	Local harmonics order [N]
K	18 GHz to 26.5 GHz	4
Ka	26.5 GHz to 40 GHz	6
Q	33 GHz to 50 GHz	8
U	40 GHz to 60 GHz	9 or 10
V	50 GHz to 75 GHz	11 or 12
E	60 GHz to 90 GHz	13 or 14
W	75 GHz to 110 GHz	16

• Option 01: Precision Frequency Reference

Frequency	10 MHz
Start-up Characteristics	±5 × 10^{-8} (≤7 min., 25°C, typ.)
Aging Rate	±5 × 10^{-10}/day (With the frequency at 24 hours after the power is turned on referenced)
Temperature Characteristics	±5 × 10^{-10} (With the frequency at 0° to 50°C and 25°C referenced)

• Option 02: Narrow Resolution Bandwidths (FFT)

Resolution Bandwidth	Setting range: 1 Hz to 1 kHz (1-3 sequence) Bandwidth accuracy: ±10% (RBW = 30, 300 Hz), ±10% (typ., RBW = 1, 3, 10, 100 Hz, 1 kHz) RBW selectivity (60 dB: 3 dB): ≤5:1 RBW switching uncertainty: ±0.5 dB
Span Setting	Minimum setting span: 100 Hz
Average Noise Level Display	RBW: 1 Hz, RF ATT: 0 dB ≤–146.5 dBm + f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤–142.5 dBm + f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤–137.5 dBm (typ., 3.15 GHz to 7.9 GHz, band 1) ≤–135.5 dBm (typ., 7.8 GHz to 15.3 GHz, band 2) ≤–125.5 dBm (typ., 15.2 GHz to 30 GHz, band 4)

• Option 04: Digital Resolution Bandwidth

Resolution Bandwidth	Setting range: 10 Hz to 1 MHz (1-3 sequence) Bandwidth accuracy: ±10% (RBW: ≥100 Hz), ±10% (typ., RBW: ≤30 Hz) Bandwidth selectivity (60 dB: 3 dB): ≤5:1 (RBW ≥100 Hz), ≤5:1 (typ., RBW: ≤30 Hz) RBW switching uncertainty: ±0.5 dB
Span Setting	Minimum span setting: 1 kHz
Detection Mode	NORMAL, POSITIVE PEAK, NEGATIVE PEAK, SAMPLE, RMS RMS: Displays root-mean-square value of average power between sample points
Average Noise Level	RBW: 10 Hz, RF ATT: 0 dB ≤–136.5 dBm + f [GHz] dB (typ., 1 MHz to 2.5 GHz, band 0) ≤–132.5 dBm + f [GHz] dB (typ., 2.5 GHz to 3.2 GHz, band 0) ≤–127.5 dBm (typ., 3.15 GHz to 7.9 GHz, band 1) ≤–119.5 dBm (typ., 7.8 GHz to 15.2 GHz, band 2) ≤–115.5 dBm (typ., 15.1 GHz to 30 GHz, band 4)

• Option 09: Ethernet Interface

Function	Control with external controller (except for power switch)
Connector	10BASE-T

• Option 18: I/Q Unbalanced Input

Connector	BNC
Impedance	Selectable between 1 MΩ (Parallel capacity: <100 pF), 50Ω
Input Level Range	Differential voltage range: 0.1 to 1 Vp-p (Input terminal) Changeable between DC connection and AC connection

• Option 21, 41: Power Meter Function

Frequency Range	100 kHz to 32 GHz, Depends on the power sensor used.
Applicable Power Sensor	MA4601A (100 kHz to 5.5 GHz), MA4701A (10 MHz to 18 GHz), MA4703A (50 MHz to 26.5 GHz), MA4705A (50 MHz to 32 GHz)
Power Measurement Range	–20 to +20 dBm
Display	Selectable from W, dBm, and dB (RELATIVE), Digital 4 digit display, 20% over range Power range: 4 range/10 dB step (Measurement level range is listed on the power sensor specifications.)
Range Switching	Auto, Manual (settable to arbitrary range irrespective of range hold or input level)
Accuracy	±0.7% (W mode), ±0.03 dB (dBm mode, dB (RELATIVE) mode) *Pressing ZERO ADJ key allows automatic adjustment to zero point.
Zero Setting	±0.5% of full scale (typ., 100 µW range of maximum sensitivity)
Zero Move Between Ranges	±0.2% (after zero setting at 100 µW range of maximum sensitivity)
Calibration Oscillator Frequency	50 MHz
Calibration Oscillator Level	1 mW ±1.2% (for one year)
Averaging	An average count can be set from 2 to 10.

• Option 23, 43, 44: Range Expansion Power Meter Function

Frequency Range	100 kHz to 32 GHz (Depends on the power sensor used)
Applicable Power Sensor	MA4601A (100 kHz to 5.5 GHz), MA4701A (10 MHz to 18 GHz), MA4703A (50 MHz to 26.5 GHz), MA4705A (50 MHz to 32 GHz)
Power Measurement Range	–30 to +20 dBm
Display	Selectable from W, dBm, and dB (RELATIVE), Digital 4 digit display, 20% over range
Power Range	5 range/10 dB step (Measurement level range is listed on the power sensor specifications.) Full scale value: –20, –10, 0, +10, +20 (10 µW to 100 mW)
Range Switching	Auto, manual (settable to arbitrary range irrespective of range hold or input level)
Accuracy	±0.6% (W mode), ±0.026 dB (dBm mode, dB (RELATIVE) mode) When including the zero drift in range1 (10 µW range) is as follows. ±1.2% (W mode), ±0.052 dB (dBm mode, dB (RELATIVE) mode) Pressing ZERO ADJ key allows automatic adjustment to zero point.
Zero Setting	±0.6% of full scale (typ., 10 µW range of maximum sensitivity)
Zero Move Between Ranges	±0.2% of full scale (after zero setting at 10 µW range of maximum sensitivity)
Calibration Oscillator Frequency	50 MHz
Calibration Oscillator Level	1 mW ±1.2% (for one year)
Averaging	An average count can be set from 2 to 10.

• Option 34: 4 GHz LO Output

Frequency	Frequency: 4 GHz Frequency accuracy: ± (4 GHz × reference frequency accuracy) ±1 Hz
Output Level	–10 dBm (typ.)
Spurious	≤–40 dBc (typ.)

• Option 46: Auto Power Recovery

Function	Disables the power switch on the front panel and automatically restores power after power failure. ON/OFF operation can be performed using the standby switch on the rear panel. *Power switch on the front panel of this unit does not have a latching function. Therefore, if power is interrupted in the ON status, the standby status is kept even after power is restored.

• Option 47: Rack Mount (IEC)

Function	Mounts the rack mount for IEC standard-compatible rack. When mounted, the tilt handle (standard) is eliminated.

• Option 48: Rack Mount (JIS)

Function	Mounts the rack mount for JIS standard-compatible rack. When mounted, the tilt handle (standard) is eliminated.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MS2687B	Spectrum Analyzer	
	Standard accessories	
	Power Cord:	1 pc
J0996B	RS-232C Cable:	1 pc
Z0808	ANR-CFX00T64 (P) [Memory Card 64MB]:	1 pc
F0014	Fuse, 6.3 A:	1 pc
MX268001A	File Transfer Utility:	1 pc
W1754AE	MS2687B Operation Manual:	1 copy
	Options	
MS2687B-01	Precision Frequency Reference (aging rate: ±5 × 10^{-10}/day)	
MS2687B-02	Narrow Resolution Bandwidths (FFT)	
MS2687B-04	Digital Resolution Bandwidth	
MS2687B-09	Ethernet Interface	
MS2687B-18	I/Q Unbalanced Input	
MS2687B-21	Power Meter Function	
MS2687B-23	Range Expansion Power Meter Function	
MS2687B-34	4 GHz LO Output	
MS2687B-41	Power Meter Function Retrofit	
MS2687B-43	Range Expansion Power Meter Function Retrofit	
MS2687B-44	Range Expansion Power Meter Function Upgrade	
MS2687B-46	Auto Power Recovery	
MS2687B-47	Rack Mount (IEC) without Handles	
MS2687B-48	Rack Mount (JIS) without Handles	
	Measurement software	
MX268701B	W-CDMA Measurement Software	
MX268702A	GSM Measurement Software	
MX268703A	cdma Measurement Software	
MX268704A	1xEV-DO Measurement Software	
MX268705A	π/4DQPSK Measurement Software	
MX268730A	WIRELESS LAN Measurement Software	
MX268751A	W-CDMA Release5 Uplink Measurement Software	
MX268760A	TD-SCDMA Measurement Software	

Model/Order No.	Name
	Application parts
W1746AE	MX268701B Operation Manual
W1854AE	MX268702A Operation Manual
W1865AE	MX268703A Operation Manual
W2090AE	MX268704A Operation Manual
W1866AE	MX268705A Operation Manual
W2080AE	MX268730A Operation Manual
W2617AE	MX268751A Operation Manual
W2593AE	MX268760A Operation Manual
J0576D	Coaxial Cord (N-P, 5D-2W, N-P), 2 m
J0561	Coaxial Cord (N-P, 5D-2W, N-P), 1 m
J0104A	Coaxial Cord (BNC-P, RG-55/U, N-P), 1 m
J0127C	Coaxial Cord (BNC-P, RG-58A/U, BNC-P), 0.5 m
J0127A	Coaxial Cord (BNC-P, RG-58A/U, BNC-P), 1 m
DGM010-02000EE	Coaxial Cord (general use, N-P · N-P, DC to 18 GHz), 2 m
DGM024-02000EE	Coaxial Cord (low-loss type, N-P · N-P, DC to 18 GHz), 2 m
J0911	Coaxial Cord (K-P · K-P, DC to 40 GHz), 1 m
J0912	Coaxial Cord (K-P · K-P, DC to 40 GHz), 0.5 m
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J1047	Ethernet Cross Cable
MA1612A	Four-port Junction Pad (5 MHz to 3000 MHz)
MA1621A	50Ω → 75Ω Impedance Transformer (75Ω, 9 kHz to 3 GHz, ±100 V, NC-type)
MP614B	50Ω → 75Ω Impedance Converter (50 MHz to 1200 MHz, 1.5 dB or lower)
J0395	Fixed Attenuator for High-power (30 dB, 30 W, DC to 9 GHz)
B0472	Fixed Attenuator for High-power (30 dB, 100 W, DC to 18 GHz)
J0078	High Power Attenuator (N type, 20 dB, 10 W, DC to 18 GHz)
J0004	Coaxial Adapter (N · P-SMA · J)
34AKNF50	Ruggedized K-to-Type N Adapter
MA2507A	DC Block Adaptor (50Ω, 9 kHz to 3 GHz, ±50 V)
J0805	DC Block, N type (10 kHz to 18 GHz, made by Wineshell)
B0452A	Hard Carrying Case (with casters)
B0452B	Hard Carrying Case (without casters)
B0488	Rear Panel Protective Pad
W1888AE	Assembling Guide Drawing for Rear Protective Pad (supplied with B0488 as standard)
B0481B	Carrybone
B0479	Soft Carrying Case (rucksack type)
MA4601A	Power Sensor (100 kHz to 5.5 GHz, –30 to +20 dBm, N connector)
MA4701A	Power Sensor (10 MHz to 18 GHz, –30 to +20 dBm, N connector)
MA4703A	Power Sensor (50 MHz to 26.5 GHz, –30 to +20 dBm, APC3.5(P) connector)
MA4705A	Power Sensor (50 MHz to 32 GHz, –30 to +20 dBm, APC3.5(P) connector)
J0370A	Sensor Connecting Cord, 1.5 m (for power meter option)
J0370C	Sensor Cord, 2.5 m (for power meter option)
J0370E	Sensor Cord, 5 m (for power meter option)
J0370G	Sensor Cord, 10 m (for power meter option)
MA2740A	External Mixer (18 GHz to 26.5 GHz)
MA2741A	External Mixer (26.5 GHz to 40 GHz)
MA2742A	External Mixer (33 GHz to 50 GHz)
MA2743A	External Mixer (40 GHz to 60 GHz)
MA2744A	External Mixer (50 GHz to 75 GHz)
MA2745A	External Mixer (60 GHz to 90 GHz)
MA2746A	External Mixer (75 GHz to 110 GHz)
	Warranty
MS2687B-90	Extended Three Year Warranty Service
MS2687B-91	Extended Five Year Warranty Service

HIGH PERFORMANCE HANDHELD SPECTRUM MASTER™

MS2720T

9 kHz to 9 GHz/13 GHz/20 GHz/32 GHz/43 GHz

Remote Control
Ethernet | USB

Taking the World's First 32 GHz and 43 GHz Handheld Spectrum Analyzers to the Next Level of Performance

NEW

From Anritsu, the inventor of the handheld spectrum analyzer first introduced in 1999, we are proud to introduce our 7th generation Spectrum Master MS2720T. The MS2720T represents the highest performance handheld spectrum analyzers available in the world as Anritsu pushes the envelope closer to benchtop quality. This generation introduces a touch screen, full-band tracking generators to 20 GHz, and best-in-class performance for dynamic range, DANL, phase noise, and sweep speed.

Spectrum and Interference Analyzer Highlights

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I, Field Strength, Spectral Emissions
- Measure Interference: Spectrogram, Signal Strength, RSSI
- Dynamic Range: > 106 dB in 1 Hz RBW
- DANL: –163 dBm in 1 Hz RBW
- Phase Noise: –112 dBc/Hz @ 10 kHz offset at 1 GHz
- Resolution Bandwidth (RBW): 1 Hz to 10 MHz
- Full-band Tracking Generators: 9, 13, 20 GHz
- Full-band Preamplifiers: included at no charge
- Channel Scanner: scan up to 20 channels at once
- Burst Detect™ Sweep Mode: Sweep 1000x in 15 MHz span
- Coverage Mapping: plot RSSI on on-screen map
- Interference Mapping: on-screen mapping with triangulation
- Operation to +55°C: full performance on AC or battery

Capabilities and Functional Highlights

- GSM/GPRS/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- LTE FDD/TDD
- CDMA/EV-DO
- WiMAX Fixed/Mobile
- Zero-span IF Output
- I/Q Waveform Capture
- Gated Sweep
- AM/FM/PM Demodulator
- High Accuracy Power Meter up to 26 GHz USB Sensors
- Remote Access Tool
- Three Hour Battery

Spectrum Analyzer Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) Apply when using internal reference and performance sweep mode; 3) Subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Measurements	Smart Measurements	Field Strength (dBm/m^2, dBW/m^2, V/m, A/m, Watt/m^2, Watt/cm^2, or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (AM, wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask)
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Frequency Offset, Signal Standard, Channel #
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/RBW Ratio
Sweep Functions	Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
	Sweep Mode	Fast (100x Performance), Performance, No FFT, Burst Detect (1000x Fast in 15 MHz span)
	Detection	Peak, RMS/Avg, Negative, Sample, Quasi-peak
	Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold%, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1-6 markers frequency and amplitude, plus delta markers frequency offset and amplitude
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
Frequency	MS2720T-0709	9 kHz to 9 GHz
	MS2720T-0713	9 kHz to 13 GHz
	MS2720T-0720	9 kHz to 20 GHz
	MS2720T-0732	9 kHz to 32 GHz
	MS2720T-0743	9 kHz to 43 GHz
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1.0 ppm/10 years Accuracy: ±0.3 ppm (25°C ±25°C) + aging
	Auto-sensing External Frequency Reference (MHz)	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608
	Sweep Time	10 µs to 600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1–3 sequence ±10% (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 10 MHz in 1–3 sequence (–3 dB bandwidth)
	RBW with Quasi-Peak Detection	200 Hz, 9 KHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
	VBW/Average Type	Linear/Log

Continued on next page

Spectral Purity	SSB Phase Noise at 1 GHz		9 GHz Instrument		13 GHz to 43 GHz Instruments	
		Offset	Maximum	Typical	Maximum	Typical
		10 kHz	–108 dBc/Hz	–112 dBc/Hz	–102 dBc/Hz	–106 dBc/Hz
		100 kHz	–110 dBc/Hz	–115 dBc/Hz	–106 dBc/Hz	–110 dBc/Hz
		1 MHz	–118 dBc/Hz	–123 dBc/Hz	–111 dBc/Hz	–116 dBc/Hz
		10 MHz	–129 dBc/Hz	–133 dBc/Hz	–123 dBc/Hz	–129 dBc/Hz
Amplitude Ranges	Dynamic Range	>106 dB minimum at 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW				
	Measurement Range	DANL to +30 dBm				
	Display Range	1 dB to 15 dB/div in 1 dB steps, ten divisions displayed				
	Reference Level Range	–120 to +30 dBm				
	Attenuator Resolution	0 dB to 65 dB, 5 dB steps				
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBμV Linear Scale Modes: nV, μV, mV, V, kV, nW, μW, mW, W, kW				
	Maximum Continuous Input	+30 dBm Peak typical, ±50 VDC (≥ 10 dB Attenuation) +23 dBm Peak typical, ±50 VDC (< 10 dB Attenuation) +13 dBm Peak typical, ±50 VDC (Preamp = ON)				
Amplitude Accuracy			+20° to +30°C (after 30 minute warm-up)		–10° to +55°C (after 60 minute warm-up)	
			Maximum	Typical	Maximum	Typical
	9 GHz Instrument	100 kHz to 7 GHz	±1.3 dB	±0.5 dB	±2.3 dB	±0.5 dB
		>7 GHz to 9 GHz	±1.8 dB	±0.5 dB	±2.8 dB	±0.5 dB
	13 GHz to 20 GHz Instruments	100 kHz to 9 GHz	±1.3 dB	±0.5 dB	±2.3 dB	±0.5 dB
		>9 GHz to 18 GHz	±2.3 dB	±0.5 dB	±3.3 dB	±0.5 dB
	32 GHz to 43 GHz Instruments	>100 kHz to 9 GHz	±1.3 dB	±0.5 dB	±2.3 dB	±0.5 dB
		>9 GHz to 40 GHz	±2.3 dB	±0.5 dB	±3.3 dB	±0.5 dB
Displayed Average Noise Level (DANL)	(RMS detection, VBW/Avg type = Log, Ref Level = –20 dBm for Preamp Off and –50 dBm for Preamp On, Performance Sweep Mode)					
			Preamp = Off		Preamp = On	
			Maximum	Typical	Maximum	Typical
	9 GHz Instrument	10 MHz to 3 GHz	–146 dBm	–149 dBm	–160 dBm	–163 dBm
		>3 GHz to 8 GHz	–140 dBm	–143 dBm	–152 dBm	–155 dBm
	13 GHz to 43 GHz Instruments	10 MHz to 4 GHz	–145 dBm	–148 dBm	–161 dBm	–164 dBm
		>4 GHz to 9 GHz	–142 dBm	–145 dBm	–159 dBm	–162 dBm
		>9 GHz to 13 GHz	–136 dBm	–139 dBm	–156 dBm	–159 dBm
	20 GHz Instrument	>13 GHz to 20 GHz	–138 dBm	–141 dBm	–157 dBm	–160 dBm
	32 GHz to 43 GHz Instruments	>13 GHz to 32 GHz	–135 dBm	–138 dBm	–154 dBm	–157 dBm
		>32 GHz to 40 GHz	–127 dBm	–130 dBm	–148 dBm	–151 dBm
Spurs			(RF input terminated, 0 dB input attenuation)			
			Preamp = Off		Preamp = On	
	Residual Spurs	<13 GHz	–90 dBm, maximum		–100 dBm, maximum	
		13 GHz to 20 GHz	–85 dBm, maximum		–100 dBm, maximum	
		>20 GHz to 32 GHz	–80 dBm, maximum		–100 dBm, maximum	
		>32 GHz to 43 GHz	–80 dBm, maximum		–95 dBm, maximum	
	Input-Related Spurs	–60 dBc, –70 dBc typical (0 dB attenuation, –30 dBm input, span < 1.7 GHz)				
Third-Order Intercept (TOI)	(–20 dBm tones 100 kHz apart, 0 dB Attenuation Preamp OFF)					
	2.4 GHz		+14 dBm minimum			
	50 MHz to 20 GHz		+20 dBm typical			
	>20 GHz to 32 GHz		+15 dBm typical			
	>32 GHz to 20 GHz		+20 dBm typical			
P1dB	<4 GHz		5 dBm typical			
	4 GHz to 20 GHz		12 dBm typical			
	>20 GHz to 32 GHz		7 dBm typical			
	>32 GHz to 43 GHz		12 dBm typical			
Second Harmonic Distortion			(0 dB input attenuation, –30 dBm input)			
	50 MHz		–54 dBc maximum			
VSWR			(>10 dB input attenuation)			
	<9 GHz Instruments	<4 GHz	1:5:1 typical			
		4 GHz to 8 GHz	1.8:1 typical			
	13 GHz to 43 GHz Instruments	<20 GHz	1.5:1 typical			
		20 GHz to 43 GHz	2.0:1 typical			

• Tracking Generator (Options 809, 813, and 820)

Setup Parameters	Frequency	Center/Start/Stop, Span, Signal Standard, Channel #, Frequency Step/Offset, Channel Offset			
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Units, Pre-Amp, Detection			
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span			
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/Average Type (Linear/Log), RBW/VBW Ratio, Span/RBW Ratio			
	Generator	On/Off, Output Power, Mode (CW/Tracking), Settings, Transmission Measurement			
	Tracking Generator Settings	External Gain/Loss, Power Statistics (On/Off)			
	Transmission Measurement Settings	Normalize (Off/On), Scale, Reference Position and Amplitude, Transmission Statistics and Offset			
	Maximum Continuous Input	+23 dBm, ±50 VDC			
Frequency	Frequency Range	MS2720T-0809	100 kHz to 9 GHz		
		MS2720T-0813	100 kHz to 13 GHz		
		MS2720T-0820	100 kHz to 20 GHz		
	Frequency Accuracy	Aging: ±1 ppm/10 year			
		Accuracy: ±0.3 ppm (25°C ±25°C) + aging			
Output Power	100 kHz to 20 GHz	–40 to 0 dBm			
	Step Size	0.1 dB nominal			
	Dynamic Range	9 GHz Instrument	>110 dB typical 100 kHz to 7 GHz		
			>100 dB typical >7 GHz to 9 GHz		
		13 GHz and 20 GHz Instruments	>100 dB typical 100 kHz to 12 GHz		
			>80 dB typical >12 GHz to 20 GHz		
Level Accuracy		(At least 30 minute warm-up after 1 hour non-operating at 15° to 35°C ambient, excludes load VSWR effects)			
	Frequency Range	20° to 30°C (after 30 minute warm-up)		0° to 50°C (after 60 minute warm-up)	
		Maximum	Typical	Maximum	Typical
	100 kHz to 9 GHz	±1.5 dB	±0.5 dB	±2.0 dB	±1.0 dB
	>9 GHz to 13 GHz	±1.6 dB	±1.0 dB	±2.1 dB	±1.5 dB
	>13 GHz to 18 GHz	±2.0 dB	±1.0 dB	±2.5 dB	±1.5 dB
VSWR	100 kHz to 5 GHz	2:1 typical			
	>5 GHz to 20 GHz	4:1 typical			

• High Accuracy Power Meter (Option 19) (Requires external USB Power Sensor)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale			
Average	# of Running Averages, Max Hold			
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)			
Limits	Limit On/Off, Limit Upper/Lower			
Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108A/18A/26A
Description	High Accuracy RF Power Sensor	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz
Connector	Type N(m), 50Ω	Type N(f), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω (8/18 GHz) Type K(m), 50Ω (26 GHz)
Dynamic Range	–30 to +20 dBm (0.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 μW to 200 mW)	–40 to +20 dBm (0.1 μW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB[*1]	±0.17 dB[*2]	±0.16 dB[*1]	±0.18 dB[*3]
Data sheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504

∗1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
∗2: Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
∗3: Expanded uncertainty with K=2 for power measurements of a CW signal greater than –20 dBm with zero mismatch

• Interference Analyzer (Option 25)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram	Collect data up to 72 hours
	Signal Strength	Gives visual and aural indication of signal strength
	Received Signal Strength Indicator (RSSI)	Collect data up to 72 hours
	Signal ID	ID up to 12 FM, GSM, W-CDMA, CDMA or Wi-Fi signals based on RF bandwidth
	Interference Mapping	Draw bearing of signal strength from GPS location on on-screen map
	Application Options	Impedance (50Ω, 75Ω, Other)

• Channel Scanner (Option 27)

General	Number of Channels	1 to 20 Channels (Power Levels)
	Measurements	Graph/Table, Max Hold (On/5 s/Off), Frequency/Channel, Current/Maximum, Dual Color
	Scanner	Scan Channels, Scan Frequencies, Scan Custom List, Scan Script Master™
	Amplitude	Reference Level, Scale
	Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
	Frequency Range	9 kHz to 9, 13, 20, 32, or 43 GHz
	Frequency Accuracy	±10 Hz + time base error
	Measurement Range	–110 to +30 dBm
	Application Options	Impedance (50Ω, 75Ω, Other)

• Coverage Mapping (Option 431)

Measurements	Indoor	Mapping RSSI, ACPR
	Outdoor Mapping	RSSI, ACPR
Setup Parameters	Mode	Spectrum Analyzer
	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/VBW Ratio
	Measurement Setup	ACPR, RSSI
	Point Distance/Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

• GPS Receiver (Option 31)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
	Note: Anritsu 2000-1528-R GPS antenna requires +5 VDC Anritsu 2000-1652-R GPS antenna requires +3.3 VDC or +5 VDC
GPS Time/Location Indicator	Time, Latitude, Longitude, and Altitude on display Time, Latitude, Longitude, and Altitude with trace storage
High Frequency Accuracy	<±25 ppb with GPS On, 3 minutes after satellite lock in selected mode (GPS Antenna connected) <±50 ppb for 3 days after GPS lock, 0° to 50°C ambient temperature (GPS Antenna disconnected)
Connector	SMA, female

• Gated Sweep (Option 90)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 to 65 ms typical) Gate Length (1 μs to 65 ms typical) Zero Span Time

• Zero Span IF Output (Option 89)

Mode	Spectrum Analyzer/Span/Zero Span
Center Frequency	140 MHz
Output Level	–25 dBm typical
Reference Level	–57 to +30 dBm (Preamp Off) –87 to –40 dBm (Preamp On)
IF Bandwidths	Up to 30 MHz (3 dB bandwidth)
RF Attenuation	Auto
Connector	BNC female

• I/Q Waveform Capture (Option 24)

Mode	Spectrum Analyzer
Capture Mode	Single or Continuous
Trigger	Free Run, External (Rising/Falling), Delay
Maximum Capture Length	800 ms
Maximum Sample Rate	40 MHz
Maximum Signal Bandwidth	32 MHz

• Secure Data (Option 7)

Set at Factory	Save measurement files on external USB flash drive only Internal memory is permanently disabled

• AM/FM/PM Signal Analyzer (Option 509)

Measurements							
Display Type	RF Spectrum (AM/FM/PM)	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*M Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*

*: Requires sine wave modulation

Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq
	Amplitude Setup	Scale, Power Offset, Adjust Range
	Measurements	Demod Type (AM, FM, PM), IFBW, Auto IFBW RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average
	Marker	Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table
RF and Modulation Measurements	AM	Modulation Rate: ±1 Hz (< 100 Hz), ±2% (>100 Hz) Depth: ±5% for (Modulation rates 10 Hz to 100 kHz)
	FM	Modulation Rate: ±1 Hz (< 100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (100 Hz to 100 kHz)**
	PM	Modulation Rate: ±1 Hz (< 100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz)**
	IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz, 70 kHz, 140 kHz
	RBW/VBW	30
	Span/RBW	100
	Sweep Time	50 µs to 50 ms (Audio Waveform)

**: IFBW must be greater than 95% occupied BW

• GSM/GPRS/EDGE Measurements (Option 880)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) RF Summary	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC) Modulation Summary	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	View Pass/Fail Limits All, RF, Demod Available Measurements Channel Power Occupied Bandwidth Burst Power Average Burst power Frequency Error Phase Error EVM Origin Offset C/I Magnitude Error Script Master™

Setup Parameters	GSM/EDGE Select	Auto, GSM, EDGE	
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel	
	Amplitude	Power Offset, Auto Range, Adjust Range	
	Sweep	Single/Continuous, Trigger Sweep	
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory	
	Measurement Summary Screen	Overall Measurements, RF Measurements, Modulation Measurements	
RF Measurements	Frequency Error	±10 Hz + time base error, 99% confidence level	
	Occupied Bandwidth	Bandwidth within which lies 99% of the power transmitted on a single channel	
	Burst Power Error	±1.5 dB, ±1 dB typical, (–50 to +20 dBm)	
Demodulation Measurements	GSMK Modulation Quality (RMS Phase)	Measurement Accuracy	±1 °
		Residual Error (GSMK)	1 °
	8 PSK Modulation Quality (EVM)	Measurement Accuracy	±1.5%
		Residual Error (8 PSK) 2	.5%

• W-CDMA/HSPA+ Measurements (Option 881)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Band Spectrum Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single carrier ACLR Multi-carrier ACLR	Code Domain Power Graph P-CPICH Power Channel Power Noise Floor EVM Carrier Feed Through Peak Code Domain Error Carrier Frequency Frequency Error Control Channel Power Abs/Rel/Delta Power CPICH, P-CCPCH S-CCPCH, PICH P-SCH, S-SCH HSPA+ Power vs. Time Constellation Code Domain Power Table Code, Status EVM, Modulation Type Power, Code Utilization Power Amplifier Capacity Codogram Modulation Summary	Scrambling Code Scanner (Six) Scrambling Codes CPICH Ec/Io Ec Pilot Dominance OTA Total Power Multipath Scanner (Six) Six Multipaths Tau Distance RSCP Relative Power Multipath Power	View Pass/Fail Limits All, RF, Demod Available Measurements Max Output Power Frequency Error EVM CPICH Occupied Bandwidth Spectral Mask ACLR PCDE P-CCPCH S-CCPCH Code Spread 3 PICH Code 128 Test Models 1 (16), (32), (64) 2 3 (16), (32) 4 (+CPICH), (-CIPCH) 5 (2 HS), (4 HS), (8 HS)

Setup Parameters	Scrambling Code, Threshold	Auto, Manual
	User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
	Maximum Spreading Factor	256, 512
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Marker	Six Markers, Table On/Off
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
RF Measurements	RF Channel Power Accuracy	±1.25 dB, ±0.7 dB typical, (temperature range 15° to 35°C)
	Occupied Bandwidth Accuracy	±100 kHz
	Adjacent Channel Leakage Ratio (ACLR)	–54 dB/–59 dB ±0.8 dB @ 5 MHz/10 MHz offset, typical, 824 MHz to 894 MHz, 1710 MHz to 2170 MHz –54 dB/–57 dB ±1.0 dB @ 5 MHz/10 MHz offset, typical, 2300 MHz to 2700 MHz
Demodulation Measurements	W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
	HSPA+ Modulations	QPSK, 16 QAM, 64 QAM
	Frequency Error	±10 Hz + time base error, 99% confidence level
	EVM Accuracy	±2.5%, 6% ≤ EVM ≤ 25%
	Residual EVM	2.5% typical
	Code Domain Power	±0.5 dB for code channel power >–25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
	CPICH (dBm) Accuracy	±0.8 dB typical
Over-the-Air (OTA) Measurements	Scrambling Code Scanner	Six strongest Scrambling Codes
	Multipath Scanner	Multipath power of six signals relative to strongest pilot

• TD-SCDMA/HSPA+ Measurements (Option 882)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error (QPSK/8 PSK/16 QAM/64 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error CDP Marker Modulation Summary	Code Scan (32) Scrambling Code Group Tau Ec/Io DwPTS Power Pilot Dominance Tau Scan (Six) Sync-DL# Tau Ec/Io DwPTS Power Pilot Dominance Record Run/Hold	View Pass/Fail Limits All, RF, Demod Available Measurements Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Noise Floor

Setup Parameters	Slot Selection	Auto, 0-6
	Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
	SYNC-DL Code	Auto, 0-31
	Scrambling/Midamble Code	Auto, 0-127
	Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
	Measurement Speed	Fast, Normal, Slow
	User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
	Demodulation Type	Auto, QPSK, 8 PSK, 16 QAM, 64 QAM
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Sweep	Hold/Run, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements	RF Channel Power Accuracy (RRC)	±1.5 dB, ±1.0 dB typical, (slot power –40 dBm to +10 dBm)
	Frequency Error	±10 Hz + time base error, in the presence of a downlink slot
Demodulation Measurements	Supported Modulation	QPSK, 8 PSK, 16 QAM, 64 QAM
	Residual EVM (rms)	3% typical, P-CCPH Slot Power > –50 dBm
	PN Offset	Within 1 × 64 chips
	Pilot Power Accuracy	±1.0 dB typical
	Timing Error (Tau) for Dominant SYNC-DL	±0.2 μs (external trigger)
	Spreading Factor	1, 16
Over-the-Air (OTA) Measurements	Code Scanner	32 Sync Codes and associated Scrambling Code Groups
	Tau Scanner	Six strongest Sync Codes
	Auto Save	Yes
	GPS Tagging and Logging	Yes

• **LTE FDD/TDD Measurements (Option 883)**

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth ACPR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization% Channel Power, Cell ID OSTP, EVM Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH Total Power (Table View) Modulation Results Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1 or 2) Modulation Summary	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power SS, P-SS, S-SS Power PBCH Power PCFICH Power Cell, Group, Sector ID

Setup Parameters	Frequency	E-UTRA Bands 1 - 5, 7 - 14, 17 - 21, 24 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
	Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous
	EVM Mode	Auto, PBCH only, Max Hold
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
LTE FDD RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +10 dBm)
LTE FDD Modulation Measurements	RS Power Accuracy	±1.0 dB typical, (RF input –50 to +10 dBm)
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Residual EVM (rms)	2.0% typical (E-UTRA Test Model 3.1, RF Input –50 to +10 dBm)
LTE FDD Over-the-Air (OTA) Measurements	Scanner	Six strongest signals if present Auto Save – Sync Signal power and Modulation Results with GPS information
	Tx Test	Scanner – Three strongest signals if present RS Power – Strongest signal
	Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: *.kml, *.mtd (tab delimited)

• LTE FDD/TDD Measurements (Option 883) (continued)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Frame View Sub-Frame View Total Frame Power DwPTS Power Transmit Off Power Cell ID Timing Error ACLR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization% Channel Power, Cell ID Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH Total Power (Table View) Modulation Results Antenna Icons Detects active antennas (1 or 2) Modulation Summary	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power SS, P-SS, S-SS Power PBCH Power PCFICH Power Cell, Group, Sector ID Frame Power DWPTS Power Transmit Off Power Timing

Setup Parameters	Frequency	E-UTRA bands 33 - 43 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
	Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous
	EVM Mode	Auto, PBCH only, Max Hold
	Trigger	No Trigger/Ext Trigger, Rising/Falling
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
LTE TDD RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –30 to +10 dBm)
LTE TDD Modulation Measurements	RS Power Accuracy	±1.0 dB typical, (RF input –50 to +10 dBm)
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Residual EVM (rms)	2.0% typical (E-UTRA Test Model 3.1, RF Input –30 to +10 dBm)
Over-the-Air (OTA) Measurements	Scanner	Six strongest signals if present Auto Save – Sync Signal power and Modulation Results with GPS information
	Tx Test	Scanner – Three strongest signals if present RS Power – Strongest signal
	Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: *.kml, *.mtd (tab delimited)

• CDMA/EV-DO Measurements (Option 884)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Multi-carrier ACPR RF Summary	Code Domain Power Graph Pilot Power Channel Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Frequency Error Abs/Rel/ Power Pilot Page Sync Q Page Code Domain Power Table Code Status Power Multiple Codes Code Utilization Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power Limit Test – 10 Tests Averaged Rho Adjusted Rho Multipath Pilot Dominance Pilot Power Pass/Fail Status	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Mask Test Frequency Error Channel Frequency Frequency error Pilot Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Code Utilization Measured PN Pilot Dominance

CDMA Setup Parameters	PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
	Walsh Codes	64, 128
	Measurement Speed	Fast, Normal, Slow
	External Trigger Polarity	Rising, Falling
	Number of Carriers	1 to 5
	Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
CDMA RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
CDMA Demodulation Measurements	Frequency Error	±10 Hz + time base error, 99% confidence level (in slow mode)
	Rho Accuracy	±0.005, for Rho >0.9
	Residual Rho	>0.995, typical, >0.99 maximum, (RF input –50 to +20 dBm)
	PN Offset	1 × 64 chips
	Pilot Power Accuracy	±1.0 dB typical, relative to channel power
	Tau	±0.5 μs typical, ±1.0 μs maximum
CDMA Over-the-Air (OTA) Measurements	Pilot Scanner	Nine strongest pilots
	Multipath Scanner	Multipath power of six signals relative to strongest pilot
	Limit Test	Average of ten tests compared to limit

• **CDMA/EV-DO Measurements (Option 884)** (continued)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Power vs. Time Pilot & MAC Power Channel Power Frequency Error Idle Activity On/Off Ratio Spectral Emission Mask Multi-carrier ACPR RF Summary	MAC Code Domain Power Graph Pilot & MAC Power Channel Power Frequency Error Rho Pilot Rho Overall Data Modulation Noise Floor MAC Code Domain Power Table Code Status Power Code Utilization Data Code Domain Power Active Data Power Data Modulation Rho Pilot Rho Overall Maximum Data CDP Minimum Data CDP Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Mulitpath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Carrier Frequency Frequency Error Spectral Mask Noise Floor Pilot Power RMS Phase Error Tau Code Utilization Measured PN Pilot Dominance

Setup Parameters	PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
	Walsh Codes	64, 128
	Measurement	Speed Fast, Normal, Slow
	External Trigger Polarity	Rising, Falling
	Slot Type	Auto, Active, Idle
	Number of Carriers	1 to 5
	Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
EV-DO RF Measurements	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
EV-DO Demodulation Measurements	EV-DO Compatibility	Rev 0 and Rev A
	Frequency Error	±10 Hz + time base error, 99% confidence level
	Rho Accuracy	±0.01, for Rho >0.9
	Residual Rho	>0.995 typical, >0.99, maximum (RF input –50 to +20 dBm)
	PN Offset	Within 1 × 64 chips
	Pilot Power Accuracy	±1.0 dB typical, relative to channel power
	Tau	±0.5 μs typical, ±1.0 μs maximum
EV-DO Over-the-Air (OTA) Measurements	Pilot Scanner	Nine strongest pilots
	Multipath Scanner	Multipath power of six signals relative to strongest pilot

• WiMAX Fixed/Mobile Measurements (Option 885)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID Sector ID (Mobile) Modulation Summary	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Base Station ID

Setup Parameters	Bandwidth (MHz)	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00
	Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
	Span (MHz)	5, 10, 15, 20
	Frame Length (ms)	2.5, 5.0, 10.0
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements
WiMAX Fixed RF Measurements (temperature range 15° to 35°C)	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
WiMAX Fixed Demodulation Measurements (temperature range 15° to 35°C)	Frequency Error	0.07 ppm + time base error, 99% confidence level
	Residual EVM (rms)	3% typical, 3.5% maximum (RF Input –50 to +20 dBm)

• WiMAX* Fixed/Mobile Measurements (Option 885) (continued)

Measurements			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power Uplink Burst Power ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID DL-MAP (Tree View) Modulation Summary	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Downlink Burst Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID

Setup Parameters	Zone Type	PUSC
	DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
	Bandwidths (MHz)	3.50, 5.00, 7.00, 8.75, 10.00
	Cyclic Prefix Ratio (CP)	1/8
	Span (MHz)	5, 10, 20, 30
	Frame Lengths (ms)	5, 10
	Demodulation	Auto, Manual, FCH
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
WiMAX Mobile RF Measurements (temperature range 15° to 35°C)	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
WiMAX Mobile Demodulation Measurements (temperature range 15° to 35°C)	Frequency Error	0.02 ppm + time base error, 99% confidence level
	Residual EVM (rms)	2.5% typical, 3.0% maximum (RF Input –50 to +20 dBm)
WiMAX Mobile Over-the-Air (OTA) Measurements	Channel Power Monitor	Over time (one week), measurement time interval 1 s to 60 s
	Preamble Scanner	Six Strongest Preambles
	Auto Save	Yes
	GPS Tagging and Logging	Yes

*: Mobile WiMAX conforms to IEEE Std. 802.16e-2005, WiMAX Forum® Air Interface - Mobile System Profile - Release 1.0 Certified, System Profiles according to WMF-T24-001-R010v07.

General Specifications

Setup Parameters	System	Status (Temperature, Battery Info, S/N, Firmware Version, Installed Options) Self Test, Application Self Test, GPS (see Option 31) Name, Date and Time, Ethernet Configuration, Volume
	System Options	Display (Brightness, Blank, Default, Black & White, Night Vision, High Contrast, Invert Black & White) Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, User Defined) Reset (Factory Defaults, Master Reset, Update Firmware) Share Center Frequency and Power (All Modes are Not Shared) Power-On (via Power Switch or when DC is Applied)
	File	Save As, Save Meas, Save, Save On Event, Recall Meas, Recall, Copy, Delete
	Save/Recall	Setups, Measurements, Screen Shots JPEG (save only)
	Delete	By File Type, All, Selected
	Internal Trace/Setup Memory	>13,000 traces
	External Trace/Setup Memory	Limited by size of USB Flash Drive
Connectors	RF In	9 GHz to 20 GHz Instruments: Type N, female, 50Ω 32 GHz to 43 GHz Instruments: Ruggedized Type K, male
	RF Out	9 GHz to 20 GHz Instruments: Type N, female, 50Ω
	GPS	SMA Female
	External Power	5.5 mm barrel connector, 12 to 14.5 VDC, < 5.0 A
	LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
	USB Interface	Two Type A, Connect Flash Drive and Power Sensor; 5-pin mini-B, Connect to PC for data transfer
	Headset Jack	3.5 mm 3-wire headset jack
	External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm
	External Reference Out	BNC, female, 50Ω, 10 MHz
	External Trigger	BNC, female, 50Ω, Maximum Input +5 VDC
	IF Out	BNC, female, 50Ω, 140 MHz
Display and Keyboard	Display	8.4" Touch Screen, 800 x 600 Resolution
	Keyboard	Backlit (Red for Night Vision, White for all other display modes)
Battery	Type, Operation	Li-Ion, 3 hour operation, typical
Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC
	Australia and New Zealand	C-tick N274
	Interference, Emissions, Immunity	EN 61326-1, EN 55011, EN 61000-4-2/3/4/5/11
Safety	Safety Class	EN 61010-1 Class 1, Pollution Degree 2
	Product Safety	IEC 60950-1 when used with Anritsu Company supplied Power Supply
Environmental	Operating Temperature	–10° to +55°C
	Maximum Humidity	85% RH, non-condensing
	Vibration, Shock, Temperature, Humidity	MIL-PRF-28800F Class 2
	Storage	–51° to +71°C
	Altitude	4600 m, operating and non-operating
	Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3
Dimensions and Mass	Dimensions	315 × 211 × 77 mm, (12.4 × 8.3 × 3.0 in)
	Mass	3.7 kg to 4.4 kg (8.1 lb to 9.8 lb) depending on Frequency Option and Tracking Generator

Master Software Tools (for your PC)

Database Management	Full Trace Retrieval	Retrieve all traces from instrument into one PC directory
	Trace Catalog	Index all traces into one catalog
	Trace Rename Utility	Rename measurement traces
	Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
Data Analysis	Trace Math and Smoothing	Compare multiple traces
	Measurement Calculator	Translate into other units
Report Generation	Report Generator	Includes GPS, power level, and calibration status along with measurements
	Edit Graph	Change scale, limit lines, and markers
	Report Format	Create reports in HTML for PDF format
	Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
	Notes	Annotate measurements
Mapping (GPS Required)	Spectrum Analyzer Mode	MapInfo, MapPoint
	Mobile WiMAX OTA Option	Google Earth, Google Maps, MapInfo
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
	Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
	Folder Spectrogram – 3D View	View Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	Traces	Add, delete, and modify limit lines and markers
	Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
	Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
	Languages	Add one language or modify non-English language menus
	Mobile WiMAX	DL-MAP Parameters
	Display	Modify display settings
Connectivity	Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
	Download	Download measurements and live traces to PC for storage and analysis
	Upload	Upload measurements from PC to instrument
	Remote Access Tool	Remote control and monitoring of instrument (via Ethernet port) over the Internet

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MS2720T	Spectrum Master (Requires Option 709, 713, 720, 732, or 743)
	Freqeuncy Options
MS2720T-0709	Frequency Range 9 kHz to 9 GHz
MS2720T-0713	Frequency Range 9 kHz to 13 GHz
MS2720T-0720	Frequency Range 9 kHz to 20 GHz
MS2720T-0732	Frequency Range 9 kHz to 32 GHz
MS2720T-0743	Frequency Range 9 kHz to 43 GHz
	Tracking Generator Options
MS2720T-0809	9 GHz Tracking Generator (Requires Option 709)
MS2720T-0813	13 GHz Tracking Generator (Requires Option 713)
MS2720T-0820	20 GHz Tracking Generator (Requires Option 720)
	Spectrum Analyzer Options
MS2720T-0025	Interference Analyzer (Option 31 is recommended)
MS2720T-0027	Channel Scanner
MS2720T-0431	Coverage Mapping (Requires Option 31 for full functionality)
MS2720T-0509	AM/FM/PM Measurements (Option 431 required for full functionality)
MS2720T-0024	I/Q Waveform Capture (Requires Option 9)
MS2720T-0089	Zero-Span IF Output
MS2720T-0090	Gated Sweep
	Power Meter Option
MS2720T-0019	High Accuracy Power Meter (Requires USB Power Sensor, sold separately)

Model/Order No.	Name
	Wireless Measurement Options
MS2720T-0009	Demodulation Hardware
MS2720T-0880	GSM/GPRS/EDGE Measurements (Requires Option 9)
MS2720T-0881	W-CDMA/HSPA+ Measurements (Requires Option 9, Option 31 recommended)
MS2720T-0882	TD-SCDMA/HSPA+ Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0883	LTE FDD/TDD Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0884	CDMA/EV-DO Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0885	WiMAX Fixed/Mobile Measurements (Requires Option 9, Option 31 required for full functionality)
	General Options
MS2720T-0007	Secure Data Operation
MS2720T-0031	GPS Receiver (Requires GPS Antenna, sold separately) - 2000-1528-R GPS Antenna, SMA(m) with 5 m (15 ft) cable, requires 5 VDC - 2000-1652-R GPS Antenna, SMA(m) with 0.3 m (1 ft) cable, requires 3.3 VDC or 5 VDC
MS2720T-0098	Standard Calibration (ANSI Z540-1-1994)
MS2720T-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)

Continued on next page

Model/Order No.	Name
	Power Sensors
	(for complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 250 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
	Manuals
	(soft copy included on Handheld Instruments Documentation Disc and at www.anritsu.com)
10920-00060	Handheld Instruments Documentation Disc
10580-00340	Spectrum Master User Guide (Hard copy included)
10580-00349	Spectrum Analyzer Measurement Guide
10580-00339	Tracking Generator Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+, LTE, TD-LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00341	Spectrum Master Programming Manual
10580-00342	Spectrum Master Maintenance Manual
	Troubleshooting Guides
	(soft copy at www.anritsu.com)
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00566	LTE eNodeB
11410-00615	TD-LTE eNodeB
11410-00463	W-CDMA/HSPA+ Base Stations
11410-00465	TD-SCDMA/HSPA+ Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00469	Mobile WiMAX Base Stations
11410-00470	Fixed WiMAX Base Stations
	Standard Accessories (included with instrument)
10920-00060	Handheld Instruments Documentation Disc
10580-00340	Spectrum Master User Guide (includes GPS Receiver)
2300-498	Master Software Tools (MST) Disc
2000-1685-R	Soft Carrying Case
633-75	High Capacity Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Cigarette Lighter 12 VDC Adapter
2000-1371-R	Ethernet Cable, 7 ft/213 cm
3-2000-1498	USB A-mini B Cable, 10 ft/305 cm
11410-00646	MS2720T Spectrum Master Technical Data Sheet
	One Year Warranty (Including battery, firmware, and software)
	Certificate of Calibration and Conformance
	Optional Accessories
	GPS Antennas
2000-1528-R	GPS Antenna, SMA(m) with 5 m (15 ft) cable, requires 5 VDC
2000-1652-R	GPS Antenna, SMA(m) with 0.3 m (1 ft) cable, requires 3.3 VDC or 5 VDC
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd gain, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd gain, Yagi
2000-1677-R	300 MHz to 3000 MHz, SMA(m), 50Ω, 3 m cable (9.8 ft) 0 to 6 dBi gain @ 950 MHz, log periodic
2000-1617	600 MHz to 21 GHz, N(f), 5 to 8 dBi gain to 12 GHz, 0 to 6 dBi gain to 21 GHz, log periodic

Model/Order No.	Name
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1487	VHF/UHF, Telescopic Whip antenna, straight or 90°, BNC(m), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
	Mag Mount Broadband Antenna
2000-1647-R	Cable 1: 698–1200 MHz 2 dBi peak gain, 1700–2700 MHz 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 2: 3000–6000 MHz 5 dBi peak gain, N(m), 50Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50Ω, 10 ft
2000-1645-R	694-894 MHz 3 dBi peak gain 1700-2700 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
2000-1646-R	750-1250 MHz 3 dBi peak gain, 1650-2000 MHz 5 dBi peak gain, 2100-2700 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
2000-1648-R	1700-6000 MHz 3 dBi peak gain, N(m), 50Ω, 10 ft
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50Ω
1030-179-R	777 MHz to 787 MHz, N(m) to N(f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50Ω
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-417-R	N(m) to QMA(f), DC to 6 GHz, 50Ω
1091-418-R	N(m) to QMA(m), DC to 18 GHz, 50Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50Ω
510-90-R	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN(m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN(f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50Ω, w/ Reinforced Grip
71693-R	Ruggedized K(f) to Type N(f)
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Miscellaneous Accessories
2000-1374	External Dual Charger for Li-Ion Batteries
633-75	High Capacity Battery Pack, 7500 mAh
66864	Rack Mount Kit, Master Platform
2000-1689	EMI Near Field Probe Kit
2000-1653	Anti-glare Screen Cover (package of 2)
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

SPECTRUM MASTER

MS2711E MS2712E MS2713E

9 kHz to 3 GHz | 9 kHz to 4 GHz | 9 kHz to 6 GHz

Remote Control
USB

Compact Handheld Spectrum Analyzer

The wireless communications market is rapidly growing as the telecommunications sectors continue to evolve. Whether you are installing, troubleshooting, or solving problems for public safety providers, or wireless service providers, Anritsu has a solution. Anritsu's new Spectrum Master has been designed for technicians, installers, field radio frequency (RF) engineers, and contractors who struggle with both keeping track of the growing number of interfering signals and assessing signal quality on a wide range of increasingly complex signals. Easy-to-use, integrated and high performing, the Spectrum Master helps users address those challenges and more. Its feature-rich and compact design helps users comply to regulatory requirements, manage and maximize efficiency, improve system up-time, and increase revenue – all in a rugged and field-proven device designed to withstand even the most punishing conditions. This next generation of Anritsu's best-in-class Spectrum Master series is ideal for spectrum monitoring, interference analysis, RF and microwave measurements, field strength measurements, transmitter spectrum analysis, electromagnetic field strength, signal strength mapping, and overall field analysis of cellular 2G/3G/4G, land mobile radio, Wi-Fi, and broadcast signals.

Designed for Field Use

The Spectrum Master was designed specifically for field environments. Weighing less than 3.45 kg, it is small and compact and easy to carry. Its field replaceable Li-Ion battery typically lasts for more than 3 hours, and a new bright 8.4-inch color display provides visibility even in broad daylight. With an operating temperature range from –10° to +55°C, a rugged case and splash proof design, the Spectrum Master works in the most extreme weather conditions with guaranteed performance anywhere and anytime.

Integrated Solution

The Spectrum Master is a multifunctional instrument that eliminates the need for you to carry and learn multiple instruments. It can be configured to across a broad range of parameters, including a 3 GHz, 4 GHz or 6 GHz spectrum analyzer, an interference analyzer, 2-port transmission measurement with built-in 32 V bias-tee, channel scanner, power meter, high accuracy power meter, and GPS receiver for time/location stamping and accuracy enhancements.

Easy-to-Use

The Spectrum Master leverages the user interface from Anritsu's popular MS2721B analyzer, giving users intuitive spectrum analyzer menus. A touchscreen keypad combination provides you with an intuitive menu-driven interface designed to give a familiar menu structure with quick access to popular measurements.

Key Facts

- 9 kHz to 3 GHz (MS2711E)
- 9 kHz to 4 GHz (MS2712E)
- 9 kHz to 6 GHz (MS2713E)
- One-button measurements: ACPR, Channel Power, Field Strength, Occupied BW, AM/FM/SSB Demod
- Interference Analyzer: Interference Mapping, Spectrogram, Signal Strength, RSSI, Signal ID
- Coverage Mapping (Indoor and Outdoor GPS Mapping)
- DANL: >–162 dBm typical (normalized to 1 Hz)
- Dynamic Range: >95 dB (>85 dB for MS2711E)
- <Phase Noise: –100 dBc/Hz @ 10 kHz offset (–90 dBc/Hz for MS2711E)
- Frequency Accuracy: <±50 ppb with GPS On
- Detection methods: Peak, RMS, Negative, Sample, Quasi-peak
- Save-on-event: automatically saves a sweep when crossing a limit line or at the end of the sweep
- Gated sweep: view pulsed or burst signals only when they are on, or off
- Three hours of battery life
- Touch-screen display
- USB port
- 8.4-inch touchscreen TFT display
- Lightweight: <3.45 kg

Functions and Description

- Spectrum Analyzer, 100 kHz to 3 GHz/4 GHz/6 GHz
  – Locates and identifies various signals over a wide frequency range. Detects signals as low as –152 dBm with phase noise better than –100 dBc/Hz (–110 dBc/Hz typical).
- Interference Analyzer (Option 25)
  – Includes everything you need to monitor, identify, and locate interference using the spectrogram display, Mapping, RSSI, Signal ID, and signal strength meter.
- GPS receiver (Option 31)
  – Provides location and UTC time information. Also improves the accuracy of the reference oscillator.

- 2-port Transmission Measurement (Option 21)
  – Offers high and low power settings for both active and passive measurements. Better than 80 dB dynamic range.
- Bias-Tee (Option 10)*
  – Possesses a built-in 32 V bias-tee that can be turned on as needed and applied to the RF In port.
- High Accuracy Power Meter (Option 19)
  – Connects high accuracy 4, 6, 8, and 18 GHz USB power sensors with better than ±0.16 dB accuracy.
- Power Meter (Option 29)
  – Makes channelized transmitter power measurements.
- Channel Scanner (Option 27)
  – Measures the power of multiple transmitted signals. Scans up to 1200 channels using Script Master.
- CW Signal Generator (Option 28)*
  – Provides CW source to test low noise amplifiers and repeaters. (Needs external CW generator kit.)
- Gated Sweep (Option 90)*
  – Views pulsed or burst signals such as WiMAX, GSM, and TD-SCDMA only when they are on.

*: Indicates option not available in the MS2711E

Specifications

- **Spectrum Analyzer**

Frequency	Frequency Range	9 kHz to 3 GHz (MS2711E), 9 kHz to 4 GHz (MS2712E), 9 kHz to 6 GHz (MS2713E) (usable to 0 Hz)			
	Maximum Continuous Input	+26 dBm			
	Tuning Resolution	1 Hz			
	Frequency Reference	Aging: ±1.0 ppm/year			
	Frequency Span	Accuracy: ±1.5 ppm (25°C ±25°C) + aging, <±50 ppb with GPS On 10 Hz to 4 GHz including zero span (MS2712E), 10 Hz to 6 GHz including zero span (MS2713E)			
	Sweep Time	Minimum 100 ms, 10 µs to 600 seconds in zero span			
	Sweep Time Accuracy	±2% in zero span			
Bandwidth	Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero span) (–3 dB bandwidth) (100 Hz to 3 MHz for MS2711E)			
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable) (10 Hz to 3 MHz for MS2711E)			
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)			
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1			
Spectral Purity	SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz (typical, 10 kHz offset) –105 dBc/Hz, –112 dBc/Hz (typical, 100 kHz offset) –115 dBc/Hz, –121 dBc/Hz (typical, 1 MHz offset)			
Amplitude Ranges	Dynamic Range	>102 dB (2.4 GHz), 2/3 (TOI-DANL) in 1 Hz RBW, (–85 dB for the MS2711E)			
	Measurement Range	DANL to +26 dBm			
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed			
	Reference Level Range	–120 to +30 dBm			
	Attenuator Range	0 to 55 dB, 5.0 dB steps			
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW			
Amplitude Accuracy	9 kHz to 100 kHz	±2.0 dB typical			
	100 kHz to 4.0 GHz	±1.25 dB, ±0.5 dB typical			
	>4.0 GHz to 6 GHz	±1.50 dB, ±0.5 dB typical			
Displayed Average Noise Level (DANL)	RBW Normalized to 1 Hz, 0 dB attenuation				
		Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
		Maximum	Typical	Maximum	Typical
	10 MHz to 2.4 GHz	–141 dBm	146 dBm	–157 dBm	–162 dBm
	>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
	>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
	>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
Spurs	Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
	Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
	Exceptions, typical	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input <–68 dBc @ F1 – 280 MHz with F1 Input <–70 dBc @ F1 + 190 MHz with F1 Input <–52 dBc @ 7349 – 2F2 MHz, with F2 Input, where F2 <2424.5 MHz			
Third-Order Intercept (TOI)		Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)			
	800 MHz	+16 dBm			
	2400 MHz	+20 dBm			
	200 MHz to 2200 MHz	+25 dBm, typical			
	>2.2 GHz to 5.0 GHz	+28 dBm, typical			
	>5.0 GHz to 6.0 GHz	+33 dBm, typical			
Second Harmonic Distortion		Preamp Off, 0 dB input attenuation, –30 dBm input			
	50 MHz	–56 dBc			
	>50 MHz to 200 MHz	–60 dBc, typical			
	>200 MHz to 3000 MHz	–70 dBc, typical			
VSWR		2:1, typical			

• 2-Port Transmission Measurement (Option 0021)

Frequency	Frequency Range	2 MHz to 3 GHz (MS2711E), 2 MHz to 4 GHz (MS2712E), 2 MHz to 6 GHz (MS2713E)
	Frequency Resolution	10 Hz
Output Power	High	0 dBm, typical
	Low	–30 dBm, typical
Dynamic Range	2 MHz to 4 GHz	80 dB
	>4 GHz to 6 GHz	70 dB
Application Options		Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• Bias-Tee (Option 0010)

Setup	On/Off, Voltage, Current (Low/High)
Voltage Range	+12 V to +32 V
Current (Low/High)	250 mA/450 mA, 1 A surge for 100 ms
Resolution	0.1 V

• GPS Receiver (Option 0031) (Antenna sold separately, P/N 2000-1528-R)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Generator
When GPS Antenna is connected	<±50 ppb with GPS On, 3 minutes after satellite lock in selected mode
Connector	SMA, female

• Power Meter (Option 0029)

Frequency Range	10 MHz to 4 GHz (MS2712E), 10 MHz to 6 GHz (MS2713E)
Span	1 kHz to 100 MHz
Display Range	–140 to +30 dBm, ≤40 dB span
Measurement Range	–120 to +26 dBm
Offset Range	0 to +100 dB
VSWR	2:1 typical
Maximum Power	+26 dBm without attenuator
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50Ω, 75Ω, Other)

• High Accuracy Power Meter (Option 0019) (Requires external USB Power Sensor(s)

Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108A	MA24118A
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz	10 MHz to 18 GHz
Connector	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω
Dynamic Range	–30 to +20 dBm (.001 to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 μW to 200 mW)	–40 to +20 dBm (0.1 μW to 100 mW)	–40 to +20 dBm (0.1 μW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB*1	±0.17 dB*2	±0.16 dB*1	±0.18 dB*3	±0.18 dB*3
Datasheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504	11410-00504

∗1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
∗2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
∗3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

• **Interference Analyzer (Option 0025)**

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram (Collect data up to one week)	
	Signal Strength (Gives visual and aural indication of signal strength)	
	Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength	
	Signal ID (up to 12 signals)	Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) >10 dB
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)	

• **Channel Scanner (Option 0027)** (Option 0027 not offered in the MS2711E)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Freq/Channel, Current/Max, Single/Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	100 kHz to 4 GHz (MS2712E), 100 kHz to 6 GHz (MS2713E)
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• **CW Signal Generator (Option 0028)** (Requires CW Signal Generator Kit, P/N 69793) (Option 0028 not offered in the MS2711E)

Setup Parameters	Frequency	Frequency, Signal Standard, Channel Number, Display Setup Help
	Amplitude	Power Level (Low/High), Offset (dB)
	Frequency Range	25 MHz to 2 GHz typical
	Output Power	High 0 dBm typical, Low –30 dBm typical Attenuator (included in kit 69793): 0 to 90 dB in 1 dB steps

• **Gated Sweep (Option 0090) (MS2712E, MS2713E)** (Requires CW Signal Generator Kit, P/N 69793) (Option 0090 not offered in the MS2711E)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 to 65 ms typical) Gate Length (1 μs to 65 ms typical) Zero Span Time

• **Coverage Mapping (Options 0431)** (Option 0431 not offered in the MS2711E)

Measurements	Indoor Mapping RSSI ACPR		Outdoor Mapping RSSI ACPR
Setup Parameters	Frequency	Center/Start/Stop, Span, Freq. Step, Signal Standard, Channel #, Channel Increment	
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection	
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span	
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW	
	Measurement Setup	ACPR, RSSI	
	Point Distance/ Time Setup	Repeat Type Time Distance	
	Save Points Map	Save KML, JPEG, Tab Delimited	
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid	

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
	System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Internal Trace/Setup Memory	2,000 traces, 2,000 Setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	RF Out	Type N, female, 50Ω (Reflection In) (Option 21 only)
	RF Out Damage Level	23 dBm, ±50 VDC (Option 21 only)
	RF In	Type N, female, 50Ω
	RF In Damage Level	+33 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation)
	GPS	SMA(f)
	External Power	5.5 mm barrel connector, 12.5 to 15 VDC, <4.0 Amps
	USB Interface (2)	Type A, Connect USB Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Headset Jack	3.5 mm mini-phone plug
	External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm 1 MHz, 5 MHz, 10 MHz, 13 MHz
	External Trigger/Clock Recovery	BNC, female, 50Ω, Maximum Input ±50 VDC
Display	Type	Resistive Touchscreen
	Size	8.4-inch daylight viewable color LCD
	Resolution	800 × 600
Battery	Type	Li-Ion
	Battery Operation	3.0 hours, typical
Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
	Australia and New Zealand	C-tick N274
	Interference	EN 61326-1
	Emissions	EN 55011
	Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11
Safety	Safety Class	EN 61010-1 Class 1
	Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	Temperature	–10° to +55°C (Operating), –40°C to +71°C (Storage)
	Maximum Humidity	95% RH (non-condensing) at 40°C
	Shock	MIL-PRF-28800F Class 2
	Altitude	4600 meters, operating and non-operating
Dimensions and Mass	Dimensions	273 × 199 × 91 mm, (10.7 × 7.8 × 3.6 in)
	Mass	3.45 kg, (7.6 lbs)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MS2711E	Spectrum Analyzer (9 kHz to 3 GHz)
MS2712E	Spectrum Analyzer (9 kHz to 4 GHz)
MS2713E	Spectrum Analyzer (9 kHz to 6 GHz)
	MS2711E Options
MS2711E-0019	High-Accuracy Power Meter (requires External Power Sensor)
MS2711E-0021	Transmission Measurement
MS2711E-0025	Interference Analyzer
MS2711E-0027	Channel Scanner
MS2711E-0029	Power Meter
MS2711E-0010	Bias T
MS2711E-0098	Standard Calibration
MS2711E-0099	Premium Calibration
	MS2712E Options
MS2712E-0021	2-Port Transmission Measurement
MS2712E-0010	Bias-Tee
MS2712E-0031	GPS Receiver (requires Antenna P/N 2000-1528-R)
MS2712E-0019	High-Accuracy Power Meter (requires External Power Sensor)
MS2712E-0029	Power Meter
MS2712E-0025	Interference Analyzer (Option 0031 recommended)
MS2712E-0027	Channel Scanner
MS2712E-0431	Coverage Mapping (requires Option 0031)
MS2712E-0090	Gated Sweep
MS2712E-0028	C/W Signal Generator (requires Option 0021) (requires CW Signal Generator Kit, P/N 69793)
MS2712E-0509	AM/FM/PM Analyzer
MS2712E-0009	20 MHz BW Demod
MS2712E-0040	GSM/EDGE RF Measurements (requires Option 0009)
MS2712E-0041	GSM/EDGE Demodulation (requires Option 0009)
MS2712E-0044	W-CDMA/HSPA+ RF Measurements (requires Option 0009)
MS2712E-0045	W-CDMA Demodulation (requires Option 0009)
MS2712E-0065	W-CDMA/HSPA+ Demodulation (requires Option 0009)
MS2712E-0035	W-CDMA/HSPA+ Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2712E-0520	P25 Analyzer Measurements (requires Option 0009)
MS2712E-0522	P25 Coverage Measurements (requires Option 0009)
MS2712E-0530	NXDN Analyzer Measurements (requires Option 0009)
MS2712E-0532	NXDN Coverage Measurements (requires Option 0009)
MS2712E-0541	LTE RF Measurements (requires Option 0009 and Option 0031)
MS2712E-0542	LTE Modulation Quality (requires Option 0009 and Option 0031)
MS2712E-0546	LTE Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2712E-0060	TD-SCDMA/HSPA+ Measurements (requires Option 0009)
MS2712E-0061	TD-SCDMA/HSPA+ Demodulation (requires Option 0009)
MS2712E-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (requires Option 0009)
MS2712E-0042	CDMA RF Measurements (requires Option 0009)
MS2712E-0043	CDMA Demodulation (requires Option 0009)
MS2712E-0033	CDMA Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2712E-0062	1xEV-DO RF Measurements (requires Option 0009)
MS2712E-0063	1xEV-DO Demodulation (requires Option 0009)
MS2712E-0034	1xEV-DO Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2712E-0046	Fixed WiMAX RF Measurements (requires Option 0009)
MS2712E-0047	Fixed WiMAX Demodulation (requires Option 0009)
MS2712E-0066	Mobile WiMAX RF Measurements (requires Option 0009)
MS2712E-0067	Mobile WiMAX Demodulation (requires Option 0009)
MS2712E-0037	Mobile WiMAX Over-the-Air Measurements (requires Option 0009)
MS2712E-0030	ISDB-T Digital Video Measurements (requires Option 0009)
MS2712E-0032	ISDB-T SFN Measurements (requires Option 0009)
MS2712E-0411	Ethernet Connectivity
MS2712E-0098	Standard Calibration (ANSI 2540-1-1994)
MS2712E-0099	Premium Calibration to Z540 plus test data

Model/Order No.	Name
	MS2713E Options
MS2713E-0021	2-Port Transmission Measurement
MS2713E-0010	Bias-Tee
MS2713E-0031	GPS Receiver (Requires Antenna P/N 2000-1528-R)
MS2713E-0019	High-Accuracy Power Meter (requires External Power Sensor)
MS2713E-0029	Power Meter
MS2713E-0025	Interference Analyzer (Option 0031 recommended)
MS2713E-0027	Channel Scanner
MS2713E-0431	Coverage Mapping (requires Option 0031)
MS2713E-0090	Gated Sweep
MS2713E-0028	C/W Signal Generator (requires Option 0021) (requires CW Signal Generator Kit, P/N 69793)
MS2713E-0509	AM/FM/PM Analyzer
MS2713E-0009	20 MHz BW Demod
MS2713E-0040	GSM/EDGE RF Measurements (requires Option 0009)
MS2713E-0041	GSM/EDGE Demodulation (requires Option 0009)
MS2713E-0044	W-CDMA/HSPA+ RF Measurements (requires Option 0009)
MS2713E-0045	W-CDMA Demodulation (requires Option 0009)
MS2713E-0065	W-CDMA/HSPA+ Demodulation (requires Option 0009)
MS2713E-0035	W-CDMA/HSPA+ Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2713E-0520	P25 Analyzer Measurements (requires Option 0009)
MS2713E-0522	P25 Coverage Measurements (requires Option 0009)
MS2713E-0530	NXDN Analyzer Measurements (requires Option 0009)
MS2713E-0532	NXDN Coverage Measurements (requires Option 0009)
MS2713E-0541	LTE RF Measurements (requires Option 0009 and Option 0031)
MS2713E-0542	LTE Modulation Quality (requires Option 0009 and Option 0031)
MS2713E-0546	LTE Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2713E-0060	TD-SCDMA/HSPA+ Measurements (requires Option 0009)
MS2713E-0061	TD-SCDMA/HSPA+ Demodulation (requires Option 0009)
MS2713E-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (requires Option 0009)
MS2713E-0042	CDMA RF Measurements (requires Option 0009)
MS2713E-0043	CDMA Demodulation (requires Option 0009)
MS2713E-0033	CDMA Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2713E-0062	1xEV-DO RF Measurements (requires Option 0009)
MS2713E-0063	1xEV-DO Demodulation (requires Option 0009)
MS2713E-0034	1xEV-DO Over-the-Air Measurements (requires Option 0009 and Option 0031)
MS2713E-0046	Fixed WiMAX RF Measurements (requires Option 0009)
MS2713E-0047	Fixed WiMAX Demodulation (requires Option 0009)
MS2713E-0066	Mobile WiMAX RF Measurements (requires Option 0009)
MS2713E-0067	Mobile WiMAX Demodulation (requires Option 0009)
MS2713E-0037	Mobile WiMAX Over-the-Air Measurements (requires Option 0009)
MS2713E-0030	ISDB-T Digital Video Measurements (requires Option 0009)
MS2713E-0032	ISDB-T SFN Measurements (requires Option 0009)
MS2713E-0411	Ethernet Connectivity
MS2713E-0098	Standard Calibration (ANSI 2540-1-1994)
MS2713E-0099	Premium Calibration to Z540 plus test data
	Power Sensors (for complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm

Continued on next page

Model/Order No.	Name
	Manuals (soft copy included on MST CD and at www.us.anritsu.com)
10580-00251	Spectrum Master User Guide (hard copy included) - Bias-Tee, GPS Receiver
10580-00242	2-Port Transmission Measurement - Bias-Tee
10580-00231	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, CW Signal Generator
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00237	Digital TV Measurement Guide - DVB-T/H, ISDB-T
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00243	P25 and NXDN Measurement Guide
10580-00256	Programming Manual
	Standard Accessories (included with instrument)
10580-00251	Spectrum Master User Guide (includes Bias-Tee, GPS Receiver)
2000-1654-R	Soft Carrying Case
2300-498	MST CD: Master Software Tools, User/Measurement Guides, Programming Manual, Troubleshooting Guides, Application Notes
633-44	Rechargeable Li-Ion Battery
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 VDC Adapter
3-2000-1498	USB A/5-pin mini-B Cable, 10 feet/305 cm
11410-00511	Spectrum Master™ MS2712E, MS2713E Technical Data Sheet
	One Year Warranty (including battery, firmware, and software)
	Certificate of Calibration and Conformance
11410-00597	Spectrum Master MS2711E Technical Data Sheet
	Optional Accessories
	Directional Antennas
2000-1411-R	822 MHz to 900 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi
2000-1677-R	300 MHz to 3 GHz, SMA(m), log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1750 MHz to 1850 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 dBd, Yagi

Model/Order No.	Name
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) - SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) - SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) - SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) - SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) - SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) - SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) - SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) - SMA(f), 50Ω
1030-149-R	High Pass, 150 MHz, N(m) to N(f), 50Ω
1030-150-R	High Pass, 400 MHz, N(m) to N(f), 50Ω
1030-151-R	High Pass, 700 MHz, N(m) to N(f), 50Ω
1030-152-R	Low Pass, 200 MHz, N(m) to N(f), 50Ω
1030-153-R	Low Pass, 550 MHz, N(m) to N(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) - N(f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50Ω
1030-179-R	777 MHz to 797 MHz, N(m) to N(f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m)-N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) - N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) - N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) - N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) - N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) - N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) - N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) - N(f)
	Adapters
1091-26-R	SMA(m) - N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) - N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) - N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) - N(f), DC to 18 GHz, 50Ω
1091-172-R	BNC(f) - N(m), DC to 1.3 GHz, 50Ω
510-102-R	N(m) - N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) - N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) - N(f), DC to 18 GHz, 50Ω
	Backpack and Transit Case
67135	Anritsu Backpack (for Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA(m); 15 ft cable
2000-1652-R	GPS Antenna, SMA(m) with 1 ft. cable
2000-1374	External Charger for Li-Ion Batteries
2000-1653	Protective Screen Cover
806-245-R	Calibration Accessory for use with Option 20 Tracking Generator
2000-1371-R	Ethernet Cable, 7 feet/213 cm
2000-1689	EMI Near Field Probe Kit
3-806-152	Cat 5e Crossover Patch Cable, 7 feet/213 cm
2300-517	Phase Noise Measurement Software (requires Ethernet Option 0411)
633-75	8000 mAh High-capacity Battery Pack

HIGH PERFORMANCE HANDHELD SPECTRUM ANALYZER

MS2721B

9 kHz to 7.1 GHz

Remote Control
Ethernet | USB

The Most Advanced Ultra-portable Spectrum Analyzer on the Market, Featuring Unparalleled Performance at a Modest Price

Continuous frequency coverage from 9 kHz to 7.1 GHz gives the wireless professional the performance needed for the most demanding measurements in harsh RF and physical environments. Whether you need spectrum monitoring, AM and FM broadcast proofing, WiFi and WiFi5 installation and testing, RF and microwave signal measurements or cellular signal measurements, the Spectrum Master family is the tool to make your job easier and more productive. Includes quasi-peak detector and CISPR bandwidths.

High Performance Highlights

- 9 kHz to 7.1 GHz Input
- 1 Hz to 3 MHz RBW Range
- Very Low Phase Noise
  (–100 dBc/Hz Maximum at 10 kHz offset, 100 kHz to 7.1 GHz)
- Built-in AM/FM/SSB Demodulator
- Built-in Preamplifier
- 65 dB Step Attenuator
- True RMS Detection
- 2+ Hours of Battery Life
- 3.1 kg (<6.9 lbs)
- 3G Modulation Cellular Measurement options
- GPS Receiver option
- Tracking Generator option
- Includes Quasi-peak detector and CISPR bandwidths
- WiMAX Measurement options

Features

Functions

- Multiple Marker: Display up to six markers on screen. Each marker includes a delta marker, effectively allowing up to 12 markers on screen. The user may also set marker 1 to be the reference for 6 delta markers.
- Marker Table: Display a table of up to six marker frequency and amplitude values plus delta marker frequency offset and amplitude.

Upper/Lower Limit

- Fixed and segmented: Each upper and lower limit can be made up of between one and 40 segments. One-button creation of a spectrum envelope and saveable limit lines.

Smart Measurements

- Occupied Bandwidth: Measures 99% to 1% power channel of a signal.
- Channel Power: Measures the total power in a specified bandwidth.
- C/I: Measures carrier to interference ratio.
- ACPR: Measures power levels in the channels immediately above and below the center channel.
- Field Strength: Uses antenna calibration tables to measure dBm/meter^2, dBmV/meter^2, W/meter and V/meter.

Specifications

Frequency	Frequency Range	9 kHz to 7.1 GHz
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1 ppm per 10 years Accuracy: ±0.3 ppm (25°C ±25°C) + aging
	Frequency Span	10 Hz to 7.1 GHz Plus 0 Hz (zero span)
	Span Accuracy	Same as frequency reference accuracy
	Sweep Time	10 µs to 600 seconds in zero span, autoset in non-zero span
	Sweep Time Accuracy	±2% in zero span
	Sweep Trigger	Free run, Single, Video, External
	Resolution Bandwidth	1 Hz to 3 MHz in 1-3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)
	Video Bandwidth	1 Hz to 3 MHz in 1-3 sequence (–3 dB bandwidth)
	SSB Phase Noise	–100 dBc/Hz Max. (10, 20 and 30 kHz offset) –102 dBc/Hz Max. (100 kHz)
Amplitude	Measurement Range	DANL to +30 dBm
	Display Range	1 to 15 dB/div in 1 dB steps. Ten divisions displayed.
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW
	Attenuator Range	0 to 65 dB
	Attenuator Resolution	5 dB steps
	Absolute Amplitude Accuracy	Power levels: ≥–50 dBm, ≤35 dB Input attenuation ±1.5 dB (9 kHz to 10 MHz) ±1.25 dB (>10 MHz to 4 GHz) ±1.75 dB (>4 GHz to 7.1 GHz) 40 to 55 dB Input attenuation ±1.5 dB (9 kHz to 10 MHz) ±1.75 dB (>10 MHz to 6.5 GHz) ±2 dB (>6.5 GHz to 7.1 GHz) 60 to 65 dB Input attenuation ±1.5 dB (9 kHz to 10 MHz) ±1.75 dB (>10 MHz to 6.5 GHz) ±3 dB (>6.5 GHz to 7.1 GHz) Preamplifier On, 0 or 10 dB Input attenuation ±1.5 dB (9 kHz to 4 GHz) ±1.75 dB (>4 GHz to 7.1 GHz)
	Second Harmonic Distortion (0 dB input attenuation, –30 dBm input)	0.05 GHz to 1.4 GHz, –50 dBc >1.4 GHz to 2 GHz, –70 dBc >2 GHz, –80 dBc
	Third Order Intercept (TOI) (preamplifier off)	Frequency Min. 600 MHz +7 dBm 3.5 GHz +9 dBm Frequency Typical 50 MHz to 300 MHz >8 dBm >300 MHz to 2.2 GHz >10 dBm >2.2 GHz to 2.8 GHz >15 dBm >2.8 GHz to 4.0 GHz >10 dBm >4.0 GHz to 7.1 GHz >13 dBm 0 dB attenuation, –20 dBm reference level, –20 dBm tones, spaced 100 kHz
	Displayed Average Noise Level: DANL in 1 Hz RBW	Test conditions (for all models): Input attenuation: 0 dB, RMS detection, Reference level = –20 dBm for preamplifier off and –50 dBm for preamplifier on. Note: Discrete spurious signals are not included in the measurement of DANL as they are covered by the residual spurious specification.
		Preamplifier On –163 dBm (Typical), –161 dBm (Max.), 10 MHz to 1 GHz –160 dBm (Typical), –159 dBm (Max.) >1 GHz to 2.2 GHz –156 dBm (Typical), –153 dBm (Max.) >2.2 GHz to 2.8 GHz –160 dBm (Typical), –159 dBm (Max.), >2.8 GHz to 4.0 GHz –158 dBm (Typical), –154 dBm (Max.), >4.0 GHz to 7.1 GHz Preamplifier Off –140 dBm (Typical), –137 dBm (Max.), 10 MHz to 1 GHz –136 dBm (Typical), –133 dBm (Max.), >1 GHz to 2.2 GHz –130 dBm (Typical), –126 dBm (Max.), >2.2 GHz to 2.8 GHz –139 dBm (Typical), –136 dBm (Max.), >2.8 GHz to 4.0 GHz –131 dBm (Typical), –127 dBm (Max.), >4.0 GHz to 7.1 GHz

Continued on next page

Amplitude	Noise Figure (derived from DANL measurement)	0 dB attenuation, 23°C: Preamplifier On Frequency — Typical 10 MHz to 1 GHz — 11 dB >1 GHz to 2.2 GHz — 14 dB >2.2 GHz to 2.8 GHz — 18 dB >2.8 GHz to 4.0 GHz — 14 dB >4.0 GHz to 7.1 GHz — 16 dB
	Input-related Spurious –30 dBm input, 0 dB RF attenuation, span <1.7 GHz	–60 dBc Max., (<–70 dBc typical)
	Residual Spurious, Preamplifier Off (RF input terminated, 0 dB RF attenuation)	–90 dBm Max.*2, 100 kHz to <3200 MHz –84 dBm Max.*2, 3200 MHz to 7100 MHz Exceptions*2: Frequency — Spurious Level 250, 300, and 350 MHz — –85 dBm Max. to 4010 MHz — –80 dBm Max. (–90 dBm typical) to 5084 MHz — –70 dBm Max. (–83 dBm typical) to 5894 MHz — –75 dBm Max. (–87 dBm typical) to 7028 MHz — –80 dBm Max. (–92 dBm typical)
	Residual Spurious, Preamplifier On (RF input terminated, 0 dB RF attenuation)	–100 dBm Max.

Options Specifications

• I/Q Demodulation Hardware (Option 9)

Hardware required to demodulate 3G, 4G and WiMAX signals

• High Accuracy Power Meter (Option 19)

(Requires external USB Power Sensor)

• Tracking Generator (Option 20)

Frequency Range	450 kHz to 7.1 GHz (usable to 100 kHz)
Power Output	–40 to 0 dBm
Connector	Type N female, 50Ω
Step Size	0.1 dB
Level Accuracy (15° to 35°C)	±1.5 dB Max. (450 kHz to 7.1 GHz, 15° to 35°C)

• Interference Analyzer (Option 25)

Signal Strength	Gives visual and aural indication of signal strength
RSSI	Collect data up to one week
Spectrogram	Collect data up to one week

• Channel Scanner (Option 27)

Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Number of Channels	1 to 20 (Power Levels)

• GPS (Option 31)

GPS Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
GPS High Frequency Accuracy when GPS Antenna is Connected	<±25 ppb with GPS On, 3 minutes after satellite lock in selected mode
Internal High Accuracy, when GPS Antenna is not Connected	<±50 ppb for 3 days, 0° to 50°C ambient temperature
Connector	BNC, female, reverse polarity

• W-CDMA/HSDPA OTA (Option 35)

Resolution	0.1 dB

• GSM/GPRS/EDGE RF Measurements (Option 40)

Occupied Bandwidth	Bandwidth within which 99% of the power transmitted on a single channel lies
Burst Power	±1 dB typical for –50 to +20 dBm (±1.5 dB Max.)
Frequency Error	±10 Hz + time base error, 99% confidence level

• GSM/GPRS/EDGE Demodulator (Option 41)

GSMK Modulation Quality	(RMS Phase) Measurement Accuracy: ±1 deg Residual Error (GSMK): 1 deg
8PSK Modulation Quality	(EVM) Measurement Accuracy: ±1.5% Residual Error (8PSK): 2.5%
	(EVM) Measurement Accuracy: ±1.5% Residual Error (8PSK): 2.5%

• **W-CDMA/HSDPA RF Measurements (Option 44)**

Frequency Ranges	824 MHz to 894 MHz 1710 MHz to 2170 MHz 2300 MHz to 2700 MHz
RF Channel Power (temperature range 15° to 35°C)	±0.7 dB typical (±1.25 dB Max.)
Occupied Bandwidth Accuracy	±100 kHz
Residual Adjacent Channel Leakage Ratio (ACLR)*3 (824 MHz to 894 MHz, 1710 MHz to 2170 MHz)	–54 dB typical at 5 MHz offset –59 dB typical at 10 MHz offset
Leakage Ratio (ACLR)*3 (2300 MHz to 2700 MHz)	–54 dB typical at 5 MHz offset –57 dB typical at 10 MHz offset
ACLR Accuracy (Single channel active) (824 MHz to 894 MHz, 1710 MHz to 2170 MHz)	±0.8 dB for ACLR ≥–45 dB at 5 MHz offset ±0.8 dB for ACLR ≥–50 dB at 10 MHz offset
ACLR Accuracy (Single channel active) (2300 MHz to 2700 MHz)	±1.0 dB for ACLR ≥–45 dB at 5 MHz offset ±1.0 dB for ACLR ≥–50 dB at 10 MHz offset
Frequency Error: ±10 Hz + Time Base Error, 99% confidence level	±10 Hz + Time Base Error, 99% confidence level

• **W-CDMA Demodulation and W-CDMA/HSDPA Demodulator (Options 45 and 65)**

EVM Accuracy*3 (824 MHz to 894 MHz, 1710 MHz to 2170 MHz)	(3GPP Test Model 4) ±2.5%; ≤EVM ≤25% (3GPP Test Model 5) ±2.5%; ≤EVM ≤20% (2300 MHz to 2700 MHz)
EVM Accuracy*3	±2.5% for 6 ≤EVM ≤20%
Residual EVM	2.5% typical
Code Domain Power	±0.5 dB for code channel power >–25 dB 16, 32, 64 DCPH (test model 1) 16, 32 DCPH (test model 2, 3)
CPICH (dBm) Accuracy	±0.8 dB typical
Scrambling Code	3 seconds

• **Fixed WiMAX RF Measurements (Option 46)**

Channel Power Accuracy*3	±1 dB Typical for +20 to –50 dBm (±1.5 dB Max.)

• **Fixed WiMAX RF Measurements (Option 46)**

Residual EVM (rms)	3% for +20 to –50 dBm (3.5% Max.)
Frequency Error	±10 Hz + time base error, 99% confidence level

*1: Excludes mismatch errors.
Excludes noise, zero set, zero drift for levels <–20 dBm.
Excludes digital modulation uncertainty between +17 and +20 dBm.
*2: After 30 min warm-up
*3: Depends on reference level, input signal level and single channel conditions

General

RF Input VSWR	2.0:1 maximum, 1.5:1 typical (≥10 dB attenuation)
Maximum Continuous Input	(≥10 dB attenuation), +30 dBm
Input Damage Level*	≥10 dB attenuation, >+43 dBm, ±50 Vdc <10 dB attenuation, >+23 dBm, ±50 Vdc * Input protection relay opens at >30 dBm with ≥10 dB input attenuation and at approximately 10 to 23 dBm with <10 dB attenuation.
ESD Damage Level	≥10 dB attenuation, >10 kV
External Reference Frequencies	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13 and 19.6608 MHz at –10 to +10 dBm
Display	Bright daylight-viewable color transmissive LCD: Full SVGA, 8 in.
Languages	Built-in English, Spanish, Italian, French, German, Japanese, Korean, and Chinese. The instrument also has the capability to have two customized languages installed from Master Software Tools.
Marker Modes	6 Markers, 9 Modes: Normal, Delta, Marker to Peak, Marker to Center, Marker to Reference Level, Next Peak Left, Next Peak Right, All Markers Off, Noise Marker, Frequency Counter Marker (1 Hz resolution), Markers Tracking or Fixed, Marker 1 reference for all deltas.
Sweeps	Full span, Zero span, Span Up/Span Down
Detection	Peak, Negative, Sample, RMS, Quasi-peak
Memory	Trace and Setup storage is limited only by the capacity of the installed external storage (CF or USB flash drive). For a 256 MB card, storage is greater than 13000 spectrum analyzer traces and over 10000 setups.
Traces	Displayed Traces: Three Traces with trace overlay. Trace A is always the live data; Traces B and C can be either stored data or traces which have been mathematically manipulated. Also Traces B and C can show Max. hold or min hold.
Interfaces	Type N female RF connector for Spectrum Analyzer input Type N female RF connector for optional Tracking Generator Reverse polarity BNC jack for optional GPS antenna connector BNC female connectors for ext. reference and ext. trigger 5-pin Mini-B USB 2.0 for data transfer to a PC USB 2.0 Host connector used with High Accuracy Power Meter and USB Flash Drives RJ45 connector for Ethernet 10/100BASE-T 2.5 mm 3-wire headset connector
Dimensions and Mass	313 (W) × 211 (H) × 77 (D) mm (12W × 8H × 3D in.) 3.1 kg (<6.9 lbs.) typical
Environmental	MIL-PRF-28800F class 2
Operating	–10° to +55°C, humidity 85% or less
Storage	–51° to +71°C
Altitude	4600 m, operating and non-operating
Safety	Conforms to EN 61010-1 for Class 1 portable equipment
Electromagnetic Compatibility	Meets European Community requirements for CE marking.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

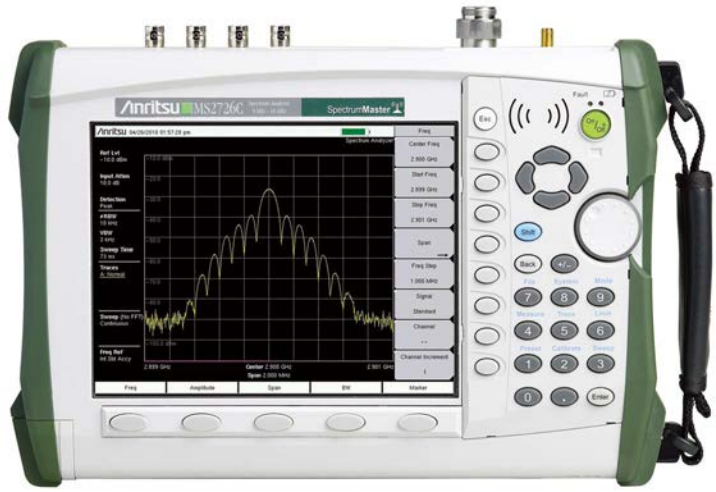
Model/Order No.	Name
	Main frame
MS2721B	Handheld Spectrum Analyzer (9 kHz to 7.1 GHz)
	Options
MS2721B-009	I/Q Demodulation Hardware
MS2721B-019	High Accuracy Power Meter
MS2721B-020	Tracking Generator
MS2721B-025	Interference Analyzer
MS2721B-027	Channel Scanner
MS2721B-031	GPS (includes GPS antenna)
MS2721B-033	cdmaOne and CDMA2000 1xRTT Over the Air (OTA) (requires Opt. 009, 031)
MS2721B-034	CDMA2000 1xEV-DO Over-the-Air Measurements (requires Opt. 009, 031)
MS2721B-035	W-CDMA/HSDPA OTA (requires Opt. 009 and 031)
MS2721B-037	IEEE 802.16 Mobile WiMAX Over-the-Air Measurements (requires Opt. 009)
MS2721B-038	TD-SCDMA/HSDPA Over-the-Air Measurements (requires Opt. 009)
MS2721B-040	GSM/GPRS/EDGE RF Measurement (requires Opt. 009)
MS2721B-041	GSM/GPRS/EDGE Demod (requires Opt. 009)
MS2721B-042	cdmaOne/CDMA2000 1X RF Measurements (requires Opt. 009)
MS2721B-043	cdmaOne/CDMA2000 1X Demodulation (requires Opt. 009)
MS2721B-044	W-CDMA/HSDPA RF Measurement (requires Opt. 009)
MS2721B-045	W-CDMA Demodulation (requires Opt. 009)
MS2721B-046	IEEE 802.16 Fixed WiMAX RF Measurements (requires Opt. 009)
MS2721B-047	IEEE 802.16 Fixed WiMAX Demodulation (requires Opt. 009)
MS2721B-060	TD-SCDMA/HSDPA Measurements (requires Opt. 009)
MS2721B-061	TD-SCDMA/HSDPA Demodulation (requires Opt. 009)
MS2721B-062	CDMA2000 1xEV-DO RF Measurements (requires Opt. 009)
MS2721B-063	CDMA2000 1xEV-DO Demodulation (requires Opt. 009)
MS2721B-065	W-CDMA/HSDPA Demod (requires Opt. 009)
MS2721B-066	IEEE 802.16 Mobile WiMAX RF Measurements (requires Opt. 009)
MS2721B-067	IEEE 802.16 Mobile WiMAX Demodulation (requires Opt. 009)
MS2721B-090	Gated Sweep
MS2721B-0541	LTE RF Measurements (requires Opt. 009)
MS2721B-0542	LTE Modulation Measurements (requires Opt. 009)
MS2721B-0546	LTE Over-the-Air Measurements (requires Opt. 009)
MS2721B-0098	Standard Calibration to Z540
MS2721B-0099	Premium Calibration to Z540 plus test data
	Standard accessories
10580-00207	Spectrum Master User Guide (includes Bias-Tee and GPS Receiver)
65729	Soft Carrying Case
40-187-R	AC – DC Adapter
806-141-R	Automotive Cigarette Lighter/12 Volt DC Adapter
2300-498	CD-ROM Containing Master Software Tools
2000-1371-R	Automotive Cigarette Lighter 12 Volt DC Adapter
633-44	Rechargeable battery, Li-Ion
1091-27-R	Type-N male to SMA female adapter
1091-172	Type-N male to BNC female adapter
2000-1520-R	2 GB USB Memory Device
3-2000-1498	USB A-mini B Cable, 10 feet/305 cm
	One Year Warranty

Model/Order No.	Name
	Optional accessories
1030-105-R	Band Pass Filters, 890 MHz to 915 MHz, N(m) to N(f), 50Ω
1030-106-R	Band Pass Filters, 1710 MHz to 1790 MHz, N(m) to N(f), 50Ω
1030-107-R	Band Pass Filters, 1910 MHz to 1990 MHz, N(m) to N(f), 50Ω
1030-109-R	Band Pass Filters, 824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	Band Pass Filters, 880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-111-R	Band Pass Filters, 1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-112-R	Band Pass Filters, 2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-114-R	Band Pass Filters, 806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
760-243-R	Transit Case
	Anritsu Master Software Tools, User/Measurement Guide
10580-00175	Anritsu HHSA User's Guide
10580-00176	Anritsu HHSA Programming Manual
10580-00177	Anritsu HHSA Maintenance Manual
2000-1411-R	Portable Yagi Antenna, 10 dBd, N(f) 822 MHz to 900 MHz
2000-1412-R	Portable Yagi Antenna, 10 dBd, N(f) 885 MHz to 975 MHz
2000-1413-R	Portable Yagi Antenna, 10 dBd, N(f) 1.71 GHz to 1.88 GHz
2000-1414-R	Portable Yagi Antenna, 9.3 dBd, N(f) 1.85 GHz to 1.99 GHz
2000-1415-R	Portable Yagi Antenna, 10 dBd, N(f) 2.4 GHz to 2.5 GHz
2000-1416-R	Portable Yagi Antenna, 10 dBd, N(f) 1.92 GHz to 2.23 GHz
2000-1030	Portable antenna, SMA(m) 1.71 GHz to 1.88 GHz, 50Ω
2000-1031	Portable antenna, SMA(m) 1.85 GHz to 1.99 GHz, 50Ω
2000-1032	Portable antenna, SMA(m) 2.4 GHz to 2.5 GHz, 50Ω
2000-1035	Portable antenna, SMA(m) 896 MHz to 941 MHz, 50Ω
2000-1200	Portable antenna, SMA(m) 806 MHz to 869 MHz, 50Ω
2000-1361	Portable Antenna, SMA(m) 5725 MHz to 5825 MHz, 50Ω
2000-1473	Portable Antenna, SMA(m) 870 MHz to 960 MHz, 50Ω
2000-1474	Portable Antenna, SMA(m) 2.4 GHz to 2.5 GHz, 50Ω
2000-1475	Portable Antenna, SMA(m) 2.11 GHz to 2.17 GHz, 50Ω
61532	Antenna Kit: 2000-1030, 2000-1031, 2000-1032, 2000-1035, 2000-1200, and 2000-1361

HIGH PERFORMANCE HANDHELD SPECTRUM MASTER
MS2722C/MS2723C/MS2724C/MS2725C/MS2726C
9 kHz to 43 GHz

Remote Control
Ethernet | USB

The Most Advanced Ultra-portable Spectrum Analyzer on the Market, Featuring Unparalleled Performance at a Modest Price



Anritsu's high performance handheld spectrum analyzer provides the wireless professional the performance needed for the most demanding measurements in harsh RF and physical environments. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or Wi-Fi and wireless network measurements, the Spectrum Master is the ideal instrument to making fast and reliable measurements.

Spectrum and Interference Analyzer Highlights
- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI
- Dynamic Range: > 104 dB in 1 Hz RBW
- DANL: –160 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz @ 10 kHz offset at 1 GHz
- Frequency Accuracy: ±25 ppb with GPS On
- 1 Hz to 10 MHz Resolution Bandwidth (RBW)
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 40 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete

Capabilities and Functional Highlights
- LTE, GSM/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- CDMA, EV-DO
- WiMAX - Fixed/Mobile
- AM/FM/SSB Demodulator
- Zero span IF Output
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter
- 4, 6, 8, 18, 26 GHz USB Sensors
- Channel Scanner
- 8.4-inch Display
- <5 minutes warm-up time
- 2.5 hours battery operation time
- Ethernet/USB Data Transfer
- MST Remote Access Tool

Specifications

Model		MS2722C	MS2723C	MS2724C	MS2725C	MS2726C
Measurements	Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m^2 or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask)				
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #				
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection				
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span				
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW				
	File	Save, Recall, Delete, Directory Management				
	Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event				
	Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All				
	Delete	Selected File, All Measurements, All Mode Files, All Content				
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy				
	Application Options	Impedance (50Ω, 75Ω, Other)				
Sweep Functions	Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type				
	Sweep Mode	Fast, Performance, No FFT				
	Detection	Peak, RMS/Avg, Negative, Sample, Quasi-peak				
	Triggers	Free Run, External, Video, Delay, Level, Slope, Hysteresis, Holdoff, Force Trigger Once				
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations				
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)				
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold				
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale				
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off				
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker				
	Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level				
	Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude				
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit				
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right				
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1				
	Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope				
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall				
Frequency	Frequency Range	9 kHz to 9 GHz (usable to 0 Hz), Preamp 100 kHz to 9 GHz	9 kHz to 13 GHz (usable to 0 Hz), Preamp 100 kHz to 13 GHz	9 kHz to 20 GHz (usable to 0 Hz), Preamp 100 kHz to 20 GHz	9 kHz to 32 GHz (usable to 0 Hz), Preamp 100 kHz to 32 GHz	9 kHz to 43 GHz (usable to 0 Hz), Preamp 100 kHz to 43 GHz
	Tuning Resolution	1 Hz				
	Frequency Reference	Aging: ±1.0 ppm/10 years Accuracy: ±0.3 ppm (25°C ±25°C) + aging				
	External Reference Frequencies	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608 MHz				
	Frequency Span	10 Hz to 9 GHz including zero span	10 Hz to 13 GHz including zero span	10 Hz to 20 GHz including zero span	10 Hz to 32 GHz including zero span	10 Hz to 43 GHz including zero span
	Sweep Time	10 µs to 600 seconds in zero span				
	Sweep Time Accuracy	±2% in zero span				
Bandwidth (Performance Sweep Mode)	Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1–3 sequence ±10% (–3 dB bandwidth)				
	Video Bandwidth (VBW)	1 Hz to 10 MHz in 1–3 sequence (–3 dB bandwidth)				
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)				
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1				
Spectral Purity	SSB Phase Noise at 1 GHz	–100 dBc/Hz @ 10 kHz offset from carrier (–104 dBc/Hz typical) –102 dBc/Hz @ 100 kHz offset from carrier (–107 dBc/Hz typical) –107 dBc/Hz @ 1 MHz offset from carrier (–114 dBc/Hz typical) –120 dBc/Hz @ 10 MHz offset from carrier (–129 dBc/Hz typical)				

Continued on next page

Model		MS2722C	MS2723C	MS2724C	MS2725C	MS2726C
Amplitude Ranges	Dynamic Range	> 104 dB @ 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW				
	Measurement Range	DANL to +30 dBm				
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed				
	Reference Level Range	–120 to +30 dBm				
	Attenuator Resolution	0 to 65 dB, 5 dB steps				
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW				
	Maximum Continuous Input	+30 dBm Peak, ±50 VDC (≥10 dB Attn) +23 dBm Peak, ±50 VDC (<10 dB Attn) +13 dBm Peak, ±50 VDC (Preamp On)				
Amplitude Accuracy (single sine wave input <Ref level, and >DANL, auto attenuation, Performance Sweep Mode)	+20° to +30°C after 30-minute warm-up	Typical: ±0.5 dB, 100 kHz to 9 GHz Maximum: ±1.3 dB, 100 kHz to 9 GHz	Typical: ±0.5 dB, 100 kHz to 13 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz	Typical: ±0.5 dB, 100 kHz to 20 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz, Add ±1.0 dB, 13 GHz to 20 GHz	Typical: ±0.5 dB, 100 kHz to 32 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz, Add ±1.0 dB, 13 GHz to 32 GHz	Typical: ±0.5 dB, 100 kHz to 40 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz, Add ±1.0 dB, 13 GHz to 40 GHz
	–10° to +40°C after 60-minute warm-up	Add ±1.0 dB, 100 kHz to 9 GHz	Add ±1.0 dB, 100 kHz to 13 GHz	Add ±1.0 dB, 100 kHz to 20 GHz	Add ±1.0 dB, 100 kHz to 32 GHz	Add ±1.0 dB, 100 kHz to 32 GHz Add ±2.0 dB, 32 GHz to 40 GHz
Displayed Average Noise Level (RMS detection, VBW/Avg type = Log., Ref Level = –20 dBm for preamp Off and –50 dBm for preamp On, Performance Sweep Mode)	(DANL in 1 Hz RBW, 0 dB attenuation) Preamp Off					
	10 MHz to 4 GHz	–141 dBm	–141 dBm	–141 dBm	–141 dBm	–141 dBm
	>4 GHz to 9 GHz	–134 dBm	–134 dBm	–134 dBm	–134 dBm	–134 dBm
	>9 GHz to 13 GHz	–	–129 dBm	–129 dBm	–129 dBm	–129 dBm
	>13 GHz to 20 GHz	–	–	–123 dBm	–123 dBm	–123 dBm
	>20 GHz to 32 GHz	–	–	–	–134 dBm	–134 dBm
	>32 GHz to 40 GHz	–	–	–	–	–127 dBm
	(DANL in 1 Hz RBW, 0 dB attenuation) Preamp On					
	10 MHz to 4 GHz	–160 dBm	–160 dBm	–160 dBm	–160 dBm	–160 dBm
	>4 GHz to 9 GHz	–156 dBm	–156 dBm	–156 dBm	–156 dBm	–156 dBm
	>9 GHz to 13 GHz	–	–152 dBm	–152 dBm	–152 dBm	–152 dBm
	>13 GHz to 20 GHz	–	–	–145 dBm	–145 dBm	–145 dBm
	>20 GHz to 32 GHz	–	–	–	–154 dBm	–154 dBm
	>32 GHz to 40 GHz	–	–	–	–	–147 dBm
Spurious	Residual Spurious (RF input terminated, 0 dB input attenuation)	Preamp Off –90 dBm 9 kHz to 9 GHz Preamp On –100 dBm 1 MHz to 9 GHz	Preamp Off –90 dBm 9 kHz to 13 GHz Preamp On –100 dBm 1 MHz to 13 GHz	Preamp Off –90 dBm 9 kHz to 13 GHz, –85 dBm 13 GHz to 20 GHz Preamp On –100 dBm 1 MHz to 20 GHz	Preamp Off –90 dBm 9 kHz to 13 GHz, –85 dBm 13 GHz to 20 GHz, –80 dBm 20 GHz to 32 GHz Preamp On –100 dBm 1 MHz to 32 GHz	Preamp Off –90 dBm 9 kHz to 13 GHz, –85 dBm 13 GHz to 20 GHz, –80 dBm 20 GHz to 43 GHz Preamp On –100 dBm 1 MHz to 32 GHz, –95 dBm 32 GHz to 43 GHz
	Input-Related Spurious	(0 dB attenuation, –30 dBm input, span <1.7 GHz) –60 dBc, –70 dBc typical				
Third-Order Intercept (TOI) (–20 dBm tones 100 kHz apart, –20 dBm Ref level, 0 dB input attenuation, preamp Off)	2.4 GHz	+15 dBm	+15 dBm	+15 dBm	+15 dBm	+15 dBm
	50 MHz to 9 GHz	+20 dBm typical	+20 dBm typical	+20 dBm typical	+20 dBm typical	+20 dBm typical
	50 MHz to 13 GHz	–				
	50 MHz to 20 GHz	–	–			
	20 MHz to 32 GHz	–	–	–	+15 dBm typical	+15 dBm typical
	32 GHz to 43 GHz	–	–	–	–	+20 dBm typical
P1dB	<4 GHz	+5 dBm typical				
	4 GHz to 9 GHz	+12 dBm typical	+12 dBm typical	+12 dBm typical	+12 dBm typical	+12 dBm typical
	4 GHz to 13 GHz	–				
	4 GHz to 20 GHz	–	–			
	20 GHz to 32 GHz	–	–	–	+7 dBm typical	+7 dBm typical
	32 GHz to 43 GHz	–	–	–	–	+12 dBm typical
Second Harmonic Distortion	50 MHz	–54 dBc				
	<4 GHz	–60 dBc typical				
	>4 GHz	–75 dBc typical				
VSWR	>10 dB input attenuation					
	<9 GHz	1:5:1 typical	–	–	–	–
	<13 GHz	–	1:5:1 typical	–	–	–
	<20 GHz	–	–	1:5:1 typical	1:5:1 typical	1:5:1 typical
	<20 GHz to 32 GHz	–	–	–	2.0:1 typical	2.0:1 typical
	<20 GHz to 43 GHz	–	–	–	–	

• GPS Receiver Option (Option 0031)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, Signal Analyzers
when GPS Antenna is connected	<±25 ppb with GPS On, 3 minutes after satellite lock in selected mode
GPS Lock – after antenna is disconnected	<±50 ppb for 3 days, 0° to 50°C ambient temperature
Connector	SMA, Female

• Secure Data Option (Option 0007)

For highly secure data handling requirements, this software option prevents the storing of measurement setup or data information onto any internal file storage location. Instead, setup and measurement information is stored ONLY to the external USB memory location.

A simple factory preset prepares the Spectrum Master for transportation while the USB memory remains behind in the secure environment. The Spectrum Master cannot be switched between secure and non-secure operation by the user once configured for secure data operation.

• High Accuracy Power Meter (Option 0019) (Requires external USB Power Sensor(s))

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108/18/26A
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz (MA24108A) 10 MHz to 18 GHz (MA24118A) 10 MHz to 26 GHz (MA24126A)
Connector	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω (MA24108/18A) Type K(m), 50Ω (MA24126A)
Dynamic Range	–30 to +20 dBm (0.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurands	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB*1	±0.17 dB*2	±0.16 dB*1	±0.18 dB*3
Datasheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504

*1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

● **Interference Analyzer (Option 0025)**

Measurements	Spectrum Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I) Spectrogram (Collect data up to 72 hours) Signal Strength (Gives visual and aural indication of signal strength) Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength Signal ID (up to 12 signals) Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) >10 dB Interference Mapping Save current point location and direction Save/Recall points/map Delete last saved point Delete all points Speaker on/off Volume Reset Max/Min hold
Application Options	Impedance (50Ω, 75Ω, Other)

● **Channel Scanner (Option 0027)**

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Custom List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	9 kHz to 43 GHz
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +30 dBm
Application Options	Impedance (50Ω, 75Ω, Other)

● **Zero Span IF Output (Option 0089)**

Mode	Spectrum Analyzer/Span/Zero Span
Center Frequency	140 MHz
Output Level	–40 to –20 dBm typical
	For a signal at Reference Level: –43 to +30 dBm (Preamp Off) or –60 to –40 dBm (Preamp On)
IF Bandwidths	Up to 30 MHz (3 dB bandwidth)
RF Attenuation	Auto
Connector	BNC female

• GSM/EDGE Signal Analyzers (Options 0040, 0041)

Measurements			
RF (Option 0040)	Demodulation (Option 0041)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC)	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC)	RF Measurements and Demodulation can be made OTA. There are no additional OTA Measurements.	Measurements Channel Power Occupied Bandwidth Burst Power Average Burst power Frequency Error Phase Error EVM Origin Offset C/I Magnitude Error Script Master™

Setup Parameters	
GSM/EDGE Select	Auto, GSM, EDGE
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screen	Overall Measurements
RF Measurements (Option 0040)	
Frequency Error	±10 Hz + time base error, 99% confidence level
Occupied Bandwidth	Bandwidth within which 99% of the power transmitted on a single channel lies
Burst Power Error	±1.5 dB, ±1 dB typical, (–50 to +20 dBm)
Demodulation (Option 0041)	
GSMK Modulation Quality (RMS Phase) Measurement Accuracy	±1 deg.
Residual Error (GSMK)	1 deg.
8 PSK Modulation Quality (EVM) Measurement Accuracy	±1.5%
Residual Error (8 PSK)	2.5%

• W-CDMA/HSPA+ Signal Analyzers (Options 0044, 0045 or 0065, 0035)

Measurements			
RF (Option 0044)	Demodulation (Option 0045 or 0065)	Over-the-Air (OTA) (Option 0035)	Pass/Fail (User Editable)
Band Spectrum Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single carrier ACLR Multi-carrier ACLR RF Summary	Code Domain Power Graph P-CPICH Power Channel Power Noise Floor EVM Carrier Feed Through Peak Code Domain Error Carrier Frequency Frequency Error Control Channel Power Abs/Rel/Delta Power CPICH, P-CCPCH S-CCPCH, PICH P-SCH, S-SCH HSDPA Power vs. Time Constellation Code Domain Power Table Code, Status EVM, Modulation Type Power, Code Utilization Power Amplifier Capacity Codogram Modulation Summary	Scrambling Code Scanner (Six) Scrambling Codes CPICH E_C/I_O E_C Pilot Dominance OTA Total Power Multipath Scanner (Six) Six Multipaths Tau Distance RSCP Relative Power Multipath Power	Measurements Max Output Power Frequency Error EVM CPICH Occupied Bandwidth Spectral Mask ACLR PCDE P-CCPCH S-CCPCH Code Spread 3 PICH Code 128 Script Master™ Test Models 1 (16), (32), (64) 2 3 (16), (32) 4 (+CPICH), (-CIPCH) 5 (2 HS), (4 HS), (8 HS)

Setup Parameters	
Scrambling Code, Threshold	Auto, Manual
User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
Maximum Spreading Factor	256, 512
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Marker	Six Markers, Table On/Off
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0044)	
RF Channel Power Accuracy	±1.25 dB, ±0.7 dB typical, (temperature range 15° to 35°C)
Occupied Bandwidth Accuracy	±100 kHz
Adjacent Channel Leakage Ratio (ACLR)	–54 dB/–59 dB ±0.8 dB @ 5 MHz/10 MHz offset, typical, Bands I – VI, VIII – XIV, XVII –54 dB/–57 dB ±1.0 dB @ 5 MHz/10 MHz offset, typical, Band VII
Demodulation (Option 0045 for W-CDMA only or 0065 for W-CDMA and HSDPA)	
W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
HSDPA Modulations	QPSK, 16QAM, 64QAM
EVM Accuracy	±2.5%, 6% ≤EVM ≤ 25%
Residual EVM	2.5% typical
Code Domain Power	±0.5 dB for code channel power >–25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
CPICH (dBm) Accuracy	±0.8 dB typical
Over-the-Air (OTA) Measurements (Option 0035)	
Scrambling Code Scanner	Six strongest Scrambling Codes
Multipath Scanner	Multipath power of six signals relative to strongest pilot

• CDMA Signal Analyzers (Option 0042, 0043, 0033)

Measurements			
RF (Option 0042)	Demodulation (Option 0043)	Over-the-Air (OTA) (Option 0033)	Pass/Fail (User Editable)
Channel Spectrum	Code Domain Power Graph	Pilot Scanner (Nine)	Measurements
Channel Power	Pilot Power	PN	Channel Power
Occupied Bandwidth	Channel Power	E_C/I_O	Occupied Bandwidth
Peak-to-Average Power	Noise Floor	Tau	Peak-to-Average Power
Spectral Emission Mask	Rho	Pilot Power	Spectral Mask Test
Multi-carrier ACPR	Carrier Feed Through	Channel Power	Frequency Error
RF Summary	Tau	Pilot Dominance	Channel Frequency
	RMS Phase Error	Multipath Scanner (Six)	Frequency error
	Frequency Error	E_C/I_O	Pilot Power
	Abs/Rel/Power	Tau	Noise Floor
	Pilot	Channel Power	Rho
	Page	Multipath Power	Carrier Feed Through
	Sync	Limit Test – 10 Tests Averaged	Tau
	Q Page	Rho	RMS Phase Error
	Code Domain Power Table	Adjusted Rho	Code Utilization
	Code	Multipath	Measured PN
	Status	Pilot Dominance	Pilot Dominance
	Power	Pilot Power	Multipath Power
	Multiple Codes	Pass/Fail Status	
	Code Utilization		
	Modulation Summary		

Setup Parameters	
PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Number of Carriers	1 to 5
Carrier Bandwidth	1.23, 1.24, 1.25 MHz
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0042)	
RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
Demodulation (Option 0043)	
Frequency Error	±10 Hz + time base error, 99% confidence level (in slow mode)
Rho Accuracy	±0.005, for Rho >0.9
Residual Rho	>0.995, typical, >0.99 maximum, (RF input –50 to +20 dBm)
PN Offset	1 × 64 chips
Pilot Power Accuracy	±1.0 dB typical, relative to channel power
Tau	±0.5 µs typical, ±1.0 µs maximum
Over-the-Air (OTA) Measurements (Option 0033)	
Pilot Scanner	Nine strongest pilots
Multipath Scanner	Multipath power of six signals relative to strongest pilot
Limit Test	Average of ten tests compared to limit

• EV-DO Signal Analyzers (Option 0062, 0063, 0034)

Measurements			
RF (Option 0062)	Demodulation (Option 0063)	Over-the-Air (OTA) (Option 0034)	Pass/Fail (User Editable)

Channel Spectrum
  Channel Power
  Occupied Bandwidth
  Peak-to-Average Power
Power vs. Time
  Pilot & MAC Power
  Channel Power
  Frequency Error
  Idle Activity
  On/Off Ratio
Spectral Emission Mask
Multi-carrier ACPR
RF Summary
	MAC Code Domain Power Graph
	  Pilot & MAC Power
	  Channel Power
	  Frequency Error
	  Rho Pilot
	  Rho Overall
	  Data Modulation
	  Noise Floor
	MAC Code Domain Power Table
	  Code
	  Status
	  Power
	  Code Utilization
	Data Code Domain Power
	  Active Data Power
	  Data Modulation
	  Rho Pilot
	  Rho Overall
	  Maximum Data CDP
	  Minimum Data CDP
	Modulation Summary
		Pilot Scanner (Nine)
		PN
		  E_C/I_O
		  Tau
		  Pilot Power
		  Channel Power
		  Pilot Dominance
		Mulitpath Scanner (Six)
		  E_C/I_O
		  Tau
		  Channel Power
		  Multipath Power
			Measurements
			  Channel Power
			  Occupied Bandwidth
			  Peak-to-Average Power
			  Carrier Frequency
			  Frequency Error
			  Spectral Mask
			  Noise Floor
			  Pilot Power
			  RMS Phase Error
			  Tau
			  Code Utilization
			  Measured PN
			  Pilot Dominance
			  Mulitpath Power

Setup Parameters	
PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Slot Type	Auto, Active, Idle
Number of Carriers	1 to 5
Carrier Bandwidth	1.23, 1.24, 1.25 MHz
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0062)	
RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
Demodulation (Option 0063)	
EV-DO Compatibility	Rev 0 and Rev A
Frequency Error	±20 Hz + time base error, 99% confidence level
Rho Accuracy	±0.01, for Rho >0.9
Residual Rho	>0.995 typical, >0.99, maximum (RF input –50 to +20 dBm)
PN Offset	Within 1 × 64 chips
Pilot Power Accuracy	±1.0 dB typical, relative to channel power
Tau	±0.5 µs typical, ±1.0 µs maximum
Over-the-Air (OTA) Measurements (Option 0034)	
Pilot Scanner	Nine strongest pilots
Multipath Scanner	Multipath power of six signals relative to strongest pilot

• LTE Signal Analyzers (Options 0541, 0542, 0543, 0546)

Measurements			
RF (Option 0541)	Modulation (Option 0542)	Over-the-Air (OTA) (Option 0546)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth ACPR RF Summary	Constellation Reference Signal Power Sync Signal Power EVM Frequency Error Carrier Frequency Cell ID Sector ID Group ID Control Channel Power RS P-SS S-SS PBCH PCFICH Modulation Summary	Synch Signal Power (Six Strongest) Power Cell ID Sector ID Group ID Dominance	Pass Fail All Pass/Fail RF Pass Fail Demod Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM (peak) EVM (rms) RS Power SS Power P-SS Power S-SS Power PBCH Power PCFICH Power Cell ID Group ID Sector ID

Setup Parameters	
Bandwidth	10 MHz
Span	1.4, 3, 5, 10, 15, 20, 30 MHz
Frame Length	2.5, 5.0, 10.0 msec
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0541)	
RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +10 dBm)
Modulation (Option 0542)	
Frequency Error	±10 Hz + time base error, 99% confidence level
Residual EVM (rms)	2.5% typical (E-UTRA Test Model 3.1) (RF Input –50 to +10 dBm)
Bandwidth = 15 MHz, 20 MHz (Option 0543) (Requires Option 0541 or 0542)	
Bandwidths	15 MHz, 20 MHz
Over-the-Air (OTA) Measurements (Option 0546)	
Scanner	Six strongest Sync Signals
Auto Save	Yes
GPS Tagging and Logging	Yes

• **Fixed and Mobile WiMAX Signal Analyzers (Options 0046, 0047, 0066, 0067, 0037)**

Measurements			
RF (Option 0046 - Fixed) (Option 0066 - Mobile)	Demodulation (Option 0047 - Fixed) (Option 0067 - Mobile)	Over-the-Air (OTA) (Option 0037 - Mobile)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power (Mobile) Uplink Burst Power (Mobile) Data Burst Power (Fixed) Crest Factor (Fixed) ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR (Mobile) Base Station ID Sector ID (Mobile) DL-MAP (Tree View) (Mobile) Modulation Summary	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID	Pass Fail All Pass/Fail RF Pass Fail Demod Measurements Channel Power Occupied Bandwidth Downlink Bust Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID (Mobile)

Setup Parameters	
Fixed WiMAX Bandwidth	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00 MHz
Fixed WiMAX Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
Fixed WiMAX Span	5, 10, 15, 20 MHz
Fixed WiMAX Frame Length	2.5 msec, 5.0 msec, 10.0 msec
Mobile WiMAX Zone Type	PUSC
Mobile WiMAX DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
Mobile WiMAX Bandwidths	3.50, 5.00, 7.00, 8.75, 10.00 MHz
Mobile WiMAX Cyclic Prefix Ratio (CP)	1/8
Mobile WiMAX Span	5, 10, 20, 30 MHz
Mobile WiMAX Frame Lengths	5 msec, 10 msec
Mobile WiMAX Demodulation	Auto, Manual, FCH
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0046 – Fixed, Option 0066 – Mobile)	
RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
Demodulated Signal Analyzer (Option 0047 – Fixed, Option 0067 – Mobile)	
Frequency Error	±10 Hz + time base error, 99% confidence level
Fixed WiMAX Residual EVM (rms)	3% typical, 3.5% maximum (RF Input –50 to +20 dBm)
Mobile WiMAX Residual EVM (rms)	2.5% typical, 3.0% maximum, (RF Input –50 to +20 dBm)
Over-the-Air (OTA) Measurements (Option 0037)	
Channel Power Monitor	Over time (one week), measurement time interval 1 to 60 sec
Preamble Scanner	Six Strongest Preambles
Auto Save	Yes
GPS Tagging and Logging	Yes

- **TD-SCDMA/HSPA+ Signal Analyzers (Options 0060, 0061, 0038)**

Measurements			
RF (Option 0060)	Demodulation (Option 0061)	Over-the-Air (OTA) (Option 0038)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error (QPSK/8 PSK/16 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error CDP Marker Modulation Summary	Code Scan (32) Scrambling Code Group Tau E_C/I_O Pilot Dominance Tau Scan (Six) Sync-DL# Tau E_C/I_O DwPTS Power Pilot Dominance Record Run/Hold	Pass Fail All Pass/Fail RF Pass Fail Demod Measurements Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Carrier Feedthrough Noise Floor

Setup Parameters	
Slot Selection	Auto, 0-6
Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
SYNC-DL Code	Auto, 0-31
Scrambling/Midamble Code	Auto, 0-127
Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
Measurement Speed	Fast, Normal, Slow
User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
Demodulation Type	Auto, QPSK, 8 PSK, 16 QAM
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Hold/Run, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0060)	
RF Channel Power Accuracy (RRC)	±1.5 dB, ±1.0 dB typical, (slot power –40 to +10 dBm)
Frequency Error	±20 Hz + time base error, in the presence of a downlink slot
Demodulation (Option 0061)	
Supported Modulation	QPSK, 8 PSK, 16QAM, MBMS
Residual EVM (rms)	3% typical, P-CCPH slot power >–50 dBm
PN Offset	Within 1 × 64 chips
Pilot Power Accuracy	±1.0 dB typical
Timing Error (Tau) for Dominant SYNC-DL	±0.2 µs (external trigger)
Spreading Factor	1, 16
Over-the-Air (OTA) Measurements (Option 0038)	
Code Scanner	32 Sync Codes and associated Scrambling Code Groups
Tau Scanner	Six strongest Sync Codes
Auto Save	Yes
GPS Tagging and Logging	Yes

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) Apply when using internal reference and performance sweep mode; 3) Subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters	
System	Status (Temperature, Battery Info, S/N, Firmware Ver, IP Address, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
System Options	Name, Date and Time, Ethernet Configuration, Display, Volume Display (Brightness, Default Colors, Black and White, Night Vision, High Contrast) Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Share Center Frequency and Power Offset between Modes Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Internal Trace/Setup Memory	>13,000 traces
External Trace/Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	
RF In	Type K, male, 50Ω, Maximum Input +30 dBm, ±50 VDC
GPS	SMA Female
External Power	5.5 mm barrel connector, 12 to 15 VDC, <5.0 Amps
LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset Jack	2.5 mm 3-wire headset connector
External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm
External Reference Out	BNC, female, 50Ω, 10 MHz
External Trigger	BNC, female, 50Ω, Maximum Input ±5 VDC
IF Out	BNC, female, 50Ω, 140 MHz
Display	
Size	8.4-inch
Resolution	800 × 600
Battery	
Type	Li-Ion
Battery Operation	3 hours, typical (MS2722C, MS2723C, MS2724C) 2.5 hours, typical (MS2725C, MS2726C)
Electromagnetic Compatibility	
European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-3/-4/-5/-6/-11
Safety	
Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	
Temperature	–10° to +55°C (Operating), –51° to +71°C (Storage)
Maximum Humidity	85%
Shock	MIL-PRF-28800F Class 2
Altitude	4600 meters, operating and non-operating
Dimensions and Mass	
Dimensions	315 × 211 × 77 mm, (12.4 × 8.3 × 3.0 in)
Mass	3.5 kg, (7.8 lbs) (MS2722C, MS2723C, MS2724C) 3.8 kg, (8.5 lbs) (MS2725C, MS2726C)

Master Software Tools (for your PC)

Database Management	
Full Trace Retrieval	Retrieve all traces from instrument into one PC directory
Trace Catalog	Index all traces into one catalog
Trace Rename Utility	Rename measurement traces
Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
DAT File Converter	Converts HHST files to MST file format and vice-versa
Data Analysis	
Trace Math and Smoothing	Compare multiple traces
Data Converter	Convert from/to Return Loss/VSWR/Cable Loss/ DTF and also into Smith Charts
Measurement Calculator	Translates into other units
Report Generation	
Report Generator	Includes GPS, power level, and calibration status along with measurements
Edit Graph	Change scale, limit lines, and markers
Report Format	Create reports in HTML for PDF format
Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
Notes	Annotate measurements
Mapping (GPS Required)	
Spectrum Analyzer Mode	MapInfo, MapPoint
Mobile WiMAX OTA Option	Google Earth, Google Maps, MapInfo
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	
Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	
Traces	Add, delete, and modify limit lines and markers
Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
Product Updates	Auto-checks Anritsu website for latest revision firmware
Firmware Upload	Upload new firmware into the instrument
Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
VSG Pattern Converter	Import user-defined patterns (ASCII text or MATLAB file format required)
Languages	Add up to two languages or modify non-English language menus
Mobile WiMAX	DL-MAP Parameters
Display	Modify display settings
Script Master™	
Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
GSM/GPRS/EDGE or W-CDMA/HSDPA Mode	Automate Signal Analysis testing requirements with annotated how-to pictures
Connectivity	
Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
Download	Download measurements and live traces to PC for storage and analysis
Upload	Upload measurements from PC to instrument
Firmware Updates	Product Update: download latest firmware version
Remote Access Tool	Remote control and monitoring of instrument (via Ethernet port) over the Internet

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MS2722C	Spectrum Analyzer (9 kHz to 9 GHz)
MS2723C	Spectrum Analyzer (9 kHz to 13 GHz)
MS2724C	Spectrum Analyzer (9 kHz to 20 GHz)
MS2725C	Spectrum Analyzer (9 kHz to 32 GHz)
MS2726C	Spectrum Analyzer (9 kHz to 43 GHz)
	Options
MS272xC-0007	Secure Data Operation
MS272xC-0009	I/Q Demodulation Hardware
MS272xC-0019	High-Accuracy Power Meter
MS272xC-0024	IQ Waveform Capture
MS272xC-0025	Interference Analyzer
MS272xC-0027	Channel Scanner
MS272xC-0031	GPS Receiver (requires Antenna P/N 2000-1528-R)
MS272xC-0033	CDMA Over-the-Air (OTA) Measurements*2
MS272xC-0034	EV-DO Over-the-Air (OTA) Measurements*2
MS272xC-0035	W-CDMA/HSPA+ Over-the-Air (OTA) Measurements*2
MS272xC-0037	IEEE 802.16 Mobile WiMAX Over-the-Air (OTA) Measurements*1
MS272xC-0038	TD-SCDMA/HSPA+ Over-the-Air (OTA) Measurements*1
MS272xC-0040	GSM/EDGE RF Measurements*1
MS272xC-0041	GSM/EDGE Demodulation*1
MS272xC-0042	CDMA RF Measurements*1
MS272xC-0043	CDMA Demodulation*1
MS272xC-0044	W-CDMA/HSPA+ RF Measurements*1
MS272xC-0045	W-CDMA Demodulation*1
MS272xC-0046	IEEE 802.16 Fixed WiMAX RF Measurements*1
MS272xC-0047	IEEE 802.16 Fixed WiMAX Demodulation*1
MS272xC-0060	TD-SCDMA/HSPA+ Measurements*1
MS272xC-0061	TD-SCDMA/HSPA+ Demodulation*1
MS272xC-0062	EV-DO RF Measurements*1
MS272xC-0063	EV-DO Demodulation*1
MS272xC-0065	W-CDMA/HSPA+ Demodulation*1
MS272xC-0066	IEEE 802.16 Mobile WiMAX RF Measurements*1
MS272xC-0067	IEEE 802.16 Mobile WiMAX Demodulation*1
MS272xC-0089	Zero-Span IF Output
MS272xC-0090	Gated Sweep
MS272xC-0098	Standard Calibration (ANSI Z540-1-1994)
MS272xC-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)
MS272xC-0431	Coverage Mapping (requires Option 0031)
MS272xC-0541	LTE RF Measurements*1
MS272xC-0542	LTE Modulation Measurements*1
MS272xC-0543	LTE BW = 15 MHz, 20 MHz (requires Option 0541 or 0542)
MS272xC-0546	LTE Over-the-Air (OTA) Measurements*1
MS272xC-0551	TD-LTE RF Measurements*1
MS272xC-0552	TD-LTE Modulation Measurements*1
MS272xC-0556	TD-LTE Over-the-Air Measurements*1 (recommend Option 0031)
	Power Sensors (for complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, 150 W
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
	Manuals (soft copy available at www.anritsu.com)
10580-00277	Spectrum Master User Guide (hard copy included) - Bias-Tee, GPS Receiver
10580-00244	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, IF Output
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00278	Programming Manual
10580-00279	Maintenance Manual

Model/Order No.	Name
	Troubleshooting Guides (soft copy included on MST CD and at www.anritsu.com)
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00566	LTE eNodeB Testing
11410-00463	W-CDMA/HSDPA Base Stations
11410-00465	TD-SCDMA/HSDPA Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations
	Standard Accessories (included with instrument)
10580-00277	Spectrum Master User Guide (includes Bias-Tee and GPS Receiver)
2300-498	MST CD: Master Software Tools, User/Measurement Guides, Programming Manual, Troubleshooting Guides, Application Notes
2000-1685-R	Soft Carrying Case
633-44	Rechargeable Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Cigarette Lighter 12 Volt DC Adapter
2000-1371-R	Ethernet Cable, 7 feet/213 cm
3-2000-1498	USB A-mini B Cable, 10 feet/305 cm
11410-00529	MS2722C Spectrum Master Technical Data Sheet
11410-00524	MS2723C Spectrum Master Technical Data Sheet
11410-00525	MS2724C Spectrum Master Technical Data Sheet
11410-00526	MS2725C Spectrum Master Technical Data Sheet
11410-00527	MS2726C Spectrum Master Technical Data Sheet
	One Year Warranty (including battery, firmware, and software)
	Certificate of Calibration and Conformance
	Optional Accessories
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21000 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic
2000-1659-R	698 MHz to 787 MHz, 8 dBd gain
2000-1660-R	1425 MHz to 1535 MHz, 12 dBd gain
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1487	VHF/UHF, Telescopic Whip antenna, straight or 90°, BNC(m), 50Ω

Continued on next page

*1: Requires Option 0009

*2: Requires Option 0009, and Option 0031

Model/Order No.	Name
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50Ω
1030-179-R	777 MHz to 787 MHz, N(m) to N(f), 50Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50Ω, w/ Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA(m) (requires 5 Vdc)
2000-1374	External Charger for Li-Ion Batteries
2000-1652-R	GPS Antenna, SMA(m) with 1 foot cable, requires 5 Vdc
633-75	High Capacity Battery Pack, 7000 mAh
66864	Rack Mount Kit, Master Platform
	Backpack and Transit Case
67135	Anritsu Backpack (for Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

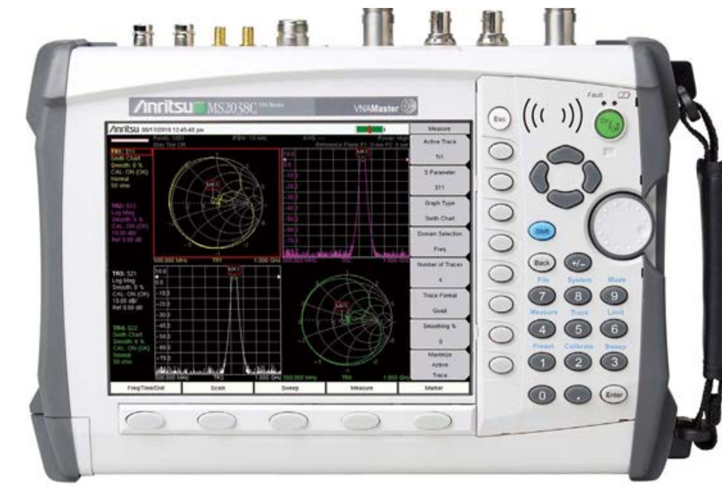
VNA MASTER

MS2026C MS2036C MS2028C MS2038C

MS2026C	MS2036C	MS2028C	MS2038C	
5 kHz to 6 GHz	5 kHz to 6 GHz 9 kHz to 9 GHz	5 kHz to 20 GHz	5 kHz to 20 GHz 9 kHz to 20 GHz	Vector Network Analyzer + Spectrum Analyzer

Remote Control
Ethernet | USB

The Ultimate Handheld Vector Network + Spectrum Analyzer for Cable, Antenna and Signal Analysis Anytime, Anywhere



High Performance Handheld S-Parameters

Anritsu introduces the MS202xC/3xC VNA Master + Spectrum Analyzer, the industry's broadest frequency handheld solution to address cable, antenna, component and signal analysis needs in the field: with frequency coverage from 5 kHz to 6/20 GHz. Equally impressive, this broadband measurement tool offers the industry's first 12-term error correction algorithm in a truly handheld, battery-operated, rugged multi-function instrument. And now the MS2036C/38C models include a powerful spectrum analyzer which multiplies user convenience by combining spectrum analysis with the VNA into a single measurement powerhouse for the harsh RF and physical environments of field test. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or 3G/4G and wireless data network measurements, this VNA/Spectrum Analyzer marriage is the ideal instrument to making fast and reliable measurements in the field.

Performance and Functional Highlights

VNA Master

- Broadband coverage of 5 kHz to 6/20 GHz
- True 2-port, 2-path Vector Network Analyzer
- Ultimate accuracy with 12-term error correction
- User-defined Quad Display for viewing all 4 S-Parameters
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- >85 dB Transmission Dynamic Range to 20 GHz
- Supports waveguide measurements
- 350 µs/data point sweep speed
- USB/Ethernet for PC data transfer and control
- Automate repetitive tasks via Ethernet & USB
- Field upgradable firmware
- Store more than 4000 traces and setups in memory
- Portable: 10.5 lbs (4.8 kg) Display
- Full Speed USB Memory support
- High resolution daylight viewable TFT color display
- Time Domain option for Distance-to-Fault diagnostics
- Internal Bias Tee option
- Vector Voltmeter option
- High Accuracy Power Meter option
- Differential option (S_{d1d1}, S_{c1c1}, S_{d1c1}, and S_{c1d1})
- Secure Data Operation option
- GPS Receiver option
- Power Monitor option
- Polar Format Impedance Display
- 4, 6, 8, 18, 26 GHz USB Power Sensors
- 8.4 in. Display
- Complies with MIL-PRF-28800F Class 2 specification

VNA Master + Spectrum Analyzer

All of the above VNA features, PLUS:

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Dynamic Range: >104 dB in 1 Hz RBW
- DANL: –160 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz @ 10 kHz offset at 1 GHz
- Frequency Accuracy: <±25 ppb with GPS On
- 1 Hz to 10 MHz Resolution Bandwidth (RBW)
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 40 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete
- Option to automatically optimize sweep-RBW-VBW tradeoff for best possible display
- Interference Analyzer Option: Spectrogram, Signal Strength, RSSI
- Channel Scanner Option
- Zero-span IF Output
- Gated Sweep
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter Option
- AM/FM/SSB Demodulation (audio only)

VNA Master Functional Specifications

Definitions

- All specifications and characteristics apply under the following conditions, unless otherwise stated:
- After 30 minutes of warm-up time, where the instrument is in VNA Mode and left in the ON state.
- Temperature range is 23°C ±5°C.
- All specifications apply when using internal reference.
- All specifications subject to change without notice. Please visit www.us.anritsu.com for most current data sheet.
- Typical performance is the measured performance of an average unit.
- Recommended calibration cycle is 12 months.

Frequency

VNA Master Frequency Range	MS2026C/36C	MS2028C/38C
	5 kHz to 6 GHz	5 kHz to 20 GHz
Frequency Accuracy	1.5 ppm	
Frequency Resolution	1 Hz to 375 MHz, 10 Hz to 6 GHz, and 100 Hz to 20 GHz	

Typical Test Port Power

VNA Master supports selection of either High (default) or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical power by bands is shown in the following table.

Frequency Range	High Port Power (dB)	Low Port Power (dBm)
5 kHz to ≤3 GHz	+3	–25
3 GHz to ≤6 GHz	–3	–25
6 GHz to ≤20 GHz	–3	–15

Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power is shown in the following table.

Frequency Range	Dynamic Range (dB)
5 kHz to ≤2 MHz	85
2 MHz to ≤3 GHz	100
3 GHz to ≤6 GHz	90
6 GHz to ≤20 GHz	85

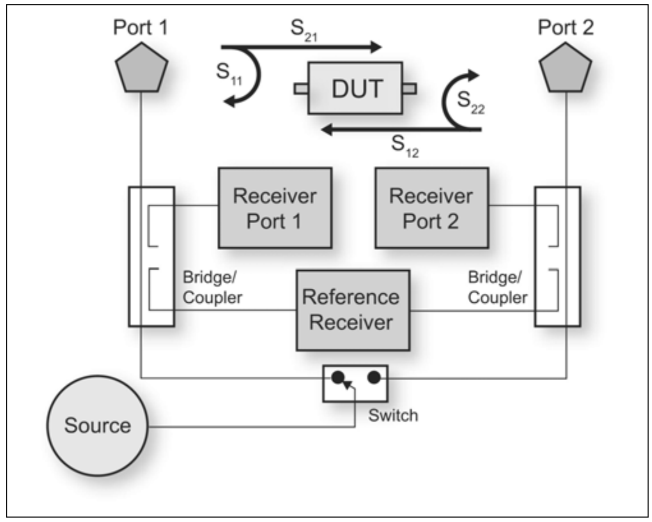
Typical Sweep Speed

The typical sweep speed for IF Bandwidth of 100 kHz, 1001 data points, and single display is shown in the following table. The three receiver architecture will simultaneously collect S_{21} and S_{11} (or S_{12} and S_{22}) in a single sweep.

Frequency Range	Typical Sweep Speed (µs/point)
5 kHz to 6 GHz	350
6 GHz to 20 GHz	650

Block Diagram

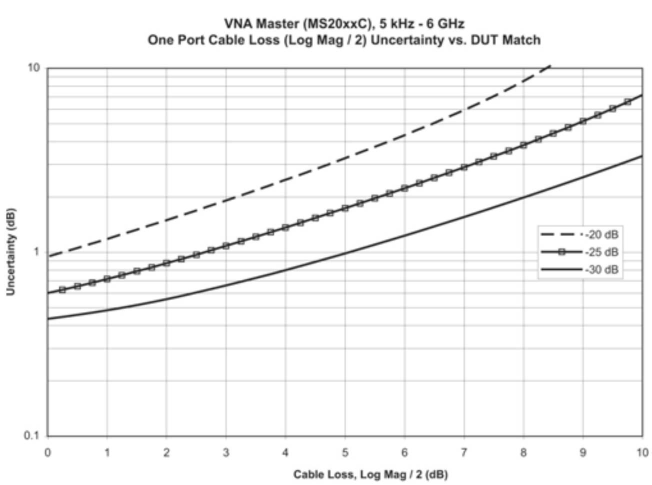
As shown in the following block diagram, the VNA Master has a 2-port, 2-path architecture that automatically measures four S-parameters with a single connection.

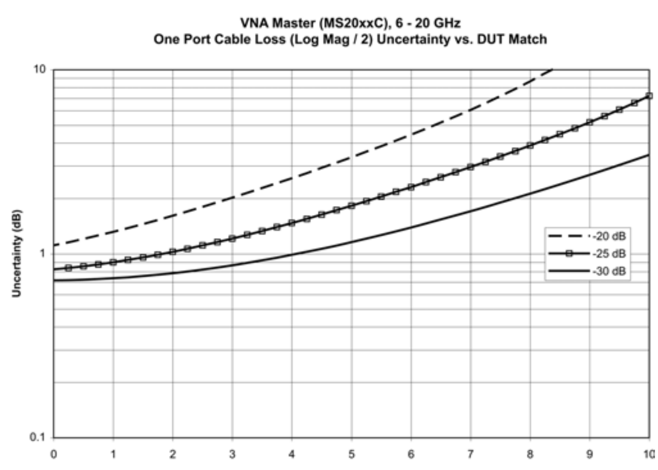


The above illustration is a simplified block diagram of VNA Master's 2-port, 2-path architecture.

Uncertainty Curves for Round-Trip Cable Loss Measurements (1-Port)

Round-trip cable loss measurements are convenient for field personnel testing installed cable or waveguide runs. This one-port technique provides one-way data after twice traversing the cable. The following two sets of uncertainty curves, less than 6 GHz on the left and greater than 6 GHz on the right, present worst-case uncertainty by DUT Match (i.e., Log Mag) when using VNA Master for one-port cable loss measurements. As a practical tip, consider using a two-port transmission measurement technique to improve upon these one-port cable loss uncertainties.





These uncertainty curves show how frequency range, DUT Match, and cable loss impact worst-case uncertainty of round-trip cable loss measurements. The uncertainty curves, separated by frequency range, are shown for DUT Match conditions of 20, 25, and 30 dB. For DUT Match of 30 dB and cable loss of 4-5 dB (reflection measurement of 8-10 dB) the worst-case uncertainties are approximately ±1 dB.

High Port Power

OSLxx50 Calibration Components (N-Connectors)
Corrected System Performance and Uncertainties:
MS202xC/3xC Model with 12-term SOLT calibration including isolation using either OSLN50 & OSLNF50 or OSLK50 & OSLKF50 Calibration Kits.

Measurement Uncertainties

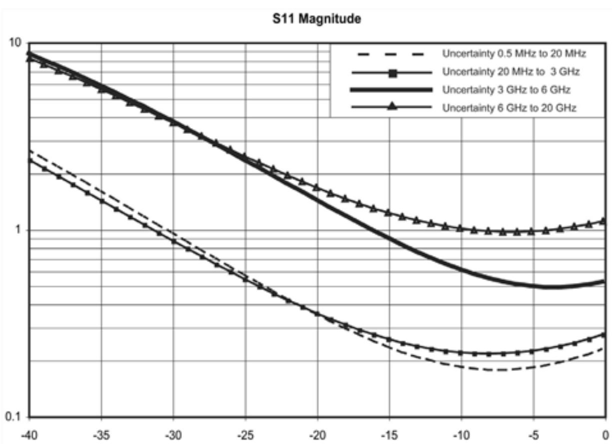
The following graphs provide measurement uncertainty at 23°C ± 5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

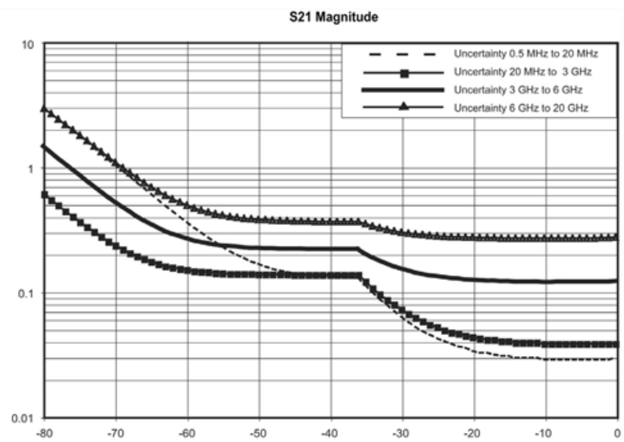
Precision calibration standards come in a convenient configuration for field work.

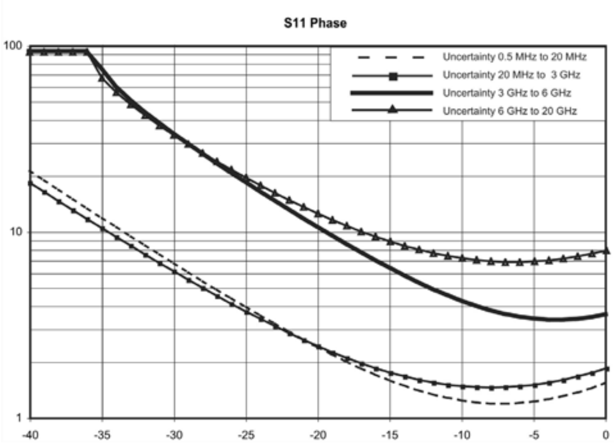
Frequency Range (GHz)	Directivity (dB)
≤5	>42
≤15	>36
≤20*	>32

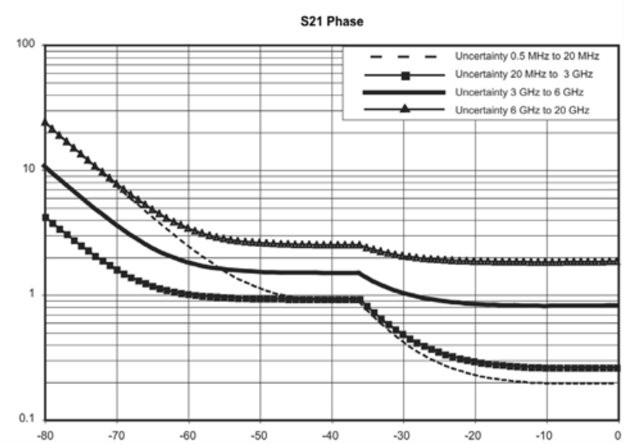
∗: N Connector guaranteed to 18 GHz, typical >18 GHz

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	+3
≤6	–3
≤20	–3









Low Port Power

OSLxx50 Calibration Components
Corrected System Performance and Uncertainties:
MS202xC/3xC Model with 12-term SOLT calibration including isolation using either OSLN50 & OSLNF50 or OSLK50 & OSLKF50 Calibration Kits

Measurement Uncertainties

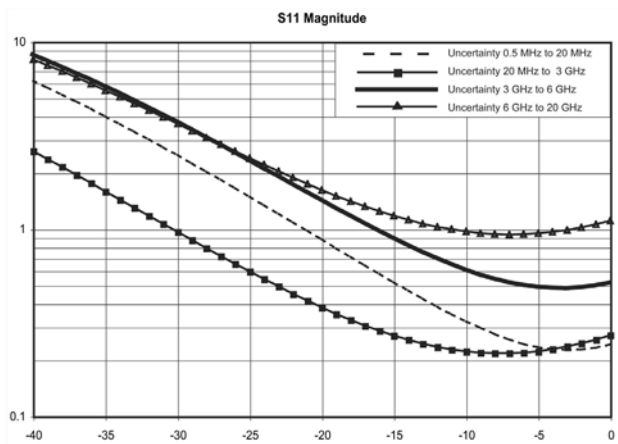
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

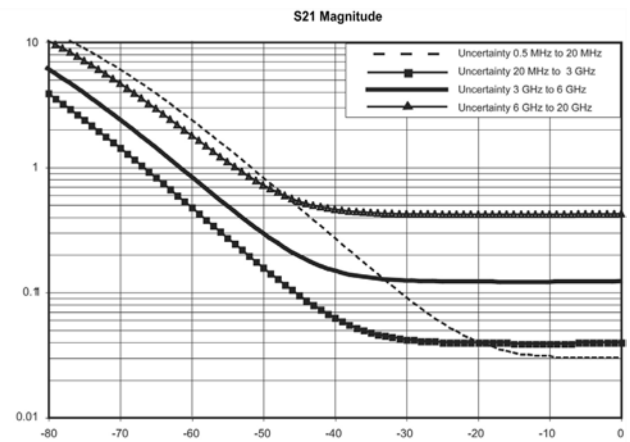
Precision calibration standards come in a convenient configuration for field work.

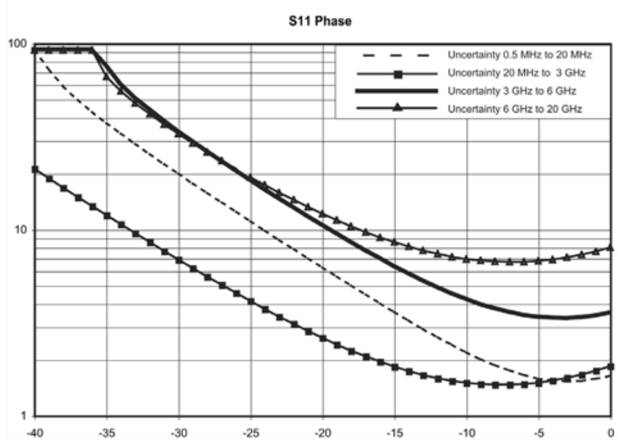
Frequency Range (GHz)	Directivity (dB)
≤5	>42
≤15	>36
≤20*	>32

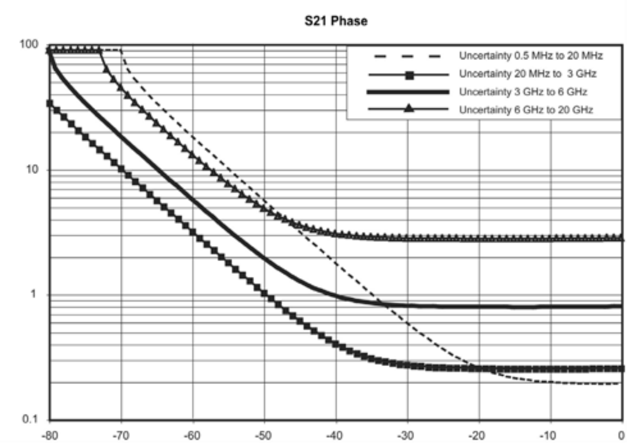
*: N Connector guaranteed to 18 GHz, typical >18 GHz

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	–25
≤6	–25
≤20	–15









High Port Power

3652A Calibration Kit (K-Connector)
Corrected System Performance and Uncertainties:
MS202xC/3xC Model with 12-term SOLT calibration including isolation using 3652A Calibration Kit

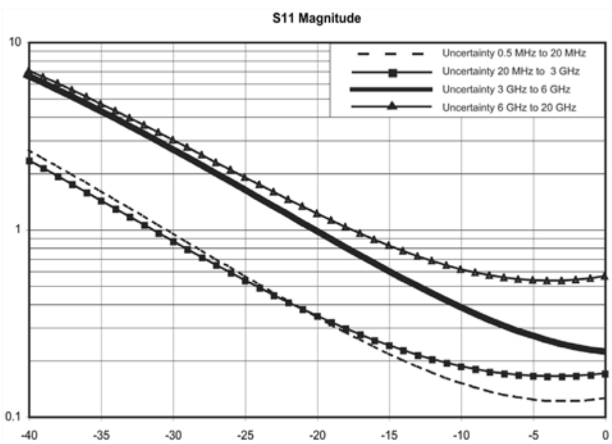
Measurement Uncertainties

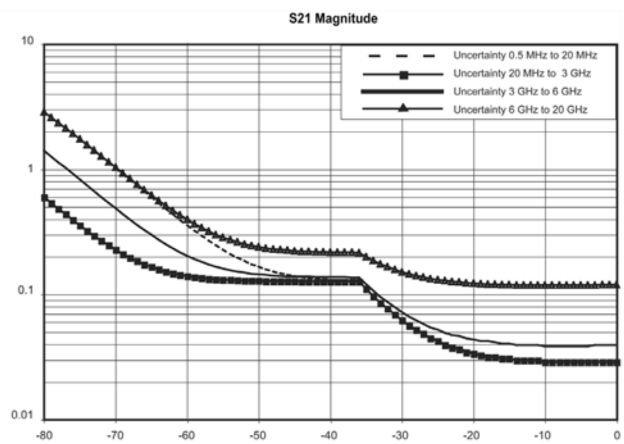
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

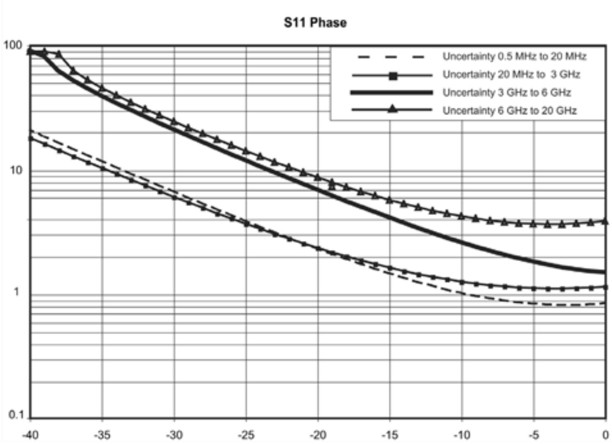
Frequency Range (GHz)	Directivity (dB)*
≤5	>34
≤15	>34
≤20*	>34

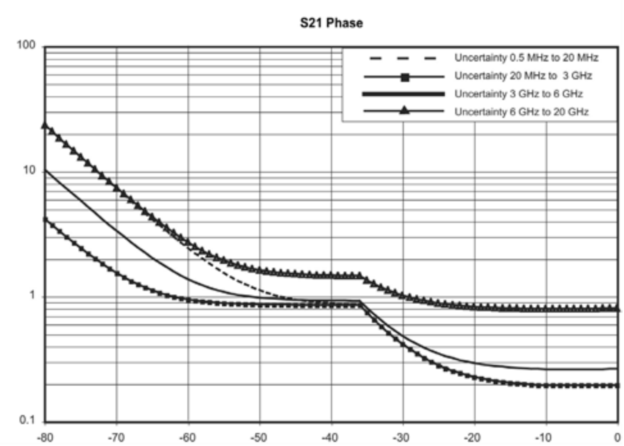
∗: Directivity spec is limited to 34 dB by the 3652A Calibration Kit, not by the instrument performance.

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	+3
≤6	–3
≤20	–3









Low Port Power

3652A Calibration Kit (K-Connector)
Corrected System Performance and Uncertainties:
MS202xC/3xC Model with 12-term SOLT calibration including isolation using 3652A Calibration Kit

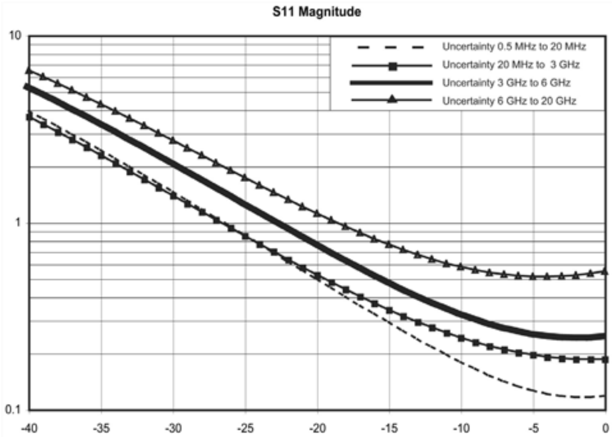
Measurement Uncertainties

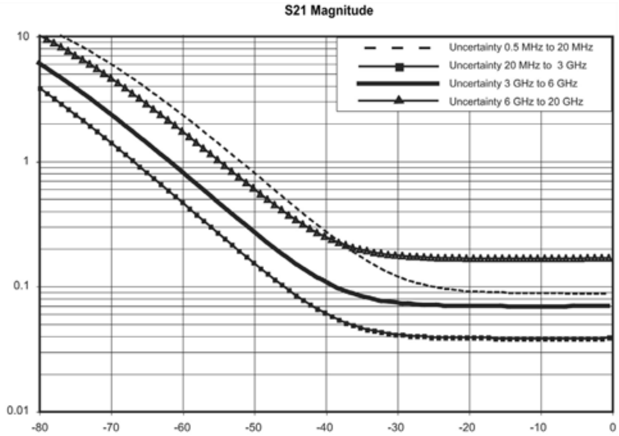
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

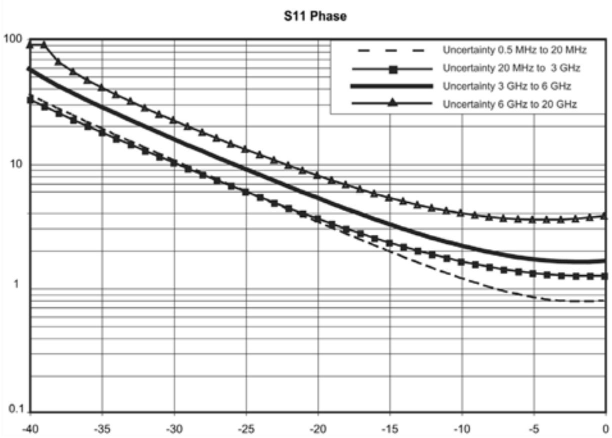
Frequency Range (GHz)	Directivity (dB)*
≤5	>34
≤15	>34
≤20*	>34

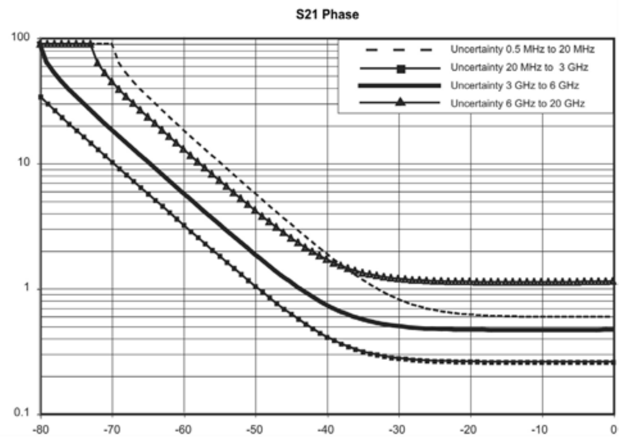
*: Directivity spec is limited to 34 dB by the 3652A Calibration Kit, not by the instrument performance.

Frequency Range (GHz)	Typical Low Port Power (dBm)
≤3	–25
≤6	–25
≤20	–25









Spectrum Analyzer Functional Specifications (Models MS2036C/38C only)

Frequency	
Frequency Range	9 kHz to 20 GHz (usable to 0 Hz), Preamp 100 kHz to 20 GHz
Tuning Resolution	1 Hz
Frequency Reference	Aging: ±1.0 ppm/10 years Accuracy: ±0.3 ppm (25°C ±25°C) + aging
External Reference Frequencies	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608 MHz
Frequency Span	10 Hz to 20 GHz including zero span
Sweep Time	10 µs to 600 seconds in zero span
Sweep Time Accuracy	±2% in zero span
Bandwidth	
Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1–3 sequence ±10% (–3 dB bandwidth)
Video Bandwidth (VBW)	1 Hz to 10 MHz in 1–3 sequence (–3 dB bandwidth)
RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	
SSB Phase Noise at 1 GHz	–100 dBc/Hz @ 10 kHz offset from carrier (–104 dBc/Hz typical) –102 dBc/Hz @ 100 kHz offset from carrier (–107 dBc/Hz typical) –107 dBc/Hz @ 1 MHz offset from carrier (–114 dBc/Hz typical) –120 dBc/Hz @ 10 MHz offset from carrier (–129 dBc/Hz typical)
Amplitude Ranges	
Dynamic Range	>104 dB @ 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW
Measurement Range	DANL to +30 dBm
Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
Reference Level Range	–120 to +30 dBm
Attenuator Resolution	0 to 65 dB, 5 dB steps
Amplitude Units	Log Scale Modes: dBm, dBV, dBmv, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW
Maximum Continuous Input	+30 dBm Peak, ±50 VDC (≥10 dB Attn) +23 dBm Peak, ±50 VDC (<10 dB Attn) +13 dBm Peak, ±50 VDC (Preamp On)
Amplitude Accuracy (single sine wave input <Ref level, and >DANL, auto attenuation, Performance Sweep mode)	
+20° to +30°C after 30 minute warm-up	Typical: ±0.5 dB, 100 kHz to 20 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz Add ±1.0 dB, 13 GHz to 20 GHz
–10° to +50°C after 60 minute warm-up	Add ±1.0 dB, 100 kHz to 20 GHz
Displayed Average Noise Level (DANL) (RMS detection, VBW/Avg type = Log., Ref Level = –20 dBm for preamp Off and –50 dBm for preamp On)	
(DANL in 1 Hz RBW, 0 dB attenuation)	Preamp Off
10 MHz to 4 GHz	–141 dBm
>4 GHz to 9 GHz	–134 dBm
>9 GHz to 13 GHz	–129 dBm (MS2038C only)
>13 GHz to 20 GHz	–123 dBm (MS2038C only)
	Preamp On
10 MHz to 4 GHz	–160 dBm
>4 GHz to 9 GHz	–156 dBm
>9 GHz to 13 GHz	–152 dBm
>13 GHz to 20 GHz	–145 dBm
Spurs	
Residual Spurious	Preamp Off (RF input terminated, 0 dB input attenuation) –90 dBm 9 kHz to 13 GHz –85 dBm 13 GHz to 20 GHz
	Preamp On (RF input terminated, 0 dB input attenuation) –100 dBm 1 MHz to 20 GHz
Input-Related Spurious	(0 dB attenuation, –30 dBm input, span <1.7 GHz) –60 dBc, –70 dBc typical
Third-Order Intercept (TOI) (–20 dBm tones 100 kHz apart, –20 dBm Ref level, 0 dB input attenuation, preamp Off)	
2.4 GHz	+15 dBm
50 MHz to 20 GHz	+20 dBm typical
P1dB	
<4 GHz	+5 dBm typical
4 GHz to 20 GHz	+12 dBm typical
Second Harmonic Distortion	
50 MHz	–54 dBc
<4 GHz	–60 dBc typical
>4 GHz	–75 dBc typical
VSWR	
>10 dB input attenuation <20 GHz	1:5:1 typical

Spectrum Analyzer Performance Capabilities

Measurements	
Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m^2 or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask)
Setup Parameters	
Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy
Application Options	Impedance (50Ω, 75Ω, Other)
Sweep Functions	
Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
Sweep Mode	Fast, Performance, No FFT
Detection	Peak, RMS/Avg, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Delay, Level, Slope, Hysteresis, Holdoff, Force Trigger Once
Trace Functions	
Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
Trace B Operations	A→B, B↔C, Max Hold, Min Hold
Trace C Operations	A→C, B↔C, Max Hold, Min Hold, A – B→C, B – A→C, Relative Reference (dB), Scale
Marker Functions	
Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off
Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	
Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall

VNA Performance Capabilities

Measurement Parameters	S_{11}, S_{21}, S_{22}, S_{12}, S_{d1d1}, S_{c1c1}, S_{d1c1}, S_{c1d1}
Number of Traces	Four: TR1, TR2, TR3, TR4
Trace Format	Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays.
Graph Types	Log Magnitude SWR Phase Real Imaginary Group Delay Smith Chart Log Mag / 2 (1-Port Cable Loss) Linear Polar Log Polar Real Impedance Imaginary Impedance
Domains	Frequency Domain, Time Domain, Distance Domain
Frequency	Start Frequency, Stop Frequency, Center Frequency, Span
Distance	Start Distance, Stop Distance
Time	Start Time, Stop Time
Frequency Sweep Type: Linear	Single Sweep, Continuous
Data Points	2 to 4001 (arbitrary setting); data points can be reduced without recalibration.
Limit Lines	Upper, Lower, 10-segmented Upper, 10-segmented Lower
Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
Data Averaging	Sweep-by-sweep
Smoothing	0 to 20%

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IF Bandwidth	10, 20, 50, 100, 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Hz)
Reference Plane	The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase,and constant impedance.
Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance.
Frequency Range	Frequency range of the measurement can be narrowed within the calibration range without recalibration.
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
Group Delay Range	< 180º of phase change within the aperture
Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.
Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
Number of Markers	Eight, arbitrary assignments to any trace
Marker Types	Reference, Delta
Marker Readout Styles	Log Mag, Cable Loss (Log Mag / 2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, and Group Delay, Linear Mag, Linear Mag and Phase
Marker Search	Peak Search, Valley Search, Find Marker Value
Correction Models	Full 2-Port, Full S_{11}, Full S_{22}, Full S_{11} & S_{22}, Response S_{21}, Response S_{12}, Response S_{21} & S_{12}, Response S_{11}, Response S_{22}, Response S_{11} & S_{22}, 1-Path 2-Port (S_{11}, S_{21}), 1-Path 2-Port (S_{22}, S_{12})
Calibration Methods	Short-Open-Load-Through (SOLT), Offset-Short (SSLT), and Triple-Offset-Short (SSST)
Calibration Standards' Coefficients	Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined Waveguide: WG11A, WG12, WG13, WG14, WG15, WG16, WG17, WG18, WG20, and four User Defined
Cal Correction Toggle	On/Off
Dispersion Compensation	Waveguide correction that improves accuracy of distance-to-fault data by compensating for different lengths propagating at different speeds.
Impedance Conversion	Support for 50Ω and 75Ω are provided.
Units	Meters, Feet
Bias Tee Settings	Internal, External, Off
Timebase Reference	Internal, External (10 MHz)
File Storage Types	Measurement, Setup (with CAL), Setup (without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), JPEG
Ethernet Configuration	DHCP or Manual (Static); IP, Gateway, Subnet entries
Languages	English, French, German, Spanish, Chinese, Japanese, Korean, Italian, plus two User Defined

Measurement Options Specifications

- **Time Domain (Option 0002)**
  (includes Distance Domain Option 0501)

The VNA Master can also display the S-parameter measurements in the time or distance domain using lowpass or bandpass processing analysis modes. The broadband frequency coverage coupled with 4001 data points means you can measure discontinuities both near and far with unprecedented clarity for a handheld tool. With this option, you can simultaneously view S-parameters in frequency, time, and distance domain to quickly identify faults in the field. Advanced features available with this option include step response, phasor impulse, gating, and frequency gated in time. The option includes computational routines that further enhance the Distance Domain results by compensating for cable loss, relative velocity of propagation, and dispersion compensation in waveguide.

Distance Domain	Round-Trip (reflection) Fault Resolution (meters):	(0.5 × c × Vp) / ΔF; (c is speed of light = 3E8 m/s, ΔF is F2 – F1 in Hz)
	One-Way (transmission) Fault Resolution (meters):	(c × Vp) / ΔF; (c is speed of light = 3E8 m/s, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters):	0 to (data points – 1) × Fault Resolution to a maximum of 3000 m (9843 ft.)
	Windowing	Rectangular, Nominal Side Lobe (NSL), Low Side Lobe (LSL), and Minimum Side Lobe (MSL)

• Power Monitor (Option 0005) Requires external detector

Transmitter measurements in the field are possible when using this VNA Master software mode with a separately purchased Anritsu 560 series detector. A variety of detectors are available to 50 GHz, but the popular 560-7N50B covers 10 MHz to 20 GHz with a measurement range of –50 to +20 dBm with better than 0.5 dB flatness to 18 GHz. After zeroing the detector to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts.

Display Range	–80 to +80 dBm (10 pW to 100 kW)
Measurement Range	–50 to +20 dBm (10 nW to 40 mW)
Offset Range	0 to +60 dB
Resolution	0.1 dB, 0.1 xW (x = n, µ, m based on detector power)
Accuracy	±1 dB maximum for >–40 dBm using 560-7N50B detector

Power Monitor Detectors* (Ordered separately):

Part Numbers	560-7N50B	560-7S50B
Frequency Range	0.01 to 20 GHz	
Impedance	50Ω	
Power Range	–55 to +16 dBm	
Return Loss	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	
Input Connector	N(m)	WSMA(m)
Frequency Response	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz	

*: See www.us.anritsu.com for additional detectors

• Secure Data Operation (Option 0007)

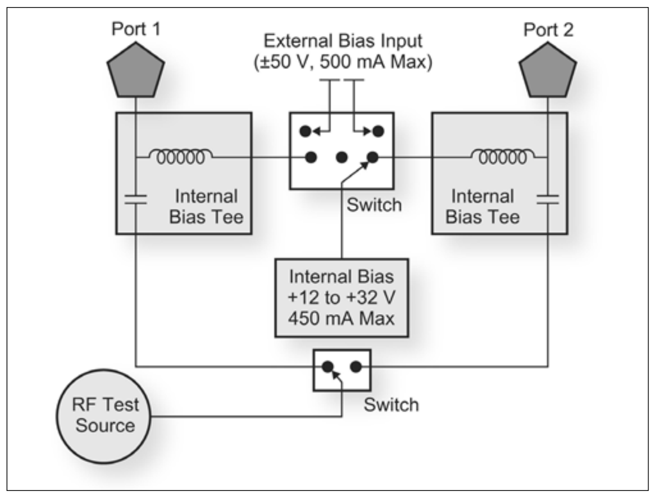
For highly secure data handling requirements, this software option prevents the storing of measurement setup or data information onto any internal file storage location. Instead, setup and measurement information is stored ONLY to the external USB memory location. A simple factory preset prepares the VNA Master for transportation while the USB memory remains behind in the secure environment.

The VNA Master cannot be switched between secure and non-secure operation by the user once configured for secure data operation. As an additional security measure, with this option enabled the user can choose to blank the frequency values displayed on the screen.

• Bias Tee (Option 0010)

For tower mounted amplifier tests, the MS202xC/3xC series with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements. For frequency sweeps in excess of 2 MHz, the VNA Master can supply internal voltage control from +12 V to +32 V in 0.1 V steps up to 450 mA. To extend battery life, an external power supply can substitute for the internal supply by using the external bias inputs instead. Both test ports can be configured to supply voltage via this integrated bias tees option. Bias can be directed to VNA Port 1 or Port 2.

Frequency Range	2 MHz to 6 GHz (MS20x6C) 2 MHz to 20 GHz (MS20x8C)
Internal Voltage/Current	+12 V to +32 V at 450 ma. Steady rate
Internal Resolution	0.1 V
External Voltage/Current	±50 V at 500 mA steady rate
Bias Tee Selections	Internal, External, Off



The VNA Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram. Connectivity is also provided for external supply (instead of internal) to preserve battery consumption.

• Vector Voltmeter (Option 0015)

A phased array system relies on phase matched cables for nominal performance. For this class of application, the VNA Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements. The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts.

For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables. The MS202xC/3xC solution is superior because the signal source is included internally, precluding the need for an external signal generator.

CW Frequency Range	5 kHz to 20 GHz
Measurement Display	CW, Table (Twelve Entries, Plus Reference)
Measurement Types	Return Loss, Insertion
Measurement Format	dB/VSWR/Impedance

• **High Accuracy Power Meter (Option 0019)**
Requires external USB power sensor.
Conduct precise measurements of CW and digitally modulated transmitters in the field using this VNA Master software mode with a separately purchased Anritsu USB power sensor. After specifying the center frequency and zeroing the sensor to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts. Option 0019 supports the USB Power Sensors in the following table.

USB Power Sensors (Ordered separately):

	PSN50	MA24105A	MA24106A	MA24108A	MA24118A	MA24126A
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26.5 GHz
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor
Connector	Type N, male, 50Ω	Type N, female, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω
Dynamic Range	–30 to +20 dBm (0.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz	50 kHz	50 kHz
Measurement	True-RMS	True-RMS	True-RMS	True-RMS. Slot Power, Burst Average Power	True-RMS, Slot power, Burst Average power	True-RMS, Slot power, Burst Average power
Measurement Uncertainty	±0.16 dB*1	±0.17 dB*2	±0.16 dB*1	±0.18 dB*3	±0.18 dB*3	±0.18 dB*3
Datasheet for Additional Specifications	11410-00414	11410-00621	11410-00424	11410-00504	11410-00504	11410-00504

∗1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors
∗2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
∗3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors

• **Interference Analyzer (Option 0025) (Models MS2036C/38C only)** (Recommend GPS)

Measurements	Spectrum Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I) Spectrogram (Collect data up to one week) Signal Strength (Gives visual and aural indication of signal strength) Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength Signal ID (up to 12 signals) Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) >10 dB
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• **Channel Scanner (Option 0027) (Models MS2036C/38C only)**

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	150 kHz to 13 GHz
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +30 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• **GPS (Option 0031)** Requires external GPS antenna
Built-in GPS provides location information (latitude, longitude, altitude) and Universal Time (UT) information for storage along with trace data so you can later verify that measurements were taken at the right location. The GPS option requires a separately ordered magnet mount GPS antenna (2000-1528-R or 2000-1652-R), which are configured to mount outside on a metallic surface. Frequency accuracy is enhanced for the Spectrum Analyzer (on MS203xC models) when Options 0025 Interference Analyzer and 0027 Channel Scanner are engaged.

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Generator when GPS Antenna is connected <±50 ppb with GPS On, 3 minutes after satellite lock in selected mode
GPS Lock – after antenna is disconnected	<±50 ppb for 3 days, 0° to 50°C ambient temperature
Connector	SMA, female

• **Balanced/Differential S-Parameters, 1-port (Option 0077)**

As an alternative to a sampling oscilloscope, verifying the performance and identifying discontinuities in high-data-rate differential cables is now possible with the VNA Master. After a full two-port calibration, connect your differential cable directly to the two test ports and reveal the S_{d1d1} performance, which is essentially differential return loss, or any of the other differential S-Parameters, S_{c1c1}, S_{d1c1}, or S_{c1d1}. With optional time domain, you can convert frequency sweeps to distance. This capability is especially valuable for applications in high data rate cables where balanced data formats are used to isolate noise and interference.

• **AM/FM/PM Demodulation Analyzer (Option 0509) (Models MS2036C/38C only)**

The VNA Master + Spectrum Analyzer models comes with AM/FM/SSB audio demodulation standard. By adding Option 0509, the instrument becomes capable of measuring, analyzing, and displaying key modulation parameters of RF Spectrum, Audio Spectrum, Audio Waveform and Demodulation Summary.
The RF Spectrum View displays the spectrum analyzer with carrier power, frequency, and occupied BW. Audio Spectrum shows the demodulated audio spectrum along with the Rate, RMS deviation, Pk-Pk/2 deviation, SINAD, Total Harmonic Distortion (THD), and Distortion/Total. Each demodulation also includes an Audio Waveform oscilloscope display that shows the time-domain demodulated waveform. There is a summary display that provides a display of all the RF and demodulation parameters.

• **Distance Domain (Option 0501) (included in Time Domain Option 0002)**

Distance Domain Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the VNA Master exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify cable discontinuities. The VNA Master converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements.
Option 0501 Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and so minimize or prevent downtime of the system.

VNA Master General Specifications (MS202xC/3xC)

• **Setup Parameters**

System	Status (Temperature, Battery Info, S/N, Firmware Ver, IP Address, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
System Options	Name, Date and Time, Ethernet Configuration, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy
Internal Trace/Setup Memory	>13,000 traces
External Trace/Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

• **Connectors**

Maximum Input (Damage Level) into Vector Network Analyzer	+23 dBm, ±50 VDC (MS202xC/3xC)
Maximum Input (Damage Level) into Spectrum Analyzer	+30 dBm, ±50 VDC (MS203xC)
VNA Connectors	Type N female (or K female with opt 0011, MS20x8C only) VNA port (× 2)
	Type BNC female Bias Tee port (enabled with opt 0010) (× 2)
	Type BNC female External Reference In port
Spectrum Analyzer Connectors	Type N, female (or K female with opt 0011) (MS203xC)
GPS	SMA female (Available with opt 0031 GPS)
External Power	5.5 mm barrel connector, 12 to 15 VDC, <5.0 Amps
LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset Jack	3.5 mm barrel connector
External Trigger	BNC, female, 50Ω, Maximum Input ±5 VDC
10 MHz Out	SMA, female, 50Ω

● Display

Size	8.4 in, daylight viewable color LCD
Resolution	800 × 600

● Power

Field replaceable Li-Ion Battery (633-44: 6600 mAh, 4.5 Amps)	40 Watts on battery power only
DC power from Universal 110 V/220 V AC/DC Adapter	55 Watts running off AC/DC adaptor while charging battery
Life time charging cycles (Li-Ion Battery, 633-44)	>300 (80% of initial capacity)
Battery Operation	3.0 hours, typical

● Size and Weight

Dimensions	Height: 211 mm (8.3 in)
	Width: 315 mm (12.4 in)
	Depth: 78 mm (3.1 in) (MS202xC) 97 mm (3.8 in) (MS203xC)
Weight, Including Battery	4.5 kg (9.9 lbs) (MS202xC) 4.8 kg (10.5 lbs) (MS203xC)

● Safety

Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Anritsu supplied Power Supply

● Environmental

MIL-PRF-28800F, Class 2 Environmental Conditions	MS202xC/3xC
Temperature, operating (°C) (3.8.2.1 & 4.5.5.14)	Passed, –10° to +55°C, Humidity 85%
Temperature, not operating (°C) (3.8.2.2 & 4.5.5.1)	Passed, –51° to +71°C
Relative humidity (3.8.2.3 & 4.5.5.1)	Passed
Altitude, not operating (3.8.3 & 4.5.5.2)	Passed*1, 4600 m
Altitude, operating (3.8.3 & 4.5.5.2)	Passed*1, 4600 m
Vibration limits (3.8.4.1 & 4.5.5.3.1)	Passed
Shock, functional (3.8.5.1 & 4.5.5.4.1)	Passed
Transit Drop (3.8.5.2 & 4.5.5.4.2)	Passed
Bench handling (3.8.5.3 & 4.5.5.4.3)	Passed
Shock, high impact (3.8.5.4 & 4.5.5.4.4)	Not Required*2
Salt exposure structural parts (3.8.8.2 & 4.5.6.2.2)	Not Required*3

*1: Qualified by similarity (tested on a similar product)
*2: Not defined in standard; must be invoked and defined by purchase description
*3: Not required for Class 2 equipment

● Electromagnetic Compatibility

European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	VNA Master™ 2-Port, 1-Path VNA
MS2026C	VNA: 5 kHz to 6 GHz
MS2028C	VNA: 5 kHz to 20 GHz
	VNA Master™ 2-Port, 1-Path VNA + Spectrum Analyzer
MS2036C	VNA: 5 kHz to 6 GHz, S/A: 9 kHz to 9 GHz
MS2038C	VNA: 5 kHz to 20 GHz, S/A: 9 kHz to 20 GHz
	The instrument includes standard one-year warranty and Certificate of Calibration and Conformance
	MS2026C VNA Master Options
MS2026C-0002	Time Domain (includes Option DTF capability)
MS2026C-0005	Power Monitor (requires external detector) (includes Option 0501 DTF capability)
MS2026C-0007	Secure Data Operation
MS2026C-0010	Built-in Bias-Tee
MS2026C-0015	Vector Voltmeter
MS2026C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2026C-0031	GPS Receiver (requires GPS antenna 2000-1528-R)
MS2026C-0077	Balanced/Differential S-Parameters, 1-port
MS2026C-0098	Z-540 Calibration
MS2026C-0099	Premium Calibration
MS2026C-0501	Distance Domain (included in Option 0002)
	MS2028C VNA Master Options
MS2028C-0002	Time Domain (includes Option DTF capability)
MS2028C-0005	Power Monitor (requires external detector)
MS2028C-0007	Secure Data Operation
MS2028C-0010	Built-in Bias-Tee
MS2028C-0011	K(f) Test Port Connectors
MS2028C-0015	Vector Voltmeter
MS2028C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2028C-0031	GPS Receiver (requires GPS antenna 2000-1528-R)
MS2028C-0077	Balanced/Differential S-Parameters, 1-port
MS2028C-0098	Z-540 Calibration
MS2028C-0099	Premium Calibration
MS2028C-0501	Distance Domain (included in Option 0002)
	MS2036C VNA Master, + Spectrum Analyzer Options
MS2036C-0002	Time Domain (includes Option 0501 DTF capability)
MS2036C-0007	Secure Data Operation
MS2036C-0010	Built-in Bias-Tee
MS2036C-0015	Vector Voltmeter
MS2036C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2036C-0025	Interference Analysis, 9 kHz to 9/20 GHz (requires external antenna)*
MS2036C-0027	Channel Scanner, 9 kHz to 9/20 GHz (requires external antenna)*
MS2036C-0031	GPS Receiver (requires GPS antenna 2000-1528-R)
MS2036C-0077	Balanced/Differential S-Parameters, 1-port
MS2036C-0098	Z-540 Calibration
MS2036C-0099	Premium Calibration
MS2036C-0501	Distance Domain (included in Option 0002)
MS2036C-0509	AM/FM/PM Analyzer
	MS2038C VNA Master, + Spectrum Analyzer Options
MS2038C-0002	Time Domain (includes Option 0501 DTF capability)
MS2038C-0007	Secure Data Operation
MS2038C-0010	Built-in Bias-Tee
MS2038C-0011	K(f) Test Port Connectors
MS2038C-0015	Vector Voltmeter
MS2038C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2038C-0025	Interference Analysis, 9 kHz to 9/20 GHz (requires external antenna)*
MS2038C-0027	Channel Scanner, 9 kHz to 9/20 GHz (requires external antenna)*
MS2038C-0031	GPS Receiver (requires GPS antenna 2000-1528-R)
MS2038C-0077	Balanced/Differential S-Parameters, 1-port
MS2038C-0098	Z-540 Calibration
MS2038C-0099	Premium Calibration
MS2038C-0501	Distance Domain (included in Option 0002)
MS2038C-0509	AM/FM/PM Analyzer
	MS202xC/3xC Standard Accessories
10580-00305	VNA Master User's Guide
10920-00060	Handheld Instruments Documentation Disc
65729	Soft Carrying Case
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Battery, Li-Ion, 6.6 Ah
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 V DC adapter
3-2000-1498	USB A-type to Mini USB B-type Cable, 3.05 m (10 ft.)
2000-1371-R	Ethernet Cable, 2.13 m (7 ft.)
3-806-152	Ethernet Crossover Cable, 2.13 m (7 ft.)

*: Requires external antenna (2000-xxxx or 61532 Antenna Kit), Recommend Option 0031 GPS

Model/Order No.	Name
	Optional Accessories
	Ancillary Equipment
2000-1528-R	GPS Antenna – Magnet Mount (active 3 to 5 V) with SMA connector and 4.6 m (15 ft) extension cable
2000-1652-R	GPS Antenna – Magnet mount (active 3 to 5 V) with SMA connector and 1 foot cable
2000-1653	Protective Screen Cover (Package of 2)
2000-1689	EMI Near Field Probe Kit
66864	Rack Mount Kit, Master Platform
2300-517	Phase Noise Measurement Software
	High Accuracy Power Sensor
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, True RMS
MA24106A	High Accuracy Power Sensor, 50 MHz to 6 GHz, True RMS
MA24108A	High Accuracy Power Sensor, 10 MHz to 8 GHz, True RMS
MA24118A	High Accuracy Power Sensor, 10 MHz to 18 GHz, True RMS
MA24126A	High Accuracy Power Sensor, 10 MHz to 26 GHz, True RMS
	Power Monitor Detectors
560-7N50B	RF Detector, 0.01 GHz to 20 GHz, Type-N(m)
560-7S50B	RF Detector, 0.01 GHz to 20 GHz, W-SMA(m)
	Detector Extender Cables
800-109	Detector Extender Cable, 7.6 m (25 ft)
800-111	Detector Extender Cable, 30.5 m (100 ft.)
	K Connector Components
OSLK50	Precision integrated Open/Short/Load K(m), DC to 20 GHz, 50Ω
OSLKF50	Precision integrated Open/Short/Load K(f), DC to 20 GHz, 50Ω
22K50	Precision K(m) Short/Open, 40 GHz
22KF50	Precision K(f) Short/Open, 40 GHz
28K50	Precision Termination, DC to 40 GHz, 50Ω, K(m)
28KF50	Precision Termination, DC to 40 GHz, 50Ω, K(f)
3652A	K Calibration Kit, DC to 40 GHz
	N-Type Connectors
OSLN50	Precision Integrated Open/Short/Load N(m), DC to 18 GHz, 50Ω
OSLNF50	Precision Integrated Open/Short/Load N(f), DC to 18 GHz, 50Ω
22N50	Precision N(m) Short/Open, 18 GHz
22NF50	Precision N(f) Short/Open, 18 GHz
28N50-2	Precision Termination, DC to 18 GHz, 50Ω, N(m)
28NF50-2	Precision Termination, DC to 18 GHz, 50Ω, N(f)
OSLN50-1	Precision N(m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50-1	Precision N(f) Open/Short/Load, 42 dB, 6 GHz
SM/PL-1	Precision N(m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision N(f) Load, 42 dB, 6 GHz
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21000 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1487	Telescopic Whip Antenna

Continued on next page

Model/Order No.	Name
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Manuals
10580-00305	VNA Master User’s Guide
10580-00306	VNA Master Programming Manual
10580-00307	VNA Master Maintenance Manual
10580-00289	VNA Measurement Guide
10580-00244	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide

Model/Order No.	Name
	Related Literature, Application Notes
11410-00206	Time Domain for Vector Network Analyzers
11410-00214	Reflectometer Measurements – Revisited
11410-00270	What is Your Measurement Accuracy?
11410-00373	Distance-to-Fault
11410-00387	Primer on Vector Network Analysis
11410-00414	High Accuracy Power Meter, PSN50
11410-00424	USB Power Sensor MA24106A
11410-00476	Essentials of Vector Network Analysis
11410-00504	Microwave USB Power Sensor MA241x8A
11410-00531	Practical Tips on Making “Vector Voltmeter (VVM)” Phase Measurements using VNA Master (Opt. 15)
11410-00544	VNA Master + Spectrum Analyzer Brochure
11410-00548	VNA Master + Spectrum Analyzer Technical Data Sheet
11410-00565	Troubleshoot Wire Cable Assemblies with Frequency-Domain Reflectometry
11410-00472	Measuring Interference
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-172	BNC(f) to N(m), DC to 1.3 GHz, 50Ω
510-90	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50Ω
510-91	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50Ω
510-92	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50Ω
510-93	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50Ω
510-96	7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50Ω
510-97	7/16 DIN(f) to 7/16 DIN(f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50Ω, with Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
34NK50	Precision Adapter, DC to 18 GHz, N(m) to K(m), 50Ω
34NKF50	Precision Adapter, DC to 18 GHz, N(m) to K(f), 50Ω

Waveguide Calibration Components and WG/Coaxial Adapters

Recommended waveguide calibration procedure requires two offset shorts and a precise load. The waveguide/coax adapter, shown attached to test port #2, adapts the VNA Master test ports to the waveguide under test.

Part Number				Frequency Range (GHz)	Waveguide Type	Compatible Flanges
1/8 Offset Short	3/8 Offset Short	Precision Load	Coaxial to Universal Waveguide Adapter*			
23UM70	24UM70	26UM70	35UM70N	5.85 to 8.20	WR137, WG14	CAR70, PAR70, UAR70, PDR70
23UM84	24UM84	26UM84	35UM84N	7.05 to 10.00	WR112, WG15	CBR84, UBR84, PBR84, PDR84
23UM100	24UM100	26UM100	35UM100N	8.20 to 12.40	WR90, WG16	CBR100, UBR100, PBR100, PDR100
23UM120	24UM120	26UM120	35UM120N	10.00 to 15.00	WR75, WG17	CBR120, UBR120, PBR120, PDR120
23UA187	24UA187	26UA187	35UA187N	3.95 to 5.85	WR187, WG12	CPR187F, CPR187G, UG-1352/U, UG-1353/U, UG-1728/U, UG-1729/U, UG-148/U, UG-149A/U
23UA137	24UA137	26UA137	35UA137N	5.85 to 8.20	WR137, WG14	CPR137F, CPR137G, UG-1356/U, UG-1357/U, UG-1732/U, UG-1733/U, UG-343B/U, UG-344/U, UG-440B/U, UG-441/U
23UA112	24UA112	26UA112	35UA112N	7.05 to 10.00	WR112, WG15	CPR112F, CPR112G, UG-1358/U, UG-1359/U, UG-1734/U, UG-1735/U, UG-52B/U, UG-51/U, UG-137B/U, UG-138/U
23UA90	24UA90	26UA90	35UA90N	8.20 to 12.40	WR90, WG16	CPR90F, CPR90G, UG-1360/U, UG-1361/U, UG-1736/U, UG-1737/U, UG-40B/U, UG-39/U, UG-135/U, UG-136B/U
23UA62	24UA62	26UA62	35UA62N	12.40 to 18.00	WR62, WG18	UG-541A/U, UG-419/U, UG-1665/U, UG1666/U
23UA42	24UA42	26UA42	35UA42K	17.00 to 26.50	WR42, WG20	UG-596A/U, UG-595/U, UG-597/U, UG-598A/U

*: For Coaxial/Waveguide Adapter part numbers, N designates Type N and K designates K-Connector

VNA MASTER

MS2024B MS2034B MS2025B MS2035B

MS2024B	MS2034B	MS2025B	MS2035B	
500 kHz to 4 GHz	500 kHz to 4 GHz 100 kHz to 4 GHz	500 kHz to 6 GHz	500 kHz to 6 GHz 100 kHz to 6 GHz	Vector Network Analyzer + Spectrum Analyzer

Remote Control
Ethernet OPTION | USB

The Affordable, Handheld Vector Network + Spectrum Analyzer for Cable, Antenna and Signal Analysis Anytime, Anywhere

Anritsu introduces the MS202xB/3xB VNA Master + Spectrum Analyzer, the industry's most affordable and compact handheld solution to address cable, antenna, component and signal analysis needs in the field. Models MS2024/25B VNA Masters bring the error-correction power of S-parameter measurements to make more precise field diagnostics. With frequency coverage from 500 kHz to 4/6 GHz. In a truly handheld, battery-operated, rugged multi-function instrument, it also provides a field-friendly touch screen user interface. MS2034B/35B models include a powerful spectrum analyzer which multiplies user convenience by combining both a VNA and a separate spectrum analyzer into a single measurement powerhouse for the harsh RF and physical environments of field test. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or 3G/4G, Land Mobile Radio, and wireless data network measurements, this VNA/Spectrum Analyzer combination is the ideal instrument to making fast and reliable measurements in the field.

Performance and Functional Highlights

VNA Master

- Broadband coverage of 500 kHz to 4/6 GHz
- 1-path, 2-port Vector Network Analyzer
- Intuitive Graphical User Interface (GUI) with convenient Touch Screen
- VNA-quality error correction for directivity and source match
- 2-port Transmission Measurements: High/Low Power
- Outstanding calibration stability, up to 16 hours
- User-defined overlays for viewing multiple S-Parameters
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- 100 dB Transmission Dynamic Range
- 850 µs/data point sweep speed
- Greater than 3 hour battery life
- USB & (optional) Ethernet for data transfer and instrument control
- Automate repetitive tasks via (optional) Ethernet & USB
- Field Upgradable Firmware
- Store more than 4000 traces and setups in memory
- Portable: 7.6 lbs (3.5 kg)
- Full Speed USB Memory support
- High resolution daylight viewable TFT color display
- "Glove Friendly" Resistive Touch Screen Display
- User-selectable menu options: Chose either VNA or simplified Cable & Antenna
- Complies with MIL-PRF-28800F Class 2 specification
- Distance Domain Option, supports optical DTF module
- Internal Bias Tee Option
- Vector Voltmeter Option, ideal for cable phase matching
- High Accuracy Power Meter Option
- GPS Receiver Option
- Polar Format Impedance Display

VNA Master + Spectrum Analyzer

All of the above VNA features, PLUS:

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID
- Dynamic Range: >95 dB in 10 Hz RBW
- DANL: –162 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: <±50 ppb with GPS On
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 41 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete
- Option to automatically optimize sweep-RBW-VBW tradeoff for best possible display
- AM/FM/SSB Audio-only Demodulation
- Store 2000 traces internally
- Channel Scanner Option
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter Option
- Coverage Mapping Option
- Optional AM/FM/PM Demodulation Analyzer

VNA Master Functional Specifications

Definitions

- All specifications and characteristics apply under the following conditions, unless otherwise stated:
- After 15 minutes of warm-up time in VNA mode, where the instrument is left in the ON state.
- Temperature range is 23°C ±5°C.
- All specifications apply when using internal reference.
- All specifications subject to change without notice. Please visit www.us.anritsu.com for most current data sheet.
- Typical performance is the measured performance of an average unit.
- Recommended calibration cycle is 12 months.

Frequency

VNA Master Frequency Range	MS2024B/34B	MS2025B/35B
	500 kHz to 4 GHz	500 kHz to 6 GHz
Frequency Accuracy	2.5 ppm	
Frequency Resolution	1 Hz	

Typical Test Port Power

VNA Master supports selection of either High (default) or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical power by bands is shown in the following table.

Frequency Range	High Port Power (dB)	Low Port Power (dBm)
500 kHz to ≤3 GHz	+3	–25
3 GHz to ≤6 GHz	0	–25

Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power is shown in the following table.

Frequency Range	Dynamic Range (dB)
2 MHz to ≤4 GHz	100
4 GHz to ≤6 GHz	90

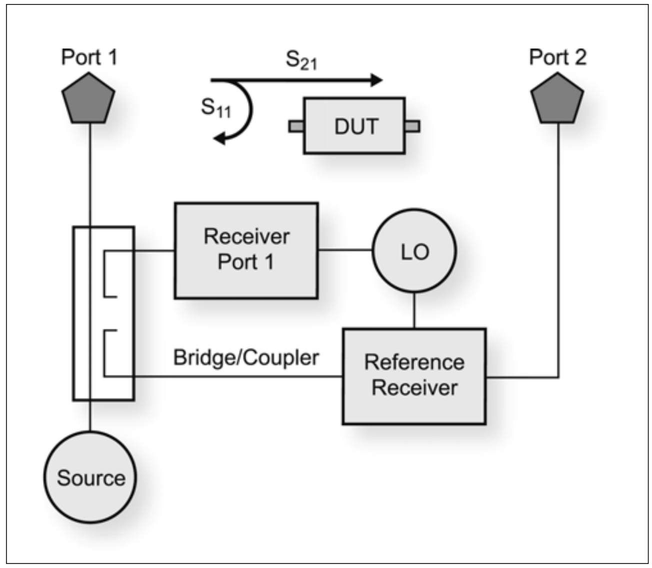
Typical Sweep Speed

The typical sweep speed for IF Bandwidth of 100 kHz, 1001 data points, and single display is shown in the following table. The two receiver architecture will simultaneously collect S_{21} and S_{11} in a single sweep.

Frequency Range	Typical Sweep Speed (µs/point)
500 kHz to 6 GHz	850

Block Diagram

As shown in the following block diagram, the VNA Master has a 2-port, 1-path architecture that automatically measures 2 S-parameters with error-correction precision inherent to VNA operation.



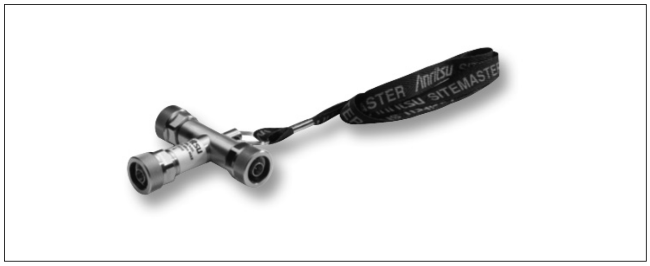
The above illustration is a simplified block diagram of VNA Master's 2-port, 1-path architecture. The magnitude AND phase information gained from Vector Network data enables the VNA Master to make significant error corrections and provide improved field measurements.

High Port Power

OSLxx50 Calibration Components (N-Connector)
Corrected System Performance and Uncertainties:
MS202xB/3xB with 1-path, 2-port calibration including isolation using either OSLN50-1 & OSLNF50-1 Calibration Kits.

Measurement Uncertainties

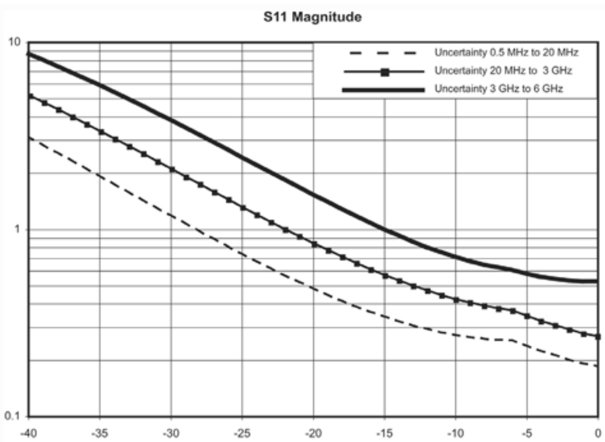
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

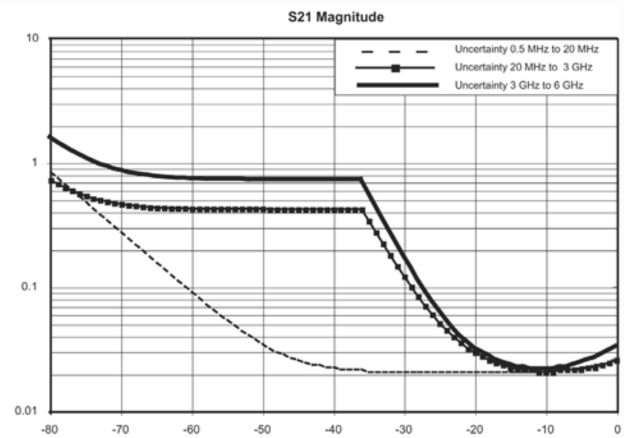


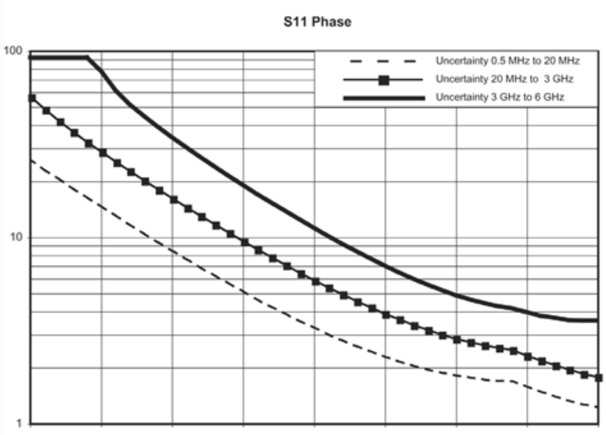
Precision calibration standards come in a convenient configuration for field work.

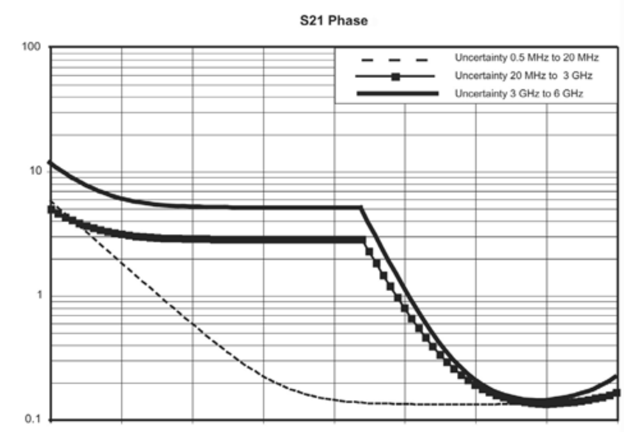
Frequency Range (GHz)	Directivity (dB)
≤6	>42

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	+3
≤6	0







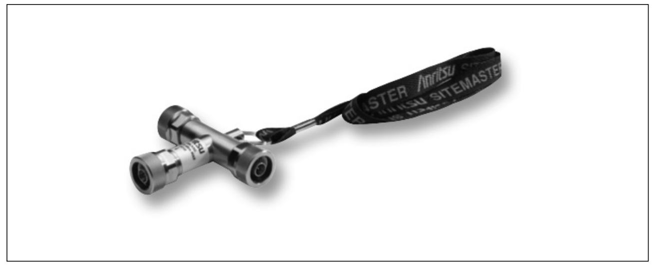


Low Port Power

OSLxx50 Calibration Components (N-Connector)
Corrected System Performance and Uncertainties:
MS202xB/3xB with 1-path, 2-port calibration including isolation using either OSLN50-1 & OSLNF50-1 Calibration Kits.

Measurement Uncertainties

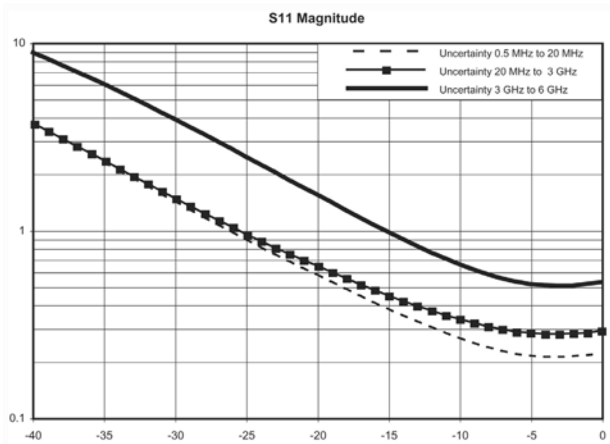
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

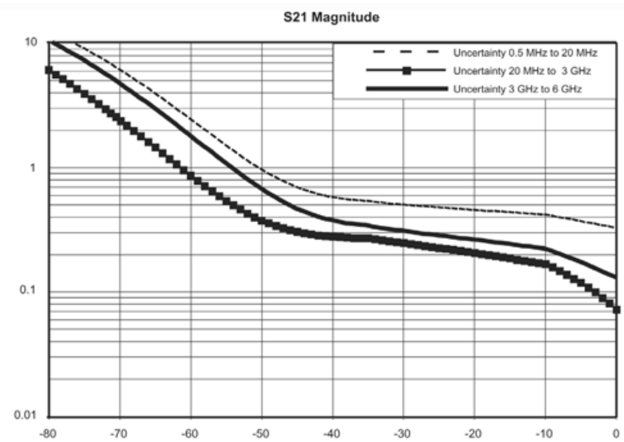


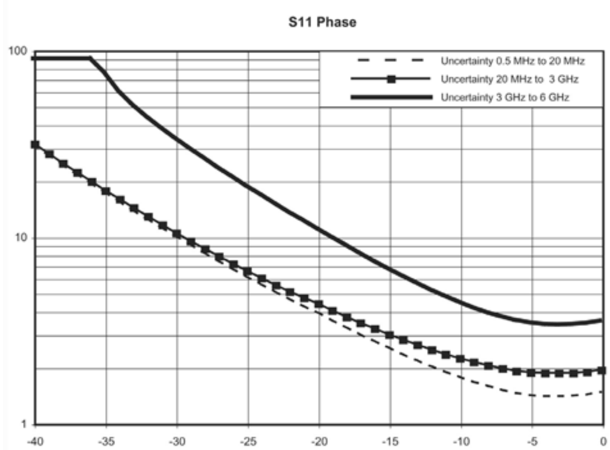
Precision calibration standards come in a convenient configuration for field work.

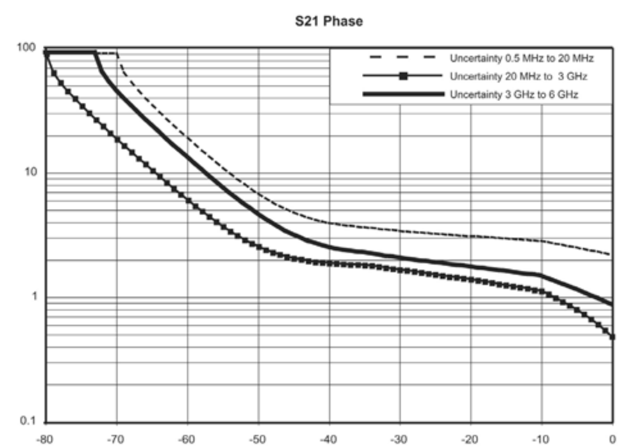
Frequency Range (GHz)	Directivity (dB)
≤6	>42

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	–25
≤6	–25









Spectrum Analyzer Functional Specifications (Models MS2034B/35B only)

Frequency				
Frequency Range	MS2034B: 100 kHz to 4 GHz, (usable to 0 Hz) MS2035B: 100 kHz to 6 GHz, (usable to 0 Hz)			
Tuning Resolution	1 Hz			
Frequency Reference	Aging: ±1.0 ppm/year Accuracy: 120 ppb (25°C ± 25°C) + aging <50 ppb with GPS locked			
Frequency Span	MS2034B: 10 Hz to 4 GHz including zero span MS2035B: 10 Hz to 6 GHz including zero span			
Sweep Time	Minimum 100 ms, 10 µs to 600 seconds in zero span			
Sweep Time Accuracy	±2% in zero span			
Bandwidth				
Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)			
Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)			
RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)			
VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1			
Spectral Purity				
SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz typical @ 10 kHz offset –105 dBc/Hz, –112 dBc/Hz typical @ 100 kHz offset –115 dBc/Hz, –121 dBc/Hz typical @ 1 MHz offset			
Amplitude Ranges				
Dynamic Range	> 95 dB (2.4 GHz), 2/3 (TOI-DANL) in 10 Hz RBW			
Measurement Range	DANL to +26 dBm			
Maximum Continuous Input	+35 dBm			
Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed			
Reference Level Range	–120 to +30 dBm			
Attenuator Resolution	0 to 55 dB, 5.0 dB steps			
Amplitude Units	Log Scale Modes: dBm, dBV, dBmv, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW			
Amplitude Accuracy (single sine wave input <Ref level, and >DANL, auto attenuation)				
–10° to +50°C after 30 minute warm-up	Typical: ±0.5 dB, 100 kHz to 6 GHz Maximum: ±1.3 dB, 100 kHz to 6 GHz			
Displayed Average Noise Level (DANL)	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
(RBW Normalized to 1 Hz, 0 dB attenuation)	Maximum	Typical	Maximum	Typical
10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
(RBW = 10 Hz, 0 dB attenuation)				
10 MHz to 2.4 GHz	–131 dBm	–136 dBm	–147 dBm	–152 dBm
>2.4 GHz to 4 GHz	–127 dBm	–131 dBm	–144 dBm	–149 dBm
>4 GHz to 5 GHz	–124 dBm	–128 dBm	–140 dBm	–145 dBm
>5 GHz to 6 GHz	–116 dBm	–121 dBm	–133 dBm	–140 dBm
Spurs				
Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
Exceptions, typical	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input <–68 dBc @ F1-280 MHz with F1 Input <–70 dBc @ F1 + 190.5 MHz with F1 Input <–52 dBc @ 7349-2F2 MHz, with F2 Input, where F2 < 2424.5 MHz <–55 dBc @ 190.5 ±F1/2 MHz, F1 <1 GHz			
Third-Order Intercept (TOI)	Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)			
800 MHz	+16 dBm			
2400 MHz	+20 dBm			
200 MHz to 2200 MHz	+25 dBm, typical			
>2.2 GHz to 5.0 GHz	+28 dBm, typical			
>5.0 GHz to 6.0 GHz	+33 dBm, typical			
Second Harmonic Distortion	Preamp Off, 0 dB input attenuation, –30 dBm input			
50 MHz	–56 dBc			
>50 MHz to 200 MHz	–60 dBc, typical			
>200 MHz to 3000 MHz	–70 dBc, typical			
VSWR	2:1, typical			

VNA Performance Capabilities

Measurement Parameters	S_{11}, S_{21}
Number of Traces	Four: TR1, TR2, TR3, TR4
Trace Format	Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays.
Graph Types	Log Magnitude SWR Phase Real Imaginary Group Delay Smith Chart Log Mag/2 (1-Port Cable Loss) Linear Polar Log Polar Real Impedance Imaginary Impedance Log Polar Real Impedance Imaginary Impedance
Domains	Frequency Domain, Distance Domain
Frequency	Start Frequency, Stop Frequency, Center Frequency, Span
Distance	Start Distance, Stop Distance
Frequency Sweep Type: Linear	Single Sweep, Continuous
Data Points	2 to 4001 (arbitrary setting); data points can be reduced without recalibration.
Limit Lines	Upper, Lower, 10 segmented Upper, 10 segmented Lower
Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
Data Averaging	Sweep-by-sweep
Smoothing	0 to 20%
IF Bandwidth	10, 20, 50, 100, 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Hz)
Reference Plane	The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase, and constant impedance.
Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance.
Frequency Range	Frequency range of the measurement can be narrowed within the calibration range without recalibration.
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
Group Delay Range	<180° of phase change within the aperture
Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.
Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
Number of Markers	Eight, arbitrary assignments to any trace
Marker Types	Reference, Delta
Marker Readout Styles	Log Mag, Cable Loss (Log Mag / 2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, and Group Delay
Marker Search	Peak Search, Valley Search, Find Marker Value
Correction Models	Full S_{11}, 1-Path, 2-Port (S_{11} & S_{21}), Response S_{11}, Response S_{21}
Calibration Methods	Short-Open-Load-Through (SOLT)
Calibration Standards' Coefficients	Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined
Cal Correction Toggle	On/Off
Impedance Conversion	Support for 50Ω and 75Ω are provided.
Units	Meters, Feet
Bias Tee Settings	Internal, Off
Timebase Reference	Internal
File Storage Types	Measurement, Setup (with CAL), Setup (without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), JPEG
Ethernet Configuration	DHCP or Manual (Static); IP, Gateway, Subnet entries
Languages	English, French, German, Spanish, Chinese, Japanese, Korean, Italian, plus two User Defined

Spectrum Analyzer Performance Capabilities (Models MS2034B/35B only)

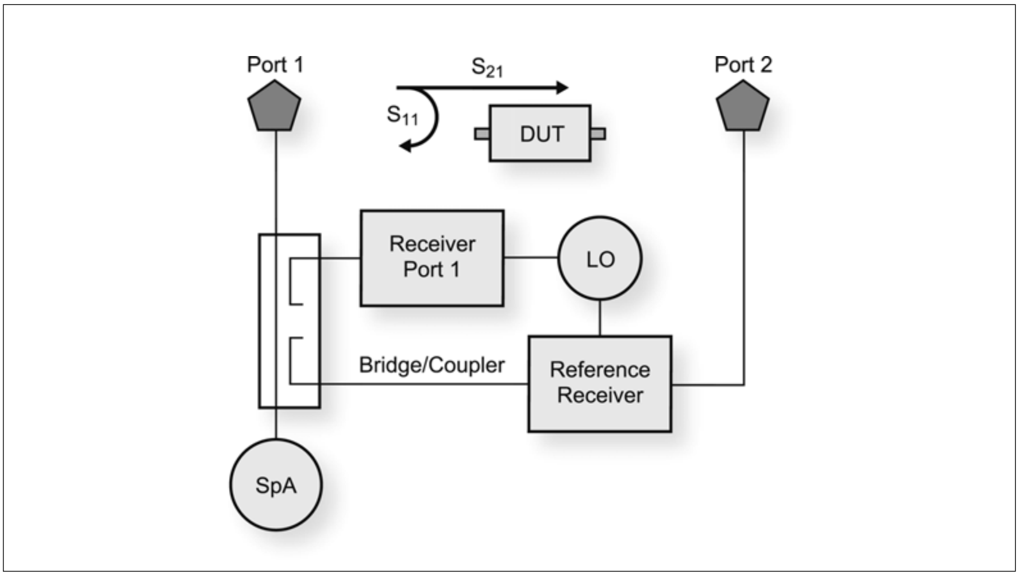
Measurements	
Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m^2 or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask Coverage Mapping (requires option 0431, and GPS Option 0031)
Setup Parameters	
Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)
Sweep Functions	
Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
Detection	Peak, RMS, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	
Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
Trace B Operations	A→B, B↔C, Max Hold, Min Hold
Trace C Operations	A→C, B↔C, Max Hold, Min Hold, A – B→C, B – A→C, Relative Reference (dB), Scale
Marker Functions	
Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off
Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker Marker Auto-Position Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	
Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41 max), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall

Measurement Options Specifications

• Bias Tee (Option 0010)

For tower mounted amplifier tests, the MS202xB/3xB series with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements.
For frequency sweeps in excess of 2 MHz, the VNA Master can supply internal voltage control from +12 V to +32 V in 0.1 V steps up to 450 mA. Bias can be directed to VNA Port 2.

Frequency Range	2 MHz to 4/6 GHz (MS202xB/3xB) at VNA Port 2
Internal Voltage/Current	+12 V to +32 V at 450 ma. Steady state
Internal Resolution	0.1 V
Bias Tee Selections	Internal, Off



The Compact VNA Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram.

• Vector Voltmeter (Option 0015)

A phased array system relies on phase matched cables for nominal performance. For this class of application, the VNA Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements.
The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts.

For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables. The MS202xB/3xB solution is superior because the signal source is included internally, precluding the need for an external signal generator

CW Frequency Range	500 kHz to 4/6 GHz
Measurement Display	CW, Table (Twelve Entries, Plus Reference)
Measurement Types	Return Loss, Insertion
Measurement Format	dB/VSWR/Impedance

• High Accuracy Power Meter (Option 0019)
Requires external USB power sensor.
Conduct precise measurements of CW and digitally modulated transmitters in the field using this VNA Master software mode with a separately purchased Anritsu USB power sensor. After specifying the center frequency and zeroing the sensor to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts.

Option 0019 supports the USB Power Sensors in the following table.

USB Power Sensors (Ordered separately):

Model	PSN50	MA24105A	MA24106A	MA24108A	MA24118A	MA24126A
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26.5 GHz
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor
Connector	Type N, male, 50Ω	Type N, female, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω
Dynamic Range	–30 to +20 dBm (0.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz	50 kHz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS. Slot Power, Burst Average Power	True-RMS, Slot power, Burst Average power	True-RMS, Slot power, Burst Average power
Measurement Uncertainty	±0.16 dB*1	±0.17 dB*2	±0.16 dB*1	±0.18 dB*3	±0.18 dB*3	±0.18 dB*3
Datasheet for Additional Specifications	11410-00414	11410-00621	11410-00424	11410-00504	11410-00504	11410-00504

∗1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors
∗2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load.
Measurement results referenced to the input side of the sensor.
∗3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors

• Interference Analyzer (Option 0025) (Models MS2034B/35B only) (Recommend GPS)

Measurements	Spectrum
	  Field Strength
	  Occupied Bandwidth
	  Channel Power
	  Adjacent Channel Power (ACPR)
	  AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only)
	  Carrier-to-Interference ratio (C/I)
	Spectrogram (Collect data up to one week)
	Signal Strength (Gives visual and aural indication of signal strength)
	Received Signal Strength Indicator (RSSI) (collect data up to one week)
	  Gives visual and aural indication of signal strength
	Signal ID (up to 12 signals)
	Center Frequency
	Bandwidth
	Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi)
	Closest Channel Number
	Number of Carriers
	Signal-to-Nose Ratio (SNR) > 10 dB
	Interference Mapping

Application Options	Impedance (50Ω, 75Ω, Other)

• Channel Scanner (Option 0027) (Models MS2034B/35B only)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	500 kHz to 4 GHz (MS2034B) 500 kHz to 6 GHz (MS2035B)
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• **GPS (Option 0031)** Requires external GPS antenna

Built-in GPS provides location information (latitude, longitude, altitude) and Universal Time (UT) information for storage along with trace data so you can later verify that measurements were taken at the right location. The GPS option requires a separately ordered magnet mount GPS antenna (2000-1528-R or 2000-1652-R), which are configured to mount outside on a metallic surface. Frequency accuracy is enhanced for the Spectrum Analyzer (on MS203xB models) when Options 0025 Interference Analyzer and 0027 Channel Scanner are engaged.

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer when GPS Antenna is connected <±50 ppb with GPS On, 3 minutes after satellite lock in selected mode
GPS Lock – after antenna is disconnected	<±50 ppb for 3 days, 0° to 50°C ambient temperature
Connector	SMA, female

• **Distance Domain (Option 0501)**

Distance-to-Fault Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the Compact VNA Master exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify discontinuities. The Compact VNA Master converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements.

Option 0501 Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and so minimize or prevent downtime of the system.

Option 0501 Distance Domain also supports field measurements for optical fiber diagnostics. Anritsu Model ODTF-1 test module (see page 15) works directly with RF techniques and converts optical DTF signals to display on the VNA Master.

• **Ethernet Connectivity (Option 0411)**

By enabling the Compact VNA Master to communicate with PCs via Ethernet, you gain the ability to operate automated testing from your PC, or conversely, to upload data from field test to the PC.

• **AM/FM/PM Demodulation Analyzer, (Option 0509) (Models MS2034B/35B only)**

The VNA Master + Spectrum Analyzer comes with AM/FM/SSB audio demodulation standard. By adding Option 0509, it then measures, analyzes and displays key modulation parameters of RF Spectrum, Audio Spectrum, Audio Waveform and FM Demod Summary. The RF Spectrum View displays the spectrum analyzer with carrier power, frequency, and occupied BW. Audio Spectrum shows the demodulated audio spectrum along with the Rate, RMS deviation, Pk-Pk/2 deviation, SINAD, Total Harmonic Distortion (THD), and Distortion/Total. Each demodulation also includes an Audio Waveform display that shows the time-domain demodulated waveform. There is a summary table that includes a summary of all the RF and Demod parameters.

• **Coverage Mapping (Option 0431)** (Requires GPS)

Measurements	Indoor Mapping		Outdoor Mapping
	RSSI ACPR		RSSI ACPR
Setup Parameters	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment	
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection	
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span	
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW	
	Measurement Setup	ACPR, RSSI	
	Point Distance / Time Setup	Repeat Type Time Distance	
	Save Points Map	Save KML, JPEG, Tab Delimited	
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid	

VNA Master General Specifications (MS202xB/3xB)

Maximum Input (Damage Level) into Vector Network Analyzer	+23 dBm, ±50 VDC
Interfaces	Type N female Spectrum Analyzer Port (MS203xB) Type N female Type BNC female Trigger In port Type BNC female External Reference In port Type SMA female GPS port supports +3.3 V or +5 V external antenna (Available with opt 0031) USB Interface, Type A (2 connectors) USB Interface, Type Mini-B RJ45 connector for Ethernet 10/100-Base T (Available with Option 0411 Ethernet) 2.5 mm 3-wire cellular headset connector

• Setup Parameters

System	Status (Temperature, Battery Info, S/N, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Internal Trace/Setup Memory	2,000 traces, 2,000 Setups
External Trace/ Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

• Connectors

VNA Port 1, VNA Port 2	Type N, female, 50Ω
RF Out Damage Level	+23 dBm, ±50 VDC
RF In Damage Level	+35 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation) (MS203xB)
GPS	SMA, female
External Power	5.5 mm barrel connector, 12.5 to 15 VDC, <4.0 Amps
USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset Jack	2.5 mm barrel connector
External Reference In	BNC, female, 50Ω, Maximum Input ±5 VDC 1 MHz, 5 MHz, 10 MHz, 13 MHz
External Trigger/ Clock Recovery	BNC, female, 50Ω , Maximum Input ±50 VDC

• Display

Type	Resistive Touch Screen
Size	8.4 in, daylight viewable color LCD
Resolution	800 × 600

• Power

Field replaceable Li-Ion Battery (633-44: 6600 mAh, 4.5 Amps)	40 Watts on battery power only
DC power from Universal 110 V/220 V AC/DC Adapter	55 Watts running off AC/DC adaptor while charging battery
Life time charging cycles (Li-Ion Battery, 633-44)	>300 (80% of initial capacity)
Battery Operation	3.6 hours, typical

• Electromagnetic Compatibility

European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11

• Safety

Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Company supplied Power Supply

• Environmental

Operating Temperature	–10° to +55°C
Maximum Humidity	85%
Shock	MIL-PRF-28800F Class 2
Storage	–40° to +71°C
Altitude	4600 meters, operating and non-operating

• Size and Weight

Dimensions	Height: 199 mm (7.8 in)
	Width: 273 mm (10.7 in)
	Depth: 91 mm (3.6 in)
Weight, Including Battery	3.5 kg (7.6 lbs)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	VNA Master™ 2-Port, 1-Path VNA
MS2024B	VNA: 500 kHz to 4 GHz
MS2025B	VNA: 500 kHz to 6 GHz
	VNA Master™ 2-Port, 1-Path VNA + Spectrum Analyzer
MS2034B	VNA: 500 kHz to 4 GHz, S/A: 100 kHz to 4 GHz
MS2035B	VNA: 500 kHz to 6 GHz, S/A: 100 kHz to 6 GHz
	The instrument includes standard one-year warranty and Certificate of Calibration and Conformance
	MS2024B VNA Master Options
MS2024B-0010	Built-in Bias-Tee, +12 V to +24 V variable
MS2024B-0015	Vector Voltmeter
MS2024B-0019	High Accuracy Power Meter (requires external USB sensor)
MS2024B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2024B-0098	Z-540 Calibration
MS2024B-0099	Premium Calibration
MS2024B-0411	Ethernet Connectivity
MS2024B-0501	Distance Domain
	MS2025B VNA Master Options
MS2025B-0010	Built-in Bias-Tee, +12 V to +24 V variable
MS2025B-0015	Vector Voltmeter
MS2025B-0019	High Accuracy Power Meter (requires external USB sensor)
MS2025B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2025B-0098	Z-540 Calibration
MS2025B-0099	Premium Calibration
MS2025B-0411	Ethernet Connectivity
MS2025B-0501	Distance Domain
	MS2034B VNA Master, + Spectrum Analyzer Options
MS2034B-0010	Built-in Bias-Tee, +12 V to +24 V variable
MS2034B-0015	Vector Voltmeter
MS2034B-0019	High Accuracy Power Meter (requires external USB sensor)
MS2034B-0025	Interference Analysis, 100 kHz to 4 GHz*1
MS2034B-0027	Channel Scanner, 100 kHz to 4 GHz*1
MS2034B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2034B-0098	Z-540 Calibration
MS2034B-0099	Premium Calibration
MS2034B-0411	Ethernet Connectivity
MS2034B-0431	Coverage Mapping*2
MS2034B-0501	Distance Domain
MS2034B-0509	AM/FM/PM Demodulation Analyzer
	MS2035B VNA Master, + Spectrum Analyzer Options
MS2035B-0010	Built-in Bias-Tee, +12 V to +24 V variable
MS2035B-0015	Vector Voltmeter
MS2035B-0019	High Accuracy Power Meter (requires external USB sensor)
MS2035B-0025	Interference Analysis, 100 kHz to 6 GHz*1
MS2035B-0027	Channel Scanner, 100 kHz to 6 GHz*1
MS2035B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2035B-0098	Z-540 Calibration
MS2035B-0099	Premium Calibration
MS2035B-0411	Ethernet Connectivity
MS2035B-0431	Coverage Mapping*2
MS2035B-0501	Distance Domain
MS2035B-0509	AM/FM/PM Demodulation Analyzer
	MS202xB/3xB Standard Accessories
10580-00220	VNA Master User's Guide
3-68736	Soft Carrying Case
2300-498	Master Software Tools CD ROM
633-75	Rechargeable Battery, Li-Ion, 7500 mAh
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 V DC adapter
3-2000-1498	USB A-to mini B cable, 3.05 m (10 ft.)

*1: Requires external antenna (2000-xxxx or 61532 Antenna Kit), Recommend Option 0031 GPS
*2: Requires Option 0031 GPS

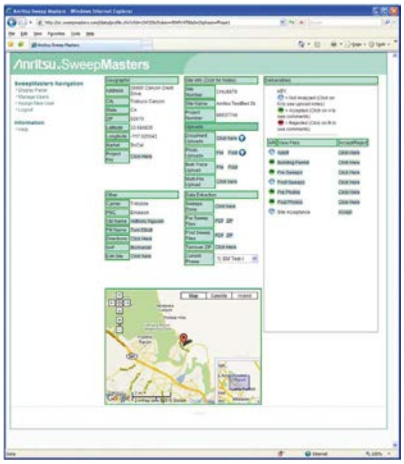
Model/Order No.	Name
	Optional Accessories
	Ancillary Equipment
2300-517	Phase Noise Measurement Software
3-806-152	Ethernet Crossover Cable
2000-1371-R	Ethernet Cable (7 ft.)
2000-1528-R	GPS Antenna – Magnet Mount (active 3 to 5 V) with SMA connector and 4.6 m (15 ft) extension cable
2000-1652-R	GPS Antenna – Magnet mount (active 3 to 5 V) with SMA connector and 1 foot cable
2000-1653	Protective Screen Cover (Package of 2)
2000-1689	EMI Near Field Probe Kit
	High Accuracy Power Sensor
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, True RMS
MA24106A	High Accuracy Power Sensor, 50 MHz to 6 GHz, True RMS
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, True RMS
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, True RMS
MA24126A	Microwave USB Power Sensor, 10 MHz to 26.5 GHz, True RMS
	N-Type Connector Components
OSLN50	Precision Integrated Open/Short/Load N(m), DC to 18 GHz, 50Ω
OSLNF50	Precision Integrated Open/Short/Load N(f), DC to 18 GHz, 50Ω
22N50	Precision N(m) Short/Open, 18 GHz
22NF50	Precision N(f) Short/Open, 18 GHz
28N50-2	Precision Termination, DC to 18 GHz, 50Ω, N(m)
28NF50-2	Precision Termination, DC to 18 GHz, 50Ω, N(f)
OSLN50-1	Precision N(m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50-1	Precision N(f) Open/Short/Load, 42 dB, 6 GHz
SM/PL-1	Precision N(m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision N(f) Load, 42 dB, 6 GHz
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21000 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110-2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50Ω
61532	Antenna Kit (Consists of: 2000-1030, 2000-1031, 2000-1032-R, 2000-1200, 2000-1035, 2000-1361, and carrying pouch)

Continued on next page

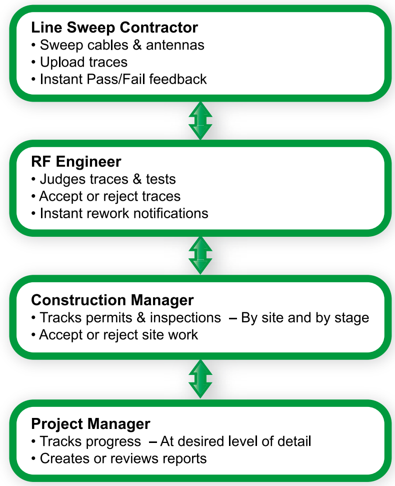
Model/Order No.	Name
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-172	BNC(f) to N(m), DC to 1.3 GHz, 50Ω
510-90	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50Ω
510-91	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50Ω
510-92	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50Ω
510-93	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50Ω
510-96	7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50Ω
510-97	7/16 DIN(f) to 7/16 DIN(f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50Ω, w/ Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Technical Data Sheet
11410-00549	VNA Master + Spectrum Analyzer Brochure
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle
	Manuals
10580-00301	VNA Master User's Guide
10580-00302	VNA Master Programming Manual
10580-00303	VNA Master Maintenance Manual
10580-00289	VNA Measurement Guide
10580-00231	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide
	Related Literature, Application Notes
11410-00206	Time Domain for Vector Network Analyzers
11410-00214	Reflectometer Measurements – Revisited
11410-00270	What is Your Measurement Accuracy?
11410-00373	Distance-to-Fault
11410-00387	Primer on Vector Network Analysis
11410-00414	High Accuracy Power Meter, PSN50
11410-00424	USB Power Sensor MA24106A
11410-00504	Microwave USB Power Sensor MA241x8A
11410-00531	Practical Tips on Making “Vector Voltmeter (VVM)” Phase Measurements using VNA Master (Opt. 15)
11410-00472	Measuring Interference
11410-00476	The Essentials of Vector Network Analysis
11410-00565	Troubleshoot Wire Cable Assemblies with Frequency-Domain Reflectometry
	Phase-Stable Test Port Cables, Armored
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(m), 50Ω

SWEEP MASTER™ WEB-BASED LINE SWEEP AND DOCUMENT TRACKING TOOLS
MX829000A/MX829001A

Capture, Verify, Manage, and Report - Cable, Antenna, and PIM Traces Plus Track Build-out Documentation



Anritsu Sweep Masters Cell Site Profile



Project Test and Documentation Flow

What is Sweep Master?

If you are a prime contractor, hiring line sweep contractors for large multi-site installation and maintenance projects, you need Sweep Master. Sweep Master is a web-based line sweep and documentation tracking tool tailored to your needs. Measurements tracked include:

- Return Loss
- Cable Loss
- Distance-to-Fault
- Transmission Measurements
- PIM
- Distance-to-PIM

Sweep Master increases the productivity of tracking these traces with

- Auto file upload and renaming
- Auto marker and limit line placement
- Auto red/green pass/fail trace flagging

Sweep Master has a basic offering, Sweep Master Pro, and a full featured offering, Sweep Master Pro+.

Sweep Master Pro

Capture and Verify

Sweep Master Pro enables an engineer or manager to capture the cable, antenna, and PIM traces that are uploaded by contractors or field technicians. Sweep Master Pro will automatically place marker and limit lines and apply pass/fail criteria for all traces with red/green flagging for quick project review status.

Sweep Master Pro+

Capture and Verify, Manage, and Report

Sweep Master Pro+ starts with the Pro capabilities and adds build management, document management, and reporting abilities.
The Pro+ simplifies construction and project management, shortens rework time, and dramatically eases reporting tasks.

Why use Sweep Master?

New tower builds, or modifications to the cables and antennas on existing cellular towers, often require five or more different types of sweeps per cable. Multiply these five tests by the number of cables being installed on a tower (often between 6 and 26) and it is quite possible to generate more than 130 traces per tower.
Getting all of these traces processed and evaluated properly can be a time consuming, error prone task. In many cases, it takes twice as long to prepare the final report as it does to sweep the cables and antennas in the first place. What takes all this time?

- Physically getting the traces back to the office for processing
- Renaming traces from field names to final names, a step required by older sweep gear
- Dealing with missing or mislabeled traces
- Checking the settings of markers and limit lines and resetting them if needed.
- Making sure that the sweeps really did pass
- Dealing with any needed rework
- Printing a PDF or electronic trace based report

Currently, some network operators are requiring reports within 24 hours of the time the work is done, adding to the urgency of the report processing work.

Sweep Master Pro Capabilities

Capturing Traces with Sweep Master

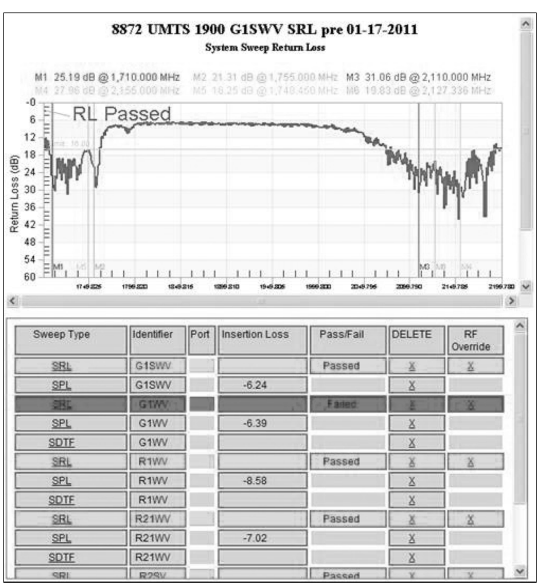
The Sweep Master Pro captures cable, antenna, and PIM traces from both before and after the site work is done. The Sweep Master Pro:

- Allows bulk upload of cable, antenna, and PIM traces
  - Upload all traces for a site in a few minutes.
  - This means that users need not manually identify each trace to the software.
- Automatically converts field name to final names
  - Converts a short, predefined, work site name to final file, trace title, and sub-title names
  - Sweep Master saves hours per site, considering that hundreds of file names, trace titles and trace subtitles are involved for each tower.

Verifying Traces with Sweep Master

- Automatically sets markers and limit lines to customer's standards
  - Ensures that markers and limit lines are set to the network operators' standard before submittal
  - Ensures that pass/fail judgments are accurate.
- Accept/Reject tools for trace reviewers
  - Red/Green Sweep pass/fail indication
  - Trace review capability
  - Trace notes
  - Automatic notifications for sweep test personnel
  - Quicker rework time

The bulk upload capability can upload hundreds of traces in seconds.

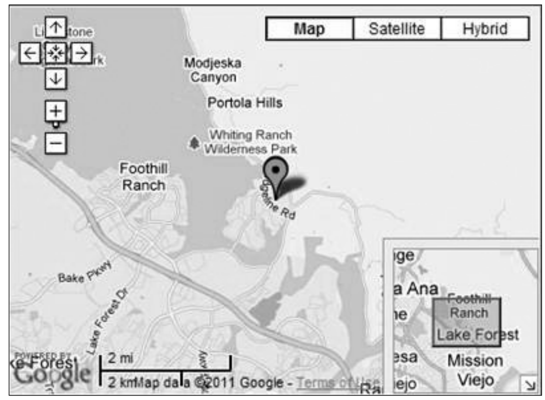


Pass/Fall judgements simplify trace review.

Site Access Instructions

- Hospital Locations
- Key contacts
- Access instructions

These capabilities create efficiency and increase quality by cutting the hours needed to create a sweep report by 75% or more while at the same time ensuring that the information is processed accurately and consistently. This can lower the over all cost of the project and ensure a high quality product. This is working smarter, not harder.



The Site Profile includes a map and access instructions

Sweep Master Pro+

The Pro+ has all the site access, trace capture and verification capabilities of the Pro, plus enhanced document capture capabilities, extensive project management capabilities, and complete reporting capabilities.

Document Capture

In addition to trace capture and verification, the Pro+ can capture build documents such as:

- "As-built" drawings
- Site work photos
- Permits
- Work orders
- Structural analysis
- Other required documents as needed

Manage

Since every document and trace has its place, indexed by type, project stage, and site, it is easy to keep track of project progress. It is also easy to spot missing documents. Designated decision makers can accept or reject individual traces, documents, or the entire site. Everyone with access, including build crews, has visibility of these actions and may even be notified by e-mail. Automatic notifications allow rework to start quickly and reduces overall project time.

The Pro+ allows construction managers or RF engineers to:

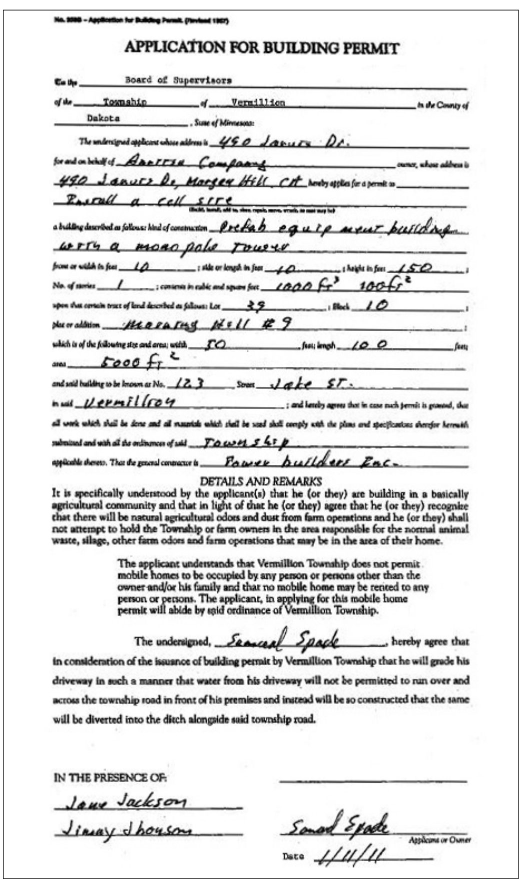
- Keep current on the build progress
- Approve or reject documents and traces by construction phase and site
- Give or withhold site acceptance
- Communicate decisions immediately to build crews
- Choose automatic e-mail notifications of events

Report

Files can be extracted as zipped (compressed) package, allowing long-term storage of documentation in an organized manner. The "Turnover Zip" function allows creation of a site turnover package with one button press. This is were the organization created during the previous stages really pays off! The turn over report is formatted to network operator standards, so report acceptance should never be an issue.

- One button turnover report generation
- Network Operator acceptable format
- Creates reports from current site information
- Reports segregated by construction phase, site, and project

The Pro+ has enhanced document capture capabilities and makes tracking traces and documents easy.



No. [illegible] – Application for Building Permit (Revised [illegible])

APPLICATION FOR BUILDING PERMIT

To the Board of Supervisors of the Township of Vermillion in the County of Dakota, State of Minnesota:

The undersigned applicant whose address is 490 Janurs Dr. for and on behalf of Anritsu Company owner, whose address is 490 Janurs Dr, Morgan Hill, CA hereby applies for a permit to Install a cell site (Build, install, add to, alter, repair, move, wreck, as case may be) a building described as follows: kind of construction Prefab equipment building with a monopole Tower front or width in feet 10; side or length in feet 10; height in feet 150; No. of stories 1; contents in cubic and square feet 1000 ft³ 100 ft² upon that certain tract of land described as follows: Lot 39; Block 10; plat or addition Morgan Hill #9; which is of the following size and area; width 50 feet; length 100 feet; area 5000 ft² and said building to be known as No. 123 Street Jake ST. in said Vermillion; and hereby agrees that in case such permit is granted, that all work which shall be done and all materials which shall be used shall comply with the plans and specifications therefor herewith submitted and with all the ordinances of said Township applicable thereto. That the general contractor is Power builders Inc.

DETAILS AND REMARKS

It is specifically understood by the applicant(s) that he (or they) are building in a basically agricultural community and that in light of that he (or they) agree that he (or they) recognize that there will be natural agricultural odors and dust from farm operations and he (or they) shall not attempt to hold the Township or farm owners in the area responsible for the normal animal waste, silage, other farm odors and farm operations that may be in the area of their home.

The applicant understands that Vermillion Township does not permit mobile homes to be occupied by any person or persons other than the owner and/or his family and that no mobile home may be rented to any person or persons. The applicant, in applying for this mobile home permit will abide by said ordinance of Vermillion Township.

The undersigned, Samuel Spade, hereby agree that in consideration of the issuance of building permit by Vermillion Township that he will grade his driveway in such a manner that water from his driveway will not be permitted to run over and across the township road in front of his premises and instead will be so constructed that the same will be diverted into the ditch alongside said township road.

IN THE PRESENCE OF:

Jane Jackson
Jimmy Thomson

Samuel Spade
Applicant or Owner

Date 1/11/11

Building permits, traces, and other construction documentation are part of the turnover package.

Customization

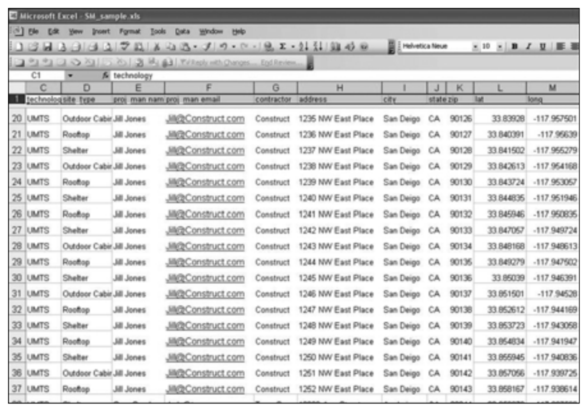
Since each tower build is unique, Sweep Master is customized to each build. Items that may be customized include:

- Tests to be Uploaded
- Number of Cables Per Site
- Color Codes
- Market Specific Final File Naming Conventions
- Pass/Fail Criteria
- Frequency Ranges for Sweeps
- Settings for Markers
- Project Phases
- Report Formats
- Site Locations
- Site Access Data

The per-site information is normally provided by the network operator in the form of a spread sheet. Other information is by means of a Method of Procedure (MOP), e-mail, or other documentation method.

Instruments

Anritsu's handheld instruments, including the Site Master, Spectrum Master, Cell Master, and BTS Master, all produce Cable, Antenna or PIM traces capable of being uploaded into the Sweep Masters domain.



Microsoft Excel - SM_sample.xls

C1 technology

	C	D	E	F	G	H	I	J	K	L	M
1	technolog	site type	proj man nam	proj man email	contractor	address	city	state	zip	lat	long
20	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1235 NW East Place	San Deigo	CA	90126	33.83928	-117.957501
21	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1236 NW East Place	San Deigo	CA	90127	33.840391	-117.95639
22	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1237 NW East Place	San Deigo	CA	90128	33.841502	-117.955279
23	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1238 NW East Place	San Deigo	CA	90129	33.842613	-117.954168
24	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1239 NW East Place	San Deigo	CA	90130	33.843724	-117.953057
25	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1240 NW East Place	San Deigo	CA	90131	33.844835	-117.951946
26	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1241 NW East Place	San Deigo	CA	90132	33.845946	-117.950835
27	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1242 NW East Place	San Deigo	CA	90133	33.847057	-117.949724
28	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1243 NW East Place	San Deigo	CA	90134	33.848168	-117.948613
29	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1244 NW East Place	San Deigo	CA	90135	33.849279	-117.947502
30	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1245 NW East Place	San Deigo	CA	90136	33.85039	-117.946391
31	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1246 NW East Place	San Deigo	CA	90137	33.851501	-117.94528
32	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1247 NW East Place	San Deigo	CA	90138	33.852612	-117.944169
33	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1248 NW East Place	San Deigo	CA	90139	33.853723	-117.943058
34	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1249 NW East Place	San Deigo	CA	90140	33.854834	-117.941947
35	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1250 NW East Place	San Deigo	CA	90141	33.855945	-117.940836
36	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1251 NW East Place	San Deigo	CA	90142	33.857056	-117.939725
37	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1252 NW East Place	San Deigo	CA	90143	33.858167	-117.938614

Site data is often delivered in the form of a spread sheet.

Anritsu instrumentation works with Sweep Masters.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Description
MX829000A	Anritsu Sweep Masters Pro services for one year Site and work information is required before fulfillment
MX829001A	Anritsu Sweep Masters Pro+ services for one year Site and work information is required before fulfillment
	Options
MX829000A-0901	1 Year Renewal

VECTOR NETWORK ANALYZERS

Selection Guide 635
Vector Network Analyzers, Microwave...................... 637
Vectorstar Broadband Vector Network Analyzers..... 648
VNA Master 655, 670
Site Master 683, 688
LMR Master... 697
Cable and Antenna Analyzer 713
Sweep Master Web-Based Line Sweep and
Document Tracking Tools 718
VNA Calibration Kits.. 721
VNA Verification Kits 723
Network Analyzer 724
Reflection Bridges/Transformers.............................. 729

Selection Guide

Group	Model	Frequency Band	Measurement Function								
			S Parameter	Power Sweep Mode	Receiver Mode	Multi-source Control	Time Domain (Option)	Mixer Measurement	Spectrum Analyzer	DTF	Crystal Unit Measurement
Vector	MS4630B	10 Hz to 300 MHz	✓*1								✓
VectorStar	MS4642A	70 kHz to 20 GHz*2	✓	✓	✓	✓	✓	✓			
	MS4644A	70 kHz to 40 GHz*2	✓	✓	✓	✓	✓	✓			
	MS4645A	70 kHz to 50 GHz*2	✓	✓	✓	✓	✓	✓			
	MS4647A	70 kHz to 70 GHz*2	✓	✓	✓	✓	✓	✓			
	ME7838A	70 kHz to 110 GHz (750 GHz)	✓	✓	✓	✓	✓	✓			
Site Master	S311D*	2 MHz to 1.6 GHz*3	✓*4							✓	
	S331D*	2 MHz to 4 GHz*3	✓*4							✓	
	S331E	2 MHz to 4 GHz*3	✓*4							✓	
	S332E	2 MHz to 4 GHz*3	✓*4						✓	✓	
	S361E	2 MHz to 6 GHz*3	✓*4							✓	
	S362E	2 MHz to 6 GHz*3	✓*4						✓	✓	
	S810D	2 MHz to 10.5 GHz*3	✓*4							✓	
	S820D	2 MHz to 20 GHz*3	✓*4							✓	
VNA Master	MS2026C	5 kHz to 6 GHz	✓				✓			✓*5	
	MS2028C	5 kHz to 20 GHz	✓				✓			✓*5	
	MS2036C	5 kHz to 6 GHz	✓				✓		✓	✓	
	MS2038C	5 kHz to 20 GHz	✓				✓		✓	✓	
	MS2024B	500 kHz to 4 GHz	✓*1							✓	
	MS2025B	500 kHz to 6 GHz	✓*1							✓	
	MS2034B	500 kHz to 4 GHz	✓*1						✓	✓	
	MS2035B	500 kHz to 6 GHz	✓*1						✓	✓	

∗ Please refer to the product brochure for details.

∗1: S_{11}/S_{21} measurement by 1 path 2 ports calibration can be performed.
∗2: Requires Option 070 (70 kHz Frequency Extension)
∗3: Requires Option 2 (2 MHz Frequency Extension)
∗4: S_{11} measurement by OSL calibration can be performed.
∗5: Requires Time Domain Option (Option 0002)

Selection Guide (Frequency Range)

Group	Model	Frequency range 10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	2 MHz	5 MHz	10 MHz	20 MHz	50 MHz	100 MHz	200 MHz	500 MHz	1 GHz	2 GHz	5 GHz	10 GHz	20 GHz	50 GHz	100 GHz	500 GHz	750 GHz	Remarks
Vector	MS4630B																								10 Hz to 300 MHz
VectorStar	MS4642A																								70 kHz to 20 GHz*1
VectorStar	MS4644A																								70 kHz to 40 GHz*1
VectorStar	MS4645A																								70 kHz to 50 GHz*1
VectorStar	MS4647A																								70 kHz to 70 GHz*1
VectorStar	ME7838A																								70 kHz to 110 GHz (750 GHz)
Site Master	S311D																								25 MHz to 1.6 GHz*2
Site Master	S331D																								25 MHz to 4 GHz*2
Site Master	S331E																								2 MHz to 4 GHz*2
Site Master	S332E																								2 MHz to 4 GHz*2
Site Master	S361E																								2 MHz to 6 GHz*2
Site Master	S362E																								2 MHz to 6 GHz*2
Site Master	S810D																								25 MHz to 10.5 GHz*2
Site Master	S820D																								25 MHz to 20 GHz*2
VNA Master	MS2026C																								5 kHz to 6 GHz
VNA Master	MS2028C																								5 kHz to 20 GHz
VNA Master	MS2036C																								5 kHz to 6 GHz
VNA Master	MS2038C																								5 kHz to 20 GHz
VNA Master	MS2024B																								500 kHz to 4 GHz
VNA Master	MS2025B																								500 kHz to 6 GHz
VNA Master	MS2034B																								500 kHz to 4 GHz
VNA Master	MS2035B																								500 kHz to 6 GHz

*1: Requires Option 070 (70 kHz Frequency Extension)
*2: Requires Option 2 (2 MHz Frequency Extension)

VECTOR NETWORK ANALYZERS, MICROWAVE

MS4640A Series

70 kHz to 70 GHz

Remote Control
GPIB | Ethernet | USB

High Performance, Broadband Network Analysis Solutions

The following provides the specifications for the MS4640A series microwave Vector Network Analyzers (VNAs) listed below, including all related options, and accessories.

Instrument Models

MS4642A: 10 MHz to 20 GHz
MS4644A: 10 MHz to 40 GHz
MS4645A: 10 MHz to 50 GHz
MS4647A :10 MHz to 70 GHz

Download the current MS4640A technical Data Sheet 11410-00513 from the Anritsu website at www.anritsu.com for complete and updated specifications.

Main Options

MS4640A-002 – Time Domain
MS4640A-007 – Receiver Offset
MS464xA-041 – Noise Figure
MS464xA-051 – Direct Access Loops
MS464xA-061 – Active Measurements Suite, 2 Attenuators
MS464xA-062 – Active Measurements Suite, 4 Attenuators
MS4640A-070 – 70 kHz Low-End Frequency Extension
MS4647A-080/081 – Broadband/Millimeter-Wave System
MS464xA-082/083 – 110 GHz and Millimeter-Wave Extensions

Separate documents found on the Anritsu website (www.us.anritsu.com\VectorStar) provides specifications for 110 GHz Broadband Coaxial, Banded Waveguide and Multiport solutions, based on the MS4640A VNA. A color detailed brochure provides in-depth descriptions of the VectorStar family's features and benefits.

System Dynamic Range

Calculated as the difference between the maximum rated source power and the specified noise floor at the specified location.

- **MS4642A, 20 GHz Model, System Dynamic Range (dB)**

Frequency Range	at Ports 1 or 2			at b_1 or b_2	
	Standard	Option 051	Option 061* or 062	Option 051	Option 061* or 062
0.07 MHz to 0.3 MHz	85	83	81	114	112
0.3 MHz to 2 MHz	102	100	98	126	124
2 MHz to 10 MHz	115	113	111	134	132
0.01 GHz to 2.5 GHz	122	119	114	140	135
2.5 GHz to 20 GHz	123	119	115	134	130

- **MS4644A, 40 GHz Model, System Dynamic Range (dB)**

Frequency Range	at Ports 1 or 2			at b_1 or b_2	
	Standard	Option 051	Option 061* or 062	Option 051	Option 061* or 062
0.07 MHz to 0.3 MHz	85	83	81	114	112
0.3 MHz to 2 MHz	102	100	98	126	124
2 MHz to 10 MHz	115	113	111	134	132
0.01 GHz to 2.5 GHz	122	119	114	140	135
2.5 GHz to 40 GHz	119	115	110	130	125

*: The Option 061 Dynamic Range reported in this column applies for S_{21} measurements.
For S_{12} Dynamic Range, use the figures from the "Option 051" column.

• MS4645A & MS4647A, 50 & 70 GHz Models, System Dynamic Range (dB)

Frequency Range	at Ports 1 or 2			at b_1 or b_2	
	Standard	Option 051	Option 061* or 062	Option 051	Option 061* or 062
0.07 MHz to 0.3 MHz	85	83	81	114	112
0.3 MHz to 2 MHz	102	100	98	126	124
2 MHz to 10 MHz	115	113	111	134	132
0.01 GHz to 2.5 GHz	122	119	114	140	135
2.5 GHz to 5 GHz	116	112	106	127	121
5 GHz to 20 GHz	115	111	105	126	120
20 GHz to 38 GHz	116	111	105	126	120
38 GHz to 50 GHz	115	109	104	124	119
50 GHz to 65 GHz	107	101	97	116	112
65 GHz to 67 GHz	103	97	91	112	106
67 GHz to 70 GHz	100	91	84	106	99

*: The Option 061 Dynamic Range reported in this column applies for S_{21} measurements. For S_{12} Dynamic Range, use the figures from the "Option 051" column.

Receiver Dynamic Range

Calculated as the difference between the maximum receiver input level for 0.1 dB compression and the specified noise floor at the specified location. Characteristic Performance.

• All Models, Receiver Dynamic Range (dB)

Frequency Range	at Ports 1 or 2			at b_1 or b_2	
	Standard	Option 051	Option 061*1 or 062	Option 051	Option 061*1 or 062
0.07 MHz to 0.3 MHz	80	79	78	90	89
0.3 MHz to 2 MHz	102	102	102	107	107
2 MHz to 10 MHz	115	115	115	115	115
0.01 GHz to 2.5 GHz	120	119	116	119	116
2.5 GHz to 5 GHz	120	118	115	117	114
5 GHz to 20 GHz	120	118	115	118	115
20 GHz to 40 GHz*2	120	118	115	118	116
38 GHz to 50 GHz	120	118	117	117	117
50 GHz to 65 GHz	117	115	115	113	114
65 GHz to 67 GHz	115	113	111	110	109
67 GHz to 70 GHz	113	110	109	107	108

*1: The Option 061 compression level reported in this column applies to Port 2 or b_2. For port 1 or b_1 compression level, use the figures from the appropriate Port × or bx "Option 051" column.
*2: 20 GHz to 38 GHz for MS4647A
0.17 dB for <0.3 MHz

Receiver Compression

Port power level beyond which the response may be compressed more than 0.1 dB relative to the normalization level. 10 Hz IF bandwidth used to remove any trace noise effects. Match not included. Performance is characteristic.

• All Models, 0.1 dB Compression Levels (dBm)

Frequency Range	at Ports 1 or 2			at a_x Loops	at b_x Loops	
	Standard	Option 051	Option 061*1 or 062	Option 051 or 06x	Option 051	Option 061*1 or 062
<0.3 MHz	+5	+5	+5	–15	–15	–15
0.3 MHz to 10 MHz	+10	+11	+12	–10	–10	–9
0.01 GHz to 2.5 GHz	+10	+11	+12	–10	–10	–9
2.5 GHz to 5 GHz	+10	+11	+12	–5	–5	–4
5 GHz to 20 GHz	+10	+11	+12	–4	–4	–3
20 GHz to 40 GHz*2	+10	+11	+12	–4	–4	–2
38 GHz to 50 GHz	+10	+12	+14	–4	–4	–1
50 GHz to 65 GHz	+10	+12	+14	–5	–5	–2
65 GHz to 67 GHz	+10	+13	+15	–5	–5	–2
67 GHz to 70 GHz	+10	+13	+15	–5	–5	–1

Noise Floor

Measured at 10 Hz IF Bandwidth with no averaging, and at –10 dBm port power. RMS, no leakage correction applied. Measurement made with a through line connection, with its effects compensated for. Performance at ax and bx loops is characteristic.

• All Models, Noise Floor (dBm)

Frequency Range	at Ports 1 or 2			at a_x Loops	at b_x Loops	
	Standard	Option 051	Option 061*1 or 062	Option 051 or 06x	Option 051	Option 061*1 or 062
0.07 MHz to 0.3 MHz	–75	–74	–73	–105	–105	–104
0.3 MHz to 2 MHz	–92	–91	–90	–117	–117	–116
2 MHz to 10 MHz	–105	–104	–103	–125	–125	–124
0.01 GHz to 2.5 GHz	–110	–108	–104	–129	–129	–125
2.5 GHz to 40 GHz*2	–110	–107	–103	–121	–122	–118
38 GHz to 50 GHz	–110	–106	–103	–121	–121	–118
50 GHz to 65 GHz	–107	–103	–101	–118	–118	–116
65 GHz to 67 GHz	–105	–100	–96	–115	–115	–111
67 GHz to 70 GHz	–103	–97	–94	–112	–112	–109

*1: The Option 061 noise floor reported in this column applies to Port 2 or b_2. For Port 1 or b_1 noise floor, use the figures from the appropriate Port × or b_x "Option 051" column.
*2: 2.5 to 38 GHz for MS4647A

Power Range

Maximum Rated Power to minimum level. The difference reflects the ALC range for standard models or with Option 051, and the ALC + Attenuator Range for models with Options 06x.

• MS4642A, 20 GHz Model, Power Range (dBm to dBm)

Frequency	Standard (No Options)	Option 051	Option 061* or 062
<0.01 GHz	+10 to –25	+9 to –25	+8 to –95
0.01 GHz to 2.5 GHz	+12 to –25	+11 to –25	+10 to –95
2.5 GHz* to 20 GHz	+13 to –20	+12 to –20	+11 to –90

• MS4644A, 40 GHz Model, Power Range (dBm to dBm)

Frequency	Standard (No Options)	Option 051	Option 061* or 062
<0.01 GHz	+10 to –25	+9 to –25	+8 to –95
0.01 GHz to 2.5 GHz	+12 to –25	+11 to –25	+10 to –95
2.5 GHz to 20 GHz	+9 to –20	+8 to –20	+7 to –90
20 GHz to 40 GHz	+9 to –25	+8 to –25	+7 to –95

• MS4645A & MS4647A, 50 & 70 GHz Models, Power Range (dBm to dBm).

Frequency	Standard (No Options)	Option 051	Option 061* or 062
<0.01 GHz	+10 to –25	+9 to –25	+8 to –85
0.01 GHz to 2.5 GHz	+12 to –25	+11 to –25	+10 to –85
2.5 GHz to 5 GHz	+6 to –20	+5 to –20	+3 to –80
5 GHz to 20 GHz	+5 to –20	+4 to –20	+2 to –80
20 GHz to 38 GHz	+6 to –25	+4 to –25	+2 to –85
38 GHz to 50 GHz	+5 to –25	+3 to –25	+1 to –85
50 GHz to 65 GHz	0 to –25	–2 to –25	–4 to –85
65 GHz to 67 GHz	–2 to –25	–3 to –25	–5 to –85
67 GHz to 70 GHz	–3 to –25	–6 to –25	–10 to –85

*: The Option 061 power range reported in this column applies to Port 1. For Port 2 Power Range, use the figures from the " Option 051" column.

Output "Default" Power

Instrument default power. For maximum rated power, go to Power Range.

Model	Standard (No Options)	Option 051, 061 or 062
MS4642A, 20 GHz	+5 dBm	+5 dBm
MS4644A, 40 GHz	+5 dBm	+5 dBm
MS4645A, 50 GHz	–3 dBm	–10 dBm
MS4647A, 70 GHz	–3 dBm	–10 dBm

Power Accuracy, Linearity, and Resolution

Frequency (GHz)	Accuracy (dB)*1	Linearity (dB)*2	Resolution (dB)
<0.01 GHz	±1.5	±1.5	0.01
0.01 GHz to 40 GHz	±1.5	±1.0	0.01
40 GHz to 67 GHz	±3.0	±1.0	0.01
67 GHz to 70 GHz	±4.0 (±3.0)	± 2.0 (± 1.0)	0.01

∗1: Measured at default power.
∗2: Measured between default and 5 dB below default port power.

Measurement Stability

Ratio measurement, with ports shorted. Characteristic

Frequency (GHz)	Magnitude (dB/°C)	Phase (degree/°C)
<0.01 GHz	<0.04	<0.4
0.01 GHz to 20 GHz	<0.02	<0.2
20 GHz to 40 GHz	<0.03	<0.5
40 GHz to 67 GHz	<0.03	<0.7
67 GHz to 70 GHz	<0.04	<0.8

Frequency Resolution, Accuracy, and Stability

Resolution	Accuracy	Stability
1 Hz	±5 × 10^{-7} Hz/Hz (at time of calibration)	<5 × 10^{-9} /°C over 0° to 50°C temperature <1 × 10^{-9}/day aging, instrument on

Phase Noise, Harmonics and Non-Harmonics (Spurious)

Measured at default power. Non-Harmonics are characteristic performance.

Frequency (GHz)	SSB Phase Noise (dBc/Hz) at 10 kHz offset	Harmonics (dBc) (second and third)	Non-Harmonic Spurious (dBc) at >1 kHz offsets
<0.01 GHz	–78	–20	–20
0.01 GHz to 2.5 GHz	–84	–20	–30
2.5 GHz to 5 GHz	–84	–20*	–30
5 GHz to 10 GHz	–78	–20	–30
10 GHz to 20 GHz	–72	–20	–30
20 GHz to 40 GHz	–66	–20	–30
40 GHz to 67 GHz	–61	–20	–30
67 GHz to 70 GHz	–61	–20	–30

Uncorrected (Raw) Port Characteristics

Characteristic performance with either Option -051, -061, or -062.

Frequency Range (GHz)	Directivity (dB)	Port Match (dB)*2
<0.01 GHz	>10*1	>8
0.01 GHz to 2.5 GHz	>9*1	>10
2.5 GHz to 5 GHz	>20	>10
5 GHz to 20 GHz	>17	>9
20 GHz to 40 GHz	>14	>7
40 GHz to 65 GHz	>11	>7
65 GHz to 67 GHz	>11	>7
67 GHz to 70 GHz	>5 (>10)	>7

∗1: Raw Directivity degraded to 4 dB (typical) below 300 kHz and in a 300 MHz window below 2.5 GHz.
∗2: Port Match is defined as the worst of source and load match.

Corrected System Performance and Uncertainties

Refer to the technical data sheet 11410-00513

Measurement Time*

Measurement times include sweep time, and band-switching time, in single channel mode. Typical.
20 µs/pt is achieved in true swept mode, with 25K points, with ALC turned on for level accuracy, with display turned-on for tuning purposes, with locking turned-on for frequency accuracy and repeatability, with correction turned on to meet published residual specifications, and over the full span of the product with all band-switch points to fully characterize a device.

• Measurement Time (ms), SYNTHESIZED sweep, Display ON and ALC ON

Calibration	Sweep Width	IF BW	401 points	1,601 points	25,001 points	100,000 points
Uncorrected or 1-port calibration	Narrow (≤1 GHz span without bandswitch points)	1 MHz	14	40	510	2,200
		30 kHz	22	90	1,230	4,900
		1 kHz	380	1600	25,000	100,000
	Wide (70 GHz span)	1 MHz	50	70	570	2,300
		30 kHz	67	120	1,300	5,000
		1 kHz	420	1,670	25,000	100,000
2-port calibration (per sweep)	Narrow (≤1 GHz span without bandswitch points)	1 MHz	14	40	510	2,200
		30 kHz	22	90	1,230	4,900
		1 kHz	400	1,610	25,000	100,000
	Wide (70 GHz span)	1 MHz	50	70	570	2,300
		30 kHz	67	120	1,300	5,000
		1 kHz	420	1,670	25,000	100,000

• Measurement Time (ms) vs. Noise Floor (dBm), SYNTHESIZED sweep, Display ON and ALC ON

Calibration	Full Band Sweep	1,601 points Measurement Time	Achieved Noise Floor (dBm) (at max. frequency)	IF BW (kHz)
2-port calibration (per sweep)	MS4642A	90	–85	100
		190	–95	10
	MS4644A	95	–80	100
		190	–90	10
	MS4647A	100	–75	100
		190	–85	10

Remote Operability

Via GPIB	Using IEEE 488.2	1 MB/s Data Transfer Speed	Use SCPI or previous generation Lightning VNA commands. Also compatible with a basic but fundamental set of HP/Agilent 8510x VNA commands.
Via LAN	Using VXI-11 Protocol	2.5 MB/s Data Transfer Speed	
Via USB	Using USBTMC Protocol	5.5 MB/s Data Transfer Speed	
Drivers (for GPIB, LAN, or USB)	National Instruments LabVIEW and LabWindows/CVI drivers. Available for downloads from both Anritsu's and NI's websites. .NET/COM driver for Windows Applications such as: Visual Studio 6 thru VS 2005, VB6, C#, C++, C, Visual C, HP Vee, and more. Available for download from the Anritsu Website. These drivers require VISA runtime, not provided by Anritsu. NI's VISA (≥ version 3.2) is recommended for .NET and USB support.		
Triggering	Internal, External, GPIB Single point, Single Sweep, Single Channel, All Channels Hand-shaking for optimum tandem sweeps (check rear panel connections)		

• Throughput Time (ms), SYNTHESIZED sweep, Display ON and ALC ON, single 20 GHz sweep, 30 kHz IFBW, including trigger and data transfer time

Communication Type	Data Format	401 points	1,601 points	100,000 points
GPIB (IEEE-488.2)	32- or 64-bit Floating	380	410	6,400
	ASCII	290	370	7,400
LAN (VXI-11)	32- or 64-bit Floating	280	320	6,300
	ASCII	290	350	7,400
USB (USBTMC class)	32- or 64-bit Floating	280	310	6,000
	ASCII	290	350	6,800

*: Subject to the conditions and including the events specified. Chosen conditions reflect true measurement conditions, based on customers' input on speed environment expectations. Full transparency and disclosure given for best comparisons and decisions.

Standard Capabilities

Operating Frequency*	MS4642A: 10 MHz to 20.2 GHz MS4644A: 10 MHz to 40.5 GHz MS4645A: 10 MHz to 50.5 GHz MS4647A: 10 MHz to 70 GHz MS4647A-070: Optional for all MS4640A Series VNAs. Provides 40 kHz to 10 MHz Coverage Extension. Provides a lower limit specified to 70 kHz but which is allowed to go to 40 kHz.
Measurement Parameters	S_{11}, S_{21}, S_{22}, S_{12}, and any user-defined combination of a_1, a_2, b_1, b_2, and 1 Refer to the separate VectorStar MN4690B Series Multiport VNA Measurement System Technical Data Sheet – 11410-00528 which is available at www.anritsu.com/vectorstar.
Domains	Frequency Domain, Power Domain, CW Draw, and Time (Distance) Domain
Frequency Sweep Types	Linear, CW, or Segmented
Power Sweep Types	Linear, log, or constant power sweeps, or constant power slope (dB/GHz) over frequency sweep
Graph Types	Single Rectilinear Graph Types: Log Magnitude, Phase, Group Delay, Linear Magnitude, Real, Imaginary, SWR, Power Out, Impedance, and Power In Dual Rectilinear Graph Types: Log Magnitude and Phase, Linear Magnitude and Phase, and Real and Imaginary Circular Graph Types: Smith Chart (Impedance), Smith Chart (Admittance), Linear Polar, and Log Polar
Data Points	25,000 Data Points: 2 to 25,000 points in up to 16 channels 100,000 Data Points: 2 to 100,000 points in single channel
Limit Lines	Single or segmented. 2 limit lines per trace. 50 segments per limit line.
Single Limit Readouts	Uses interpolation to determine the intersection frequency
Test Limits	Both single and segmented limits can be used for PASS/FAIL testing.
Data Averaging	Point-by-point (default), max Averaging = IF Bandwidth/1 Hz Sweep-by-sweep (no limit)
IF Bandwidth	1, 3, 10, 30, 100, 300 Hz; 1, 3, 10, 30, 100, and 300 kHz; 1 MHz
Reference Plane	Line Length or Time Delay: The reference planes of a calibration or other normalization can be changed by entering a line length or time delay. Dielectric Constants: Dielectric constants may be entered for different media so the length entry can be physically meaningful. Dispersion Modeling: Dispersion modeling is used in the cases of microstrip and waveguide to take into account frequency dependent phase velocities. Attenuations: Attenuations (with frequency slope) and constant phase offsets can also be entered to better describe any reference plane distortions. De-embedding: For more complete reference plane manipulation, the full de-embedding system can also be used.
Measurement Frequency Range	Frequency Range Change: Frequency range of the measurement can be narrowed within the calibration range without recalibration. CW Mode: CW mode permits single frequency measurements also without recalibration. Interpolation Not Activated: If interpolation is not activated, the subset frequency range is forced to use calibration frequency points. Interpolation Activated: If interpolation is activated, any frequency range that is a subset of the calibration frequency range can be used, but there may be some added interpolation error.
Group Delay Aperture	Group Delay Aperture: Defined as the frequency span over which the phase change is computed at a given frequency point. Aperture: The aperture can be changed without recalibration. Minimum Aperture: The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
Group Delay Range	<180° of phase change within the aperture
Channels and Traces	16 channels, each with up to 16 traces
Display	Color touch screen LCD, 10.4” diagonal
Display Colors	Unlimited colors for data traces, memory, text, markers, graticules and limit lines.
Trace Memory and Math	A separate memory for each trace can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data. The trace data can be saved and recalled.
Intra-trace Math	Any two traces within a channel can also be combined (via addition, subtraction, multiplication or division) and displayed on another trace.
Scale Resolution (minimum per division)	Log Magnitude: 0.001 dB Linear Magnitude: 1 pU Phase: 0.01° Group Delay: 0.001 ps Time: 0.001 ps Distance: 0.1 µm SWR: 1 pU Power: 0.01 dB
Markers	12 per trace (× 16 traces × 16 channels, for a total of 3,072) Coupled or decoupled within a channel Data displayed in graph area or in table form
Reference Marker	Additional marker per trace for reference
Marker Statistics	Mean, max, min, standard deviation , per trace or over a marker region
Marker Search and Tracking	Search and/or track for min, max, peak, or target value
Filter Parameters	Display × dB bandwidth and frequencies, center frequency, loss, Q and shape factors
Blank Frequency Information	Blanking function removes all references to frequencies on the display. Frequency references can only be restored through a system preset or GPIB command.

*: Extended frequency range over which these models and options will operate, but without any implied or warranted performance specifications.

Calibration and Correction Capabilities

Calibration Methods	Short-Open-Load-Through (SOLT) with Fixed or Sliding Load Offset-Short (SSLT) with Fixed or Sliding Load Triple-Offset-Short (SSST) with Fixed or Sliding Load Short-Open-Load-Reciprocal (SOLR) Reciprocal or Unknown Through Method (SSLR, SSSR) Line-Reflect-Line (LRL)/Line-Reflect-Match (LRM) Advanced-LRM (A-LRM™) for improved on-wafer calibrations AutoCal with Thru Update available
Correction Models	2-Port (Forward, Reverse, or both directions) 1-Port (s_{11}, s_{22}, or both) Transmission Frequency Response (Forward, Reverse, or both directions) Reflection Frequency Response (s_{11}, s_{22}, or both)
Merged Calibration	Merge multiple calibrations over bands of frequency points and with different algorithms
Calibration Standards' Coefficients	Use the Anritsu calibration kit USB Memory Device to load kit coefficients and characterization files. Enter manual coefficients into user-defined locations. Use NIST models for Loads.
Reference Impedance	Modify the reference impedance from 50Ω to any impedance but not 0Ω
Interpolation	Allows interpolation between calibration frequency points
Adapter Removal Calibration	Characterizes and "removes" an adapter that is used during calibration that will not be used for subsequent device measurements; for accurate measurement of non-insertable devices
Dispersion Compensation	Selectable as Coaxial, other non-dispersive (e.g., for coplanar waveguide), Waveguide, or Microstrip.
Power	Power Meter Correction: Different power meter calibrations are available to enhance power accuracy at the desired reference plane (to usually »0.1 dB for short periods of time). Flat Power Calibrations: A flat power calibration (when in frequency sweep mode) is available at a user-selectable power level, if it is within the power adjustment range of the internal source. Other power levels are then arrived at by offset transfers. Linear Power Calibrations: A linear power calibration is performed over a range of power levels for use in power sweep mode and is performed at a specified frequency or frequency range. External Power Meter: Both calibrations are performed using an external power meter (Anritsu MA2438A, MA2488A, MA249xA, Agilent 437 or equivalent) over the Dedicated GPIB port or other suitable control ports.
Embedding/De-embedding	De-embedding: De-embedding is generally used for removal of test fixture contributions, modeled networks and other networks described by S-parameters (s2p files) from measurements. Embedding: Similarly, the Embedding function can be used to simulate matching circuits for optimizing amplifier designs or simply adding effects of a known structure to a measurement. Multiple Networks: Multiple networks can be embedded/de-embedded and changing the port and network orientations is handled easily. Extraction Utility: An extraction utility is part of this package that allows the easier computation of de-embedding files based on some additional calibration steps and measurements.
Impedance Conversion	Allows entry of different reference impedances (complex values) for different ports

Optional Capabilities

Time Domain Measurements Option 002	Displays all S-parameters and overlays with Frequency Domain Low-pass Mode with added harmonics frequency list flexibility Band-pass Mode Phasor Impulse Mode Windowing Gating (pass-band or reject-band) Frequency with Time Gate
Receiver Offset Option 007	Allows for independent source and receive functions for Mixer, Harmonics, IMD and other measurements, where the source and receive frequencies are offset. Multiple Source Control Mode: To independently control the frequencies of up to four external sources, in addition to the internal source, and the receiver, in a synchronized manner. NxN Frequency-translated Devices' Calibration and Measurements Capability: For accurate and absolute magnitude and phase measurements of match, gain/loss, and group delay of devices such as mixers and converters
Noise Figure Option 041	Description: Adds VNA capability to measure degradation of the signal-to-noise ratio caused by components in a signal chain. The Noise Figure measurement is based on a cold source technique for improved accuracy. Various levels of match and fixture correction are available for additional enhancement. Required Options: Option 051 (above), Option 061, or Option 062 (below) is required. Compatible Options: Compatible with Option 002 Time Domain, Option 007 Receiver Offset, Option 070 70 kHz Low Frequency Extension, Option 081 Broadband/Millimeter-Wave, and Option 083 Millimeter-Wave Extension. Incompatible Options: Requires front/rear panel access loops so it cannot be used with Option 080 or 082. Multiport Systems: Compatible with the MN4690B Series Multiport System on any model VNA but Noise Figure is only when configured as a 2-Port VNA. Additional Information: For detailed Noise Figure mesurement, theory, description, and operation, see the VectorStar MS4640A Series VNA Calibration and Measurement Guide – 10410-00269.
Direct Access Loops Option 051	Adds three Access loops per port for Source, Test, and Receive Paths ≥2.5 GHz Frequency Coverage loops, located at front panel <2.5 GHz Frequency Coverage loops, located at rear panel (These loops are included when ordering option 06x shown below. Therefore, options 05x and 06x are mutually exclusive.)

Continued on next page

Active Measurements Suite Option 06x	Adds Step Attenuators, Bias Tees, and Direct Access Loops, and Gain Compression and Efficiency Measurement Capabilities. Attenuators: 70 dB, 10 dB/step, for MS4642A and MS4644A 60 dB, 10 dB/step, for MS4647A Option 061: 2 attenuators: One in Source 1 path, and one in Receive 2 path Option 062: 4 attenuators: One in each Source and in each Receive paths Bias Tees: 0.4 A max., 40 VDC max. 3 kHz BW (nominal), looking into a High Impedance 10 MΩ to Ground for DUT Static Discharge Protection Located at rear panel Access Loops: Includes option 05x loops, listed above (Therefore, options 05x and 06x are mutually exclusive.) Gain Compression: Swept Power Gain Compression at a cw frequency P_{xdB} over Swept Frequency, up to 401 points
70 kHz Frequency Extension Option 070	Extends the standard 10 MHz low-end start frequency to 70 kHz, for 70 kHz to 20, 40, 50, or 70 GHz coverage models.
MS4647A Broadband/Millimeter-Wave Connection Capability Option 080/081	For a standalone MS4647A VNA instrument. Provides connection capability to the ME7838A Broadband/Millimeter-Wave system. Option 080: Modular Broadband connection capability for MS4647A VNAs without Option 051, 061, or 062. Option 081: Modular Broadband connection capability for MS4647A VNAs with Option 051, 061, or 062. ME7838A Technical Data Sheet: For detailed ME7838A specifications, see the VectorStar ME7838A Modular Broadband/ Millimeter-Wave Technical Data Sheet – 11410-00593.
MS4640A Banded Millimeter-Wave Connection Capability Option 082/083	For standalone MS4642A, MS4644A, MS4645A, and MS4647A VNA instruments. Provides connection capability to the ME7838A Millimeter-Wave system. Option 082: Millimeter-Wave connection capability for MS4642A, 44A, 45A, or 47A VNAs without Option 051, 061, or 062. Option 083: Millimeter-Wave connection capability for MS4642A, 44A, 45A, or 47A VNAs with Option 051, 061, or 062. ME7838A Technical Data Sheet: For detailed ME7838A specifications, see the VectorStar ME7838A Modular Broadband/ Millimeter-Wave Technical Data Sheet – 11410-00593.

CPU and related

CPU	Intel I5
Display	26 cm Color XGA Touch-Screen Display
Storage Memory	Serial-ATA (SATA) Solid State Drive (SSD), for OS, Programs, and Data. (>30 GB)
Security	Internal Drive: Rear Panel accessible Solid State Drive (SSD). Removable: Undo two (2) screws and disconnect a single cable to remove SSD. Additional SSDs: Additional SSDs with installed operating system available (Option 004)
Operating System	Windows XP Professional Environment
Virus Protection	If the VNA is to be attached to a public-accessible network, best practices recommend a user-installed anti-virus software application. Trend Micro's Anti-Virus software products have been tested and are recommended by Anritsu for use with the MS4640A Series VNAs.

Front Panel Connections

Test Ports 1 and 2	Universal Test Port Connectors, easily exchangeable in case of damage K (male) for MS4642A and MS4644A V (male) for MS4645A and MS4647A Damage Input Levels: +27 dBm max., 40 VDC max.
Direct Access Loops (optional)	For Source, Test and Receive paths, 3 per port, for ≥ 2.5 GHz frequency coverage K (females) for MS4642A and MS4644A V (females) for MS4645A and MS4647A Damage Input Levels: +20 dBm max., 0 VDC max.
USB Ports	Two Type A USB 2.0 Ports for peripherals such as keyboard, mouse, memory stick, hardware key, etc. (two more USB ports located at the rear panel)
Chassis Grounding Port	Banana (female)

Ports to Millimeter-Wave Test Set – Optional

Type	For RF, LO1, and LO2.
MS4640A	K (females)

Rear Panel Connections

AC Power Input	AC Input connector, with On/Off switch, and fuses 350 VA max., 90 VAC to 264 VAC, 47 Hz to 63 Hz (power factor controlled)	
System HDD	System Hard Drive Interface	
USB Control Port	Type B USB 2.0 port for controlling the instrument externally, for remote operation	
USB Ports	Two type A USB 2.0 Ports for peripherals such as keyboard, mouse, memory stick, hardware key, etc. (more USB ports at the front panel)	
Keyboard and Mouse Ports	Dedicated PS/2 ports. Could be used with USB keyboard and mouse via adapters, sparing USB 2.0 ports.	
LAN Port	10/100BASE-T Ethernet	
GPIB Port (talker/listener)	Type D-24, female, IEEE 488.2 compatible, for controlling the instrument externally, for remote operation	
GPIB Port (dedicated controller)	Type D-24, female, for the control of external instruments such as power meters, external test sets, etc.	
External I/O Port	25-pin D-Sub, female, User-defined I/O for custom external test set interface, to synchronize with different sweep states, such as Start, Stop, Driven Port, etc. Pin 1: Limit Pass/Fail Pin 2, 3, 15, 16: TTL In Pin 4, 13 14, 21: GND Pin 5-12, 17-20, 22: TTL Out Pin 23-25: Reserved	
Serial Port	9-pin D-Sub, male, compatible with RS-232, provides control for AutoCal modules, etc.	
VGA Port	15-pin mini D-Sub, for simultaneously projecting the instrument's screen display onto an external VGA monitor, with 1024 × 768 min. resolution	
Bias Inputs (optional)	BNC (female), one per port	
Bias Fuses (optional)	One per port. (0.5 A, 250 V)	
Direct Access Loops (optional)	For Source, Test and Receive paths, 3 per port, for <2.5 GHz frequency coverage SMA (females) Damage Input Levels: +20 dBm max., 0 VDC max.	
IF Inputs/Outputs	a1, a2, b1, b2, IF Inputs/Outputs, SMA (females) Inputs used with external converters such as mmW modules, or for antenna testing. Outputs used with external IF digitizers and processors. Nominal Inputs: 5 MHz to 20 MHz (mode dependent), 0 dBm for full scale Nominal Outputs: 0.2 MHz to 100 MHz (mode dependent), +10 dBm max.	
10 MHz In	BNC (female), auto-sensing, better than 1000 ppm accuracy recommended. Signal: –10 to +3 dBm, 50Ω Nominal	
10 MHz Out	BNC (female), derived from the internal reference, unless an external 10 MHz reference input is applied. Signal: 0 ±5 dBm sinusoidal, 50Ω Nominal	
Analog In 1 & 2	BNC (females), two independent inputs for measurements simultaneous with the RF measurements, for current sensing, efficiency computation, power detection, etc. Range: –10 V to +10 V with automatic offset and gain calibrations Accuracy: 2 mV + 2% for |V| <5 V; 2% for |V| >5 V Nominal input impedance: 60 kΩ	
Ext Analog Out	BNC (female), for external attenuator control, external switch control, analog triggering assistance, measurement system integration and other purposes. Normal operating modes: Sawtooth sync sweep, TTL indication of driving port, open loop level controller. Range: –10 V to +10 V; low impedance drive Accuracy: 20 mV + 2% Load: >5 kΩ	
Ext Trigger	BNC (female) 0 to 3.3 V input (5 V tolerant) High impedance (>100 kΩ)	100 ns minimum input pulse width Programmable edge trigger
Lock Status	BNC (female) 0 to 3.3 V input (5 V tolerant) High impedance (>100 kΩ)	100 ns minimum input pulse width Positive-edge trigger
Ready for Trigger	BNC (female) 0 to 3.3 V latched output Low impedance (to 50Ω)	Voh = 2 V min @ –12 mA Vol = 0.8 V max @ +12 mA
Trigger Out	BNC (female) 0 to 3.3 V pulse output 1 usec positive pulse	Low impedance (to 50Ω) Voh = 2 V min @ –12 mA Vol = 0.8 V max @ +12 mA

MS4640A Rear Panel

Mechanical and Environmental

Dimensions (without rack mount option)	Height: 267 mm body (6u) 286 mm between feet outer edges Width: 426 mm body 457 mm between feet outer edges 487 mm between front panel handles outer edges Depth: 502 mm body 591 mm between handle and foot outer edges
Mass	<28 kg (Fully-loaded MS4647A weight shown)
Environmental (Operating)	Conforms to MIL-PRF-28800F (class 3) Temperature Range: 0° to +50°C without error codes* Relative Humidity: 5 to 95% at +40°C Altitude: 4,600 m
Environmental (Non-operating)	Temperature Range: –40° to +75°C Relative Humidity: 0 to 90% at +65°C (non-condensing) Altitude: 15,200 m
EMI	Meets the emissions and immunity requirements of: EN55011/1991 Class A/CISPR-11 Class A EN50082-1/1993 IEC 801-2/1984 (4 kV CD, 8 kV AD) IEC 1000-4-3/1995 (3 V/m, 80-1000 MHz) IEC 801-4/1988 (500 V SL, 1000 V PL) IEC 1000-4-5/1995 (2 kV L-E, 1 kV L-L)

*: Except for 'unleveled' error messages that may occur at temperature outside the specified performance temperature range of 25°C ±5°C.

Automatic Calibrators (AutoCal)

The 36585-Series Precision Automatic Calibrator (AutoCal) Module provides industry-leading performance in corrected characteristics using over-determined algorithms, and transferring characteristics from a highly accurate LRL type calibration. The resulting accuracies will even out perform a Sliding Load SOLT calibration. In order to remove the effects of matched adapters, the Precision 36585-Series AutoCal comes in a variety of connector gender types (m-m, f-f, and m-f). Adapter Removal Calibration routine is still available in the VectorStar software. With coverage from 70 kHz to 70 GHz, the 36585-series Precision AutoCal offers not only the fastest and most reliable calibration, but also the most accurate broadband coaxial VNA calibration method, with the longest re-characterization period of 12 months.

• 36585-series Precision AutoCal

The 36585-Series Precision Automatic Calibrator (AutoCal) Module provides industry-leading performance in corrected characteristics using over-determined algorithms, and transferring characteristics from a highly accurate LRL type calibration. The resulting accuracies will beat that of a Sliding Load SOLT calibration. In order to remove the effects of matched adapters, the Precision 36585-series AutoCal comes in a variety of connector gender types. Adapter Removal Calibration routine is still available in the VectorStar software. With coverage from 70 kHz to 70 GHz, the 36585-series Precision AutoCal offers not only the fastest and most reliable calibration, but also the most accurate broadband coaxial VNA calibration method, with the longest re-characterization period of 12 months.

36585V series Precision AutoCal

36585 series Precision AutoCal

Description	Additional Information	Part Number
Precision AutoCal, K 70 kHz to 40 GHz, 2-port	K (male) to K (male)	36585K-2M
	K (female) to K (female)	36585K-2F
	K (male) to K (female)	36585K-2MF
Precision AutoCal, V 70 kHz to 70 GHz, 2-port	V (male) to V (male)	36585V-2M
	V (female) to V (female)	36585V-2F
	V (male) to V (female)	36585V-2MF

• AutoCal General and Environmental

36581-series Dimensions	155 mm (W) × 65 mm (H) × 90 mm (D) body (excluding connectors)
36585-series Dimensions	64 mm (W) × 42 mm (H) × 140 mm (D) body (excluding connectors)
Control	Serial RS-232 control by the VNA via supplied 9-pin D-Sub cable (allowing forward-compatibility to legacy AutoCals)
Power	DC powered via supplied universal 110 V/220 V AC/DC adapter (with enough power to maintain optimum stability)
Operating Temperature	+18° to +28°C
Storage Temperature	–20° to +70°C
Relative Humidity	5% to 95% at 40°C
EMC	Conforms to the EMC Directive, 89/336/EEC per EN61326 EN55011:1991 EN61000-3-2:1995 EN61000-3-3:1995
Immunity	EN61000-4-2:1995 EN61000-4-3:1995 EN61000-4-4:1995 EN61000-4-5:1995 EN61000-4-6:1995 EN61000-4-11:1995

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MS4642A	Vector Network Analyzer 10 MHz to 20 GHz
MS4644A	Vector Network Analyzer 10 MHz to 40 GHz
MS4645A	Vector Network Analyzer 10 MHz to 50 GHz
MS4647A	Vector Network Analyzer 10 MHz to 70 GHz
	Included Accessories
	User Documentation CD:
	The user documentation CD includes PDF files for the VectorStar Operation Manual, User Interface Reference Manual, Programming Manual, Programming Manual Supplement, Calibration and Measurement Guide, Technical Data Sheet and Configuration Guide, and Maintenance Manual.
	Online Help:
	The instrument is equipped with context-sensitive help built from the first five documents above. A standalone copy of the help is included on the user documentation CD.
	Peripherals: Optical USB Mouse
	Power: Power Cord
	Options
MS4640A-001	Rack Mount; adds handles and removes feet for shelf-mounting, into a 19" universal rack.
MS4640A-002	Time Domain
MS4640A-004	Hard Drive, Serial-ATA, with OS; Additional HD, Pluggable at rear panel
MS4640A-007	Receiver Offset
MS4640A-041	Noise Figure (requires Option 051, 061, or 062)
MS4642A-051	Direct Access Loops for MS4642A, not available with options 061, 062
MS4644A-051	Direct Access Loops for MS4644A, not available with options 061, 062
MS4645A-051	Direct Access Loops for MS4645A, not available with options 061, 062
MS4647A-051	Direct Access Loops for MS4647A, not available with options 061, 062
MS4642A-061	Active Measurements Suite for MS4642A with 2 Step Attenuators
MS4642A-062	Active Measurements Suite for MS4642A with 4 Step Attenuators
MS4644A-061	Active Measurements Suite for MS4644A with 2 Step Attenuators
MS4644A-062	Active Measurements Suite for MS4644A with 4 Step Attenuators
MS4645A-061	Active Measurements Suite for MS4645A with 2 Step Attenuators
MS4645A-062	Active Measurements Suite for MS4645A with 4 Step Attenuators
MS4647A-061	Active Measurements Suite for MS4647A with 2 Step Attenuators
MS4647A-062	Active Measurements Suite for MS4647A with 4 Step Attenuators
MS4640A-070	70 kHz Low-End Frequency Extension
MS4640A-098	Z540/Guide 25 Calibration, No Data
MS4640A-099	Premium Calibration, With Data
	Automatic Calibrators, Precision AutoCal
36585K-2M	K Precision AutoCal, 70 kHz to 40 GHz; K (male) to K (male)
36585K-2F	K Precision AutoCal, 70 kHz to 40 GHz; K (female) to K (female)
36585K-2MF	K Precision AutoCal, 70 kHz to 40 GHz; K (male) to K (female)
36585V-2M	V Precision AutoCal, 70 kHz to 70 GHz V (male) to V (male)
36585V-2F	V Precision AutoCal, 70 kHz to 70 GHz V (female) to V (female)
36585V-2MF	V Precision AutoCal, 70 kHz to 70 GHz V (male) to V (female)
	Automatic Calibrators, Standard AutoCal
36581KKF	K Standard AutoCal, 40 MHz to 20 GHz K (male) to K (female)
36583S	Matched Adapters Set, SMA
36583L	Matched Adapters Set, 3.5 mm
36583K	Matched Adapters Set, K

Model/Order No.	Name
	Calibration Kits, Mechanical
3650A	SMA/3.5 mm Calibration Kit, without Sliding Loads
3650A-1	SMA/3.5 mm Calibration Kit, with Sliding Loads
3652A	K Calibration Kit, without Sliding Loads
3652A-1	K Calibration Kit, with Sliding Loads
3654D	V Calibration Kit, without Sliding Loads
3654D-1	V Calibration Kit, with Sliding Loads
3657	V Multi-Line Calibration Kit, without Shorts
3657-1	V Multi-Line Calibration Kit, with Shorts
	Verification Kits
3666-1	SMA/3.5 mm Verification Kit
3668-1	K Verification Kit
3669B-1	V Verification Kit
	Test Port Cables, Ruggedized Semi-rigid
3670K50-1	K (female) to K (male), 1 each, 30.5 cm (12")
3670K50-2	K (female) to K (male), 1 each, 61.0 cm (24")
3670V50A-1	V (female) to V (male), 1 each, 30.5 cm (12"), rated to 70 GHz
3670V50A-2	V (female) to V (male), 1 each, 61.0 cm (24"), rated to 70 GHz
	Test Port Cables, Flexible, Phase Stable
3671S50-1	K* (female) to 3.5 mm (male), 2 each, 63.5 cm (25")
3671K50-1	K* (female) to K (male), 2 each, 63.5 cm (25")
3671K50-2	K* (female) to K (male), 1 each, 96.5 cm (38")
3671K50-3	K* (female) to K (male), 1 each, 63.5 cm (25") and K* (female) to K (female), 1 each, 63.5 cm (25")
3671V50B-1	V* (female) to V (male), 2 each, 63.5 cm (25"), rated to 67 GHz
3671V50B-2	V* (female) to V (male), 1 each, 96.5 cm (38"), rated to 67 GHz
	Test Port Converters, to change or replace VNA test ports
34YK50C	Universal Test Port Connector to K (male), using 01-202 wrench (not included)
34YV50C	Universal Test Port Connector to V (male), using 01-202 wrench (not included)
	Universal Test Fixture
3680-20	UTF, DC to 20 GHz
3680K	UTF, DC to 40 GHz
3680V	UTF, DC to 60 GHz
36801K	Right Angle Launcher, DC to 30 GHz
36801V	Right Angle Launcher, DC to 50 GHz
36803	Bias Probe
36804B-10M	Microstrip Calibration/Verification Kit, 10 mil, DC to 50 GHz
36804B-15M	Microstrip Calibration/Verification Kit, 15 mil, DC to 30 GHz
36804B-25M	Microstrip Calibration/Verification Kit, 25 mil, DC to 15 GHz
	Precision Fixed Attenuators, Adapters (in and out of series, waveguide to coaxial), and more
11410-00235	Refer to our extensive Precision RF & Microwave Components Catalog
	Tools and Accessories
2100-5	GPIB Cable, 0.5 m
2100-1	GPIB Cable, 1 m
2100-2	GPIB Cable, 2 m
2100-4	GPIB Cable, 4 m
760-246-R	Transit Case, MS4640A; hard plastic with wheels, 85 cm × 70 cm × 45 cm
01-201	Torque Wrench (for tightening male devices) 8 mm (5/16"), 0.9 N-m (8 in-lb) for SMA, 3.5 mm, 2.4 mm, K and V
01-204	Wrench, Universal (circular, open-ended) for SMA, 3.5 mm, 2.4 mm, K and V
01-203	Torque Wrench (for tightening the VNA test ports to female devices) 20.6 mm (13/16"), 0.9 N-m (8 in-lb)
01-202	Wrench (for servicing the universal test port) for the removal or installation of a test port
01-504	Torque End Wrench, 6 mm, 0.45 N · m (4 lbf · in), for tightening W1 connectors.
01-505	6 mm × 7 mm Open End Wrench,Backing wrench for 6 mm torque wrench above for W1 connectors.
01-511	Torque End Wrench, 4 mm (5/32 in), 0.22 N · m (2 lbf · in), for tightening the SSMC TEST and REF connectors on 3743A Modules

*: Ruggedized style for VNA test ports. Does not fit standard male connectors.

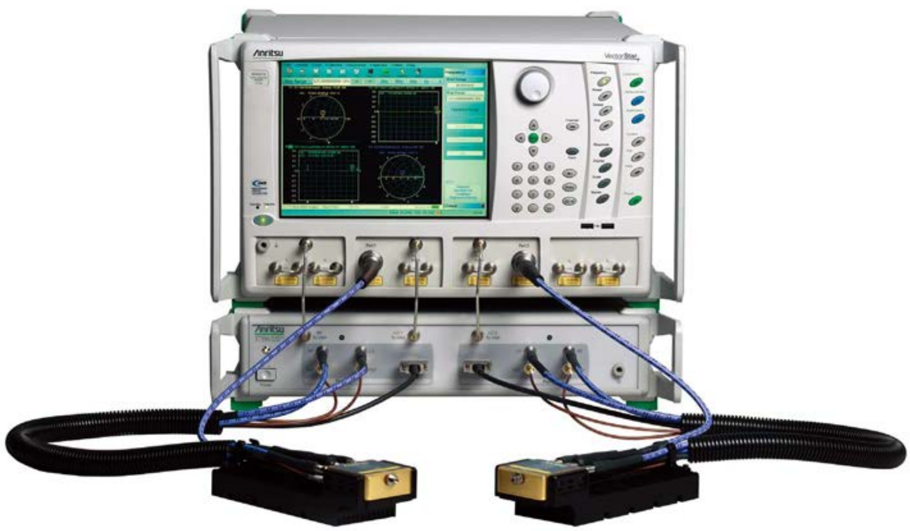
VECTORSTAR™ BROADBAND VECTOR NETWORK ANALYZERS

ME7838A Series

Millimeter Waveguide VNA System, 50 GHz to 750 GHz (1.1 THz)

Remote Control
GPIB | Ethernet

High Performance, Broadband Network Analysis Solutions



The ME7838A broadband VNA system provides single sweep coverage from 70 kHz to 110 GHz and is operational from 40 kHz to 125 GHz. It consists of the following items:

- MS4647A VectorStar VNA, 70 kHz to 70 GHz with Option 007, Option 070, and Option 080/081
- 3739B Broadband Millimeter-wave Test Set and Interface Cables
- 3743A Millimeter-wave Modules, 2 each

The ME7838A Millimeter-wave configuration provides waveguide output from 50 GHz to 750 GHz (1.1 THz) in waveguide bands. The system can extend the broadband system or be configured to operate only as a waveguide system. It consists of the following items:

- MS464xA VectorStar VNA, with Option 007 and Option 082/083
- 3739B Broadband/Millimeter-Wave Test Set and Interface Cables
- Millimeter-Wave modules, 2 each

Broadband/Millimeter-Wave System Options

- MS4640A-002, Time Domain
- MS4640A-041, Noise Figure
- MS4640A-051, External VNA Direct Access Loops
- MS4640A-061, Active Measurement Suite, with 2 Attenuators
- MS4640A-062, Active Measurement Suite, with 4 Attenuators
- SC8215 and SC7287 Kelvin Bias Tees

Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

Warm-Up Time	After 90 minutes of warm-up time, where the instrument is left in the ON state.
Temperature Range	Over the 25°C ±5°C temperature range.
Error-Corrected Specifications	For error-corrected specifications, over 23°C ±3°C, with <1°C variation from calibration temperature. For error-corrected specifications are warranted and include guard bands, unless otherwise stated.
Typical Performance	"Typical" specifications describe expected, but not warranted, performance based on sample testing. Typical performance indicates the measured performance of an average unit and do not guarantee the performance of any individual product. "Typical" specifications do not account for measurement uncertainty and are shown in parenthesis, such as (–102 dB), or noted as Typical.
User Cables	Specifications do not include effects of any user cables attached to the instrument.
Discrete Spurious Responses	Specifications may exclude discrete spurious responses.
Internal Reference Signal	All specifications apply with internal 10 MHz Crystal Oscillator Reference Signal.
Characteristic Performance	Characteristic performance indicates a performance designed-in and verified during the design phase. It does include guard-bands and is not covered by the product warranty.
Below 300 kHz	All uncertainties below 300 kHz are typical.
Recommended Calibration Cycle	12 months
Interpolation Mode	All specifications are with Interpolation Mode Off.
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site at www.anritsu.com.

Specifications for Broadband Configuration

ME7838A Broadband System 70 kHz to 110 GHz

Does not include source or receive attenuators for Port1 or Port2. Kelvin bias tees not included. Connection to Triax output Source Measure Units (SMUs) available.

• System and Receiver Dynamic Range, Noise Floor*1

System dynamic range is measured as the difference between maximum port power and the RMS noise floor in a 10 Hz bandwidth and no averaging (ports terminated).
Noise floor is calculated as the difference between maximum rated port power and system dynamic range.
Receiver Dynamic Range is calculated as the difference between the receiver compression level and the noise floor at ports 1 or 2.
Normalizing measurement made with a through line connection, with its effects compensated for. The 806-206 (1.85 mm, 24" long) cables are assumed between the VNA and the 3743A modules. Typical.

Frequency	System Dynamic Range (dB)		Receiver Dynamic Range (dB)		Noise Floor (dBm)	
	ME7838A	ME7838A Option 062	ME7838A	ME7838A Option 062	ME7838A	ME7838A Option 062
70 kHz to 300 kHz	93	90	89	86	–83	–80
0.3 MHz to 2 MHz	103	100	103	102	–93	–90
2 MHz to 10 MHz	115	112	115	114	–105	–102
0.01 GHz to 2.5 GHz	120	116	121	122	–110	–109
2.5 GHz to 24 GHz	110	105	121	121	–110	–108
24 GHz to 54 GHz	110	107	124	123	–114	–113
54 GHz to 60 GHz	108	108	122	122	–112	–112
60 GHz to 67 GHz	108	108	117	117	–107	–107
67 GHz to 80 GHz	108	108	120	120	–110	–110
80 GHz to 85 GHz	107	107	123	123	–113	–113
85 GHz to 90 GHz	107	107	121	121	–111	–111
90 GHz to 105 GHz	109	109	121	121	–111	–111
95 GHz to 105 GHz	107	107	117	117	–107	–107
105 GHz to 110 GHz	109	109	122	122	–112	–112
110 GHz to 120 GHz*2	107	107	115	115	–110	–110
120 GHz to 125 GHz*2	104	104	112	112	–107	–107

*1: Excludes localized spurious responses and crosstalk
*2: 110 GHz to 125 GHz frequency range is available as operational.

Test Port Power, Receiver Compression*3

Port power control is provided by the base VNA for frequencies below 54 GHz, and by the 3743A mmWave module for frequencies greater than 54 GHz.
Receiver compression point is defined as the port power level beyond which the response may be compressed more than 0.2 dB relative to normalization level. 10 Hz IF bandwidth used to remove trace noise effects. All typical.

Frequency	Port Power		Receiver Compression	
	Max. Power ME7838A	Max. Power ME7838A Option 62	Compression ME7838A	Compression ME7838A Option 62
70 kHz to 300 kHz	10	10	6	6
0.3 MHz to 2 MHz	10	10	10	12
2 MHz to 10 MHz	10	10	10	12
0.01 GHz to 2.5 GHz	10	7	11	13
2.5 GHz to 24 GHz	0	–3	11	13
24 GHz to 54 GHz	–4	–6	10	10
54 GHz to 60 GHz	–4	–4	10	10
60 GHz to 67 GHz	1	1	10	10
67 GHz to 80 GHz	–2	–2	10	10
80 GHz to 85 GHz	–6	–6	10	10
85 GHz to 90 GHz	–4	–4	10	10
90 GHz to 105 GHz	–2	–2	10	10
95 GHz to 105 GHz	0	0	10	10
105 GHz to 110 GHz	–3	–3	10	10
110 GHz to 120 GHz*4	–3	–3	5	5
120 GHz to 125 GHz*4	–3	–3	5	5

*3: Using the 806-206 1.85 mm 24" test port cables between the VNA and the 3743A mmWave modules.
*4: 110 GHz to 125 GHz frequency range is available as operational.

• Power Range, Accuracy, Linearity, and Resolution

Accuracy is defined at –10 dBm or max. rated power, whichever is lower. Linearity is defined as the incremental error between the accuracy test power level and 5 dB below. Typical.

Frequency	Range (dB)		Accuracy (dB)	Linearity (dB)	Resolution (dB)
	ME7838A	ME7838A Option 062			
70 kHz to 300 kHz	–25 to +10	–85 to +10	±1.5	±1.5	0.01
0.3 MHz to 2 MHz	–25 to +10	–85 to +10	±1.5	±1.5	0.01
2 MHz to 10 MHz	–25 to +10	–85 to +10	±1.5	±1.5	0.01
0.01 GHz to 2.5 GHz	–25 to +10	–85 to +8	±1.5	±1.0	0.01
2.5 GHz to 24 GHz	–25 to 0	–85 to –3	±1.5	±1.0	0.01
24 GHz to 54 GHz	–30 to –4	–90 to –6	±1.5	±1.0	0.01
54 GHz to 60 GHz	–55 to –4	–55 to –4	±2.0	±1.5	0.01
60 GHz to 67 GHz	–55 to 1	–55 to +1	±2.0	±1.5	0.01
67 GHz to 80 GHz	–55 to –2	–55 to –2	±2.0	±1.5	0.01
80 GHz to 85 GHz	–55 to –6	–55 to –6	±2.0	±1.5	0.01
85 GHz to 90 GHz	–55 to –4	–55 to –4	±2.0	±1.5	0.01
90 GHz to 105 GHz	–55 to –2	–55 to –2	±2.0	±1.5	0.01
95 GHz to 105 GHz	–55 to 0	–55 to 0	±3.0	±2.0	0.01
105 GHz to 110 GHz	–50 to –3	–50 to –3	±3.0	±2.0	0.01
110 GHz to 120 GHz*	–40 to –3	–40 to –3	±4.0	±3.0	0.01
120 GHz to 125 GHz*	–40 to –3	–40 to –3	±4.0	±3.0	0.01

*: 110 GHz to 125 GHz frequency range is available as operational.

High Level Noise

Noise measured at 1 kHz IF bandwidth, at maximum power or compression limit (whichever is less), with through transmission. RMS. Typical.

Frequency	Magnitude (dB)	Phase (degree/°C)
70 kHz to 500 kHz	< 0.04	< 0.4
0.5 MHz to 2 MHz	< 0.005	< 0.05
2 MHz to 10 MHz	< 0.005	< 0.05
0.01 GHz to 2.5 GHz	< 0.005	< 0.05
2.5 GHz to 24 GHz	< 0.006	< 0.06
24 GHz to 54 GHz	< 0.005	< 0.06
54 GHz to 80 GHz	< 0.005	< 0.06
80 GHz to 110 GHz	< 0.008	< 0.09
110 GHz to 120 GHz*	< 0.010	< 0.20
120 GHz to 125 GHz*	< 0.025	< 0.30

*: 110 GHz to 125 GHz frequency range is available as operational.

Stability

Ratioed measurement at max. leveled power and with nominally a full reflect or a stable thru over the normal specified temperature range. Typical.

Frequency	Magnitude (dB/°C)	Phase (degree/°C)
70 kHz to 300 kHz	< 0.04	< 0.4
0.3 MHz to 2 MHz	< 0.04	< 0.4
2 MHz to 10 MHz	< 0.04	< 0.4
0.01 GHz to 2.5 GHz	< 0.03	< 0.3
2.5 GHz to 24 GHz	< 0.03	< 0.3
24 GHz to 54 GHz	< 0.03	< 0.4
54 GHz to 80 GHz	< 0.03	< 0.4
80 GHz to 110 GHz	< 0.03	< 0.5
110 GHz to 120 GHz*	< 0.06	< 1.0
120 GHz to 125 GHz*	< 0.1	< 1.0

*: 110 GHz to 125 GHz frequency range is available as operational.

Frequency Resolution, Accuracy, and Stability

Resolution	Accuracy	Stability
1 Hz	±5 × 10^{-7} Hz/Hz (at time of calibration)	<5 × 10^{-9}/°C over 0° to 50°C temperature <1 × 10^{-9}/day aging, instrument on

Uncorrected (Raw) Port Characteristics

Typical performance with either ME7838A or ME7838A with Option 062.

Frequency	Directivity (dB)	Port Match (dB)
<10 MHz	10*1	8
0.01 GHz to 2.5 GHz	9*1	10
2.5 GHz to 30 GHz	5*1	12
30 GHz to 40 GHz	5*1	5
40 GHz to 54 GHz	10	5
54 GHz to 80 GHz	10	10
80 GHz to 110 GHz	5	7
110 GHz to 120 GHz*2	5	7
120 GHz to 125 GHz*2	5	7

*1: Raw directivity is degraded below 300 kHz, 2.2 GHz to 2.5 GHz and in narrow bands within 10 GHz to 34 GHz
*2: 110 GHz to 125 GHz frequency range is available as operational.

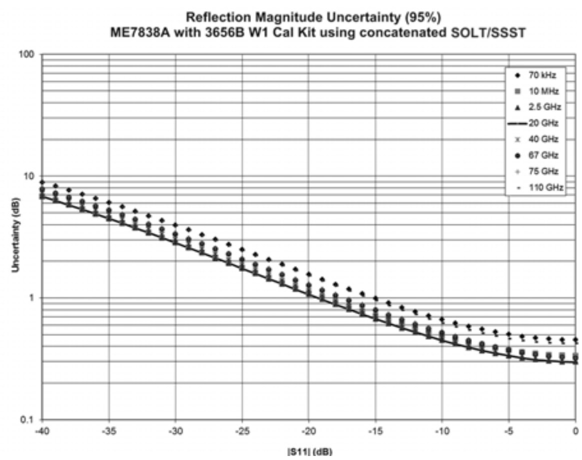
Corrected System Performance and Uncertainties

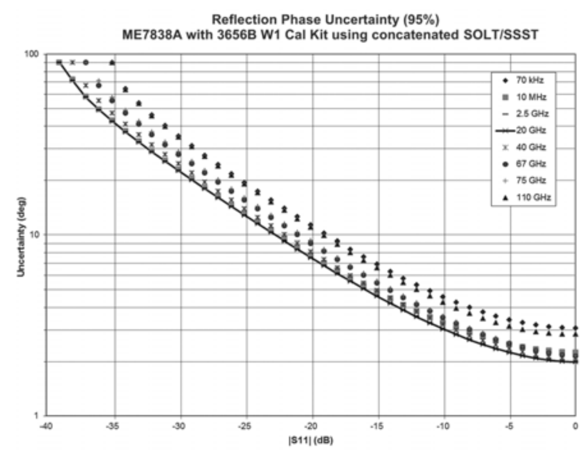
With 12-term concatenated SOLT and Triple Offset Short Calibration, using the 3656B W1 Cal Kit. Typical.

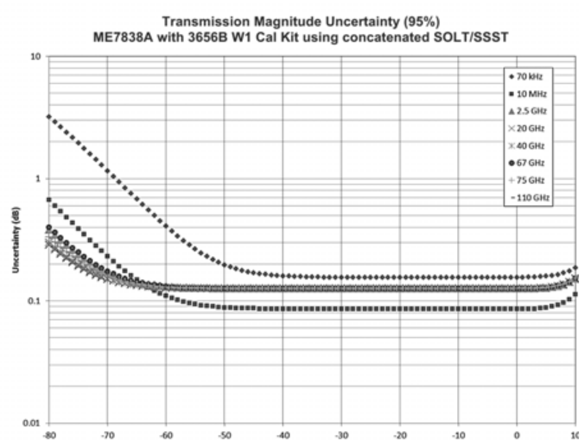
Frequency	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Tracking (dB)	Transmission Tracking (dB)
70 kHz to 10 MHz	36	36	36	±0.1	±0.1
0.01 GHz to 2.5 GHz	40	41	40	±0.05	±0.03
2.5 GHz to 20 GHz	40	41	40	±0.05	±0.05
20 GHz to 67 GHz	38	41	38	±0.05	±0.07
67 GHz to 95 GHz	37	42	37	±0.05	±0.07
95 GHz to 110 GHz	35	35	35	±0.05	±0.07

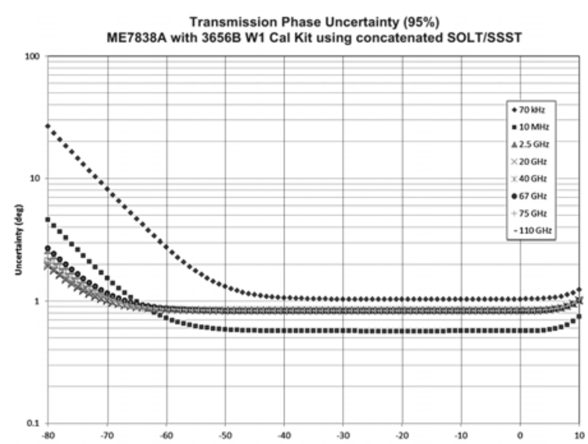
• Measurement Uncertainties

The graphs give measurement uncertainties after the above calibration. The errors are worst case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability while noise effects are added on an RSS basis. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that $S_{11} = S_{22} = 0$. For reflection uncertainties, it is assumed that $S_{21} = S_{12} = 0$. For other conditions, please use our free Exact Uncertainty calculator software, down-loadable from the Anritsu website at, *www.us.anritsu.com.*



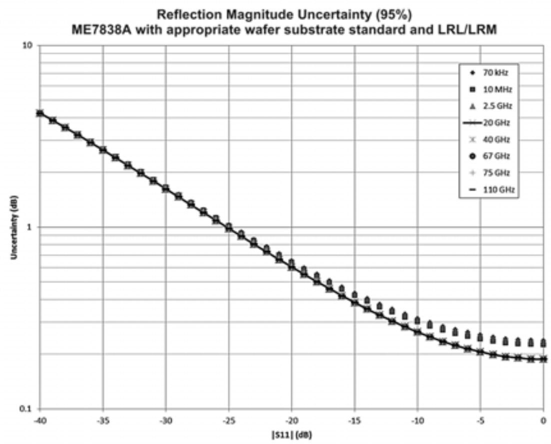


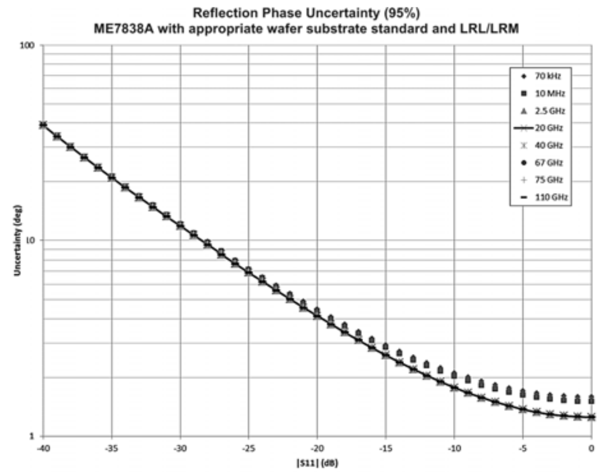


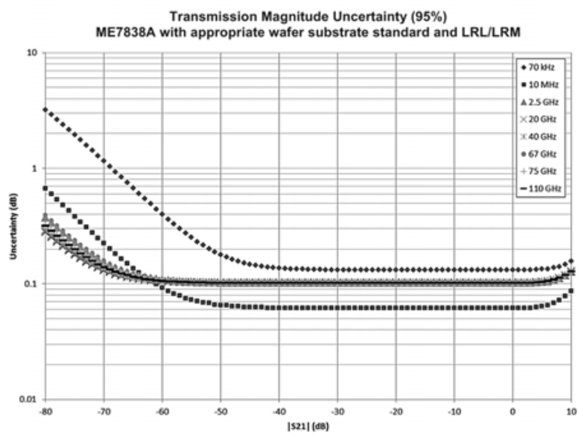


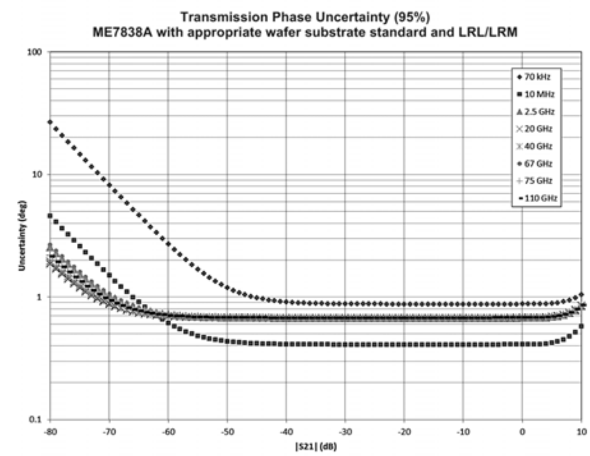
Corrected System Performance and Uncertainties

With 12 term LRL/LRM calibration using on-wafer substrate standards. Typical. Based on a typical vendor supplied impedance standard substrate.









Measurement Time

Measurement times include sweep time, retrace time, and band-switching time. Typical. Measurement Time (ms). Full Band, 70 kHz to 110 GHz, Display ON and ALC ON.

Calibration	IF BW	401 points	1,601 points	10,001 points	25,001 points
1-port calibration	1 MHz	80	100	350	700
	30 kHz	90	160	600	1,500
	10 kHz	110	240	1,100	2,600
	1 kHz	470	1,600	10,000	25,000
	10 Hz	47,000	160,000	1,000,000	2,500,000
2-port calibration	1 MHz	160	200	700	1,400
	30 kHz	180	320	1,200	3,000
	10 kHz	220	480	2,200	5,200
	1 kHz	940	3,200	20,000	50,000
	10 Hz	94,000	320,000	2,000,000	5,000,000

• Measurement Time (ms) vs. System dynamic range (dB)

Full Band, Display ON and ALC ON.

Calibration	401 points Measurement Time	Achieved System Dynamic Range (Opt. 062 at 54 GHz)	IF BW and Averaging Used
Uncorrected or 1-port calibration	110 470	77 87	10 kHz/no avg 1 kHz/no avg
2-port calibration	220 940	77 87	10 kHz/no avg 1 kHz/no avg

SC8038 and SC7287 Kelvin Bias Tees

Provides Sense and Force SMC connections per combiner, close to the mmWave module, to minimize the IR drops associated with the impedances between the bias tee and the DUT. The SC8038 is a bias tee providing DC bias from 70 kHz to 110 GHz with Max. Voltage: 16 VDC, Max Current: 100 mA. The SC7287 is a bias tee providing DC bias from 100 MHz to 110 GHz with Max Voltage: 50 VDC, Max. Current: 500 mA. For applications requiring Source Measure Units (SMUs) with tri-axial outputs, a tri-axial (male) to BNC (male) cable is available, with the inner-shield isolated from ground at the bias tee BNC end, to float at the SMU’s guard potential. (Check the accessories list for ordering information.)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
ME7838A	ME7838A Broadband System, 70 kHz to 110 GHz Order the base VectorStar model with the listed options: • MS4647A, 70 kHz to 70 GHz VNA MS4640A-007, receiver offset MS4640A-070, 70 kHz frequency coverage • 3739B, broadband test set with 36" interface cables • 3743A, Millimeter-wave, 2 ea. • ME7838A-SS020, On-site system assembly and verification Include one of the following: • MS4647A-080, MS4647A with ME7838A system option OR • MS4647A-081, MS4647A with ME7838A system option and option 051 or 061 or 062 Include one of the following: • 806-206, 1.85 mm phase stable VNA RF cables, 24", M-F, 2 ea. OR • 806-209, 1.85 mm phase stable VNA RF cables, 36", M-F, 2 ea.
Additional Options	• MS4640A-001, MS4640A rack mount • 3739B-001, 3739B rack mount • MS4640A-002, Time domain
	The following must be ordered with option MS4647A-081 • MS4647A-051, External VNA loops • MS4647A-061, Active measurement suite, 2 attenuators • MS4647A-062, Active measurement suite, 4 attenuators
	ME7838A Waveguide-Band System to 110 GHz – SM6499 or SM6527 mm-Wave Modules Choose and order one of the three base VectorStar models with options listed: • MS4644A VNA, 10 MHz to 40 GHz • MS4640A-007 • MS4644A-082 or MS4644A-083 • MS4645A VNA, 10 MHz to 50 GHz • MS4640A-007 • MS4645A-082 or MS4645A-083 • MS4647A VNA, 10 MHz to 70 GHz • MS4647A-007 • MS4647A-080 or MS4647A-081 Add options if desired: • Include Options 051, 061, or 062 • MS4640A-070 for 70 kHz operation in base VNA • MS4640A-002 for Time Domain • MS4640A-041 for Noise Figure Order: • 3739B mm-Wave Test Set Choose Extended-E or Extended-W Band Modules: • SM6499, 56 GHz to 94 GHz Extended E Band module, 2 each • SM6527, 65 GHz to 110 GHz Extended W Band module, 2 each

Model/Order No.	Name
	ME7838A Waveguide-Band System – Anritsu 3740/41A; OML; VDI mm-Wave Modules Choose and order one of the three base VectorStar models with options listed: • MS4642A VNA, 10 MHz to 20 GHz • MS4640A-007 Receiver Offset • MS4642A-082 or MS4642A-083 • MS4644A VNA, 10 MHz to 40 GHz • MS4640A-007 Receiver Offset • MS4644A-082 or MS4644A-083 • MS4645A VNA, 10 MHz to 50 GHz • MS4640A-007 Receiver Offset • MS4645A-082 or MS4645A-083 • MS4647A VNA, 10 MHz to 70 GHz • MS4647A-007 Receiver Offset • MS4647A-080 or MS4647A-081 Add options if desired: • Include Options 051, 061, or 062 • MS4640A-070 for 70 kHz operation in base VNA • MS4640A-002 for Time Domain Order: • 3739B mm-Wave test set • SM6600 Interface Cables forAnritsu 3740/41A mm-Wave Modules • SM6537 Interface Cables forOML/VDI mm-Wave Modules Choose one of the two appropriate millimeter-wave module combinations: • 2 each TxRx transmission and reflection millimeter-wave modules • 1 each TxRx transmission and reflection module, and • 1 each Tx transmission only module
	Accessories
SC8215	Kelvin Bias Tee 70 kHz to 110 GHz Max. Voltage: 16 VDC, max. Current: 100 mA
SC7287	Kelvin Bias Tee 100 MHz to 110 GHz Max. Voltage: 50 VDC, max. Current: 500 mA
SC8218	Triax (male) to SMC (male) Cable, (Inner-shield floating at SMC end), 1.5 m (60 in) longtwo (2) needed per Kelvin Bias Tee
ML2437A	Power Meter, Single Channel For flat test port power calibration
SC7770	Thermal Sensor, with special characterization. 70 kHz to 70 GHz, V (female)
SM6494	System floor console. Includes larger size writing table
2100-1	GPIB Cable, 1 m
2100-2	GPIB Cable, 2 m
2100-4	GPIB Cable, 4 m
01-201	Torque Wrench (for tightening male devices) 8 mm (5/16"), 0.9 N.m (8 in.lb) for SMA, 3.5 mm, 2.4 mm, K and V
01-202	Universal Test Port Connector Wrench
01-203	Torque Wrench (for tightening the VNA test ports to female devices) 20.6 mm (13/16"), 0.9 N.m (8 in.lb)
01-204	Anritsu Stainless Steel Connector Wrench, (circular, open-ended) for SMA, 3.5 mm, 2.4 mm, K and V
806-206	1.85 mm Cable, 61 cm (24 in) long, for connecting the VNA and the 3743A Modules
806-209	1.85 mm Cable, 91 cm (36 in) long, for connecting the VNA and the 3743A Modules

Continued on next page

Model/Order No.	Name
	Calibration/Verification Kits
3656B	W1 (1 mm) Calibration/Verification Kit
3655V	WR-15 Waveguide Calibration Kit, Without Sliding Loads
3655V-1	With Sliding Loads
3655E	WR-12 Waveguide Calibration Kit, Without Sliding Loads
3655E-1	With Sliding Loads
3655W	WR-10 Waveguide Calibration Kit, Without Sliding Loads
3655W-1	With Sliding Loads
3650A	SMA/3.5 mm Calibration Kit, Without Sliding Loads
3650A-1	With Sliding Loads
3652A	K Calibration Kit, Without Sliding Loads
3652A-1	With Sliding Loads
3654D	V Calibration Kit, Without Sliding Loads
3654D-1	With Sliding Loads
3657	V Multi-Line Calibration Kit, Without Shorts
3657-1	With Shorts
	Test Port Cables, Flexible, High Performance
3671W1-50-1	W1 (male) to W1 (female), 1 each, 10.0 cm
3671W1-50-2	W1 (male) to W1 (female), 1 each, 13.0 cm
3671W1-50-3	W1 (male) to W1 (female), 1 each, 16.0 cm
3671KFS50-60	K (female) to 3.5 mm (male) cable, 60 cm (one cable)
3671KFK50-60	K (female) to K (male) cable, 60 cm (one cable)
3671KFK50-100	K (female) to K (male) cable, 1 each, 100 cm (one cable)
3671KFKF50-60	K (female) to K (female) cable, 1 each, 60 cm (once cable)
3671VFV50-60	V (female) to V (male) cable, 1 each, 60 cm (one cable)
3671VFV50-100	V (female) to V (male) cable, 1 each, 100 cm (one cable)
3671KFSF50-60	K (female) to 3.5 mm (female) cable, 1 each, 60 cm (one cable)
3671VFVF50-60	V (female) to V (female) cable, 1 each, 60 cm (one cable)
	Adapters and more
34WV50	W1 (male) to V (male) Adapter, W1 (1 mm) to V, Coaxial
34WVF50	W1 (male) to V (female) Adapter
34WFV50	W1 (female) to V (male) Adapter
34WFVF50	W1 (female) to V (female) Adapter
33WW50	W1 (male) to W1 (male) Adapter, W1 (1 mm) in-series, Coaxial
33WWF50	W1 (male) to W1 (female) Adapter
33WFWF50	W1 (female) to W1 (female) Adapter
35WR10W	WR10 to W1 (male) Adapter, W1 (1 mm) to WR10 Waveguide
35WR10WF	WR10 to W1 (female) Adapter
SC7260	WR12 to W1 (male) Adapter, W1 (1 mm) to WR12 Waveguide
SC7442	WR12 to W1 (female) Adapter
35WR15V	WR15 to V (male) Adapter, V (1.85 mm) to WR15 Waveguide
35WR15VF	WR15 to V (female) Adapter
Refer to our extensive Precision RF & Microwave Components Catalog, 11410-00235, for more information.	

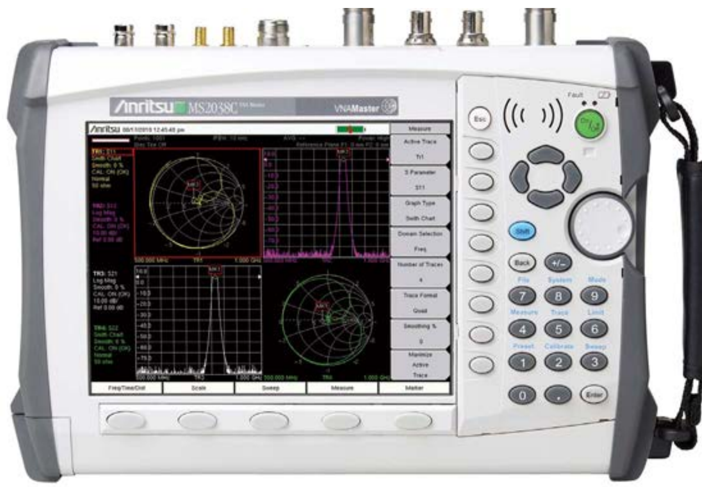
VNA MASTER

MS2026C MS2036C MS2028C MS2038C

MS2026C	MS2036C	MS2028C	MS2038C	
5 kHz to 6 GHz	5 kHz to 6 GHz 9 kHz to 9 GHz	5 kHz to 20 GHz	5 kHz to 20 GHz 9 kHz to 20 GHz	Vector Network Analyzer + Spectrum Analyzer

Remote Control
Ethernet | USB

The Ultimate Handheld Vector Network + Spectrum Analyzer for Cable, Antenna and Signal Analysis Anytime, Anywhere



High Performance Handheld S-Parameters

Anritsu introduces the MS202xC/3xC VNA Master + Spectrum Analyzer, the industry's broadest frequency handheld solution to address cable, antenna, component and signal analysis needs in the field: with frequency coverage from 5 kHz to 6/20 GHz. Equally impressive, this broadband measurement tool offers the industry's first 12-term error correction algorithm in a truly handheld, battery-operated, rugged multi-function instrument. And now the MS2036C/38C models include a powerful spectrum analyzer which multiplies user convenience by combining spectrum analysis with the VNA into a single measurement powerhouse for the harsh RF and physical environments of field test. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or 3G/4G and wireless data network measurements, this VNA/Spectrum Analyzer marriage is the ideal instrument to making fast and reliable measurements in the field.

Performance and Functional Highlights

VNA Master

- Broadband coverage of 5 kHz to 6/20 GHz
- True 2-port, 2-path Vector Network Analyzer
- Ultimate accuracy with 12-term error correction
- User-defined Quad Display for viewing all 4 S-Parameters
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- >85 dB Transmission Dynamic Range to 20 GHz
- Supports waveguide measurements
- 350 µs/data point sweep speed
- USB/Ethernet for PC data transfer and control
- Automate repetitive tasks via Ethernet & USB
- Field upgradable firmware
- Store more than 4000 traces and setups in memory
- Portable: 10.5 lbs (4.8 kg) Display
- Full Speed USB Memory support
- High resolution daylight viewable TFT color display
- Time Domain option for Distance-to-Fault diagnostics
- Internal Bias Tee option
- Vector Voltmeter option
- High Accuracy Power Meter option
- Differential option (S_{d1d1}, S_{c1c1}, S_{d1c1}, and S_{c1d1})
- Secure Data Operation option
- GPS Receiver option
- Power Monitor option
- Polar Format Impedance Display
- 4, 6, 8, 18, 26 GHz USB Power Sensors
- 8.4 in. Display
- Complies with MIL-PRF-28800F Class 2 specification

VNA Master + Spectrum Analyzer

All of the above VNA features, PLUS:

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Dynamic Range: >104 dB in 1 Hz RBW
- DANL: –160 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz @ 10 kHz offset at 1 GHz
- Frequency Accuracy: <±25 ppb with GPS On
- 1 Hz to 10 MHz Resolution Bandwidth (RBW)
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 40 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete
- Option to automatically optimize sweep-RBW-VBW tradeoff for best possible display
- Interference Analyzer Option: Spectrogram, Signal Strength, RSSI
- Channel Scanner Option
- Zero-span IF Output
- Gated Sweep
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter Option
- AM/FM/SSB Demodulation (audio only)

VNA Master Functional Specifications

Definitions

- All specifications and characteristics apply under the following conditions, unless otherwise stated:
- After 30 minutes of warm-up time, where the instrument is in VNA Mode and left in the ON state.
- Temperature range is 23°C ±5°C.
- All specifications apply when using internal reference.
- All specifications subject to change without notice. Please visit www.us.anritsu.com for most current data sheet.
- Typical performance is the measured performance of an average unit.
- Recommended calibration cycle is 12 months.

Frequency

VNA Master Frequency Range	MS2026C/36C	MS2028C/38C
	5 kHz to 6 GHz	5 kHz to 20 GHz
Frequency Accuracy	1.5 ppm	
Frequency Resolution	1 Hz to 375 MHz, 10 Hz to 6 GHz, and 100 Hz to 20 GHz	

Typical Test Port Power

VNA Master supports selection of either High (default) or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical power by bands is shown in the following table.

Frequency Range	High Port Power (dB)	Low Port Power (dBm)
5 kHz to ≤3 GHz	+3	–25
3 GHz to ≤6 GHz	–3	–25
6 GHz to ≤20 GHz	–3	–15

Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power is shown in the following table.

Frequency Range	Dynamic Range (dB)
5 kHz to ≤2 MHz	85
2 MHz to ≤3 GHz	100
3 GHz to ≤6 GHz	90
6 GHz to ≤20 GHz	85

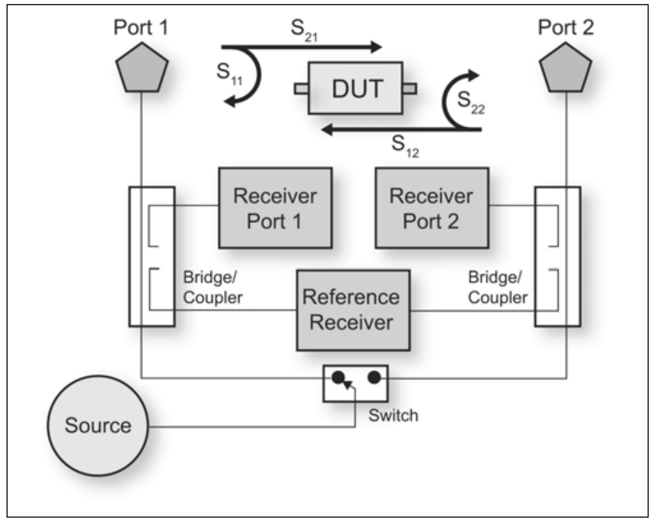
Typical Sweep Speed

The typical sweep speed for IF Bandwidth of 100 kHz, 1001 data points, and single display is shown in the following table. The three receiver architecture will simultaneously collect S_{21} and S_{11} (or S_{12} and S_{22}) in a single sweep.

Frequency Range	Typical Sweep Speed (µs/point)
5 kHz to 6 GHz	350
6 GHz to 20 GHz	650

Block Diagram

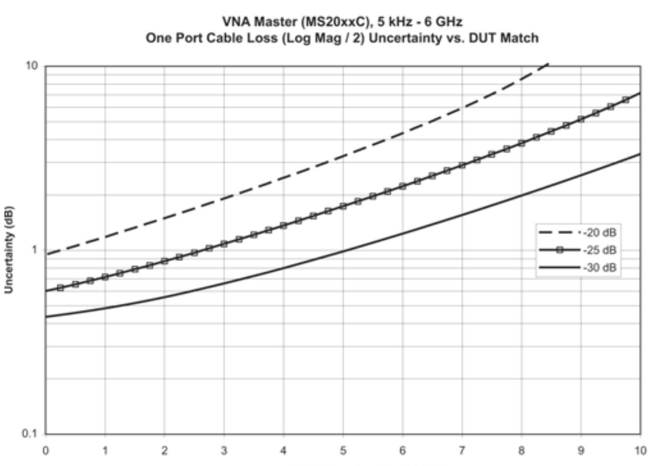
As shown in the following block diagram, the VNA Master has a 2-port, 2-path architecture that automatically measures four S-parameters with a single connection.

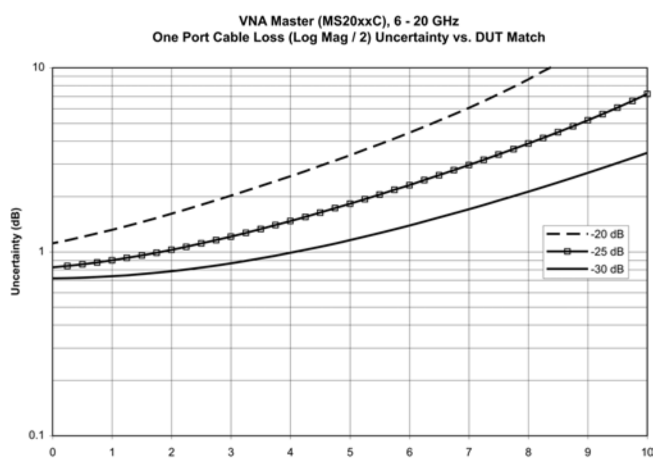


The above illustration is a simplified block diagram of VNA Master's 2-port, 2-path architecture.

Uncertainty Curves for Round-Trip Cable Loss Measurements (1-Port)

Round-trip cable loss measurements are convenient for field personnel testing installed cable or waveguide runs. This one-port technique provides one-way data after twice traversing the cable. The following two sets of uncertainty curves, less than 6 GHz on the left and greater than 6 GHz on the right, present worst-case uncertainty by DUT Match (i.e., Log Mag) when using VNA Master for one-port cable loss measurements. As a practical tip, consider using a two-port transmission measurement technique to improve upon these one-port cable loss uncertainties.





These uncertainty curves show how frequency range, DUT Match, and cable loss impact worst-case uncertainty of round-trip cable loss measurements. The uncertainty curves, separated by frequency range, are shown for DUT Match conditions of 20, 25, and 30 dB. For DUT Match of 30 dB and cable loss of 4-5 dB (reflection measurement of 8-10 dB) the worst-case uncertainties are approximately ±1 dB.

High Port Power

OSLxx50 Calibration Components (N-Connectors)
Corrected System Performance and Uncertainties:
MS202xC/3xC Model with 12-term SOLT calibration including isolation using either OSLN50 & OSLNF50 or OSLK50 & OSLKF50 Calibration Kits.

Precision calibration standards come in a convenient configuration for field work.

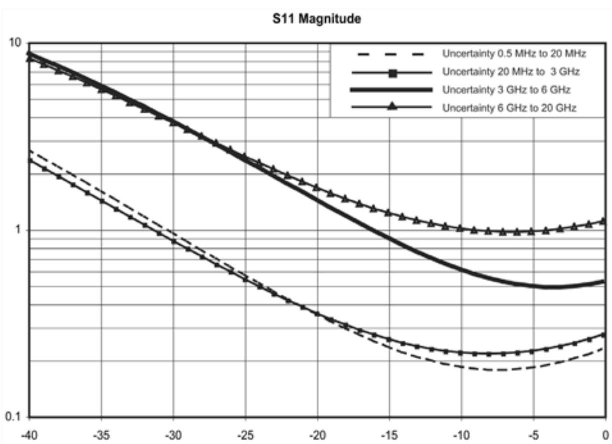
Measurement Uncertainties

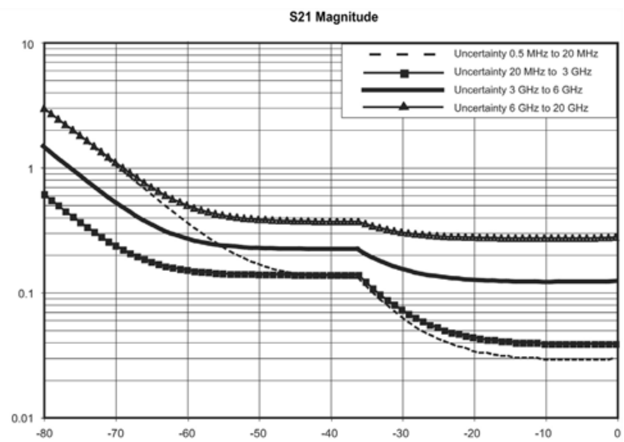
The following graphs provide measurement uncertainty at 23°C ± 5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

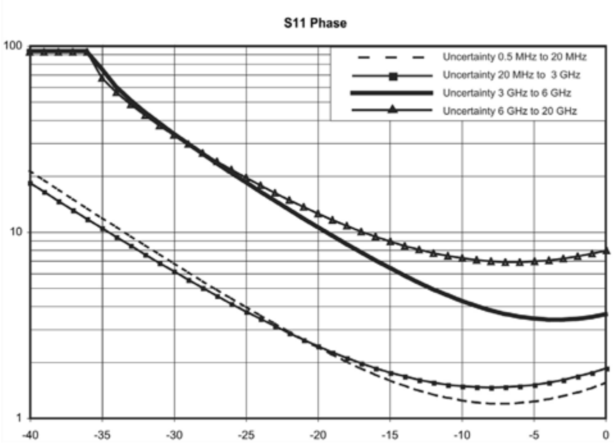
Frequency Range (GHz)	Directivity (dB)
≤5	>42
≤15	>36
≤20*	>32

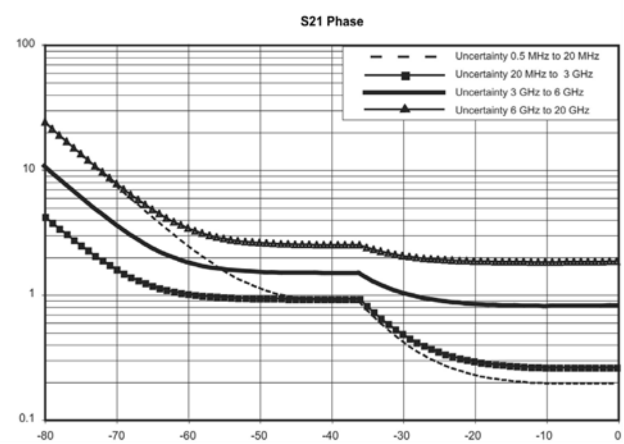
*: N Connector guaranteed to 18 GHz, typical >18 GHz

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	+3
≤6	–3
≤20	–3









Low Port Power

OSLxx50 Calibration Components
Corrected System Performance and Uncertainties:
MS202xC/3xC Model with 12-term SOLT calibration including isolation using either OSLN50 & OSLNF50 or OSLK50 & OSLKF50 Calibration Kits

Precision calibration standards come in a convenient configuration for field work.

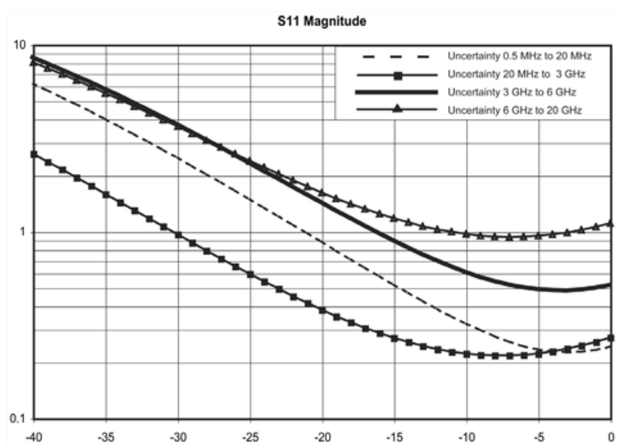
Measurement Uncertainties

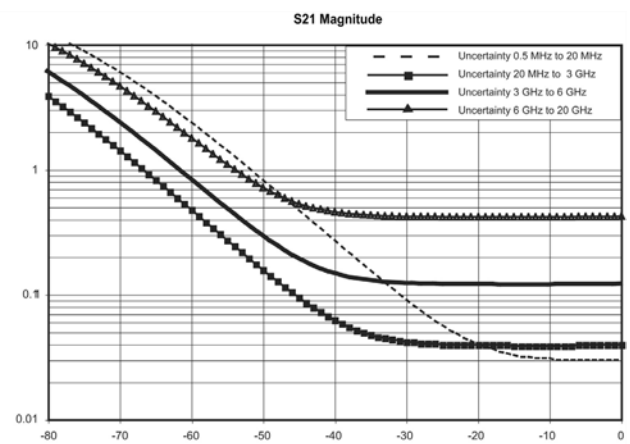
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

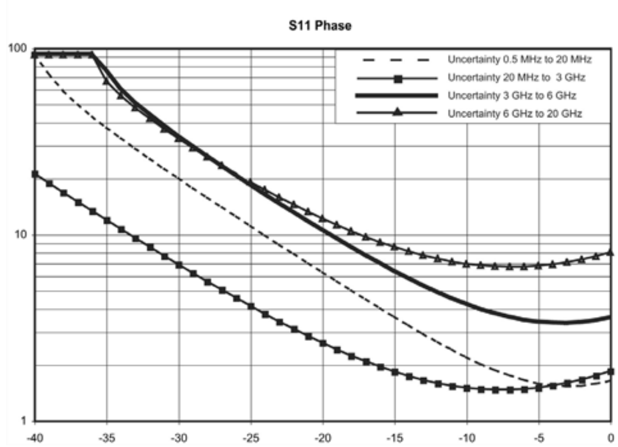
Frequency Range (GHz)	Directivity (dB)
≤5	>42
≤15	>36
≤20*	>32

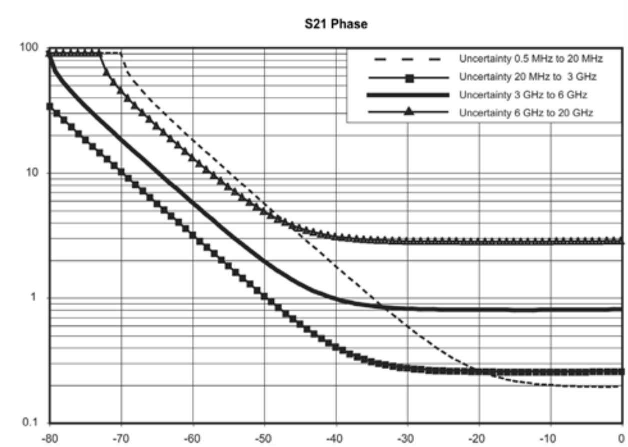
*: N Connector guaranteed to 18 GHz, typical >18 GHz

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	–25
≤6	–25
≤20	–15









High Port Power

3652A Calibration Kit (K-Connector)
Corrected System Performance and Uncertainties:
MS202xC/3xC Model with 12-term SOLT calibration including isolation using 3652A Calibration Kit

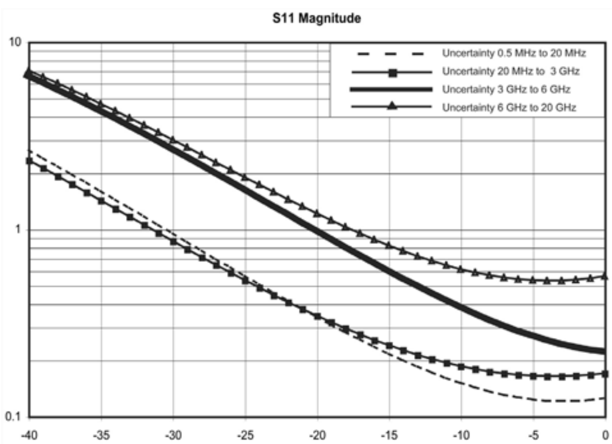
Measurement Uncertainties

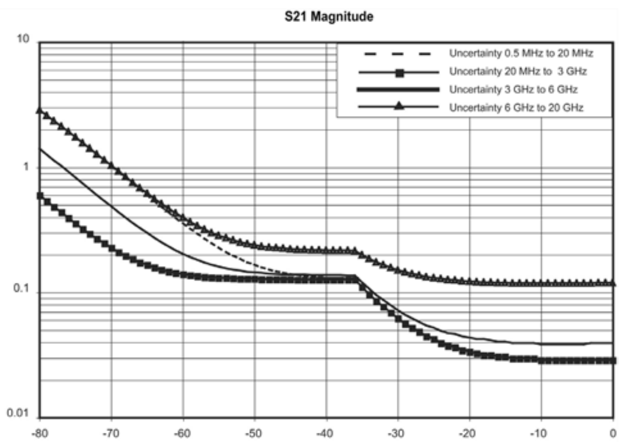
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

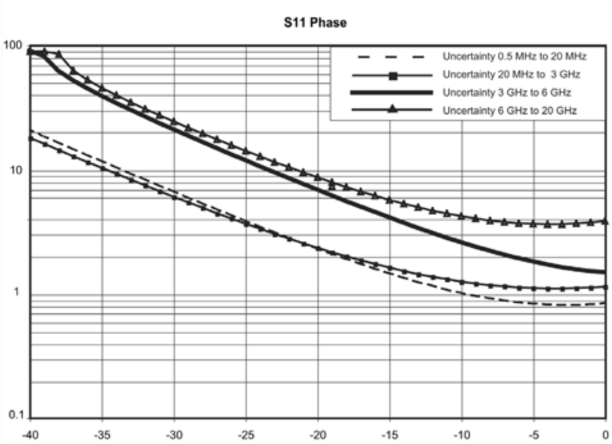
Frequency Range (GHz)	Directivity (dB)*
≤5	>34
≤15	>34
≤20*	>34

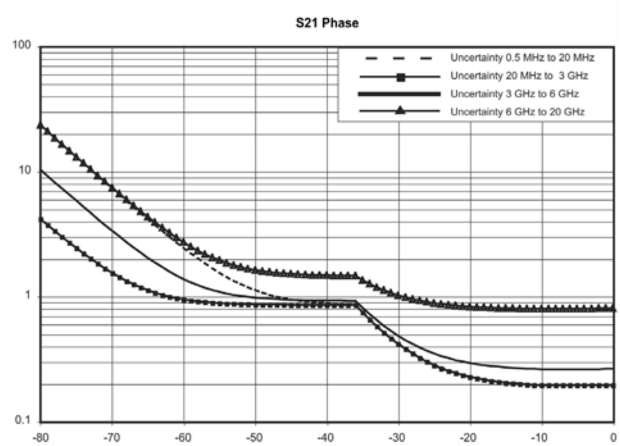
*: Directivity spec is limited to 34 dB by the 3652A Calibration Kit, not by the instrument performance.

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	+3
≤6	–3
≤20	–3









Low Port Power

3652A Calibration Kit (K-Connector)
Corrected System Performance and Uncertainties:
MS202xC/3xC Model with 12-term SOLT calibration including isolation using 3652A Calibration Kit

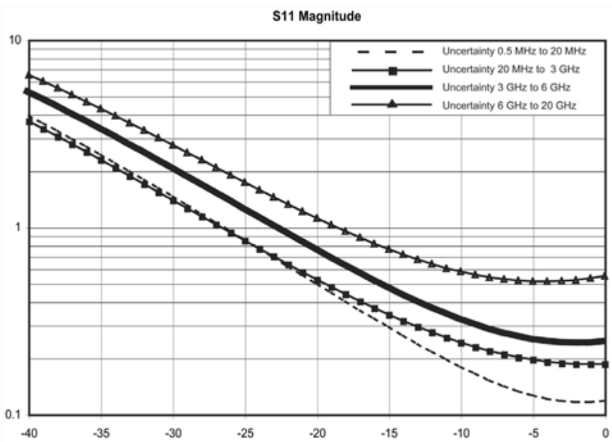
Measurement Uncertainties

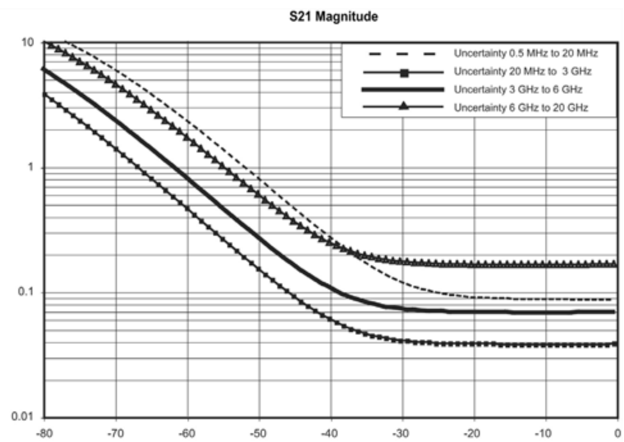
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

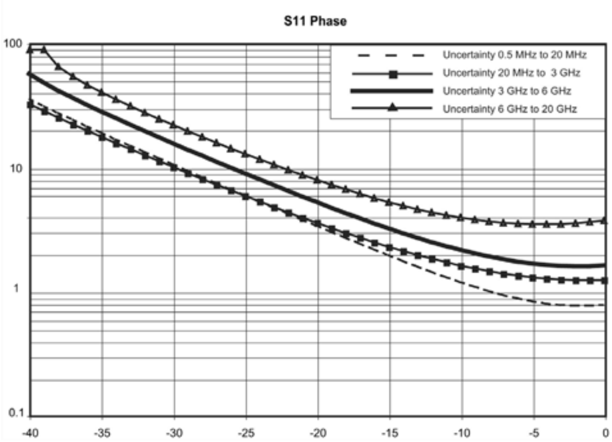
Frequency Range (GHz)	Directivity (dB)*
≤5	>34
≤15	>34
≤20*	>34

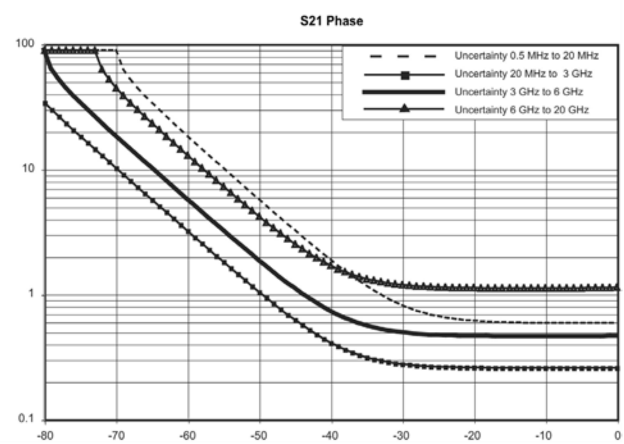
Frequency Range (GHz)	Typical Low Port Power (dBm)
≤3	–25
≤6	–25
≤20	–25

∗: Directivity spec is limited to 34 dB by the 3652A Calibration Kit, not by the instrument performance.









Spectrum Analyzer Functional Specifications (Models MS2036C/38C only)

Frequency	
Frequency Range	9 kHz to 20 GHz (usable to 0 Hz), Preamp 100 kHz to 20 GHz
Tuning Resolution	1 Hz
Frequency Reference	Aging: ±1.0 ppm/10 years Accuracy: ±0.3 ppm (25°C ±25°C) + aging
External Reference Frequencies	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608 MHz
Frequency Span	10 Hz to 20 GHz including zero span
Sweep Time	10 µs to 600 seconds in zero span
Sweep Time Accuracy	±2% in zero span
Bandwidth	
Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1–3 sequence ±10% (–3 dB bandwidth)
Video Bandwidth (VBW)	1 Hz to 10 MHz in 1–3 sequence (–3 dB bandwidth)
RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	
SSB Phase Noise at 1 GHz	–100 dBc/Hz @ 10 kHz offset from carrier (–104 dBc/Hz typical) –102 dBc/Hz @ 100 kHz offset from carrier (–107 dBc/Hz typical) –107 dBc/Hz @ 1 MHz offset from carrier (–114 dBc/Hz typical) –120 dBc/Hz @ 10 MHz offset from carrier (–129 dBc/Hz typical)
Amplitude Ranges	
Dynamic Range	>104 dB @ 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW
Measurement Range	DANL to +30 dBm
Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
Reference Level Range	–120 to +30 dBm
Attenuator Resolution	0 to 65 dB, 5 dB steps
Amplitude Units	Log Scale Modes: dBm, dBV, dBmv, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW
Maximum Continuous Input	+30 dBm Peak, ±50 VDC (≥10 dB Attn) +23 dBm Peak, ±50 VDC (<10 dB Attn) +13 dBm Peak, ±50 VDC (Preamp On)
Amplitude Accuracy (single sine wave input <Ref level, and >DANL, auto attenuation, Performance Sweep mode)	
+20° to +30°C after 30 minute warm-up	Typical: ±0.5 dB, 100 kHz to 20 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz Add ±1.0 dB, 13 GHz to 20 GHz
–10° to +50°C after 60 minute warm-up	Add ±1.0 dB, 100 kHz to 20 GHz
Displayed Average Noise Level (DANL) (RMS detection, VBW/Avg type = Log., Ref Level = –20 dBm for preamp Off and –50 dBm for preamp On)	
(DANL in 1 Hz RBW, 0 dB attenuation)	Preamp Off
10 MHz to 4 GHz	–141 dBm
>4 GHz to 9 GHz	–134 dBm
>9 GHz to 13 GHz	–129 dBm (MS2038C only)
>13 GHz to 20 GHz	–123 dBm (MS2038C only)
	Preamp On
10 MHz to 4 GHz	–160 dBm
>4 GHz to 9 GHz	–156 dBm
>9 GHz to 13 GHz	–152 dBm
>13 GHz to 20 GHz	–145 dBm
Spurs	
Residual Spurious	Preamp Off (RF input terminated, 0 dB input attenuation) –90 dBm 9 kHz to 13 GHz –85 dBm 13 GHz to 20 GHz
	Preamp On (RF input terminated, 0 dB input attenuation) –100 dBm 1 MHz to 20 GHz
Input-Related Spurious	(0 dB attenuation, –30 dBm input, span <1.7 GHz) –60 dBc, –70 dBc typical
Third-Order Intercept (TOI) (–20 dBm tones 100 kHz apart, –20 dBm Ref level, 0 dB input attenuation, preamp Off)	
2.4 GHz	+15 dBm
50 MHz to 20 GHz	+20 dBm typical
P1dB	
<4 GHz	+5 dBm typical
4 GHz to 20 GHz	+12 dBm typical
Second Harmonic Distortion	
50 MHz	–54 dBc
<4 GHz	–60 dBc typical
>4 GHz	–75 dBc typical
VSWR	
>10 dB input attenuation <20 GHz	1:5:1 typical

Spectrum Analyzer Performance Capabilities

Measurements	
Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m^2 or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask)
Setup Parameters	
Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy
Application Options	Impedance (50Ω, 75Ω, Other)
Sweep Functions	
Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
Sweep Mode	Fast, Performance, No FFT
Detection	Peak, RMS/Avg, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Delay, Level, Slope, Hysteresis, Holdoff, Force Trigger Once
Trace Functions	
Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
Trace B Operations	A→B, B↔C, Max Hold, Min Hold
Trace C Operations	A→C, B↔C, Max Hold, Min Hold, A – B→C, B – A→C, Relative Reference (dB), Scale
Marker Functions	
Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off
Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	
Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall

VNA Performance Capabilities

Measurement Parameters	S_{11}, S_{21}, S_{22}, S_{12}, S_{d1d1}, S_{c1c1}, S_{d1c1}, S_{c1d1}
Number of Traces	Four: TR1, TR2, TR3, TR4
Trace Format	Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays.
Graph Types	Log Magnitude SWR Phase Real Imaginary Group Delay Smith Chart Log Mag / 2 (1-Port Cable Loss) Linear Polar Log Polar Real Impedance Imaginary Impedance
Domains	Frequency Domain, Time Domain, Distance Domain
Frequency	Start Frequency, Stop Frequency, Center Frequency, Span
Distance	Start Distance, Stop Distance
Time	Start Time, Stop Time
Frequency Sweep Type: Linear	Single Sweep, Continuous
Data Points	2 to 4001 (arbitrary setting); data points can be reduced without recalibration.
Limit Lines	Upper, Lower, 10-segmented Upper, 10-segmented Lower
Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
Data Averaging	Sweep-by-sweep
Smoothing	0 to 20%

Continued on next page

IF Bandwidth	10, 20, 50, 100, 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Hz)
Reference Plane	The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase,and constant impedance.
Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance.
Frequency Range	Frequency range of the measurement can be narrowed within the calibration range without recalibration.
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
Group Delay Range	< 180º of phase change within the aperture
Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.
Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
Number of Markers	Eight, arbitrary assignments to any trace
Marker Types	Reference, Delta
Marker Readout Styles	Log Mag, Cable Loss (Log Mag / 2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, and Group Delay, Linear Mag, Linear Mag and Phase
Marker Search	Peak Search, Valley Search, Find Marker Value
Correction Models	Full 2-Port, Full S_{11}, Full S_{22}, Full S_{11} & S_{22}, Response S_{21}, Response S_{12}, Response S_{21} & S_{12}, Response S_{11}, Response S_{22}, Response S_{11} & S_{22}, 1-Path 2-Port (S_{11}, S_{21}), 1-Path 2-Port (S_{22}, S_{12})
Calibration Methods	Short-Open-Load-Through (SOLT), Offset-Short (SSLT), and Triple-Offset-Short (SSST)
Calibration Standards' Coefficients	Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined Waveguide: WG11A, WG12, WG13, WG14, WG15, WG16, WG17, WG18, WG20, and four User Defined
Cal Correction Toggle	On/Off
Dispersion Compensation	Waveguide correction that improves accuracy of distance-to-fault data by compensating for different lengths propagating at different speeds.
Impedance Conversion	Support for 50Ω and 75Ω are provided.
Units	Meters, Feet
Bias Tee Settings	Internal, External, Off
Timebase Reference	Internal, External (10 MHz)
File Storage Types	Measurement, Setup (with CAL), Setup (without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), JPEG
Ethernet Configuration	DHCP or Manual (Static); IP, Gateway, Subnet entries
Languages	English, French, German, Spanish, Chinese, Japanese, Korean, Italian, plus two User Defined

Measurement Options Specifications

- **Time Domain (Option 0002)**
  (includes Distance Domain Option 0501)

The VNA Master can also display the S-parameter measurements in the time or distance domain using lowpass or bandpass processing analysis modes. The broadband frequency coverage coupled with 4001 data points means you can measure discontinuities both near and far with unprecedented clarity for a handheld tool. With this option, you can simultaneously view S-parameters in frequency, time, and distance domain to quickly identify faults in the field. Advanced features available with this option include step response, phasor impulse, gating, and frequency gated in time. The option includes computational routines that further enhance the Distance Domain results by compensating for cable loss, relative velocity of propagation, and dispersion compensation in waveguide.

Distance Domain	Round-Trip (reflection) Fault Resolution (meters):	(0.5 × c × Vp) / ΔF; (c is speed of light = 3E8 m/s, ΔF is F2 – F1 in Hz)
	One-Way (transmission) Fault Resolution (meters):	(c × Vp) / ΔF; (c is speed of light = 3E8 m/s, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters):	0 to (data points – 1) × Fault Resolution to a maximum of 3000 m (9843 ft.)
	Windowing	Rectangular, Nominal Side Lobe (NSL), Low Side Lobe (LSL), and Minimum Side Lobe (MSL)

• Power Monitor (Option 0005) Requires external detector
Transmitter measurements in the field are possible when using this VNA Master software mode with a separately purchased Anritsu 560 series detector. A variety of detectors are available to 50 GHz, but the popular 560-7N50B covers 10 MHz to 20 GHz with a measurement range of –50 to +20 dBm with better than 0.5 dB flatness to 18 GHz. After zeroing the detector to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts.

Display Range	–80 to +80 dBm (10 pW to 100 kW)
Measurement Range	–50 to +20 dBm (10 nW to 40 mW)
Offset Range	0 to +60 dB
Resolution	0.1 dB, 0.1 xW (x = n, µ, m based on detector power)
Accuracy	±1 dB maximum for >–40 dBm using 560-7N50B detector

Power Monitor Detectors* (Ordered separately):

Part Numbers	560-7N50B	560-7S50B
Frequency Range	0.01 to 20 GHz	
Impedance	50Ω	
Power Range	–55 to +16 dBm	
Return Loss	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	
Input Connector	N(m)	WSMA(m)
Frequency Response	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz	

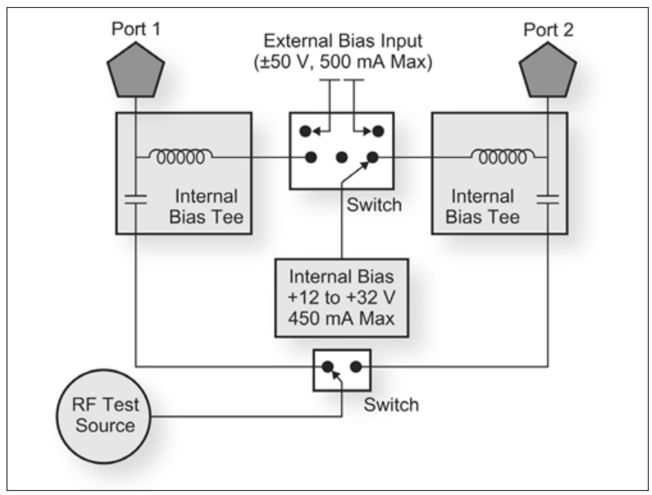
*: See www.us.anritsu.com for additional detectors

• Secure Data Operation (Option 0007)
For highly secure data handling requirements, this software option prevents the storing of measurement setup or data information onto any internal file storage location. Instead, setup and measurement information is stored ONLY to the external USB memory location. A simple factory preset prepares the VNA Master for transportation while the USB memory remains behind in the secure environment.

The VNA Master cannot be switched between secure and non-secure operation by the user once configured for secure data operation. As an additional security measure, with this option enabled the user can choose to blank the frequency values displayed on the screen.

• Bias Tee (Option 0010)
For tower mounted amplifier tests, the MS202xC/3xC series with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements. For frequency sweeps in excess of 2 MHz, the VNA Master can supply internal voltage control from +12 V to +32 V in 0.1 V steps up to 450 mA. To extend battery life, an external power supply can substitute for the internal supply by using the external bias inputs instead. Both test ports can be configured to supply voltage via this integrated bias tees option. Bias can be directed to VNA Port 1 or Port 2.

Frequency Range	2 MHz to 6 GHz (MS20x6C) 2 MHz to 20 GHz (MS20x8C)
Internal Voltage/Current	+12 V to +32 V at 450 ma. Steady rate
Internal Resolution	0.1 V
External Voltage/Current	±50 V at 500 mA steady rate
Bias Tee Selections	Internal, External, Off



The VNA Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram. Connectivity is also provided for external supply (instead of internal) to preserve battery consumption.

• Vector Voltmeter (Option 0015)
A phased array system relies on phase matched cables for nominal performance. For this class of application, the VNA Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements. The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts.

For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables. The MS202xC/3xC solution is superior because the signal source is included internally, precluding the need for an external signal generator.

CW Frequency Range	5 kHz to 20 GHz
Measurement Display	CW, Table (Twelve Entries, Plus Reference)
Measurement Types	Return Loss, Insertion
Measurement Format	dB/VSWR/Impedance

• High Accuracy Power Meter (Option 0019)
Requires external USB power sensor.

Conduct precise measurements of CW and digitally modulated transmitters in the field using this VNA Master software mode with a separately purchased Anritsu USB power sensor. After specifying the center frequency and zeroing the sensor to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts. Option 0019 supports the USB Power Sensors in the following table.

USB Power Sensors (Ordered separately):

	PSN50	MA24105A	MA24106A	MA24108A	MA24118A	MA24126A
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26.5 GHz
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor
Connector	Type N, male, 50Ω	Type N, female, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω
Dynamic Range	–30 to +20 dBm (0.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz	50 kHz	50 kHz
Measurement	True-RMS	True-RMS	True-RMS	True-RMS. Slot Power, Burst Average Power	True-RMS, Slot power, Burst Average power	True-RMS, Slot power, Burst Average power
Measurement Uncertainty	±0.16 dB*1	±0.17 dB*2	±0.16 dB*1	±0.18 dB*3	±0.18 dB*3	±0.18 dB*3
Datasheet for Additional Specifications	11410-00414	11410-00621	11410-00424	11410-00504	11410-00504	11410-00504

∗1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors
∗2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
∗3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors

• Interference Analyzer (Option 0025) (Models MS2036C/38C only) (Recommend GPS)

Measurements	Spectrum Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I) Spectrogram (Collect data up to one week) Signal Strength (Gives visual and aural indication of signal strength) Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength Signal ID (up to 12 signals) Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) >10 dB
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• Channel Scanner (Option 0027) (Models MS2036C/38C only)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	150 kHz to 13 GHz
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +30 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• GPS (Option 0031) Requires external GPS antenna
Built-in GPS provides location information (latitude, longitude, altitude) and Universal Time (UT) information for storage along with trace data so you can later verify that measurements were taken at the right location. The GPS option requires a separately ordered magnet mount GPS antenna (2000-1528-R or 2000-1652-R), which are configured to mount outside on a metallic surface. Frequency accuracy is enhanced for the Spectrum Analyzer (on MS203xC models) when Options 0025 Interference Analyzer and 0027 Channel Scanner are engaged.

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Generator when GPS Antenna is connected <±50 ppb with GPS On, 3 minutes after satellite lock in selected mode
GPS Lock – after antenna is disconnected	<±50 ppb for 3 days, 0° to 50°C ambient temperature
Connector	SMA, female

• Balanced/Differential S-Parameters, 1-port (Option 0077)

As an alternative to a sampling oscilloscope, verifying the performance and identifying discontinuities in high-data-rate differential cables is now possible with the VNA Master. After a full two-port calibration, connect your differential cable directly to the two test ports and reveal the S_{d1d1} performance, which is essentially differential return loss, or any of the other differential S-Parameters, S_{c1c1}, S_{d1c1}, or S_{c1d1}. With optional time domain, you can convert frequency sweeps to distance. This capability is especially valuable for applications in high data rate cables where balanced data formats are used to isolate noise and interference.

• AM/FM/PM Demodulation Analyzer (Option 0509) (Models MS2036C/38C only)

The VNA Master + Spectrum Analyzer models comes with AM/FM/SSB audio demodulation standard. By adding Option 0509, the instrument becomes capable of measuring, analyzing, and displaying key modulation parameters of RF Spectrum, Audio Spectrum, Audio Waveform and Demodulation Summary.
The RF Spectrum View displays the spectrum analyzer with carrier power, frequency, and occupied BW. Audio Spectrum shows the demodulated audio spectrum along with the Rate, RMS deviation, Pk-Pk/2 deviation, SINAD, Total Harmonic Distortion (THD), and Distortion/Total. Each demodulation also includes an Audio Waveform oscilloscope display that shows the time-domain demodulated waveform. There is a summary display that provides a display of all the RF and demodulation parameters.

• Distance Domain (Option 0501) (included in Time Domain Option 0002)

Distance Domain Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the VNA Master exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify cable discontinuities. The VNA Master converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements.
Option 0501 Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and so minimize or prevent downtime of the system.

VNA Master General Specifications (MS202xC/3xC)

• Setup Parameters

System	Status (Temperature, Battery Info, S/N, Firmware Ver, IP Address, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
System Options	Name, Date and Time, Ethernet Configuration, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy
Internal Trace/Setup Memory	>13,000 traces
External Trace/Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

• Connectors

Maximum Input (Damage Level) into Vector Network Analyzer	+23 dBm, ±50 VDC (MS202xC/3xC)
Maximum Input (Damage Level) into Spectrum Analyzer	+30 dBm, ±50 VDC (MS203xC)
VNA Connectors	Type N female (or K female with opt 0011, MS20x8C only) VNA port (× 2)
	Type BNC female Bias Tee port (enabled with opt 0010) (× 2)
	Type BNC female External Reference In port
Spectrum Analyzer Connectors	Type N, female (or K female with opt 0011) (MS203xC)
GPS	SMA female (Available with opt 0031 GPS)
External Power	5.5 mm barrel connector, 12 to 15 VDC, <5.0 Amps
LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset Jack	3.5 mm barrel connector
External Trigger	BNC, female, 50Ω, Maximum Input ±5 VDC
10 MHz Out	SMA, female, 50Ω

• Display

Size	8.4 in, daylight viewable color LCD
Resolution	800 × 600

• Power

Field replaceable Li-Ion Battery (633-44: 6600 mAh, 4.5 Amps)	40 Watts on battery power only
DC power from Universal 110 V/220 V AC/DC Adapter	55 Watts running off AC/DC adaptor while charging battery
Life time charging cycles (Li-Ion Battery, 633-44)	>300 (80% of initial capacity)
Battery Operation	3.0 hours, typical

• Size and Weight

Dimensions	Height: 211 mm (8.3 in)
	Width: 315 mm (12.4 in)
	Depth: 78 mm (3.1 in) (MS202xC) 97 mm (3.8 in) (MS203xC)
Weight, Including Battery	4.5 kg (9.9 lbs) (MS202xC) 4.8 kg (10.5 lbs) (MS203xC)

• Safety

Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Anritsu supplied Power Supply

• Environmental

MIL-PRF-28800F, Class 2 Environmental Conditions	MS202xC/3xC
Temperature, operating (°C) (3.8.2.1 & 4.5.5.14)	Passed, –10° to +55°C, Humidity 85%
Temperature, not operating (°C) (3.8.2.2 & 4.5.5.1)	Passed, –51° to +71°C
Relative humidity (3.8.2.3 & 4.5.5.1)	Passed
Altitude, not operating (3.8.3 & 4.5.5.2)	Passed*1, 4600 m
Altitude, operating (3.8.3 & 4.5.5.2)	Passed*1, 4600 m
Vibration limits (3.8.4.1 & 4.5.5.3.1)	Passed
Shock, functional (3.8.5.1 & 4.5.5.4.1)	Passed
Transit Drop (3.8.5.2 & 4.5.5.4.2)	Passed
Bench handling (3.8.5.3 & 4.5.5.4.3)	Passed
Shock, high impact (3.8.5.4 & 4.5.5.4.4)	Not Required*2
Salt exposure structural parts (3.8.8.2 & 4.5.6.2.2)	Not Required*3

*1: Qualified by similarity (tested on a similar product)
*2: Not defined in standard; must be invoked and defined by purchase description
*3: Not required for Class 2 equipment

• Electromagnetic Compatibility

European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	VNA Master™ 2-Port, 1-Path VNA
MS2026C	VNA: 5 kHz to 6 GHz
MS2028C	VNA: 5 kHz to 20 GHz
	VNA Master™ 2-Port, 1-Path VNA + Spectrum Analyzer
MS2036C	VNA: 5 kHz to 6 GHz, S/A: 9 kHz to 9 GHz
MS2038C	VNA: 5 kHz to 20 GHz, S/A: 9 kHz to 20 GHz
	The instrument includes standard one-year warranty and Certificate of Calibration and Conformance
	MS2026C VNA Master Options
MS2026C-0002	Time Domain (includes Option DTF capability)
MS2026C-0005	Power Monitor (requires external detector) (includes Option 0501 DTF capability)
MS2026C-0007	Secure Data Operation
MS2026C-0010	Built-in Bias-Tee
MS2026C-0015	Vector Voltmeter
MS2026C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2026C-0031	GPS Receiver (requires GPS antenna 2000-1528-R)
MS2026C-0077	Balanced/Differential S-Parameters, 1-port
MS2026C-0098	Z-540 Calibration
MS2026C-0099	Premium Calibration
MS2026C-0501	Distance Domain (included in Option 0002)
	MS2028C VNA Master Options
MS2028C-0002	Time Domain (includes Option DTF capability)
MS2028C-0005	Power Monitor (requires external detector)
MS2028C-0007	Secure Data Operation
MS2028C-0010	Built-in Bias-Tee
MS2028C-0011	K(f) Test Port Connectors
MS2028C-0015	Vector Voltmeter
MS2028C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2028C-0031	GPS Receiver (requires GPS antenna 2000-1528-R)
MS2028C-0077	Balanced/Differential S-Parameters, 1-port
MS2028C-0098	Z-540 Calibration
MS2028C-0099	Premium Calibration
MS2028C-0501	Distance Domain (included in Option 0002)
	MS2036C VNA Master, + Spectrum Analyzer Options
MS2036C-0002	Time Domain (includes Option 0501 DTF capability)
MS2036C-0007	Secure Data Operation
MS2036C-0010	Built-in Bias-Tee
MS2036C-0015	Vector Voltmeter
MS2036C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2036C-0025	Interference Analysis, 9 kHz to 9/20 GHz (requires external antenna)*
MS2036C-0027	Channel Scanner, 9 kHz to 9/20 GHz (requires external antenna)*
MS2036C-0031	GPS Receiver (requires GPS antenna 2000-1528-R)
MS2036C-0077	Balanced/Differential S-Parameters, 1-port
MS2036C-0098	Z-540 Calibration
MS2036C-0099	Premium Calibration
MS2036C-0501	Distance Domain (included in Option 0002)
MS2036C-0509	AM/FM/PM Analyzer
	MS2038C VNA Master, + Spectrum Analyzer Options
MS2038C-0002	Time Domain (includes Option 0501 DTF capability)
MS2038C-0007	Secure Data Operation
MS2038C-0010	Built-in Bias-Tee
MS2038C-0011	K(f) Test Port Connectors
MS2038C-0015	Vector Voltmeter
MS2038C-0019	High Accuracy Power Meter (requires external USB sensor)
MS2038C-0025	Interference Analysis, 9 kHz to 9/20 GHz (requires external antenna)*
MS2038C-0027	Channel Scanner, 9 kHz to 9/20 GHz (requires external antenna)*
MS2038C-0031	GPS Receiver (requires GPS antenna 2000-1528-R)
MS2038C-0077	Balanced/Differential S-Parameters, 1-port
MS2038C-0098	Z-540 Calibration
MS2038C-0099	Premium Calibration
MS2038C-0501	Distance Domain (included in Option 0002)
MS2038C-0509	AM/FM/PM Analyzer
	MS202xC/3xC Standard Accessories
10580-00305	VNA Master User's Guide
10920-00060	Handheld Instruments Documentation Disc
65729	Soft Carrying Case
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Battery, Li-Ion, 6.6 Ah
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 V DC adapter
3-2000-1498	USB A-type to Mini USB B-type Cable, 3.05 m (10 ft.)
2000-1371-R	Ethernet Cable, 2.13 m (7 ft.)
3-806-152	Ethernet Crossover Cable, 2.13 m (7 ft.)

*: Requires external antenna (2000-xxxx or 61532 Antenna Kit), Recommend Option 0031 GPS

Model/Order No.	Name
	Optional Accessories
	Ancillary Equipment
2000-1528-R	GPS Antenna – Magnet Mount (active 3 to 5 V) with SMA connector and 4.6 m (15 ft) extension cable
2000-1652-R	GPS Antenna – Magnet mount (active 3 to 5 V) with SMA connector and 1 foot cable
2000-1653	Protective Screen Cover (Package of 2)
2000-1689	EMI Near Field Probe Kit
66864	Rack Mount Kit, Master Platform
2300-517	Phase Noise Measurement Software
	High Accuracy Power Sensor
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, True RMS
MA24106A	High Accuracy Power Sensor, 50 MHz to 6 GHz, True RMS
MA24108A	High Accuracy Power Sensor, 10 MHz to 8 GHz, True RMS
MA24118A	High Accuracy Power Sensor, 10 MHz to 18 GHz, True RMS
MA24126A	High Accuracy Power Sensor, 10 MHz to 26 GHz, True RMS
	Power Monitor Detectors
560-7N50B	RF Detector, 0.01 GHz to 20 GHz, Type-N(m)
560-7S50B	RF Detector, 0.01 GHz to 20 GHz, W-SMA(m)
	Detector Extender Cables
800-109	Detector Extender Cable, 7.6 m (25 ft)
800-111	Detector Extender Cable, 30.5 m (100 ft.)
	K Connector Components
OSLK50	Precision integrated Open/Short/Load K(m), DC to 20 GHz, 50Ω
OSLKF50	Precision integrated Open/Short/Load K(f), DC to 20 GHz, 50Ω
22K50	Precision K(m) Short/Open, 40 GHz
22KF50	Precision K(f) Short/Open, 40 GHz
28K50	Precision Termination, DC to 40 GHz, 50Ω, K(m)
28KF50	Precision Termination, DC to 40 GHz, 50Ω, K(f)
3652A	K Calibration Kit, DC to 40 GHz
	N-Type Connectors
OSLN50	Precision Integrated Open/Short/Load N(m), DC to 18 GHz, 50Ω
OSLNF50	Precision Integrated Open/Short/Load N(f), DC to 18 GHz, 50Ω
22N50	Precision N(m) Short/Open, 18 GHz
22NF50	Precision N(f) Short/Open, 18 GHz
28N50-2	Precision Termination, DC to 18 GHz, 50Ω, N(m)
28NF50-2	Precision Termination, DC to 18 GHz, 50Ω, N(f)
OSLN50-1	Precision N(m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50-1	Precision N(f) Open/Short/Load, 42 dB, 6 GHz
SM/PL-1	Precision N(m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision N(f) Load, 42 dB, 6 GHz
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21000 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1487	Telescopic Whip Antenna

Continued on next page

Model/Order No.	Name
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Manuals
10580-00305	VNA Master User's Guide
10580-00306	VNA Master Programming Manual
10580-00307	VNA Master Maintenance Manual
10580-00289	VNA Measurement Guide
10580-00244	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide

Model/Order No.	Name
	Related Literature, Application Notes
11410-00206	Time Domain for Vector Network Analyzers
11410-00214	Reflectometer Measurements – Revisited
11410-00270	What is Your Measurement Accuracy?
11410-00373	Distance-to-Fault
11410-00387	Primer on Vector Network Analysis
11410-00414	High Accuracy Power Meter, PSN50
11410-00424	USB Power Sensor MA24106A
11410-00476	Essentials of Vector Network Analysis
11410-00504	Microwave USB Power Sensor MA241x8A
11410-00531	Practical Tips on Making "Vector Voltmeter (VVM)" Phase Measurements using VNA Master (Opt. 15)
11410-00544	VNA Master + Spectrum Analyzer Brochure
11410-00548	VNA Master + Spectrum Analyzer Technical Data Sheet
11410-00565	Troubleshoot Wire Cable Assemblies with Frequency-Domain Reflectometry
11410-00472	Measuring Interference
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-172	BNC(f) to N(m), DC to 1.3 GHz, 50Ω
510-90	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50Ω
510-91	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50Ω
510-92	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50Ω
510-93	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50Ω
510-96	7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50Ω
510-97	7/16 DIN(f) to 7/16 DIN(f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50Ω, with Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
34NK50	Precision Adapter, DC to 18 GHz, N(m) to K(m), 50Ω
34NKF50	Precision Adapter, DC to 18 GHz, N(m) to K(f), 50Ω

Waveguide Calibration Components and WG/Coaxial Adapters

Recommended waveguide calibration procedure requires two offset shorts and a precise load. The waveguide/coax adapter, shown attached to test port #2, adapts the VNA Master test ports to the waveguide under test.

Part Number				Frequency Range (GHz)	Waveguide Type	Compatible Flanges
1/8 Offset Short	3/8 Offset Short	Precision Load	Coaxial to Universal Waveguide Adapter*			
23UM70	24UM70	26UM70	35UM70N	5.85 to 8.20	WR137, WG14	CAR70, PAR70, UAR70, PDR70
23UM84	24UM84	26UM84	35UM84N	7.05 to 10.00	WR112, WG15	CBR84, UBR84, PBR84, PDR84
23UM100	24UM100	26UM100	35UM100N	8.20 to 12.40	WR90, WG16	CBR100, UBR100, PBR100, PDR100
23UM120	24UM120	26UM120	35UM120N	10.00 to 15.00	WR75, WG17	CBR120, UBR120, PBR120, PDR120
23UA187	24UA187	26UA187	35UA187N	3.95 to 5.85	WR187, WG12	CPR187F, CPR187G, UG-1352/U, UG-1353/U, UG-1728/U, UG-1729/U, UG-148/U, UG-149A/U
23UA137	24UA137	26UA137	35UA137N	5.85 to 8.20	WR137, WG14	CPR137F, CPR137G, UG-1356/U, UG-1357/U, UG-1732/U, UG-1733/U, UG-343B/U, UG-344/U, UG-440B/U, UG-441/U
23UA112	24UA112	26UA112	35UA112N	7.05 to 10.00	WR112, WG15	CPR112F, CPR112G, UG-1358/U, UG-1359/U, UG-1734/U, UG-1735/U, UG-52B/U, UG-51/U, UG-137B/U, UG-138/U
23UA90	24UA90	26UA90	35UA90N	8.20 to 12.40	WR90, WG16	CPR90F, CPR90G, UG-1360/U, UG-1361/U, UG-1736/U, UG-1737/U, UG-40B/U, UG-39/U, UG-135/U, UG-136B/U
23UA62	24UA62	26UA62	35UA62N	12.40 to 18.00	WR62, WG18	UG-541A/U, UG-419/U, UG-1665/U, UG1666/U
23UA42	24UA42	26UA42	35UA42K	17.00 to 26.50	WR42, WG20	UG-596A/U, UG-595/U, UG-597/U, UG-598A/U

*: For Coaxial/Waveguide Adapter part numbers, N designates Type N and K designates K-Connector

VNA MASTER

MS2024B MS2034B MS2025B MS2035B

MS2024B	MS2034B	MS2025B	MS2035B	
500 kHz to 4 GHz	500 kHz to 4 GHz 100 kHz to 4 GHz	500 kHz to 6 GHz	500 kHz to 6 GHz 100 kHz to 6 GHz	Vector Network Analyzer + Spectrum Analyzer

Remote Control
Ethernet OPTION | USB

The Affordable, Handheld Vector Network + Spectrum Analyzer for Cable, Antenna and Signal Analysis Anytime, Anywhere

Anritsu introduces the MS202xB/3xB VNA Master + Spectrum Analyzer, the industry's most affordable and compact handheld solution to address cable, antenna, component and signal analysis needs in the field. Models MS2024/25B VNA Masters bring the error-correction power of S-parameter measurements to make more precise field diagnostics. With frequency coverage from 500 kHz to 4/6 GHz. In a truly handheld, battery-operated, rugged multi-function instrument, it also provides a field-friendly touch screen user interface. MS2034B/35B models include a powerful spectrum analyzer which multiplies user convenience by combining both a VNA and a separate spectrum analyzer into a single measurement powerhouse for the harsh RF and physical environments of field test. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or 3G/4G, Land Mobile Radio, and wireless data network measurements, this VNA/Spectrum Analyzer combination is the ideal instrument to making fast and reliable measurements in the field.

Performance and Functional Highlights

VNA Master

- Broadband coverage of 500 kHz to 4/6 GHz
- 1-path, 2-port Vector Network Analyzer
- Intuitive Graphical User Interface (GUI) with convenient Touch Screen
- VNA-quality error correction for directivity and source match
- 2-port Transmission Measurements: High/Low Power
- Outstanding calibration stability, up to 16 hours
- User-defined overlays for viewing multiple S-Parameters
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- 100 dB Transmission Dynamic Range
- 850 µs/data point sweep speed
- Greater than 3 hour battery life
- USB & (optional) Ethernet for data transfer and instrument control
- Automate repetitive tasks via (optional) Ethernet & USB
- Field Upgradable Firmware
- Store more than 4000 traces and setups in memory
- Portable: 7.6 lbs (3.5 kg)
- Full Speed USB Memory support
- High resolution daylight viewable TFT color display
- "Glove Friendly" Resistive Touch Screen Display
- User-selectable menu options: Chose either VNA or simplified Cable & Antenna
- Complies with MIL-PRF-28800F Class 2 specification
- Distance Domain Option, supports optical DTF module
- Internal Bias Tee Option
- Vector Voltmeter Option, ideal for cable phase matching
- High Accuracy Power Meter Option
- GPS Receiver Option
- Polar Format Impedance Display

VNA Master + Spectrum Analyzer

All of the above VNA features, PLUS:

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID
- Dynamic Range: >95 dB in 10 Hz RBW
- DANL: –162 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: <±50 ppb with GPS On
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 41 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete
- Option to automatically optimize sweep-RBW-VBW tradeoff for best possible display
- AM/FM/SSB Audio-only Demodulation
- Store 2000 traces internally
- Channel Scanner Option
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter Option
- Coverage Mapping Option
- Optional AM/FM/PM Demodulation Analyzer

VNA Master Functional Specifications

Definitions

- All specifications and characteristics apply under the following conditions, unless otherwise stated:
- After 15 minutes of warm-up time in VNA mode, where the instrument is left in the ON state.
- Temperature range is 23°C ±5°C.
- All specifications apply when using internal reference.
- All specifications subject to change without notice. Please visit www.us.anritsu.com for most current data sheet.
- Typical performance is the measured performance of an average unit.
- Recommended calibration cycle is 12 months.

Frequency

VNA Master Frequency Range	MS2024B/34B	MS2025B/35B
	500 kHz to 4 GHz	500 kHz to 6 GHz
Frequency Accuracy	2.5 ppm	
Frequency Resolution	1 Hz	

Typical Test Port Power

VNA Master supports selection of either High (default) or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical power by bands is shown in the following table.

Frequency Range	High Port Power (dB)	Low Port Power (dBm)
500 kHz to ≤3 GHz	+3	–25
3 GHz to ≤6 GHz	0	–25

Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power is shown in the following table.

Frequency Range	Dynamic Range (dB)
2 MHz to ≤4 GHz	100
4 GHz to ≤6 GHz	90

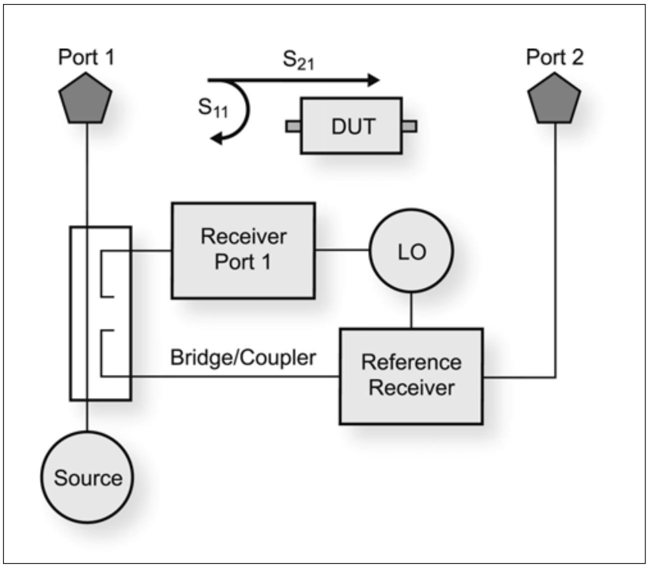
Typical Sweep Speed

The typical sweep speed for IF Bandwidth of 100 kHz, 1001 data points, and single display is shown in the following table. The two receiver architecture will simultaneously collect S_{21} and S_{11} in a single sweep.

Frequency Range	Typical Sweep Speed (µs/point)
500 kHz to 6 GHz	850

Block Diagram

As shown in the following block diagram, the VNA Master has a 2-port, 1-path architecture that automatically measures 2 S-parameters with error-correction precision inherent to VNA operation.



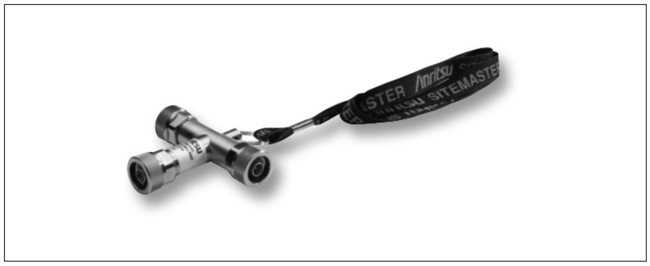
The above illustration is a simplified block diagram of VNA Master's 2-port, 1-path architecture. The magnitude AND phase information gained from Vector Network data enables the VNA Master to make significant error corrections and provide improved field measurements.

High Port Power

OSLxx50 Calibration Components (N-Connector)
Corrected System Performance and Uncertainties:
MS202xB/3xB with 1-path, 2-port calibration including isolation using either OSLN50-1 & OSLNF50-1 Calibration Kits.

Measurement Uncertainties

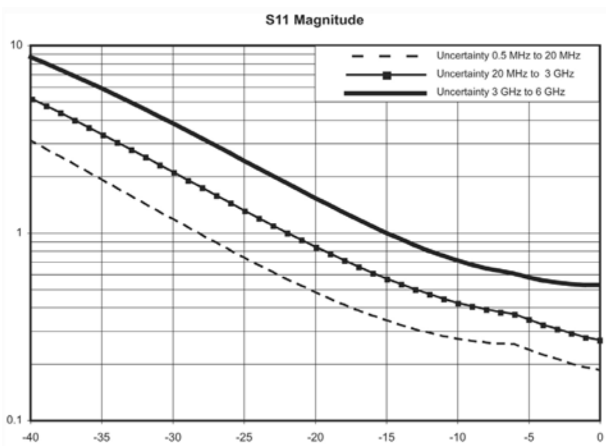
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

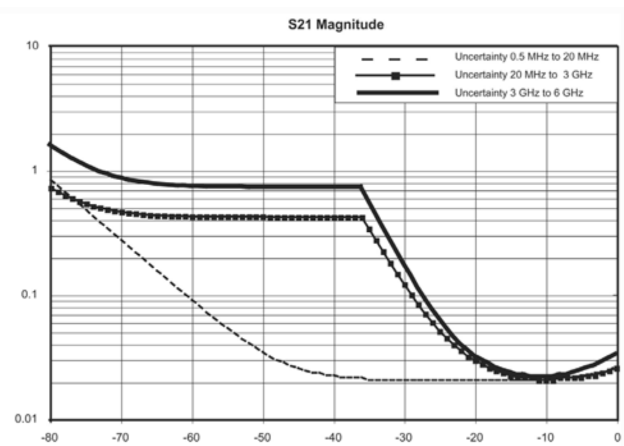


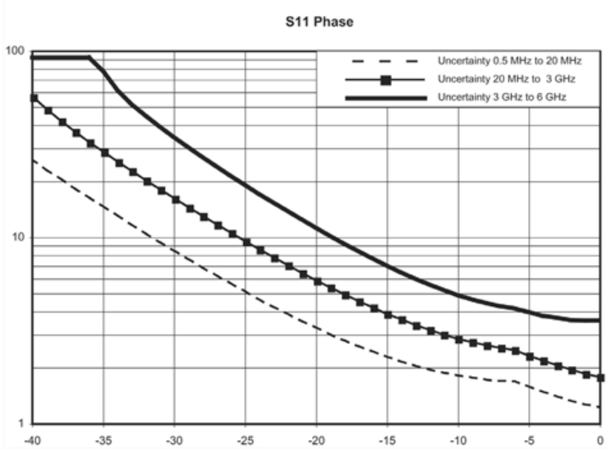
Precision calibration standards come in a convenient configuration for field work.

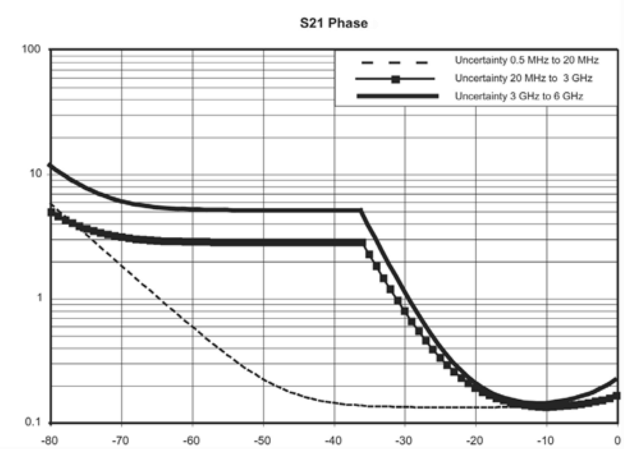
Frequency Range (GHz)	Directivity (dB)
≤6	>42

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	+3
≤6	0







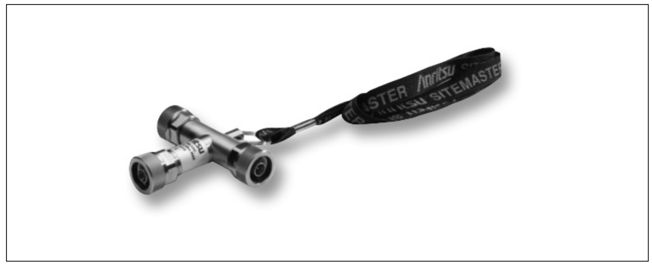


Low Port Power

OSLxx50 Calibration Components (N-Connector)
Corrected System Performance and Uncertainties:
MS202xB/3xB with 1-path, 2-port calibration including isolation using either OSLN50-1 & OSLNF50-1 Calibration Kits.

Measurement Uncertainties

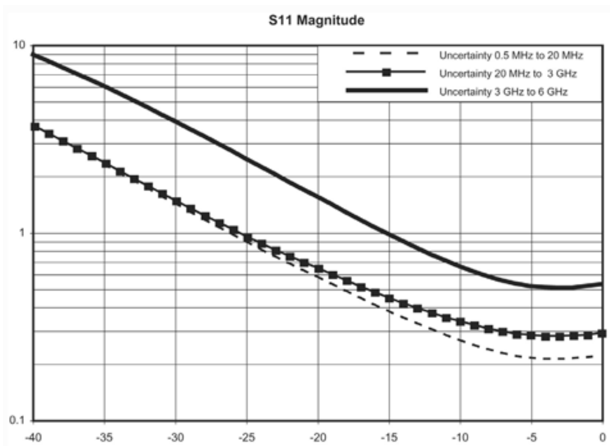
The following graphs provide measurement uncertainty at 23°C ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.

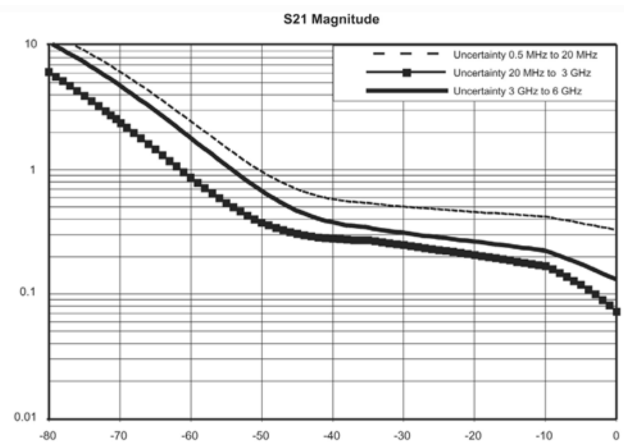


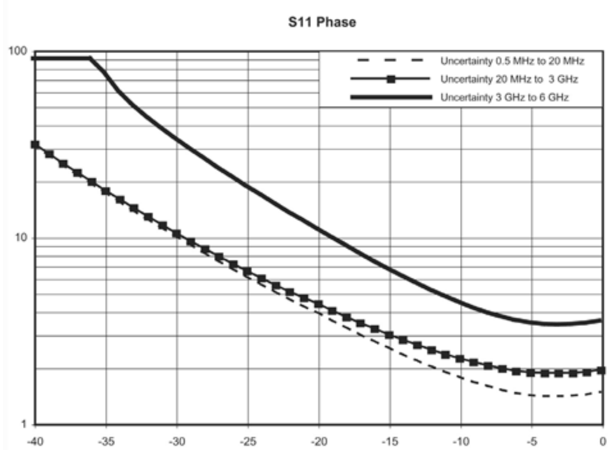
Precision calibration standards come in a convenient configuration for field work.

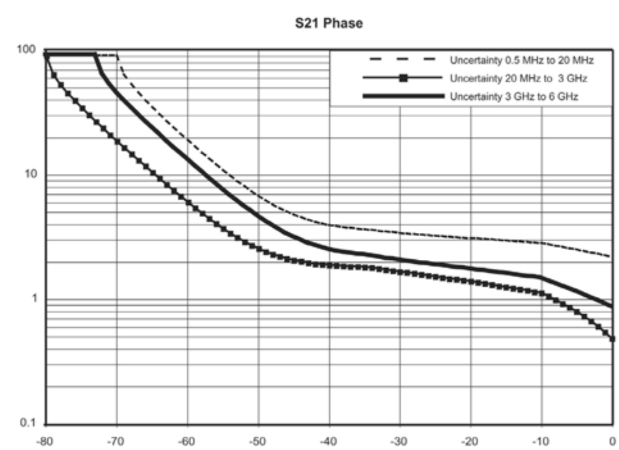
Frequency Range (GHz)	Directivity (dB)
≤6	>42

Frequency Range (GHz)	Typical High Port Power (dBm)
≤3	–25
≤6	–25









Spectrum Analyzer Functional Specifications (Models MS2034B/35B only)

Frequency				
Frequency Range	MS2034B: 100 kHz to 4 GHz, (usable to 0 Hz) MS2035B: 100 kHz to 6 GHz, (usable to 0 Hz)			
Tuning Resolution	1 Hz			
Frequency Reference	Aging: ±1.0 ppm/year Accuracy: 120 ppb (25°C ± 25°C) + aging <50 ppb with GPS locked			
Frequency Span	MS2034B: 10 Hz to 4 GHz including zero span MS2035B: 10 Hz to 6 GHz including zero span			
Sweep Time	Minimum 100 ms, 10 µs to 600 seconds in zero span			
Sweep Time Accuracy	±2% in zero span			
Bandwidth				
Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)			
Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)			
RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)			
VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1			
Spectral Purity				
SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz typical @ 10 kHz offset –105 dBc/Hz, –112 dBc/Hz typical @ 100 kHz offset –115 dBc/Hz, –121 dBc/Hz typical @ 1 MHz offset			
Amplitude Ranges				
Dynamic Range	> 95 dB (2.4 GHz), 2/3 (TOI-DANL) in 10 Hz RBW			
Measurement Range	DANL to +26 dBm			
Maximum Continuous Input	+35 dBm			
Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed			
Reference Level Range	–120 to +30 dBm			
Attenuator Resolution	0 to 55 dB, 5.0 dB steps			
Amplitude Units	Log Scale Modes: dBm, dBV, dBmv, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW			
Amplitude Accuracy (single sine wave input <Ref level, and >DANL, auto attenuation)				
–10° to +50°C after 30 minute warm-up	Typical: ±0.5 dB, 100 kHz to 6 GHz Maximum: ±1.3 dB, 100 kHz to 6 GHz			
Displayed Average Noise Level (DANL)	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
(RBW Normalized to 1 Hz, 0 dB attenuation)	Maximum	Typical	Maximum	Typical
10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
(RBW = 10 Hz, 0 dB attenuation)				
10 MHz to 2.4 GHz	–131 dBm	–136 dBm	–147 dBm	–152 dBm
>2.4 GHz to 4 GHz	–127 dBm	–131 dBm	–144 dBm	–149 dBm
>4 GHz to 5 GHz	–124 dBm	–128 dBm	–140 dBm	–145 dBm
>5 GHz to 6 GHz	–116 dBm	–121 dBm	–133 dBm	–140 dBm
Spurs				
Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
Exceptions, typical	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input <–68 dBc @ F1-280 MHz with F1 Input <–70 dBc @ F1 + 190.5 MHz with F1 Input <–52 dBc @ 7349-2F2 MHz, with F2 Input, where F2 < 2424.5 MHz <–55 dBc @ 190.5 ±F1/2 MHz, F1 <1 GHz			
Third-Order Intercept (TOI)	Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)			
800 MHz	+16 dBm			
2400 MHz	+20 dBm			
200 MHz to 2200 MHz	+25 dBm, typical			
>2.2 GHz to 5.0 GHz	+28 dBm, typical			
>5.0 GHz to 6.0 GHz	+33 dBm, typical			
Second Harmonic Distortion	Preamp Off, 0 dB input attenuation, –30 dBm input			
50 MHz	–56 dBc			
>50 MHz to 200 MHz	–60 dBc, typical			
>200 MHz to 3000 MHz	–70 dBc, typical			
VSWR	2:1, typical			

VNA Performance Capabilities

Measurement Parameters	S_{11}, S_{21}
Number of Traces	Four: TR1, TR2, TR3, TR4
Trace Format	Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays.
Graph Types	Log Magnitude SWR Phase Real Imaginary Group Delay Smith Chart Log Mag/2 (1-Port Cable Loss) Linear Polar Log Polar Real Impedance Imaginary Impedance Log Polar Real Impedance Imaginary Impedance
Domains	Frequency Domain, Distance Domain
Frequency	Start Frequency, Stop Frequency, Center Frequency, Span
Distance	Start Distance, Stop Distance
Frequency Sweep Type: Linear	Single Sweep, Continuous
Data Points	2 to 4001 (arbitrary setting); data points can be reduced without recalibration.
Limit Lines	Upper, Lower, 10 segmented Upper, 10 segmented Lower
Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
Data Averaging	Sweep-by-sweep
Smoothing	0 to 20%
IF Bandwidth	10, 20, 50, 100, 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Hz)
Reference Plane	The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase, and constant impedance.
Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance.
Frequency Range	Frequency range of the measurement can be narrowed within the calibration range without recalibration.
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
Group Delay Range	<180° of phase change within the aperture
Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.
Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
Number of Markers	Eight, arbitrary assignments to any trace
Marker Types	Reference, Delta
Marker Readout Styles	Log Mag, Cable Loss (Log Mag / 2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, and Group Delay
Marker Search	Peak Search, Valley Search, Find Marker Value
Correction Models	Full S_{11}, 1-Path, 2-Port (S_{11} & S_{21}), Response S_{11}, Response S_{21}
Calibration Methods	Short-Open-Load-Through (SOLT)
Calibration Standards' Coefficients	Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined
Cal Correction Toggle	On/Off
Impedance Conversion	Support for 50Ω and 75Ω are provided.
Units	Meters, Feet
Bias Tee Settings	Internal, Off
Timebase Reference	Internal
File Storage Types	Measurement, Setup (with CAL), Setup (without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), JPEG
Ethernet Configuration	DHCP or Manual (Static); IP, Gateway, Subnet entries
Languages	English, French, German, Spanish, Chinese, Japanese, Korean, Italian, plus two User Defined

Spectrum Analyzer Performance Capabilities (Models MS2034B/35B only)

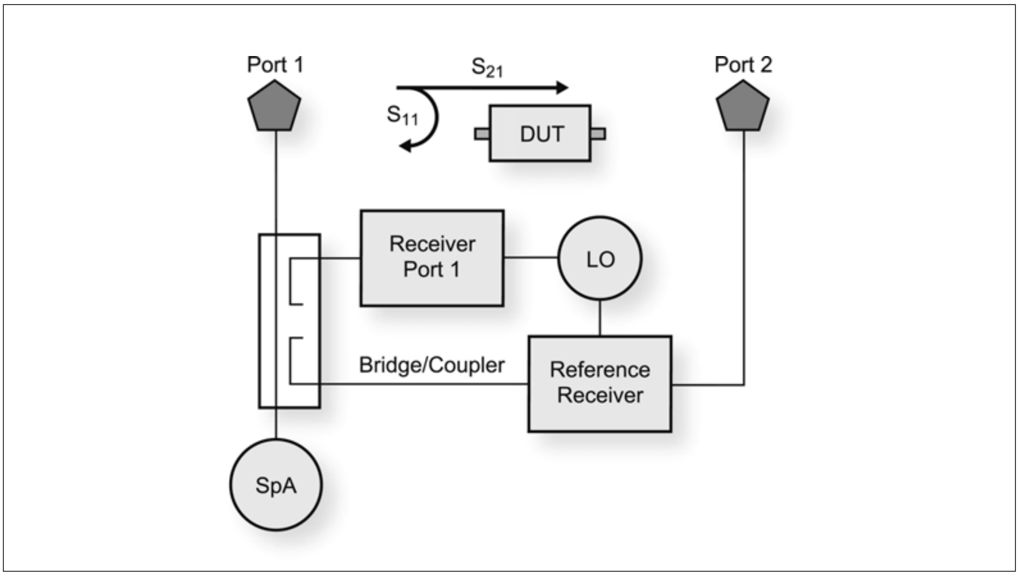
Measurements	
Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m^2 or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask Coverage Mapping (requires option 0431, and GPS Option 0031)
Setup Parameters	
Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)
Sweep Functions	
Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
Detection	Peak, RMS, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	
Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
Trace B Operations	A→B, B↔C, Max Hold, Min Hold
Trace C Operations	A→C, B↔C, Max Hold, Min Hold, A – B→C, B – A→C, Relative Reference (dB), Scale
Marker Functions	
Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off
Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker Marker Auto-Position Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	
Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41 max), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall

Measurement Options Specifications

• Bias Tee (Option 0010)

For tower mounted amplifier tests, the MS202xB/3xB series with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements.
For frequency sweeps in excess of 2 MHz, the VNA Master can supply internal voltage control from +12 V to +32 V in 0.1 V steps up to 450 mA. Bias can be directed to VNA Port 2.

Frequency Range	2 MHz to 4/6 GHz (MS202xB/3xB) at VNA Port 2
Internal Voltage/Current	+12 V to +32 V at 450 ma. Steady state
Internal Resolution	0.1 V
Bias Tee Selections	Internal, Off



The Compact VNA Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram.

• Vector Voltmeter (Option 0015)

A phased array system relies on phase matched cables for nominal performance. For this class of application, the VNA Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements.
The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts.

For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables. The MS202xB/3xB solution is superior because the signal source is included internally, precluding the need for an external signal generator

CW Frequency Range	500 kHz to 4/6 GHz
Measurement Display	CW, Table (Twelve Entries, Plus Reference)
Measurement Types	Return Loss, Insertion
Measurement Format	dB/VSWR/Impedance

• High Accuracy Power Meter (Option 0019)
Requires external USB power sensor.

Conduct precise measurements of CW and digitally modulated transmitters in the field using this VNA Master software mode with a separately purchased Anritsu USB power sensor. After specifying the center frequency and zeroing the sensor to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts.

Option 0019 supports the USB Power Sensors in the following table.

USB Power Sensors (Ordered separately):

Model	PSN50	MA24105A	MA24106A	MA24108A	MA24118A	MA24126A
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26.5 GHz
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor
Connector	Type N, male, 50Ω	Type N, female, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω	Type N, male, 50Ω
Dynamic Range	–30 to +20 dBm (0.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz	50 kHz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS. Slot Power, Burst Average Power	True-RMS, Slot power, Burst Average power	True-RMS, Slot power, Burst Average power
Measurement Uncertainty	±0.16 dB*1	±0.17 dB*2	±0.16 dB*1	±0.18 dB*3	±0.18 dB*3	±0.18 dB*3
Datasheet for Additional Specifications	11410-00414	11410-00621	11410-00424	11410-00504	11410-00504	11410-00504

*1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors
*2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load.
Measurement results referenced to the input side of the sensor.
*3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors

• Interference Analyzer (Option 0025) (Models MS2034B/35B only) (Recommend GPS)

Measurements	Spectrum Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I) Spectrogram (Collect data up to one week) Signal Strength (Gives visual and aural indication of signal strength) Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength Signal ID (up to 12 signals) Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) > 10 dB Interference Mapping
Application Options	Impedance (50Ω, 75Ω, Other)

• Channel Scanner (Option 0027) (Models MS2034B/35B only)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	500 kHz to 4 GHz (MS2034B) 500 kHz to 6 GHz (MS2035B)
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• **GPS (Option 0031)** Requires external GPS antenna

Built-in GPS provides location information (latitude, longitude, altitude) and Universal Time (UT) information for storage along with trace data so you can later verify that measurements were taken at the right location. The GPS option requires a separately ordered magnet mount GPS antenna (2000-1528-R or 2000-1652-R), which are configured to mount outside on a metallic surface. Frequency accuracy is enhanced for the Spectrum Analyzer (on MS203xB models) when Options 0025 Interference Analyzer and 0027 Channel Scanner are engaged.

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer when GPS Antenna is connected <±50 ppb with GPS On, 3 minutes after satellite lock in selected mode
GPS Lock – after antenna is disconnected	<±50 ppb for 3 days, 0° to 50°C ambient temperature
Connector	SMA, female

• **Distance Domain (Option 0501)**

Distance-to-Fault Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the Compact VNA Master exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify discontinuities. The Compact VNA Master converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements.

Option 0501 Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and so minimize or prevent downtime of the system.

Option 0501 Distance Domain also supports field measurements for optical fiber diagnostics. Anritsu Model ODTF-1 test module (see page 15) works directly with RF techniques and converts optical DTF signals to display on the VNA Master.

• **Ethernet Connectivity (Option 0411)**

By enabling the Compact VNA Master to communicate with PCs via Ethernet, you gain the ability to operate automated testing from your PC, or conversely, to upload data from field test to the PC.

• **AM/FM/PM Demodulation Analyzer, (Option 0509) (Models MS2034B/35B only)**

The VNA Master + Spectrum Analyzer comes with AM/FM/SSB audio demodulation standard. By adding Option 0509, it then measures, analyzes and displays key modulation parameters of RF Spectrum, Audio Spectrum, Audio Waveform and FM Demod Summary. The RF Spectrum View displays the spectrum analyzer with carrier power, frequency, and occupied BW. Audio Spectrum shows the demodulated audio spectrum along with the Rate, RMS deviation, Pk-Pk/2 deviation, SINAD, Total Harmonic Distortion (THD), and Distortion/Total. Each demodulation also includes an Audio Waveform display that shows the time-domain demodulated waveform. There is a summary table that includes a summary of all the RF and Demod parameters.

• **Coverage Mapping (Option 0431)** (Requires GPS)

Measurements	Indoor Mapping	Outdoor Mapping
	RSSI ACPR	RSSI ACPR
Setup Parameters	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
	Measurement Setup	ACPR, RSSI
	Point Distance / Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

VNA Master General Specifications (MS202xB/3xB)

Maximum Input (Damage Level) into Vector Network Analyzer	+23 dBm, ±50 VDC
Interfaces	Type N female Spectrum Analyzer Port (MS203xB) Type N female Type BNC female Trigger In port Type BNC female External Reference In port Type SMA female GPS port supports +3.3 V or +5 V external antenna (Available with opt 0031) USB Interface, Type A (2 connectors) USB Interface, Type Mini-B RJ45 connector for Ethernet 10/100-Base T (Available with Option 0411 Ethernet) 2.5 mm 3-wire cellular headset connector

• Setup Parameters

System	Status (Temperature, Battery Info, S/N, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Internal Trace/Setup Memory	2,000 traces, 2,000 Setups
External Trace/ Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

• Connectors

VNA Port 1, VNA Port 2	Type N, female, 50Ω
RF Out Damage Level	+23 dBm, ±50 VDC
RF In Damage Level	+35 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation) (MS203xB)
GPS	SMA, female
External Power	5.5 mm barrel connector, 12.5 to 15 VDC, <4.0 Amps
USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset Jack	2.5 mm barrel connector
External Reference In	BNC, female, 50Ω, Maximum Input ±5 VDC 1 MHz, 5 MHz, 10 MHz, 13 MHz
External Trigger/ Clock Recovery	BNC, female, 50Ω , Maximum Input ±50 VDC

• Display

Type	Resistive Touch Screen
Size	8.4 in, daylight viewable color LCD
Resolution	800 × 600

• Power

Field replaceable Li-Ion Battery (633-44: 6600 mAh, 4.5 Amps)	40 Watts on battery power only
DC power from Universal 110 V/220 V AC/DC Adapter	55 Watts running off AC/DC adaptor while charging battery
Life time charging cycles (Li-Ion Battery, 633-44)	>300 (80% of initial capacity)
Battery Operation	3.6 hours, typical

• Electromagnetic Compatibility

European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11

• Safety

Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Company supplied Power Supply

• Environmental

Operating Temperature	–10° to +55°C
Maximum Humidity	85%
Shock	MIL-PRF-28800F Class 2
Storage	–40° to +71°C
Altitude	4600 meters, operating and non-operating

• Size and Weight

Dimensions	Height: 199 mm (7.8 in) Width: 273 mm (10.7 in) Depth: 91 mm (3.6 in)
Weight, Including Battery	3.5 kg (7.6 lbs)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	VNA Master™ 2-Port, 1-Path VNA
MS2024B	VNA: 500 kHz to 4 GHz
MS2025B	VNA: 500 kHz to 6 GHz
	VNA Master™ 2-Port, 1-Path VNA + Spectrum Analyzer
MS2034B	VNA: 500 kHz to 4 GHz, S/A: 100 kHz to 4 GHz
MS2035B	VNA: 500 kHz to 6 GHz, S/A: 100 kHz to 6 GHz
	The instrument includes standard one-year warranty and Certificate of Calibration and Conformance
	MS2024B VNA Master Options
MS2024B-0010	Built-in Bias-Tee, +12 V to +24 V variable
MS2024B-0015	Vector Voltmeter
MS2024B-0019	High Accuracy Power Meter (requires external USB sensor)
MS2024B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2024B-0098	Z-540 Calibration
MS2024B-0099	Premium Calibration
MS2024B-0411	Ethernet Connectivity
MS2024B-0501	Distance Domain
	MS2025B VNA Master Options
MS2025B-0010	Built-in Bias-Tee, +12 V to +24 V variable
MS2025B-0015	Vector Voltmeter
MS2025B-0019	High Accuracy Power Meter (requires external USB sensor)
MS2025B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2025B-0098	Z-540 Calibration
MS2025B-0099	Premium Calibration
MS2025B-0411	Ethernet Connectivity
MS2025B-0501	Distance Domain
	MS2034B VNA Master, + Spectrum Analyzer Options
MS2034B-0010	Built-in Bias-Tee, +12 V to +24 V variable
MS2034B-0015	Vector Voltmeter
MS2034B-0019	High Accuracy Power Meter (requires external USB sensor)
MS2034B-0025	Interference Analysis, 100 kHz to 4 GHz*1
MS2034B-0027	Channel Scanner, 100 kHz to 4 GHz*1
MS2034B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2034B-0098	Z-540 Calibration
MS2034B-0099	Premium Calibration
MS2034B-0411	Ethernet Connectivity
MS2034B-0431	Coverage Mapping*2
MS2034B-0501	Distance Domain
MS2034B-0509	AM/FM/PM Demodulation Analyzer
	MS2035B VNA Master, + Spectrum Analyzer Options
MS2035B-0010	Built-in Bias-Tee, +12 V to +24 V variable
MS2035B-0015	Vector Voltmeter
MS2035B-0019	High Accuracy Power Meter (requires external USB sensor)
MS2035B-0025	Interference Analysis, 100 kHz to 6 GHz*1
MS2035B-0027	Channel Scanner, 100 kHz to 6 GHz*1
MS2035B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2035B-0098	Z-540 Calibration
MS2035B-0099	Premium Calibration
MS2035B-0411	Ethernet Connectivity
MS2035B-0431	Coverage Mapping*2
MS2035B-0501	Distance Domain
MS2035B-0509	AM/FM/PM Demodulation Analyzer
	MS202xB/3xB Standard Accessories
10580-00220	VNA Master User's Guide
3-68736	Soft Carrying Case
2300-498	Master Software Tools CD ROM
633-75	Rechargeable Battery, Li-Ion, 7500 mAh
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 V DC adapter
3-2000-1498	USB A-to mini B cable, 3.05 m (10 ft.)

*1: Requires external antenna (2000-xxxx or 61532 Antenna Kit), Recommend Option 0031 GPS
*2: Requires Option 0031 GPS

Model/Order No.	Name
	Optional Accessories
	Ancillary Equipment
2300-517	Phase Noise Measurement Software
3-806-152	Ethernet Crossover Cable
2000-1371-R	Ethernet Cable (7 ft.)
2000-1528-R	GPS Antenna – Magnet Mount (active 3 to 5 V) with SMA connector and 4.6 m (15 ft) extension cable
2000-1652-R	GPS Antenna – Magnet mount (active 3 to 5 V) with SMA connector and 1 foot cable
2000-1653	Protective Screen Cover (Package of 2)
2000-1689	EMI Near Field Probe Kit
	High Accuracy Power Sensor
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, True RMS
MA24106A	High Accuracy Power Sensor, 50 MHz to 6 GHz, True RMS
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, True RMS
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, True RMS
MA24126A	Microwave USB Power Sensor, 10 MHz to 26.5 GHz, True RMS
	N-Type Connector Components
OSLN50	Precision Integrated Open/Short/Load N(m), DC to 18 GHz, 50Ω
OSLNF50	Precision Integrated Open/Short/Load N(f), DC to 18 GHz, 50Ω
22N50	Precision N(m) Short/Open, 18 GHz
22NF50	Precision N(f) Short/Open, 18 GHz
28N50-2	Precision Termination, DC to 18 GHz, 50Ω, N(m)
28NF50-2	Precision Termination, DC to 18 GHz, 50Ω, N(f)
OSLN50-1	Precision N(m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50-1	Precision N(f) Open/Short/Load, 42 dB, 6 GHz
SM/PL-1	Precision N(m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision N(f) Load, 42 dB, 6 GHz
	Directional Antennas
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21000 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110-2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50Ω
61532	Antenna Kit (Consists of: 2000-1030, 2000-1031, 2000-1032-R, 2000-1200, 2000-1035, 2000-1361, and carrying pouch)

Continued on next page

Model/Order No.	Name
	Bandpass Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-172	BNC(f) to N(m), DC to 1.3 GHz, 50Ω
510-90	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50Ω
510-91	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50Ω
510-92	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50Ω
510-93	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50Ω
510-96	7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50Ω
510-97	7/16 DIN(f) to 7/16 DIN(f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50Ω, w/ Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Technical Data Sheet
11410-00549	VNA Master + Spectrum Analyzer Brochure
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle
	Manuals
10580-00301	VNA Master User's Guide
10580-00302	VNA Master Programming Manual
10580-00303	VNA Master Maintenance Manual
10580-00289	VNA Measurement Guide
10580-00231	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide
	Related Literature, Application Notes
11410-00206	Time Domain for Vector Network Analyzers
11410-00214	Reflectometer Measurements – Revisited
11410-00270	What is Your Measurement Accuracy?
11410-00373	Distance-to-Fault
11410-00387	Primer on Vector Network Analysis
11410-00414	High Accuracy Power Meter, PSN50
11410-00424	USB Power Sensor MA24106A
11410-00504	Microwave USB Power Sensor MA241x8A
11410-00531	Practical Tips on Making “Vector Voltmeter (VVM)” Phase Measurements using VNA Master (Opt. 15)
11410-00472	Measuring Interference
11410-00476	The Essentials of Vector Network Analysis
11410-00565	Troubleshoot Wire Cable Assemblies with Frequency-Domain Reflectometry
	Phase-Stable Test Port Cables, Armored
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(m), 50Ω

SITE MASTER™

S331L

Cable & Antenna Analyzer: 2.0 MHz to 4.0 GHz, Power Meter: 50 MHz to 4.0 GHz

Remote Control
USB

Handheld Cable & Antenna Analyzer
Featuring Classic and Advanced Modes

NEW

Introduction

Anritsu is proud to introduce the new Site Master™ S331L, our 9th generation compact handheld Cable & Antenna Analyzer.
The S331L is newly designed from the ground up. We took all of our experience, customer feedback, field trials, and the latest technology advancements, and developed the best value in a low cost, field optimized, trusted, reliable, rugged, easy to use, one port Cable & Antenna analyzer.

Optimized for Field Use

- > 8 Hours Battery Life
- Instant On from Standby Mode
- Highest RF Immunity
- Built-in InstaCal™ Module
  - Fast, One-connection Calibration
- FlexCal™ Calibration
  - One Calibration for All Frequencies
- Built-in Power Meter
- Rugged and Reliable
- Impact, Dust, and Splash Resistant
- Smallest, Lightest Site Master™

Easy to Use

- Integrated Help Function
- S331D-like Classic Mode
- S331E-like Advanced Mode
  - Additional Markers
  - Customizable Shortcuts
  - Full-screen View
- Multiple USB Ports
  - Alphanumeric Keyboard
  - EZ Name Quick Matrix
- Backlit Keypad

Efficient Sweep Management

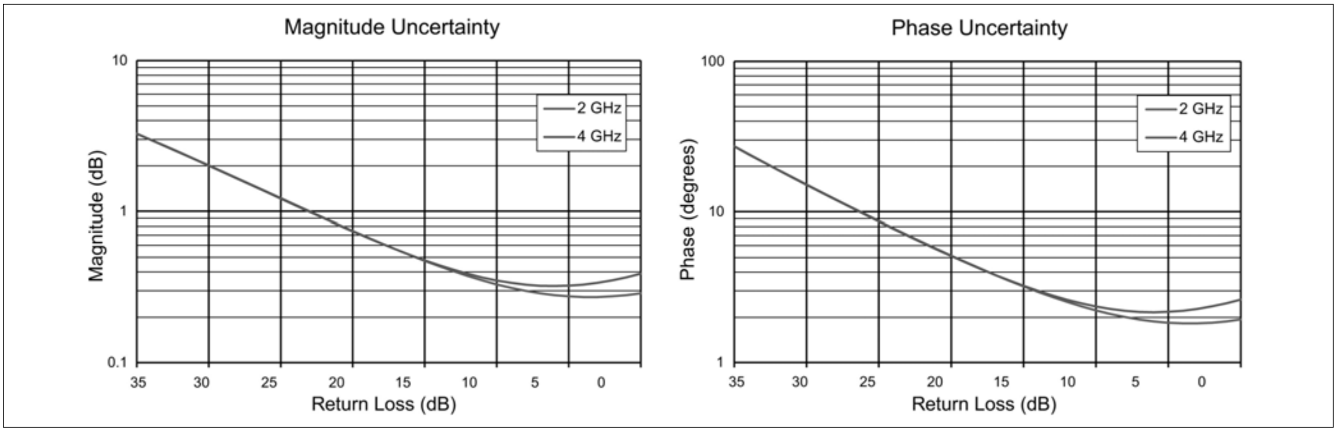
- Internally Store >1000 Files
  - Sweeps, Setups, Screen Shots
- Fast Preview of Stored Sweeps
- Line Sweep Tools (LST) Software
  - Edit Sweeps, Rename, Archive
  - Generate PDF or HTML Reports
- Standard*.dat Sweep File Format
- Compatible with HHST
  - Widely Accepted by Operators
- SweepMasters DIRECT
  - Online Trace Delivery Service

Cable and Antenna Analyzer Specifications

All specifications and characteristics apply to revision 1 instruments under the following conditions, unless otherwise stated: 1) Instrument within its recommended calibration cycle, 2) After 5 minutes of warm-up time, where the instrument has completely stabilized to the ambient temperature, 3) Internal frequency reference used, 4) Cable analyzer and VNA measurements applicable after standard OSL calibration is performed using Anritsu calibration components, 5) Typical data does not include guard band for measurement uncertainty and temperature variation and is not warranted, 6) All specifications subject to change without notice, 7) Recommended calibration cycle is 12 months.

Measurements	VSWR	
	Return Loss	
	Cable Loss (One Port)	
	Distance-to-Fault (DTF) Return Loss	
	Distance-to-Fault (DTF) VSWR	
Setup Parameters – Classic Mode	Measurement Display	Single Display with independent markers
	Frequency	F1/F2
	DTF	D1/D2, DTF Aid, Cable Loss, Propagation Velocity, Cable type
	Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Top, Bottom Auto Scale, Full Scale
	Sweep	Data Points, Run/Hold, Single/Continuous, RF Immunity (High/Low)
	Data Points	130, 259, 517, 1033
	Markers	Markers 1 to 6 (On/Off), Delta Markers 2 to 4 (Ref M1), Marker to Peak/Valley, Marker Table, Marker 5 (Peak/Valley between M1 & M2), Marker 6 (Peak/Valley between M3 & M4)
	Traces	Copy Trace To Memory, Trace Display, Trace Math
	Limit Line	On/Off, Edit Value, Limit Alarm, Pass/Fail On/Off, Limit Preset
	Calibration	Cal Type OSL/Standard/FlexCal™/InstaCal™
	Save/Recall	Setups, Measurements, Screen Shots
Setup Parameters – Advanced Mode	Measurement Display	Single Display with independent markers
	Frequency	Start Frequency (F1), Stop Frequency (F2)
	DTF	Start Distance (D1), Stop Distance (D2), Units m/ft, DTF Aid, Cable List, Cable Loss, Propagation Velocity
	Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
	Amplitude	Top, Bottom, Auto Scale, Full Scale
	Sweep	Data Points, Run/Hold, Single/Continuous, RF Immunity (High/Low)
	Data Points	130, 259, 517, 1033
	Markers	Markers 1 to 8 (On/Off), Delta Markers 2 to 8 (Ref M1), Marker to Peak/Valley, Marker Table, Marker 5 & 7 (Peak/Valley between M1 & M2), Marker 6 & 8 (Peak/Valley between M3 & M4)
	Traces	Copy Trace to Memory, Trace Display, Trace Math
	Limit Line	On/Off, Edit Value, Limit Alarm, Pass/Fail On/Off, Limit Preset
	Calibration	Cal Type OSL/Standard/FlexCal™/InstaCal™
	Save/Recall	Setups, Measurements, Screen Shots
Frequency	Frequency Range	2 MHz to 4 GHz
	Frequency Accuracy	±5 ppm @ 23°C ±3°C
	Frequency Resolution	1 kHz
Power	Output Power	+3 dBm, typical
Interference Immunity	On-Channel	+17 dBm outside calibrated sweep range
	On-Frequency	+13 dBm within calibrated sweep range
Measurement Speed	Return Loss	≤1.50 ms/data point, RF immunity low, typical
	Distance-to-Fault	≤1.75 ms/data point, RF immunity low, typical
Return Loss	Measurement Range Resolution	0 to 60 dB 0.01 dB
VSWR	Measurement Range	1 to 65
	Resolution	0.01
Cable Loss	Measurement Range	0 to 30 dB
	Resolution	0.01 dB
Distance-to-Fault	Vertical Range Return Loss	0 to 60 dB
	Vertical Range VSWR	1 to 65
	Fault Resolution (meters)	$(1.5 \times 10^8 \times vp)/\Delta F$ (vp = propagation velocity, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters)	0 to (Data Points – 1) × Fault Resolution, to maximum of 1500 meters (4921 feet)
Measurement Accuracy	Corrected Directivity	23°C ±3°C ≥38 dB, InstaCal™ calibration ≥42 dB, OSL calibration (OSLN50-1, OSLNF50-1)

Return Loss Measurement Uncertainty



Internal Power Meter Specifications

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	Running Average, Max Hold On/Off, Run/Hold, Average Mode Cont/Single
Limits	Limit On/Off, Limit Upper/Lower
Frequency Range	50 MHz to 4 GHz
Display Range	–100 to +100 dBm
Measurement Range	–33 to +20 dBm
Offset Range	Max ±100 dB, user settable value
VSWR	1.5:1 typical
Maximum Power	+27 dBm, ±45 VDC (damage level)
Connector Type	N(m), 50 Ω
Accuracy	±0.7 dB (0 dBm, 1 GHz CW, @ 23°C ±3°C)
Frequency Response and Linearity	Additional ±0.8 dB (±0.5 dB typical)
Temperature Effect	Additional ±0.02 dB per 1°C change (typical)

General Specifications

Setup Parameters	System Info	Status, Battery
	System Setups	Date/Time, Language, Display/Audio
	Date/Time	Day, Month, Year, Time
	Language	English, French, German, Italian, Spanish, Russian, Portuguese, Japanese, Korean, Chinese
	Display/Audio	Brightness, Color Schemes, Screen Shot Settings, Volume
	Diagnostics	Self Test
	Preset	Preset, Reset
	Reset	Factory Reset, Master Reset, Update Firmware
	File	Save, Recall, File Management
	File Management	Rename, Create Folder, Copy, Paste, Delete, Navigation
	Navigation	Top, Bottom, Page Up, Page Down
	Save	Measurement (*.dat), Setup (*.stp), Screen Shot (*.png)
	Internal Trace/Setup Memory	>1000 files (files may be traces, setups, screen shots, or any combination)
	External Trace/Setup Memory	Limited only by size of USB Flash drive
Connectors	RF Out/Reflect In	Type N, female, 50Ω, Maximum Input +23 dBm, ±50 VDC
	InstaCal™/Power Meter	Type N, male, 50Ω, Maximum Input +27 dBm, ±45 VDC (Damage Level)
	External Power	5.5 mm barrel connector, 11 to 14 VDC, <3.0 A
	USB Ports	USB 2.0 Type A (two ports)
	USB Interface	Type mini-B, Connect to PC for data transfer
Display	Type	TFT Resistive Touch Screen
	Size	7.0" daylight viewable color LCD
	Resolution	800 × 480
Battery	Type	Li-Ion
	Battery Operation	>8.0 Hours typical (70% brightness setting, continuous usage)

Continued on next page

Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
	Interference	EN 61326-1
	Emissions EN 55011	EN 55011
	Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11
	Australia and New Zealand	C-tick N274
Safety	Safety Class	EN 61010-1 Class 1
	Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	Temperature	–10° to +55°C (Operating), –40° to +71°C (Storage)
	Maximum Humidity	95% non-condensing
	Altitude	4600 meters
	Shock	MIL-PRF-28800F Class 2
Dimensions and Mass	Dimensions	250 × 177 × 61 mm (10.0 × 7.1 × 2.4 in)
	Mass	<2.0 kg (4.4 lb), including battery

Anritsu Tool Box and Line Sweep Tools (for your PC)

Line Sweep Tools (LST) is a free PC based program that increases productivity for people who deal with numerous Cable and Antenna traces every day. LST is the next generation of Anritsu's familiar Handheld Software Tools (HHST) and shares its uncomplicated user interface, giving a new face to the term "ease of use."

Cable Editor[*1]	Instrument Cable Lists may be retrieved from the instrument, modified as required, and uploaded back into instrument.
Distance to Fault[*2] (DTF)	Easily convert Return Loss or VSWR traces to Distance to Fault traces with one button press.
Measurement Calculator	Provides quick conversion between commonly used measurement units such as VSWR, RL, and others.
Signal Standard Editor[*1]	Signal Standard Lists may be retrieved from the instrument, modified as required, and uploaded back into instrument.
Naming Grid	A naming grid function makes changing file names, trace titles, and trace subtitles from field values to those required by contract simple and quick. Once the naming grid is populated with user defined file name segments, a few simple button presses will then fill out the file, title, and sub-title names. Quickly applied to multiple traces, the naming grid can save time, increase efficiency and accuracy.
Presets	Presets make applying markers and a limit line to similar traces quick and easy. They only need to be set once, and recorded. After this, applying them to a similar trace requires only one button push. This speeds up trace processing and makes providing consistent marker and limit line settings easy.
Report Generator	The report generator creates a professional PDF or HTML based report. Reports may include GPS[*3] location, power level[*3], company logo[*4], instrument and calibration status along with a display of all open traces. It also may contain additional information such as addresses and phone numbers.
Capture	Plots to Screen, Database, *.dat, *.jpg
Connect	To PC using USB, Ethernet, Serial
Download/Upload[*1]	Lists/measurements and live traces to PC for storage and analysis.
Supported File Types	Input: *.dat, *.vna, *.mna, *.pim, *.tm Output: *.dat, *.vna, *.pim, *.tm, *.csv, *.bmp, *.jpg, *.png

*1: Instrument type/model must match original
*2: Only *.dat and *.vna file types supported
*3: Model dependent
*4: Optionally set by user

SweepMasters DIRECT

SweepMasters DIRECT is an easy-to-use online trace delivery service for your S331L cable and antenna analyzer traces.
When used with the S331L, it allows you to capture, upload, and deliver traces.

Standard Functions	Create Groups, Modify Groups, Create Sites, Modify Sites, View Sites, Create Users, Modify Users, Add Users, Modify Company Profile, Upload Traces, View Trace list, Send Traces
Supported File Types	S331L *.dat file format
Export Data	Send download link from selected Site to recipients via email. Download link contains single zip file. Zip file

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
S331L	Cable and Antenna Analyzer (2 MHz to 4 GHz)
	Internal InstaCal™ (2 MHz to 4 GHz)
	Internal Power Meter (50 MHz to 4 GHz)
	Calibration and Extended Warranty Options
S331L-ES210	Warranty Extension to 2 Years, Return to Anritsu
S331L-ES310	Warranty Extension to 3 Years, Return to Anritsu
S331L-ES510	Warranty Extension to 5 Years, Return to Anritsu
	Warranty with Z540 Calibration
S331L-ES210	N/A
S331L-ES310	Warranty Extension to 3 Years, Return to Anritsu
S331L-ES510	Warranty Extension to 5 Years, Return to Anritsu
	Calibration Only Options
S331L-0098	Standard Calibration to Z540
S331L-0099	Premium Calibration to Z540 plus test data
	Standard Accessories (included with instrument)
10920-00060	Handheld Instruments Documentation Disc
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) DVD Disc
11410-00616	Site Master™ S331L Technical Data Sheet
10580-00321	Site Master™ S331L User Guide (Hard copy)
2000-1676-R	Soft Carrying Case
2000-1691-R	Stylus with Coiled Tether
2000-1687-R	Torque Multiplier N(m)
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 VDC Adapter
3-2000-1498	USB A/5-pin mini-B Cable, 305 cm (120 in)
	One Year Warranty
	Certificate of Calibration and Conformance
	Recommended Spare Accessories (not included)
2000-1691-R	Replacement Stylus with coiled tether
2000-1687-R	Replacement Torque Multiplier N(m)
	Manuals
10580-00253	Site Master™ S331L Maintenance Manual

Model/Order No.	Name
	Other Site Master™ Models From Anritsu
	(more data available at www.anritsu.com)
	Cable & Antenna Analyzers
S331E/S361E	2 MHz to 4 GHz (S331E), 2 MHz to 6 GHz (S361E) 2204 Data Points, 8.4" TFT Touch Screen, Dual Display Capability, Smith Chart Display Optional 2-port Tx Measurements Optional GPS Optional Bias Tee Optional High Accuracy Power
	Cable & Antenna Analyzers with Integrated Spectrum Analyzer
S332E/S362E	Cable & Antenna Analyzer Features: 2 MHz to 4 GHz (S332E), 2 MHz to 6 GHz (S362E) 2204 Data Points, 8.4" TFT Touch Screen, Dual Display Capability, Smith Chart Display Optional 2-port Tx Measurements Optional GPS Optional Bias Tee Optional High Accuracy Power Meter (requires external USB sensor sold separately) Spectrum Analyzer Features: 100 kHz to 4 GHz (S332E), 100 kHz to 6 GHz (S362E) Optional Interference Analysis with Interference Mapping Spectrogram, Signal ID Optional Coverage Mapping Optional AM/FM/PM Analysis
	Microwave Cable & Antenna Analyzers
S810D/S820D	2 MHz to 10.5 GHz (S810D) 2 MHz to 20 GHz (S820D) Available 2-port Transmission Measurements Supports Waveguide Measurements

Model/Order No.	Name
	Optional Accessories
	Calibration Components, 50 Ω
OSLN50-1	Precision Open/Short/Load, N(m), 42 dB, 6.0 GHz, 50 Ω
OSLNF50-1	Precision Open/Short/Load, N(f), 42 dB, 6.0 GHz, 50 Ω
2000-1618-R	Precision Open/Short/Load, 7/16 DIN(m), DC to 6.0 GHz 50 Ω
2000-1619-R	Precision Open/Short/Load, 7/16 DIN(f), DC to 6.0 GHz 50 Ω
22N50	Open/Short, N(m), DC to 18 GHz, 50 Ω
22NF50	Open/Short, N(f), DC to 18 GHz, 50 Ω
SM/PL-1	Precision Load, N(m), 42 dB, 6.0 GHz
SM/PLNF-1	Precision Load, N(f), 42 dB, 6.0 GHz
	PCalibration Components, 75 Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50 Ω to 75 Ω
22N75	Open/Short, N(m), DC to 3 GHz, 75 Ω
22NF75	Open/Short, N(f), DC to 3 GHz, 75 Ω
26N75A	Precision Termination, N(m), DC to 3 GHz, 75 Ω
26NF75A	Precision Termination, N(f), DC to 3 GHz, 75 Ω
	Adapters
510-90-R	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50 Ω
510-91-R	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50 Ω
510-92-R	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω
510-93-R	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω
510-96-R	7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50 Ω
510-97-R	7/16 DIN(f) to 7/16 DIN(f), DC to 7.5 GHz, 50 Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50 Ω with Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Unidirectional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Unidirectional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	Phase-Stable Test Port Cables, Armored w/Reinforced Grip
	(recommended for cable & antenna line sweep applications)
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
	Interchangeable Adapter Phase Stable Test Port Cables, Armored w/Reinforced Grip
	(recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the reinforced grip series cables. Now you can also change the adapter interface on the grip to four different connector types)
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50 Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50 Ω
	Phase-Stable Test Port Cables, Armored
	(ideal for use with tightly spaced connectors and other general use applications)
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(m), 50 Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-256-R	Large Transit Case with Wheels and Handle

SITE MASTER

S331E	S332E	S361E	S362E		Remote Control
2 MHz to 4 GHz	2 MHz to 4 GHz 9 kHz to 4 GHz	2 MHz to 6 GHz	2 MHz to 6 GHz 9 kHz to 6 GHz	Cable & Antenna Analyzer Spectrum Analyzer	USB

Compact Handheld Cable & Antenna Analyzer with Spectrum Analyzer

The wireless communications market continues to evolve at a rapid pace. Operators and service providers have to maintain old networks while upgrading to the new 3G and 4G networks to keep up with changing consumer demands. They face the additional challenge of needing to ensure their networks are competitive from a reliability, quality, and cost perspective. As a result of all this, they expect more of the contractors and technicians who maintain their networks. To stay competitive, these contractors and technicians must maintain more base stations than before and complete a wide variety of tasks in the shortest time possible.
Anritsu is pleased to introduce its eighth-generation compact handheld Site Master cable and antenna analyzer series with integrated spectrum analyzer. The new Site Master analyzers offer the same ease of use, ruggedness, and familiar menus as its predecessor S331D and S332D. In addition, Anritsu has enhanced the Site Master to address all the customer requirements and suggestions received over the years.
Indeed, for more than 14 years, Anritsu's Site Master has been the de facto standard for contractors, installers, and wireless service providers who need a portable and rugged cable and antenna analyzer. The Site Master reduces per site maintenance expense, maximizes system up-time, and breaks away from the traditional fix-after-failure maintenance mode by finding small problems before major failures occur. Radio frequency (RF) engineers and field technicians for installing and maintaining communication systems use Site Master's frequency domain reflectrometry (FDR)-based approach to improve the quality of their communication systems.
Although the new Site Master resides in a modern platform that takes advantage of the latest technologies and is loaded with features that will enhance productivity, it provides more value for better productivity without giving up the familiar look and feel.

Integrated

The Site Master is a 4 GHz or 6 GHz cable and antenna analyzer that can be configured to include either a 4 GHz or 6 GHz spectrum analyzer, 2-port transmission measurement with built-in 32 V bias tee, an interference analyzer with spectrogram displays, a channel scanner, power meter, high accuracy power meter, and GPS receiver for time and location stamping. Because of its multi-functional capabilities, it eliminates the need for you to carry and learn multiple instruments.

Trusted

Anritsu builds upon its expertise in portable compact cable and antenna analyzers and spectrum analyzers. The Site Master is approved by all major operators and service providers worldwide.

Designed for Field Use

The Site Master was designed specifically for field environments. It weighs less than 6 lbs and its field replaceable Li-Ion battery typically lasts for more than 4 hours. A new bright 8.4-inch color display provides visibility even in broad daylight. With an operating temperature range from –10° to +55°C, the Site Master will work in the most extreme weather conditions. The analyzer is almost impervious to the bumps and bangs typically encountered by portable field equipment, and its ruggedized case and splash proof design allow you to depend on high performance anywhere, anytime.

Functions and Description

- Cable and Antenna Analyzer, 2 MHz to 4 GHz/6 GHz
  – Characterizes cable and antenna systems with return loss, cable loss, VSWR, distance-to-fault measurements. Also includes 1-port phase and Smith chart displays. Offers faster than 1 ms/data point sweep speed and a dual display.
- Spectrum Analyzer, 9 kHz to 4 GHz/6 GHz
  – Locates and identifies various signals over a wide frequency range. Detect signals as low as –152 dBm with phase noise better than –100 dBc/Hz.
- 2-port Transmission Measurement (Option 21)
  – Provides high and low power settings for both TMA gain and antenna-antenna isolation measurements. Offers better than 80 dB dynamic range.
- Bias Tee (Option 10)
  – Provides built-in 32 V bias tee that can be turned on as needed, and which eliminates the need to carry an external supply.
- High Accuracy Power Meter (Option 19)
  – Connects high accuracy 4, 6, 8, 18, and 26 GHz USB power sensors with better than 0.16 dB accuracy.
- Power Meter (Option 29)
  – Makes channelized transmitter power measurements.
- Interference Analyzer (Option 25)
  – Includes the popular spectrogram display for monitoring intermittent signals over time.
- Interference Mapping
  – Triangulate location of interference with on display maps.

- Channel Scanner (Option 27)
  – Measures the power of multiple transmitted signals.
- CW Signal Generator (Option 28)
  – Includes CW source to test low noise amplifiers, repeaters. (This requires an external CW generator kit.)
- GPS Receiver (Option 31)
  – Provides location and UTC time information. Also improves the accuracy of the reference oscillator.
- Gated Sweep (Option 90)
  – Views pulsed or burst signals such as WiMAX, GSM, and TD-SCDMA only when they are on.
- Ethernet Connectivity (Option 0411)
- PIM Analyzer (Option 0419)
- Coverage Mapping (Option 0431)
- AM/FM/PM Coverage Mapping (Option 0509)

Specifications

• Cable and Antenna Analyzer

Frequency	Frequency Range	2 MHz to 4 GHz (S331E, S332E), 2 MHz to 6 GHz (S361E, S362E)
	Frequency Accuracy	≤±2.5 ppm @ 25°C
	Frequency Resolution	1 kHz (RF immunity low), 100 kHz (RF immunity high)
Output Power	High	0 dBm, typical
	Low	–30 dBm, typical
Interference Immunity	On-Channel	+17 dBm @ >1.0 MHz from carrier frequency
	On-Frequency	0 dBm within ±10 kHz of the carrier frequency
Measurement Speed	Return Loss	≤1.00 msec/data point, RF immunity low, typical
	Distance-to-Fault	≤1.25 msec/data point, RF immunity low, typical
Return Loss	Measurement Range	0 to 60 dB
	Resolution	0.01 dB
VSWR	Measurement Range	1:1 to 65:1
	Resolution	0.01
Cable Loss	Measurement Range	0 to 30 dB
	Resolution	0.01 dB
Distance-to-Fault	Vertical Range Return Loss	0 to 60 dB
	Vertical Range VSWR	1:1 to 65:1
	Fault Resolution (meters)	$(1.5 \times 10^8 \times vp)/\Delta F$ (vp = velocity propagation constant, ΔF is F2 – F1 in Hz)
	Horizontal Range (meters)	0 to (Data Points-1) × Fault Resolution, to a maximum of 1500 meters (4921 ft)
1-Port Phase	Measurement Range	–180° to +180°
	Resolution	0.01°
Smith Chart	Resolution	0.01 50/75Ω Selectable
Measurement Accuracy	Corrected Directivity	>42 dB, OSL calibration>38 dB, InstaCal™ calibration

• Spectrum Analyzer (S332E, S362E)

Frequency	Frequency Range	9 kHz to 4 GHz (S332E), 9 kHz to 6 GHz (S362E) (usable to 0 Hz)
	Maximum Continuous Input	+26 dBm
	Tuning Resolution	1 Hz
	Frequency Reference	Aging: ±1.0 ppm/year Accuracy: ±1.5 ppm (25°C ±25°C) + aging, <±50 ppb with GPS On
	Frequency Span	10 Hz to 4 GHz including zero span (S332E), 10 Hz to 6 GHz including zero span (S362E)
	Sweep Time	Minimum 100 ms, 10 μs to 600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz typical @ 10 kHz offset –105 dBc/Hz, –112 dBc/Hz typical @ 100 kHz offset –115 dBc/Hz, –121 dBc/Hz typical @ 1 MHz offset
Amplitude Ranges	Dynamic Range	>95 dB (2.4 GHz), 2/3 (TOI-DANL) in 10 Hz RBW
	Measurement Range	DANL to +26 dBm
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
	Reference Level Range	–120 to +30 dBm
	Attenuator Range	0 to 55 dB, 5.0 dB steps
	Maximum Continuous Input	+30 dBm
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBmV, dBW, dBmW, dBmW, dBA, dBmA, dBmA Linear Scale Modes: nV, mV, mV, V, kV, nW, mW, mW, W, kW, nA, mA, mA, A
Amplitude Accuracy	9 kHz to 100 kHz	±2.0 dB typical
	100 kHz to 4.0 GHz	±1.25 dB, ±0.5 dB typical
	>4.0 GHz to 6 GHz	±1.50 dB, ±0.5 dB typical

Continued on next page

		Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
		Maximum	Typical	Maximum	Typical
Displayed Average Noise Level (DANL)	(RBW Normalized to 1 Hz, 0 dB attenuation)				
	10 MHz to 2.4 GHz	–141 dBm	146 dBm	–157 dBm	–162 dBm
	>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
	>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
	>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
	(RBW = 10 Hz, 0 dB attenuation)				
	10 MHz to 2.4 GHz	–131 dBm	136 dBm	–147 dBm	–152 dBm
	>2.4 GHz to 4 GHz	–127 dBm	–131 dBm	–144 dBm	–149 dBm
	>4 GHz to 5 GHz	–124 dBm	–128 dBm	–140 dBm	–145 dBm
	>5 GHz to 6 GHz	–116 dBm	–121 dBm	–133 dBm	–140 dBm
Spurs	Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
	Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
	Exceptions, typical	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input <–68 dBc @ F1 – 280 MHz with F1 Input <–70 dBc @ F1 + 190 MHz with F1 Input <–52 dBc @ 7349 – 2F2 MHz, with F2 Input, where F2 <2424.5 MHz <–55 dBc @ 190.5 ± F1/F2 MHz, F1 <1 GHz			
Third-Order Intercept (TOI)		Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)			
	800 MHz	+16 dBm			
	2400 MHz	+20 dBm			
	200 MHz to 2200 MHz	+25 dBm, typical			
	>2.2 GHz to 5.0 GHz	+28 dBm, typical			
	>5.0 GHz to 6.0 GHz	+33 dBm, typical			
Second Harmonic Distortion		Preamp Off, 0 dB input attenuation, –30 dBm input			
	50 MHz	–56 dBc			
	>50 MHz to 200 MHz	–60 dBc, typical			
	>200 MHz to 3000 MHz	–70 dBc, typical			
VSWR		2:1, typical			

• Ethernet Connectivity (Option 0411)

Connector	RJ45
LAN Speed	10 Mbps
Mode	Static, DHCP
Static IP Settings	IP address Subnet Mask IP Gateway
Remote Control	Remote Access utility provided with Master Software Tools
Data Upload	With Line Sweep Tools through LAN connection

• 2-Port Transmission Measurement (Option 0021)

Frequency	Frequency Range	2 MHz to 4 GHz (S331E, S332E), 2 MHz to 6 GHz (S361E, S362E)
	Frequency Resolution	10 Hz
Output Power	High	0 dBm, typical
	Low	–30 dBm, typical
Dynamic Range	2 MHz to 4 GHz	95 dB, typical
	>4 GHz to 6 GHz	85 dB, typical
Application Options		Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• Bias-Tee (Option 0010)

Setup	On/Off, Voltage, Current (Low/High)
Voltage Range	+12 V to +32 V
Current (Low/High)	250 mA/450 mA, 1 A surge for 100 ms
Resolution	0.1 V

• GPS Receiver Option (Option 0031) (Antenna sold separately, P/N 2000-1528-R)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, CW Signal Generator
When GPS Antenna is connected	<±50 ppb with GPS On, 3 minutes after satellite lock in selected mode
Connector	SMA, female

• Power Meter (S332E, S362E)

Frequency Range	10 MHz to 4 GHz (S332E), 10 MHz to 6 GHz (S362E)
Span	1 kHz to 100 MHz
Display Range	–140 to +30 dBm, ≤40 dB span
Measurement Range	–120 to +26 dBm
Offset Range	0 to +100 dB
VSWR	2:1 typical
Maximum Power	+30 dBm without attenuator
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50Ω, 75Ω, Other)

• High Accuracy Power Meter (Option 0019) (Requires external USB Power Sensor(s)

Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108A	MA24118A	MA24126A
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26 GHz
Connector	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type K(m)
Dynamic Range	–30 to +20 dBm (.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm (0.1 µW to 100 mW)	–40 to +20 dBm
VBW	100 Hz	100 Hz	100 Hz	50 kHz	50 kHz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB[*1]	±0.17 dB[*2]	±0.16 dB[*1]	±0.18 dB[*3]	±0.18 dB[*3]	±0.18 dB[*3]
Datasheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504	11410-00504	11410-00504

∗1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
∗2: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
∗3: Expanded uncertainty with K = 2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

• Interference Analyzer (Option 0025) (S332E, S362E)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram (Collect data up to one week)	
	Signal Strength (Gives visual and aural indication of signal strength)	
	Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength	
	Signal ID (up to 12 signals)	Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) >10 dB
	Interference Mapping (Triangulate location of interference with on display maps)	
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)	

• AM/FM/PM Signal Analyzers (Option 0509) (S332E, S362E)

Measurements	RF Spectrum (AM/FM/PM)	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	—	—
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-PK)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-PK)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-PK)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-PK)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-PK)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-PK)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*

Continued on next page

Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq
	Amplitude	Scale, Power Offset, Adjust Range
	Setup	Demod Type (AM, FM, PM), IFBW, Auto IFBW
	Measurements	RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average
	Marker	On/Off, Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table, All Markers Off
Specifications	AM	Modulation Rate: ±1 Hz (<100 Hz), ±2% (>100 Hz) Depth: ±5% for (Modulation rates 10 Hz to 100 kHz)
	FM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (100 Hz to 100 kHz)**
	PM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz)**
	IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz, 70 kHz, 140 kHz
	RBW/VBW	30
	Span/RBW	100
	Sweep Time	50 µs to 50 ms (Audio Waveform)

*: Requires Sinewave modulation
**: IFBW must be greater than 95% occupied BW

• Channel Scanner (Option 0027) (S332E, S362E)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Freq/Channel, Current/Max, Single/Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	100 kHz to 4 GHz (S332E), 100 kHz to 6 GHz (S362E)
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 dBm to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

• CW Signal Generator (Option 0028) (S332E, S362E) (Requires CW Signal Generator Kit, P/N 69793)

Setup Parameters	Frequency	Frequency, Signal Standard, Channel Number, Display Setup Help
	Amplitude	Power Level (Low/High), Offset (dB)
	Frequency Range	2 MHz to 2 GHz
	Frequency Reference Accuracy	±1.5 ppm (25°C ±25°C) + aging, <±50 ppb with GPS On
	Output Power	High 0 dBm typical, Low –30 dBm typical Attenuator (included in kit 69793): 0 to 90 dB in 1 dB steps

• Gated Sweep (Option 0090) (S332E, S362E) (Requires CW Signal Generator Kit, P/N 69793)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 to 65 ms typical) Gate Length (1 µs to 65 ms typical) Zero Span Time

• Ethernet Connectivity (Option 0411)

Connector	RJ45
LAN Speed	10 Mbps
Mode	Static, DHCP
Static IP settings	IP address Subnet Mask IP Gateway
Remote Control	Remote Access utility provided with Master Software Tools
Data Upload	With Line Sweep Tools through LAN connection

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
	System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Internal Trace/Setup Memory	2,000 traces, 2,000 Setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	RF Out	Type N, female, 50Ω (Reflection In) (Option 21 only)
	RF Out Damage Level	23 dBm, ±50 VDC (Option 21 only)
	RF In	Type N, female, 50Ω
	RF In Damage Level	+30 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation)
	GPS	SMA(f)
	External Power	5.5 mm barrel connector, 12.5 to 15 VDC, <4.0 Amps
	USB Interface (2)	Type A, Connect USB Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Headset Jack	3.5 mm mini-phone plug
	External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm 1 MHz, 5 MHz, 10 MHz, 13 MHz
	External Trigger/Clock Recovery	BNC, female, 50Ω, Maximum Input ±50 VDC
Display	Type	Resistive Touchscreen
	Size	8.4" daylight viewable color LCD
	Resolution	800 × 600
Battery	Type	Li-Ion
	Battery Operation	4.0 hours, typical (S331E, S361E) 3.0 hours, typical (S332E, S362E)
Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
	Australia and New Zealand	C-tick N274
	Interference	EN 61326-1
	Emissions	EN 55011
	Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11
Safety	Safety Class	EN 61010-1 Class 1
	Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	Temperature	–10° to +55°C (Operating), –40° to +71°C (Storage)
	Maximum Humidity	95% RH (non-condensing) at +40°C
	Shock	MIL-PRF-28800F Class 2
	Altitude	4600 meters, operating and non-operating
ESD	RF Port Center Pin	Withstands up to ±15 kV
Dimensions and Mass	Dimensions	273 × 199 × 91 mm (10.7 × 7.8 × 3.6 in)
	Mass	2.71 kg (6.0 lbs, S331E, S361E), 3.71 kg (8.2 lbs, S332E, S362E)

Line Sweep Tools (for your PC)

Trace Capture	Browse to Instrument	View and copy traces from the test equipment to your PC using Windows Explorer
	Open Legacy File	Open DAT files captured with Hand Held Software Tools v6.61
	Open Current File	Open VNA or DAT file
	Capture Plots to:	The Line Sweep Tools screen, DAT files, Database, or JPEG
Traces	Trace Types	Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith Chart, and PIM
	Trace Formats	DAT, VNA, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF
Report Generation	Report Generator	Includes GPS location along with measurements
	Report Format	Create reports in HTML or PDF format
	Report Setup	Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo
	Trace Setup	1 trace Portrait Mode, 2 Trace Portrait Mode, 1 Trace Landscape Mode
Trace Validation	Presets	7 presets allow “one click” setting of up to 6 markers and one limit line
	Marker Controls	6 regular Markers, Marker Peak, Marker valley, Marker between, and frequency entry
	Delta Markers	6 Delta markers
	Limit Line	Enable and drag or value entry. Also works with presets
	Next Trace Button	Next Trace and Previous trace arrow keys allow quick switching between traces
Tools	Cable Editor	Allows creation of custom cable parameters
	Distance to Fault	Converts a Return Loss trace to a Distance to Fault trace
	Measurement Calculator	Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power
	Signal Standard Editor	Creates new band and channel tables
	Renaming Grid	36 user definable phrases for creation of file names, trace titles, and trace subtitles
Connectivity	Connections	Ethernet, USB cable, USB Memory Stick, and RS-232 Serial Null Modem cable

Master Software Tools (for your PC)

Database Management	Full Trace Retrieval	Retrieve all traces from instrument into one PC directory
	Trace Catalog	Index all traces into one catalog
	Trace Rename Utility	Rename measurement traces
	Group Edit	Title, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
	DAT File Converter	Converts HHST files to MST file format and vice-versa
Data Analysis	Trace Math and Smoothing	Compare multiple traces
	Data Converter	Convert from/to Return Loss, VSWR, Cable Loss, DTF and also into Smith Charts
	Measurement Calculator	Translates into other units
Report Generation	Report Generator	Includes GPS, power level, and calibration status along with measurements
	Edit Graph	Change scale, limit lines, and markers
	Report Format	Create reports in HTML for PDF format
	Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
	Notes	Annotate measurements
Mapping (GPS Required)	Spectrum Analyzer Mode	MapInfo, MapPoint
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
	Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
	Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	Traces	Add, delete, and modify limit lines and markers
	Antennas, Cables, Signal Standards	Modify instrument’s Antenna, Cable, and Signal Standard List
	Product Updates	Auto-checks Anritsu website for latest revision firmware
	Firmware Upload	Upload new firmware into the instrument
	Languages	Add up to two languages and modify non-English language menus
	Display	Modify display settings
Script Master™	Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
Connectivity	Connections	Connect to PC using USB
	Download	Download measurements and live traces to PC for storage and analysis
	Upload	Upload measurements from PC to instrument
	Firmware Updates	Create USB Flash Drive for firmware update

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Site Masters
S331E	2 MHz to 4 GHz Cable and Antenna Analyzer
S332E	2 MHz to 4 GHz Cable and Antenna Analyzer 100 kHz to 4 GHz Spectrum Analyzer
S361E	2 MHz to 6 GHz Cable and Antenna Analyzer
S362E	2 MHz to 6 GHz Cable and Antenna Analyzer 100 kHz to 6 GHz Spectrum Analyzer
	S331E Site Master Options
S331E-0010	Bias-Tee (Requires Option 0021)
S331E-0019	High-Accuracy Power Meter
S331E-0021	2-Port Transmission Measurement
S331E-0031	GPS Receiver (Requires Antenna P/N 2000-1528-R)
S331E-0098	Standard Calibration (ANSI 2540-1-1994)
S331E-0099	Premium Calibration (ANSI 2540-1-1994 plus test data)
S331E-0411	Ethernet Connectivity
	S332E Site Master Options
S332E-0010	Bias-Tee
S332E-0019	High-Accuracy Power Meter
S332E-0021	2-Port Transmission Measurement
S332E-0025	Interference Analyzer
S332E-0027	Channel Scanner
S332E-0028	C/W Signal Generator (Requires CW Signal Generator Kit, P/N 69793)
S332E-0029	Power Meter
S332E-0031	GPS Receiver (Requires Antenna P/N 2000-1528-R)
S332E-0090	Gated Sweep
S332E-0098	Standard Calibration (ANSI 2540-1-1994)
S332E-0099	Premium Calibration (ANSI 2540-1-1994 plus test data)
S332E-0411	Ethernet Connectivity
S332E-0431	Coverage Mapping (Requires Option 0031)
S332E-0509	AM/FM/PM Analyzer
	S361E Site Master Options
S361E-0010	Bias-Tee (Requires Option 0021)
S361E-0019	High-Accuracy Power Meter
S361E-0021	2-Port Transmission Measurement
S361E-0031	GPS Receiver (Requires Antenna P/N 2000-1528-R)
S361E-0098	Standard Calibration (ANSI 2540-1-1994)
S361E-0099	Premium Calibration (ANSI 2540-1-1994 plus test data)
S361E-0411	Ethernet Connectivity
	S362E Site Master Options
S362E-0010	Bias-Tee
S362E-0019	High-Accuracy Power Meter
S362E-0021	2-Port Transmission Measurement
S362E-0025	Interference Analyzer
S362E-0027	Channel Scanner
S362E-0028	C/W Signal Generator (Requires CW Signal Generator Kit, P/N 69793)
S362E-0029	Power Meter
S362E-0031	GPS Receiver (Requires Antenna P/N 2000-1528-R)
S362E-0090	Gated Sweep
S362E-0098	Standard Calibration (ANSI 2540-1-1994)
S362E-0099	Premium Calibration (ANSI 2540-1-1994 plus test data)
S362E-0411	Ethernet Connectivity
S362E-0431	Coverage Mapping (Requires Option 0031)
S362E-0509	AM/FM/PM Analyzer

Model/Order No.	Name
	Power Sensors (For complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
	Manuals (soft copy included on MST CD and at www.us.anritsu.com)
10580-00252	Site Master User Guide
10580-00241	Cable and Antenna Analyzer Measurement Guide
10580-00242	2-Port Transmission Measurement - Bias-Tee
10580-00231	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, CW Signal Generator
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00215	ODTF-1 Optical Distance-to-Fault Module
10580-00256	Programming Manual
	Standard Accessories (included with instrument)
10580-00252	Site Master User Guide
2000-1654-R	Soft Carrying Case
2300-498	Master Software Tools (MST) CD Disc
10920-00060	Handheld Instruments Documentation Disc
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) DVD Disc
2300-539	easyTest Tools CD Disc
633-44	Rechargeable Li-Ion Battery
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 VDC Adapter
3-2000-1498	USB A/5-pin mini-B Cable, 10 feet/305 cm
11410-00484	Site Master™ S331E, S332E, S361E, S362E Technical Data Sheet One Year Warranty (Including battery, firmware, and software) Certificate of Calibration and Conformance
	Optional Accessories
	Calibration Components, 50Ω
ICN50B	InstaCal™ Calibration Module, 38 dB, 2 MHz to 6.0 GHz, N(m), 50Ω
OSLN50-1	Precision Open/Short/Load, N(m), 42 dB, 6.0 GHz, 50Ω
OSLNF50-1	Precision Open/Short/Load, N(f), 42 dB, 6.0 GHz, 50Ω
2000-1618-R	Precision Open/Short/Load, 7/16 DIN(m), DC to 6.0 GHz 50Ω
2000-1619-R	Precision Open/Short/Load, 7/16 DIN(f), DC to 6.0 GHz 50Ω
22N50	Open/Short, N(m), DC to 18 GHz, 50Ω
22NF50	Open/Short, N(f), DC to 18 GHz, 50Ω
SM/PL-1	Precision Load, N(m), 42 dB, 6.0 GHz
SM/PLNF-1	Precision Load, N(f), 42 dB, 6.0 GHz
	Calibration Components, 75Ω
22N75	Open/Short, N(m), DC to 3 GHz, 75Ω
22NF75	Open/Short, N(f), DC to 3 GHz, 75Ω
26N75A	Precision Termination, N(m), DC to 3 GHz, 75Ω
26NF75A	Precision Termination, N(f), DC to 3 GHz, 75Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50Ω to 75Ω

Continued on next page

Model/Order No.	Name
	Phase-Stable Test Port Cables, Armored w/ Reinforced Grip (recommended for cable & antenna line sweep applications)
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - N(f), 50Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - N(f), 50Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
	Inter Changeable Adaptor Phase Stable Test Port Cables, Armored w/Reinforced Grip (recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the Reinforced grip series cables. Now you can also change the adaptor interface on the grip to four different connector types)
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50Ω
	Phase-Stable Test Port Cables, Armored (recommended for use with tightly spaced connectors and other general purpose applications)
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) - N(f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) - N(m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) - N(f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) - N(m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(m), 50Ω
	Adapters
1091-26-R	SMA(m) - N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) - N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) - N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) - N(f), DC to 18 GHz, 50Ω
1091-172-R	BNC(f) - N(m), DC to 1.3 GHz, 50Ω
510-90-R	7/16 DIN(f) - N(m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN(f) - N(f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN(m) - N(m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN(m) - N(f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN(m) - 7/16 DIN(m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN(f) - 7/16 DIN(f), DC to 7.5 GHz, 50Ω
1091-379-R	7/16 DIN(f) - 7/16 DIN(f), DC to 6 GHz, 50Ω, w/ Reinforced Grip
510-102-R	N(m) - N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
	Precision Adapters
34NN50A	Precision Adapter, N(m) - N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) - N(f), DC to 18 GHz, 50Ω
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA(m)
69793	CW Signal Generator Kit
2000-1374	External Charger for Li-Ion Batteries
2300-532	Map Master CD
2000-1652-R	GPS Antenna, SMA(m) with 1 foot cable
2000-1689	EMI Near Field Probe Kit
2000-1371-R	Ethernet Cable, 7 feet/213 cm
3-806-152	Cat 5e Crossover Patch Cable, 7 feet/213 cm)
2300-517	Phase Noise Measurement Software (requires Ethernet Option 0411)
633-75	8000 mAh High-capacity Battery Pack
2000-1653	Anti-glare Screen Cover (package of 2)

LMR MASTER™
S412E
500 kHz to 1.6 GHz

Land Mobile Radio Modulation Analyzer and Signal Analyzer, Vector Network Analyzer, Spectrum Analyzer

The S412E is Anritsu's second generation solution for installing and maintaining public safety systems. Built on Anritsu's ninth generation handheld platform, the S412E combines a high performance receiver/spectrum analyzer with the world's most advanced handheld vector network analyzer plus a powerful vector signal generator with internally adjustable power from 0 to –130 dBm.

Spectrum Analyzer Highlights
- Measurements: Occupied Bandwidth, Channel Power, ACPR, C/I, Coverage Mapping
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Mapping
- Optional 6 GHz Frequency Coverage
- Dynamic Range: >95 dB in 10 Hz RBW
- DANL: –152 dBm in 10 Hz RBW
- Phase Noise: –100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: 120 ppb standard (25°C ±25°C); <50 ppb after 3 minutes with GPS lock

VNA Analyzer Highlights
- Broadband coverage of 500 kHz to 1.6 GHz
- 1-path, 2-port Vector Network Analyzer (VNA) w/quad trace display
- Optional 6 GHz Frequency Coverage
- Intuitive Graphical User Interface (GUI) with convenient Touch Screen
- VNA-quality error correction for directivity and source match
- Outstanding calibration stability, up to 16 hours
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- 100 dB transmission dynamic range to 1.6 GHz
- 850 μs/data point sweep speed

Land Mobile Radio Signal Analyzer Highlights
- 500 kHz to 1.6 GHz frequency coverage
- Internal signal generator: 0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
- 2.0 dB signal generator accuracy (Typical)
- P25/P25p2, NXDN, and ETSI DMR BER test patterns including 1011 Hz, 1031 Hz, and O.153
- Analyzes Narrowband FM analog systems
- Analyzes P25 (TIA-102.CAAA-C), P25 Phase 2 (TIA-102.CCAA), DMR (MotoTRBO™), NXDN™, and ITC-R PTC digital systems
- Simultaneous analysis and generation of P25/NXDN/DMR2 test signals
- Independent control of both receive/transmit frequencies and test patterns

Capabilities and Functional Highlights
- 3 hour battery operation time
- Analog FM and digital LMR analyzer
- High accuracy internal power meter
- On-Screen Coverage Mapping (Outdoor and Indoor)
- Channel Scanner
- GPS tagging of saved traces
- USB Data Transfer
- <5 minute warm-up time
- 8.4 inch daylight-viewable TFT LCD color resistive touchscreen – allows use while wearing gloves
- Complies with MIL-PRF-28800 Class 2

Spectrum Analyzer Specifications

Measurements	Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m² or dBmV/m)
		Occupied Bandwidth (measures 99 to 1% power channel of a signal)
		Channel Power (measures the total power in a specified bandwidth)
		ACPR (adjacent channel power ratio)
		AM/FM/SSB Audio Demodulation (wide/narrow FM, AM, upper/lower SSB)
		C/I (carrier-to-interference ratio)
		Emission Mask
		Coverage Mapping (requires option 0431)
Setup Parameters	Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
	Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)
Sweep Functions	Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
	Detection	Peak, RMS, Negative, Sample, Quasi-peak
	Triggers	Free Run, External, Video, Change Position, Manual
Trace Functions	Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
	Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
	Trace B Operations	A → B, B ↔ C, Max Hold, Min Hold
	Trace C Operations	A → C, B ↔ C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale
Marker Functions	Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off
	Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker Marker Auto-Position Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
	Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude
Limit Line Functions	Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
	Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
	Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
	Limit Line Envelope	Create Envelope, Update Amplitude, Points (41 max.), Offset, Shape Square/Slope
	Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
Frequency	Frequency Range	100 kHz to 1.6 GHz, (6 GHz with Option 6)
	Tuning Resolution	1 Hz
	Tuning Resolution	±1.0 ppm/year
	Accuracy	120 ppb (25° ±25°C) + aging, <50 ppb + aging with GPS lock
	Frequency Span	100 Hz to 1.6 GHz including zero span (100 Hz to 6 GHz with Option 6)
	Sweep Time	100 ms, 10 µs to 600 seconds in zero span
	Sweep Time Accuracy	±2% in zero span
Bandwidth	Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ±10% (1 MHz max in zero-span) (–3 dB bandwidth)
	Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)
	RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
	VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
Spectral Purity	SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz typical @ 10 kHz offset
		–105 dBc/Hz, –112 dBc/Hz typical @ 100 kHz offset
		–115 dBc/Hz, –121 dBc/Hz typical @ 1 MHz offset
Amplitude Ranges	Dynamic Range	>95 dB (2.4 GHz), 2/3 (TOI-DANL) in 10 Hz RBW
	Measurement Range	DANL to +26 dBm
	Maximum Continuous Input	+33 dBm
	Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
	Reference Level Range	–120 to +30 dBm
	Attenuator Resolution	0 to 55 dB, 5.0 dB steps
	Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV
		Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW
Amplitude Accuracy (single sine wave input < Ref level, and > DANL, auto attenuation)	–10° to +50°C after 30 minute warm-up	Typical: ±0.5 dB, 100 kHz to 6 GHz
		Maximum: ±1.3 dB, 100 kHz to 6 GHz

Continued on next page

Displayed Average Noise Level (DANL)		Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
(RBW Normalized to 1 Hz, 0 dB attenuation)		Maximum	Typical	Maximum	Typical
	10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
	>2.4 GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
	>4 GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
	>5 GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
(RBW = 10 Hz, 0 dB attenuation)					
	10 MHz to 2.4 GHz	–131 dBm	–136 dBm	–147 dBm	–152 dBm
	>2.4 GHz to 4 GHz	–127 dBm	–131 dBm	–144 dBm	–149 dBm
	>4 GHz to 5 GHz	–124 dBm	–128 dBm	–140 dBm	–145 dBm
	>5 GHz to 6 GHz	–116 dBm	–121 dBm	–133 dBm	–140 dBm
Spurs	Residual Spurious	<–90 dBm (RF input terminated, 0 dB input attenuation, >10 MHz)			
	Input-Related Spurious	<–75 dBc (0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset >4.5 MHz)			
	Exceptions, typical	<–70 dBc @ <2.5 GHz, with 2072.5 MHz Input			
		<–68 dBc @ F1 – 280 MHz with F1 Input			
		<–70 dBc @ F1 + 190.5 MHz with F1 Input			
		<–52 dBc @ 7349 – 2F2 MHz, with F2 Input, where F2 <2424.5 MHz			
		<–55 dBc @ 190.5 ±F1/2 MHz, F1 <1 GHz			
Third-Order Intercept (TOI)	Preamp Off (–20 dBm tones 100 kHz apart, 10 dB attenuation)				
	800 MHz	+16 dBm			
	2400 MHz	+20 dBm			
	200 MHz to 2200 MHz	+25 dBm, typical			
	>2.2 GHz to 5.0 GHz	+28 dBm, typical			
	>5.0 GHz to 6.0 GHz	+33 dBm, typical			
Second Harmonic Distortion	Preamp Off, 0 dB input attenuation, –30 dBm input				
	50 MHz	–56 dBc			
	>50 MHz to 200 MHz	–60 dBc, typical			
	>200 MHz to 3000 MHz	–70 dBc, typical			
VSWR	2:1, typical				

Vector Network Analyzer

Definitions

- All specifications and characteristics apply under the following conditions, unless otherwise stated:
- After 15 minutes of warm-up time, where the instrument is left in the ON state.
- Temperature range is 25° ±5°C.
- All specifications apply when using internal reference.
- All specifications subject to change without notice. Please visit www.anritsu.com for most current datasheet.
- Typical performance is the measured performance of an average unit.
- Recommended calibration cycle is 12 months.

Frequency

- Frequency Range: 500 kHz to 1.6 GHz (500 kHz to 6.0 GHz with Option 16)
- Frequency Accuracy: 2.5 ppm
- Frequency Resolution: 1 Hz

Typical Test Port Power

LMR Master supports selection of either High (default) or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical power by bands is shown in the following table.

Frequency Range	High Port Power	Low Port Power
500 kHz to ≤3 GHz	+3 dB	–25 dBm
3 GHz to ≤6 GHz	0 dB	–25 dBm

Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 100 Hz IF Bandwidth and High Port Power is shown in the following table.

Frequency Range	Dynamic Range
2 MHz to ≤4 GHz	100 dB
4 GHz to ≤6 GHz	90 dB

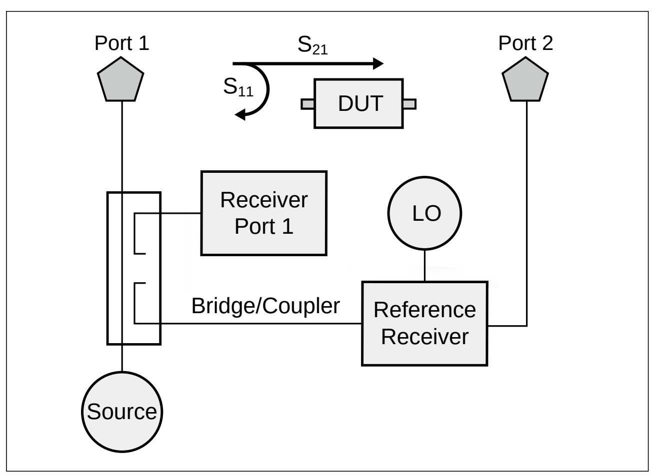
Typical Sweep Speed

The typical sweep speed for IF Bandwidth of 100 Hz, 1001 data points, and single display is shown in the following table. The two receiver architecture will simultaneously collect S_{21} and S_{11} (or S_{12} and S_{22}) in a single sweep.

Frequency Range	Typical Sweep Speed
500 kHz to 6 GHz	850 µs/point

Block Diagram

As shown in the following block diagram, the LMR Master has a 2-port, 1-path architecture that automatically measures 2 S-parameters with error-correction precision inherent to VNA operation.



The above illustration is a simplified block diagram of LMR Master's 2-port, 1-path architecture. The magnitude AND phase information gained from Vector Network data enables the LMR Master to make significant error corrections and provide improved field measurements.

Vector Network Analyzer

High Port Power

OSLxx50 Calibration Components (N-Connector) Corrected System Performance and Uncertainties:

S412E with 1-path, 2-port calibration including isolation using either OSLN50-1 & OSLNF50-1 Calibration Kits

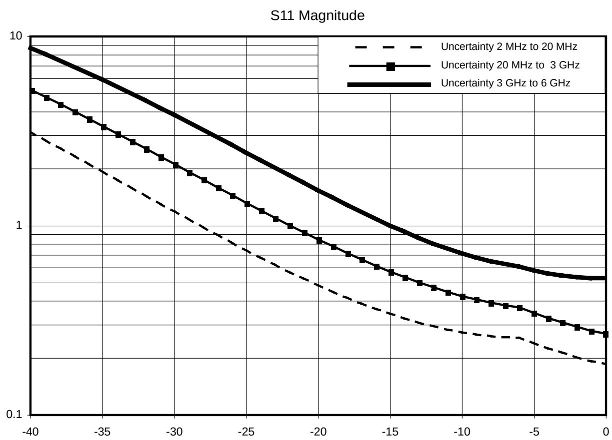
Frequency Range	Directivity
≤6 GHz	>42 dB

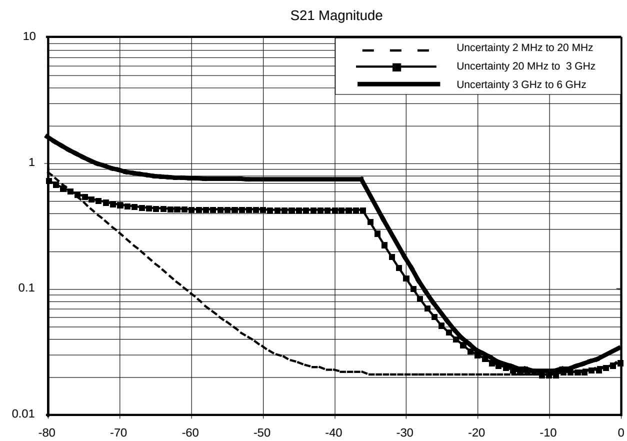
Frequency Range	Typical High Port Power
≤3 GHz	+3 dBm
≤6 GHz	0 dBm

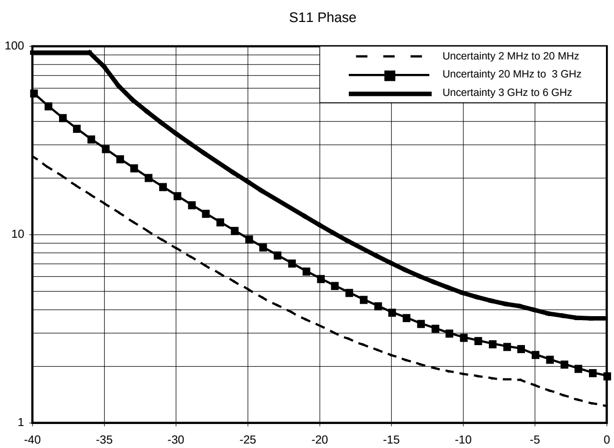
Precision calibration standards come in a convenient configuration for field work.

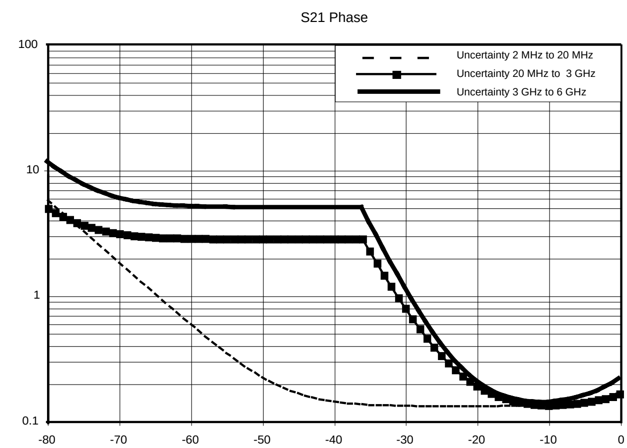
Measurement Uncertainties

The following graphs provide measurement uncertainty at 23° ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.









Vector Network Analyzer

Low Port Power

OSLxx50 Calibration Components (N-Connectors) Corrected System Performance and Uncertainties:

S412E with 1-path, 2-port calibration including isolation using either OSLN50-1 or OSLNF50-1 Calibration Kits.

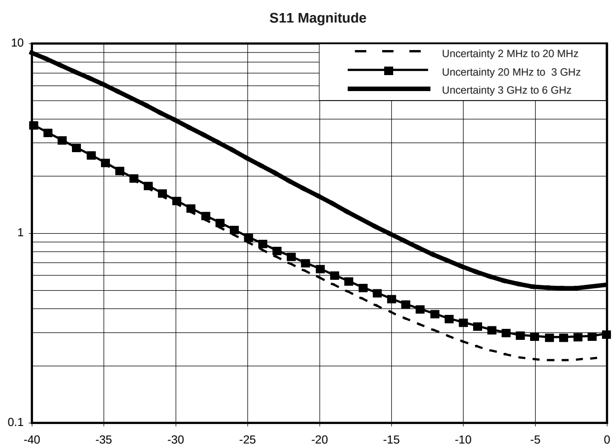
Frequency Range	Directivity
≤6 GHz	>42 dB

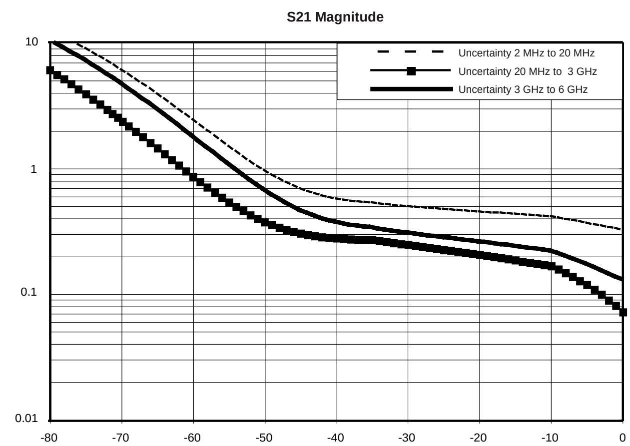
Frequency Range	Typical Low Port Power
≤3 GHz	–25 dBm
≤6 GHz	–25 dBm

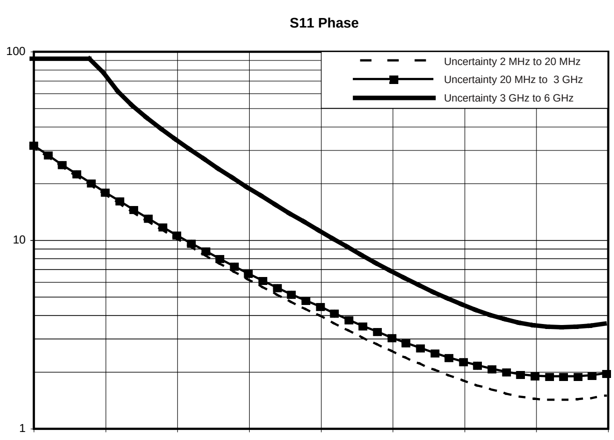
Precision calibration standards come in a convenient configuration for field work.

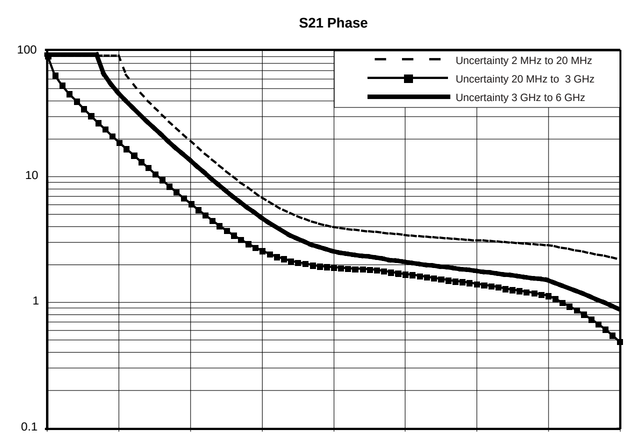
Measurement Uncertainties

The following graphs provide measurement uncertainty at 23° ±5°C for the above indicated connector type and calibration. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.







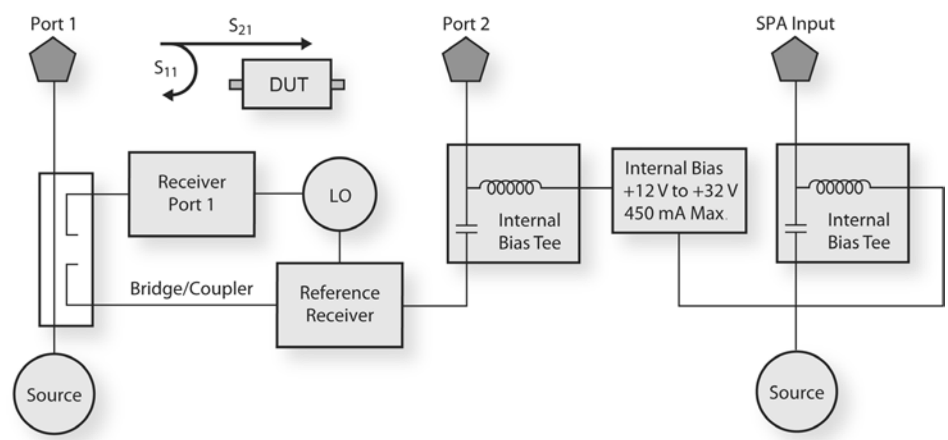


VNA Performance Capabilities

Bias Tee (Option 0010)

For tower mounted amplifier tests, the S412E with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements. For frequency sweeps in excess of 2 MHz, the LMR Master can supply internal voltage control from +12 V to +32 V in 0.1 V steps up to 450 mA. Bias can be directed to VNA Port 2.

Frequency Range	2 MHz to 4 GHz/6 GHz at VNA Port 2
Internal Voltage/Current	+12 V to +32 V at 450 ma. Steady state
Internal Resolution	0.1 V
Bias Tee Selections	Internal, Off



The Compact LMR Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram.

Vector Voltmeter (Option 0015)

A phased array system relies on phase matched cables for nominal performance. For this class of application, the LMR Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements. The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts. For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables.
The S412E solution is superior because the signal source is included internally, precluding the need for an external signal generator.

CW Frequency Range	2 MHz to 6 GHz
Measurement Display	CW, Table (Twelve Entries, Plus Reference)
Measurement Types	Return Loss, Insertion
Measurement Format	dB/VSWR/Impedance

Distance Domain (Option 0501)

Distance-to-Fault Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the Compact VNA Master exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify discontinuities. The Compact VNA Master converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements.
Option 0501 Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and so minimize or prevent downtime of the system.
Option 0501 Distance Domain also supports field measurements for optical fiber diagnostics. Anritsu Model ODTF-1 test module works directly with RF techniques and converts optical DTF signals to display on the VNA Master.

Maximum Distance (4001 data points, 1.6 GHz span)	374.9 m (1,229.9 ft)
Maximum Distance (4001 data points, 6.0 GHz span)	99.9 m (327.75 ft)
Minimum Distance Resolution (1.6 GHz span)	18.7 cm (7.36 in)
Minimum Distance Resolution (6.0 GHz span)	4.99 cm (1.97 in)
Measurement Display	Return Loss, VSWR
Measurement Format	dB, VSWR

Interference Analyzer (Option 0025)

Measurements	Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
	Spectrogram	Collect data up to one week
	Signal Strength	Gives visual and aural indication of signal strength
	Received Signal Strength Indicator (RSSI)	Collect data up to one week Gives visual and aural indication of signal strength
	Signal ID (up to 12 signals)	Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) >10 dB
	Interference Mapping	Triangulate location of interference with on display maps
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)	

GPS Receiver Option (Option 0031) (Antenna sold separately, P/N 2000-1528-R or 2000-1652-R)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy when GPS Antenna is connected	Spectrum Analyzer, Interference Analyzer, CW Signal Analyzers
	<50 ppb with GPS On, 3 minutes after satellite lock in selected mode
Connector	SMA, Female

Coverage Mapping (Options 0431)

Measurements	Indoor Mapping	RSSI ACPR
	Outdoor Mapping	RSSI ACPR
Setup Parameters	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
	Measurement Setup	ACPR, RSSI
	Point Distance/Time Setup	Repeat Type Time Distance
	Save Points Map	Save KML, JPEG, Tab Delimited
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

Channel Scanner (Option 0027)

Number of Channels	1 to 20 Channels
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Freq/Channel, Current/Max, Single/Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Accuracy	±10 Hz + Frequency Reference
Measurement Range	–110 to +26 dBm
Application Options	Bias-Tee (On/Off), Impedance (50Ω, 75Ω, Other)

Internal Power Meter

Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Full Band
Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	Acquisition Fast/Med/Slow, # of Running Averages
Limits	Limit On/Off, Limit Upper/Lower
Frequency Range	10 MHz to 1.6 GHz (S412E), 10 MHz to 6 GHz (Option 0006)
Span	1 kHz to 100 MHz
Display Range	–140 to +30 dBm, ≤40 dB span
Measurement Range	–120 to +26 dBm
Offset Range	0 to +100 dB
VSWR	2:1 typical
Maximum Power	Same as RF In Damage Level
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50Ω, 75Ω, Other)

High Accuracy Power Meter (Option 0019) (Requires external USB Power Sensor(s))

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale			
Average	# of Running Averages, Max Hold			
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)			
Limits	Limit On/Off, Limit Upper/Lower			
Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108/18/26A
Description	High Accuracy RF Power Sensor	Inline Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz (MA24108A) 10 MHz to 18 GHz (MA24118A) 10 MHz to 26 GHz (MA24126A)
Connector	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω	Type N(m), 50Ω (MA24108/18A) Type K(m), 50Ω (MA24126A)
Dynamic Range	–30 to +20 dBm (.001 mW to 100 mW)	+3 to +51.76 dBm (2 mW to 150 W)	–40 to +23 dBm (0.1 µW to 200 mW)	–40 to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB[*1]	±0.17 dB[*2]	±0.16 dB[*1]	±0.18 dB[*3]
Datasheet (for complete specifications)	11410-00414	11410-00483	11410-00424	11410-00504

*1: Total RSS measurement uncertainty (0° to 50°C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
*2: Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
*3: Expanded uncertainty with K=2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

CW Signal Generator

Setup Parameters	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Tx Pattern	CW, AM w/1 kHz, FM w/1 kHz
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15° to 35°C, –120 to 0 dBm) Typical
	Frequency Range	500 kHz to 1.6 GHz
	Frequency Accuracy	Same as Spectrum Analyzer

P25 Analyzer and P25 Talk-Out Coverage (Options 0521, 0522)

Measurements	P25 Analyzer (Option 0521)	Received Power Frequency Error Modulation Fidelity NAC (hex) Symbol Rate Error BER (1011 Hz, O.153, Voice, and Control Channel)
	P25 Talk-Out Coverage (Option 0522)	BER RSSI Modulation Fidelity
Graphs	P25 Analyzer (Option 0521)	Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display
	P25 Talk-Out Coverage (Option 0522)	Outdoor measured values are overlayed on a geo-tagged map, or displayed on a value vs. time graph, and are exportable to both KML and CSV text (Requires option 0031 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.
Setup Parameters	Frequency	Center Frequency
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	P25 Modulation Types: C4FM, CQPSK P25 BER patterns: 1011 Hz, O.153 (V.52), Voice, Control Channel P25 Phase 2 Modulation Types: CQPSK Base & Mobile Station P25 Phase 2 BER patterns: 1031 Hz, Silence, Voice, Control Channel
	Measurement	P25 Analyzer, P25 Coverage
	P25 Analyzer	Active Graph, Maximize Active Trace, Graph Type, Symbol Span
	Graph Type	Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary
	Symbol Span	2, 3, 4, 5
	P25 Coverage (Option 0522)	USB Memory File Format .p25, .kml, both Log data on/off
RF Measurements (Option 0521) (temperature range 15° to 35°C)	Received Power dBm	±1.25 dB, ±0.5 dB typical
	Frequency Error Hz	±10 Hz + Frequency Reference
	Modulation Fidelity %	
	BER/MER %	
	Symbol Deviation Hz	
	Network Access Code Hex	
	Symbol Rate Error MHz	
Measurements (Option 0522)	RSSI, BER, Mod Fid vs. Time Option 0522 requires Option 0031 GPS and a suitable GPS antenna	

Signal Generator

Setup Parameters	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	P25 Tx Pattern	P25: 1011 Hz, 1011 Hz Cal, Intfr, Silence, Busy, Idle, High Dev, Low Dev, O.153 (v. 52), CW, AM and FM
	P25p2 Tx Patterns	Base Station (Selectable timeslot): 1031 Hz, 1031 Hz Cal, Silence, CW, AM, FM Mobile Station (Selectable timeslot): 1031 Hz, 1031 Hz Cal, Silence, CW, AM, FM
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15° to 35°C, –120 to 0 dBm) Typical
	Frequency Range	500 kHz to 1.6 GHz
	Mod Fidelity	1.25% max., 0.75 typical
	Frequency Accuracy	Same as Spectrum Analyzer

DMR2 Analyzer and DMR2 Talk-Out Coverage (Options 0591, 0592)

Measurements	DMR2 Analyzer (Option 0591)	Received Power Frequency Error Modulation Fidelity Color Code (decimal) RX & TX Timeslot Symbol Rate Error Symbol Deviation BER Mobile Station: 1031 Hz, O.153, Voice, Silence, Idle and Control Channel Base Station: 1031 Hz, 1031 Hz 1% BER, O.153, O.153 1% BER, Silence, TSCC
	DMR2 Talk-Out Coverage (Option 0592)	BER RSSI Modulation Fidelity
Graphs	DMR2 Analyzer (Option 0591)	Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display
	DMR2 Talk-Out Coverage (Option 0592)	Outdoor measured values are overlayed on a geo-tagged map, or displayed on a value vs. time graph, and are exportable to both KML and CSV text (Requires option 0031 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.
Setup Parameters	Frequency	Center Frequency
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	Modulation Type (Base Station, Mobile Station), BER pattern (1031 Hz, O.153, Voice, Control Channel, Silence, Idle)
	Measurement	DMR2 Analyzer, DMR2 Coverage
	DMR2 Analyzer	Active Graph, Maximize Active Trace, Graph Type, Symbol Span
	Graph Type	Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary
	Symbol Span	2, 3, 4, 5
	DMR2 Coverage (Option 0592)	USB Memory File Format .dmr2, .kml, both Log data on/off
RF Measurements (Option 0591) (temperature range 15° to 35°C)	Received Power dBm	±1.25 dB, ±0.5 dB typical
	Frequency Error Hz	±10 Hz + Frequency Reference
	Modulation Fidelity %	
	BER/MER %	
	Symbol Deviation Hz	
	Color Code Decimal	
	Receive Timeslot	
	Transmit Timeslot	
	Symbol Rate Error MHz	
Measurements (Option 0592)	RSSI, BER, Modulation Fidelity	

Signal Generator

Setup Parameters	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Tx Pattern	(Selectable timeslot) 1031 Hz, O.153 (v. 52), Silence, 1031 Hz with 1% BER, O.153 (v. 52) with 1% BER, TSCC (only available in Base Station Modulation Type), CW, AM and FM
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15° to 35°C, –120 to 0 dBm) Typical
	Frequency Range	500 kHz to 1.6 GHz
	Mod Fidelity	1.25% max., 0.75 typical
	Frequency Accuracy	Same as Spectrum Analyzer

NXDN Analyzer and NXDN Talk-Out Coverage (Options 0531, 0532)

Measurements	NXDN Analyzer (Option 0531)	Received Power Frequency Error Modulation Fidelity RAN (hex) Symbol Rate Error Symbol Deviation BER (1031 Hz, O.153, Voice, and Control Channel)
	NXDN Talk-Out Coverage (Option 0532)	BER RSSI Modulation Fidelity
Graphs	NXDN Analyzer (Option 0531)	Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display
	NXDN Talk-Out Coverage (Option 0532)	Outdoor measured values are overlayed on a geo-tagged map and exportable to both KML and CSV text (Requires option 0031 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan.
Setup Parameters	Frequency	Center Frequency
	Amplitude	Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range
	Setup	Modulation Bandwidth (6.25 kHz and 12.5 kHz), BER pattern (1031 Hz, O.153, Voice, Control Channel)
	Measurement	NXDN Analyzer, NXDN Coverage
	NXDN Analyzer	Active Graph, Maximize Active Trace, Graph Type, Symbol Span
	Graph Type	Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary
	Symbol Span	2, 3, 4, 5
	NXDN Coverage (Option 0532)	USB Memory File Format .nxdn, .kml, both Log data on/off
RF Measurements (Option 0531) (temperature range 15° to 35°C)	Received Power dBm	±1.25 dB, ±0.5 dB typical
	Frequency Error Hz	±10 Hz + Frequency Reference
	Modulation Fidelity %	
	BER/MER %	
	Symbol Deviation Hz	
	Radio Access Number Hex	
	Symbol Rate Error MHz	
Measurements (Option 0532)	RSSI, BER, Mod Fid vs. Time	

Signal Generator

Setup Parameters	Mod Bandwidth	6.25 kHz, 12.5 kHz
	Generator	On/Off
	Tx Output Level	0.1 dB resolution, 0 to –130 dBm (spec to –120 dBm)
	Tx Pattern	1031 Hz, O.153 (v. 52), High Dev, Low Dev, UDCH Pattern 10, CAC, 1031 Hz DTS, FACCH3 DTS, Framed PN9, CW, AM, FM
RF Characteristics	Power Level Accuracy	2.0 dB (CW Pattern, temperature range 15° to 35°C, –120 to 0 dBm) Typical
	Frequency Range	500 kHz to 1.6 GHz
	Mod Fidelity	1.25% max.
	Frequency Accuracy	Same as Spectrum Analyzer

AM/FM/PM Signal Analyzers (Option 0509)

Measurements							
	RF Spectrum AM/FM/PM	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied Bandwidth	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD*1 THD*1 Distortion/Total Vrms*1	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD*1 THD*1 Distortion/Total Vrms*1	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD*1 THD*1 Distortion/Total Vrms*1	FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD*1 THD*1 Distortion/Total Vrms*1	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD*1 THD*1 Distortion/Total Vrms*1	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD*1 THD*1 Distortion/Total Vrms*1

Setup Parameters	Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq
	Amplitude	Scale, Power Offset, Adjust Range
	Setup	Demod Type (AM, FM, PM), IFBW, Auto IFBW
	Measurements	RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average
	Marker	On/Off, Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table, All Markers Off
Specifications	AM	Modulation Rate: ±1 Hz (<100 Hz), ±2% (>100 Hz) Depth: ±5% for (Modulation rates 10 Hz to 100 kHz)
	FM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (100 Hz to 100 kHz)*2
	PM	Modulation Rate: ±1 Hz (<100 Hz); ±2% (100 Hz to 100 kHz) Deviation Accuracy: ±5% (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz)*2
	IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence
	Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz
	RBW/VBW	30
	Span/RBW	100
	Sweep time	50 µs to 50 ms (Audio Waveform)

*1: Requires Sinewave modulation
*2: IFBW must be greater than 95% occupied BW

LTE Signal Analyzers (Options 0541, 0542, 0546)

Measurements			
RF (Option 0541)	Modulation (Option 0542)	Over-the-Air (OTA) (Option 0546)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth ACLR RF Summary Spectral Emission Mask Category A or B (Opt 1)	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization %, Channel Power, Cell ID OSTP, Frame EVM by modulation Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH, PHICH, PDCCH Total Power (Table View) EVM Modulation Results Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1/2)	Scanner Cell ID (Group, Sector) S-SS Power, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS Power, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power RS EVM SS, P-SS, S-SS Power SS, P-SS, S-SS EVM PBCH Power PBCH EVM PCFICH Power PCFICH EVM PHICH Power, EVM PDCCH Power, EVM Cell, Group, Sector ID OSTP Tx Time Alignment

Setup Parameters	Frequency	E-UTRA bands 1 – 5, 7 – 14, 17 – 21, 23 – 25 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Bandwidth	1.4, 3, 5, 10, 15, 20 MHz
	Span	1.4, 3, 5, 10, 15, 20, 30 MHz
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Quality
RF Measurements (Option 0541) (requires Option 0031)	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +10 dBm) (Option 0541) ±1.5 dB, ±1.0 dB typical, (RF input –30 to +10 dBm) (Option 0551)
Modulation (Option 0542) (requires Option 0031)	Frequency Error	±10 Hz + time base error, 99% confidence level
	Residual EVM (rms)	2.0% typical (E-UTRA Test Model 3.1, RF Input –50 to +10 dBm) for BW ≤10 MHz 2.5% typical (E-UTRA Test Model 3.1, RF Input –50 to +10 dBm) for BW >10 MHz
Over-the-Air (OTA) Measurements (Option 0546) (requires Option 0031)	Scanner	Six strongest signals if present Auto Save — Sync Signal Power and Modulation Results with GPS tagging
	Auto Save	Scanner — three strongest signals if present RS Power — strongest signal
	Mapping	Map On-screen S-SS Power, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner — three strongest signals if present Save and Export Scanner data: *.kml, *.mtd (tab delimited)

IEEE 802.16 Fixed WiMAX Signal Analyzers (Options 0046, 0047)

Measurements			
RF (Option 0046)	Demodulation (Option 0047)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor ACPR	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID	There are no additional OTA Measurements. RF Measurements and Demodulation can be made OTA	Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Base Station ID

Setup Parameters	Bandwidth	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00 MHz
	Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
	Span	5, 10, 15, 20 MHz
	Frame Length	2.5, 5.0, 10.0 msec
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0046) (temperature range 15° to 35°C)	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
Demodulation (Option 0047) (temperature range 15° to 35°C)	Frequency Error	0.07 ppm + time base error, 99% confidence level
	Residual EVM (rms)	3% typical, 3.5% maximum (RF Input –50 to +20 dBm)

IEEE 802.16 Mobile WiMAX Signal Analyzers (Options 0066, 0067, 0037)

Measurements			
RF (Option 0066)	Demodulation (Option 0067)	Over-the-Air (OTA) (Option 0037)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power Uplink Burst Power ACPR	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID DL-MAP (Tree View)	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID	Channel Power Occupied Bandwidth Downlink Bust Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID

Setup Parameters	Zone Type	PUSC
	DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
	Bandwidths	3.50, 5.00, 7.00, 8.75, 10.00 MHz
	Cyclic Prefix Ratio (CP)	1/8
	Span	5, 10, 20, 30 MHz
	Frame Lengths	5, 10 msec
	Demodulation	Auto, Manual, FCH
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
	Sweep	Single/Continuous, Trigger Sweep
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements (Option 0066) (temperature range 15° to 35°C)	RF Channel Power Accuracy	±1.5 dB, ±1.0 dB typical, (RF input –50 to +20 dBm)
Demodulation (Option 0067) (temperature range 15° to 35°C)	Frequency Error	0.02 ppm + Frequency Reference, 99% confidence level
	Residual EVM (rms)	2.5% typical, 3.0% maximum, (RF Input –50 to +20 dBm)
Over-the-Air (OTA) Measurements (Option 0037)	Channel Power Monitor	Over time (one week), measurement time interval 1 to 60 sec
	Preamble Scanner	Six Strongest Preambles
	Auto Save	Yes
	GPS Logging	Yes

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters	System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
	System Options	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
	File	Save, Recall, Delete, Directory Management
	Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
	Delete	Selected File, All Measurements, All Mode Files, All Content
	Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
	Internal Trace/Setup Memory	2,000 traces, 2,000 Setups
	External Trace/Setup Memory	Limited by size of USB Flash drive
	Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode
Connectors	VNA Port 1, VNA Port 2, RF In, Signal Gen	Type N, female, 50Ω
	VNA Port 1 Damage Level	23 dBm, ±50 VDC
	RF In	Type N, female, 50Ω
	RF In Damage Level	+33 dBm peak, ±50 VDC, Maximum Continuous Input (≥10 dB attenuation)
	GPS	SMA(f)
	External Power	5.5 mm barrel connector, 12.5 VDC to 15 VDC, <4.0 Amps
	USB Interface (2)	Type A, Connect USB Flash Drive and Power Sensor
	USB Interface	5-pin mini-B, Connect to PC for data transfer
	Headset Jack	3.5 mm mini-phone plug
	External Reference In	BNC, female, 50Ω, Maximum Input +10 dBm 1 MHz, 5 MHz, 10 MHz, 13 MHz
	External Trigger/Clock Recovery	BNC, female, 50Ω, Maximum Input ±50 VDC
Display	Type	Resistive Touchscreen
	Size	8.4” daylight viewable color LCD
	Resolution	800 × 600
Battery	Type	Li-Ion, 6300 mAh rated capacity
	Battery Operation	3.0 hours, typical
Electromagnetic Compatibility	European Union	CE Mark, EMC Directive 2004/108/EC Low Voltage Directive 2006/95/EC
	Australia and New Zealand	C-tick N274
	Interference	EN 61326-1
	Emissions	EN 55011
	Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11
Safety	Safety Class	EN 61010-1 Class 1
	Product Safety	IEC 60950-1 when used with Company supplied Power Supply
Environmental	Temperature	–10° to +55°C (Operating), –40° to +71°C (Storage)
	Maximum Humidity	95% RH (non-condensing) at 40°C
	Shock	MIL-PRF-28800F Class 2
	Altitude	4600 meters, operating and non-operating
ESD	RF Port Center Pin	Withstands up to ±15 kV
Dimensions and Mass	Dimensions	273 × 199 × 91 mm (10.7 × 7.8 × 3.6 in)
	Mass	3.6 kg (7.9 lbs)

Master Software Tools (for your PC)

Database Management	Full Trace Retrieval	Retrieve spectrum analyzer traces from instrument into one PC directory
	Trace Catalog	Index all traces into one catalog
	Trace Rename Utility	Rename measurement traces
	Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
	DAT File Converter	Converts HHST files to MST file format and vice-versa
Data Analysis	Trace Math and Smoothing	Compare multiple traces
	Data Converter	Convert from/to Return Loss, VSWR, Cable Loss, DTF and also into Smith Charts
	Measurement Calculator	Translates into other units
Report Generation	Report Generator	Includes GPS, power level, and calibration status along with measurements
	Edit Graph	Change scale, limit lines, and markers
	Report Format	Create reports in HTML for PDF format
	Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
	Notes	Annotate measurements
Mapping (GPS Required)	Spectrum Analyzer Mode	MapInfo, MapPoint
Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)	Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
	Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
	Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List/Parameter Editors	Traces	Add, delete, and modify limit lines and markers
	Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
	Product Updates	Auto-checks Anritsu website for latest revision firmware
	Firmware Upload	Upload new firmware into the instrument
	Languages	Add up to two languages and modify non-English language menus
	Display	Modify display settings
Script Master™	Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
	GSM/GPRS/EDGE or W-CDMA/HSDPA Mode	Automate Signal Analysis testing requirements with annotated how-to pictures
Connectivity	Connections	Connect to PC using USB
	Download	Download measurements and live traces to PC for storage and analysis
	Upload	Upload measurements from PC to instrument
	Firmware Updates	Create USB Flash Drive for firmware update

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
S412E	500 kHz to 1.6 GHz Vector Network Analyzer 100 kHz to 1.6 GHz Spectrum Analyzer 10 MHz to 1.6 GHz Power Meter 10 MHz to 1.66 GHz NBFM Analyzer 500 kHz to 1.6 GHz CW Signal Generator
	Options
S412E-0010	High Voltage Variable Bias Tee
S412E-0501	Distance Domain
S412E-0031	GPS Receiver (requires Antenna P/N 2000-1528-R)
S412E-0019	High-Accuracy Power Meter (requires External Power Sensor)
S412E-0025	Interference Analyzer (Option 0031 recommended)
S412E-0027	Channel Scanner
S412E-0006	6 GHz Coverage on Spectrum Analyzer
S412E-0016	6 GHz Coverage on Vector Network Analyzer
S412E-0015	Vector Voltmeter
S412E-0431	Coverage Mapping[*1]
S412E-0509	AM/FM/PM Analyzer
S412E-0521	P25 Analyzer Measurements
S412E-0522	P25 Coverage Measurements[*2]
S412E-0591	DMR2 Analyzer Measurements
S412E-0592	DMR2 Coverage Measurements[*3]
S412E-0531	NXDN Analyzer Measurements
S412E-0532	NXDN Coverage Measurements[*4]
S412E-0541	LTE RF Measurements[*1]
S412E-0542	LTE Modulation Quality[*1]
S412E-0546	LTE Over-the-Air Measurements[*1]
S412E-0046	IEEE 802.16 Fixed WiMAX RF Measurements[*1]
S412E-0047	IEEE 802.16 Fixed WiMAX Demodulation[*1]
S412E-0066	IEEE 802.16 Mobile WiMAX RF Measurements[*1]
S412E-0067	IEEE 802.16 Mobile WiMAX Demodulation[*1]
S412E-0037	IEEE 802.16 Mobile WiMAX Over-the-Air Measurements[*1]
S412E-0098	Standard Calibration (ANSI 2540-1-1994)
S412E-0099	Premium Calibration to Z540 plus test data
S412E-0721	PTC Analyzer
S412E-0722	PTC Coverage Measurements[*5]

Model/Order No.	Name
	Power Sensors (For complete ordering information see the respective datasheets of each sensor)
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor,10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
	Manuals (soft copy included on Handheld Document Disc and at www.anritsu.com)
10920-00060	Handheld Instruments Documentation Disc
10580-00318	LMR Master User Guide (Hard copy included)
10580-00289	Vector Network Analyzer Measurement Guide
10580-00244	Spectrum Analyzer Measurement Guide • Interference Analyzer, Channel Scanner, Gated Sweep, CW Signal Generator, AM/FM/PM Analyzer, Interference Mapping, Coverage Mapping
10580-00234	3GPP Signal Analyzer Measurement Guide • GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00243	Land Mobile Radio Measurement Guide
10580-00240	Power Meter Measurement Guide • High Accuracy Power Meter
10580-00319	Programming Manual

∗1: Requires Option 0031
∗2: Requires Options 0031 and 0521
∗3: Requires Options 0031 and 0591
∗4: Requires Options 0031 and 0531
∗5: Requires Options 0031 and 0721

Continued on next page

Model/Order No.	Name
	Troubleshooting Guides
	(soft copy at www.anritsu.com)
11410-00551	Spectrum Analyzers Field Users Guide
11410-00472	Interference Troubleshooting Guide
11410-00566	LTE eNode Testing Troubleshooting Guide
	Standard Accessories (included with instrument)
10920-00060	Handheld Instruments Documentation Disc
10580-00318	LMR Master User Guide (includes Bias-Tee, GPS Receiver)
2000-1654-R	Soft Carrying Case
2300-498	Master Software Tools (MST) CD Disc
633-44	Rechargeable Li-Ion Battery
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter Adapter
3-2000-1498	USB A/5-pin mini-B Cable, 10 feet/305 cm
11410-00486	LMR Master S412E Technical Data Sheet, One Year Warranty (Including battery, firmware, and software), Certificate of Calibration and Conformance
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) DVD Disc
	Optional Accessories
	Directional Antennas
2000-1411-R	822 MHz to 900 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1517-R	600 MHz to 21 GHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic
	Portable Antennas
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1487	Telescoping Whip Antenna, BNC
	Filters
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50Ω
1030-149-R	High Pass, 150 MHz, N(m) to N(f), 50Ω
1030-150-R	High Pass, 400 MHz, N(m) to N(f), 50Ω
1030-151-R	High Pass, 700 MHz, N(m) to N(f), 50Ω
1030-152-R	Low Pass, 200 MHz, N(m) to N(f), 50Ω
1030-153-R	Low Pass, 550 MHz, N(m) to N(f), 50Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50Ω
	Attenuators
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

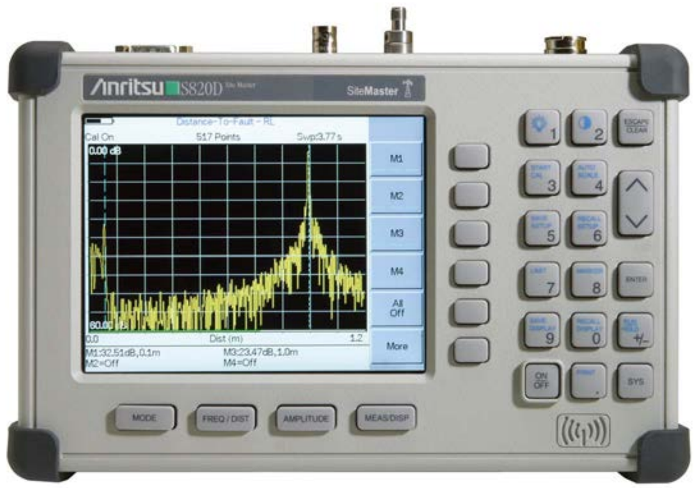
Model/Order No.	Name
	Phase-Stable Test Port Cables, Armored w/ Reinforced Grip
	(recommended for cable & antenna line sweep applications)
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to N(f), 50Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to N(f), 50Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50Ω
	Phase-Stable Test Port Cables, Armored
	(recommended for use with tightly spaced connectors and other general purpose applications)
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(f), 50Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(m), 50Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(f), 50Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(m), 50Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(f), 50Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(m), 50Ω
	Adapters
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50Ω
510-102-R	N(m) to N(m), DC to 11 GHz, 50Ω, 90 degrees right angle
510-90-R	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50Ω
510-91-R	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50Ω
510-92-R	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50Ω
510-93-R	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50Ω
510-96-R	7/16 DIN(m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97-R	7/16 DIN(f) to 7/16 DIN (f), DC to 7.5 GHz, 50Ω
1091-379-R	Tuff-Grip TMA Bypass Adapter, 7/16 DIN(f) - 7/16 DIN(f), DC to 6 GHz, 50Ω
	Precision Adapters
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50Ω
	Backpack and Transit Case
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle
	Miscellaneous Accessories
2000-1528-R	GPS Antenna, SMA(m) with 15 ft cable
2000-1652-R	GPS Antenna, SMA(m) with 1 ft cable
633-44	Extra Rechargeable Li-Ion Battery
2000-1374	External Charger for Li-Ion Batteries
2300-532	Map Master CD
2000-1653	Protective Screen Cover (Package of 2)
633-75	Extra Extended Capacity Rechargeable 7500 mAh Battery Pack
66864	Rack Mount Kit, Master Platform
	Calibration Components
OSLN50-1	Precision Open/Short/Load, N(m), 42 dB, 6.0 GHz, 50Ω
OSLNF50-1	Precision Open/Short/Load, N(f), 42 dB, 6.0 GHz, 50Ω
22N50	Open/Short, N(m), DC to 18 GHz, 50Ω
22NF50	Open/Short, N(f), DC to 18 GHz, 50Ω
SM/PL-1	Precision Load, N(m), 42 dB, 6.0 GHz, 50Ω
SM/PLNF-1	Precision Load, N(f), 42 dB, 6.0 GHz, 50Ω

CABLE AND ANTENNA ANALYZER

S810D/S820D Broadband SiteMaster

2 MHz to 20 GHz

The Leading Handheld Broadband Microwave Transmission Line & Antenna Analyzer



Anritsu's handheld, battery-operated Broadband Site Master is the most accurate and convenient tool available for field installation, verification, troubleshooting and repair of microwave cables and communication systems. With calibrated vector error correction and a convenient user interface, difficult test specifications become easy to verify, quality is improved, and maintenance expenses are reduced. The Broadband Site Master serves microwave site installers, point-to-point operators, point-to-multipoint operators, radio manufacturers, private/public networks that support microwave links for the installation and maintenance of microwave cables. The Broadband Site Master tests both waveguide and coaxial cables more conveniently than laboratory-sized scalar analyzers or microwave vector network analyzers.

Enhanced Performance and Functionality

The Broadband Site Master offers the following improvements over the preceding model:

- Increased frequency range to cover 2 MHz to 20 GHz with a single connection
- New CW source module for true two-port cable loss measurements of long cables operating up to 20 GHz
- New smoothing feature improves accuracy of cable loss measurements
- Added capability to support user-defined calibration kits: two coaxial and two waveguide kits
- Increase in speed of power monitor measurements by 4x
- Simplified calibration routine with more messages and added support for the new T-Calibration components (OSLK50, OSLN50, Cal Kits)
- Enhanced calibration support for TNC cables

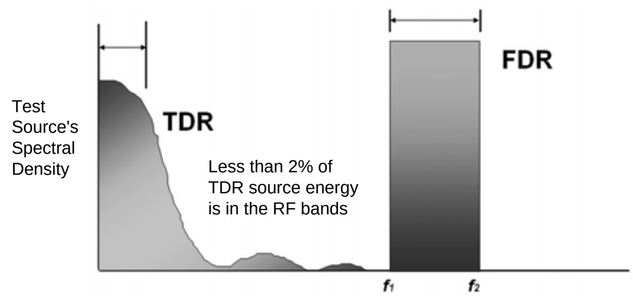
Cost Savings and Quality Improvement

Market competition requires operators to reduce per site maintenance expenses. Site Master's Frequency Domain Reflectometry (FDR) technique breaks away from the traditional fix-after-failure maintenance process by finding small, hard to identify problems before major failures occur.

Sixty to eighty percent of a typical cell site's problems are caused by problematic cables, connectors and antennas. Cables installed in aircraft and on-board ships are difficult to troubleshoot and can cause extensive down time. When cables are damaged, mis-positioned, or contaminated with moisture, Site Master identifies the problem quickly. Antenna degradation reduces the cell coverage pattern. Site Master can pinpoint the antenna problem from ground level quickly so climbing the antenna tower becomes unnecessary.

FDR Technique

Frequency Domain Reflectometry (FDR) and Time Domain Reflectometry (TDR) have similar acronyms, and both techniques are used to test transmission lines, but that's where the similarities end. The TDR technique is not sensitive to RF problems. The TDR stimulus is a DC pulse, not RF. Thus, TDR is unable to detect system RF degradations that often lead to system failures. The FDR technique saves costly, time-consuming trouble shooting efforts by testing cable feedline and antenna systems at their proper operating frequency. Deficient connectors, lightning arrestors, cables, jumpers, or antennas are replaced before call quality is compromised.



DC Pulse versus Frequency Sweep

The FDR approach in Site Master can detect faults earlier than TDR because RF spectral density is concentrated in the band-of-interest between f_1 and f_2.

Insightful and Convenient Measurements

Site Master performs various RF measurements aimed at simplifying transmission line and antenna system analysis: Return Loss, SWR, Cable Loss, and Distance-to-Fault (DTF). A single soft key selection on the main menu activates the desired measurement mode.

- **Return Loss, SWR**

Return Loss and SWR measurements ensure conformance to system performance specifications. The measurement can easily be toggled between either one of the two parameters, and can be performed without climbing the tower.

• Cable Loss Measurements Using 1-Port Approach
Cable Loss measurements determine the level of insertion loss within the cable feedline system. Insertion loss can be verified prior to deployment, when you have access to both ends of the cable, or on installed cables without access to the opposite end. Smoothing feature can improve accuracy.

• Distance-to-Fault
Although a Return Loss test can tell users the magnitude of signal reflections, it cannot tell the precise location of a fault within the cable system. A Distance-to-Fault measurement provides the clearest indication of trouble areas as it gives both the magnitude of signal reflection and the location of the signal anomaly.

• Vector Error Correction
Vector error correction within the S8x0D Series improves the quality and convenience of measurements compared to traditional scalar techniques. Accuracy and repeatability are enhanced as errors such as test port match and source match are corrected out.

• Waveguide Dispersion and Calibration
Vector error correction using FDR improves the quality of Distance-to-Fault data. Not only is the reflection magnitude more accurate, but the waveguide dispersion correction for fault location (different frequencies propagate at different speeds in waveguide) is more accurate and repeatable. Unlike scalar-based systems, the Broadband Site Master S8x0D Series does not suffer reflection magnitude errors and length inaccuracies in proportion to the relative lengths of the coaxial input cable and waveguide under test.

• Coaxial Connections
Site Master supports frequently used coaxial connectors such as K, N, and TNC.

Optional Features

• Low Frequency Extension (S8x0D/2) (Option 02)
The standard Broadband Site Master spans 25 MHz to 10.5 GHz or 20 GHz in a single coaxial connection. The start frequency can optionally extend down to 2 MHz for handheld frequency coverage from 2 MHz to 10.5 GHz or 20 GHz.
With this extended frequency range, the Broadband Site Master offers a unique capability to test a wide range of cables and antennas in the field where access to AC power is limited or non-existent. As an alternative, Option 2 is also bundled with the CW Source of Option 22 for 2-port measurements.

• Power Monitor (S8x0D/5) (Option 05)
When cable losses or physical distances are too much for a one-port measurement or option S8x0D/22xF, an external synthesizer can be used as a source and Option 5 with a 560 Series RF Detector as receiver to perform thru-line insertion loss measurements. These high precision detectors significantly help minimize mismatch uncertainty with detector flatness better than 0.5 dB up to 18 GHz. The Power Monitor also features:

- Measurement range (–50 to +20 dBm)
- Display range (–80 to +80 dBm)
- Display formats: absolute power (dBm or Watts) and relative power (dB or %).
- Built-in auto averaging automatically reduces noise effects.
- Zeroing allows optimum measurement accuracy at low power levels

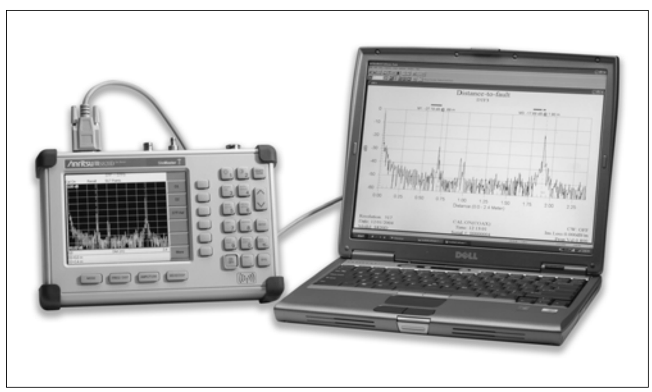
• GPS Receiver (S8x0D/31) (Option 31)
GPS provides location information (latitude, longitude, altitude) and Universal Time (UT) information. Site Master can stamp each trace with location information to check if the measurements are taken at the right location. Site Master stores the GPS location information until the unit is turned off. This stored location information can be used to stamp traces taken indoors at the same cell site location. The GPS option includes a magnet mount antenna with a 15 foot (~ 5 m) cable to mount on the car or other useful surface.

• 2-Port Cable Loss (S8x0D/22xF)
Using the standard 1-port approach, accurate cable loss measurements up to 10 dB are achievable, but the round trip loss of 20 dB is easy to exceed at higher frequencies. A CW source is needed when cable loss exceeds 10 dB. The Broadband Site Master offers an optional CW source with power monitor capability for conducting higher accuracy cable loss measurements in the field.
In this approach, the CW source provides swept frequency coverage (same frequency range as the Broadband Site Master) with the 560 Series RF Detectors as the receiver. The external CW Source Module only supports the 2-Port Cable Loss measurement where the display shows swept cable loss versus frequency for a true 2-Port Cable Loss measurement.

Use 2-port Cable Loss to conduct precise cable measurements of lossy microwave cables.

Handheld Software Tools

Each Broadband Site Master ships with a test assistant: a copy of Anritsu's Handheld Software Tools for Windows® 2000/XP. This allows an operator to add the processing capabilities of a PC and this software utility to the S8x0D to form a powerful and flexible measurement solution.



Connect the S8x0D to a PC via a serial (null modem) cable to transfer data or further analyze results.

Specifications

The specifications on the following pages describe the warranted performance of the instrument at 23°C ±3°C when the unit is calibrated with the appropriate coaxial calibration kit for the built-in test port connector. A warm-up time of fifteen minutes should be allowed prior to verifying system specifications. Performance parameters denoted as "typical" indicate non-warranted specifications.

Frequency Range	25 MHz to 20000 MHz (S820D) 25 MHz to 10500 MHz (S810D)
Frequency Accuracy (Fixed CW On)	≤3 ppm at +25°C
Frequency Resolution	10 kHz (100 kHz for Distance-to-Fault)
Output Power (from RF Out Port)	<0 dBm (at any particular frequency)
Immunity to Interfering Signals	On-channel: +13 dBm On-frequency: –10 dBm
Measurement Speed	Return Loss, SWR, DTF: ≤2 sec/sweep for 517 data points (CW ON) ≤4 sec/sweep for 517 data points (CW OFF)
Number of Data Points	130, 259, 517
Return Loss	Range: 0.00 to 60.00 dB Resolution: 0.01 dB
VSWR	Range: 1.00 to 65.53 Resolution: 0.01
Coax/Waveguide (1-port) Insertion Loss	Range: 0.00 to 30.00 dB Resolution: 0.01 dB
Measurement Accuracy	≥42 dB corrected directivity after calibration for <5 GHz ≥36 dB corrected directivity after calibration for <15 GHz ≥32 dB corrected directivity after calibration for >15 GHz (see uncertainty curves) (with option 11NF, the accuracy is only specified up to 18 GHz)
Distance-to-Fault	Vertical range Return loss: 0.00 to 60 dB VSWR: 1.00 to 65.53 Horizontal range: 0 to (# of data points – 1) × Horizontal Resolution to a maximum of 1197m (3929 ft), # of data points = 130, 259, 517 Horizontal resolution Coaxial Cable (Rectangular windowing): $\frac{(1.5 \times 10^8)(V_p)}{\Delta F}$ Where V_p is the cable's relative propagation velocity Where ΔF is the stop frequency minus the start frequency (in Hz) Waveguide: $\frac{1.5 \times 10^8 (\sqrt{1-(F_C/F_1)^2})}{\Delta F}$ Where F_C is waveguide cutoff frequency (in Hz); F_1 is the start frequency (in Hz), ΔF is the stop frequency minus the start frequency (in Hz)
Test Port Connector	Precision K (f) or N (f) (Option 11NF)

• Low Frequency Extension (S8x0D/2) (Option 02)

Frequency Range	2 MHz to 20000 MHz (S820D) 2 MHz to 10500 MHz (S810D) (All other specs remain the same as standard S8x0D)

• 2-Port Cable Loss (S8x0D/22xF)

CW Source Module (CWM220B-xF)	Frequency range: 2 MHz to 20000 MHz (with S820D) 2 MHz to 10500 MHz (with S810D) Frequency accuracy: ≤3 ppm at 25°C Max power at RF out port: +15 dBm, maximum (typically >–10 dBm) Ports CWM220B-NF: N (f), ±15 VDC, +20 dBm, maximum input, no damage CWM220B-SF: SMA (f), ±15 VDC, +20 dBm, maximum input, no damage
2-Port Cable Loss Measurement	Detector Range: –50 to +20 dBm, 10 nW, 100 mW Display Range: –60 to +60 dBm Resolution: 0.1 dB Measurement Accuracy (following a calibration; accuracy only specified from 0 to 30 dB): ±0.85 dB, maximum for <10 dB cable loss ±1.35 dB, maximum for <30 dB cable loss (using 560-7S50B from 10 MHz to 20 GHz or 560-7N50B from 10 MHz to 18 GHz)

• GPS Location Indicator (S8x0D/31) Includes GPS Antenna

GPS Location Indicator (S8x0D/31)	Latitude, Longitude, Altitude, and Universal Time on display Latitude, Longitude, Altitude, and Universal Time on trace storage
Ports Added to S8x0D	Reverse BNC (m), 50 Ω for use with GPS antenna only

• General

<table>
<tr><td colspan="2">Language Support</td><td colspan="2">Chinese, English, French, German, Japanese, and Spanish</td></tr>
<tr><td colspan="2">Internal Trace Memory</td><td colspan="2">Up to 200 traces</td></tr>
<tr><td colspan="2">Setup Configurations</td><td colspan="2">21</td></tr>
<tr><td colspan="2">Custom Cable Configuration Memory</td><td colspan="2">Up to 200 configurations</td></tr>
<tr><td colspan="2">Display</td><td colspan="2">TFT color display with adjustable backlight</td></tr>
<tr><td colspan="2">Ports</td><td colspan="2">RF Out
Standard Type K (f) test port, 50Ω: +23 dBm (Peak), ±50 VDC, Maximum input without damage
Optional (S8x0D/11NF) Type N (f) test port, 50Ω: +23 dBm (Peak), ±50 VDC, Maximum input without damage
Serial Interface
9 pin D-sub: RS-232 three wire serial</td></tr>
<tr><td colspan="2">CE</td><td colspan="2">Electromagnetic Compatibility: Meets European Community requirement EN61326-1: 1998
Safety: Meets European Community requirement EN61010-1: 2001</td></tr>
<tr><td rowspan="4">Environment Condition and Status (MIL-PRF-28800F, Class 2)</td><td rowspan="2">Temperature/ Humidity</td><td>Operating</td><td>–10° to +55°C, humidity 85% or less</td></tr>
<tr><td>Non-operating</td><td>–51° to +71°C (recommend storing battery separately between 0° to +40°C for any prolonged non-operating storage period)</td></tr>
<tr><td rowspan="2">Mechanical</td><td>Vibration</td><td>Sine (5 Hz to 55 Hz); Random (10 Hz to 500 Hz)</td></tr>
<tr><td>Shock</td><td>30G, 11 msec, half sine</td></tr>
<tr><td colspan="2">Power Supply</td><td colspan="2">External: DC input: 12 Volt to 15 Volt DC, 5 A
Internal: NiMH battery: 10.8 Volts, 1800 mAh</td></tr>
<tr><td colspan="2">Dimensions and Mass</td><td colspan="2">254 (W) × 178 (H) × 61 (D) mm (10.0 × 7.0 × 2.4 in), <2.28 kg (<5 lbs) including battery</td></tr>
</table>

∗1: Qualified by similarity (tested on a similar product)
∗2: Not defined in standard; must be invoked and defined by purchase description
∗3: Not required for Class 2 equipment

Ordering Information

Please specify the model/order number, name and quantity when ordering.

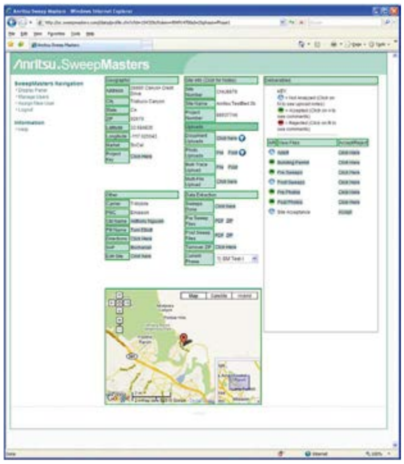
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Basic Models
S810D	Cable and Antenna Analyzer (25 MHz to 10.5 GHz) with built-in DTF, K (f) Test Port Connector
S820D	Cable and Antenna Analyzer (25 MHz to 20 GHz) with built-in DTF, K (f) Test Port Connector
	Standard accessories
10680-00001	Site Master S810D/S820D User's Guide
2300-347	Anritsu Handheld Software Tools CD-ROM
48258	Soft Carrying Case
633-27	Rechargeable NiMH Battery
34RKNF50	Precision Adapter, Ruggedized K (m) to N (f) (not included when option 11NF is ordered)
40-168	AC/DC Adapter
806-141	Automotive Cigarette Lighter/12 Volt Adapter
800-441	Serial Interface (Null Modem) Cable
551-1691-R	USB to RS-232 Adapter Cable
	Options
S8x0D/2	2 MHz Low Frequency Extension
S8x0D/5	Power Monitor (detector not included)
S8x0D/11NF	Replaces Standard K (f) Test Port Connector with N (f)
S8x0D/22SF	SMA 2-Port Cable Loss includes the following bundled items: CWM220B-SF, SMA (f) CW Source Module 560-7S50B, WSMA (m) RF Detector S8x0D/5, Power Monitor 66379, DIN to D-sub adapter cable for Power Monitor S8x0D/2, 2 MHz Low Frequency Extension
S8x0D/22NF	N (f) 2-Port Cable Loss includes the following bundled items: CWM220B-NF, N (f) CW Source Module 560-7N50B, N (m) RF Detector S8x0D/5, Power Monitor 66379, DIN to D-sub adapter cable for Power Monitor S8x0D/2, 2 MHz Low Frequency Extension
S8x0D/31	GPS Receiver (includes 2000-1410 GPS antenna)

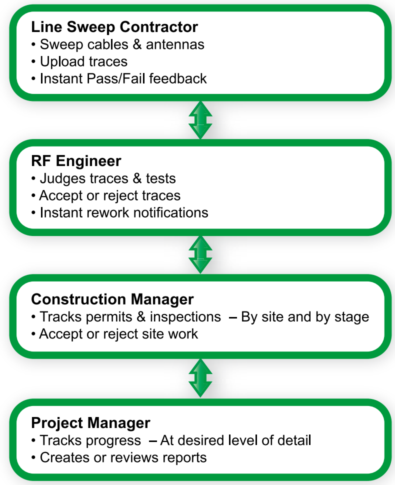
Model/Order No.	Name
	Coaxial Calibration Components
	K Connectors
22K50	Precision K (m) Short/Open, 40 GHz
22KF50	Precision K (f) Short/Open, 40 GHz
28K50	Precision Termination, DC to 40 GHz, 50Ω, K (m)
28KF50	Precision Termination, DC to 40 GHz, 50Ω, K (f)
15KKF50-1.5A	Armored Test Port Cable, 1.5 m K (m) to K (f) 20 GHz
15RKKF50-1.5A	Ruggedized Armored Test Port Cable, 1.5 m, K (m) to K (f) 20 GHz
OSLK50	Precision integrated Open/Short/Load K (m), DC to 20 GHz, 50 Ω
OSLKF50	Precision Open, Short, Load, DC to 20 GHz, K(f), 50 Ω
	N-Type Connectors
22N50	Precision N (m) Short/Open, 18 GHz
22NF50	Precision N (f) Short/Open, 18 GHz
28N50-2	Precision Termination, DC to 18 GHz, 50Ω, N (m)
28NF50-2	Precision Termination, DC to 18 GHz, 50Ω, N (f)
15NNF50-1.5B	Armored Test Port Cable, 1.5 m, N (m) to N (f) 18 GHz
42N50-20	5 W Attenuator, N (m) to N (f), 18 GHz
OSLN50	Precision Integrated Open/Short/Load N (m), DC to 18 GHz, 50 Ω
OSLNF50	Precision Open, Short, Load, DC to 18 GHz, N(f), 50 Ω
	TNC Connectors
1015-54	TNC Termination (f), 18 GHz
1015-55	TNC Termination (m), 18 GHz
1091-53	TNC Open (m), 18 GHz
1091-54	TNC Short (m), 18 GHz
1091-55	TNC Open (f), 18 GHz
1091-56	TNC Short (f), 18 GHz
	Adapters
34RKNF50	Precision Adapter, Ruggedized K (m) to N (f)
34NN50A	Precision N (m) to N (m) Adapter, 18 GHz
34NFNF50	Precision N (f) to N (f) Adapter, 18 GHz
K220B	Precision Adapter, K (m) to K (m), 40 GHz
K222B	Precision Adapter, K (f) to K (f), 40 GHz
1091-26	Adapter, N (m)-SMA (m), DC to 18 GHz, 50Ω
1091-27	Adapter, N (m)-SMA (f), DC to 18 GHz, 50Ω
1091-80-R	Adapter, N (f)-SMA (m), DC to 18 GHz, 50Ω
1091-81-R	Adapter, N (f)-SMA (f), DC to 18 GHz, 50Ω
513-62	Adapter, TNC (f) to N (f), 18 GHz, 50Ω
1091-315	Adapter, TNC (m) to N (f), 18 GHz, 50Ω
1091-324	Adapter, TNC (f) to N (m), 18 GHz, 50Ω
1091-325	Adapter, TNC (m) to N (m), 18 GHz, 50Ω
1091-317	Adapter, TNC (m) to SMA (f), 18 GHz, 50Ω
1091-318	Adapter, TNC (m) to SMA (m), 18 GHz, 50Ω
1091-323	Adapter, TNC (f) to TNC (f), 18 GHz, 50Ω
1091-326	Adapter, TNC (m) to TNC (m), 18 GHz, 50Ω
	Optional accessories
760-243-R	Transit Case with Wheels
760-245	Transit Case for Microwave Site Master
2000-1029	Battery Charger (External)
2000-1410	Magnet Mount GPS Antenna with 15 ft. cable
	Optional extender cables
800-109	Detector Extender Cable, 7.6 m (25 ft)
800-111	Detector Extender Cable, 30.5 m (100 ft)
	Manuals
10680-00001	Site Master S810D/S820D User's Guide
10680-00002	Site Master S810D/S820D Programming Manual
10680-00003	Site Master S810D/S820D Maintenance Manual
	Related literature, application notes
11410-00214	Reflectometer Measurements – Revisited
11410-00206	Time Domain
11410-00270	What is Your Measurement Accuracy?
11410-00185	Distance-To-Fault

SWEEP MASTER™ WEB-BASED LINE SWEEP AND DOCUMENT TRACKING TOOLS
MX829000A/MX829001A

Capture, Verify, Manage, and Report - Cable, Antenna, and PIM Traces Plus Track Build-out Documentation



Anritsu Sweep Masters Cell Site Profile



Project Test and Documentation Flow

What is Sweep Master?

If you are a prime contractor, hiring line sweep contractors for large multi-site installation and maintenance projects, you need Sweep Master. Sweep Master is a web-based line sweep and documentation tracking tool tailored to your needs. Measurements tracked include:

- Return Loss
- Cable Loss
- Distance-to-Fault
- Transmission Measurements
- PIM
- Distance-to-PIM

Sweep Master increases the productivity of tracking these traces with

- Auto file upload and renaming
- Auto marker and limit line placement
- Auto red/green pass/fail trace flagging

Sweep Master has a basic offering, Sweep Master Pro, and a full featured offering, Sweep Master Pro+.

Sweep Master Pro

Capture and Verify

Sweep Master Pro enables an engineer or manager to capture the cable, antenna, and PIM traces that are uploaded by contractors or field technicians. Sweep Master Pro will automatically place marker and limit lines and apply pass/fail criteria for all traces with red/green flagging for quick project review status.

Sweep Master Pro+

Capture and Verify, Manage, and Report

Sweep Master Pro+ starts with the Pro capabilities and adds build management, document management, and reporting abilities.
The Pro+ simplifies construction and project management, shortens rework time, and dramatically eases reporting tasks.

Why use Sweep Master?

New tower builds, or modifications to the cables and antennas on existing cellular towers, often require five or more different types of sweeps per cable. Multiply these five tests by the number of cables being installed on a tower (often between 6 and 26) and it is quite possible to generate more than 130 traces per tower.
Getting all of these traces processed and evaluated properly can be a time consuming, error prone task. In many cases, it takes twice as long to prepare the final report as it does to sweep the cables and antennas in the first place. What takes all this time?

- Physically getting the traces back to the office for processing
- Renaming traces from field names to final names, a step required by older sweep gear
- Dealing with missing or mislabeled traces
- Checking the settings of markers and limit lines and resetting them if needed.
- Making sure that the sweeps really did pass
- Dealing with any needed rework
- Printing a PDF or electronic trace based report

Currently, some network operators are requiring reports within 24 hours of the time the work is done, adding to the urgency of the report processing work.

Sweep Master Pro Capabilities

Capturing Traces with Sweep Master

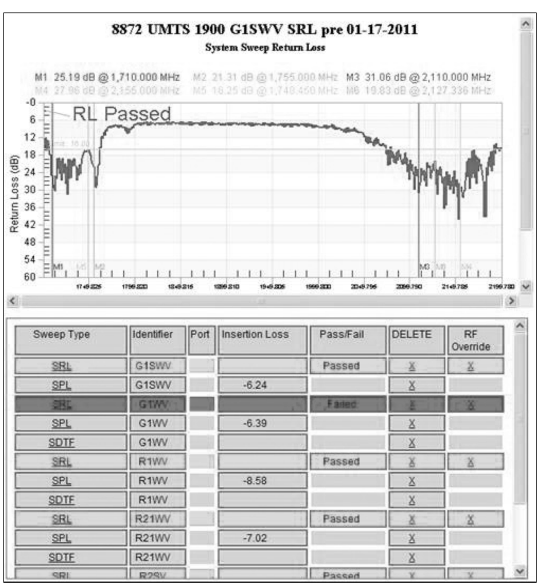
The Sweep Master Pro captures cable, antenna, and PIM traces from both before and after the site work is done. The Sweep Master Pro:

- Allows bulk upload of cable, antenna, and PIM traces
  - Upload all traces for a site in a few minutes.
  - This means that users need not manually identify each trace to the software.
- Automatically converts field name to final names
  - Converts a short, predefined, work site name to final file, trace title, and sub-title names
  - Sweep Master saves hours per site, considering that hundreds of file names, trace titles and trace subtitles are involved for each tower.

Verifying Traces with Sweep Master

- Automatically sets markers and limit lines to customer's standards
  - Ensures that markers and limit lines are set to the network operators' standard before submittal
  - Ensures that pass/fail judgments are accurate.
- Accept/Reject tools for trace reviewers
  - Red/Green Sweep pass/fail indication
  - Trace review capability
  - Trace notes
  - Automatic notifications for sweep test personnel
  - Quicker rework time

The bulk upload capability can upload hundreds of traces in seconds.



Pass/Fall judgements simplify trace review.

Site Access Instructions

- Hospital Locations
- Key contacts
- Access instructions

These capabilities create efficiency and increase quality by cutting the hours needed to create a sweep report by 75% or more while at the same time ensuring that the information is processed accurately and consistently. This can lower the over all cost of the project and ensure a high quality product. This is working smarter, not harder.

The Site Profile includes a map and access instructions

Sweep Master Pro+

The Pro+ has all the site access, trace capture and verification capabilities of the Pro, plus enhanced document capture capabilities, extensive project management capabilities, and complete reporting capabilities.

Document Capture

In addition to trace capture and verification, the Pro+ can capture build documents such as:

- "As-built" drawings
- Site work photos
- Permits
- Work orders
- Structural analysis
- Other required documents as needed

Manage

Since every document and trace has its place, indexed by type, project stage, and site, it is easy to keep track of project progress. It is also easy to spot missing documents. Designated decision makers can accept or reject individual traces, documents, or the entire site. Everyone with access, including build crews, has visibility of these actions and may even be notified by e-mail. Automatic notifications allow rework to start quickly and reduces overall project time.

The Pro+ allows construction managers or RF engineers to:

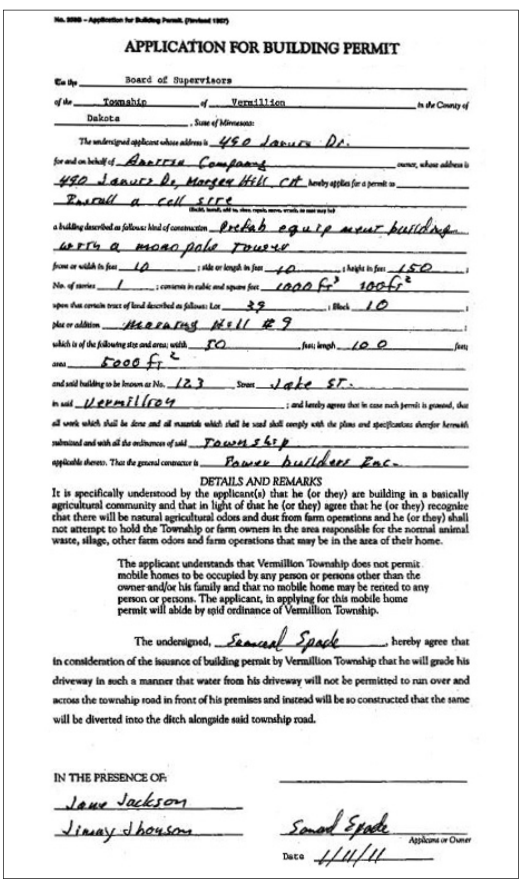
- Keep current on the build progress
- Approve or reject documents and traces by construction phase and site
- Give or withhold site acceptance
- Communicate decisions immediately to build crews
- Choose automatic e-mail notifications of events

Report

Files can be extracted as zipped (compressed) package, allowing long-term storage of documentation in an organized manner. The "Turnover Zip" function allows creation of a site turnover package with one button press. This is were the organization created during the previous stages really pays off! The turn over report is formatted to network operator standards, so report acceptance should never be an issue.

- One button turnover report generation
- Network Operator acceptable format
- Creates reports from current site information
- Reports segregated by construction phase, site, and project

The Pro+ has enhanced document capture capabilities and makes tracking traces and documents easy.



APPLICATION FOR BUILDING PERMIT

To the Board of Supervisors of the Township of Vermillion in the County of Dakota, State of Minnesota:

The undersigned applicant whose address is 490 Janura Dr. for and on behalf of Anritsu Company owner, whose address is 490 Janura Dr, Morgan Hill CA hereby applies for a permit to Install a cell site a building described as follows: kind of construction Prefab equipment building with a monopole tower

front or width in feet 10; side or length in feet 10; height in feet 150;
No. of stories 1; contents in cubic and square feet 1000 ft³ 100ft²
upon that certain tract of land described as follows: Lot 39; Block 10;
plat or addition Morgan Hill #9;
which is of the following size and area; width 50 feet; length 100 feet;
area 5000 ft²
and said building to be known as No. 123 Street Jake St.
in said Vermillion; and hereby agrees that in case such permit is granted, that all work which shall be done and all materials which shall be used shall comply with the plans and specifications therefor herewith submitted and with all the ordinances of said Township applicable thereto. That the general contractor is Power builders Inc.

DETAILS AND REMARKS

It is specifically understood by the applicant(s) that he (or they) are building in a basically agricultural community and that in light of that he (or they) agree that he (or they) recognize that there will be natural agricultural odors and dust from farm operations and he (or they) shall not attempt to hold the Township or farm owners in the area responsible for the normal animal waste, silage, other farm odors and farm operations that may be in the area of their home.

The applicant understands that Vermillion Township does not permit mobile homes to be occupied by any person or persons other than the owner and/or his family and that no mobile home may be rented to any person or persons. The applicant, in applying for this mobile home permit will abide by said ordinance of Vermillion Township.

The undersigned, Samuel Spade, hereby agree that in consideration of the issuance of building permit by Vermillion Township that he will grade his driveway in such a manner that water from his driveway will not be permitted to run over and across the township road in front of his premises and instead will be so constructed that the same will be diverted into the ditch alongside said township road.

IN THE PRESENCE OF:
Jane Jackson
Jimmy Thomson

Samuel Spade
Applicant or Owner
Date 1/11/11

Building permits, traces, and other construction documentation are part of the turnover package.

Customization

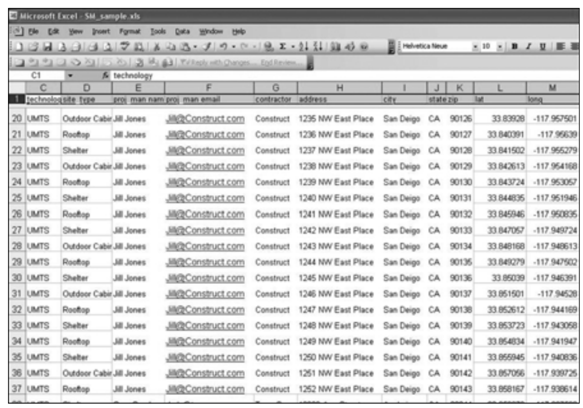
Since each tower build is unique, Sweep Master is customized to each build. Items that may be customized include:

- Tests to be Uploaded
- Number of Cables Per Site
- Color Codes
- Market Specific Final File Naming Conventions
- Pass/Fail Criteria
- Frequency Ranges for Sweeps
- Settings for Markers
- Project Phases
- Report Formats
- Site Locations
- Site Access Data

The per-site information is normally provided by the network operator in the form of a spread sheet. Other information is by means of a Method of Procedure (MOP), e-mail, or other documentation method.

Instruments

Anritsu's handheld instruments, including the Site Master, Spectrum Master, Cell Master, and BTS Master, all produce Cable, Antenna or PIM traces capable of being uploaded into the Sweep Masters domain.



Microsoft Excel - SM_sample.xls

	C	D	E	F	G	H	I	J	K	L	M
1	technolog	site type	proj man nam	proj man email	contractor	address	city	state	zip	lat	long
20	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1235 NW East Place	San Deigo	CA	90126	33.83928	-117.957501
21	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1236 NW East Place	San Deigo	CA	90127	33.840391	-117.95639
22	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1237 NW East Place	San Deigo	CA	90128	33.841502	-117.955279
23	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1238 NW East Place	San Deigo	CA	90129	33.842613	-117.954168
24	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1239 NW East Place	San Deigo	CA	90130	33.843724	-117.953057
25	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1240 NW East Place	San Deigo	CA	90131	33.844835	-117.951946
26	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1241 NW East Place	San Deigo	CA	90132	33.845946	-117.950835
27	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1242 NW East Place	San Deigo	CA	90133	33.847057	-117.949724
28	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1243 NW East Place	San Deigo	CA	90134	33.848168	-117.948613
29	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1244 NW East Place	San Deigo	CA	90135	33.849279	-117.947502
30	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1245 NW East Place	San Deigo	CA	90136	33.85039	-117.946391
31	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1246 NW East Place	San Deigo	CA	90137	33.851501	-117.94528
32	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1247 NW East Place	San Deigo	CA	90138	33.852612	-117.944169
33	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1248 NW East Place	San Deigo	CA	90139	33.853723	-117.943058
34	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1249 NW East Place	San Deigo	CA	90140	33.854834	-117.941947
35	UMTS	Shelter	Jill Jones	Jill@Construct.com	Construct	1250 NW East Place	San Deigo	CA	90141	33.855945	-117.940836
36	UMTS	Outdoor Cabir	Jill Jones	Jill@Construct.com	Construct	1251 NW East Place	San Deigo	CA	90142	33.857056	-117.939725
37	UMTS	Rooftop	Jill Jones	Jill@Construct.com	Construct	1252 NW East Place	San Deigo	CA	90143	33.858167	-117.938614

Site data is often delivered in the form of a spread sheet.

Anritsu instrumentation works with Sweep Masters.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Description
MX829000A	Anritsu Sweep Masters Pro services for one year Site and work information is required before fulfillment
MX829001A	Anritsu Sweep Masters Pro+ services for one year Site and work information is required before fulfillment
	Options
MX829000A-0901	1 Year Renewal

VNA
Calibration Kits

For Performing Precise Calibrations of Vector Network Analyzers

3753R


3651

The Anritsu Calibration Kits contain all the precision components and tools required to calibrate your VNA for 12-term error-corrected measurements in the connector style of your choice. Components are included for calibrating male and female test ports as required. The kits support calibration with opens, shorts, an broadband loads. Option 1 adds sliding terminations and a pin depth gauge where required.

3650A SMA/3.5 mm Calibration Kit consisting of:
- 34ASF50-2 Female Adapter (2)
- 33SFSF50 Female-Female Adapter (2)*
- 33SS50 Male-Male Adapter*
- 28S50-2 Broadband Male Termination (2)
- 28SF50-2 Broadband Female Termination (2)
- 33SSF50 Male-Female Adapter (2)*
- 24S50 Male Open
- 24SF50 Female Open
- 23S50 Male Short
- 23SF50 Female Short
- 34AS50-2 Male Adapter (2)
- Connector Thumb Wheel (4)
- 01-201 Torque Wrench
- 01-210 Reference Flat
- 01-222 Pin Depth Gauge
- 01-223 Pin Depth Gauge
- Calibration coefficients media

Option 1 adds the following:
- 01-212 Female Flush Short
- 01-211 Male Flush Short
- 17SF50 Female Sliding Termination
- 17S50 Male Sliding Termination

3651 GPC-7 Calibration Kit consisting of:
- 28A50-2 Broadband Termination (2)
- 24A50 Open
- 23A50 Short
- 01-200 Torque Wrench
- 01-221 Collet Extractor Tool and 4 Collets
- Calibration coefficients diskette

Option 1 adds the following:
- 17A50 Sliding Termination
- 01-210 Reference Flat
- 01-220 Pin Depth Gauge

3652A K Connector® Calibration Kit consisting of:
- 34AKF50 Female Adapter (2)
- 33KFKF50B Female-Female Adapter (2)*
- 33KK50B Male-Male Adapter*
- 28K50 Broadband Male Termination (2)
- 28KF50 Broadband Female termination (2)
- 33KKF50B Male-Female Adapter (2)*
- 24K50 Male Open
- 24KF50 Female Open
- 23K50 Male Short
- 23KF50 Female Short
- 34AK50 Male Adapter (2)
- 01-201 Torque Wrench
- 01-210 Reference Flat
- 01-222 Pin Depth Gauge
- 01-223 Pin Depth Gauge
- Calibration coefficients media
- Connector thumb wheel (4)

Option 1 adds the following:
- 17KF50 Female Sliding Termination
- 17K50 Male Sliding Termination
- 01-212 Female Flush Short
- 01-211 Male Flush Short

3653 Type N Calibration Kit consisting of:
- 23NF50 Female Short
- 23N50 Male Short
- 24NF50 Female Open
- 24N50 Male Open
- 28N50-2 Broadband Male Termination (2)
- 28NF50-2 Broadband Female Termination (2)
- 34AN50-2 Male Adapter (2)
- 34ANF50-2 Female Adapter (2)
- 01-213 Reference Gauge
- 01-224 Pin Depth Gauge
- Calibration coefficients diskette

3654D V Connector® Calibration Kit consisting of:
- 23V50B-5.1 Male Short 5.1 mm
- 23VF50B-5.1 Female Short 5.1 mm
- 24V50B Male Open
- 24VF50B Female Open
- 28V50B Male Broadband Termination (2)
- 28VF50B Female Broadband Termination (2)
- 17VF50B Female Sliding Termination
- 17V50B Male Sliding Termination
- 33VV50B Male-Male Adapter*
- 33VFVF50B Female-Female Adapter (2)*
- 33VVF50B Male-Female Adapter (2)*
- Calibration coefficients diskette
- Connector thumb wheel (4)
- 01-201 Torque Wrench
- 01-210 Reference Flat
- 01-322 Pin Depth Gauge
- 01-323 Female Adapter for pin gauge
- 01-204 Adapter Wrench
- 01-312 Male Flush Short
- 01-311 Female Flush Short

3655 Series Waveguide Calibration Kit

The 3655 Series Calibration Kit contains all of the precision components and tools required to calibrate your VNA for 12-term error-corrected measurements of test devices with the appropriate waveguide designation. Components are included for calibrating both module ports. The kit supports calibration with offset shorts and broadband loads. Option 1 adds a sliding termination.

Consisting of:
- Short, Flush (2)
- Offsets, 1/8 and 3/8 Wavelength
- Terminations, Fixed (2)
- Test Port Sections (2)

Option 1 adds the following:
- Sliding Termination

3656B W1 Calibration/Verification Kit consisting of:
- 23W50-1 Male Offset Short (2.02 mm)
- 23W50-2 Male Offset Short (2.65 mm)
- 23W50-3 Male Offset Short (3.180 mm)
- 24W50 Male Open (1.510 mm)
- 28W50 Male Broadband Termination
- 23WF50-1 Female Offset Short 1 (2.02 mm)
- 23WF50-2 Female Offset Short 2 (2.65 mm)
- 23WF50-3 Female Offset Short 3 (3.180 mm)
- 28WF50 Female Broadband Termination
- 24WF50 Female Open (1.930 mm)
- 33WSC50 Fixed Male SC Connector
- 33WFSC50 Fixed Female SC Connector
- Interchangeable Sliders, SC Connectors
- Locking Keys, SC Connectors
- 01-402 Interchange Adapter Fixed Male
- 33WWF50 Male-Female Adapter
- 33WW50 Male-Male Adapter
- 33WFWF50 Female-Female Adapter
- 01-504 6 mm Torque Wrench
- 01-505 6-7 mm End Wrench
- 18WWF50-1B Stepped Impedance Thruline (Verification Device)
- 18WWF50-1 50Ω Matched Thruline (Verification Device)
- Calibration coefficients diskette

The following kits are for use with MS462XX Scorpion VNAs.

3750R SMA/3.5 mm 9 GHz Calibration Kit consisting of:
- 23LF50 Female Short
- 23L50 Male Short
- 24LF50 Female Open
- 24L50 Male Open
- 28L50R Male Termination (2)
- 28LF50R Female Termination (2)
- 01-204 Adapter wrench
- Calibration coefficients diskette

3751R GPC-7 9 GHz Calibration Kit consisting of:
- 23A50 Short
- 24A50 Open
- 28A50R Termination (2)
- Calibration coefficients diskette

3753R Type N 9 GHz Calibration Kit consisting of:
- 23NF50 Female Short
- 24NF50 Female Open
- 24N50 Male Open
- 28NF50R Female Termination (2)
- 28N50R Male Termination (2)
- 23N50 Male Short
- Calibration coefficients diskette

3753-75R 75Ω Type N 3 GHz Calibration Kit consisting of:
- 23N75-3 Male Short
- 23NF75-3 Female Short
- 24N75-3 Male Open
- 24NF75-3 Female Open
- 28N75-3 Male Termination (2)
- 28NF75-3 Female Termination (2)
- 34NN75-3 Male-Male Adapter
- 34NNF75-3 Male-Female Adapter
- 34NFNF75-3 Female-Female Adapter
- Calibration coefficients diskette

VNA
Verification Kits

For Confirming Accuracy of Vector Network Analyzers

3669B

The Anritsu Verification Kits contain precision components with characteristics that are traceable to NIST. Used primarily by the metrology laboratory, these components provide the most dependable means of determining the system accuracy of your VNA. A disk containing factory measured test data for all components is supplied for comparison with customer-measured data.

3663 Type N Verification Kit consisting of:
- 42N-50, 50 dB Attenuator
- 18N50-10, 10 cm Airline
- 42N20, 20 dB Attenuator
- 18N50-10B, 10 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3666 SMA/3.5 mm Verification Kit consisting of:
- 19S50-7, 7.5 cm Airline
- 19SF50-7B, 7.5 cm Stepped Impedance Airline (Beatty standard)
- 42S-50, 50 dB Attenuator
- 42S-20, 20 dB Attenuator
- Verification kit disks

3667 GPC-7 Verification Kit consisting of:
- 42A-50, 50 dB Attenuator
- 18A50-10, 10 cm Airline
- 42A-20, 20 dB Attenuator
- 18A50-10B, 10 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3668 K Connector® Verification Kit consisting of:
- 19K50-7, 7.5 cm Airline
- 42K-50, 50 dB Attenuator
- 42K-20, 20 dB Attenuator
- 18K50-7B, 7.5 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3669B V Connector® Verification Kit consisting of:
- 42V-40, 40 dB Attenuator
- 42V-20, 20 dB Attenuator
- 19V50-5, 5 cm Airline
- 18V50-5B, 5 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

W1 (1.0 mm) Verification Components are included in W1 Calibration kit and Verification Kit (3656). See previous section for details.

The following kits are for use with MS462XX Scorpion VNAs.

3663R Type N 9 GHz Verification Kit consisting of:
- 42N-50, 50 dB Attenuator
- 42N20, 20 dB Attenuator
- 42NOP-20 N Mismatch attenuator
- Verification kit disks

3666R SMA/3.5 mm 9 GHz Verification Kit consisting of:
- 42L-50, 50 dB Attenuator
- 42L-20, 20 dB Attenuator
- 42LOP-20 SMA/3.5 mm Mismatch Attenuator
- Verification kit disks

3667R GPC-7 9 GHz Verification Kit consisting of:
- 42A-50, 50 dB Attenuator
- 42A-20, 20 dB Attenuator
- 42AOP-20 GPC-7 Mismatch Attenuator
- Verification kit disks

NETWORK ANALYZER

MS4630B

10 Hz to 300 MHz

Remote Control
GPIB

For Fast Evaluation of IF Filters and Resonators

The MS4630B is targeted at production lines demanding fast and accurate measurements of electronic devices.
It is perfect for accurate high-speed evaluation of IF filter resonance and group delay characteristics, as well as for evaluating the impedance characteristics of resonators in AV equipment and personal computers.
High-speed synthesizer and DSP technologies offer speeds of 150 µs per measurement point and post-processing data analysis functions have been strengthened by improved macros for greatly increased total production throughput.
The dynamic range has been improved to 120 dB (RBW: 1 kHz).
In addition sweep conditions are easily set by adding the optional List Sweep function or by using PTA software.
While weight has been dramatically cut too.

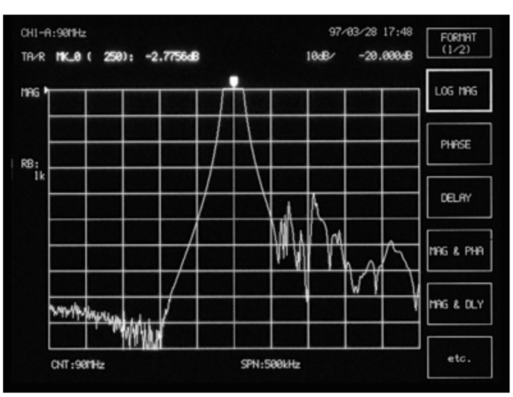
Features

- High-speed evaluation of IF filters, Resonators, etc.
- Greatly increased production/inspection capacity

Performance and Functions

• Wide Dynamic Range

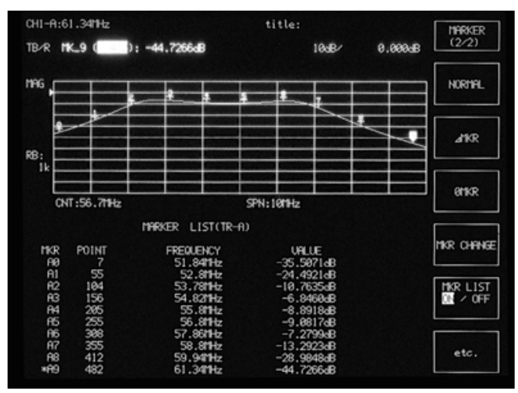
The wide dynamic range of 120 dB (RBW: 1 kHz) supports fast and accurate out-of-band measurement of filters.



Filter Out-of-band Attenuation Measurement

• Multi-markers

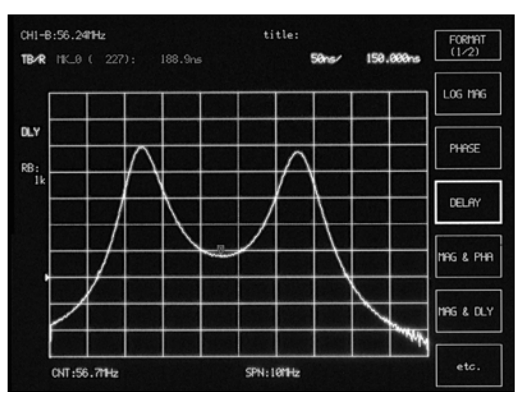
Up to 10 independent markers can be set for each channel.
The marker list function displays all data at each marker as tables and waveforms simultaneously.



Multi-markers

• High-accuracy Group Delay Measurement

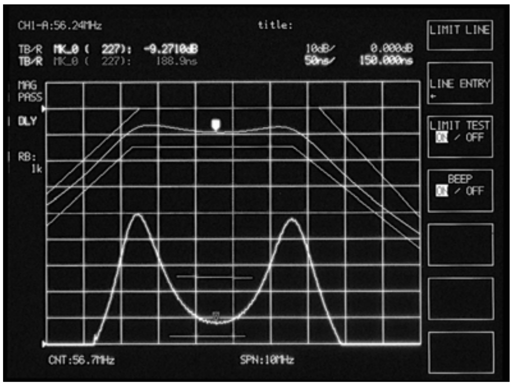
Group delay characteristics can be measured with high accuracy at a resolution of 1/10,000 of the measurement range.



Group Delay Characteristics

• Limit Tests

Devices are pass/fail evaluated in real time using the single and segmented limit test functions.



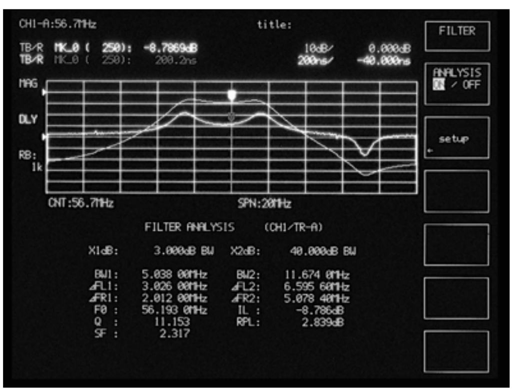
Filter Pass/Fail Evaluation using Limit Test

• Filters

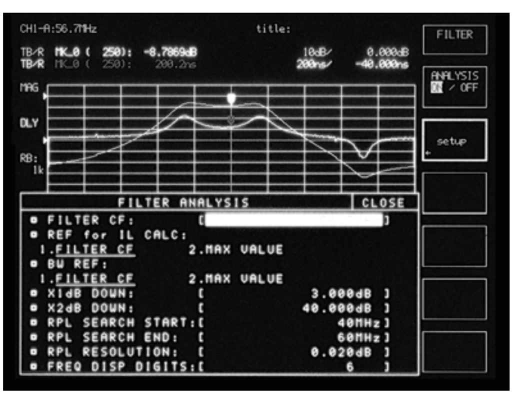
Analysis Functions

Filter characteristics, such as 3 dB bandwidth, center frequency (fo), in-band ripple, out-of-band attenuation, etc., are processed digitally and analyzed at high speed. Users can easily enter or change default values by using the filter analysis setup menu.

The frequency, output level, waiting time and RBW can be set at each measurement point to shorten filter measurement time.



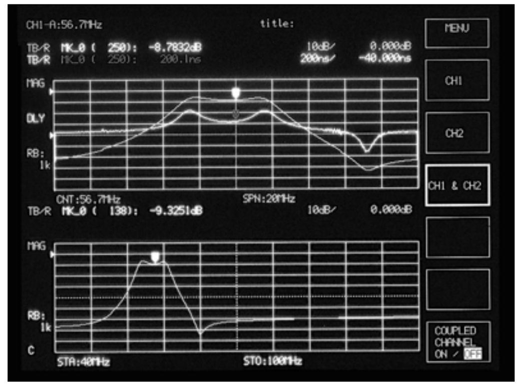
Filter Analysis Screen



Filter Analysis Setup Menu

• Simultaneous In-band and Spurious Response Data Display

Previously, spurious detection and passband measurement required switching the measurement setup. However, the MS4630B alternate sweep function displays the measured passband and spurious data simultaneously. And the very short switching time greatly improves measurement efficiency.

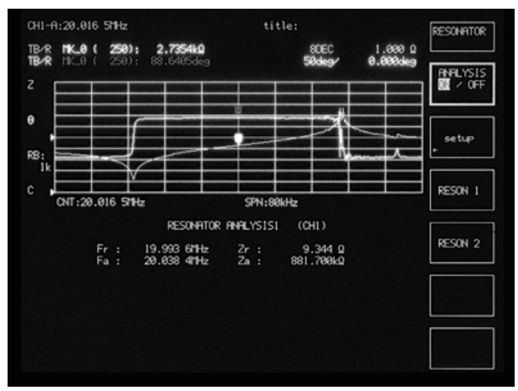


Spurious Measurement using Alternate Sweeping

• Resonators

High-speed Measurement of Characteristics

The MS4630B has dedicated waveform analysis functions to improve the efficiency of resonator evaluation. Resonator 1 analyzes the resonance frequency (Fr) and impedance (Zr) while Resonator 2 adds measurement of resonator equivalence to the Resonator 1 measurements.



Resonator 1 Measurements

Resonator 2 Measurements

Specifications

MS4630B Network Analyzer

<table>
<tr><td>Measurement Items</td><td>Transmission characteristics (ratio measurement): Amplitude, Phase, Group delay
Reflection/Impedance characteristics: Amplitude, Phase (with external transducer)
Level characteristics: Absolute amplitude</td></tr>
<tr><td>Frequency</td><td>Range: 10 Hz to 300 MHz
Resolution: 0.01 Hz
Accuracy (standard)
  Aging rate: ≤1 × 10^{-6}/day (15 minutes after power-on)
  Temperature characteristics: ≤±5 × 10^{-6} (0° to +50°C)
Accuracy (Option 13: High-stability reference oscillator)
  Aging rate: ≤±2 × 10^{-8}/day (24 h after power-on)
  Temperature characteristics: ≤±5 × 10^{-8} (0° to +50°C)</td></tr>
<tr><td>Input</td><td>Channel No.
  Standard: 2 (R, TA), Option 12: 3 (R, TA, TB)
Impedance: 50Ω, 1 MΩ switchable
Input range (IRG): 0/+20 dBm
Max. input power
  AC: +20 dBm, DC ±2.2 V (50Ω)
  AC: 0 dBm, DC: ±20 V (1 MΩ)
  Connector: BNC-J
  Probe source: 12 ±1 V, 100 mA (with protective circuit for shorts)</td></tr>
<tr><td>Average Noise Level</td><td>≤–120 dBm (RBW: 1 kHz, 1 MHz to 300 MHz), ≤–110 dBm (RBW: 1 kHz, 80 kHz to 1 MHz)</td></tr>
<tr><td>Crosstalk</td><td>Between channels: ≥120 dB (80 kHz to 300 MHz), ≥110 dB (up to 80 kHz)
Between transmitter and receiver: ≥125 dB</td></tr>
<tr><td>Resolution Bandwidth</td><td>3, 10, 30, 100, 500 Hz, 1, 2, 3, 4, 5, 10, 20 kHz and automatic setting</td></tr>
<tr><td>Output</td><td>Level range
  Output A: 0 to +21 dBm, Option 10: –70 to +21 dBm
  Output B: –6 to +15 dBm (–9.5 to +11.5 dB when Option 14 added),
    Option 10: –76 to +15 dBm (–79.5 to +11.5 dB when Option 14 added)
Resolution: 0.01 dB
Level accuracy: ≤±1.0 dB (Frequency: 100 MHz, Output A: +10 dBm)
Level linearity: ≤±0.5 dB (0 dBm reference, Frequency: 100 MHz, Output A: 0 to +21 dBm)
Level deviation: ≤±1.5 dB (Output A: +10 dBm, 100 MHz reference)
Step error: ±0.5 dB (Option 10)
Impedance: 50Ω
Connector: BNC-J</td></tr>
<tr><td>Amplitude Measurement</td><td>Measurement range: ≥120 dB
Measurement resolution: 0.001 dB
Display scale: 0.01 to 50 dB/div (1-2-5 sequence)
Dynamic accuracy
<table>
<tr><td>Level relative to IRG</td><td>80 kHz to 100 MHz</td><td>10 kHz to 300 MHz</td></tr>
<tr><td>0 to –10 dB</td><td>±0.20 dB</td><td>±0.20 dB</td></tr>
<tr><td>–10 to –60 dB</td><td>±0.05 dB</td><td>±0.05 dB</td></tr>
<tr><td>–60 to –70 dB</td><td>±0.10 dB</td><td>±0.30 dB</td></tr>
<tr><td>–70 to –80 dB</td><td>±0.30 dB</td><td>±1.00 dB</td></tr>
<tr><td>–80 to –90 dB</td><td>±1.20 dB</td><td>±4.00 dB</td></tr>
<tr><td>–90 to –100 dB</td><td>±4.00 dB</td><td>–</td></tr>
</table></td></tr>
<tr><td>Phase Measurement</td><td>Measurement range: ±180°
Measurement resolution: 0.001°
Display scale: 0.01° to 50° /div (1-2-5 sequence)
Dynamic accuracy
<table>
<tr><td>Level relative to IRG</td><td>80 kHz to 100 MHz</td><td>10 kHz to 300 MHz</td></tr>
<tr><td>0 to –10 dB</td><td>±1.5°</td><td>±1.5°</td></tr>
<tr><td>–10 to –60 dB</td><td>±0.3°</td><td>±0.3°</td></tr>
<tr><td>–60 to –70 dB</td><td>±0.8°</td><td>±2.0°</td></tr>
<tr><td>–70 to –80 dB</td><td>±2.0°</td><td>±6.0°</td></tr>
<tr><td>–80 to –90 dB</td><td>±6.0°</td><td>±20.0°</td></tr>
<tr><td>–90 to –100 dB</td><td>±20.0°</td><td>–</td></tr>
</table></td></tr>
<tr><td>Group Delay Measurement</td><td>DRG: $\Delta\theta/(360 \times \Delta F)$ *$\Delta\theta$: phase measurement range; ΔF: frequency span × smoothing aperture (%),
  smoothing aperture: 20% to $\left(\frac{2}{\text{number measurement points}}\right) \times 100\%$
Measurement resolution: 2.78 × $10^{-5}/\Delta F$
Display scale: 1 ps/div to 50 ms/div
Dynamic accuracy: Phase measurement accuracy/(360 × aperture frequency)</td></tr>
<tr><td>Calibration, Correction</td><td>Calibration types: Frequency response, 1 port, 1 path-2 port, Frequency response/isolation calibration, π-NET calibration
Calibration data interpolation:
  Measurement frequency, when number of measurement points changed, based on calibration data before change, new calibration data interpolation possible (except at log frequency measurement and 1001 measurement points)
Normalize: X–S
Electrical length calibration
  Range: 0 to ±999999.9999999 m, Resolution: 100 nm
Phase offset range: ±180°</td></tr>
</table>

Continued on next page

Sweeping	Frequency sweep: LIN (CENTER/SPAN, START/STOP), LOG (START/STOP) Level sweep: LIN (START/STOP/STEP) List sweep: Frequency, Level, RBW, The individual setting in the waiting time Number of measurement points: 11, 21, 51, 101, 251, 501, 1001 Break point: Between 1 and 1001 Sweep time: 150 µs/point, 38 ms/250 points full sweep (RBW: 20 kHz, normalize calibration, 1 trace) Setting range: 1 ms to 27.5 h Sweep functions Sweep range: Full sweep, Part sweep (between markers) Sweep control: REPEAT/SINGLE, STOP/CONT Sweep trigger: INT/EXT (RISE, FALL, LEVEL)
Display	Max. display screens: 2 channels, 4 traces Display format: LOG MAG (M), PHASE (P), DELAY (D), M/P, M/D, LIN MAG (LIN), LIN/P, LIN/D, REAL (R), IMAG (I), R/I, Z, Z/θ, Q, Z/Q, POLAR, VSWR, IMPD (Z∠θ, Rs + Ls/Cs, Q/D, R + jx), ADMT (Y∠θ, Rp + Lp/Cp, Q/D, G + jB) Display: 640 × 480 dots, 6.5-inch color LCD
Markers	Marker functions: NORMAL MKR, Δ MKR, 0 MKR, MKR → MAX, MKR → MIN, MKR → CF, Δ → SPAN, MKR → +PEAK, MKR → –PEAK, MKR TRACK + PEAK, MKR TRACK–PEAK, MKR CHANGE, MKR OFFSET Setting: Set marker position to frequency or point Multi-marker: 10 markers max. for each trace Filter function: F0, IL, passband (L, R), attenuation band (L, R), Ripple, Q, SF Resonator function RESON 1: Fr, Fa, Zr, Za (0 PHASE), Fm, Fn, Zm, Zn (MAX/MIN) RESON 2: Fs, Fr, Fa, Zr, Za, Q, equivalence constant (R1, L1, C1, C0)
Trace Data Calculation	Averaging functions Method: SUM, MAX, MIN, Count: 1 to 1000 Measurement data memory (max. 1001 points each memory in same format as display format) Main trace (MT) memory: 2 each (XMEM) for Channel 1 and Channel 2 Calibration S memory: 2 each (SMEM) for Channel 1 and Channel 2 Image memory: 2 each (IMEM) for Channel 1 and Channel 2 Sub-trace (ST): Following calculation between MT and ST (traces calculation of same data as display format) MT → ST, MT = MT–ST, MT = ST Limit line: Single or segment (10) limit line, pass/fail evaluation against limit line
Measurement Parameters Auto-setting	Receive bandwidth and sweep time: Receive bandwidth set automatically for set sweep time Automatically set to give minimum sweep time at set receive bandwidth
Auxiliary Media	Saving/Recalling data: Measurement parameters, Measured data, Calibration data, PTA application programs saved/recalled to/from FD, PMC and Internal function memory Function memory FD: 100 functions max. PMC: 100 functions max. (depends on PMC capacity) Drive and capacity Internal memory: 512 KB (non-volatile) 3.5-inch FDD: 1 Capacity: 720 KB (2DD), 1.44 MB (2HD), MS-DOS format (BMP, text file) Option 01: PMC (32 KB to 512 KB)
Printing	Video plotter, Printer, FD (BMP format)
Rear-panel I/O	Frequency: 5 MHz/10 MHz ±10 ppm Level: ≥0.7 Vp-p (AC coupling) Input impedance: 50Ω (connector: BNC-J) Reference oscillator output Frequency: 10 MHz Level: TTL (DC coupling, connector: BNC-J) External trigger input: TTL Level (connector: BNC-J) GPIB: IEEE488.2 (Amphenol 24 pin connector) I/O Port: Parallel interface for PTA (Amphenol 36 pin connector) RGB output: For external monitor (D-Sub 15 pin connector) Video output: Separate (DIN 8 pin) Centronics (Option 02): Parallel interface for printer (D-Sub 25 pin connector) RS-232C (Option 02): Serial interface (D-Sub 9 pin connector)
External Control	Standard: GPIB and PTA, Option 02: RS-232C
Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) (–15/+10%, 250 V(ac) max, 100 V/200 V system auto-switching), 47.5 Hz to 63 Hz, ≤180 VA (max.)
Dimensions and Mass	426 (W) × 177 (H) × 451 (D) mm, ≤15 kg
Environmental Conditions	Temperature range: 0° to +50°C (operating; FDD: +4° to +50°C), –20° to +60°C (storage)
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

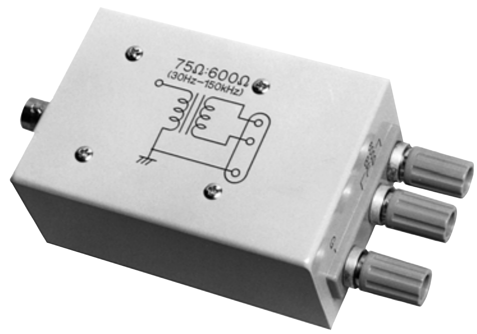
Model/Order No.	Name	
	Main frame	
MS4630B	Network Analyzer	
	Standard accessories	
	Power Cord:	1 pc
F0013	Fuse, 5 A:	2 pcs
W1534AE	MS4630B Operation Manual (Main frame):	1 copy
W1535AE	MS4630B Operation Manual (Remote control):	1 copy
	Options	
MS4630B-01	PMC Interface	
MS4630B-02	RS-232C, Centronics Interface (Printer output, external control)	
MS4630B-10	Output Attenuator (70 dB, mechanical type)	
MS4630B-12	3-Channel Receiver	
MS4630B-13	High Stability Reference Oscillator (Aging rate: $\leq\pm2\times10^{-8}$/day)	
MS4630B-14	3-Branch Output (for 3-channel receiver)	
	Optional accessories	
MA2201A*	Reflection Bridge (10 Hz to 250 kHz, 600Ω, unbalanced, MA214 terminal)	
MA2301A*	Reflection Bridge (2 kHz to 2 MHz, 75Ω, unbalanced, MA214 terminal)	
MA2302A*	Reflection Bridge (2 kHz to 2 MHz, 135Ω, unbalanced, MA214 terminal)	
MA2303A	Reflection Bridge (2 kHz to 2 MHz, 150Ω, unbalanced, MA214 terminal)	
MA2401A	Reflection Bridge (10 Hz to 70 kHz, 60 kHz to 30 MHz, 50Ω, unbalanced, BNC-R)	
MA2402A*	Reflection Bridge (10 Hz to 70 kHz, 60 kHz to 30 MHz, 75Ω, unbalanced, BNC-R)	
MA2204A	Impedance Probe (30 Hz to 300 kHz, 2Ω to 1 MΩ)	
MA2403A	Impedance Probe (30 kHz to 30 MHz, 2Ω to 1 MΩ)	
MA4605A	Impedance Converter (DC to 300 MHz, 50Ω/75Ω unbalanced)	
MA1506A	π-Network (1 MHz to 125 MHz, for resonator measurement)	
MA8603A	50Ω Termination (BNC-P)	
MA8603B	50Ω Termination (BNC-J)	
MA8604A	50Ω Open/Short (BNC-P)	
MA8604B	50Ω Open/Short (BNC-J)	
MP669A	75Ω Termination (BNC-P)	
MP669B	75Ω Termination (BNC-J)	
MP670A	75Ω Open/Short (BNC-P)	
MP670B	75Ω Open/Short (BNC-J)	
J0127A	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 1.0 m	
J0127B	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 2.0 m	
J0127C	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 0.5 m	
P0005	Memory Card (32 KB)	
P0006	Memory Card (64 KB)	
P0007	Memory Card (128 KB)	
P0008	Memory Card (256 KB)	
P0009	Memory Card (512 KB)	
B0329C	Front Cover (1MW4U)	
B0333C	Rack Mount Kit	
B0334C	Carrying Case (hard type)	

*: Requires Impedance Conversion Adapter when using MS4630B Network Analyzer.

REFLECTION BRIDGES/TRANSFORMERS

MA2401A

MA2201A



MA29A

When connected to a reflection bridge, the network analyzers can measure reflection coefficient. This system is used to measure the input and output impedance of telecommunication, video, and audio equipment, and the S-parameter (S_{11} and S_{22}) of two-port networks.

The transformers are impedance-conversion devices used with the network analyzers to measure the magnitude, phase, delay, level, and spectrum of devices with balanced input and output impedances.

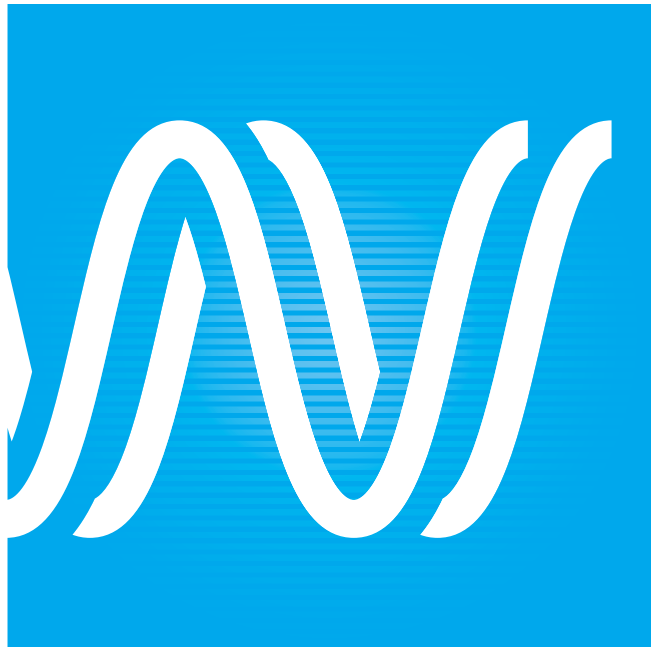
Specifications

• Reflection Bridges

Model	MA2201A	MA2301A	MA2302A	MA2303A	MA2401A	MA2402A
Impedance	600Ω balanced	75Ω balanced	135Ω balanced	150Ω balanced	50Ω unbalanced	75Ω unbalanced
Connector	Terminal (compatible with M-214)				BNC-R	
Frequency Range	10 Hz to 250 kHz	2 kHz to 2 MHz			10 Hz to 70 kHz, 60 kHz to 30 MHz	
Directivity	≥50 dB (50 Hz to 150 kHz), ≥40 dB (10 Hz to 250 kHz)	≥40 dB				
Standard Termination	600Ω, 0Ω	75Ω, 0Ω	135Ω, 0Ω	150Ω, 0Ω	50Ω, 0Ω	75Ω, 0Ω
Dimensions and Mass	66 (W) × 53 (H) × 149 (D) mm, ≤800 g				54 (W) × 53 (H) × 120 (D) mm, ≤800 g	
Input/Output Impedance	75Ω unbalanced				50Ω unbalanced	75Ω unbalanced

• Transformers

Model	MA29A	MA29J	MA313A	MA313J	MA314A	MA314J	MA315A	MA315J	MA422A1
Input Impedance	75Ω	50Ω	75Ω	50Ω	75Ω	50Ω	75Ω	50Ω	75Ω
Output Impedance	600Ω	600Ω	75Ω	75Ω	135Ω	135Ω	150Ω	150Ω	110Ω
Frequency Range	30 Hz to 150 kHz		4 kHz to 2 MHz						10 kHz to 30 MHz
Connector	Input: BNC, Output: Compatible with M-214								
Frequency Response	≤0.5 dB		≤0.3 dB						≤0.5 dB
Return Loss	≥25 dB								
Dimensions and Mass	60 × 90 × 42 mm (without connector), ≤1 kg								



SIGNAL GENERATORS

Selection Guide 731
RF/Microwave Signal Generator 733
Fast Switching Microwave Signal Generator 746
Analog Signal Generator 749

Synthesizer Selection Guide (Measurement Function)

Group	Model	Functions																															Remarks
		Frequency Extensions			Level Extensions									Modulation						Others													
		10 MHz to 2 GHz	10 MHz to 2.2 GHz	0.1 Hz to 10 MHz	mm Wave (50 GHz to 500 GHz) signal source	110 dB step attenuator (<20 GHz)	110 dB step attenuator (<40 GHz)	90 dB step attenuator (>40 GHz)	120 dB step attenuator (<10 GHz)	23 dBm high power (<20 GHz)	19 dBm high power (<20 GHz, with Option 13)	13 dBm high power (<40 GHz)	9 dBm high power (<40 GHz, with Option 13)	AM modulation (Internal signal source is another)	FM/ΦM modulation (Internal signal source is another)	Pulse modulation (Internal signal source is another, <40 GHz)	Pulse modulation (Internal signal source is another, >40 GHz)	For AM/FM/ΦM modulation (Internal signal source)	For pulse modulation (Internal signal source)	Low phase noise	Analog sweep	High stability time base	Creation software of an arbitrary waveform	IF Up-conversion	Power monitor	Rear panel RF output (<40 GHz)	Rear panel RF output (>40 GHz)	Delete front panel	Scan modulation	Rack mount kit (without slides)	Rack mount kit (with slides)	Ultra-Stable Phase Tracking	
Main frame	MG3691C	✓	✓	✓		✓			✓	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	2 GHz to 10 GHz
	MG3692C	✓	✓	✓	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	2 GHz to 20 GHz
	MG3693C	✓	✓	✓	∗1		✓					✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	2 GHz to 31.8 GHz
	MG3694C	✓	✓	✓	∗1		✓					✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	2 GHz to 40 GHz
	MG3695C	✓	✓	✓	∗1			✓						✓	✓		✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	2 GHz to 50 GHz
	MG3697C	✓	✓	✓	∗1			✓						✓	✓		✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	2 GHz to 67 GHz (setting range: 2 GHz to 70 GHz)
	MG37022A	✓				✓										∗2			✓			✓				✓		✓		✓	✓		2 GHz to 20 GHz
Options	1A																													✓			Either selection
	1B																														✓		
	2A					✓																											Chooses with main frame frequency
	2B						✓																										
	2C							✓																									
	2E								✓																								
	3																			✓													
	4		✓																														
	5	✓																															
	6																				✓												
	7																							✓									<40 GHz model: the combined use with Option 18 is impossible.
	8																								✓								
	9A																									✓							
	9B																										✓						
	10																						✓										Requires Option 23
	12														✓																		
	14													✓																			
	15A									✓																							Chooses according to the inclusion situation of main frame frequency and pulse modulation.
	15B										✓																						
	15C											✓																					
	15D												✓																				
	16																					✓											
	17																											✓					
	18																																±15 VDC output (for MG369xC)
	20																												✓				
	22			✓																													Modulation function is un-corresponding
	26A															✓																	Chooses with main frame frequency
	26B																✓																
	27																	✓	✓														Three signal for AM, FM/ΦM, and Pulse
	28A													✓	✓	✓		✓	✓														Chooses with main frame frequency
	28B													✓	✓		✓	✓	✓														
	36																															✓	Requires Option 3 or 3x. Not available with Option 7 or with both Option 18 and 20 together

∗1: The maximum of frequency required for frequency extension to mm Wave is 20 GHz.
Therefore, when using it only by for mm Wave, a model 20 GHz or more is unnecessary.

∗2: Internal Pulse Generator: Included with Option 26.

Model	Frequency Range	Output Level Range	Harmonics	Non-harmonics	SSB Phase Noise (CW 1 GHz, 20 kHz offset)	Amplitude Modulation	Frequency Modulation	Pulse Modulation	Sine-wave	Triangular-wave	Square-wave	Sawtooth-wave	Mass
MG3740A (Opt. 032/062)	100 kHz to 2.7 GHz	–110 to +17 dBm [Standard] –144 to +25 dBm [Option]	<–30 dBc	<–68 dBc (187.5 MHz < f ≤ 750 MHz)	–131 dBc/Hz (typ.)	✓	✓	✓	✓	Opt.	Opt.	Opt.	≤13.7kg
MG3740A (Opt. 034/064)	100 kHz to 4 GHz												
MG3740A (Opt. 036/066)	100 kHz to 6 GHz												

Synthesizer Selection Guide (Frequency Range)

Group	Model	Frequency Range																										Remarks
		0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	2 MHz	5 MHz	10 MHz	20 MHz	50 MHz	100 MHz	200 MHz	500 MHz	1 GHz	2 GHz	5 GHz	10 GHz	20 GHz	50 GHz	100 GHz	200 GHz	300 GHz	500 GHz	
Main frame	MG3691C																											2 GHz to 10 GHz
	MG3692C																											2 GHz to 20 GHz
	MG3693C																											2 GHz to 30 GHz
	MG3694C																											2 GHz to 40 GHz
	MG3695C																											2 GHz to 50 GHz
	MG3697C																											2 GHz to 67 GHz
	MG37022A																											2 GHz to 20 GHz
Options	4																											8 MHz to 2.2 GHz
	5																											8 MHz to 2 GHz
	22																											0.1 Hz to 10 MHz
	2000-1694-15-R																											50 GHz to 75 GHz
	2000-1694-12-R																											60 GHz to 90 GHz
	2000-1694-10-R																											75 GHz to 110 GHz
	2000-1694-08-R																											90 GHz to 140 GHz
	2000-1694-06-R																											110 GHz to 170 GHz
	2000-1694-05-R																											140 GHz to 220 GHz
	2000-1694-03-R																											220 GHz to 325 GHz
	2000-1694-02-R																											325 GHz to 500 GHz

Model	Frequency Range																		Remarks
	0.1 Hz	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz	10 MHz	20 MHz	30 MHz	50 MHz	100 MHz	1 GHz	2 GHz	3 GHz	5 GHz	10 GHz	
MG3740A (Opt. 032/062)																			100 kHz to 2.7 GHz
MG3740A (Opt. 034/064)																			100 kHz to 4 GHz
MG3740A (Opt. 036/066)																			100 kHz to 6 GHz

RF/MICROWAVE SIGNAL GENERATOR

MG3690C Series

0.1 Hz to 70 GHz/500 GHz

Remote Control
GPIB

The Ideal Microwave Signal Generator

Value Without Compromise

Your microwave signal generation requirements have never been tougher, and yet your capital equipment budget has never been tighter. You need the most value you can get in a synthesizer, but you can't compromise performance. You need a synthesizer that meets today's needs yet can be upgraded at a reasonable cost to satisfy future requirements without shattering your test equipment budget. Anritsu's MG3690C series of synthesizers deliver the highest performance and the highest value available today.

Features

Basic CW Generators configurable to full-featured Signal Generators.

- Broad Frequency Coverage, in a Single Output: 0.1 Hz to 70 GHz
  - 6 Models, 2 to 10, 20, 31.8, 40, 50, and 67 GHz (operational to 70 GHz)
  - 8 MHz Coverage Optional (Analog or Digital Down-Conversion)
  - 0.1 Hz Coverage Optional
- mmW Coverage up to 500 GHz, in Waveguide
- Ultra-Low SSB Phase Noise Option
- –109 dBc/Hz (typically) at 1 kHz Offset, 10 GHz Carrier
- Excellent Harmonics and Spurious Response
- High Output Power Option
  - +26 dBm to 10 GHz
  - +23 dBm to 20 GHz
  - +19 dBm to 40 GHz
  - +9 dBm to 67 GHz
- CW and Step Sweep Modes; Analog Sweep Optional
- <5 ms Switching Time (typically) for <100 MHz steps
- 0.01 Hz standard Frequency Resolution
- Phase Offset Capability
- AM, FM/ΦM Modulations Optional
  - Internal LF Generator Optional
- Pulse Modulation Optional
  - 100 ns Leveled Width, >1 GHz
  - Internal Pulse Generator Optional
- IF Up-Conversion Option, for IQ Modulation Solutions
- Intuitive, Menu-driven Front Panel
- Proven Reliability with 3 Year Standard Warranty
- Completely Configurable and Upgradable

High Performance Signal Generators

The ultimate in full-function signal generation. They provide all the features of the other families along with comprehensive, high-performance modulation for signal simulation applications. Additional features in these units include:

- Internal pulse generator with swept delay capability for moving target simulation
- Flexible pulse triggering including free-run, delayed, gated, and composite
- 0 to 90% AM, log or linear, over DC to 100 kHz rates
- Four FM modes for up to 10 MHz deviation at 8 MHz rates or 100 MHz deviation at 100 Hz rates
- Phase modulation (ΦM) up to 400 radians deviation at 1 MHz rates
- Internal AM, FM, and ΦM generators, each with 7 modulating waveforms
- Optional user-defined, downloaded complex modulation

Automatic Test Equipment

The MG3690C is an ideal signal generator for an A.T.E. system. It packs the highest performance available in a 13.3 cm (3u) package, with a 450 mm depth that minimizes rack space. High output power assures adequate signal strength to the device under test even after A.T.E. switching and cabling losses. Accurately leveled output power to –125 dBm in 0.01 dB steps facilitates receiver sensitivity measurements. For improved MTBF, an electronic step attenuator replaces the traditional mechanical step attenuator. Fast 5 ms switching time maximizes system throughput. Internal list mode frees the A.T.E. controller to perform measurement analysis tasks. Free application drivers, including the IVI-COM driver and National Instruments LabView® drivers, save you time and money in code generation and maintenance. For additional cost savings, Option 17 eliminates the complete front panel, including circuitry.

Interchangeable Virtual Instruments Standard

The IVI standard defines a standard instrument driver model that enables instrument interchangeability and interoperability without software changes. Anritsu's IVI-driver supported synthesizer minimizes instrument development and maintenance cost through the use of IVI-standard interfaces as well as instrument-specific interfaces for unique instrument features. The IVI standard provides a single driver that supports the common application development environments such as Visual Basic, Visual C++, and Labview.

Anritsu Corporation leads the way with IVI technology, having released the first COM-based IVI driver supporting the Signal Generator instrument class, and includes the driver with every MG3690C series synthesizer. As an active member of the IVI Foundation, Anritsu supports the Foundation's drive toward instrument driver standardization as a powerful means of delivering interchangeable ATE instrumentation solutions.

Specifications

For detailed and most up-to-date specifications, please refer to the MG3690C data sheet, p/n 11410-00515. The latest version of this data sheet is available for down-loading in pdf format in the MG3690C section of the Anritsu website www.anritsu.com.

CW Mode	Accuracy		Same as internal or external 10 MHz time base
	Internal Time Base Stability	With Aging	<2 × 10^{-9}/day (<5 × 10^{-10}/day with Option 16)
		With Temperature	<2 × 10^{-8}/°C over 0° to 55°C (<2 × 10^{-10}/°C with Option 16)
	Resolution		0.01 Hz
	External 10 MHz Reference Input		Accepts external 10 MHz ±50 Hz, 0 to +20 dBm time base signal. Automatically disconnects the internal high-stability time-base option, if installed. BNC, rear panel, 50Ω impedance
	10 MHz Reference Output		1 Vp-p into 50Ω, AC coupled. Rear panel BNC; 50Ω impedance
	Phase Offset		Adjustable in 0.1° steps
	Electronic Frequency Control (EFC) Input		–4 V to +4 V input range; (8 × 10^{-8}) Hz/v sensitivity typical; ≤250 Hz modulation BW; rear panel BNC; high impedance
Phase-locked Step Sweep Mode	Sweep Width		Independently selected, 0.01 Hz to full range. Every frequency step in sweep range is phase-locked
	Accuracy		Same as internal or external 10 MHz time base
	Resolution (minimum step size)		0.01 Hz
	Linear/Log Sweep		User-selectable linear or log sweep. In log sweep, step size logarithmically increases with frequency
	Steps		User-selectable number of steps or the step size
	Number of Steps		Variable from 1 to 10,000
	Step Size		0.01 Hz to the full frequency range of the instrument. (If the step size does not divide into the selected frequency range, the last step is truncated.)
	Dwell Time per Step		Variable from 1 ms to 99 seconds
	Fixed Rate Sweep		Allows the user to set the total time of the sweep, including lock time. Variable from 20 ms to 99 seconds
Alternate Sweep Mode	Sweeps alternately in step sweep between any two sweep ranges. Each sweep range may be associated with a power level.		
Analog Sweep Mode (Option 6)	Sweep Width		Independently selected from 1 MHz to full frequency range. With Option 4, Digital Down Converter, analog sweep is only available ≥500 MHz. Analog sweep is not available <10 MHz with option 22.
	Accuracy		The lesser of ±30 MHz or (±2 MHz + 0.25% of sweep width) for sweep speeds of ≤50 MHz/ms.
	Sweep Time Range		30 ms to 99 seconds
Manual Sweep Mode	Provides stepped, phase-locked adjustment of frequency between sweep limits. User-selectable number of steps or step size.		
List Sweep Mode	Under GPIB or Ethernet control, or via the front panel, up to 4 tables with 2000 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. One table of 2000 points is stored in non-volatile memory. All other tables are stored in volatile memory.		
Programmable Frequency Agility	Under GPIB or Ethernet control, up to 3202 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. Data is stored in volatile memory.		
Markers	Up to 20 independent, settable markers (F0 – F9 and M0 – M9)		
	Video Markers		+5 V or –5 V marker output, selectable from system menus. AUX I/O connector, rear panel
	Marker Accuracy		Same as sweep frequency accuracy
	Intensity Markers		Produces an intensity dot on analog display traces, obtained by a momentary dwell in RF sweep, in analog sweeps of <1 second.
	Marker Resolution		Analog Sweep: 1 MHz or Sweep Width/4096, which ever is greater Step Sweep: 0.01 Hz
Sweep Triggering	Sweep triggering is provided for step frequency sweep, list frequency sweep, and CW power sweep.		
	Auto		Triggers sweep automatically
	External		Triggers a sweep on the low-to-high transition of an external TTL signal. AUX I/O connector, rear panel
	Single		Triggers, aborts, and resets a single sweep. Reset sweep may be selected to be at the top or bottom of the sweep

Continued on next page

General	Stored Setups		Stores front panel settings and nine additional front-panel setups in a non-volatile RAM. A system menu allows for saving and recalling instrument setups. Whenever the instrument is turned on, control settings and values are the same as when last turned off.
	Memory Sequencing Input		Accepts a TTL low-level signal to sequence through ten stored setups. AUX I/O connector, rear panel
	Self-test		Instrument self-test is performed when Selftest soft-key is selected. If an error is detected, an error message is displayed in a window on the LCD identifying the probable cause and remedy.
	Secure Mode		Disables all frequency and power level state displays. Stored setups saved in secure mode remain secured when recalled. Mode selectable from a system menu and via GPIB.
	Parameter Entry		Instrument-controlled parameters can be entered in three ways—keypad, rotary data knob, or the "∧" and "∨" touch pads of the cursor-control key (use up/down-arrow symbol). The keypad is used to enter new parameter values; the rotary data knob and the cursor-control key are used to edit existing parameter values. The "<" and ">" touch pads of the cursor-control key move the cursor left and right one digit under the open parameter. The rotary data knob or the "∧" and "∨" touch pads will increment or decrement the digit position over the cursor. Controlled parameters are frequency, power level, sweep time, dwell time, and number of steps. Keypad entries are terminated by pressing the appropriate soft key. Edits are terminated by exiting the edit menu
	Reset		Returns all instrument parameters to predefined default states or values. Any pending GPIB I/O is aborted. Selectable from the system menu
	Master/Slave Operation		Allows two output signals to be swept with a user-selected frequency offset. One instrument controls the other via AUX I/O and SERIAL I/O connections. Requires a Master/Slave Interface Cable Set (Part No. ND36329)
	User Level Flatness Correction		Allows user to calibrate out path loss due to external switching and cables via entered power table from a GPIB power meter or calculated data. When user level correction is activated, entered power levels are delivered at the point where calibration was performed. Supported power meters are Anritsu ML2437A, ML2438A, ML2480A/B, ML2490A, and ML4803A and HP 437B, 438A, and 70100A. Five user tables are available with up to 801 points/table.
	Warm Up Time	From Standby	30 minutes
		From Cold Start (0°C)	120 hours to achieve specified frequency stability with aging. Instruments disconnected from ac line power for more than 72 hours require 30 days to return to specified frequency stability with aging
	Power		85 V(ac) to 264 V(ac), 48 Hz to 440 Hz, 250 VA maximum
	Standby		With AC line power connected, unit is placed in standby when front panel power switch is released from the OPERATE position
	Mass		18 kg maximum
	Dimensions		429 (W) × 133 (H) × 450 (D) mm
Remote Operation	All instrument functions, settings, and operating modes (except for power on/standby) are controllable using commands sent from an external computer via Ethernet (VXI-11 over TCP/IP) or GPIB (IEEE-488 interface bus). Note: For users who wish to use a USB control interface, the following adapter available from National Instruments is recommended: USB: NI GPIB-USB-MS		
	GPIB Address		Selectable from a system menu
	IEEE-488 Interface Function Subset	Source Handshake	SH1
		Acceptor Handshake	AH1
		Talker	T6
		Listener	L4
		Service Request	SR1
		Remote/Local	RL1
		Parallel Poll	PP1
		Device Clear	DC1
		Device Trigger	DT1
		Controller Capability	C0, C1, C2, C3, C28
		Tri-state Driver	E2
	GPIB Status Annunciators		When the instrument is operating in remote, the GPIB status annunciators (listed below) will appear in a window on the front panel LCD
	Remote		Operating on the GPIB or via Ethernet, all instrument front panel keys (except for the SYSTEM key and the RETURN TO LOCAL soft key) are ignored.
	LLO (local lockout)		Disables the RETURN TO LOCAL soft-key. Instrument can be placed in local mode only via GPIB or by cycling line power
	Emulations		The instrument responds to the published GPIB commands and responses of the Anritsu Models 6600, 6700, and 6XX00-series signal sources. When emulating another signal source, the instrument will be limited to the capabilities, mnemonics, and parameter resolutions of the emulated instrument.
Environmental	Temperature Range		0° to +50°C (Operating), –40° to +75°C (Storage)
	Relative Humidity		5 to 95% at 40°
	Altitude		4,600 m, 43.9 cm Hg
	EMI		EMI: Meets the emission and immunity requirements of EN61326: 1998 EN55011: 1991/CISPR-11: 1990 Group 1 Class A EN61000-4-2: 1995 – 4 kV CD, 8 kV AD EN61000-4-3: 1997 – 3 V/m EN61000-4-4: 1995 – 0.5 kV SL, 1 kV PL EN61000-4-5: 1995 – 1 kV – 2 kV L-E EN61000-4-6: 1996 EN61000-4-11: 1994

Spectral Purity

All specifications apply at the lesser of +10 dBm output or maximum specified leveled output power, unless otherwise noted.

Spurious Signals

• Harmonic and Harmonic Helated

Frequency Range	Standard
0.1 Hz to 10 MHz (Option 22)	<–30 dBc
10 MHz to ≤100 MHz (Option 4)	<–40 dBc
>100 MHz to ≤2.2 GHz (Option 4)	<–50 dBc
10 MHz to ≤50 MHz (Option 5)	<–30 dBc
>50 MHz to <2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤20 GHz	<–60 dBc*1
>20 GHz to ≤40 GHz	<–40 dBc*2
>40 GHz to ≤50 GHz (MG3695C)	<–40 dBc*1
>40 GHz to ≤67 GHz (MG3697C)	<–25 dBc

*1: –30 dBc typical with high power Option 15
*2: 20 GHz to 21 GHz and 39 GHz to 40 GHz – 20 dBc typical (Option 15 only)

• Non-harmonics

Frequency Range	Standard
0.1 Hz to 10 MHz (Option 22)	<–30 dBc
10 MHz to ≤2.2 GHz (Option 4)	<–60 dBc
10 MHz to ≤2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤67 GHz	<–60 dBc

• Power Line and Fan Rotation Spurious Emissions (dBc)

Frequency Range	Offset from Carrier		
	<300 Hz	300 Hz to 1 kHz	>1 kHz
≥10 MHz to ≤500 MHz (Option 4)	<–68	<–72	<–72
>500 MHz to = 1050 MHz (Option 4)	<–62	<–72	<–72
>1050 MHz to ≤2200 MHz (Option 4)	<–56	<–66	<–66
≥0.01 GHz to ≤8.4 GHz	<–50	<–60	<–60
>8.4 GHz to ≤20 GHz	<–46	<–56	<–60
>20 GHz to ≤40 GHz	<–40	<–50	<–54
>40 GHz to ≤67 GHz	<–34	<–44	<–48

• Residual FM (CW and Step Sweep modes, 50 Hz to 15 kHz BW)

Frequency Range	Residual FM (Hz RMS) Option 3, 3x	Standard
≤8.4 GHz	<40	<120
>8.4 GHz to ≤20 GHz	<40	<220
>20 GHz to ≤40 GHz	<80	<440
>40 GHz to ≤67 GHz	<160	<880

• Residual FM (Analog Sweep and Unlocked FM modes, 50 Hz to 15 kHz BW)

Frequency Range	Residual FM (kHz RMS)	
	Unlocked Narrow FM mode	Unlocked Wide FM mode or Analog Sweep
0.01 GHz to <20 GHz	<10	<25
>20 GHz to <40 GHz	<20	<50
>40 GHz to <67 GHz	<40	<100

• AM Noise Floor

Typically <–145 dBm/Hz at 0 dBm output and offsets >5 MHz from carrier.

Single-Sideband Phase Noise*

• Single-Sideband Phase Noise (dBc/Hz): (Typical)

Frequency Range	Offset from Carrier					
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
0.1 Hz to <10 MHz (Option 22)	–80 (–100)	–90 (–110)	–120 (–125)	–130 (–139)	–130 (–141)	–130 (–141)
10 MHz to 15.625 MHz (Option 4)	–102 (–113)	–128 (–133)	–142 (–149)	–145 (–152)	–145 (–153)	–145 (–153)
>15.625 MHz to 31.25 MHz (Option 4)	–97 (–109)	–125 (–130)	–142 (–147)	–144 (–149)	–144 (–153)	–145 (–155)
>31.25 MHz to 62.5 MHz (Option 4)	–92 (–104)	–122 (–128)	–140 (–146)	–142 (–146)	–143 (–150)	–145 (–155)
>62.5 MHz to 125 MHz (Option 4)	–87 (–98)	–114 (–118)	–133 (–139)	–130 (–140)	–130 (–143)	–145 (–155)
>125 MHz to 250 MHz (Option 4)	–82 (–93)	–108 (–113)	–126 (–134)	–124 (–134)	–124 (–138)	–145 (–153)
>250 MHz to 500 MHz (Option 4)	–75 (–87)	–102 (–109)	–120 (–128)	–118 (–127)	–118 (–130)	–143 (–149)
>500 MHz to 1050 MHz (Option 4)	–70 (–80)	–94 (–100)	–115 (–123)	–115 (–122)	–116 (–126)	–138 (–144)
>1050 MHz to 2200 MHz (Option 4)	–65 (–74)	–86 (–96)	–113 (–117)	–111 (–116)	–114 (–120)	–133 (–139)
10 MHz to <2000 MHz (Option 5)	–62 (–72)	–85 (–95)	–100 (–104)	–102 (–106)	–102 (–106)	–111 (–114)
2 GHz to 6 GHz	–54 (–64)	–81 (–88)	–102 (–109)	–103 (–110)	–106 (–114)	–128 (–133)
>6 GHz to 10 GHz	–52 (–62)	–75 (–85)	–98 (–106)	–104 (–109)	–106 (–113)	–126 (–132)
>10 GHz to 20 GHz	–45 (–55)	–69 (–78)	–92 (–101)	–98 (–103)	–98 (–106)	–124 (–131)
>20 GHz to 40 GHz	–38 (–48)	–62 (–72)	–86 (–94)	–92 (–100)	–92 (–100)	–118 (–124)
>40 GHz to 67 GHz	–32 (–42)	–56 (–66)	–80 (–88)	–87 (–94)	–82 (–91)	–112 (–118)

• Single-Sideband Phase Noise (dBc/Hz) - Option 3: (Typical)

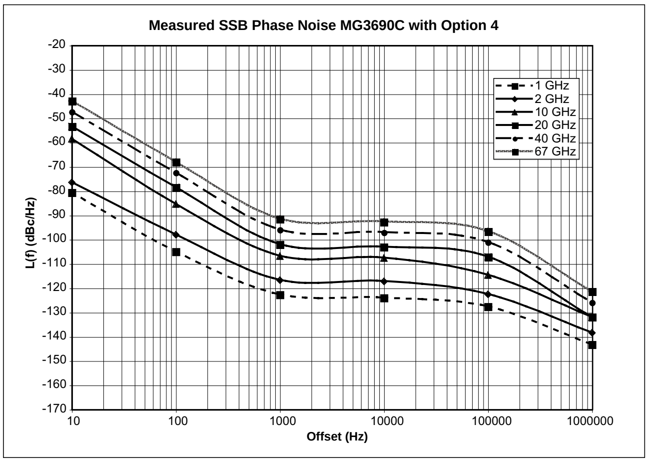
Frequency Range	Offset from Carrier					
	10 Hz	100 Hz	1 kHz**	10 kHz**	100 kHz	1 MHz
0.1 Hz to < 10 MHz (Option 22)	–80 (–100)	–90 (–110)	–120 (–125)	–130 (–139)	–130 (–141)	–130 (–141)
10 MHz to 15.625 MHz (Option 4)	–102 (–120)	–128 (–140)	–142 (–150)	–145 (–152)	–148 (–153)	–148 (–152)
>15.625 MHz to 31.25 MHz (Option 4)	–97 (–108)	–125 (–128)	–142 (–149)	–145 (–153)	–148 (–153)	–148 (–155)
>31.25 MHz to 62.5 MHz (Option 4)	–92 (–109)	–122 (–131)	–140 (–146)	–145 (–153)	–148 (–153)	–148 (–156)
>62.5 MHz to 125 MHz (Option 4)	–87 (–98)	–114 (–118)	–134 (–139)	–142 (–147)	–143 (–148)	–148 (–155)
>125 MHz to 250 MHz (Option 4)	–82 (–93)	–108 (–113)	–129 (–134)	–138 (–143)	–137 (–142)	–148 (–153)
>250 MHz to 500 MHz (Option 4)	–77 (–91)	–102 (–114)	–124 (–130)	–132 (–137)	–128 (–137)	–144 (–153)
>500 MHz to 1050 MHz (Option 4)	–72 (–83)	–98 (–103)	–119 (–123)	–126 (–132)	–122 (–132)	–139 (–150)
>1050 MHz to 2200 MHz (Option 4)	–66 (–77)	–92 (–101)	–113 (–119)	–121 (–126)	–117 (–125)	–135 (–146)
10 MHz to <2000 MHz (Option 5)	–64 (–72)	–85 (–95)	–100 (–104)	–102 (–106)	–102 (–106)	–111 (–114)
2 GHz to 6 GHz	–54 (–77)	–82 (–93)	–106 (–111)	–115 (–119)	–112 (–119)	–138 (–142)
>6 GHz to 10 GHz	–52 (–73)	–75 (–88)	–102 (–109)	–113 (–119)	–115 (–120)	–134 (–140)
>10 GHz to 20 GHz	–52 (–66)	–69 (–82)	–100 (–105)	–109 (–115)	–109 (–115)	–130 (–137)
>20 GHz to 40 GHz	–45 (–59)	–63 (–75)	–94 (–98)	–104 (–108)	–103 (–109)	–122 (–131)
>40 GHz to 67 GHz	–40 (–51)	–58 (–68)	–89 (–91)	–97 (–103)	–97 (–103)	–118 (–125)

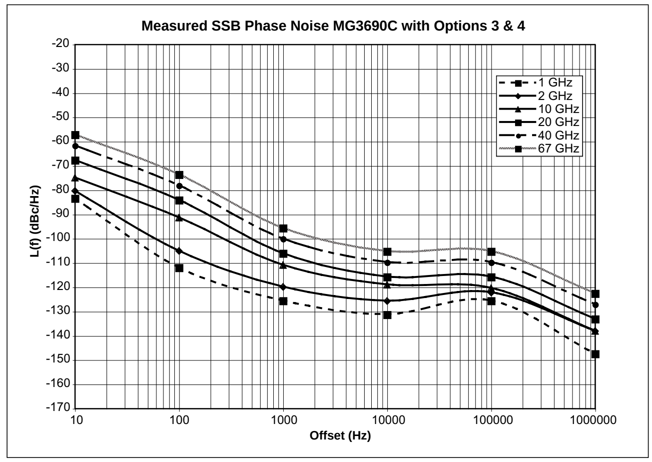
• Single-Sideband Phase Noise (dBc/Hz) - Option 3X: (Typical)

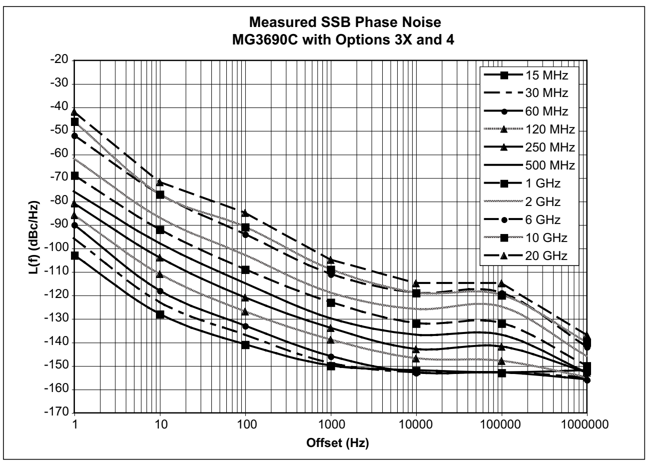
Frequency Range	Offset from Carrier						
	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
0.1 Hz to <10 MHz (Option 22)	–60 (–70)	–80 (–100)	–90 (–110)	–120 (–125)	–130 (–139)	–130 (–141)	–130 (–141)
10 MHz to 15.625 MHz (Option 4)	–94 (–103)	–118 (–128)	–136 (–141)	–142 (–150)	–145 (–152)	–148 (–153)	–148 (–152)
>15.625 MHz to 31.25 MHz (Option 4)	–88 (–96)	–113 (–123)	–130 (–137)	–142 (–149)	–145 (–153)	–148 (–153)	–148 (–155)
>31.25 MHz to 62.5 MHz (Option 4)	–83 (–90)	–109 (–118)	–125 (–133)	–140 (–146)	–145 (–153)	–148 (–153)	–148 (–156)
>62.5 MHz to 125 MHz (Option 4)	–77 (–86)	–103 (–111)	–119 (–127)	–134 (–139)	–142 (–147)	–143 (–148)	–148 (–155)
>125 MHz to 250 MHz (Option 4)	–71 (–81)	–97 (–104)	–113 (–121)	–129 (–134)	–138 (–143)	–137 (–142)	–148 (–153)
>250 MHz to 500 MHz (Option 4)	–67 (–76)	–91 (–98)	–107 (–115)	–124 (–130)	–132 (–137)	–128 (–137)	–144 (–153)
>500 MHz to 1050 MHz (Option 4)	–60 (–69)	–84 (–92)	–101 (–109)	–119 (–123)	–126 (–132)	–122 (–132)	–139 (–150)
>1050 MHz to 2200 MHz (Option 4)	–53 (–62)	–77 (–87)	–95 (–103)	–113 (–119)	–121 (–126)	–117 (–125)	–135 (–146)
10 MHz to <2000 MHz (Option 5)	–38 (–45)	–68 (–78)	–85 (–95)	–100 (–104)	–102 (–106)	–102 (–106)	–111 (–114)
2 GHz to 6 GHz	–46 (–52)	–70 (–77)	–86 (–94)	–106 (–111)	–115 (–119)	–112 (–119)	–138 (–142)
>6 GHz to 10 GHz	–38 (–46)	–68 (–77)	–83 (–91)	–102 (–109)	–113 (–119)	–115 (–120)	–134 (–140)
>10 GHz to 20 GHz	–35 (–42)	–64 (–72)	–80 (–85)	–100 (–105)	–109 (–115)	–109 (–115)	–130 (–137)
>20 GHz to 40 GHz	–29 (–36)	–58 (–65)	–74 (–79)	–94 (–98)	–104 (–108)	–103 (–109)	–122 (–131)
>40 GHz to 67 GHz	–23 (–30)	–53 (–59)	–69 (–73)	–89 (–91)	–97 (–103)	–97 (–103)	–118 (–125)

*: Phase noise is specified and guaranteed only with internal reference. In External Reference mode, the phase noise of the external supplied reference, and the selected external reference bandwidth, will dictate the instrument phase noise performance. Phase noise is not degraded when adding high power Option 15.

Typical MG3690C single sideband phase noise at 10 GHz carrier.







RF Output

Power level specifications apply at 25°C ±10°C.

- **Maximum Leveled Output Power**[*3]

Model Number	Configuration	Frequency Range (GHz)	Output Power (dBm)	Output Power with Step Attenuator (dBm)	Output Power with Electronic Step Attenuator (dBm)
MG3691C	w/opt 4 or 5 STD	<2 GHz[*1] ≥2 GHz[*2] to ≤10 GHz	+19.0 +19.0	+18.0 +18.0	+15.0 +13.0
MG3692C	w/opt 4 or 5 STD STD	<2 GHz[*1] ≥2 GHz[*2] to ≤10 GHz >10 GHz to ≤20 GHz	+19.0 +19.0 +17.0	+18.0 +18.0 +15.0	Not available
MG3693C	w/opt 4 or 5 STD STD STD	<2 GHz[*1] ≥2 GHz[*2] to ≤10 GHz >10 GHz to ≤20 GHz >20 GHz to ≤31.8 GHz	+15.0 +15.0 +12.0 +9.0	+14.0 +14.0 +10.0 +6.0	Not available
MG3694C	w/opt 4 or 5 STD STD STD	<2 GHz[*1] ≥2 GHz[*2] to ≤10 GHz >10 GHz to ≤20 GHz >20 GHz to ≤40 GHz	+15.0 +15.0 +12.0 +9.0	+14.0 +14.0 +10.0 +6.0	Not available
MG3695C	w/opt 4 or 5 STD STD STD	<2 GHz[*1] ≥2 GHz[*2] to ≤20 GHz >20 GHz to ≤40 GHz >40 GHz to ≤50 GHz	+12.0 +10.0 +6.0 +3.0	+10.0 +8.0 +3.0 +0.0	Not available
MG3697C	w/opt 4 or 5 STD STD STD	<2 GHz[*1] ≥2 GHz[*2] to ≤20 GHz >20 GHz to ≤40 GHz >40 GHz to ≤67 GHz	+12.0 +10.0 +6.0 +3.0	+10.0 +8.0 +3.0 +0.0[*4]	Not available

*1: ≤2.2 GHz with Option 4
*2: >2.2 GHz with Option 4
*3: For output power with Option 22, 0.1 Hz to 10 MHz coverage, derate all specifications by 2 dB
*4: Typical 60 to 67 GHz

• **Maximum Leveled Output Power with Option 15 (high power) installed**[*3]

Model Number	Configuration	Frequency Range (GHz)	Output Power (dBm)	Output Power with Step Attenuator (dBm)	Output Power with Electronic Step Attenuator (dBm)
MG3691C	w/opt 4 or 5	<2 GHz[*1]	+19.0	+18.0	+15.0
	w/opt 4 or 5	≥2 GHz[*2] to ≤10 GHz	+25.0	+24.0	+16.0
	w/o opt 4 or 5	≥2 GHz to ≤10 GHz	+26.0	+25.0	+16.0
MG3692C	w/opt 4 or 5	<2 GHz[*1]	+19.0	+18.0	Not available
	w/opt 4 or 5	≥2 GHz[*2] to ≤20 GHz	+21.0	+19.0	
	w/o opt 4 or 5	≥2 GHz to ≤20 GHz	+23.0	+21.0	
MG3693C	w/opt 4 or 5	<2 GHz[*1]	+17.0	+16.0	Not available
	w/opt 4 or 5	≥2 GHz[*2] to ≤20 GHz	+21.0	+19.0	
	w/opt 4 or 5	>20 GHz to 31.8 GHz	+17.0	+15.0	
	w/o opt 4 or 5	≥2 GHz to ≤20 GHz	+23.0	+21.0	
	w/o opt 4 or 5	>20 GHz to ≤31.8 GHz	+19.0	+17.0	
MG3694C	w/opt 4 or 5	<2 GHz[*1]	17.0	+16.0	Not available
	w/opt 4 or 5	≥2 GHz[*2] to ≤20 GHz	+21.0	+19.0	
	w/opt 4 or 5	>20 GHz to ≤40 GHz	+17.0	+15.0	
	w/o opt 4 or 5	≥2 GHz to ≤20 GHz	+23.0	+21.0	
	w/o opt 4 or 5	>20 GHz to ≤40 GHz	+19.0	+17.0	
MG3695C	w/opt 4 or 5	<2 GHz[*1]	+16	+14	Not available
	w/opt 4 or 5	≥2 GHz[*2] to ≤20 GHz	+21	+19	
	w/opt 4 or 5	>20 GHz to ≤40 GHz	+17	+15	
	w/opt 4 or 5	>40 GHz to ≤50 GHz	+11	+8	
	w/o opt 4 or 5	≥2 GHz to ≤20 GHz	+23	+21	
	w/o opt 4 or 5	>20 GHz to ≤40 GHz	+19	+17	
	w/o opt 4 or 5	>40 GHz to ≤50 GHz	+13	+10	
MG3697C	w/opt 4 or 5	<2 GHz[*1]	+16	+15	Not available
	w/opt 4 or 5	≥2 GHz[*2] to ≤20 GHz	+19	+18	
	w/opt 4 or 5	>20 GHz to ≤40 GHz	+16	+14	
	w/opt 4 or 5	>40 GHz to ≤67 GHz	+9	+6[*4]	
	w/opt 4 or 5	>67 GHz to ≤70 GHz	+3[*5]	0[*5]	
	w/o opt 4 or 5	≥2 GHz to ≤20 GHz	+21	+19	
	w/o opt 4 or 5	>20 GHz to ≤40 GHz	+19	+16	
	w/o opt 4 or 5	>40 GHz to ≤67 GHz	+9	+6[*4]	
	w/o opt 4 or 5	>67 GHz to ≤70 GHz	+3[*5]	0[*5]	

*1: ≤2.2 GHz with Option 4
*2: >2.2 GHz with Option 4
*3: For output power with Option 22, 0.1 Hz to 10 MHz coverage, derate all specifications by 2 dB
*4: Typical 60 GHz to 67 GHz
*5: Typical

Minimum Settable Power	Without an Attenuator	–20 dBm
	With an Attenuator	–120 dBm
Minimum Leveled Output Power	Without an Attenuator	–15 dBm (–20 dBm, typical)
	With an Attenuator	–115 dBm (MG3691C, MG3692C, MG3693C, and MG3694C) –105 dBm (MG3695C and MG3697C)
	With an Electronic Attenuator	–125 dBm (MG3691C)
Unleveled Output Power Range (Typical)	Without an Attenuator	>40 dB below max. power
	With an Attenuator	>130 dB below max. power
Power Level Switching Time (to within specified accuracy)	Without Change in Step Attenuator	<3 ms typical
	With Change in Step Attenuator	<20 ms typical
	With Change in Electronic Step Attenuator	<3 ms typical. Power level changes across –70 dB step will result in 20 ms delay
Step Attenuator (Option 2)	Adds a 10 dB/step attenuator, with 110 dB range on models ≤40 GHz, and 90 dB range on models >40 GHz. Option 2E adds an electronic version with 120 dB range, only available on an MG3691C. Option 2E is not available on units with Option 22, coverage down to 0.1 Hz.	

Accuracy and Flatness	Accuracy specifies the total worst case accuracy. Flatness is included within the accuracy						
	Step Sweep and CW Modes	Attenuation below Max. power		Frequency (GHz)			
				≤40[*2]	40 to 50	50 to 60	60 to 67
		Accuracy	0 to 25 dB	±1.0 dB	±1.5 dB	±1.5 dB	±1.5 dB
			25 to 60 dB	±1.0 dB	±1.5 dB	±3.5 dB[*1]	N/A
			60 to 100 dB	±1.0 dB	±2.5 dB[*1]	±3.5 dB[*1]	N/A
		Flatness	0 to 25 dB	±0.8 dB	±1.1 dB	±1.1 dB	±1.1 dB
			25 to 60 dB	±0.8 dB	±1.1 dB	±3.1 dB[*1]	N/A
			60 to 100 dB	±0.8 dB	±2.1 dB[*1]	±3.1 dB[*1]	N/A
	Analog Sweep Mode (typical)	Attenuation below Max. power		Frequency (GHz)			
				0.01 to 0.05	0.05 to 20	20 to 40	40 to 67
		Accuracy	0 to 12 dB	±2.0 dB	±2.0 dB	±2.0 dB	±3.0 dB
			12 to 30 dB	±3.5 dB	±3.5 dB	±4.6 dB	±5.6 dB
			30 to 60 dB	±4.0 dB	±4.0 dB	±5.2 dB	±6.2 dB
			60 to 122 dB	±5.0 dB	±5.0 dB	±6.2 dB	±7.2 dB
		Flatness	0 to 12 dB	±2.0 dB	±2.0 dB	±2.0 dB	±2.5 dB
			12 to 30 dB	±3.5 dB	±3.5 dB	±4.1 dB	±5.1 dB
			30 to 60 dB	±4.0 dB	±4.0 dB	±4.6 dB	±5.6 dB
			60 to 122 dB	±5.0 dB	±5.0 dB	±5.2 dB	±6.2 dB

Other Output Power Specifications	Output Units		Output units selectable as either dBm or mV. Selection of mV assumes 50Ω load. All data entry and display are in the selected units
	Output Power Resolution		0.01 dB or 0.001 mV
	Source Impedance		50Ω nominal
	Source SWR (internal leveling)		<2.0 typical
	Power Level Stability with Temperature		0.04 dB/°C typical
	Level Offset		Offsets the displayed power level to establish a new reference level
	Output On/Off		Toggles the RF output between an off and on state. During the off state, the RF oscillator is turned off. The on or off state is indicated by two LEDs located below the OUTPUT ON/OFF key on the front panel
	Rf On/Off Between Frequency Steps		System menu selection of RF on or RF off during frequency switching in CW, step sweep, and list sweep modes
	Rf On/Off During Retrace		System menu selection of RF on or RF off during retrace
	Internal Leveling		Power is leveled at the output connector in all modes
	External Leveling	External Detector	Levels output power at a remote detector location. Accepts a positive or negative 0.5 mV to 500 mV input signal from the remote detector. EXT ALC ADJ adjusts the input signal range to an optimum value. BNC connector, front and rear panel
		External Power Meter	Levels output power at a remote power meter location. Accepts a ±1 V full scale input signal from the remote power meter. EXT ALC ADJ adjusts the input signal range to an optimum value. BNC connector, rear panel
		External Leveling Bandwidth	30 kHz typical in detector mode. 0.7 Hz typical in power meter mode
		User Level Flatness Correction	Number of points: 2 to 801 points per table Number of tables: 5 available Entry modes: GPIB power meter or computed data

CW Power Sweep	Range	Sweeps between any two power levels at a single CW frequency
	Resolution	0.01 dB/step (Log) or 0.001 mV (Linear)
	Accuracy	Same as CW power accuracy
	Log/Linear Sweep	Power sweep selectable as either log or linear. Log sweep is in dB; linear sweep is in mV
	Step Size	User-controlled, 0.01 dB (Log) or 0.001 mV (Linear) to the full power range of the instrument
	Step Dwell Time	Variable from 1 ms to 99 seconds. If the sweep crosses a step attenuator setting, there will be a sweep dwell of approximately 20 ms to allow setting of the step attenuator
Sweep Frequency/ Step Power	A power level step occurs after each frequency sweep. Power level remains constant for the length of time required to complete each sweep	

*1: Typical
*2: Accuracy and Flatness with high power option 15, is ±1.5 dB. It is also ±1.5 dB below 20 MHz with or without Option 15.

Frequency/Phase Modulation (Option 12)

Option 12 adds frequency and phase modulation, driven externally via a rear panel BNC connector, 50Ω. For internal modulation, add Internal LF and Pulse Generators Option 27. Frequency/Phase Modulation is not available <10 MHz with Option 22.
For the most accurate FM and ΦM measurements, Bessel Null methods are used. When verifying FM and ΦM, the use of the "carrier null" technique is recommended. Measured residual FM effects must be subtracted from modulation meter measurements.

Frequency Generator Multiplication/Division Ratios	Frequency Range	Divide Ratio, n
	<10 MHz (Option 22)	Modulation not available
	≥10 MHz to ≤15.625 MHz (Option 4)	256
	>15.625 MHz to ≤31.25 MHz (Option 4)	128
	>31.25 MHz to ≤62.5 MHz (Option 4)	64
	>62.5 MHz to ≤125 MHz (Option 4)	32
	>125 MHz to ≤250 MHz (Option 4)	16
	>250 MHz to ≤500 MHz (Option 4)	8
	>500 MHz to ≤1050 MHz (Option 4)	4
	>1050 MHz to ≤2200 MHz (Option 4)	2
	>10 MHz to ≤2000 MHz (Option 5)	1
	>2 GHz to ≤20 GHz	1
	>20 GHz to ≤40 GHz	1/2
	>40 GHz to ≤67 GHz	1/4

Frequency Modulation:

Parameter	Modes	Conditions	Specifications	Conditions	Specifications
		For all Frequencies other than <2.2 GHz with Option 4		For Frequencies <2.2 GHz with Option 4	
Deviation	Locked	Rate = 1 kHz to 8 MHz	± [Lesser of 10 MHz or 300 * (mod rate)]/n	Rate = 1 kHz to (Lesser of 8 MHz or 0.03 * Fcarrier)	± [Lesser of 10 MHz or 300 * (mod rate)]/n
	Locked Low-noise	Rate = 50 kHz to 8 MHz	± [Lesser of 10 MHz or 3 * (mod rate)]/n	Rate = 50 kHz to (Lesser of 8 MHz or 0.03 * Fcarrier)	± [Lesser of 10 MHz or 3 * (mod rate)]/n
	Unlocked Narrow	Rate = DC to 8 MHz	±10 MHz/n	Rate = DC to (Lesser of 8 MHz or 0.03 * Fcarrier)	± (10 MHz)/n
	Unlocked Wide	Rate = DC to 100 Hz	±100 MHz/n	Rate = DC to 100 Hz	± (100 MHz)/n
Bandwidth (3 dB)	Locked		1 kHz to 10 MHz		1 kHz to (Lesser of 10 MHz or 0.03 * Fcarrier)
	Locked Low-noise		30 kHz to 10 MHz		30 kHz to (Lesser of 8 MHz or 0.03 * Fcarrier)
	Unlocked Narrow		DC to 10 MHz		DC to (Lesser of 10 MHz or 0.03 * Fcarrier)
	Unlocked Wide		DC to 100 Hz		DC to 100 Hz
Flatness	Locked	Rate = 10 kHz to 1 MHz	±1 dB relative to 100 kHz	Rate = 10 kHz to (Lesser of 1 MHz or 0.01 * Fcarrier)	±1 dB relative to 100 kHz
Accuracy	Locked and Low-noise Unlocked Narrow	Rate = 100 kHz sinewave Int. or 1 Vpk Ext.	10% (5% typical)	Rate = 100 kHz sinewave Int. or 1 Vpk Ext.	10% (5% typical)
Incidental AM	Locked and Low-noise Unlocked Narrow	1 MHz Rate, ±1 MHz Dev.	<2% typical	Rate and Dev. = Lesser of 1 MHz or 0.01 * Fcarrier	<2% typical
Harmonic Distortion	Locked	10 kHz Rate, ±1 MHz Dev.	<1%	Rate = 10 kHz, Dev.= ± (1 MHz)/n	<1%
External Sensitivity	Locked Locked Low-noise Unlocked Narrow Unlocked Wide	(±1 V maximum input)	± (10 kHz/V to 20 MHz/V)/n ± (10 kHz/V to 20 MHz/V)/n ± (10 kHz/V to 20 MHz/V)/n ± (100 kHz/V to 100 MHz/V)/n	(±1 Vpk maximum input)	± (10 kHz/V to 20 MHz/V)/n ± (10 kHz/V to 20 MHz/V)/n ± (10 kHz/V to 20 MHz/V)/n ± (100 kHz/V to 100 MHz/V)/n

Phase Modulation:

Parameter	Modes	Conditions	Specifications	Conditions	Specifications
		For all Frequencies other than < 2.2 GHz with Option 4		For Frequencies < 2.2 GHz with Option 4	
Deviation	Narrow	Rate = DC to 8 MHz	± [Lesser of 3 rad or (5 MHz/mod rate)]/n	Rate = DC to (Lesser of 8 MHz or 0.03 * Fcarrier)	± [Lesser of 3 rad or (5 MHz/mod rate)]/n
	Wide	Rate = DC to 1 MHz	± [Lesser of 400 rad or (10 MHz/mod rate)]/n	Rate = DC to (Lesser of 1 MHz or 0.03 * Fcarrier)	± [Lesser of 400 rad or (10 MHz/mod rate)]/n
Bandwidth (3 dB)	Narrow		DC to 10 MHz		DC to (Lesser of 10 MHz or 0.03 * Fcarrier)
	Wide		DC to 1 MHz		DC to (Lesser of 1 MHz or 0.03 * Fcarrier)
Flatness	Narrow	Rate = DC to 1 MHz	±1 dB relative to 100 kHz	Rate = DC to (Lesser of 1 MHz or 0.01 * Fcarrier)	±1 dB relative to 100 kHz rate
	Wide	Rate = DC to 500 kHz	±1 dB relative to 100 kHz	Rate = DC to (Lesser of 500 kHz or 0.01 * Fcarrier)	±1 dB relative to 100 kHz rate
Accuracy	Narrow and Wide	100 kHz Internal or 1 Vpk External, sine	10%	100 kHz Internal or 1 Vpk External, sine	10%
External Sensitivity	Narrow Wide	(±1 V maximum input)	± (0.0025 rad/V to 5 rad/V)/n ± (0.25 rad/V to 500 rad/V)/n	(±1 Vpk maximum input)	± (0.0025 rad/V to 5 rad/V)/n ± (0.25 rad/V to 500 rad/V)/n

Amplitude Modulation (Option 14)

Option 14 adds amplitude modulation, driven externally via a rear panel BNC connector 50Ω. For internal modulation, add Internal LF and Pulse Generators Option 27.
All amplitude modulation specifications apply at 50% depth, 1 kHz rate, with RF level set 6 dB below maximum specified leveled output power, unless otherwise noted. Amplitude Modulation is not available <10 MHz with Option 22.

AM Depth (typical)	0 to 90% linear; 20 dB log	
AM Bandwidth (3 dB)*	DC to 50 kHz minimum, DC to 100 kHz typical	
Flatness (DC to 10 kHz rates)	±0.3 dB	
Accuracy	±5%	
Distortion	<5% typical	
Incidental Phase Modulation (30% depth, 10 kHz rate)	<0.2 radians typical	
External AM Input	Log AM or Linear AM input, rear panel BNC, 50Ω input impedance. For internal modulation, add LF Generator Option 27.	
	Sensitivity	Log AM: Continuously variable from 0 dB per volt to 25 dB per volt.
		Linear AM: Continuously variable from 0% per volt to 100% per volt.
	Maximum Input	±1 Vpk

*: Typical below 2.2 GHz, when ordered with Options 4 and 15.

Pulse Modulation (Option 26)

Option 26 adds pulse modulation, driven externally via a rear panel BNC connector, TTL. For internal modulation, add Internal LF and Pulse Generators Option 27.
Pulse modulation specifications apply at maximum rated power, unless otherwise noted. Pulse modulation is not available <10 MHz with Option 22.

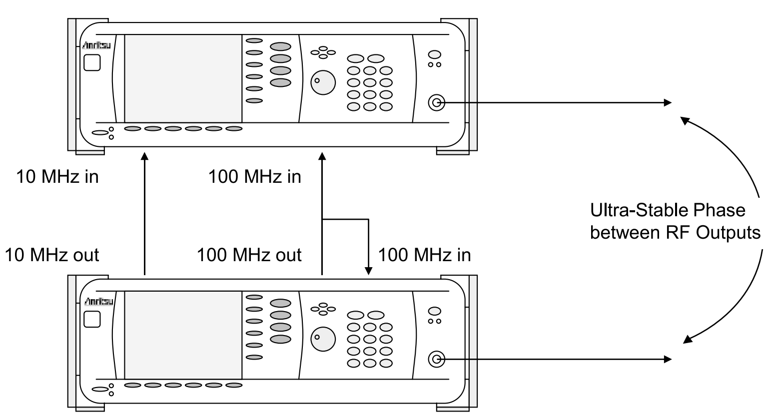
On/Off Ratio	>80 dB (>70 dB with high power Option 15)			
Minimum Leveled Pulse Width	100 ns, ≥1 GHz 1 µs, <1 GHz			
Minimum Unleveled Pulse Width	<10 ns			
Level Accuracy Relative to CW (100 Hz to 1 MHz PRF)	±0.5 dB, ≥1 µs pulse width ±1.0 dB, <1 µs pulse width			
Pulse Delay (typical)	External Mode: 50 ns			
PRF Range	DC to 10 MHz, unleveled 100 Hz to 5 MHz, leveled			
Frequency Range	Rise & Fall Time (10 to 90%)	Overshoot	Pulse Width Compression[*1]	Video Feedthrough[*1]
≥10 to <31.25 MHz (Option 4)	400 ns[*1]	33%[*1]	40 ns	±70 mV
≥31.25 to <125 MHz (Option 4)	90 ns[*1]	22%[*1]	12 ns	±130 mV
≥125 to <500 MHz (Option 4)	33 ns[*1]	11%[*1]	12 ns	±70 mV
≥500 to <2200 MHz (Option 4)	15 ns	10%[*1]	12 ns	±15 mV
≥10 to <1000 MHz (Option 5)	15 ns/10 ns[*1]	10%[*1]	8 ns	±30 mV
≥1 to <2 GHz (Option 5)	10 ns/5 ns[*1]	10%[*1]	8 ns	±30 mV
≥2 to ≤67 GHz[*2]	10 ns/5 ns[*1]	10%[*3]	8 ns	±30 mV
External Input	Rear panel BNC. For internal modulation, add Pulse Generator Option 27.			
	Drive Level	TTL compatible input		
	Input Logic	Positive-true or negative-true, selectable from modulation menu.		

*1: Typical
*2: Rise time and pulse width compression >20 GHz, degrades by 2 ns with High Power Option 15.
*3: For 50 and 67 GHz units, overshoot >40 GHz is 20% typical at rated power.

Ultra-Stable Phase Tracking (Option 36)

Option 36 enables up to three MG3690C units fitted with option 3, 3X to phase track with a very high degree of stability. Option 36 provides additional rear panel connectors to link internal reference signals together.

100 MHz Reference Output	Provides the reference signal to drive up to two other MG3690C. All must have Option 36 and either option 3 or 3x. This signal is only intended for use with other Option 36 instruments.
100 MHz Reference Input	Accepts the 100 MHz reference signal from another MG3690C fitted with Option 36. This input is only intended for use with other Option 36 instruments.
Phase Drift	<±1º over 5 seconds (typical), <±1.5º over 100 seconds (typical), after 24 hours warm-up time.



Internal LF and Pulse Generators (Option 27)

An internal pulse generator and two internal waveform generators are added, one providing a frequency or phase modulating signal and the other an amplitude modulating signal. This Internal LF and Pulse Generators option can only be ordered in combination with either FM/ΦM, AM, or Pulse options, 12, 14, and 26 respectively.

Waveforms	Sinusoid, square-wave, triangle, positive ramp, negative ramp, Gaussian noise, uniform noise. (Check Option 10 for User-Defined)	
Rate	0.1 Hz to 10 MHz sinusoidal 0.1 Hz to 100 kHz square-wave, triangle, ramps	
Resolution	0.1 Hz	
Accuracy	Same as instrument timebase ±0.014 Hz	
Output	Two BNC connectors on the rear panel, FM/ΦM OUT and AM OUT	
Pulse Triggers	Free run, triggered, gated, delayed, triggered with delay, swept-delay	
Pulse Modes	Singlet, doublet, triplet, quadruplet.	
Parameter	Selectable Clock Rate	
	Narrow (100 MHz)	Wide (10 MHz)
Pulse Width	30 ns to 160 ms	100 ns to 1.6 s
Pulse Period*	100 ns to 160 ms	600 ns to 1.6 s
Variable Delay Singlet Doublet Triplet Quadruplet	 0 to 160 ms 100 ns to 160 ms 100 ns to 160 ms 100 ns to 160 ms	 0 to 1.6 s 300 ns to 1.6 s 300 ns to 1.6 s 300 ns to 1.6 s
Resolution	10 ns	100 ns
Accuracy	10 ns (5 ns typical)	
Inputs/Outputs	Inputs/Outputs: Video pulse and sync out, rear panel BNC connectors	

*: Period must be longer than the sum of delay and width by 5 clock cycles minimum.

Millimeter-Wave Multiplier 2000-1694 Series

2000-1694 series external waveguide output multipliers are available for banded frequency coverage up to 500 GHz. These external multipliers require at a minimum, an MG3692C with 20 GHz coverage. The output power required to drive the modules is +10 dBm. They can be powered from an external power supply (+12 VDC, 1.5 A typical) using the supplied double banana power cord, or from the 40-187-R DC Power Supply and 2000-1710-R Millimeter-wave Power Supply Adapter (both included with the modules).

2000-1694 series multipliers have a saturated, unleveled, output power, yet their inherent flatness is exceptional. Modulating the input drive will indeed modulate the output, except for the case of Amplitude Modulation. Since the output is saturated, Amplitude Modulation is not recommended with these millimeter-wave modules. Frequency and Phase Modulation is possible, but the achieved deviation will be multiplied based on the multiplication factor of the module. Pulse modulation is also possible, with even sharper rise and fall times than the input. All modulation performances are not specified.

For ease of operation, the MG3690C allows the user to enter a frequency scaling factor, the module's multiplication factor, which will be used only for purposes of displaying the proper frequency at the output of the millimeter-wave module, on the MG3690C front panel display.

Millimeter-Wave Multiplier 2000-1694 Series are not for use with MG3690C Option 18.

Multiplier p/n[*1, *2, *3]	2000-1694-15-R	2000-1694-12-R	2000-1694-10-R	2000-1694-08-R	2000-1694-06-R	2000-1694-05-R	2000-1694-03-R	2000-1694-02-R
Frequency	50 GHz to 75 GHz	60 GHz to 90 GHz	75 GHz to 110 GHz	90 GHz to 140 GHz	110 GHz to 170 GHz	140 GHz to 220 GHz	220 GHz to 325 GHz	325 GHz to 500 GHz
Waveguide Output	WR-15	WR-12	WR-10	WR-08	WR-06	WR-05	WR-03	WR-02.2
Flange[*4]	(008)	(009)	(010)	(M08)	(M06)	(M05)	(M03)	(M02.2)
Output Power (typical)	+8 dBm	+6 dBm	+7 dBm	–5 dBm	–9 dBm	–15 dBm	–25 dBm[*5]	–27 dBm[*5]
Output Flatness (typical) (Unleveled)	±2 dB	±2 dB	±3 dB	–	–	–	–	–
Output Match	>11.7 dB	>11.7 dB	>11.7 dB	>11.7 dB	>11.7 dB	>11.7 dB	6 dB (typical)	6 dB (typical)
Multiplication Factor (m)	× 4	× 6	× 6	× 8	× 12	× 12	× 18	× 30
Input Frequency	12.5 GHz to 18.8 GHz	10 GHz to 15 GHz	12.5 GHz to 18.4 GHz	11.2 GHz to 17.5 GHz	9.1 GHz to 14.2 GHz	11.6 GHz to 18.4 GHz	12.2 GHz to 18.1 GHz	10.8 GHz to 16.7 GHz
Frequency Accuracy	(Synthesizer Accuracy × m)							
Frequency Resolution	(Synthesizer Resolution × m)							
Manual Adjustable Attenuator[*6]	25 dB min							–
Harmonics & Spurious[*7, *8]	–20 dBc (typical)							–
Input Power Required	+10 dBm							
RF Input Connector	SMA (female)							
DC Power	12 VDC, 1.5 A (double-banana power cord included)[*2]							
Dimensions	145 × 110 × 72 mm (not including feet, interfaces, or optional manual attenuation adjuster)							
Mass	<1 kg							
Temperature	+20° to +30°C							

*1: These millimeter-wave modules are produced by OML Inc. (Oleson Microwave Labs), located in Morgan Hill, CA., with mutual collaborative experiences over many years. For detailed and up-to-date specifications, please call OML, Inc. or visit their website at http://www.omlinc.com.
*2: Multipliers require power from an external power supply (+12 VDC, 1.5 A typical) using the supplied double banana power cord, or from the 40-187-R DC Power Supply and 2000-1710-R Millimeter-wave Power Supply Adapter (both included with the modules).
*3: Warranty period for the 2000-1694 Series is one year.
*4: Waveguide output flanges are per MIL-DTL-3922/67D (UG387/U-M).
*5: Output power is estimated.
*6: Available as an option. To order, add "A" to multiplier module part number (for example, 2000-1694-15A-R). Not available with 2000-1694-02-R.
*7: In-band mixing products typically ≤ –15 dBc in the lower 10% of the waveguide band.
*8: As relates to multiplied output frequencies.

Inputs and Outputs*1

EXT ALC IN	Provides for leveling the RF output signal externally with either a detector or power meter. Signal requirements are shown in the RF Output specifications.
RF OUTPUT (Option 9)*2	Provides for RF output from 50Ω source impedance. K Connector, female. Option 9 moves the RF Output connector to the rear panel.
10 MHz REF IN	Accepts an external 10 MHz ±100 Hz, 0 to +20 dBm time-base signal. Automatically disconnects the internal high-stability time-base option, if installed. 50Ω impedance.
10 MHz REF OUT	Provides a 1 Vp-p, AC coupled, 10 MHz signal derived from the internal frequency standard. 50Ω impedance.
100 MHz REF IN (Option 36)	Accepts the 100 MHz signal from an MG3690C with Option 36 for ultra-stable phase tracking.
100 MHz REF OUT (Option 36)	Provides the 100 MHz signal for an MG3690C with Option 36 ultra-stable phase tracking.
HORIZ OUT (Horizontal Sweep Output)	Provides 0 V at beginning and +10 V at end of sweep, regardless of sweep width. In CW mode, the voltage is proportional to frequency between 0 V at low end and +10 V at the high end of range. In CW mode, if CW RAMP is enabled, a repetitive, 0 to +10 V ramp is provided.
EFC IN	Provides the capability to frequency modulate the internal crystal oscillator, allowing phase locking the synthesizer inside an external lock loop.
AUX I/O (Auxiliary Input/Output)	Provides for most of the rear panel BNC connections through a single, 25-pin, D type connector. Supports master-slave operation with another synthesizer or allows for a single-cable interface with the Model 56100A Scalar Network Analyzer and other Anritsu instruments.
SERIAL I/O (Serial Input/Output)	Provides access to RS-232 terminal ports to support service and calibration functions and master slave operations.
IEEE-488 GPIB	Provides input/output connections for the General Purpose Interface Bus (GPIB).
mmW BIAS (Option 18)*2	Provides the bias for the external waveguide multipliers for coverage up to 325 GHz.
RF, LO, IF (Option 7)*2	Provides access to an internal IF up-conversion mixer, Option 7.
PULSE TRIG IN (Option 26)	Accepts an external TTL compatible signal to pulse modulate the RF output signal or to trigger or to gate the optional internal pulse generator. Available with Option 26, Pulse Modulation.
PULSE SYNC OUT (Option 27)	Provides a TTL compatible signal, synchronized to the internal pulse modulation output, Option 27.
PULSE VIDEO OUT (Option 27)	Provides a video modulating signal from the internal pulse generator, Option 27.
AM IN (Option 14)	Accepts an external signal to amplitude modulate the RF output signal, Option 14. 50Ω impedance
FM/ΦM IN (Option 12)	Accepts an external signal to frequency or phase modulate the RF output signal, Option 12. 50Ω impedance
AM OUT (Option 27)	Provides the amplitude modulation waveform from the internal LF generator, Option 27.
FM/ΦM OUT (Option 27)	Provides the frequency or phase modulation waveform from the internal LF generator, Option 27.
SCAN MOD IN (Option 20)*2	Accepts an external signal to scan modulate the RF output signal, Option 20, High Impedance.
POWER MONITOR IN (Option 8)	Accepts an external detector for power monitoring, Option 8.

*1: Connectors may be available but not active if option not ordered.
*2: Options (7 & 18), (7 & 20), (8 & 9) are mutually exclusive, as they share the same rear panel space.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MG3691C	2 GHz to 10 GHz CW Generator
MG3692C	2 GHz to 20 GHz CW Generator
MG3693C	2 GHz to 31.8 GHz CW Generator
MG3694C	2 GHz to 40 GHz CW Generator
MG3695C	2 GHz to 50 GHz CW Generator
MG3697C	2 GHz to 67 GHz CW Generator (operational to 70 GHz)
	Options and accessories
MG3690C/1A	Rack Mount with slides – Rack mount kit containing a set of track slides (90 degree tilt capability), mounting ears, and front panel handles to let the instrument be mounted in a standard 19-inch equipment rack.
MG3690C/1B	Rack Mount without slides – Modifies rack mounting hardware to install unit in a console that has mounting shelves. Includes mounting ears and front panel handles.
MG3690C/2X	Mechanical Step Attenuator – Adds a 10 dB/step attenuator. Rated RF output power is reduced. (This option comes in different versions, based on instrument configuration.)
MG3690C/2E	Electronic Step Attenuator – Adds a 10 dB/step electronic attenuator with a 120 dB range for the MG3691C. Rated RF output power is reduced.
MG3690C/3*1	Ultra Low Phase Noise, main band – Adds new modules to significantly reduce SSB phase noise. (Not available with Option 3x.)
MG3690C/3X*1	Premium Phase Noise, improves Option 3 (<1 kHz offset). (Not available with Option 3)
MG3690C/4	8 MHz to 2.2 GHz RF coverage, Ultra-Low Phase Noise version – Uses a digital down converter to significantly reduce SSB phase noise.*2
MG3690C/5	8 MHz to 2 GHz RF coverage – Uses an analog down converter.*2
MG3690C/6	Analog Sweep Capability (limited to ≥500 MHz when used with Option 4)
MG3690C/7	IF Up-Conversion – Adds an internal 40 GHz mixer for up-converting an IF signal. (Not available with MG3695C, MG3697C, or with Option 18, 20 or 36)
MG3690C/8	Power Monitor – Adds internal power measurement capability (not available with Option 9).
MG3690C/9X	Rear Panel Output – Moves the RF output connector to the rear panel. (This option comes in different versions, based on instrument configuration.)
MG3690C/10	User-Defined Modulation Waveform Software – External software package provides the ability to download user-defined waveforms into the memory of the internal waveform generator, serially or via GPIB. External PC and an instrument with LF Generator, Option 27, are required. This external software package can only be used with Option 10 enabled instruments.
MG3690C/12	Frequency and Phase Modulation – External, via a rear panel BNC connector. For internal modulation capability, requires additionally LF Generator, Option 27.
MG3690C/14	Amplitude Modulation – External, via a rear panel BNC connector. For internal modulation capability, requires additionally LF Generator, Option 27.
MG3690C/15X	High Power – Adds high-power RF components to the instrument to increase its output power level. (This option comes in different versions, based on instrument configuration.)
MG3690C/16	High Stability Time Base – Adds an ovenized, 10 MHz crystal oscillator as a high-stability time base.
MG3690C/17	Delete Front Panel – Deletes the front panel for use in remote control applications where a front panel display and keyboard control are not needed.
MG3690C/18	DC Output – Adds a rear panel BNC Twinax connector supplying +15 VDC, 1A (nominal). (Not available with Option 7 or 15x)
MG3690C/20	Scan Modulation – Adds an internal Scan modulator for simulating high-depth amplitude modulated signals. Requires an external modulating signal input capability. (Not available on models MG3693C, MG3694C, MG3695C, MG3697C, or with Options 2E, 7, 15X, or 22)
MG3690C/22	0.1 Hz to 10 MHz Audio coverage – Uses a DDS for coverage down to approximately DC. When adding Option 22, the output power is derated by 2 dB. The frequency resolution below 10 MHz is 0.02 Hz. No modulation is available in the 0.1 Hz to 10 MHz band (Not available without Option 4 or 5 or with Option 20 or 2E).

Model/Order No.	Name
MG3690C/26X*3	Pulse Modulation – External, via a rear panel BNC connector. For internal modulation capability, requires additionally Pulse Generator, Option 27. (This option comes in different versions, based on instrument configuration.)
MG3690C/27	Internal LF and Pulse Generators – Provides modulation waveforms for internal AM, FM, FM, and Pulse. (Not available without Option 12, 14, or 26.)
MG3690C/28X*3	Analog Modulation Suite – For ease of ordering and package pricing, this option bundles Options 12, 14, 26 and 27, offering internaland external AM, FM, ΦM, and Pulse Modulation. (This option comes in different versions, based on instrument configuration.)
MG3690C/36	Ultra-Stable Phase Tracking - Provides the capability for ultra-stable phase tracking between instruments using the internal 100 MHz reference. (Requires Option 3 or 3x) (Not available with Option 7 or with both Option 18 and 20 together)
	Accessories
34RKNF50	DC to 20 GHz, Ruggedized Type N female adapter for units with a K Connector Output
ND36329	Master/Slave Interface Cable Set
63270	Transit Case
2300-469	IVI Driver, includes LabView® driver
806-97	Aux I/O Cable, 25 pin to BNC: Provides BNC access to V/GHz and Sequential Sync connections and other AUX I/O data lines
	Millimeter Wave Accessories*4
2000-1694-15-R	50 GHz to 75 GHz V band Multiplier Source Module, WR-15
2000-1694-12-R	60 GHz to 90 GHz E band Multiplier Source Module, WR-12
2000-1694-10-R	75 GHz to 110 GHz W band Multiplier Source Module, WR-10
2000-1694-08-R	90 GHz to 140 GHz F band Multiplier Source Module, WR-08
2000-1694-06-R	110 GHz to 170 GHz D band Multiplier Source Module, WR-06
2000-1694-05-R	140 GHz to 220 GHz G band Multiplier Source Module, WR-05
2000-1694-03-R	220 GHz to 325 GHz H band Multiplier Source Module, WR-03
2000-1694-02-R	325 GHz to 500 GHz Multiplier Source Module, WR-02.2
40-187-R	DC Power Supply (Included with Multiplier Source Module)
2000-1710-R	Millimeter wave Power Supply Adapter (Included with Multiplier Source Module)
	Upgrades
	Economical upgrades are available to upgrade any model to any higher performing model. Consult Anritsu for details.

*1: Phase Noise performance is controlled by United States Export Control regulations. For solutions that do not require export licences, please consult your Anritsu Sales Representative.
*2: All specifications for Options 4 and 5 apply ≥10 MHz.
*3: Pulse Modulation performance is controlled by United States Export Control regulations, >31.8 GHz. For Pulse Modulation solutions that do not require export licenses, please consult with your Anritsu sales representative.
*4: To order a multiplier with an optional manually adjustable attenuator, add an "A" to the multiplier module part number (for example, 2000-1694-15A-R). Not available with 200-1694-02-R

FAST SWITCHING MICROWAVE SIGNAL GENERATOR

MG37022A

10 MHz to 20 GHz

Remote Control
GPIB | Ethernet | USB

Fast Switching Microwave Signal Generator, 100 µsec Switching Speed

The MG37020A Fast Switching Microwave Signal Generator is the "ideal microwave signal generator" for applications where fast frequency switching speed is a critical parameter, including data intensive applications, high throughput manufacturing test, and signal simulation. The MG37020A Fast Switching Microwave Signal Generator provides fast switching speed along with high output power, low phase noise, spectral purity, high performance pulse modulation, size, upgradeability, reliability and service. Our signal generators are configurable for a broad range of applications from R&D to manufacturing and depot repair. Anritsu provides you a total solution including proven reliability and standard 3 year warranty plus pre- and post-sale support that is the best in the industry.

Features

- 10 MHz to 20 GHz
- 100 ms Switching Time (typ.)
- +23 dBm at 20 GHz (optional)
- –105 dBc/Hz (typ.) Phase Noise, 10 GHz, 10 kHz Offset
- Pulse Modulation (optional)
  - 100 ns Leveled Width, >1 GHz
  - Internal Pulse Generator (optional)
- Windows Platform with Touchscreen Display
- USB, LAN, GPIB
- 3 Year standard warranty

Specifications

The specifications in the following pages describe the warranted performance of the generator for 25°C ±10°C. Typical specifications describe expected, but not warranted, performance based on sample testing.

Frequency Coverage

Model/Option 4	Frequency Coverage	Output Type
MG37022A	2 to 20 GHz	K (f)
Option 4	10 MHz to 2.2 GHz	K (f)

Option 4: Frequency extension down to 10 MHz. Option 4 uses a digital down-converter (DDC) with successive divide-by-two circuitry. It offers reduced SSB phase noise compared to heterodyne down-converters.

- **CW Mode**

Accuracy: Same as internal or external 10 MHz time base.
Internal Time Base Stability:
With aging: $<2 \times 10^{-9}$/day
With temperature: $<2 \times 10^{-8}$/deg C over 0° to 50°C
Internal Time Base Calibration:
The internal time base can be calibrated via the System Cal Menu to match an external reference (10 MHz ±50 Hz).
Resolution: 0.001 Hz
External 10 MHz Reference Input:
Accepts external 10 MHz ±50 Hz (typical), 0 to +20 dBm time base signal. Automatically detects and switches to the external reference (when applied). Rear panel BNC, 50Ω impedance. Selectable bandwidth for best phase noise immunity or best phase tracking performance.
10 MHz Reference Output:
>–5 dBm 50Ω. AC coupled.
Rear panel BNC: 50Ω impedance.
Electronic Frequency Control (EFC) Input:
–5 V to +5 V input range. 2.5×10^{-6} Hz/V sensitivity (typical).
<250 Hz modulation bandwidth. Rear Panel BNC: high impedance

- **Phase-Locked Step Mode**

Sweep Width: Independently selected, 0.001 Hz to full range.
Every frequency step in sweep range is phase-locked.
Accuracy: Same as internal or external 10 MHz time base.
Resolution (Minimum Step Size): 0.001 Hz
Steps: User-selectable number of steps or the step size.
Number of Steps: Variable from 1 to 10,000
Step Size: 0.001 Hz to the full frequency range of the instrument.
(If the step size does not divide into the selected frequency range, the last step is truncated.)
Dwell Time Per Step: Variable from 50 µs to 30 seconds

- **List Sweep Mode**

Under remote control or via the front panel, up to 4 tables of 3 table types with 10,001 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. One table type of 10,001 points is stored in volatile memory, all other tables are stored in non-volatile memory.

Frequency Switching Time

• Switching Time (t_{sw})

t_{sw} (µsec)	Condition
<100 µsec (typical)	Step not starting at or crossing a Dwell Frequency
<500 µsec (typical)	Step starting at or crossing a Dwell Frequency

Filter Switching Dwell Frequencies: 3.3, 5.5, 8.4 and 13.25 GHz
Filter Switching Dwell Frequencies, 2.2 GHz (Option 4):
12.5, 15.625, 22.5, 31.25, 43.75, < 62.5, 87.5, 125, 175, 250, 350, 500, 700, 1050 and 1500 MHz

Note: Optimum switching time will be achieved using list mode with external manual transfer.

Spectral Purity

All specifications apply at the lesser of the maximum specified leveled output power or +10 dBm output power level, unless otherwise indicated.

• Spurious Signals

Harmonic and Harmonically-related:

Frequency Range	
10 MHz to 100 MHz (Option 4)	<–40 dBc
>100 MHz to 2.2 GHz (Option 4)	<–50 dBc
2 GHz (2.2 GHz with Option 4) to 20 GHz	<–50 dBc*

*: –30 dBc typical with high power Option 15

Non-harmonics:

Frequency Range	
10 MHz to 100 MHz (Option 4)	<–40 dBc
2 GHz (2.2 GHz with Option 4) to 20 GHz	<–40 dBc

Power Line and Fan Rotation Spurious Emissions (dBc):

Frequency Range	Offset from Carrier		
	<300 Hz	300 Hz to 1 kHz	>1 kHz
10 MHz to 500 MHz (Option 4)	<–68	<–72	<–72
>500 MHz to 1050 MHz (Option 40)	<–62	<–72	<–72
>1050 MHz to 2.2 GHz (Option 4)	<–56	<–66	<–66
>2.2 GHz to 8.4 GHz	<–50	<–60	<–60
>8.4 GHz to 20 GHz	<–46	<–56	<–60

Residual FM (CW and Step Sweep modes, 50 Hz to 15 kHz BW):

Frequency Range	Residual FM (Hz rms)
10 MHz to 10 GHz	<80
>10 GHz to 20 GHz	<80

AM Noise Floor: Typically <–145 dBm/Hz at 0 dBm output and offsets > 5 MHz from carrier.

Sub-Harmonics:

2 GHz to 2.5 GHz	<–30 dBc
2.5 GHz to 4 GHz	None
4 GHz to 20 GHz	<–30 dBc (typical)

Single-Sideband Phase Noise*

• Single-Sideband Phase Noise (dBc/Hz): (typical)

Frequency Range	Offset from Carrier					
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
10 MHz to 15.625 MHz (Option 4)	–101 (–115)	–126 (–132)	–139 (–143)	–142 (–145)	–142 (–145)	–145 (–148)
>15.625 MHz to 31.25 MHz (Option 4)	–95 (–106)	–121 (–127)	–134 (–142)	–139 (–145)	–139 (–145)	–145 (–148)
>31.25 MHz to 62.5 MHz (Option 4)	–89 (–96)	–116 (–122)	–129 (–140)	–135 (–145)	–137 (–145)	–142 (–150)
>62.5 MHz to 125 MHz (Option 4)	–83 (–92)	–110 (–116)	–127 (–139)	–129 (–140)	–134 (–139)	–138 (–146)
>125 MHz to 250 MHz (Option 4)	–77 (–89)	–104 (–113)	–123 (–133)	–123 (–137)	–128 (–134)	–132 (–144)
>250 MHz to 500 MHz (Option 4)	–71 (–85)	–98 (–105)	–117 (–126)	–117 (–130)	–122 (–128)	–126 (–140)
>500 MHz to 1050 MHz (Option 4)	–65 (–77)	–92 (–100)	–111 (–118)	–111 (–119)	–116 (–118)	–120 (–131)
>1050 MHz to <2.2 GHz (Option 4)	–59 (–70)	–86 (–95)	–105 (–112)	–105 (–117)	–110 (–114)	–114 (–122)
2 GHz (2.2 GHz with Option 4) to 6 GHz	–50 (–60)	–77 (–88)	–96 (–104)	–96 (–108)	–101 (–107)	–105 (–115)
>6 GHz to 10 GHz	–46 (–55)	–73 (–83)	–92 (–102)	–92 (–105)	–100 (–104)	–101 (–115)
>10 GHz to 20 GHz	–40 (–50)	–67 (–77)	–86 (–95)	–86 (–98)	–94 (–98)	–95 (–114)

*: Phase Noise is specified and guaranteed only with internal reference. In external reference mode, the phase noise of the external supplied reference and the external reference bandwidth will dictate the instrument phase noise performance. Phase noise is not degraded when adding the high power Option 15.

RF Output

Power level specifications apply at 25° ±10°C.

• Maximum Leveled Output Power:

Model Number	Configuration	Frequency Range	Output Power	Output Power with Option 2Step Attenuator
MG37022A	Standard	2 GHz to 10 GHz >10 GHz to 20 GHz	+19.0 dBm +17.0 dBm	+18.0 dBm +15.0 dBm
	Option 4	10 MHz to 2.2 GHz >2.2 GHz to 10 GHz >10 GHz to 20 GHz	+19.0 dBm +19.0 dBm +17.0 dBm	+18.0 dBm +18.0 dBm +15.0 dBm

• Maximum Leveled Output Power with High Power Option 15:

MG37022A	Standard	2 GHz to 20 GHz	+23.0 dBm	+21.0 dBm
	Option 4	10 MHz to 2.2 GHz >2.2 GHz to 20 GHz	+19.0 dBm +21.0 dBm	+18.0 dBm +19.0 dBm

• Minimum Leveled Output Power:

MG37022A	Standard	10 MHz to 20 GHz	–5.0 dBm (–10.0 dBm typical)	–105.0 dBm (–110.0 dBm typical)
	High Power (Option 15)	10 MHz to 20 GHz	–5.0 dBm (–10.0 dBm typical)	–105.0 dBm (–110.0 dBm typical)

• Unleveled Output Power Range (typical)

Without Step Attenuator (Option 2): >40 dB below max settable power
With Step Attenuator (Option 2): >130 dB below max settable power

• Power Level Switching Time (to within specified accuracy)

Without Change in Step Attenuator (Option 2): <100 µs typical
With Change in Step Attenuator (Option 2): <20 ms typical

Accuracy and Flatness*

Accuracy specifies the total worst case accuracy.

Flatness is included within the accuracy specification.

Accuracy: ±1.0 dB
Flatness: ±0.8 dB

• Accuracy and Flatness with High Power (Option 15)

Accuracy: ±1.5 dB
Flatness: ±1.5 dB

*: Specification only applies to the output level from maximum leveled output power to 100 dBm below maximum leveled output power.

• Other Output Power Specifications

Output Units: Output units are in dBm.
Output Power Resolution: 0.01 dB
Source Impedance: 50Ω nominal
Source VSWR (Internal Leveling): <2.0:1 typical
Power Level Stability with Temperature: 0.04 dB/deg C typical
Output On/Off: Toggles the RF output between an off and on state. During the off state, the RF oscillator is turned off. The off or on state is indicated by two LEDs located above and below the OUTPUT ON/OFF key on the front panel. Switching the RF on from an off state will require 1 ms for the output to be phase-locked and leveled.
RF On/Off Between Frequency Steps: System menu selection of RF on or RF off during frequency switching in CW, Step sweep and List Sweep modes. RF off state will provide >40 dB of attenuation of output power and will increase any switching time.
Internal Leveling: Power is leveled at the output connector in all modes.

Modulation

• Pulse Modulation (Option 26):

Option 26 adds pulse modulation, driven externally via a rear panel BNC connector (TTL levels) and an internal modulation waveform generator. Pulse modulation specifications apply at maximum rated power, unless otherwise indicated.
On/Off ratio: >80 dB (>70 dB with high power Option 15)
Minimum Leveled Pulse Width:
<100 ns, 2 GHz (2.2 GHz with Option 4) to 20 GHz
<1 µs, 10 MHz to <2 GHz (2.2 GHz with Option 4)
Minimum Unleveled Pulse width: <10 ns
Leveled Accuracy Relative to CW (100 Hz to 1 MHz PRF):
±0.5 dB, ^{3}1 µs pulse width
±1.0 dB, <1 µs pulse width
Pulse delay (typical): 50 ns in External Mode
Pulse Repetition Frequency (PRF) Range:
DC to 10 MHz, unleveled
100 Hz to 5 MHz, leveled

Frequency Range	Rise and Fall Time*	Overshoot	Pulse width Compression	Video Feedthrough
10 MHz to 31.25 MHz (Option 4)	400 ns typical	33% typical	40 ns typical	±70 mV typical
>31.25 MHz to 125 MHz (Option 4)	90 ns typical	22% typical	12 ns typical	±130 mV typical
>125 MHz to 500 MHz (Option 4)	33 ns typical	11% typical	12 ns typical	±70 mV typical
>500 MHz to <2.2 GHz (Option 4)	15 ns typical	10%	12 ns typical	±50 mV typical
2 GHz (2.2 GHz with Option 4) to 20 GHz	10 ns (5 ns typical)	10%	8 ns typical	±30 mV typical

*: Rise and Fall Time, 10 to 90%

External Input: Rear-panel BNC.
Drive Level and Input Logic: TTL compatible input, active high or active low selectable from modulation menu.

• Internal Pulse Generator (Included with Option 26)

Modes: Single, double, triple, quadruple
Triggers: Free-run, triggered, gated
Inputs/Outputs: Video pulse and sync out, rear-panel BNC connectors

Pulse Parameter	Specification, 100 MHz Clock Rate
Pulse Width	10 ns to 10 s
Pulse Period	30 ns to 10 s
Variable Delay, Single Pulse	0 to 10 s
Variable Delay, Doublet, Triplet, Quadruplet	100 ns to 10 s
Resolution	10 ns
Accuracy	10 ns (5 ns typical)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MG37022A	2 to 20 GHz Fast Switching Signal Generator
	Options
MG37022A-001	Rack Mount with Slides - Kit contains a set of track slides, mounting ears and front panel handles for standard 19 inch equipment rack.
MG37022A-002	Mechanical Step Attenuator - Adds a 110 dB range, 10 dB/step attenuator. RF output power is reduced.
MG37022A-004	10 MHz to 2.2 GHz RF Coverage - Uses a digital down converter to significantly reduce SSB phase noise
MG37022A-011	Rack Mount without slides Modifies rack mounting hardware to install unit in a console that has mounting shelves. Includes mounting ears and front panel handles.
MG37022A-009	Rear Panel Output - Moves the RF output connector to the rear panel.
MG37022A-015	High Power - Adds high-power RF components to the instrument to increase the output power level.
MG37022A-017	Delete Front Panel - Deletes the front panel for use in remote controlled applications. (Only available with Option 1)
MG37022A-026	Pulse Modulation - Includes internal waveform generator and external input via a rear panel BNC connector.
MG37022A-035	Removable Hard Drive - Provides the capability to remove the internal hard drive, and includes one replacement hard drive with instrument software.
MG37022A-036	Ultra Stable Phase Track - Provides the capability for ultra-stable phase tracking between instruments using the internal 100 MHz reference.
MG37022A-037	Performance Suite – For ease of ordering and package pricing, this option bundles Options 2, 4, 15 and 26.
MG37022A-088	1 msec Switching Speed Limit - Limits the frequency switching speed to 1 msec to comply with United States Export Control regulations
MG37022A-098	Standard Calibration to ISO17025 and ANSI/NCSL Z540. Provides a calibration certificate, decal and “Calibration void if removed” tamper seals.
MG37022A-099	Premium Calibration to ISO17025 and ANSI/NCSL Z540. Provides everything included with Option 98 plus test report and uncertainty data.
	Optional accessories
34RKNF50	DC to 20 GHz Ruggedized K male to Type-N female adapter.
63270	Transit Case (16 kg, 65 cm × 81 cm, roll-away on two wheels).
806-97	AUX I/O Cable, 25 pin to BNC: Sequential Sync, Marker Out, Bandswitch Blanking, Retrace Blanking, Sweep Dwell In, V/GHz and Horizontal Out.

ANALOG SIGNAL GENERATOR

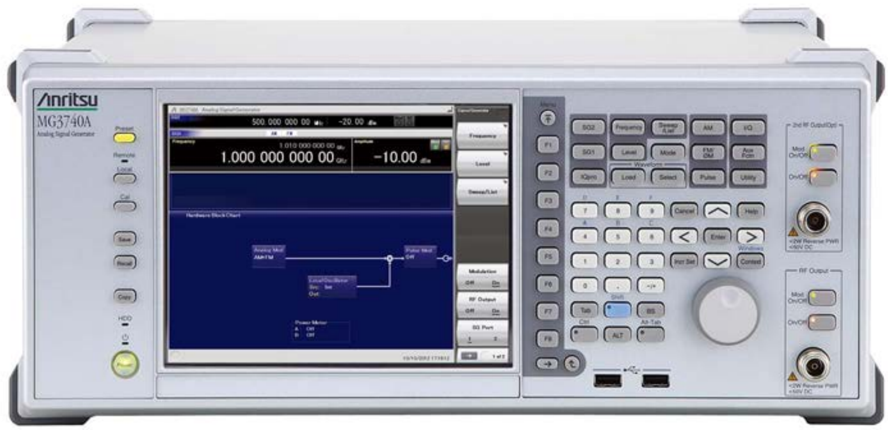
MG3740A

100 kHz to 2.7 GHz/4.0 GHz/6.0 GHz

Remote Control
GPIB | Ethernet | USB

Excellent RF Performance, Versatile Modulation Functions, Built-in Dual RF Outputs

NEW



The MG3740A Analog Signal Generator has excellent RF specifications, including SSB Phase Noise, output level, etc., and versatile modulation functions (AM/FM/ΦM/Pulse).

• High-Purity Signal Source for Testing Analog Radio

The excellent SSB phase noise performance supports narrowband radio Rx sensitivity suppression tests.

<–140 dBc/Hz (nominal) [100 MHz, 20-kHz offset, CW]

Excellent level accuracy over a wide level range, the MG3740A is the solution for accurate tests of radio Rx sensitivity and amplifier distortion characteristics.

Setting Range: –144 to +25 dBm
(CW, Opt. 041/071, 042/072, 043/073 installed)

• Cuts Tact Time

To shorten tact times on production lines the MG3740A supports two standard modes.

The List/Sweep mode switches the frequency and level faster than 600 µs.

• Cut Equipment Costs

The dual RF outputs supporting wanted + interference waves for tests of Rx characteristics, evaluation of wireless and amplifier intermodulation characteristics, and output of RF/LO signals for mixer tests, cut test costs by eliminating the need for two signal generators.

• Extendible Narrowband Digital Modulation Function

Adding the digital modulation option adds a digital modulation signal generator function providing a cost-effective solution for testing public safety digital radio systems.

Digital Modulation Performance

• RF Modulation Bandwidth: 2 MHz
• Sampling Rate: 20 kHz to 8 MHz

• Main Applications

• Testing Rx characteristics of analog radio
• Testing amplifier distortion and intermodulation characteristics
• RF/LO Signal source for evaluating mixer characteristics
• Testing Rx characteristics of narrowband digital radio

Key Features

• Basic Performance

SSB Phase Noise Performance

<–140 dBc/Hz (nom.) @100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.) @1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.) @2 GHz, 20-kHz offset, CW

High-power Output [Opt. 041/071]

+23 dBm @CW, 400 MHz to 3 GHz

High-speed Switching

< 600 µs @List/Sweep mode

High Level Accuracy

Absolute Level Accuracy: ±0.5 dB
Linearity: ±0.2 dB (typ.)

Choice of Reference Oscillators

• Standard
  Aging rate ±1 × 10^{-6}/year, ±1 × 10^{-7}/day
• High Stability Reference Oscillator [Opt. 002]
  Aging rate ±1 × 10^{-7}/year, ±1 × 10^{-8}/day
• Rubidium Reference Oscillator [Opt. 001]
  Aging rate ±1 × 10^{-10}/month

• Dual RF

One Unit Supports Two RF Outputs Max.

• Frequency Range
  1stRF: 100 kHz to 2.7 GHz [Opt. 032]
  100 kHz to 4.0 GHz [Opt. 034]
  100 kHz to 6.0 GHz [Opt. 036]
  2ndRF: 100 kHz to 2.7 GHz [Opt. 062]
  100 kHz to 4.0 GHz [Opt. 064]
  100 kHz to 6.0 GHz [Opt. 066]
• Independent Baseband and RF Outputs

- **Expandability**
- Analog modulation (AM/FM/ΦM) functions and pulse modulation (PM) functions [Standard]
- Additional analog modulation input options [Opt. 050/080]
- USB Power Sensors [Sold separately]

- **Operability**
- Simple Touch-panel Operation
- Signal Flowcharts with Signal Block Diagrams
- Frequency Channel Table

- **Connections with External Equipment**
- Remote Control Interfaces
- USB Connections

- **Expansion to Digital Modulation Signal Generator**
- Digital Modulation [Opt. 020]

  Adding the digital modulation option [Opt. 020] supports generation of digital modulation signals by outputting narrowband digital modulation signals.

  Digital Modulation Performance
    RF Modulation Bandwidth: 2 MHz
    Sampling Rate: 20 kHz to 8 MHz

  Waveform generation software: IQproducer (License sold separately)
    TDMA IQproducer
    Fading IQproducer
- BER Test Function [Opt. 021]
- Output Two Signals from One RF Out [Opt. 048/078]
  Wanted Signal + Interfere Signal
  Wanted Signal + Delayed Signal, etc.

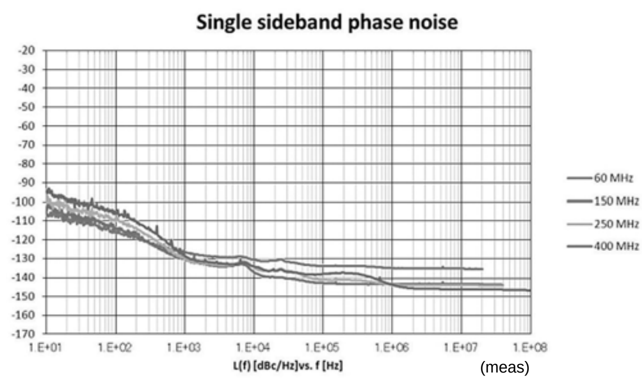
Basic Performance

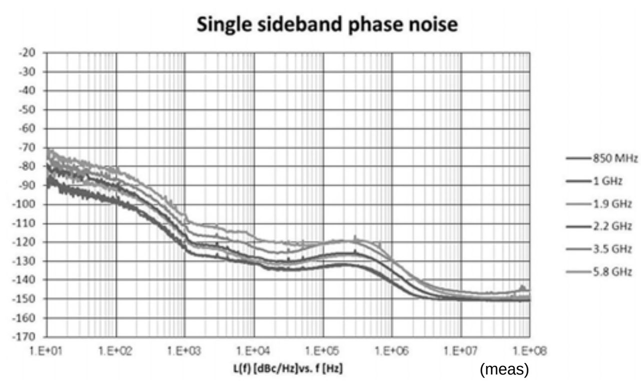
- **SSB Phase Noise**

<–140 dBc/Hz (nom.) @100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.) @1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.) @2 GHz, 20-kHz offset, CW

SSB phase noise is an important performance index for signal generators. For example, when using a signal generator for the following purposes, it is important to pre-confirm that the signal generator performance satisfies the measurement specifications.

- Communications with narrow bandwidth of several kHz
- CW interference waveforms
- Full range of reference and local signals





Example: SSB Phase Noise
(Phase Noise Optimization <200 kHz, CW, Optimize S/N Off, with Opt. 002)

- **Low-power Output [Opt. 042*1/072*2]**

∗1: Low Power Extension for 1stRF [Opt. 042]
∗2: Low Power Extension for 2ndRF [Opt. 072]

Amplitude Setting Range

Options	Setting Range [dBm]	
	without Reverse Power Protection*3	with Reverse Power Protection*3
Standard	–110 to +17	–110 to +17
with High-power Extension	–110 to +30	–110 to +25
with Low-power Extension	–144 to +17	–144 to +17
with High-power Extension and Low-power Extension	–144 to +30	–144 to +25

∗3: Reverse Power Protection for 1stRF/2ndRF [Opt. 043/073]

The MG3740A supports a convenient option for extending the lower RF output limit when performing high-sensitivity Rx tests.

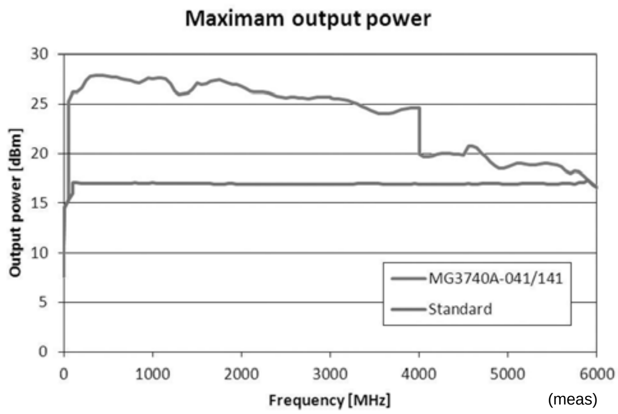
• High-power Output [Opt. 041*1/071*2]

*1: High Power Extension for 1stRF [Opt. 041]
*2: High Power Extension for 2ndRF [Opt. 071]

Level Accuracy is assured at high levels (CW)

Frequency Range	Standard	Opt. 041/071
100 kHz ≤ f < 10 MHz	+5 dBm	+5 dBm
10 MHz ≤ f < 50 MHz	+10 dBm	+10 dBm
50 MHz ≤ f < 400 MHz	+13 dBm	**+20 dBm**
400 MHz ≤ f ≤ 3 GHz		**+23 dBm**
3 GHz < f ≤ 4 GHz		**+20 dBm**
4 GHz < f ≤ 5 GHz		+13 dBm
5 GHz < f ≤ 6 GHz	+11 dBm	+11 dBm

These options expand the MG3740A RF output upper limit.
They are used when compensating for level losses of parts in the measurement path.



• Supports Rubidium Reference Oscillator (Option)

Three reference oscillator options are supported. Select the high-stability reference oscillator option [Opt. 002] when requiring high accuracy depending on the measurement conditions; for even higher accuracy, select the rubidium reference oscillator [Opt. 001]. However, if external high-accuracy reference signals are available, selecting the standard reference oscillator option helps reduce unnecessary costs.

Reference Oscillator

- **Standard**
  Aging Rate: $\pm 1 \times 10^{-6}$/year, $\pm 1 \times 10^{-7}$/day
  Temperature Stability: $\pm 2.5 \times 10^{-6}$ (5° to 45°C)
- **High Stability Reference Oscillator [Opt. 002]**
  Aging Rate: $\pm 1 \times 10^{-7}$/year, $\pm 1 \times 10^{-8}$/day
  Temperature Stability: $\pm 2 \times 10^{-8}$ (5° to 45°C)
  Start-up Characteristics*: $\pm 5 \times 10^{-7}$ (2 minutes after power-on)
  $\pm 5 \times 10^{-8}$ (5 minutes after power-on)

Rubidium Reference Oscillator [Opt. 001]

Aging Rate: $\pm 1 \times 10^{-10}$/month
Temperature Stability: $\pm 2 \times 10^{-9}$ (5° to 45°C)
Start-up Characteristics*: $\pm 1 \times 10^{-9}$ (7.5 minutes after power-on)

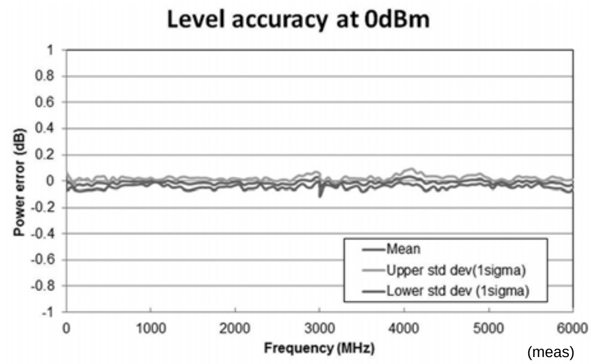
*: Compared to frequency after 24-h warm-up at 23°C

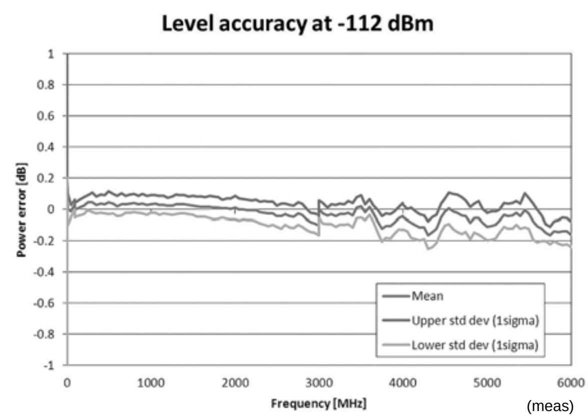
• High Level Accuracy

Absolute Level Accuracy: ±0.5 dB*1
Linearity: ±0.2 dB (typ.)*2

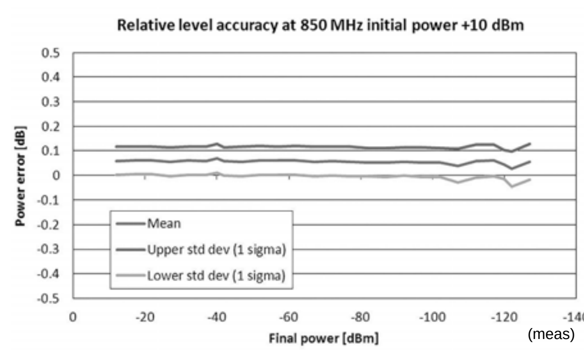
*1: 400 MHz to 3 GHz, –110 to +10 dBm
*2: 50 MHz to 3 GHz, –110 to –1 dBm

Excellent level accuracy and linearity are key factors with a large impact on measurement accuracy.

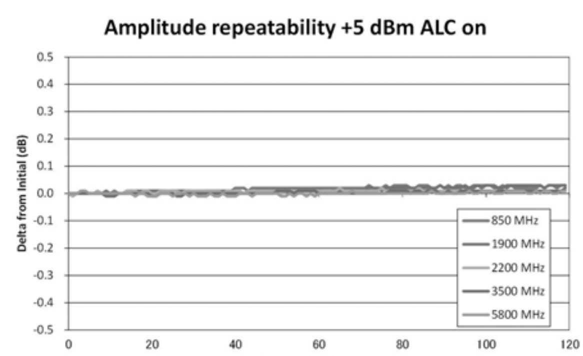




Frequency Characteristic



Linearity



Aging

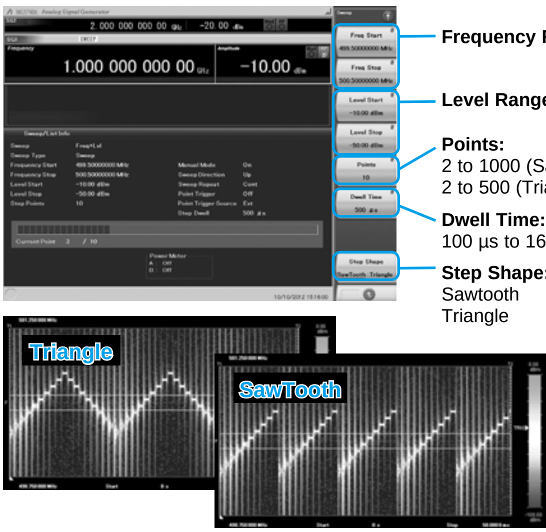
● **High-speed Switching**

<600 µs @List/Sweep mode

To shorten tact times on production lines the MG3740A supports two standard modes each with high-speed frequency and level switching.

• **Sweep Mode**

In this mode, the dwell time per point or number of points is split between the frequency range and level range (Start/Stop).
This mode is used when matching dwell time per point and frequency/level steps.



Frequency Range

Level Range

Points:
2 to 1000 (Sawtooth)
2 to 500 (Triangle)

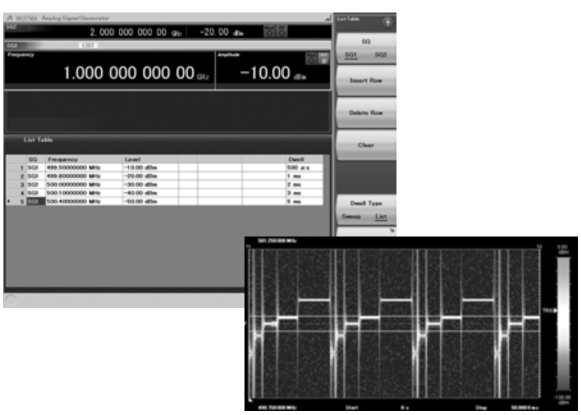
Dwell Time:
100 µs to 16 s

Step Shape:
Sawtooth
Triangle

10 points, 500-µs Dwell Time

• **List Mode**

In this mode, the frequency, level and dwell time can be set for each of up to 500 points. This mode is used when wanting to set any dwell time, and frequency/level step per point.



5 points, Any Dwell Time

● **Dual VSG: Two RF Outputs**

The MG3740A supports two RF outputs (1stRF/2ndRF) max. in one unit. Moreover, different frequencies can be set independently at 1stRF and 2ndRF.
Not only different frequencies but also different levels and modulations can be set independently at each SG while each is tracking the other. The all-in-one MG3740A eliminates the need for two conventional signal generators when requiring wanted + interference waveforms for evaluating Rx signal characteristics, testing intermodulation characteristics of radio equipment and amplifiers, and generating RF/LO signals for evaluating mixers.

Notes: Supported frequency bands cannot be changed after shipment.
IQ input is supported only by SG1 (1stRF) and requires Opt. 017.

2ndRF
Frequency Range:
100 kHz to 2.7 GHz [Opt. 062]
100 kHz to 4.0 GHz [Opt. 064]
100 kHz to 6.0 GHz [Opt. 066]
∗ Whether or not install and the frequency model can be selected at any time.

1stRF
Frequency Range:
100 kHz to 2.7 GHz [Opt. 032]
100 kHz to 4.0 GHz [Opt. 034]
100 kHz to 6.0 GHz [Opt. 036]
∗ Must install any one of these.

Expandability

● AM/FM/ΦM/Pulse Function

This option supports the following modulation functions as standard. Analog modulation (AM/FM/ΦM) is supported using both CW and internal modulation signals.
Pulse modulation can be performed at any cycle or timing and also supports modulation using an external input signal.

• Amplitude Modulation

Depth: 0 to 100% (Linear)
0 to 10 dB (Exponential)
Modulation Frequency: 0.1 Hz to 50 MHz

• Frequency Modulation

Deviation: 0 to 40 MHz
Modulation Frequency: 0.1 Hz to 40 MHz, or (50 MHz-FM Rate), whichever smaller

• Φ-Modulation

Deviation angle: 0 to 160 rad.
or (40 MHz/ΦM Rate) rad., whichever smaller
Modulation Frequency: 0.1 Hz to 40 MHz,
or (40 MHz/ΦM Deviation), whichever smaller

• Pulse Modulation

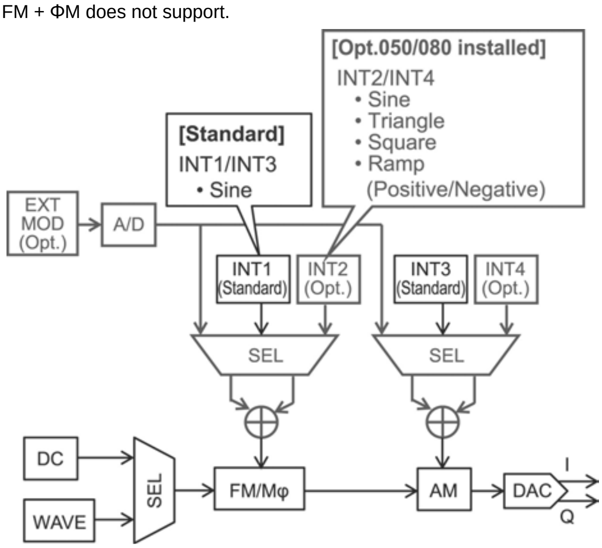
Modulation Frequency: 0.1 Hz to 10 MHz
Modulation Period: 10 ns to 20 s

• Additional Analog Modulation Input [Opt. 050/080]

Adding additional analog modulation input options (Opt. 050/080) extends to two internal modulation sources (AM/FM/ΦM) and one external modulation source supporting simultaneous two-signal modulation. This is used when superimposing tone squelch signals.

- AM + FM
- AM + ΦM
- Internal 1 + Internal 2
- Internal + External

∗ FM + ΦM does not support.



● USB Power Sensors [Sold separately]

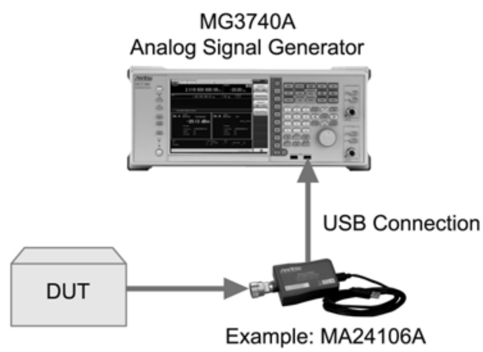
Up to two USB power sensors can be connected to the MG3740A to display the measurement results on the MG3740A screen.

USB Power Sensor

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

∗: MA24104A has been discontinued. Replacement model is MA24105A.

Level Offset: –100 to +100 dB
Average: 1 to 2048
Unit: dBm, W
COM Port: 2 to 8

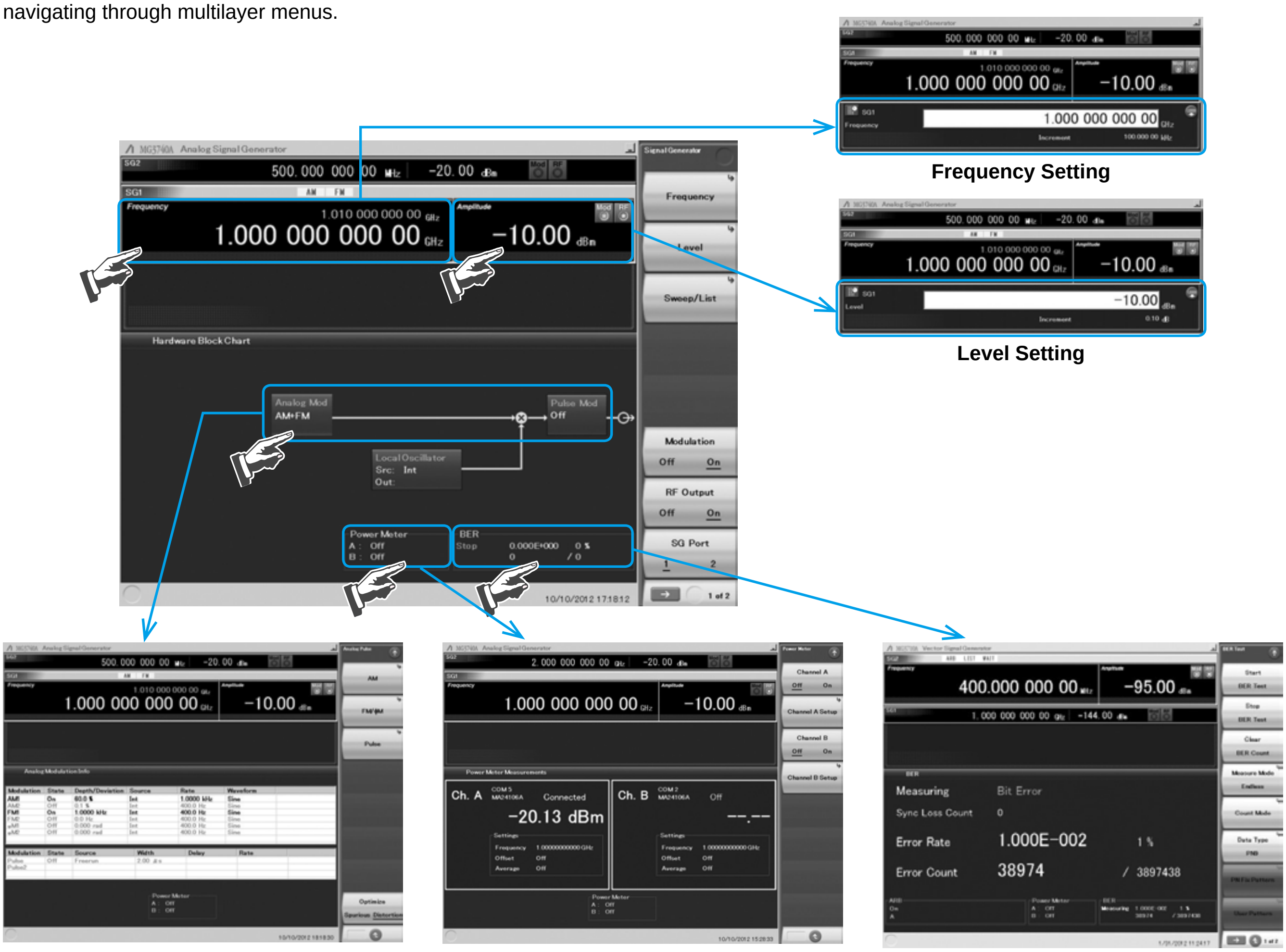


Power Meter Measurement Screen

Operability

• Easy Touch-panel Operation

Simply touching parts of the screen display with a finger fetches related function keys and numeric inputs, offering a fast and easy way of navigating through multilayer menus.



Frequency Setting

Level Setting

AM/FM/ΦM/Pulse Function

Power Meter Function

BER Function [Opt. 021]

• Signal Flowcharts

The Hardware Block Chart provides an intuitive at-a-glance understanding of the settings and signals for each block (Analog Mod, Pulse Mod, Local, etc.)

Hardware Block Chart Screen

• Frequency Channel Table

Sometimes frequencies need setting by Channel No. The built-in frequency channel table where frequencies are set by channel number is ideal for this application. Once set and saved, these pre-settings can be read whenever needed.

Channel Table Setting

- Group: 1 to 19
- Start Channel: 0 to 20000
- End Channel: (Start Channel) to 20000
- Start Frequency
- Channel Spacing

Connection with External Equipment

● Remote Control Interfaces

The MG3740A has GPIB, Ethernet and USB interfaces as standard, supporting the following functions:

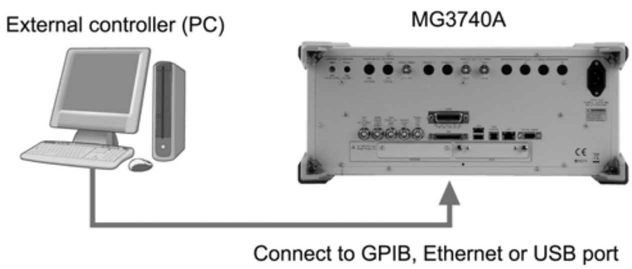
- Control all functions, except power switch
- Read all status conditions and settings
- Interrupts and serial polls

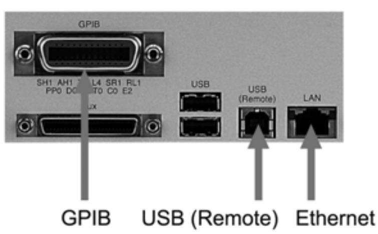
While in the Local status, the interface is determined automatically by the communication start command from the external controller (PC). To change the interface, put the MG3740A into the Local status again by pressing the Local key on the front panel and then send a command via the desired interface.

• GPIB: Conforms to IEEE488.1/IEEE488.2 standards
SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2

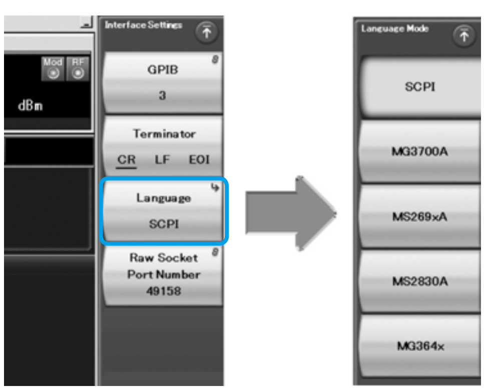
• Ethernet: Conforms to VXI-11 protocol using TCP/IP Control programs
SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0

• USB: Conforms to USBTMC-USB488 protocols
SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0n





To remotely control the MG3740A, either select the SCPI mode command format defined by the SCPI Consortium, or select backwards compatible modes supporting earlier MG3700A, MS269xA, MS2830A, and MG364xA commands

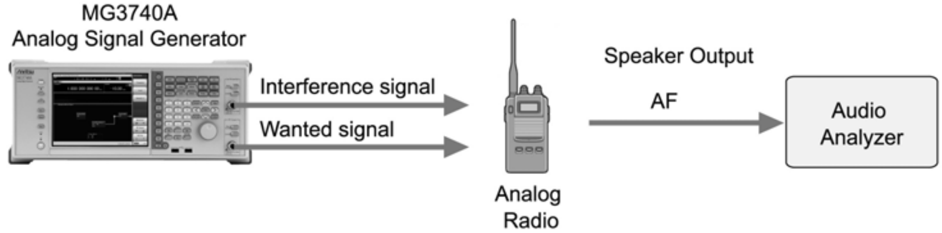


Command Format Setting Example

● USB Connections

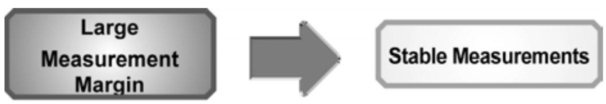
The two type-A USB2.0 connectors on the front and rear panels support keyboard, mouse and USB memory connections. Supported USB power sensors can be connected too.

Analog Radio Rx Characteristics Tests



Setup for analog radio Rx characteristics tests

The MG3740A outputs RF signals for radio operation verification tests and evaluation of Rx characteristics, when the radio AF output can be measured with an external audio analyzer.



• High-Purity Signal Source for Testing Analog Radio

Supports SSB Phase Noise Performance –140 dBc/Hz nom. (@100 MHz)
Phase noise performance affects measurement results at narrow bandwidths of several kHz. In particular, high phase-noise performance is required for interference waveforms.
The excellent SSB phase noise performance supports narrowband radio Rx sensitivity suppression tests.

<–140 dBc/Hz (nom.) @100 MHz, 20-kHz offset, CW
<–131 dBc/Hz (typ.) @1 GHz, 20-kHz offset, CW
<–125 dBc/Hz (typ.) @2 GHz, 20-kHz offset, CW

The excellent level accuracy over a wide output level range supports accurate Rx sensitivity tests.

Amplitude setting range: –110 to +17 dBm (Standard)
–144 to +17 dBm (with opt. 042/072)
Absolute level accuracy: ±0.5 dB*1
Linearity 1: ±0.2 dB (typ)*2

∗1: 400 MHz to 3 GHz, –110 to +10 dBm
∗2: 50 MHz to 3 GHz, –110 to –1 dBm

• Supports Maximum Two RF Outputs

The dual RF outputs of the all-in-one MG3740A help cut infrastructure costs by eliminating the need for two signal sources when outputting wanted + interference waves for RX characteristics tests, and evaluating intermodulation characteristics, etc. Additionally, there is no need for troublesome settings at each of two separate signal generators helping cut operation time and costs using the frequency/level synchronization function.

• AM/FM/ΦM/Pulse Function (Standard)

Supports built-in analog modulation (AM/FM/ΦM) functions and pulse modulation (PM) functions.
Adding additional analog modulation input options (Opt. 050/080) supports modulation by external signal input. This is used when superimposing tone squelch signals.

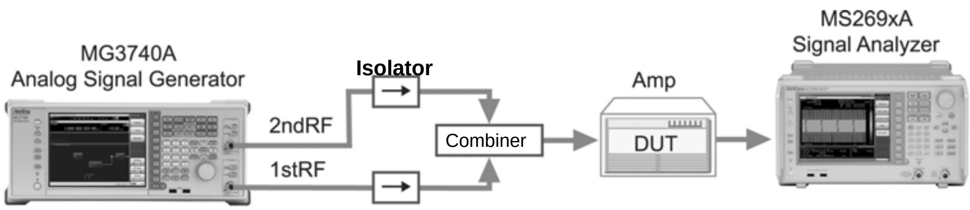
- AM + FM
- AM + ΦM
- Internal 1 + Internal 2
- Internal + External

∗ FM + ΦM does not support.

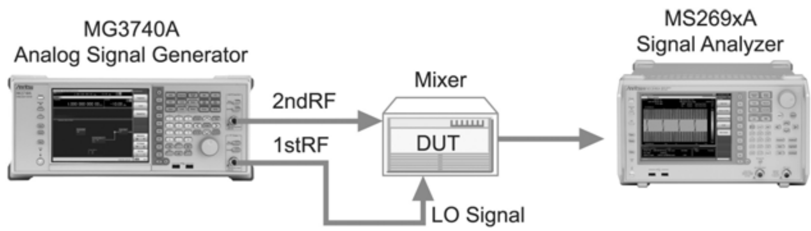
Analog Radio Main Rx Characteristics Evaluation Items

Test Items	Key MG3740A Features	
Sensitivity	✓	Wide level range, High level accuracy, Internal modulation function (standard)
Passing Bandwidth, Attenuation	✓	High level accuracy, Frequency offset setting function
AF Level	✓	Internal modulation function (standard)
Demodulation Frequency Characteristics	✓	Internal modulation function (standard)
Demodulation Distortion	✓	Internal modulation function (standard)
Demodulation S/N	✓	Internal modulation function (standard), External modulation function (Option)
Spurious Response	✓	High level accuracy, Internal modulation function (standard)
Sensitivity Suppression Effect	✓	Dual RF, Low SSB Phase Noise ∗All-in-one evaluation without requiring two separate signal sources.
Intermodulation Characteristics	✓	Dual RF, Low SSB Phase Noise ∗Two units of MG3740A support evaluation without requiring three separate signal sources.

Reference Signal Generator for Evaluating Characteristics of Amplifiers, Mixers, etc.

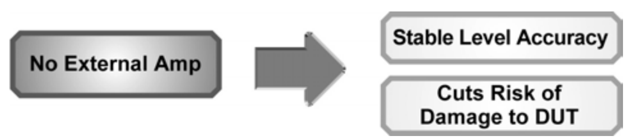


Setup for evaluating intermodulation characteristics of amplifier



Setup for evaluating distortion characteristics of Mixer

The dual RF outputs of the MG3740A are ideal for evaluating intermodulation (IM3) characteristics of amplifiers, etc., as well as for use as RF/LO signal sources for testing mixers, eliminating the need for two separates signal generators. The high-performance MS269xA Signal Analyzer series is recommended for intermodulation and harmonic wave distortion measurements.



• Supports Maximum Two RF Outputs

Usually, two general signal generators are required to output two continuous waveforms when evaluating the intermodulation characteristics of amplifiers, etc., or for use as RF/LO signal sources at mixer tests. A maximum of two RF outputs (1stRF/2ndRF) can be installed in the MG3740A and the product lineup includes models with different 1stRF and 2ndRF frequencies. Different frequencies and levels can be set at the two signal outputs and the frequency/level synchronization function cuts the setting workload too.

• USB Power Sensor

Up to two USB power sensors (separately sold) can be connected to the MG3740A.
USB connectors to display the measurement results on the MG3740A screen.

Model	Frequency Range	Dynamic Range
MA24104A*	600 MHz to 4 GHz	+3 to +51.76 dBm
MA24105A	350 MHz to 4 GHz	+3 to +51.76 dBm
MA24106A	50 MHz to 6 GHz	–40 to +23 dBm
MA24108A	10 MHz to 8 GHz	–40 to +20 dBm
MA24118A	10 MHz to 18 GHz	–40 to +20 dBm
MA24126A	10 MHz to 26 GHz	–40 to +20 dBm

*: MA24104A has been discontinued. Replacement model is MA24105A.

• High-power Output Option (Opt. 041/071) Supports CW Levels of +23 dBm

In general, an external amp is required when the output of a signal generator is insufficient, such as covering the measurement system transmission path loss and inputting high-level modulation signals for amp distortion characteristics tests. Since the output of an external amp cannot be assured, it must be checked with a power meter each time the frequency and level are changed. Moreover, when using an external amp, sometimes the DUT may be damaged by mishandling errors. The MG3740A high-power output supports signals required for measuring path loss. In addition, stable measurement is assured when used within the guaranteed setting range. And the risk of mistakenly damaging the DUT is reduced, even at the output limit.

Expansion to Digital Modulation Signal Generator

The MG3740A Analog Signal Generator can be expanded to add digital modulation generation functions, supporting evaluation of digital public safety radio systems.
All-in-one support for both analog and digital tests maximizes equipment investment efficiency.

● Digital Modulation [Opt. 020]

Adding the digital modulation option [Opt. 020] supports generation of digital modulation signals by outputting narrowband digital modulation signals.

Digital Modulation Performance
- RF Modulation Bandwidth: 2 MHz
- Sampling Rate: 20 kHz to 8 MHz

● Dual Waveform Memory: Four Waveform Outputs Max.

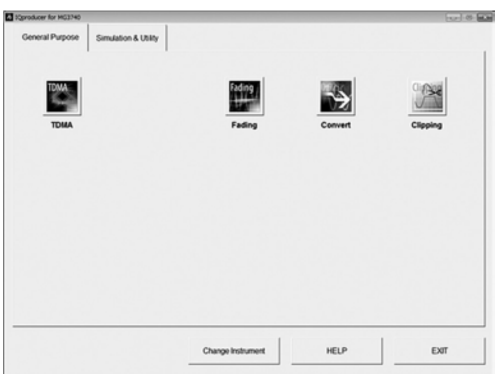
In the standard configuration, one RF (1stRF or 2ndRF) has one waveform memory. However, adding the baseband signal combine option (Opt. 048/078) upgrades to two memories for one RF.
In other words, models with two RFs (1stRF and 2ndRF) installed can have a maximum of four waveform memories. Two waveform patterns can be set easily on-screen for one RF, each with different frequency offset, level offset and delay time settings to output a combined baseband RF signal. With this setup, one MG3740A supports the following test environment — a setup that previously required two signal generators:

Wanted Signal + Interference Signal
Wanted Signal + Delayed Signal

● Waveform Generation Software (Separate license)

The IQproducer system provides an easy-to-use GUI for setting parameters according to each communications method.
The parameter setting results file can be saved as a file for easy recall later.

∗ For detail, refer to the IQproducer catalog.



IQproducer Main Screen

[MG3740A Option IQproducer]

• MX370102A TDMA IQproducer

Sets required parameters for TDMA waveform patterns and generates various waveform patterns.

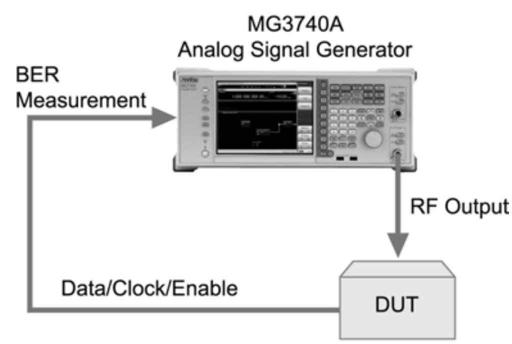
• MX370107A Fading IQproducer

Performs IQ channel fading processing, correlation matrix calculation, AWGN combination.

● BER Test Function [Opt. 021]

This option installs a BER measurement function for measuring error rates between 100 bps and 40 Mbps using the DUT demodulated Data/Clock/Enable signals. The results are displayed on the MG3740A screen.

- **Input Bit Rate: 100 bps to 40 Mbps**
- **Input Signal: Data, Clock, Enable (Polarity reversal supported)**
- **Input Level: TTL**
- **Input Connector: BNC-J**
- **Measured Patterns:**
  PN9/11/15/20/23, ALL1, ALL0, Alternate (0101...), User Data, PN9fix/11fix/15fix/20fix/23fix
- **Count Mode**
  Data: Measures until specified Data count
  Error: Measures until specified Error count
- **Measurable Bit Count: ≤2^{32} – 1 (4,294,967,295 bits)**
- **Measurement Mode**
  Single: Measures specified measurement bit count once
  Continuous: Repeats Single measurement
  Endless: Continues measurement to upper limit of measurement bits

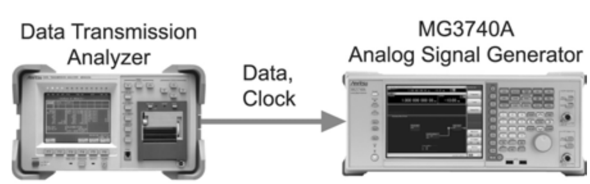


The BER can be measured using
the DUT-demodulated Data/Clock/Enable.

● BER Measurement Upper Limit

The table below shows one example of a BER measurement that indicates SyncLoss. Actual results depend on the specific communication systems and data rate, and will not necessarily match the measurement values below.

Error Rate	PN9	PN11	PN15	PN20	PN23
6.0%	–	–	–	–	–
5.0%	ok	–	–	–	–
4.0%	ok	ok	–	–	–
3.0%	ok	ok	ok	–	–
2.5%	ok	ok	ok	–	–
2.0%	ok	ok	ok	ok	ok
1.0%	ok	ok	ok	ok	ok



• Key Differences from MG3710A Vector Signal Generator

Installing the Digital Modulation Option (Opt. 020) in the MG3740A Analog Signal Generator adds the functions of a digital modulation signal generator. The key differences in the main functions compared to the conventional MG3710A Vector Signal Generator are listed below.

Key Functional Differences between MG3740A Analog Signal Generator and MG3710A Vector Signal Generator

	MG3740A Analog Signal Generator	MG3710A* Vector Signal Generator	Remarks
Frequency Range	100 kHz to 2.7 GHz (Opt. 032/062) 100 kHz to 4.0 GHz (Opt. 034/064) 100 kHz to 6.0 GHz (Opt. 036/066)	100 kHz to 2.7 GHz (Opt. 032/062) 100 kHz to 4.0 GHz (Opt. 034/064) 100 kHz to 6.0 GHz (Opt. 036/066)	Supports two signal generators (1stRF/2ndRF output) in one unit
Analog Modulation Internal Source	[Standard]	[Standard]	AM, FM/ΦM Each one internal source
Additional Analog Modulation Input	[Opt. 050/080]	[Opt. 050/080]	Extends to one external input, two internal source (AM, FM/ΦM)
Digital Modulation	[Opt. 020] Digital modulation performance - RF modulation bandwidth: 2 MHz - Sampling rate: 20 kHz to 8 MHz	[Standard] Digital modulation performance - RF modulation bandwidth: 160 MHz - Sampling rate: 20 kHz to 200 MHz	
Pre-installed Waveform Patterns	No	Yes	LTE FDD/TDD (E-TM1.1 to E-TM3.3) W-CDMA/HSDPA, GSM/EDGE, CDMA2000 1X/1xEV-DO, WLAN (IEEE802.11a/11b/11g), etc.
IQproducer	TDMA IQproducer Fading IQproducer	Listed bellow	Listed bellow
ARB Memory Upgrade (per RF)	[Opt. 045/075] Max. 256 Msamples	[Opt. 046/076] Max. 1024 Msamples	Standard: 64 Msamples
Combination of Baseband Signal	[Opt. 048/078]	[Opt. 048/078]	
AWGN Generator	No	[Opt. 049/079]	
Analog IQ Input/Output	No	[Opt. 018]	
Universal Input/Output	[Opt. 017] - Sweep Output (1stRF) - AUX-BNC conversion adapter	[Opt. 017] - Baseband Reference Clock Input/Output - Sweep Output (1stRF) - Local Signal Input/Output - AUX-BNC conversion adapter	
BER Measurement Function	[Opt. 021]	[Opt. 021]	

*: The MG3710A Vector Signal Generator is recommended for many purposes.
For detail, refer to the MG3710A product brochure.

• IQproducer Support Systems

Main frame support IQproducer

IQproducer* Support Systems		MG3740A (with Opt. 020)	MG3710A
Standard Accessories	W-CDMA IQproducer	—	✓
	AWGN IQproducer	—	✓
Options	MX370101A HSDPA/HSUPA IQproducer	—	✓
	MX370102A TDMA IQproducer	✓	✓
	MX370103A CDMA2000 1xEV-DO IQproducer	—	✓
	MX370104A Multi-carrier IQproducer	—	✓
	MX370105A Mobile WiMAX IQproducer	—	✓
	MX370106A DVB-T/H IQproducer	—	✓
	MX370107A Fading IQproducer	✓	✓
	MX370108A LTE IQproducer	—	✓
	MX370108A-001 LTE-Advanced FDD Option	—	✓
	MX370109A XG-PHS IQproducer	—	✓
	MX370110A LTE TDD IQproducer	—	✓
	MX370111A WLAN IQproducer	—	✓
	MX370111A-002 802.11ac (160 MHz) Option	—	✓
	MX370112A TD-SCDMA IQproducer	—	✓

*: For detail, MX3701xxA IQproducer product brochure.

• IQproducer License

IQproducer is PC application software for generating waveform patterns. The parameters are set using IQproducer and the waveform pattern is created to output the signal by selection at the MG3740A. This one software application includes all the following systems.
Since it runs on any PC, the supported functions and parameter range can be verified before purchase.

<u>When outputting a waveform pattern from the MG3740A, no signal is output unless a license for that system is installed in the main frame.</u>

*: Requires MG3740A-020/120.

* Refer to the “IQproducer catalog” for details.

• MX370102A TDMA IQproducer

Sets required parameters for TDMA waveform patterns and generates various waveform patterns. Setting parameters include Modulation, Frame, Slot, Data, Filter, etc. Supports wide application range including public wireless.

• MX370107A Fading IQproducer

Performs IQ channel fading processing, correlation matrix calculation, AWGN combination. Input data file created by selecting waveform pattern file created with other IQproducer software, and IQ data (ASCII) created with other general-purpose simulation tools.

Specifications

● Frequency Setting Range

• 1stRF

MG3740A-032 9 kHz to 2.7 GHz
MG3740A-034 9 kHz to 4 GHz
MG3740A-036 9 kHz to 6 GHz

• 2ndRF

MG3740A-062 9 kHz to 2.7 GHz
MG3740A-064 9 kHz to 4 GHz
MG3740A-066 9 kHz to 6 GHz

● Switching Speed (List Mode)

Frequency ≤600 µs
Level ≤600 µs

● Amplitude Setting Range

Options	Setting Range [dBm]	
	without Reverse Power Protection	with Reverse Power Protection
Standard	–110 to +17	–110 to +17
with High-power Extension	–110 to +30	–110 to +25
with Low-power Extension	–144 to +17	–144 to +17
with High-power Extension and Low-power Extension	–144 to +30	–144 to +25

Level Accuracy is assured at high levels (CW)

Frequency Range	Standard	Opt. 041/071
100 kHz ≤ f < 10 MHz	+5 dBm	+5 dBm
10 MHz ≤ f < 50 MHz	+10 dBm	+10 dBm
50 MHz ≤ f < 400 MHz	+13 dBm	**+20 dBm**
400 MHz ≤ f ≤ 3 GHz		**+23 dBm**
3 GHz < f ≤ 4 GHz		**+20 dBm**
4 GHz < f ≤ 5 GHz		+13 dBm
5 GHz < f ≤ 6 GHz	+11 dBm	+11 dBm

● Absolute Level Accuracy (at CW, 18° to 28°C, –110 to +5 dBm)

±0.5 dB (typ.) (100 kHz ≤ f < 50 MHz)
±0.5 dB (50 MHz ≤ f ≤ 3 GHz)
±0.7 dB (3 GHz < f ≤ 4 GHz)
±0.8 dB (4 GHz < f ≤ 6 GHz)

● Harmonics

<–30 dBc

● Non-Harmonics

Output level ≤+5 dBm, CW, Frequency offset ≥10 kHz
<–62 dBc (100 kHz ≤ f ≤ 187.5 MHz)
<–68 dBc (187.5 MHz < f ≤ 750 MHz)
<–62 dBc (750 MHz < f ≤ 1.5 GHz)
<–56 dBc (1.5 GHz < f ≤ 3 GHz)
<–50 dBc (3 GHz < f ≤ 6 GHz)

● Single Sideband Phase Noise (at CW, 20 kHz offset)

<–140 dBc/Hz (nom.) (100 MHz)
<–131 dBc/Hz (typ.) (1 GHz)
<–125 dBc/Hz (typ.) (2 GHz)

● Analog Modulation

• Amplitude Modulation

Depth: 0 to 100% (Linear)
0 to 10 dB (Log)
Modulation Frequency: 0.1 Hz to 50 MHz

• Frequency Modulation

Deviation: 0 Hz to 40 MHz
Modulation Frequency: 0.1 Hz to 40 MHz, or (50-MHz FM Rate), whichever smaller

• Φ-Modulation

Deviation angle: 0 to 160 rad., or (40 MHz/ΦM Rate) rad., whichever smaller
Modulation Frequency: 0.1 Hz to 40 MHz, or (40 MHz/ΦM Deviation), whichever smaller

• Pulse Modulation

Modulation Frequency: 0.1 Hz to 10 MHz
Modulation Period: 10 ns to 20 s

● Digital Modulation Performance [Opt. 020 installed]

• RF Modulation Bandwidth

2 MHz

• ARB Memory Size

64 Msamples (256 MB) [with 1stRF, 2ndRF]
256 Msamples (1 GB) [Opt. 045/075]

• Sampling Rate

20 kHz to 8 MHz

• DAC Resolution

14/15/16 bits

● Dimensions, Weight

426 (W) × 177 (H) × 390 (D) mm
≤13.7 kg (with 1stRF, excluding other option)

● Power Requirements

100 V(ac) to 120 V(ac), 200 V(ac) to 240 V(ac)
50 Hz to 60 Hz

*: Refer to the Data Sheet for specification details such as guaranteed setting ranges, etc.

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MG3740A	Analog Signal Generator
	Standard accessories
P0031A	Power Cord: 1 pc USB Memory (USB2.0 Flash Driver, ≥256 MB) Install CD-ROM [Operation manual (PDF) and application software (IQproducer)]
	Options
	(Common Parts)
MG3740A-001	Rubidium Reference Oscillator (Select when ordering main frame, aging rate: ±1 × 10^{-10}/month)
MG3740A-002	High Stability Reference Oscillator (Select when ordering main frame, aging rate: ±1 × 10^{-7}/year)
MG3740A-011	2ndary HDD (Select when ordering main frame, spare HDD for saving user data without Windows OS)
MG3740A-017	Universal Input/Output (Select when ordering main frame, Adds BNC connector for outputting Sweep Output signal (only supports SG1) to rear panel of main frame, includes J1539A AUX Conversion Adapter)
MG3740A-020	Digital Modulation (Select when ordering main frame, Built-in Digital Modulation function. Digital modulation Performance: - RF modulation bandwidth: 2 MHz - Sampling rate: 20 kHz to 8 MHz)
MG3740A-021	BER Test Function (Select when ordering main frame, Built-in BER measurement, Bit Rate: 100 bps to 40 Mbps J1539A AUX Conversion Adapter required for Data/Clock/Enable signal input)
MG3740A-029	OS Upgrade to Windows 7 [Select when ordering main frame, Upgrades MG3740A OS to Windows 7 (32 bit, Professional) (retrofit not supported)]
MG3740A-101*	Rubidium Reference Oscillator Retrofit
MG3740A-102*	High Stability Reference Oscillator Retrofit
MG3740A-111*	2ndary HDD Retrofit
MG3740A-117*	Universal Input/Output Retrofit
MG3740A-120*	Digital Modulation Retrofit
MG3740A-121*	BER Test Function Retrofit
MG3740A-313	Removable HDD [Spare HDD for storing user data with Windows OS MG3740A with Opt. 029 (Windows 7) cannot apply Opt. 313.]

*: Retrofitted to shipped MG3740A

Model/Order No.	Name
	(For 1stRF)
MG3740A-032	1stRF 100 kHz to 2.7 GHz (Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation)
MG3740A-034	1stRF 100 kHz to 4 GHz (Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation)
MG3740A-036	1stRF 100 kHz to 6 GHz (Select when ordering main frame, select 1stRF frequency range, frequency cannot be changed after installation)
MG3740A-041	High Power Extension for 1stRF (Select when ordering main frame, increases upper limit of output signal power setting range)
MG3740A-042	Low Power Extension for 1stRF (Select when ordering main frame, increases lower limit of output signal power setting range)
MG3740A-043	Reverse Power Protection for 1stRF (Select when ordering main frame, prevents damage caused by reverse input to output connector)
MG3740A-045	ARB Memory Upgrade 256 Msample for 1stRF (Select when ordering main frame, expands ARB memory capacity. Requires MG3740A-020.)
MG3740A-048	Combination of Baseband Signal for 1stRF (Select when ordering main frame, adds baseband combine function. Requires MG3740A-020.)
MG3740A-050	Additional Analog Modulation Input for 1stRF (Select when ordering main frame, Adds BNC connector for inputting external signals to rear panel of mainframe.)
MG3740A-141*	High Power Extension for 1stRF Retrofit
MG3740A-142*	Low Power Extension for 1stRF Retrofit
MG3740A-143*	Reverse Power Protection for 1stRF Retrofit
MG3740A-145*	ARB Memory Upgrade 256 Msample for 1stRF Retrofit (Requires MG3740A-020/120)
MG3740A-148*	Combination of Baseband Signal for 1stRF Retrofit (Requires MG3740A-020/120)
MG3740A-150*	Additional Analog Modulation Input for 1stRF Retrofit
	(For 2ndRF)
MG3740A-062	2ndRF 100 kHz to 2.7 GHz (Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation)
MG3740A-064	2ndRF 100 kHz to 4 GHz (Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation)
MG3740A-066	2ndRF 100 kHz to 6 GHz (Select when ordering main frame, select 2ndRF frequency range, frequency cannot be changed after installation)
MG3740A-071	High Power Extension for 2ndRF (Select when ordering main frame, increases upper limit of output signal power setting range)
MG3740A-072	Low Power Extension for 2ndRF (Select when ordering main frame, increases lower limit of output signal power setting range)
MG3740A-073	Reverse Power Protection for 2ndRF (Select when ordering main frame, prevents damage caused by reverse input to output connector)
MG3740A-075	ARB Memory Upgrade 256 Msample for 2ndRF (Select when ordering main frame, expands ARB memory capacity. Requires MG3740A-020.)
MG3740A-078	Combination of Baseband Signal for 2ndRF (Select when ordering main frame, adds baseband combine function. Requires MG3740A-020.)
MG3740A-080	Additional Analog Modulation Input for 2ndRF (Select when ordering main frame, Adds BNC connector for inputting external signals to rear panel of mainframe.)
MG3740A-162*	2ndRF 100 kHz to 2.7 GHz Retrofit (when 2ndRF not installed)
MG3740A-164*	2ndRF 100 kHz to 4 GHz Retrofit (when 2ndRF not installed)
MG3740A-166*	2ndRF 100 kHz to 6 GHz Retrofit (when 2ndRF not installed)
MG3740A-171*	High Power Extension for 2ndRF Retrofit
MG3740A-172*	Low Power Extension for 2ndRF Retrofit
MG3740A-173*	Reverse Power Protection for 2ndRF Retrofit
MG3740A-175*	ARB Memory Upgrade 256 Msample for 2ndRF Retrofit (Requires MG3740A-020/120)
MG3740A-178*	Combination of Baseband Signal for 2ndRF Retrofit (Requires MG3740A-020/120)
MG3740A-180*	Additional Analog Modulation Input for 2ndRF Retrofit

Continued on next page

Model/Order No.	Name
	Maintenance service
MG3740A-ES210	2 Years Extended Warranty Service
MG3740A-ES310	3 Years Extended Warranty Service
MG3740A-ES510	5 Years Extended Warranty Service
	Softwares (License for IQproducer)
MX370102A	TDMA IQproducer (license for main frame, manual, PDF)
MX370107A	Fading IQproducer (license for main frame, manual, PDF)
	Optional accessories
W3580AE	MG3710A/MG3740A Operation Manual (Main Unit) (Booklet, for MG3710A/MG3740A Main Frame, Operation, Remote Control)
W2496AE	MG3710A/MG3740A Operation Manual (IQproducer) (Booklet, for IQproducer, Operation for Common Parts)
W2916AE	MX370102A Operation Manual (Booklet, for TDMA IQproducer)
W2995AE	MX370107A Operation Manual (Booklet, for Fading IQproducer)
J1539A	AUX Conversion Adapter (Converts MG3740A rear-panel AUX connector to BNC connector)
MA24105A	Inline Peak Power Sensor (350 MHz to 4 GHz, Inline type, with USB A to micro-B Cable)
MA24106A	USB Power Sensor (50 MHz to 6 GHz, with USB A to mini-B Cable)
MA24108A	Microwave USB Power Sensor (10 MHz to 8 GHz, with USB A to micro-B Cable)
MA24118A	Microwave USB Power Sensor (10 MHz to 18 GHz, with USB A to micro-B Cable)
MA24126A	Microwave USB Power Sensor (10 MHz to 26 GHz, with USB A to micro-B Cable)
K240B	Power Divider (K connector, DC to 26.5 GHz, K-J, 50 Ω, 1 Wmax)
MA1612A	Four-Port Junction Pad (5 MHz to 3 GHz, N-J)
MP752A	Termination (DC to 12.4 GHz, 50 Ω, N-P)
MA2512A	Band Pass Filter (For W-CDMA, passband: 1.92 GHz to 2.17 GHz)
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2.0 m (N-P · 5D-2W · N-P)
J0127A	Coaxial Cord, 1.0 m (BNC-P · RG-58A/U · BNC-P)
J0127B	Coaxial Cord, 2.0 m (BNC-P · RG-58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG-58A/U · BNC-P)
J0322A	Coaxial Cord, 0.5 m (SMA-P · SMA-P, DC to 18 GHz, 50 Ω)
J0322B	Coaxial Cord, 1.0 m (SMA-P · SMA-P, DC to 18 GHz, 50 Ω)
J0322C	Coaxial Cord, 1.5 m (SMA-P · SMA-P, DC to 18 GHz, 50 Ω)
J0322D	Coaxial Cord, 2.0 m (SMA-P · SMA-P, DC to 18 GHz, 50 Ω)
J0004	Coaxial Adapter (N-P · SMA-J Conversion Adapter, DC to 12.4 GHz)
J1261B	Ethernet Cable (Shield Type, Straight-through, 3 m)
J1261D	Ethernet Cable (Shield Type, Crossover, 3 m)
J0008	GPIB Cable, 2.0 m
B0635A	Rack Mount Kit (EIA)
B0657A	Rack Mount Kit (JIS)
B0636A	Carrying Case (Hard Type, With Casters)
B0645A	Soft Carrying Case (Soft Type)
Z0975A	Keyboard (USB)
Z0541A	USB Mouse

Typical (typ.):
Performance not warranted. Must products meet typical performance.
Nominal (nom.):
Values not warranted. Included to facilitate application of product.
Measured (meas):
Performance not warranted. Data actually measured by randomly selected measuring instruments.

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RF MICROWAVE MEASURING INSTRUMENTS

Microwave Frequency Counter 764
Wideband Peak Power Meters......................... 768, 775
Power Meters 777
Inline Peak Power Sensor....................................... 780
USB Power Sensors.. 786
Resistance Attenuator... 791
Programmable Attenuator 792
Pre-Amplifier.. 793
EMI Probe 794
Dipole Antennas 795, 796
Log-Periodic Antenna... 797
Biconical Antenna.. 798
Rod Antenna 799
Loop Antenna.. 799
Standard Dipole Antenna 800
Signal Generator 801

Anritsu

MICROWAVE FREQUENCY COUNTER

MF2400C Series

10 Hz to 20 GHz, 27 GHz, 40 GHz

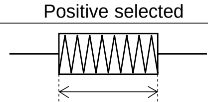
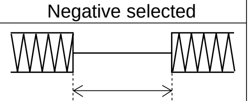
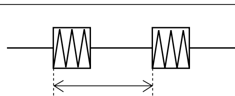
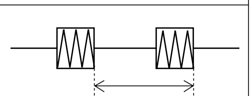
Remote Control
GPIB

Newest Burst Wave Measurements

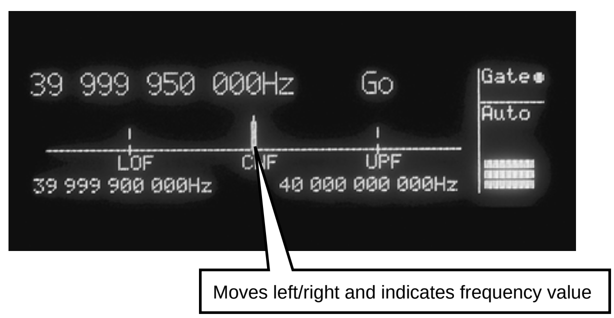
The MF2400C series Microwave Frequency Counter lineup is composed of three frequency counters:
the MF2412C (20 GHz), the MF2413C (27 GHz), and
the MF2414C (40 GHz).
This series is ideal for evaluating mobile radio communications devices and circuits, and can also measure the carrier frequency and pulse width of burst signals.
In addition to displaying measurement results on the 12-digit vacuum fluorescent display (VFD), frequency values can be read using the analog display function, which can be used for monitoring and is especially useful for adjusting the frequency of oscillators.
Furthermore, the template function is perfect for assessing whether or not results fall within upper and lower frequency limit specification. Because the evaluation result is output from the AUX connector on the back panel as a Go/No-go signal, an easy-to-use, automatic measurement system can be configured using the GPIB function.

• Wide Band Measurement
The lineup of three counters with upper frequency limits of 20, 27, and 40 GHz, satisfies every usage requirement. In addition, a high-frequency fuse protects the input circuit from over-power signals, and a variety of adapters is available for coupling each connector.

• High-accuracy Burst Measurement
The carrier frequency, burst width, and burst repetition rate of burst signals from 100 ns to 0.1 s input to Input 1 can be measured quickly and accurately.

Measurement	Positive selected	Negative selected
Burst width	 Measurement at Burst ON	 Measurement at Burst OFF
Burst repetition	 Measurement of On-On period	 Measurement of Off-Off period

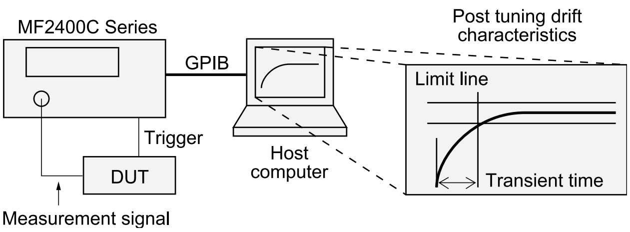
• Analog Display Function
Using this function, the entire VFD becomes an analog meter and values are indicated by the meter needle. In addition to quickly grasping changes in measured frequency, this permits faster frequency adjustment and Go/No-Go evaluation of oscillators, which previously required reading of many digits. This analog meter also solves problems of misreading frequency values.



• Template Function
When the upper and lower frequency limits have been preset, "Go" is displayed when the measured frequency is within the preset range; if it is out of range, "No-Go" is displayed. In addition, the Go/No-Go signal can be output from the AUX connector on the rear panel as a TTL signal.
This is very useful for configuring an automatic Pass/Fail evaluation system (using analog display).

● High-speed Transient Measurement

Frequency counters have an interval (sample rate) when measurement is not performed, so sudden frequency changes during this period cannot be measured.
However, the MF2400C series overcomes problems of measuring fast transients by capturing frequency variations at speeds of up to 10 μs and saving a maximum of 2000 sampling points. Saved data can be read by a PC host using GPIB. When it is combined with a host computer, frequency changes can be displayed graphically. This is very effective for measuring VCO start-up characteristics and PLL lock times.

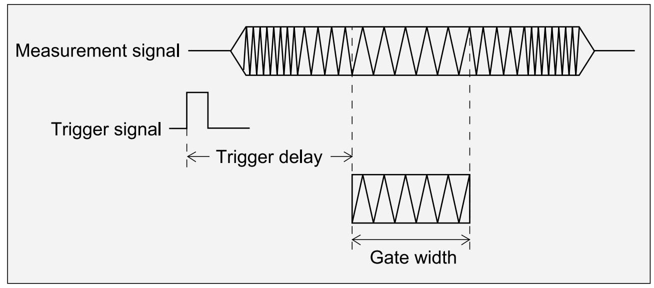


● High-stability Reference Crystal Oscillator

A high-stability reference crystal oscillator is installed as standard in this counter instead of being available as an option in the previous MF2400B series.
It supports an order-of-magnitude better measurement stability than previous instruments without additional investment.

● Gating Function

At burst signal measurement, the carrier frequency may be different at the burst start, middle, and end.
In the MF2400C series, the carrier signal frequency at any position of the signal (delay time from trigger signal leading edge) and at any specified time (gate time) can be measured using a combination of the gating and trigger delay functions.



● Added Save and Recall Functions

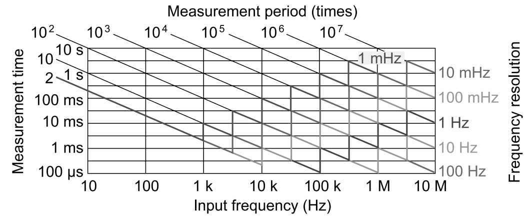
Up to 10 setups can be saved in the internal memory and freely recalled. Saving complex setups in advance, such as burst triggers and gate settings, supports immediate recall for measurement, reducing both measurement setup time and malfunctions due to setup mistakes.

Specifications

● MF2400C Series Microwave Frequency Counter

<table>
<tr><td rowspan="4">Input</td><td>Frequency Range</td><td>Input 1
MF2412C: 600 MHz to 20 GHz
MF2413C: 600 MHz to 27 GHz
MF2414C: 600 MHz to 40 GHz
Input 2
10 MHz to 1 GHz (50Ω), 10 Hz to 10 MHz (1 MΩ)</td></tr>
<tr><td>Input Level Range (Sine wave input)</td><td>Input 1
–33 to +10 dBm (<12.4 GHz), –28 to +10 dBm (<20 GHz), –25 to +10 dBm (<27 GHz),
[–44.6 + 0.741 × frequency (GHz)] to +10 dBm (≤40 GHz)
Input 2
25 mVrms to 2 Vrms (50Ω), 25 mVrms to 10 Vrms (1 MΩ)</td></tr>
<tr><td>Impedance, Coupling</td><td>Input 1: 50Ω, AC coupled
Input 2: 50Ω or ≥1 MΩ (≤35 pF), AC coupled</td></tr>
<tr><td>Connector</td><td>Input 1
MF2412C: N-type, MF2413C: SMA-type, MF2414C: K-type
Input 2: BNC-type</td></tr>
<tr><td rowspan="3">Gating Function</td><td>Trigger Mode</td><td>Int: Triggered by measurement signal
Ext: Triggered by external signal
*Trigger level: 1.5 V ± (2 to 10 Vp-p), Trigger pulse width: ≥1 μs, Impedance: ≥100Ω, Coupling: DC
LINE: Triggered by AC line signal</td></tr>
<tr><td>Trigger Delay</td><td>20 ns to 0.1 s (Delay time until counter started by trigger detection), Off
(≤320 ns in 20 ns steps, and <1 μs in 40 ns steps variable; ≥1 μs in continuously variable as effective two digits)</td></tr>
<tr><td>Gate Width</td><td>100 ns to 0.1 s (<1 μs in 20 ns steps variable; ≥1 μs in continuously variable as effective two digits)</td></tr>
<tr><td rowspan="6">Pulse Modulation Wave Measurement</td><td>Frequency Range</td><td>MF2412C: 600 MHz to 20 GHz, MF2413C: 600 MHz to 27 GHz, MF2414C: 600 MHz to 40 GHz</td></tr>
<tr><td>Pulse Width</td><td>100 ns to 0.1 s (NARROW), 1 μs to 0.1 s (WIDE)</td></tr>
<tr><td>Pulse Repetition Cycle</td><td>340 ns to 0.1 s (pulse off time: ≥240 ns)</td></tr>
<tr><td>Carrier Frequency Measurement (MANUAL measurement mode)</td><td>Max. resolution: 1 kHz (pulse width: 100 ns to 1 μs), 100 Hz (pulse width: 1 μs to 10 μs),
10 Hz (pulse width: 10 μs to 100 μs), 1 Hz (pulse width: 100 μs to 1 ms),
0.1 Hz (pulse width: 1 ms to 100 ms)
Measurement time: (T or T_S whichever is greater) × $\{1/(f_R \times T_{GW})\}^2$
<table><tr><td>Resolution</td><td>1 Hz</td><td>10 Hz</td><td>100 Hz</td><td>1 kHz</td><td>10 kHz</td><td>100 kHz</td><td>1 MHz</td></tr><tr><td>Measurement time</td><td>200 s</td><td>20 s</td><td>2 s</td><td>200 ms</td><td>20 ms</td><td>5 ms</td><td>5 ms</td></tr></table>
*Example of measurement time when measurement carrier frequency = 1 GHz, T = $2/f_R$, and T_{GW} = $0.1/f_R$
f_R: frequency resolution, T_{GW}: gate width, T_S: processing time (50 μs), T: Pulse repetition cycle
Accuracy: ±2 count ± time base accuracy × measurement frequency ± trigger accuracy ± residual error*1</td></tr>
<tr><td>Pulse Width Measurement</td><td>Resolution: 1 ns
Accuracy: ±20 ns ± time base accuracy × measurement pulse width ± trigger accuracy (time)
Unit: μs (fixed)</td></tr>
<tr><td>Pulse Period Measurement</td><td>Resolution: 1 ns
Accuracy: ±20 ns ± time base accuracy × measurement period ± trigger accuracy (time)
Unit: μs (fixed)</td></tr>
</table>

Continued on next page

Carrier Wave Frequency Measurement: Resolution, Measurement Time	Input 1 NORMAL: 1 MHz/1 µs to 0.1 Hz/10 s FAST: 1 MHz/0.18 µs to 0.1 Hz/1.8 s (typ.) Input 2 10 MHz to 1 GHz (50Ω): 1 MHz/1 µs to 0.1 Hz/10 s 10 Hz to 10 MHz (1 MΩ): 1 MHz to 0.001 Hz Measurement time shown on right 
Carrier Wave Frequency Measurement: Measurement Accuracy	Input 1 NORMAL: ±1 count ± time base accuracy × measurement frequency ± residual error*2 FAST: ±1 count ± time base accuracy × measurement frequency ± trigger accuracy ± residual error*1 Input 2 10 MHz to 1 GHz: ±1 count ± time base accuracy × measurement frequency 10 Hz to 10 MHz: ±1 count ± time base accuracy × measurement frequency ± trigger accuracy
Auto/Manual Measurement	Auto FM tolerance: 35 MHzp-p, Acquisition time: ≤50 ms Manual (CW measurement) Input frequency range: ±30 MHz (600 MHz to 1 GHz), ±40 MHz (≥1 GHz) Acquisition time: ≤15 ms Manual (Burst measurement) Input frequency range: ±30 MHz (600 MHz to 1 GHz, pulse width mode: WIDE) ±20 MHz (≥1 GHz, pulse width mode: NARROW) ±40 MHz (≥1 GHz, pulse width mode: WIDE) Acquisition time: ≤15 ms
Functions	Template: Inputs at upper/lower limit of frequency, Judged Go/No-Go Frequency offset: +offset, –offset, ppm Statistical processing: Mean, Maximum, Minimum, p-p Save/recall: 10 panel settings (max)
Aux Output	Output for Go/No-Go, Count end, Input level detection, Internal gating, Restart, and Acquisition signal
Sample Rate	1 ms to 10 s (1-2-5 steps), Hold
High-speed Sample Period/Frequency Resolution	Input 1: 10 µs/10 kHz, 100 µs/1 kHz, 1 ms/100 Hz Input 2: 10 µs/100 kHz, 100 µs/10 kHz, 1 ms/1 kHz *Measurement frequency: 100 MHz
Memory Backup	Saved in backup memory at power off
Display	Display digits: 12 digits and 1 digit (– mark) VFD: 256 × 64 dots
Reference Crystal Oscillator	Frequency: 10 MHz Warm-up: $\pm 5 \times 10^{-8}$/10 minutes Aging rate: $\pm 5 \times 10^{-9}$/day, $\pm 8 \times 10^{-8}$/year (after 24 h warm-up) Temperature characteristics: $\pm 5 \times 10^{-8}$ (0° to 50°C)
External Reference Input	1, 2, 5, 10 MHz, Input voltage: 1 to 5 Vp-p (AC coupled), Input impedance: ≥1 kΩ
External Reference Output	1, 2, 5, 10 MHz*3, Output voltage: ≥2 Vp-p (Open end, AC coupled), Output impedance: ≤400Ω
Remote Control	GPIB (conforms to IEEE488.2 standards): SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
Power Supply	100 V(ac) to 120 V(ac)/200 V(ac) to 240 V(ac) (auto-switching), 50 Hz to 60 Hz, ≤90 VA, ≤80 VA
Operating Temperature	0° to 50°C
Dimensions and Mass	213 (W) × 88 (H) × 350 (D) mm, ≤5 kg
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*1: Measurement frequency (GHz)/2 count (rms), 5 GHz Measurement example: 5/2 = 2.5 count (rms)
*2: Measurement frequency (GHz)/10 count (rms), 5 GHz Measurement example: 5/10 = 0.5 count (rms)
*3: 10 MHz when using internal reference signal; outputs signal based on this signal (1, 2, 5, 10 MHz) when using external reference signal

• Options: Crystal Oscillator

Option Number	MF2412C-003	MF2413C-003	MF2414C-003
Frequency	10 MHz		
Aging Rate	$\pm 5 \times 10^{-10}$/day, $\pm 2 \times 10^{-8}$/year *After power-on, with reference to frequency after 72 h		
Temperature Characteristics	$\pm 5 \times 10^{-9}$ –10° to +60°C (with reference to +25°C)		

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MF2412C	Microwave Frequency Counter (10 Hz to 20 GHz, N-J connector)
MF2413C	Microwave Frequency Counter (10 Hz to 27 GHz, SMA-J connector)
MF2414C	Microwave Frequency Counter (10 Hz to 40 GHz, K-J connector)
	Standard accessories
	Power Cord: 1 pc
F0012	Fuse, 3.15 A: 2 pcs
W2897AE	MF2412C/2413C/2414C Operation Manual: 1 copy
	Options
MF2412C-003	Crystal Oscillator (5×10^{-10}/day)
MF2413C-003	Crystal Oscillator (5×10^{-10}/day)
MF2414C-003	Crystal Oscillator (5×10^{-10}/day)
	Optional accessories
K224B*1,*2	Coaxial Adapter (K-P · K-J, SMA compatible, DC to 40 GHz, SWR: 1.2)
34RKNF50*2	Coaxial Adapter (ruggedized K-P · N-J, DC to 20 GHz, SWR: 1.25)
J0527*2	Coaxial Cord, 2 ft (K-P · K-P)
J0127A	Coaxial Cord, 1 m (BNC-P · RG-58A/U · BNC-P)
J0853*3	Coaxial Cord, 2 m (N-P · SF104P · N-P)
J0854*4	Coaxial Cord, 2 m (APC3.5-P · SF104P · APC3.5-P)
MP612A*5	Fuse Holder (N-P · N-J, DC to 1 GHz, without elements)
MP613A*5	Fuse Element (DC to 1 GHz, Power rating: 17 dBm, Failsafe rating: ≥35 dBm, 5 pcs/set)
J0007	408JE-104 GPIB Cable (1 m)
J0008	408JE-104 GPIB Cable (2 m)
B0409	Carrying Case (With B0329L Protection Cover)
B0598A	Carrying Bag (Soft type, with B0329L Protection Cover)
B0390G	Rack Mount (19" type, one unit)
B0411A	Rack Mount (19" type, two units, side-by-side)
B0329L	Protection Cover

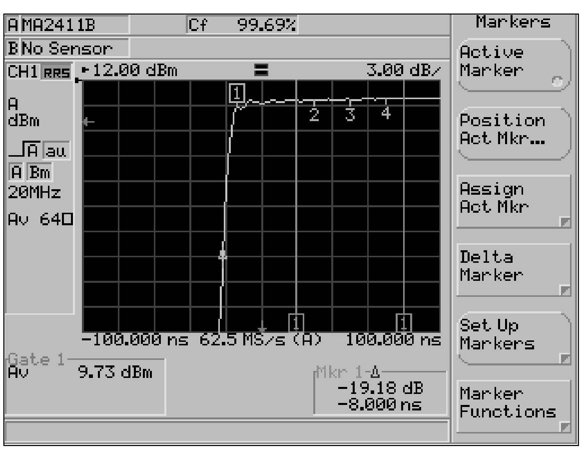
*1: The K224B Coaxial Adapter prevents damage to the input connector.
*2: MF2414C Parts
*3: MF2412C Parts
*4: MF2413C and MF2414C Parts
*5: The MF2400C series has the MP612A Fuse Holder (with MP613A Fuse Element) to prevent over-power input.
In addition, the MP612A has an N-type connector, so an adapter matching the coupled connector type is required.

WIDEBAND PEAK POWER METERS
ML2490A Series
10 MHz to 50 GHz*

Remote Control
GPIB | Ethernet

For High Resolution Rising Edge, Narrow Pulse Radar and 4G Power Measurements

The ML2490A is the latest addition to the Anritsu Peak Power meter line and extends the performance of the successful ML2480B series for the most demanding high bandwidth peak power measurement applications. This new instrument incorporates extra wide bandwidth and a high resolution sampling system to provide detailed information on the power profile of Radar signals and the latest generation of wide bandwidth OFDM 4G systems.
The ML2490A series supports all the functionality of the ML2480B series and offers in addition a mainframe bandwidth of 65 MHz and an 8 ns rise time with the MA2411B Pulse sensor.
The ML2490A series has been designed to use the MA2411B Pulse sensor and the MA2490/91A wideband sensors, and is fully compatible with the wide range of Anritsu diode and universal sensors. See the section on the ML2430A Series Power Meters for more details on these sensors.
The power meter also offers a high performance CW mode creating a truly universal power meter for all applications.

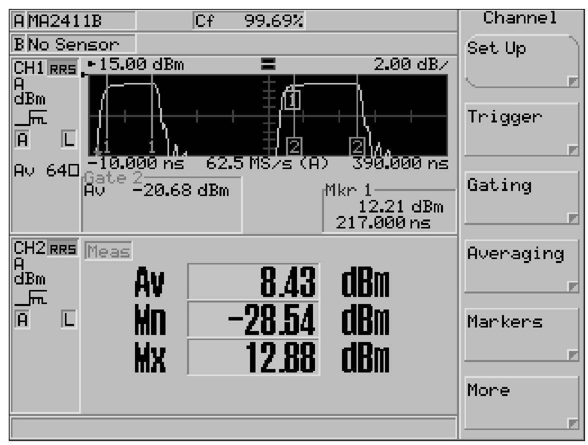


Fast Rise Time Measurements

*: Frequency range is sensor dependent

Graphical or Numerical Results can be selected and displayed.
A comprehensive GPIB command set gives a wide range of commands to extract data from the signal under test.
A variety of built-in processing functions such as gates and markers enable precise sections of the signal to be measured and analysed using different processing functions.
Two versions of the product are available: The ML2495A Single sensor Input version and the ML2496A, the dual sensor input version. The ML2496A can be used for measuring gain under pulsed conditions.
The ML2490A is the ideal companion for other Anritsu test equipment, such as the MG3690B series and the MG3700A series.

Performance
- 65 MHz mainframe Bandwidth
- 8 ns Rise time with MA2411B sensor
- 50 ns to 7 s Signal capture time
- Multi-pulse triggering capability
- External Video Connection



Title Flexible Display offers Single or Dual display output.

Features
• 1 ns Settable Display Resolution
The ML2490A has 1 ns settable resolution on time based measurements from 50 ns to 3.2 µs.

• 50 ns Minimum Time Display
The ML2490A can be set to measure narrow pulse width signals.

• 8 ns Typical Rise Time with MA2411B Sensor
The ML2490A rise time is typically 8 ns with the MA2411B pulse sensor providing a fast measurement on the most demanding of radar signals.

• 65 MHz Bandwidth
The power meter mainframe has 65 MHz bandwidth. Wide enough for accurate rise time measurements on radar signals or for measuring the peak signal of the latest 4G OFDM signals.

• Two Sample Modes
For time durations up to 3.2 µs, the ML2490A series has a continuous sample rate. This can be set either automatically or the sample rate can be adjusted directly by the user.
For time durations of 50 ns to 3.2 µs the power meter uses Repetitive sampling to build up the trace to 1 ns settable display resolution. Changeover between the two modes is automatic.

• External Video Connector
The ML2490A has a video connector on the rear panel as standard. The power meter can be connected to a standard VGA monitor. The power meter can be located remotely in a test rack and the video screen located close to where the adjustments are taking place.

• 50 MHz and 1 GHz Calibration Signals
The ML2490A has 50 MHz and 1 GHz calibrators as standard. Frequency is automatically selected with the appropriate sensor.

• Dual Display Channel

The ML2490A supports dual display channels. Each display channel is a measurement set up and can use any selection or combination of the sensor inputs. The instrument can be configured to view one display channel or two. The instrument can be switched between display channels quickly and simply via the CH1/CH2 Hard 'hot' key on the front panel. The user can choose to view the measurement results as a graph profile or numerical readout.

• Measurement Gates

At the heart of the power meter's signal processing lies the measurement gate facility. The new power meter supports up to 4 independently set gates or 8 gates repeated in a pattern. The gate allows the user to capture the relevant information from the signal under test. The wide bandwidth and high speed A/D allow the positioning of the gate very accurately within the signal profile. The user can choose between several measurements performed within the gate. Average, peak, crest, max and min are available as selections for the output. The max and min data are time stamped so that the position of these signals is recorded within the gate and can be used to record the overshoot and undershoot of a pulsed signal.

• Markers

4 independent markers are available for denoting points of interest on the signal profile. The active marker can be scrolled directly from the front panel. A delta marker can be set independently from the active marker to read the difference or the average power result. The delta marker can be linked to provide continuous scrolling through the signal.

• Special Marker Features

A set of specialised automatic marker functions has been provided for to ease the measurement of pulsed systems. These functions are automatic pulse rise time, pulse fall time, off time and pulse repetition interval.

• Trigger Facilities

High speed measurements require precise triggering. The trigger level can be set manually or automatically.
The ML2490A series offer the following trigger modes. Continuous, internal trigger on the rising or falling edge of either input A or input B and external TTL trigger.
The external trigger allows the power meter to be synchronised to external equipment. Data collection can be delayed for a pre-determined time after the trigger point. The trigger facility incorporates a settable frame arming facility which enables the power meter to synchronize to multi-pulse signals. A pre-trigger facility allows the capture and display of pre-trigger information on the signal.
The single shot trigger facility can be used to capture specific one off events with a bandwidth of 20 MHz.
Long duration pulses can also be measured in CW mode.

• Test Limits

The ML2490 series has two different types of automatic test limits. For many applications a simple power limit can be set up to test the upper and /or lower boundaries of the signal. For pulsed systems such as radar a time varying limit line can be set up to test all aspects of the pulse profile. The power meter can be set up to indicate pass or fail and to hold the measurement display on failure which is important when trying to track down intermittent faults. An internal limit editor enables the user to create and select his or her own limit profiles.

• Presets

The ML2490A offers a number of radio system presets. Each preset configures the power meter settings to measure a radio system. Radar and OFDM presets are available.

• Settings Stores

The power meter has 20 settings stores. These provide a convenient way of having application specific measurement set ups for easy recall by the user.

• Remote Interfaces

The ML2490A series supports Ethernet (10/100BASE-T LAN), GPIB, and RS 232 as standard.

• Secure Mode

The ML2490A series has a secure mode for operations in security sensitive areas. Once activated the secure mode wipes all information stored in the non-volatile RAM on power up.

• CW Meter Mode

Functions as a dual purpose high accuracy, high dynamic range CW power meter.

Applications

• Radar

The high bandwidth and sample rate of the ML2490A provide accurate peak measurements on a variety of radar, Radio-navigation and Radio-location systems.
The ML2490A series has a number of features tailored for peak power measurement on pulsed systems. With a typical 8 ns rise time, and a 1 ns resolution on the measurement, the ML2490A and MA2411B have the performance to look at the rising edge of radar signals.
The power meter can be easily set up to trigger on a pulse or sequence of pulses. Up to 4 independent gates can be set to measure the average, max and min powers on a sequence of pulses. The data for the max and min includes the timestamp and gives the user automatic display of the position and value of the maximum overshoot and minimum undershoot in each pulse.
A set of automatic marker functions gives pulse rise time, fall time, off time and Pulse Repetition Interval. The Delta marker can be set up to measure the droop of the pulse top.
The Trigger event display is available as either arrows on the border of the screen or as an adjustable trigger event waveform on the display. All timings for the gates and markers are taken from the trigger event.
The offset table function corrects the power meter reading to read the true output power when the power meter is being used with a coupler or high power attenuator in the radar test system.

• OFDM Systems

Multi-carrier OFDM systems place high demands on the amplifiers and other components in the systems. The latest generation of communication systems (such as WiFi, WiMAX) are adopting OFDM technologies. Conventional power meters do not have the bandwidth to see the signal power envelope change as the symbols in the multi-carrier system change. The ML2490A series can measure both continuous OFDM and framed OFDM. The increased bandwidth reduces errors made by lower bandwidth meters.

• GSM/EDGE/GPRS

The graphical display and the measurement gates make the measurement of GSM and PCS systems straightforward. The ML2480B series power meter is set up to trigger on the GSM pulse. The active gate is set up to measure the power within the 10% to 90% section of the burst profile. An automatic limit can be used to give pass or fail indication. The display shows the results from the active gate, indicating the average power within the burst. GPRS and GSM test modes can be tested easily with the use of the multiple gates. A GSM gate pattern can be repeated up to eight times to allow the power meter to capture and read back the power from each of the slots, giving up to eight simultaneous measurements. EDGE measurements are quick and simple to make. The high sample rate leads to improved settling time and the use of the trigger hold off facility prevents re-triggering on the symbol transitions. PHS and IS-136 systems can also be measured effectively and quickly in this way.

• 3G-CDMA

The ML2490A series has been designed to measure the peak power of all the major CDMA systems in the world including those that use Time Division Duplexing such as TD-SCDMA. The display can be configured to measure Average, Peak and Crest Factor. The measurement period can be set for accurate results. TDD systems can be displayed as a graph profile and the measurement gates can be set to measure and display the peak and crest factor during the transmission. CCDF, CDF and PDF statistical functions are supported on the CDMA measurements and enable the designers of power amplifiers to correctly estimate the margins on the peak power handling capabilities of the amplifiers.

• Amplifier and Return Loss Measurements

Use the dual input ML2496A to measure the gain or the return loss of an amplifier under its correct operating conditions. Power amplifiers designed for peak applications, whether pulsed or CDMA, cannot operate at full peak power with CW test inputs. The gain and output power can only be measured accurately using a peak power meter under representative conditions. The Power Added Efficiency of chipsets can be measured using the PAE feature and a current probe connected to the power meter.

• PowerMax

PowerMax is a free graphical user-interface software, for the ML249xA power meter series (with firmware v2.20 or greater). PowerMax provides the user an enhanced visualization of instrument display and full remote control of the instrument, allowing continuous view of measurement traces in real-time, archiving or printing of data and plots for future analysis.
PowerMax runs on a standard PC running Windows® 95 (or higher), and communicates with the power meter via Ethernet interface.

• MA2490A and MA2491A Wideband Sensors

The MA2490 series sensors are wideband sensors suitable for pulse and CDMA applications. They have a selectable 5/20 MHz bandwidth. The MA2490A covers the range 50 MHz to 8 GHz and the MA2491A extends the range to 18 GHz. These sensors have a Rise time of 18 ns. The sensor incorporates a "chopper" which extends the RMS measurement range to –60 dBm. Upper limit is +20 dBm.

• MA2411B Pulse Sensor

The MA2411B Pulse sensor is specifically designed for fast measurements on pulsed or 4G systems. The sensor has a rise time of 8 ns. This sensor covers the frequency range 300 MHz to 40 GHz.

Power Meter Specifications

<table>
<tr><td></td><td colspan="2">ML2430A Series</td><td colspan="2">ML2480B Series</td><td colspan="2">ML2490A Series</td><td>Comments</td></tr>
<tr><td></td><td>ML2437A</td><td>ML2438A</td><td>ML2487B</td><td>ML2488B</td><td>ML2495A</td><td>ML2496A</td><td></td></tr>
<tr><td>Signal Inputs</td><td>1</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td><td></td></tr>
<tr><td>Frequency Range</td><td colspan="6">100 kHz to 65 GHz (sensor dependent)</td><td></td></tr>
<tr><td>Dynamic Range</td><td colspan="6">–70 to +20 dBm (dependent on sensor, external coupler or attenuator)</td><td>Continuous
or Peak</td></tr>
<tr><td rowspan="5">Performance</td><td colspan="2">100 kHz (Profile mode)</td><td colspan="2">Pulse/Modulated mode
20 MHz with MA2491A sensor
CW mode
17 kHz ranges 1–4
35 Hz range 5</td><td colspan="2">Pulse/Modulated mode
>65 MHz range 7
>38 MHz range 8
>16 MHz range 9
(Repetitive Sampling)
20 MHz (One shot)
Combined B/W (with MA2411B sensor)
>39 MHz range 7
>29 MHz range 8
>12 MHz range 9
MA2411B nominal Bandwidth = 50 MHz
CW mode
17 kHz range 1-4
36 Hz range 5</td><td>Nominal
Video BW</td></tr>
<tr><td colspan="2">31.25 kS/s</td><td colspan="2">Auto/Manual
CW Mode
75 kS/s
Pulse/Modulated Mode
31.25 kS/s to 62.5 MS/s
(dependent on trigger capture time)
Conflicts between selected settings and other
instrument settings are indicated through userwarnings (displayed and GPIB)</td><td colspan="2">Auto/Manual
CW Mode
75 kS/s
Pulse/Modulated Mode
31.25 kS/s to 62.5 MS/s Continuous Sampling
(Trigger capture time 3.2 µs to 7 s, 200 data points)
1 GS/s Random Repetitive Sampling
(Trigger capture time 50 ns - 3.2 µs, 200 data points)
Conflicts between selected settings and other instrument settings are indicated through user warnings (displayed and GPIB)</td><td>Sampling rate</td></tr>
<tr><td colspan="2">N/A</td><td colspan="2"><18 ns
(with MA2411B sensor) Typical</td><td colspan="2">8 ns, Maximum 12 ns
(with MA2411B sensor)
Fall-time typically 11 ns</td><td>System rise-time (10% to 90% at +10 dBm)</td></tr>
<tr><td colspan="2">N/A</td><td colspan="4">10% to 90% Rise-time measurement of –20 to +20 dBm Peak power (with MA2491A)</td><td>Rise-time measurement dynamic range</td></tr>
<tr><td colspan="2">N/A</td><td colspan="4">≤3% in linear power at +10 dBm</td><td>Overshoot (Pulse/ Modulated mode)</td></tr>
<tr><td rowspan="2">Accuracy
(Defined by uncertainty calculations with relevant sensor and source match conditions)</td><td colspan="2"><0.5%</td><td colspan="4">CW Mode
<0.5% (±0.02 dB absolute Accuracy, ±0.04 dB relative Accuracy)
Pulse/Modulated Mode
<0.8% Nominal range 7, 8</td><td>Instrumentation Accuracy</td></tr>
<tr><td colspan="6">Equivalent Noise Power
(512 Moving Average)
MA2472D / MA2491A / MA24002A
Range 1: 0.5 µW / 2 µW / N/A
Range 2: 50 nW / 100 nW / 0.5 nW
Range 3: 0.8 nW / 2 nW / 8 µW
Range 4: 0.2 nW / 1 nW / 2 µW
Range 5: 50 pW / 0.5 nW / 0.5 nW
(CW mode)
Range 7: 5 µW / 15 µW / N/A
Range 8: 1 µW / 5 µW / N/A
Range 9: 0.5 µW / 2 µW / N/A
(Pulse/Modulated mode)</td><td>Equivalent Noise Power is RSS of Zero Set, Zero Drift and noise.
Zero Set and Drift is measured over on hour warm-up at constant ambient temperature.
Noise is measured over five minutes over 512 averaging after one hour warm up at constant ambient temperature.</td></tr>
</table>

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	ML2430A Series		ML2480B Series		ML2490A Series		Comments
	ML2437A	ML2438A	ML2487B	ML2488B	ML2495A	ML2496A	
Operation	2		2 (CW or Pulse/Modulated measurement modes)				Measurement Display-Readout (Numerical)
	Power vs. Time graphic of readout data or Profile of Peak power for analysis of repetitive pulse or transient waveforms		2 (Pulse/Modulated measurement mode)				Measurement Display-Profile (Graph)
	Single channel power sweep or frequency sweep						Source sweep
	±5 dB range CW (Readout mode) only						Peaking meter
	Dynamic range covered by five overlapping amplifier ranges, R1, R2, R3, R4 and R5 Universal Sensor MA2481/82D ranges 1 to 6		Pulse modulated mode: Dynamic range covered by three overlapping amplifier ranges, R7, R8 and R9 CW mode: Dynamic range covered by five overlapping amplifier ranges, R1, R2, R3, R4 and R5 Universal Sensor MA2481/82D ranges 1 to 6				Amplifier Range
	Auto or Manual (current range or selectable 1 through 5)		Automatic or manual. When in manual clear indication given to user (display and GPIB) of fault conditions (under or over-range)				Range Hold
Features (summary)	0.1 to 0.001 dB Linear power units, 3 to 6 digit, 1 to 3 digits selectable to right of decimal nW to W; Voltage, 1 to 2 digits selectable to right of decimal		0.1 to 0.001 dB				Display resolution in Readout mode
	0.01 dB						Display resolution in Profile mode
	Profile and P vs. T modes: 200 pixels display resolution For a 1 ms Profile window, cursor resolution on the display is 5 µs		16 ns Pulse/Modulated mode 15 µs CW Mode		1 ns (RRS mode) 16 ns (non RRS mode) Pulse/Modulated mode 15 µs CW Mode		Time measurement resolution
	Hold, Max, Min						Measurement hold
	Average, Min, Max		Average, Min, Max, Peak, Crest, PAE (Power Added Efficiency)				Measurements
	—		PDF, CDF, CCDF				Power statistics
	0.00 to 20.00 V nominal						Voltage measurement range
	Watt, %, Volts						Display units (Lin) Display units (Log)
	–199.99 to +199.99 dB						Display range
	1		Four Independently set Gates or eight repeated Gates One Fence per Measurement gate Gate measurement supports Average, Peak, Crest, Max and Min				Measurement Gates
	2		Four Markers and One Delta Marker, Marker to Max/Min, Pulse Rise/Fall-time, Pulse Width, Off Period, Pulse Repetition Interval Rise Fall/Search Parameter Variable % Reference: Max Marker or Gate Power Level				Markers
	Fixed value high and low limits with audible, rear panel TTL output, and/or visible Pass/Fail alarm indication Failure indication can latch for transient failure detection		Simple pass/fail for CW Complex limits for pulsed and TDMA systems 30 Limits Stores available on the instrument				Limit lines
	–199.99 to +199.99 dB (Fixed value or frequency dependent table)						Offset range
Averaging	Auto (Moving), Manual (Moving, Repeat)						Type
	1 to 512						Range
	Low, Medium and High settings apply post average low pass filter to improve visibility at high display resolution		N/A				Low-level Averaging

Continued on next page

	ML2430A Series		ML2480B Series		ML2490A Series		Comments
	ML2437A	ML2438A	ML2487B	ML2488B	ML2495A	ML2496A	
Triggering	Internal, External (TTL or RF Blanking), GPIB, Manual, Continuous		Continuous (not in Random Repetitive Sampling mode) Internal, External TTL (Rising or falling Edge), GPIB or external Bus				Source
	Manual Single power value set to cover entire measurement dynamic range of sensor Auto Automatically sets trigger level for signal over measurement dynamic range						Trigger modes
	N/A		Variable-auto set and manual 20 MHz, 2 MHz, 200 kHz, 20 kHz				Nominal Internal Trigger Bandwidth
	Sets the trigger arming, unless the trigger source is set to EXT TTL When ARMING is set to Blanking ON, only samples taken when the rear panel Digital Input BNC is active will be averaged in the measurement		Repetitive Sampling Modes: Automatic Frame for QAM and multi-pulse Continuous Sampling Modes: Single Automatic Frame for QAM and multi-pulse				Arming Sources
	N/A		0 to 64 × trigger capture time range or 120 s whichever is the greater				Frame Arming Time range
	–15 to 20 dBm (all diode sensors, selectable to –25 dBm)		–28 to +10 dBm with MA2472D CW mode –18 to +14 dBm with MA2491A –30 to +10 dBm with MA2472D Pulse/Modulated mode				Internal Trigger dynamic range
	1 dB						Internal Trigger level Accuracy (typical)
	0.1 dB						Internal Trigger settable resolution
	N/A		±2 ns or display resolution, whichever is the larger (Trigger Capture time 50 ns to 3.2 μs) ±16 ns or display resolution whichever is the larger (Trigger Capture time 3.2 μs to 7 s)				Trigger time resolution Uncertainty
	0.0 to 999 ms		Pulse modulated mode Pretrigger (-ve): 95% of the Trigger Capture range Post Trigger: Set by 256K buffer and sample rate CW mode Post Trigger Only: 0-999 ms depending on Trigger Capture period setting				Trigger delay range
	TTL rising or falling edge (BNC input)						External Trigger range
	N/A		90% of trigger capture range				Pre-trigger range
	0.5% of display period or 100 ns		200 display points 1 ns or 0.5% of trigger capture time, whichever is the larger 400 display points 1 ns or 0.25% of trigger capture time (400 points), whichever is the larger				Trigger delay settable resolution
Triggering	N/A		±2 ns for pre and post trigger (Trigger capture time of 3.2 μs or 50 ns)				Trigger delay uncertainty
	N/A		±15 ns (20 MHz trigger BW)				Trigger latency
	Profile mode: 10 ms to 7 s P v T mode: 1 m to 24 hrs		3.2 μs to 7 s		50 ns to 7 s		
	N/A		200 display points 16 ns or 0.5% of trigger capture time, whichever is the larger 400 display Points 16 ns or 0.25% of trigger capture time, whichever is the larger		200 display points 1 ns or 0.5% of trigger capture time, whichever is the larger 400 display Points 1 ns or 0.25% of trigger capture time, whichever is the larger		Trigger capture time settable resolution
	On-screen indicator/message		Trigger point depicted by trigger edge waveform (edge represents trigger point of signal). Display position of trigger edge waveform adjustable.				Trigger point display (on-screen)
System Configuration	10 storage registers plus RESET default settings		20 settings stores Preset accessible on Front Panel Offset tables				Save/Recall
	Wipes non-volatile memory on power up when active.						Secure mode

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	ML2430A Series		ML2480B Series		ML2490A Series		Comments
	ML2437A	ML2438A	ML2487B	ML2488B	ML2495A	ML2496A	
Interfaces	Yes		No				Remote monitoring
	Yes		No				Modem Compatibility
	>600 readings/sec (per input channel) Emulation of Anritsu ML4803, Agilent 436, 437 and 438		>400 Readings/second CW Mode [TR3 mode] >350 Readings/second Pulse/Modulated Mode (Continuous Sampling) [1 μs pulse, readout mode, Display turned off, TR3 Mode] >10 profile transfers/sec Pulse/Modulated Mode (Profile data) [200 points per sweep, Binary Float Output, 5 μs Trigger Capture Time] >20 Readings/sec Pulse/Modulated Mode (Repetitive Sampling) [50 ns pulse, readout mode, Display turned off, TR3 Mode] Back Compatible with ML2480B with Additional functionality added				GPIB (IEEE–488.2, IEC–625)
	N/A		Allows remote control, direct from a PC or Local/Wide-area network, using Dynamic (Auto) or Static IP assignment				Ethernet (10/100BASE-T LAN)
	Supports software download, Instrument control and modem dial-out. 1200, 2400, 4800, 9600, 19200, 38400, 57600 Baud rates supported		Supports software download and Instrument control 1200, 2400, 4800, 9600, 19200, 38400, 57600 Baud rates supported				RS232
	Operating Modes: Display voltage reading on selected channel Voltage proportional to frequency for sensor calibration factor compensation Blanking Input -TTL levels only Selectable positive or negative polarity Input Range: 0 to 20 V Resolution: 0.5 mV Control: Adjustable voltage to frequency relationship		Can be configured for: Cal factor correction from synthesiser, Ext Voltage Voltmeter, Connection:- current probe for PAE applications				Cal Factor Voltage Input (BNC)
	TTL, maximum frequency of 800 kHz		TTL, maximum frequency of 10 MHz				External trigger (BNC)
	Two outputs configurable to Log or Lin Operating Modes: Selectable channel adjusted for calibration factors and other power reading correction settings Pass/Fail – Selectable TTL High or Low Channel output -Near real time analog Uncalibrated AC Modulation Output -Output 1 only Dwell Output -Output 2 only Output Range: –5.0 to 5.0 V Resolution: 0.1 mV		Output 1 can be configured for: Analog Output, Pass/Fail TTL o/p Limits, Levelling: -Sensor Input A Output 2 can be configured for: Analog Output, Pass/Fail TTL o/p Limits, Levelling: -Sensor Input B, Trigger Output				Analogue Output (BNC)
Reference Calibrator	1 mW						Power
	±1.2% per year, ±0.9% RSS						Power accuracy (Traceable to National Standards)
	50 MHz (nominal)		50 MHz (standard), 1 GHz (optional)		50 MHz, 1 GHz (both standard)		Frequency
	<1%		<1% (50 MHz) <2% (1 GHz)				Frequency Accuracy
	<1.04		<1.12 (50 MHz) <1.2 (1 GHz)				VSWR
	N female						Connector type
Display	Monochrome LCD, with backlight and adjustable contrast		Color LCD				Display
External Video Output	N/A		1/4 VGA				External Video Output
Parallel Printer Port	Compatible with Deskjet 540 and 340 Models. Other 500 Series and 300 Series and later are typically compatible. Also Canon BJC 80		N/A				

Continued on next page

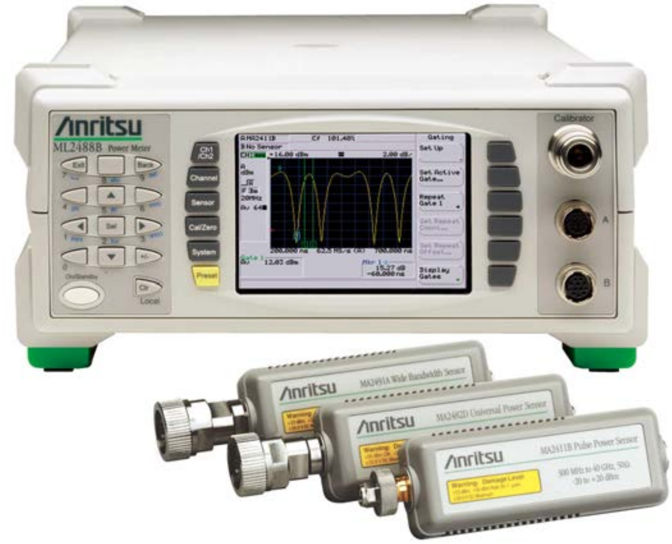
	ML2430A Series		ML2480B Series		ML2490A Series		Comments
	ML2437A	ML2438A	ML2487B	ML2488B	ML2495A	ML2496A	
General	MIL-T28800F, class 3						
Non Volatile RAM Battery	Lithium (10 year life)		Lithium (5 year life)				
Battery Option	>6 hr usable with 3000 mAhr (NiMH) battery		N/A				
DC Power Requirements	12 to 24 VDC, Reverse protected to –40 V Maximum input 30 V		N/A				
AC Power Requirements	85 V(ac) to 264 V(ac), 47 Hz to 440 Hz, 40 VA Maximum		85 V(ac) to 264 V(ac), 47 Hz to 440 Hz				
EMI, EMC, Safety	Complies with requirements for CE marking EN 61326, EN61010-1						
Operating Temperature	0° to +50°C						Mainframe only, see sensor specification for performance of sensors Storage Temperature
Storage Temperature	–40° to +70°C						
Moisture	Splash and rain resistant, 95% humidity non-condensing						Width × Height × Depth
Dimensions	223 (W) × 150 (H) × 390 (D) mm						
Mass	3 kg (excluding battery option)		3 kg				
Warranty	1 year Standard, 3 year Optional						

WIDEBAND PEAK POWER METERS
ML2480B Series

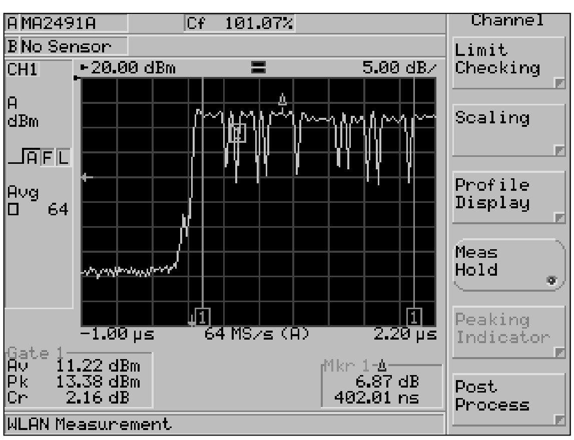
10 MHz to 50 GHz*

Remote Control
GPIB | Ethernet

For High Speed Modulated Power Measurements



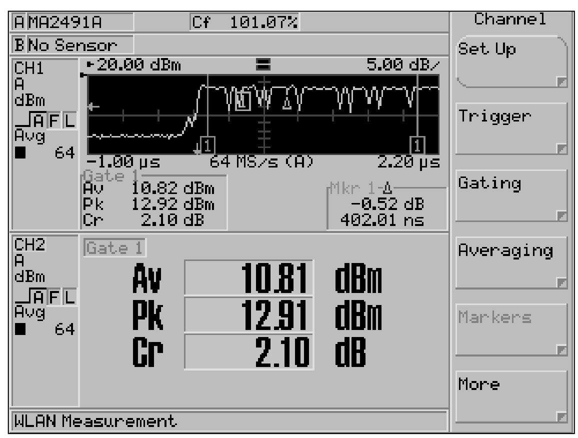
The ML2480B Series Power Meters are especially designed for accurate power measurements on high speed modulated measurements, as well as pulsed power measurements.
The power meter combines advances in diode sensor technology with DSP to produce a compact and economical high speed peak power meter. A new color display is used to display the results in graphical or numerical format. The power meter incorporates features normally found in digital oscilloscopes to produce an easy to use high speed peak power meter. A high speed GPIB interface can be used for rapid automation of the power measurement.
The ML2480B series has been designed to use the new MA2491A Wideband Sensor. The ML2480B is fully compatible with the wide range of Anritsu diode, fast thermal and universal sensors. See the section on the ML2430A Series Power Meters for more details on these sensors.
Two versions of the product are available; the ML2487B Single Input unit and the ML2488B Dual Input unit.



Performance

The ML2480B series has a 20 MHz signal amplifier bandwidth and a sampling rate of 64 MS/s. This makes the power meter especially suitable for measuring signals with high modulation rates such as WLAN, 3G or EDGE signals as well as providing fast rise times for examining pulsed signals such as radar.

The new MA2490A/91A wideband sensors have been designed for a variety of applications. With a selectable 5/20 MHz bandwidth, measurements can be made on the rising edges of pulsed systems as well as CDMA waveforms. The new sensors have a dynamic range of –60 to +20 dBm in CW mode and a range of –25 to +20 dBm in pulse modulated mode.
The new power meter combines the very best of high-speed measurement technology and CW stability.



Profile or Readout Displays can be chosen

Features

- **Dual Display Channel**

The ML2480B series supports dual display channels. Each display channel is a measurement set up and can use any selection or combination of the sensor inputs. The instrument can be configured to view one display channel or two. The instrument can be switched between display channels quickly and simply via the CH1/CH2 "hot" key on the front panel. The user can choose to view the measurement results as a graph profile or numerical readout.

*: Frequency range is sensor dependent.

• Measurement Gates

At the heart of the new power meter's signal processing lies the measurement gate facility. The new power meter supports up to four independently set gates or eight gates repeated in a pattern. The gate allows the user to capture the relevant information from the signal under test. The wide bandwidth and high speed A/D allow the positioning of the gate very accurately within the signal profile. The user can choose between several measurements performed within the gate. Average, peak, crest, Max. and min are available as selections for the output.
The Max. and min data are time stamped so that the position of these signals is recorded within the gate and can be used to record the overshoot and undershoot of a pulsed signal.
Exclusion zones within the measurement gate are also available. Termed fences, these can be used to exclude sections of the signal from the measurement gate. Particularly useful for excluding mid-burst training sequences. Each gate has a switchable fence associated with it.

• Markers

Four independent markers are available for denoting points of interest on the signal profile. The active marker can be scrolled directly from the front panel. A delta marker can be set independently from the active marker to read the difference or the average power result. The delta marker can be linked to provide continuous scrolling through the signal.
A set of specialized automatic marker functions has been provided to ease the measurement of pulsed systems. These functions are automatic pulse rise time, pulse fall time, off time and pulse repetition interval.

• Trigger facilities

High speed measurements require precise triggering. The ML2480B series offer the following trigger modes:
Continuous, internal trigger on the rising or falling edge of either input A or input B and external TTL trigger. The external trigger allows the power meter to be synchronized to external equipment. Data collection can be delayed for a pre-determined time after the trigger point. The trigger facility incorporates a settable hold off facility which prevents the trigger from being re-armed and re-triggering on a noisy signal. A pre-trigger facility allows the capture and display of pre-trigger information on the signal.
The single shot trigger facility can be used to capture specific one off events.

• Test Limits

The ML2480B series has two different types of automatic test limits. For many applications a simple power limit can be set up to test the upper and /or lower boundaries of the signal. For pulsed systems such as radar, TDMA phone systems or WLAN, a time varying limit line can be set up to test all aspects of the pulse profile.
The power meter can be set up to indicate pass or fail and to hold the measurement display on failure which is important when trying to track down intermittent faults. An internal limit editor enables the user to create and select their own limit profiles.

• Presets

The ML2480B series offers a number of radio system presets. Each preset configures the power meter settings to measure a radio system. GSM, GPRS, W-CDMA, WLAN and *Bluetooth* are some of the examples of radio systems supported by this facility.

• Settings stores

The ML2480B series power meter has 20 settings stores. These provide a convenient way of having application specific measurement set ups for easy recall by the user.

• Remote Interfaces

The ML2480B series supports Ethernet, GPIB and RS232 as standard.

• Secure mode

The ML2480B series has a secure mode for operations in security sensitive areas. Once activated the secure mode deletes all information stored in the non-volatile RAM on power up.

Applications

• WLAN

The ML2480B series is the ideal power meter for all variants of the 802.11 WLAN specification. The 20 MHz bandwidth allows users for the first time to get an accurate peak (and average) power reading without having to resort to manual correction of the peak reading due to bandwidth limitations. The wide bandwidth of the signal channel allows for the accurate placement of the gate to measure precise selections of the signal such as the OFDM training sequence at the start of the 802.11g signal.

• GSM/EDGE/GPRS

The graphical display and the measurement gates make the measurement of GSM and PCS systems straightforward.
The ML2480B series power meter is set up to trigger on the GSM pulse. The active gate is set up to measure the power within the 10% to 90% section of the burst profile. An automatic limit can be used to give pass or fail indication. The display shows the results from the active gate, indicating the average power within the burst. GPRS and GSM test modes can be tested easily with the use of the multiple gates. A GSM gate pattern can be repeated up to eight times to allow the power meter to capture and read back the power from each of the slots, giving up to eight simultaneous measurements. EDGE measurements are quick and simple to make. The high sample rate leads to improved settling time and the use of the trigger hold off facility prevents re-triggering on the symbol transitions. PHS and IS-136 systems can also be measured effectively and quickly in this way.

• 3G-CDMA

The ML2480B series has been designed to measure the peak power of all the major CDMA systems in the world including those that use Time Division Duplexing such as TD-SCDMA. The display can be configured to measure Average, Peak and Crest Factor. The measurement period can be set for accurate results. TDD systems can be displayed as a graph profile and the measurement gates can be set to measure and display the peak and crest factor during the transmission.
CCDF, CDF and PDF statistical functions are supported on the CDMA measurements and enable the designers of power amplifiers to correctly estimate the margins on the peak power handling capabilities of the amplifiers.

• Amplifier and PAE Measurements

Use the dual input ML2488B to measure the gain or the return loss of an amplifier under its correct operating conditions. Power amplifiers designed for peak applications, whether pulsed or CDMA, cannot operate at full peak power with CW test inputs. The gain and output power can only be measured accurately using a peak power meter under representative conditions.

• MA2490A and MA2491A Wideband Sensors

The MA2490 series sensors are wideband sensors suitable for pulse and CDMA applications. They have a selectable 5 MHz/ 20 MHz bandwidth. The MA2490A covers the range 50 MHz to 8 GHz and the MA2491A extends the range to 18 GHz. These sensors have a Rise time of 18 ns. Rise time on this sensor is 18 ns. The sensor incorporates a 'chopper' which extends the RMS measurement range to –60 dBm. Upper limit is +20 dBm.

• MA2411B Pulse Sensor

The MA2411B Pulse sensor is specifically designed for pulse measurements and does not incorporate a CW mode. The rise time of this sensor when used with the ML2480B is 18 ns. The sensor is capable of faster rise times with the ML2490A power meters. The MA2411B covers the frequency range 300 MHz to 40 GHz. Requires 1 GHz Calibrator option ML2400A/15 on ML2480B.

• PowerMax

PowerMax is a free graphical user-interface software, for the ML249xA power meter series (with firmware v2.20 or greater). PowerMax provides the user an enhanced visualization of instrument display and full remote control of the instrument, allowing continuous view of measurement traces in real-time, archiving or printing of data and plots for future analysis.
PowerMax runs on a standard PC running Windows® 95 (or higher), and communicates with the power meter via Ethernet interface.

POWER METERS
ML2430A Series

Remote Control
GPIB

For Measuring Wide Dynamic Range Power

The ML2430A series Power Meters combine the advantages of thermal meter accuracy, diode meter speed, and peak power meter display graphics. The result is a single instrument that achieves 90 dB dynamic range with a single sensor. The ML2430A series includes graphics display capability as a standard feature.
The ruggedized housing and optional high-capacity NiMH battery bring convenience and accuracy to field service applications.

Performance

• Speed and Dynamic Range

The 90 dB range MA2470D series Power Sensors' high sensitivity reaches stable power readings to –70 dBm. 35 kHz sample rates profile cellular, PCS, and other pulsed signals to 0.1 µsec resolution. Modern connector technology achieves industry-leading return loss for improved accuracy through 50 GHz. The 87 dB range MA2440D series High Accuracy Sensors further improve return loss performance by adding a matching circuit to the MA2470D series' front end.

New power sensor technology achieves industry leading measurement linearity and high sensitivity.

• Universal Power Sensors

The MA2480D series Universal Power Sensor will measure any modulated or multi-tone signal thanks to a patented sensor architecture with three diode pairs. Universal power sensors deliver over 80 dB of dynamic range with speed and accuracy.
Average power measurements on W-CDMA signals can now be made without the need for special power meters. Universal sensors are also ideal for power measurements on other digitally modulated carriers such as HDTV, DAB or QAM modulated radio links.
The sensor architecture ensures that one of the diode pairs is always operating in its square law region. The meter selects the diode pair operating in its square law region and is designed so that even the peaks of CDMA signals are measured accurately. Anritsu's three stage diode pair approach leads to a very much faster measurement time than the two stage approach used in previous generations of average power sensors. No slowing of measurement speed is observed at switching points, making them transparent to the user. Universal power sensors are also ideal for applications where multiple signals are present, such as intermodulation measurements and satellite multi carrier power loading measurements.
A unique additional capability of the Anritsu Universal power sensor is the ability to use it as a standard diode sensor for fast CW measurements and pulse or TDMA measurements. In this mode the fast response of diode sensors is maintained across the full dynamic range of the sensor, meaning that for the majority of users it is the only sensor that they will ever need - a truly Universal Power Sensor.

• GPIB Speed

Industry leading speed of >600 continuous readings per second is achieved under a variety of operating conditions including averaging settings, sensor control settings, triggering conditions, operating mode, sensor type, and GPIB interface manufacturer. The ML2430A series offers the ability to measure and transfer a high-speed burst of 200 data points using profile operating mode with sampling rates of 35k per second.

• GPIB Emulation

With 99.9% emulation of older meters, the ML2430A series improves ATE system productivity. Typical test system speed improvement is 2 to 10 times faster system speed depending upon the number of measurements taken during the test, the minimal use of wait statements within the code, and the meter model emulated.

• Triggering Controls

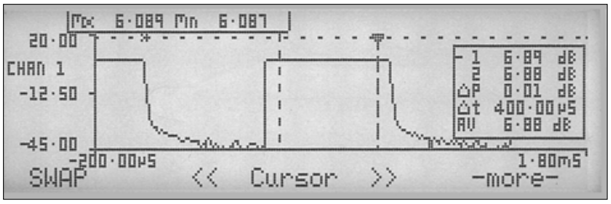
What use is high speed without triggering and sample controls? Data acquisition event arming and triggering functions traditionally found on expensive peak power meters are standard in the ML2430A series. Triggering delay and the sample integration time per reading can be directly controlled by the operator. Trigger sources include, continuous, internal, external TTL, and manual. Thus, data acquisition can be optimally controlled for synchronization with other test equipment.

• Burst profile graphics display

The ML2430A features random repetitive sampling for high resolution of fast signals. A time domain graphic display profiles pulsed signals over a power range of –40 to +20 dBm. 35 kHz sampling speed produces clear power profiles of cellular and PCS signals including TDMA, PHS, GSM, and DCS-1800. Pulse top power is easily and repeatedly measured using between cursor averaging. Measure pulse-top power over >80 dB dynamic range in readout mode at GPIB speeds >200 readings per second.

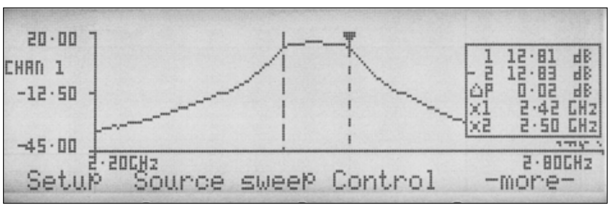
- **Power vs. Time Graphics Display**

The power versus time mode is a strip chart style display for monitoring gain and output power variations over time/temperature, supply voltage, or a component tolerance. In service applications, measurement of power versus time aids trouble shooting of unusual conditions, such as intermittent switches or abnormal power control in a mobile telephone base stations. The power versus time mode provides a clear strip chart display of RF power variation.



- **Source Sweep Graphic Display**

Power Sweep or frequency sweep data are acquired at more than 10 sweeps per second over GPIB. Synchronization with synthesizers requires connection (BNC) of a 10.0 V sweep ramp input and an RF blanking/dwell input.



- **Parallel Printer Connector**

Many deskjet series printers can be connected directly to the ML2430A for fast documentation of performance on the bench or in the field. Meter calibration, triggering, and averaging settings are listed with the display printout. Thus, evidence of DUT (device under test) anomalies can be duplicated quickly.

- **90 dB Dynamic Range**

Typical communications industry ATE systems operate over a 60 to 80 dB dynamic range. The MA2470D series' 90 dB dynamic range replaces two 50 dB sensors. Furthermore, an RF switch is no longer needed for the two sensors. This reduces software control complexity and further speeds test execution.

- **Sensor EEPROM**

All MA2400D series sensors are equipped with internal EEPROMs for storage of calibration factor data vs. frequency. This allows the power meter to interpolate and correct readings automatically, improving accuracy and convenience.

- **High Reliability**

A rugged polycarbonate chassis handles drop shocks and rough field treatment. The absence of vent holes makes the meter splash resistant. A front cover panel and softcase are optional for further environmental protection. Power sensors are also ruggedized for rough handling.

- **Improved Accuracy**

Mismatch uncertainty is typically the largest source of error. The MA2400D series Power Sensors offer a typical 5 to 6 dB improvement in sensor return loss, typically cutting mismatch uncertainty in half. The MA2440D series High Accuracy Sensors incorporate a matching pad which further improves return loss by 5 to 6 dB — again halving mismatch uncertainty.

- **Offset Table for Path Loss Correction**

Compensating for the true frequency response of attenuators, couplers, cables, switches, and other test setup devices improves measurement accuracy. For this reason, the ML2430A series can apply an offset table of attenuation-versus-frequency in addition to the traditional fixed dB offset capability. When a power sensor connection is preceded with a new 1N series wideband power limiter, the offset table compensates for frequency response. Thus, the combination achieves an accurate, "burnout-proof" sensor.

- **Softkey Menu Control**

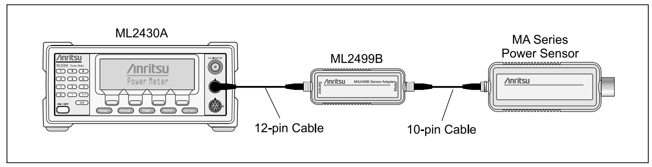
Softkey menus simplify instrument control by making the user interface easier to understand. The numerical keypad simplifies the operator interface.

- **Battery**

The optional NiMH "Smart" battery supports high charge density for a typical 8 hour day of operation. Accurate fuel gauging, <2 hour fast charge cycling, and the elimination of NiCd style memory effect further enhance the convenience of this battery technology.

- **Voltmeter**

The ML2430A series also supports high-speed voltage measurement. A rear panel BNC measures voltage or operates as V/GHz input supporting automated sensor calibration factor correction.



- **High power applications**

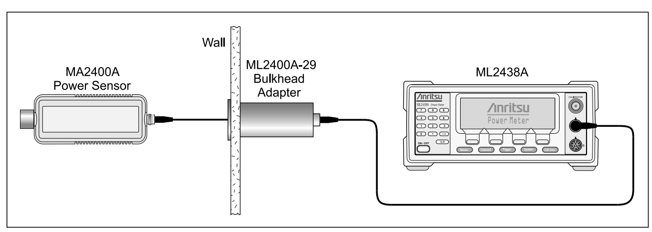
Traditional high power sensors are expensive and have degraded accuracy specifications. Further, their annual calibration requires more time and expense. Anritsu's new User Calibration Factor Tables avoid these problems. Any attenuator or coupler can be compensated by entering frequency and attenuation values into the MA2400D Series Power Sensors internal EEPROM. The attenuation device can be semi-permantly attached; the power meter automatically applies compensation during the 0.0 dBm, 50 MHz calibration reference process. The User Calibration Factor Tables are easily deactivated – allowing the power sensor to be used stand-alone also.

- **Remote monitoring by telephone**

Monitor transmitter performance remotely with standard telephone lines using the ML2430A's full duplex RS232 and dial-out capabilities. When the ML2430A detects a high or low limit line violation, it will automatically dial a phone number. The meter's data acquisition settings can adjust to monitor average power or the burst power of specific timeslots. The RS232 port uses the same commands as the GPIB. Contact your Anritsu representative for PC compatible software.

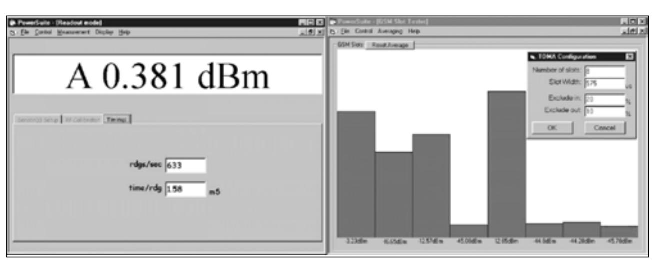
- **Locate power sensors remotely**

When a power sensor's cable must pass through walls or shielded enclosures, the ML2400A/29 Bulkhead Adapter provides a convenient connection between two sensor cables.



- **PowerSuite**

PowerSuite software runs on a standard PC running Windows® 95 (or higher), via GPIB or RS232. PowerSuite is a very flexible package that provides full user control over measurement settings. The PC screen can be set for continuous update so that changes to the device or system under test can be viewed instantly. Alternatively, plots can be archived for later analysis.



Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Power Meter Models
ML2495A	Pulse Power Meter, Single Input
ML2496A	Pulse Power Meter, Dual Input
ML2487B	Wideband Power Meter, Single Input
ML2488B	Wideband Power Meter, Dual Input
ML2437A	CW Power Meter, Single Input
ML2438A	CW Power Meter, Dual Input
	ML2490A series options
2400-82	Rack Mount, single unit
2400-83	Rack Mount, side-by-side
ML2400A-05	Front Bail Handle
ML2490A-06	Rear Mount Input A on ML2495A
ML2490A-07	Rear Input A and Reference on ML2495A
ML2490A-08	Rear Mount Inputs A, B and Reference on ML2496A
ML2490A-09	Rear Mount Inputs A, B on ML2496A
ML2490A-98	Calibration to Z540, ISO Guide 25
ML2490A-99	Premium Calibration
13000-00238	Extra Operation Manual ML2480B/90A
13000-00239	Extra Programming Manual ML2480B/90A
	ML2480B series options
2400-82	Rack Mount, single unit
2400-83	Rack Mount, side-by-side
ML2480B-005	Front Mounted (for ML248xB models)
ML2480B-006	Rear Mount Input A on ML2487B
ML2480B-007	Rear Input A and Reference on ML2487B
ML2480B-008	Rear Mount Inputs A, B and Reference on ML2488B
ML2480B-009	Rear Mount Inputs A, B on ML2488B
ML2480B-015	Factory Fitted 50 MHz and 1 GHz Calibrator (required by MA2411B Sensor)
ML2480B-098	Calibration to Z540, ISO Guide 25
ML2480B-099	Premium Calibration
13000-00238	Extra Operation Manual ML2480B/90A
13000-00239	Extra Programming Manual ML2480B/90A
13000-00174	Extra Operating Manual: Japanese
13000-00175	Extra Programming Manual: Japanese
	Option 5, 2400-82, and 2400-83 are mutually exclusive for any given ML2480B/90A.
	Options 6, 7, 8 and 9 are mutually exclusive for any given ML2480B/90A.
	ML2430A series options
2400-82	Rack Mount, single unit
2400-83	Rack Mount, side-by-side
ML2400A-05	Front Bail Handle
ML2400A-06	Rear Mount Input A on ML2437A
ML2400A-07	Rear Input A and Reference on ML2437A
ML2400A-08	Rear Mount Inputs A, B and Reference on ML2438A
ML2400A-09	Rear Mount Inputs A and B on ML2438A
2000-1603	NiMH Battery
2000-996-R	Desktop Battery Charger with Power Supply
2000-1534-R	Desktop Battery Charger with Power Supply (for use in Japan only)
2000-1538-R	3 m Sensor Cable
2000-1539-R	5 m Sensor Cable
2000-1540-R	10 m Sensor Cable
2000-1541-R	30 m Sensor Cable
2000-1542-R	50 m Sensor Cable
2000-1543-R	100 m Sensor Cable
2000-1545	Bulkhead Adapter
10585-00001	Extra Operation and Programming Manual ML2437/8A
10585-00003	Maintenance Manual ML2400A Series
ML2400A-98	Calibration to Z540, ISO Guide 25
ML2400A-99	Premium Calibration
ML2400A-30A	Option 30, Extra Operation/Prog Manual (For use in Japan only)
	Option 5, 2400-82, and 2400-83 are mutually exclusive for any given ML2430A unit.
	Options 6, 7, 8 and 9 are mutually exclusive for any given ML2430A unit.
	Pulse/modulated performance only specified with 1.5M sensor cable length option.
	Software upgrades, Labview drivers and application notes can be downloaded from the Anritsu web site at www. Anritsu.com

Model/Order No.	Name
	Standard accessories
	PowerMax (ML249xA and ML248xB only)
	PowerSuite (ML243xA only)
	Power Cord for destination country
	One 1.5 m sensor cord per meter input
	Operation Manual
	Programming Manual
	Certificate of Calibration (also included with sensors)
	General options and accessories
760-209	Hardside Transit Case
D41310	Soft Carry Case with Shoulder Strap
2000-1535	Front Panel Cover
2000-1536-R	0.3 m Sensor Cable
2000-1537-R	Spare 1.5 m Sensor Cable
2000-1544	RS232 Bootload Cable
	Power sensor models
MA2472D	Standard Diode Sensor (10 MHz to 18 GHz, –70 to 20 dBm)
MA2473D	Standard Diode Sensor (10 MHz to 32 GHz, –70 to 20 dBm)
MA2474D	Standard Diode Sensor (10 MHz to 40 GHz, –70 to 20 dBm)
MA2475D	Standard Diode Sensor (10 MHz to 50 GHz, –70 to 20 dBm)
MA2442D	High Accuracy Diode Sensor (10 MHz to 18 GHz, –67 to 20 dBm)
MA2444D	High Accuracy Diode Sensor (10 MHz to 40 GHz, –67 to 20 dBm)
MA2445D	High Accuracy Diode Sensor (10 MHz to 50 GHz,–67 to 20 dBm)
MA2481D	Universal Sensor (10 MHz to 6 GHz, –60 to 20 dBm)
MA2482D	Universal Sensor (10 MHz to 18 GHz, –60 to 20 dBm)
MA2490A	Wideband Sensor (50 MHz to 8 GHz, –60 to 20 dBm)
MA2491A	Wideband Sensor (50 MHz to 18 GHz, –60 to 20 dBm)
MA2411B	Pulse Sensor (300 MHz to 40 GHz, –20 to 20 dBm)
MA24002A	Thermal Sensor (10 MHz to 18 GHz, –30 to 20 dBm)
MA24004A	Thermal Sensor (10 MHz to 40 GHz, –30 to 20 dBm)
MA24005A	Thermal Sensor (10 MHz to 50 GHz, –30 to 20 dBm)
MA24106A	True-RMS USB Power Sensor (50 MHz to 6 GHz, –40 to 23 dBm)
	General options and accessories (USB sensor)
2000-1566-R	1.8 m USB A to Mini-B cable
2000-1593-R	3 m USB A to Mini-B cable
2000-1594-R	5 m USB A to Mini-B cable
2300-512	MA24106A Installation CD
	Available options (USB sensor)
MA24106A-097	Option 97, Accredited Calibration
MA24106A-098	Option 98, Standard Calibration to Z540, ISO Guide 25
MA24106A-099	Option 99, Premium Calibration your Anritsu

See your Anritsu Representative or Components catalogue for available Attenuators, Limiters, Coaxial adapters, Waveguide-to-Coaxial adapter, Splitters & Dividers, Loads, Bridges, Open/Shorts, and Calibrated Torque wrenches.

For complete power meter and sensor specifications;
Technical Datasheet p/n: 11410-00423.

INLINE PEAK POWER SENSOR

MA24105A

True-RMS, 350 MHz to 4 GHz

A Standalone, Compact, and Highly Accurate bi-directional Inline Peak Power Sensor for your RF Power Measurement Needs

The Anritsu MA24105A Inline Peak Power Sensor is designed to take accurate average power measurements over 2 mW to 150 W, from 350 MHz to 4 GHz. The sensor employs a "dual path" architecture that enables True-RMS measurements over the entire frequency and dynamic range allowing users to measure CW, multi-tone and digitally modulated signals such as GSM/EDGE, CDMA/EV-DO,W-CDMA/HSPA+, WiMAX, and TD-SCDMA. The forward direction path also include a 4 MHz bandwidth channel that has peak and comparator/integrator circuits that add measurement functions such as PEP power, crest factor, CCDF, and burst average power. Another detection circuit on the reverse direction adds reverse power measurement capabilities including reverse power, reflection coefficient (magnitude), return-loss, and SWR. The presence of a micro-controller along with signal conditioning circuitry, ADC, and power supply in the sensor makes it a complete miniature power meter.

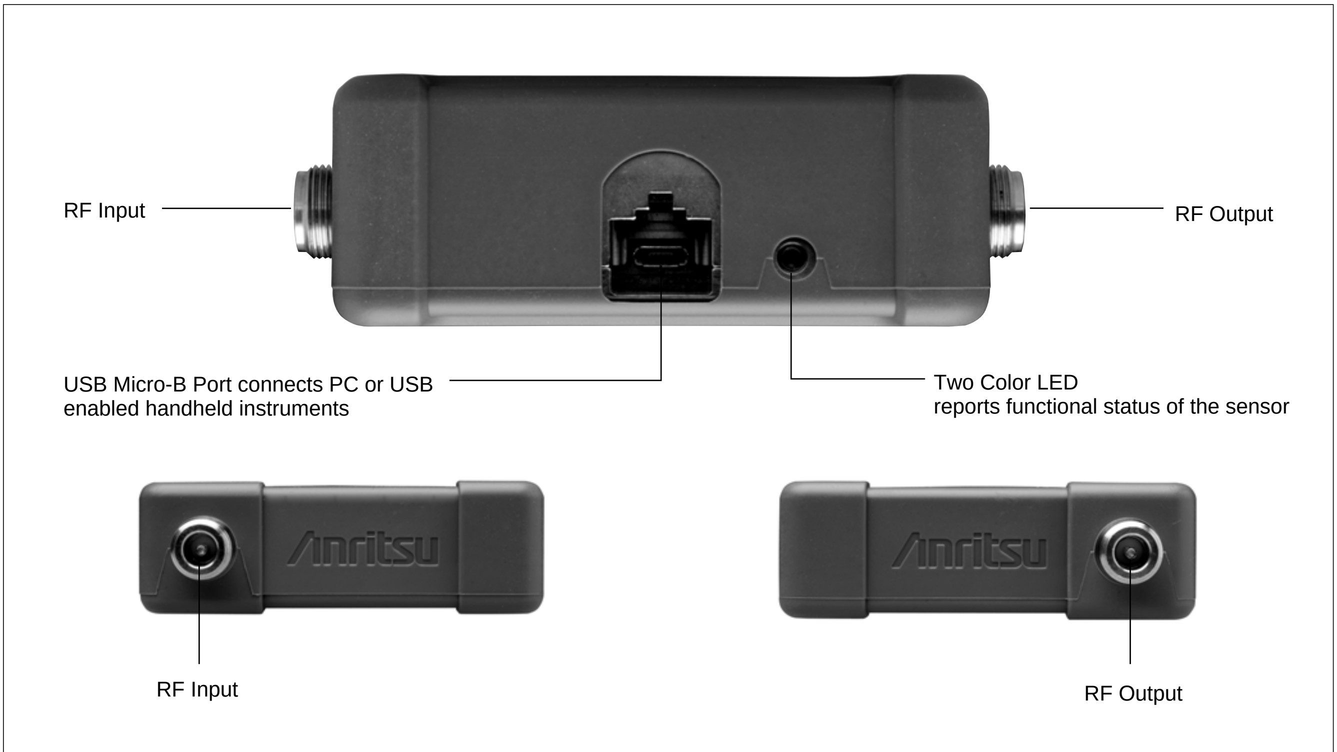
Features and Benefits

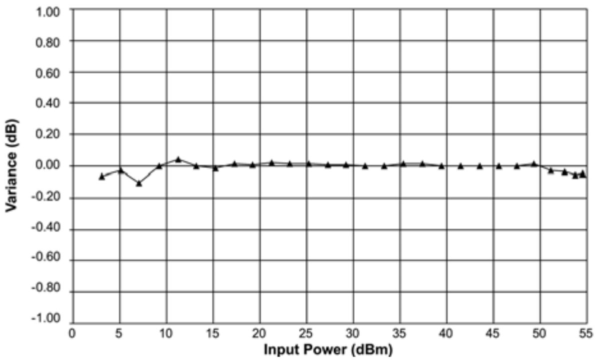
- Broad Frequency Range (350 MHz to 4 GHz)
  - Covers all major cellular and communication bands, such as WLL, GSM/EDGE, CDMA/EV-DO, W-CDMA/HSPA+, WiMAX, and TD-SCDMA
- Widest Dynamic Range Inline Power Sensor in its Class
  - Eliminates need for additional low level power sensors
- Forward and Reverse Measurements
  - Measures both transmitted power and reflection from antenna or other reflections using the single inline tool.
- True-RMS Measurements to 150 W
  - Enables accurate average power measurements of modulated signals
- Standalone, Low Cost, Plug and Play Device
  - No extra elements or element holder required
- Compatible with Anritsu Handheld Instruments
  - No base unit needed
- High Power Handling
  - Ideal for high crest factor signal and base station transmitter output power measurements
- Eliminates the need for 1 mW Calibration
  - Reduces test time and handling in production

Complements Your Existing Instrument

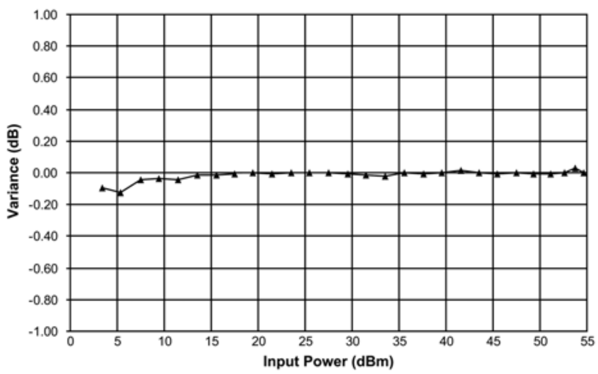
Operation with Personal Computer (PC)
The power sensor can be used with a personal computer running Microsoft® Windows via USB. It comes with PowerXpert™ application (version 2.0 or greater) for data display, analysis, and sensor control. The software provides a front panel display making the personal computer appear like a traditional power meter. The application has abundant features like data logging, power versus time graph, and offset table that enable quick and accurate measurements.

Operation with Anritsu Handheld Instruments
Handheld instruments having the high accuracy power meter software Option 19 can operate the MA24105A Inline Peak Power Sensor. The MA24105A is currently compatible with Site Master™ (S3xxE), Spectrum Master™ (MS271xE and MS272xB), Cell Master™ (MT8212E), BTS Master™ (MT822xB), VNA Master™ (MS202xA/B and MS203xA) and Economy Benchtop Spectrum Analyzers (MS271xB). The power sensor easily connects to these instruments via a USB A/Micro-B cable.

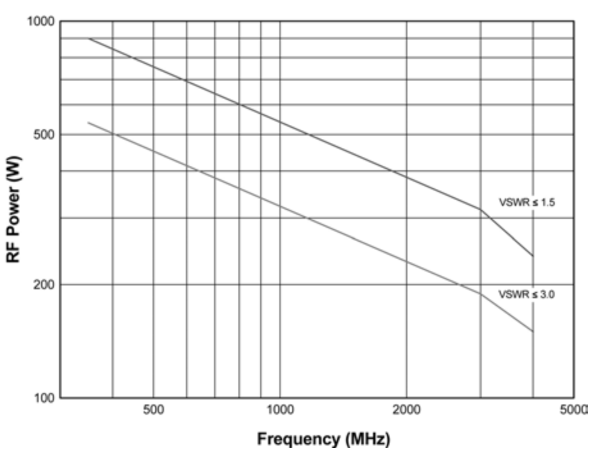




Measurement linearity error referenced to an ideal thermal power sensor measurement of a 900 MHz CW signal in the forward direction.



Reverse Direction linearity graph.



Maximum power handling capacity of the sensor terminated with a load having VSWR of ≤1.0, ≤1.2, ≤1.5 and ≤3.0.

• High Accuracy Measurements

Accurate power measurements in the field are important for verifying that transmitter outputs are operating at specified levels. For example, service technicians need to verify base station output power because lower output power can quickly translate into large coverage differences. Highly accurate average power measurements to 150 W are assured as the calibration data is stored directly in the sensor and all necessary corrections (frequency and temperature) are done inside the microprocessor of the sensor. Also, the return loss and directivity of the instrument are optimized to maintain high accuracy. The standards used to calibrate this sensor are directly traceable to NIST.

• Continuous Monitoring of Radio Systems

This sensor is designed to have good match and low insertion loss making it ideal for continuous power monitoring of transmitter systems and antennas. The data logging function in the PowerXpert software application for PC equips the user the ability to record measured power over time to a hard disc or other storage media. This is useful for long term drift measurements, environmental testing, and trend analysis. A user settable data logging interval allows measurement speed adjustment to match the user test application requirements. Data are stored as comma-separate files that can be directly opened in Microsoft Excel allowing powerful custom analysis of measured data.

• Ideal for Field

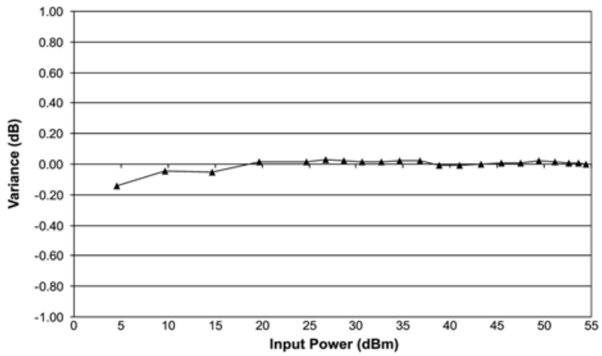
The MA24105A power sensor provides lab performance accuracy in a rugged and portable field solution. The sensor is accurate over a wide temperature range (0° to 55°C), making it perfect for cellular base station installation and maintenance applications. Field and service technicians will appreciate the small size and lightweight of this stand-alone unit as they will not have to carry extra elements, heavy high power attenuators, or power meters. A very easy to use PC application with a large display makes the job even easier for technicians who need accurate measurement results quickly.

• Average Measurements of CW, Pulsed, or Modulated Signals

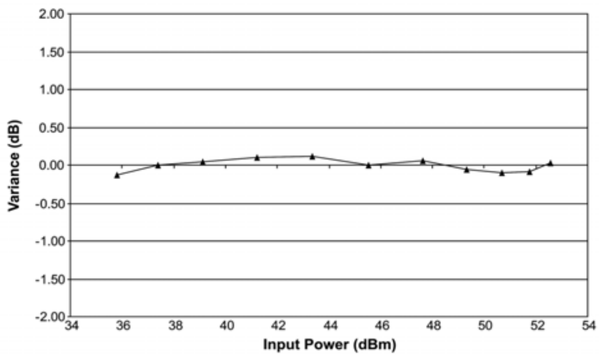
The MA24105A is rated to meet all specifications up to an average input power level of 150 W. Although the average power of all signals should be kept at or below 150 W, time varying and burst signals having peak powers less than the limits shown in the Maximum Power graph can be measured. To ensure accurate readings, the peak to average ratio (crest factor) of signals must be less than 12 dB.

• Peak Power, Crest Factor, Burst Average and Complementary Cumulative Distribution Function (CCDF)

The MA24105A and associated PowerXpert™ application provide information critical to development, manufacture and operation of modern communications systems. The Peak Power function enables the user to determine the maximum power of the modulated signal envelope. The ratio between the Peak Power and Average Power result provides the Crest Factor. Of particular use in TDMA systems, the Burst Average Function uses duty cycle information obtained either automatically or as user-entry to calculate the average power during a burst based on the measurement of Average Power. Critical to those working with spread spectrum systems, which exhibit a non-deterministic envelope, the CCDF feature shows the percentage of the time that the peak power exceeds a user-set threshold.



Forward average power linearity error referenced to an ideal thermal power sensor measurement of a W-CDMA signal at 2 GHz.



Forward Peak power linearity error referenced to Anritsu MA2491A peak power sensor measurement of a W-CDMA signal.

• Reverse Power, Reflection Coefficient (magnitude), Return Loss and Standing Wave Ratio (SWR)

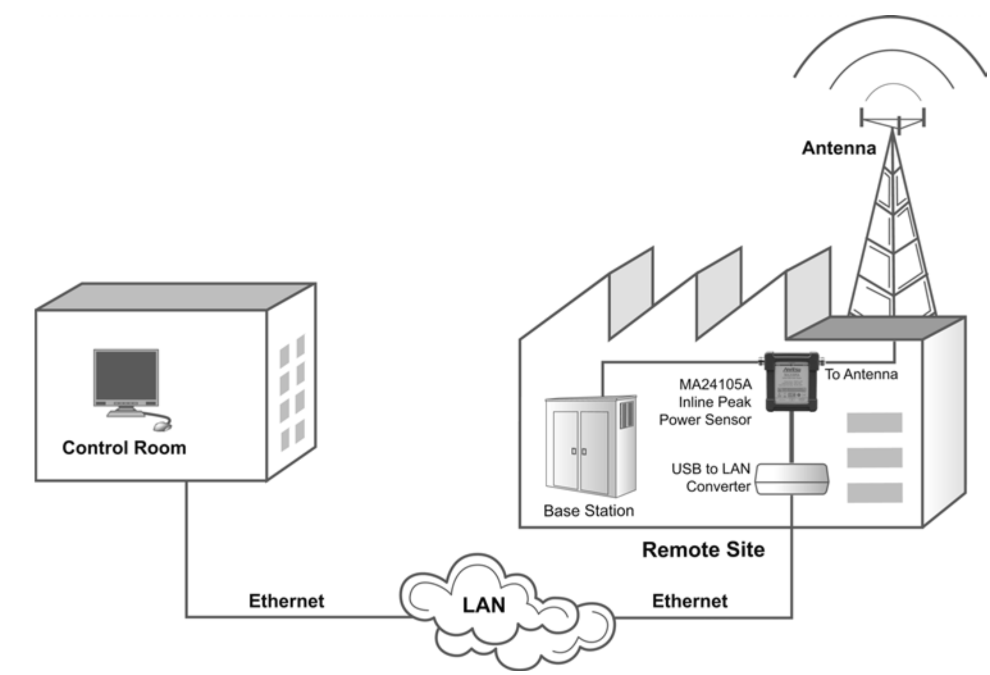
The MA24105A sensor's capability to measure both forward and reverse average power also permits the user to gain information about the load mismatch. This result is conveniently available in Reflection Coefficient (magnitude), Return Loss and SWR forms.

• Optimized for Production

The MA24105A facilitates lab quality measurements on the production floor for a fraction of cost of existing solutions. Since the sensor is connected directly to the PC, there is no need for a base unit saving valuable rack space. The Inline Sensor can measure signals with levels as low as 2 mW, thus eliminating the need of terminated power sensors in the production line resulting in reduced capital expenditure and set up costs. The sensor's speed is optimized for best accuracy and noise performance thus making it suitable for wide variety of ATE applications. Multiple sensors can be connected and remote controlled via a single PC allowing flexibility to match specific measurement needs. A software toolkit is supplied with every sensor containing a sample program with source code for controlling the sensor. The 1 mW reference calibrator typically needed by power meters has also been eliminated as the connecting USB cable only transfers digital data (corrected power), minimizing test station complexity, sensor handling and test times.

• Remote Monitoring via LAN

Since the USB cable connected to the sensor only transfers corrected power back to the host, a 1 mW reference calibrator is not required. USB data transfer capabilities limit the cable length to 5 meters prohibiting remote monitoring. However, this limitation can be overcome by installing a low cost USB-to-LAN hub converter (e.g. BELKIN® F5L009) at the measurement site along with the MA24105A. In this way, power monitoring can be performed across continents if desired.



Specifications

<table>
<tr><td rowspan="9">Sensor</td><td>Frequency Range</td><td colspan="5">350 MHz to 4 GHz</td></tr>
<tr><td>Dynamic Range</td><td colspan="5">2 mW to 150 W (+3 to +51.76 dBm)</td></tr>
<tr><td>Input Return Loss</td><td colspan="5">≥29.5 dB from 350 MHz to 3 GHz
≥26.5 dB from >3 GHz to 4 GHz</td></tr>
<tr><td>Insertion Loss (typical)</td><td colspan="5">≤0.15 dB from 350 MHz to 1.25 GHz
≤0.20 dB from >1.25 GHz to 4 GHz</td></tr>
<tr><td>Directivity</td><td colspan="5">≥28 dB from 350 MHz to <1 GHz
≥30 dB from ≥1 GHz to ≤3 GHz
≥28 dB from >3 GHz to 4 GHz</td></tr>
<tr><td>Measurement Channel</td><td colspan="5">2 (Forward and Reverse)</td></tr>
<tr><td>Signal Channel Bandwidth</td><td colspan="5">Average: 100 Hz
Peak (Selectable): 4 MHz (full)
400 kHz
8 kHz</td></tr>
<tr></tr>
<tr></tr>
<tr><td rowspan="9">Base Average Power Measurement</td><td>Measurement Range</td><td colspan="5">Range 1: +3 to +38 dBm
Range 2: +38 to +51.76 dBm</td></tr>
<tr><td>Maximum Power*1</td><td colspan="5">150 W average, 300 W pulse</td></tr>
<tr><td>Measurement Uncertainty*2</td><td colspan="5">±3.8% (Range 1 and Range 2)</td></tr>
<tr><td>Effect of Noise*3</td><td colspan="5">±170 µW (Range 1)
±1.9 mW (Range 2)</td></tr>
<tr><td>Effect of Zero Set*4</td><td colspan="5">±250 µW (Range 1)
±3.0 mW (Range 2)</td></tr>
<tr><td>Effect of Zero Drift*4</td><td colspan="5">±230 µW (Range 1)
±2.7 mW (Range 2)</td></tr>
<tr><td>Effect of Temperature (0° to 50°C)</td><td colspan="5">±0.06 dB</td></tr>
<tr><td>Effect of Digital Modulation*5</td><td colspan="5">±0.02 dB</td></tr>
<tr></tr>
<tr><td>Forward Average Power Measurement</td><td colspan="6">Forward Average Power Uncertainty is same as Base Average Power Uncertainty</td></tr>
<tr><td rowspan="7">Forward Peak Power Measurement*6</td><td>Measurement Range</td><td colspan="5">+33 to +54.77 dBm</td></tr>
<tr><td rowspan="2">Burst Signal Measurement Base Uncertainty</td><td rowspan="2">Repetition Rate: ≥10/s
Duty Cycle: ≥10%</td><td colspan="4">Full Bandwidth: ± (Base Average Power Uncertainty +7% + 400 mW)</td></tr>
<tr><td colspan="4">4 kHz and 200 kHz Bandwidth: ± (Base Average Power Uncertainty + 3% + 200 mW</td></tr>
<tr><td>Effect of Low Repetition Rate</td><td colspan="5">≤10/s: ±1.6% ±150 mW</td></tr>
<tr><td>Effect of Low Duty Cycle</td><td colspan="5">0.1 to 10%: ±100 mW</td></tr>
<tr><td>Effect of Short Burst Width</td><td colspan="5">500 ps to 1 µs: ±5%
200 ps to <500 ps: ±10%</td></tr>
<tr><td>Spread-spectrum Measurement Uncertainty</td><td colspan="5">± (Base Average Power Uncertainty + 15% + 400 mW)</td></tr>
<tr><td rowspan="4">Reverse Power Measurement*6</td><td>Measurements Range</td><td colspan="5">+3 to +51.76 dBm</td></tr>
<tr><td>Maximum Power*1</td><td colspan="5">150 W average</td></tr>
<tr><td>Measurement Uncertainty*2</td><td colspan="5">± (Base Average Power Uncertainty)</td></tr>
<tr><td>Spread-spectrum Measurement Uncertainty</td><td colspan="5">± (Base Average Power Uncertainty + 15% + 400 mW)</td></tr>
<tr><td rowspan="3">Complementary Cumulative Distribution Function (CCDF)</td><td>Measurement Uncertainty*7</td><td colspan="5">±0.2%</td></tr>
<tr><td>Threshold Range</td><td colspan="5">+3 to +54.77 dBm</td></tr>
<tr><td>Accuracy of Threshold</td><td colspan="5">± (Base Average Power Uncertainty + 5% + 500 mW)</td></tr>
<tr><td rowspan="2">Burst Average Power</td><td>Measurement Uncertainty (User)</td><td colspan="5">Same as Base Average Power Uncertainty except Zero Set, Zero Drift and Noise is multiplied by T/t (duty cycle)</td></tr>
<tr><td>Measurement Uncertainty (Auto)*8</td><td colspan="5">± (Base Average Power Uncertainty except Zero Set, Zero Drift and Noise is multiplied by T/t (duty cycle) ±2%)</td></tr>
<tr><td rowspan="2">Combination Measurements</td><td>Reflection Measurement Uncertainty</td><td colspan="5">± (Base Average Power Uncertainty + Reverse Power Measurement Uncertainty)</td></tr>
<tr><td>Crest Factor Uncertainty</td><td colspan="5">± (Base Average Power Uncertainty + Forward Peak Power Measurement Uncertainty)</td></tr>
<tr><td rowspan="7">System</td><td>Measurand</td><td>Forward/Reverse True-RMS/Average power</td><td>Peak Power</td><td>Crest Factor</td><td>Burst Average Power</td><td>CCDF</td></tr>
<tr><td>Measurement Resolution</td><td colspan="4">0.01 dB</td><td>0.01%</td></tr>
<tr><td>Offset Range</td><td colspan="4">100 dB</td><td>100%</td></tr>
<tr><td>Averaging Range</td><td colspan="5">1 to 512</td></tr>
<tr><td>Measurement Speed (typical)</td><td>1.7 meas. per second</td><td>2.5 meas. per second</td><td>1.4 meas. per second</td><td>0.7 meas. per second</td><td>1.6 meas. per second</td></tr>
<tr><td>Interface</td><td colspan="5">USB 2.0</td></tr>
<tr><td>Host Operating System (PowerXpert™ version 2.0 compatibility)</td><td colspan="5">Microsoft Windows Vista, Window 7, Windows XP, and Windows 2000</td></tr>
</table>

Continued on next page

General	USB	Current (via host USB)*10	100 mA typical at 5 V
	Dimensions*9	87 (W) × 102 (H) × 30 (D) mm	
	Mass	535 g (1.18 lb)	
Environmental*11	Temperature Range	0° to +55°C (Operating), –51° to +80°C (Storage)	
	Humidity	45% relative humidity at 55°C (non-condensing) 75% relative humidity at 40°C (non-condensing) 95% relative humidity at 30°C (non-condensing)	
	Shock	30 g's half-sine, 11 ms duration	
	Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g's max. Random: 10 Hz to 500 Hz Power Spectral Density: 0.03 g^2/Hz	
	EMC	Meets EN 61326, EN 55011	
	Safety	Meets EN 61010-1	

All specs are applicable after twenty minutes warm-up at room temperature and after zeroing unless specified otherwise.
*1: Maximum power depends upon the system SWR and frequency of operation (see maximum power table)
*2: Expanded uncertainty with K=2 for power measurements of a CW signal with a matched load. Measurement results referenced to the input side of the sensor.
*3: Expanded uncertainty with K=2 after zero operation when measured with 128 averages for 5 minutes. In high aperture time mode, noise is 50 μW and 12 mW in range 1 and range 2 respectively.
*4: After one hour warm-up and zero operation. Measured with 128 averages for one hour keeping the temperature within ±1°C.
*5: Measurement uncertainty with reference to a CW signal of equal power and frequency at 25°C.
*6: All measurement errors "Effects" should be RSSed before directly added to "Base" error for overall measurement uncertainty.
*7: Pulse Power >+37 dBm, T >50 μs (Full BW), T >400 μs (200 kHz BW), T >20 ms (4 kHz BW)
*8: Average Power >+33 dBm, Pulse width >5 μs (Full BW), Pulse Width >40 μs (200 kHz BW), Pulse Width >2 ms (4 kHz BW)
*9: Not including N connector.
*10: 150 mA max.
*11: Tests were performed per MIL-PRF-28800F (Class 2)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
 MA24105A	**Main frame** Inline Peak Power Sensor
 2000-1606-R 2300-526 10585-00021	**Included Accessories** 1.8 m USB 2.0 A to Micro-B cable Product CD - Anritsu PowerXpert and USB power sensors Quick Start Guide
  01-200	**Optional Accessories** **Calibrated Torque Wrenches** Calibrated torque wrench for N connector
 3-1010-122 3-1010-123 3-1010-124 42N50-20 42N50A-30 1010-121 1010-127-R 1010-128-R	**Power Attenuators** DC to 12.4 GHz, 20 dB, 5 W, 50Ω, N male to N female DC to 8.5 GHz, 30 dB, 50 W, 50Ω, N male to N female DC to 8.5 GHz, 40 dB, 100 W, 50Ω, N male to N female DC to 18 GHz, 20 dB, 5 W, 50Ω, N male to N female DC to 18 GHz, 30 dB, 50 W, 50Ω, N male to N female DC to 18 GHz, 30 dB, 100 W, 50Ω, N male to N female DC to 3 GHz, 30 dB, 150 W, 50Ω, N male to N female DC to 3 GHz, 40 dB, 150 W, 50Ω, N male to N female
   28N50-3 28N50-2 28NF50-2	**Precision Terminations** (To be used in conjunction with appropriate Power Attenuators) DC to 8.6 GHz, 50Ω, N male DC to 18 GHz, 40 dB, 50Ω, N male DC to 18 GHz, 40 dB, 50Ω, N female
 510-90 510-91 510-92 510-93 33NFNF50B 33NNF50B 33NN50B 34AN50 34ANF50 34NFK50 34NFKF50 34NK50 34NKF50	**Precision Coaxial Adapters** DC to 3.3 GHz, N male to 7/16 DIN female DC to 3.3 GHz, N female to 7/16 DIN female DC to 3.3 GHz, N male to 7/16 DIN male DC to 3.3 GHz, N female to 7/16 DIN male DC to 18 GHz, N female to N female DC to 18 GHz, N male to N female DC to 18 GHz, N male to N male DC to 18 GHz, GPC-7 to N male DC to 18 GHz, GPC-7 to N female DC to 18 GHz, N female to K male DC to 18 GHz, N female to K female DC to 18 GHz, N male to K male DC to 18 GHz, N male to K female

USB POWER SENSORS

MA24106A/MA24108A/MA24118A/MA24126A

50 MHz to 6 GHz 10 MHz to 8 GHz 10 MHz to 18 GHz 10 MHz to 26 GHz

Low Cost, Compact, and Highly Accurate Power Sensors for RF and Microwave Applications

MA24106A

MA24118A

MA24108A

MA24126A

Description

Anritsu USB power sensors eliminate the need of traditional benchtop power meters. These are highly accurate, standalone instruments that communicate with a PC via USB. The power measurement capability of these sensors is intended to mimic that of a traditional thermal (thermo-electric) power sensor with a wider dynamic range. These sensors are ideal for measuring average power of CW, modulated RF waveforms such as 3G, 4G, OFDM, and multi-tone signals. In other words, these sensors measure true RMS power regardless of the type of the input signal.
The presence of a micro-controller along with signal conditioning circuitry, ADC, and power supply in the sensors makes them a complete miniature power meter. All Anritsu power sensors come standard with an application software for use with PC that mimics the user interface of a power meter.
In addition to the average power measurement capability, the MA24108A, MA24118A and MA24126A sensors have internal and external triggering capability that facilitates individual slot power measurements of TDMA waveforms as well as burst power measurements of periodic and non-periodic waveforms.
These capabilities can be invoked in the power sensor by operating the sensor in Scope or Time slot mode.
Anritsu USB power sensors are compatible with Site Master (S3xxE), Spectrum Master (MS271xE and MS272xB), Cell Master (MT8212E), BTS Master (MT822xB), VNA Master (MS202xA/B and MS203xA) products and Economy Bench-top Spectrum Analyzers (MS271xB).

MA24106A Features and Benefits

- True RMS measurements over 63 dB dynamic range enables accurate CW and modulated power measurements.
- Ready for use in a wide variety of applications, including installation and maintenance of base stations, testing of 3G and 4G devices, cell phones and general purpose RF devices.
- High damage power levels and ESD protection circuitry showcases ruggedness and reliability
- Low power consumption (100 mA typ) extends Laptop battery life
- Presence of signal channel/analog signal acquisition HW and on-board (frequency as well as temperature) corrections eliminates the need for a reference calibration, simplifying the measurement process and reduction of test time in production
- Light weight, low cost easy to use with a PC or Laptop
- 1 year cal cycle
- Worldwide calibration and service centers ensure reduced downtime and local support

MA24108A, MA24118A and MA24126A Features and Benefits

- Broad frequency range (10 MHz to 26 GHz)
  – Covers all major cellular bands
- True RMS measurements
  – Enables accurate modulated power measurements (e.g. GSM, CDMA2000, W-CDMA, 128QAM etc.)
- NIST Traceable calibrations
  – Provides traceable measurements needed for Aerospace application
- Compatible with Anritsu handhelds
  – No base unit needed
- Built-in internal and external trigger (only used with PC)
  – Facilitates multi slot measurement of TDD waveforms (e.g. GSM, WiMAX, and TD-SCDMA)
- High power handling (+33 dBm)
  – Ideal for high crest factor signal measurements
- 1 mW calibration need eliminated
  – Reduces test time and handling in production
- Worldwide calibration and service centers
  – Ensure reduced downtime and quick support

MA24106A Specifications

Sensor	Frequency Range	50 MHz to 6 GHz
	Dynamic Range	–40 to +23 dBm
	Input Return Loss	>26 dB (50 MHz to <2 GHz) >20 dB, (2 GHz to 6 GHz)
	Measurement Ranges	Range 1, –40 to –5 dBm Range 2, –5 to +23 dBm
	Signal Channel Bandwidth	100 Hz, typical
Measurement Uncertainty	Linearity	±0.13 dB (power level <+18 dBm) ±0.18 dB (power level ≥+18 dBm)
	Calibration Factor[*1]	±0.06 dB
	Noise[*2]	<2.5 nW (–40 to –5 dBm) <0.6 μW (–5 to +23 dBm)
	Zero Set	<10 nW (–40 to –5 dBm) <1.7 μW (–5 to +23 dBm)
	Zero Drift[*3]	<3.0 nW (–40 to –5 dBm) <0.5 μW (–5 to +23 dBm)
	Temperature Compensation[*4] (0° to 50°C)	±0.06 dB
	Effect of Digital Modulation[*4]	±0.02 dB (power level <+18 dBm) ±0.10 dB (power level ≥+18 dBm)
System	Measurand	True-RMS/Average power
	Measurement Resolution	0.01 dB
	Offset Range	±100 dB
	Averaging Range	1 to 256
	Measurement Speed[*5]	10 measurement per second, typical
	Range	Auto ranging between Range 1 and Range 2
	Interface	USB 2.0
	Host Operating System (Anritsu Power Meter PC application compatibility)	Microsoft® Windows® Vista (32 bit), Windows XP, and Windows 2000
General	Current (via host USB)[*6]	100 mA typical at 5 V
	Maximum DC Voltage at RF Port	±25 V
	Maximum CW Power	+33 dBm
	Dimensions[*7]	56 (W) × 30 (H) × 85 (D) mm typical (2.2 in. × 1.18 in. × 3.35 in.)
	Mass	180 grams typical (6.4 oz.)
Environmental[*8]	Temperature Range	0° to +55°C (Operating), –51° to +71°C (Storage)
	Humidity	45% relative humidity at 55°C (non-condensing) 75% relative humidity at 40°C (non-condensing) 95% relative humidity at 30°C (non-condensing)
	Shock	30 g half-sine, 11 ms duration
	Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz, Power Spectral Density 0.03 g^2/Hz
	EMC	Meets EN 61326, EN 55011
	Safety	Meets EN 61010-1

Notes: All specs are applicable after twenty minutes warm-up at room temperature unless specified otherwise.

∗1: Expanded uncertainty with K = 2 for absolute power measurements on CW signal at 0 dBm calibration level from 50 MHz to 6 GHz.
∗2: Expanded uncertainty with K = 2 after zero operation when measured with 128 averages for 5 minutes.
In high aperture time mode, noise is 1.3 nW and 0.3 μW in range 1 and range 2 respectively.
∗3: After one hour warm-up and zero operation. Measured with 128 averages for one hour keeping the temperature within ±1°C.
∗4: Measurement error with reference to a CW signal of equal power and frequency at 25°C.
∗5: One measurement per second, typical in high aperture time mode.
∗6: 150 mA max.
∗7: Not including N connector.
∗8: Tests were performed per MIL-PRF-28800F (Class 2)

MA24108A/MA24118A/MA24126A Specifications

Model			MA24108A	MA24118A	MA24126A
Sensor	Frequency Range		10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26 GHz
	Dynamic Range (CW)		–40 to +20 dBm		
	Dynamic Range (Timeslot)		–40 to +20 dBm		
	Dynamic Range (Scope)		–40 to +20 dBm		
	SWR		<1.17, 10 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 8 GHz	<1.17, 10 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 12 GHz <1.25, 12 GHz to 18 GHz	<1.90, 10 MHz to 50 MHz <1.17, 50 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 12 GHz <1.25, 12 GHz to 18 GHz <1.35, 18 GHz to 26 GHz
	Signal Channel Rise Time		8 µs typical		
	Video Bandwidth		50 kHz typical		
	Sampling Rate		140 ks/s, typical		
	Measurement Ranges		Range 1, +20 to –7 dBm typical Range 2, –7 to –40 dBm typical Auto ranging between range 1 and 2		
Measurement Uncertainty	Linearity		<3%		
	Cal Factor[*1]		<2.3% at 10 MHz <1.5%, 50 MHz to 8 GHz	<2.3% at 10 MHz <1.5%, 50 MHz to 18 GHz	<3.5% at 10 MHz <2.0%, 50 MHz to 2 GHz <2.5%, 3 GHz to 8 GHz <3.0%, 9 GHz to 15 GHz <3.5%, 16 GHz to 26 GHz
	Noise[*2]		<8 µW, Range 1 <40 nW, Range 2		
	Zero Set[*3]		<1 µW, Range 1 <10 nW, Range 2		
	Zero Drift[*4]		<0.5 µW, Range 1 <3 nW, Range 2		
	Effect of Temperature		<1.4%		
	Effect of Digital Modulation[*5]		<0.5%, <+18 dBm <1.4%, >+18 dBm		
System	Measurand		Average power		
	Measurement Resolution[*6]		0.01 dB max via PowerXpert, 0.001 dB max via remote command		
	Offset Correction[*7]		–100 to +150 dB		
	Averaging		Auto, Manual		
	Type		Moving, Repeat		
	Number of Averages (manual)[*8]		1 to 40,000		
	Auto Average	Resolution[*9]	1 dB, 0.1 dB, 0.01 dB, 0.001 dB		
		Source (slot # or scope data point number)	Timeslot: 1 to 128 Scope: 1 to 1024		
Continuous Average Mode	Duty Cycle Correction		0.01% to 100%		
	Aperture Time		0.01 ms to 300 ms		
	Measurement Time[*10]		N × (Capture Time × 2.5) + T_d + T_{com}		
Scope Mode	Capture Time		0.01 ms to 300 ms		
	Data Points		1 to 1024		
	Resolution		0.007 ms, max via remote command 0.01 ms, max via PowerXpert		
	Measurement Time[*11]		N × (Capture Time × 3.75) +(P_n × T_{dp}) + T_{com}		
Timeslot Mode	Maximum Number of Slots		128		
	Slot with		0.01 ms to 100 ms		
	Maximum Capture Time		300 ms (slot width × number of slots)		
	Resolution		0.007 ms, max via remote command 0.01 ms, max via PowerXpert		
	Exclusion Periods	Start Exclusion	0 ms to 10 ms		
		End Exclusion	0 ms to 10 ms		
	Measurement Time[*11]		N × (Capture Time × 3.75) + (P_n × T_{dp}) + T_{com}		

Continued on next page

Model			MA24108A	MA24118A	MA24126A
Trigger	Source*12		Bus, Continuous, Internal and External		
	Internal Trigger	Dynamic Range	–20 to +20 dBm		
		Level Accuracy	± 0.5 dB, typical		
		Slope	Positive or negative		
		Delay Range	–5 ms to +10 s		
		Delay Resolution	10 µs		
	External Trigger	Impedance	100 kΩ		
		Type	TTL/CMOS		
		Slope	Positive or negative		
		Delay Range	–5 ms to +10 s		
		Delay Resolution	10 µs		
		Positive Threshold Voltage	2.0 V typical		
		Negative Threshold Voltage	1.2 V typical		
		Hysteresis	0.8 V typical		
General	RF Connector		N male, K male (MA24126A)		
	Interface to Host		USB 2.0 full speed (compatible with USB 1.0 and 1.1)		
	Current Consumption		150 mA, typical		
	External Trigger Input		MCX (female), 12 V max		
	Damage Levels at RF Port		+33 dBm, ±20 V DC		
	Size		25 mm × 45 mm × 110 mm, excluding N connector		
	Weight		230 g (0.51 lb)		
Environmental*13	Temperature Range		0° to +55°C (Operating), –51° to +71°C (Storage)		
	Humidity		45% relative humidity at 55°C (non-condensing) 75% relative humidity at 40°C (non-condensing) 95% relative humidity at 30°C (non-condensing)		
	Shock		30 g half-sine, 11 ms duration		
	Vibration		Sinusoidal: 5 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz Power Spectral Density: 0.03 g^2/Hz		
	EMC		EN 61326, EN 55011		
	Safety		EN 61010-1		
PowerXpert v2.0 (PC requirements)	Processor and RAM		Minimum: Equivalent to Intel® Pentium® III with 1 GB RAM or Intel® Pentium® IV with 512 MB RAM Recommended: Equivalent to Intel® Pentium® IV with 1 GB RAM		
	Operating System		Microsoft® Windows 7, Windows Vista®, Windows XP and Windows 2000		
	Hard-disk Free Space		100 MB, minimum		
	Display Resolution		1024 × 768, minimum		
	Interface		USB 2.0 full speed (compatible with USB 1.0 and 1.1)		

Notes: All specs are applicable after twenty minutes warm-up at room temperature unless specified otherwise.

*1: Expanded uncertainty with K = 2 for absolute power measurements on CW signal at 0 dBm and calibration frequencies 10 MHz, 50 MHz, 100 MHz, 300 MHz, 500 MHz, and 1 GHz to 8 GHz (for MA24108A), or to 18 GHz (MA24118A) or to 26 GHz (for MA24126A) in 1 GHz increments.
*2: Expanded uncertainty with K = 2 after zero operation when measured with 1 average, and 20 ms aperture time for 5 minutes. Effect of Noise can be reduced by increasing the number of averages and/or increasing the aperture time. Noise goes down as square root of number of averages and aperture time.
For example with 128 averages, the Noise is 3.5 nW (40 nW divided by √128). Effect of increased aperture time is calculated in the same way.
*3: Expanded uncertainty with K = 2 after zero operation when measured with 1 average, and 20 ms aperture time for 5 minutes.
*4: Expanded uncertainty with K = 2 after one hour warm-up and zero operation, 1 average, 20 ms aperture time, and keeping the temperature within ±1°C.
*5: Measurement error with reference to a CW signal of equal power and frequency at 25°C.
*6: Resolution in PowerXpert application is 2 digits after the decimal. Native resolution of the sensor is 3 digits after the decimal.
*7: Offset correction feature is available only through PowerXpert application. There is no remote command for it in the sensor firmware.
*8: Maximum number of averages allowed in Continuous Average mode and Timeslot mode is 40,000. In scope, the maximum number of averages is equal to 8231936 divided by data points.
*9: Averaging resolution of 0.001 dB is not available with PowerXpert application. It is defined as the place after the decimal to which the reading becomes stable. E.g. if 0.01 is selected then the reading will typically be stable ±0.01 dB. Please refer to the remote operation chapter in the user guide for information regarding access to this feature.
*10: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1606-R). T_d is the delay compensation for smaller Capture Times, T_d = 0 for Capture Time >9 ms, T_d = 3 ms for 2 ms <Capture Time <9 ms, T_d = 5 ms for Capture Time <2 ms, T_{com} = 5 ms, command processing time.
*11: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1606-R). Where N is the number of repeat averages, N = 1 for moving average mode, P_n = Number of points, T_{dp} = 0.05 ms (Communication delay (approx) due to each point), T_{com} = 5 ms, command processing time.
*12: Bus trigger not available in PowerXpert application.
*13: Tests were performed per MIL-PRF-28800F (Class 2).

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MA24106A	USB Power Sensor
	Included accessories
2000-1566-R	1.8 m USB 2.0 A to Mini-B Cable
2300-512	MA24106A Installation CD
	Available options
MA24106A-097	Option 97, Accredited Calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included.
MA24106A-098	Option 98, Standard Calibration to ISO17025 and ANSI/NCSL Z540.
MA24106A-099	Option 99, Premium Calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included.
	Optional accessories
2000-1593-R	Cable, 3.0 m USB 2.0 A to Mini-B Cable
2000-1594-R	Cable, 5.0 m USB 2.0 A to Mini-B Cable
01-200	Calibrated Torque Wrench for N Connector
01-204	Calibrated Torque Wrench for K and V Connectors
3-1010-123	Power Attenuator, N(m) to N(f), DC to 8.5 GHz, 30 dB, 50 W, 50Ω
3-1010-124	Power Attenuator, N(m) to N(f), DC to 8.5 GHz, 40 dB, 100 W, 50Ω
3-1010-122	Power Attenuator, N(m) to N(f), DC to 12.4 GHz, 20 dB, 5 W, 50Ω
42N50-20	Power Attenuator, N(m) to N(f), DC to 18 GHz, 20 dB, 5 W, 50Ω
42N50-30	Power Attenuator, N(m) to N (f), DC to 18 GHz, 30 dB, 50 W, 50Ω
510-90	Precision Coaxial Adapter, N(m) to 7/16 DIN(f), DC to 3.3 GHz
510-91	Precision Coaxial Adapter, N(f) to 7/16 DIN(f), DC to 3.3 GHz
510-92	Precision Coaxial Adapter, N(m) to 7/16 DIN(m), DC to 3.3 GHz
510-93	Precision Coaxial Adapter, N(f) to 7/16 DIN(m), DC to 3.3 GHz
33NFNF50B	Precision Coaxial Adapter, N(f) to N(f), DC to 18 GHz
33NNF50B	Precision Coaxial Adapter, N(m) to N(f), DC to 18 GHz
33NN50B	Precision Coaxial Adapter, N(m) to N(m), DC to 18 GHz
34AN50	Precision Coaxial Adapter, GPC-7 to N(m), DC to 18 GHz
34ANF50	Precision Coaxial Adapter, GPC-7 to N(f), DC to 18 GHz
34NFK50	Precision Coaxial Adapter, N(f) to K(m), DC to 18 GHz
34NFKF50	Precision Coaxial Adapter, N(f) to K(f), DC to 18 GHz
34NK50	Precision Coaxial Adapter, N(m) to K(m), DC to 18 GHz
34NKF50	Precision Coaxial Adapter, N(m) to K(f), DC to 18 GHz

Model/Order No.	Name
	Main frame
MA24108A	8 GHz USB Power Sensor
MA24118A	18 GHz USB Power Sensor
MA24126A	26 GHz USB Power Sensor
	Included accessories
2300-526	Product CD – Anritsu PowerXpert and USB Power Sensors
10585-00021	Quick Start Guide
2000-1605-R	1.5 m BNC (m) to MCX (m) Cable
2000-1606-R	1.8 m USB A to Micro-B Cable with Latch
	Available options
MA24108A-097	Option 97, Accredited Calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24108A-098	Option 98, Standard Calibration to ISO17025 and ANSI/NCSL Z540
MA24108A-099	Option 99, Premium Calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included.
MA24118A-097	Option 97, Accredited Calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24118A-098	Option 98, Standard Calibration to ISO17025 and ANSI/NCSL Z540
MA24118A-099	Option 99, Premium Calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included.
MA24126A-097	Option 97, Accredited Calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included.
MA24126A-098	Option 98, Standard Calibration to ISO17025 and ANSI/NCSL Z540
MA24126A-099	Option 99, Premium Calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included.
	Optional accessories
01-200	Calibrated Torque Wrench for N Connector
01-204	Calibrated Torque Wrench for K and V Connectors
2000-1614-R	Cable, 5.0 m USB A to Micro-B Cable with Latch
3-1010-123	Power Attenuator, DC to 8.5 GHz 30 dB; 50 W, 50Ω; N (m) to N (f)
3-1010-124	Power Attenuator, DC to 8.5 GHz 40 dB; 100 W, 50Ω; N (m) to N (f)
3-1010-122	Power Attenuator, DC to 12.4 GHz 20 dB; 5 W, 50Ω; N (m) to N (f)
42N50-20	Power Attenuator, DC to 18 GHz 20 dB; 5 W, 50Ω; N (m) to N (f)
42N50-30	Power Attenuator, DC to 18 GHz 30 dB; 50 W, 50Ω; N (m) to N (f)
41KB-3	Power Attenuator, DC to 26.5 GHz; 3 dB, 50Ω; K (m) to K (f)
41KB-6	Power Attenuator, DC to 26.5 GHz; 6 dB, 50Ω; K (m) to K (f)
41KB-10	Power Attenuator, DC to 26.5 GHz; 10 dB, 50Ω; K (m) to K (f)
41KB-20	Power Attenuator, DC to 26.5 GHz; 20 dB, 50Ω; K (m) to K (f)
43KB-3	Power Attenuator, DC to 26.5 GHz; 3 dB, 50Ω; K (m) to K (f)
43KB-6	Power Attenuator, DC to 26.5 GHz; 6 dB, 50Ω; K (m) to K (f)
43KB-10	Power Attenuator, DC to 26.5 GHz; 10 dB, 50Ω; K (m) to K (f)
43KB-20	Power Attenuator, DC to 26.5 GHz; 20 dB, 50Ω; K (m) to K (f)
510-90	Precision Coaxial Adapter, DC to 3.3 GHz; N (m) to 7/16 DIN (f)
510-91	Precision Coaxial Adapter, DC to 3.3 GHz; N (f) to 7/16 DIN (f)
510-92	Precision Coaxial Adapter, DC to 3.3 GHz; N (m) to 7/16 DIN (m)
510-93	Precision Coaxial Adapter, DC to 3.3 GHz; N (f) to 7/16 DIN (m)
33NFNF50B	Precision Coaxial Adapter, DC to 18 GHz; N (f) to N (f)
33NNF50B	Precision Coaxial Adapter, DC to 18 GHz; N (m) to N (f)
33NN50B	Precision Coaxial Adapter, DC to 18 GHz; N (m) to N (m)
34AN50	Precision Coaxial Adapter, DC to 18 GHz; GPC-7 to N (m)
34ANF50	Precision Coaxial Adapter, DC to 18 GHz; GPC-7 to N (f)
34NFK50	Precision Coaxial Adapter, DC to 18 GHz; N (f) to K (m)
34NFKF50	Precision Coaxial Adapter, DC to 18 GHz; N (m) to K (f)
34NK50	Precision Coaxial Adapter, DC to 18 GHz; N (m) to K (m)
34NKF50	Precision Coaxial Adapter, DC to 18 GHz; N (m) to K (f)
1091-26	Precision Coaxial Adapter, DC to 18 GHz; N (m) to SMA (m)
1091-27	Precision Coaxial Adapter, DC to 18 GHz; N (m) to SMA (f)
1091-80-R	Precision Coaxial Adapter, DC to 18 GHz; N (f) to SMA (m)
1091-81-R	Precision Coaxial Adapter, DC to 18 GHz; N (f) to SMA (f)

RESISTANCE ATTENUATOR
MN510C
DC to 500 MHz

Build-to order product

The MN510C is a variable resistance attenuator for measurement of 50 Ω impedance system. This attenuator has a wide frequency range and highly accurate, compact, lightweight with good articulation, and easy to handle. Moreover, comparison measurement can be made far more smoothly when used in conjunction with a key box.

Specifications

Frequency Range	DC to 500 MHz
Connector	N-type, 50Ω unbalanced
Return Loss	≥30 dB (DC to 100 MHz) ≥25 dB (100 MHz to 300 MHz) ≥20 dB (300 MHz to 500 MHz)
Maximum Attenuation	91 dB
Step Dial	10 dB × 8, 1 dB × 10, 0.1 dB × 10
Attenuation Accuracy	Step accuracy: ±0.2 dB (0 to 10 dB, DC to 500 MHz) ±0.3 dB (0 to 91 dB, DC to 300 MHz) ±0.5 dB (0 to 91 dB, 300 MHz to 500 MHz) Residual loss: ≤0.2 dB (DC to 100 MHz) ≤0.4 dB (100 MHz to 300 MHz) ≤0.5 dB (300 MHz to 500 MHz)
Maximum Input	0.25 W (24 dBm)
Operating Temperature Range	0° to 45°C
Dimensions and Mass	210 (W) × 95 (H) × 150 (D) mm, ≤3 kg

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MN510C	Resistance Attenuator (Build-to order product)
	Standard accessories
J0025A	Coaxial Cord (S-5DWP · 5D-2W · S-5DWP), 1 m: 2 pcs
W0219CE	MN510C Instruction Manual: 1 copy

PROGRAMMABLE ATTENUATOR
MN63A, MN65A, MN72A

DC to 2 GHz   DC to 6 GHz   DC to 18 GHz

Remote Control
GPIB

For Configuring Automated Measurement Systems

MN63A

The MN63A/65A/72A provide GPIB as a standard feature and are suitable for automatic measuring system components used in R&D, inspection, or production. The 50 Ω models are available in three different frequency ranges, which can be selected to match the application for maximum economy. The attenuation calibration value is stored in the internal memory and can be uploaded to the system controller for checking against measured values, permitting a significant increase in system accuracy. A relative setting function is also provided, which allows measurement to be referenced to any arbitrary level. Rotary encoders are standard, allowing simple, smooth setting under manual control.

Features
- Wide frequency range
- High accuracy
- Long operating life
- High-speed switching
- Readout of attenuation calibration via GPIB
- Relative attenuation display function
- Rotary encoders for smooth manual setting

Specifications

MN63A, MN65A, MN72A Programmable Attenuator

Model	MN63A	MN65A	MN72A
Frequency Range	DC to 2 GHz	DC to 6 GHz	DC to 18 GHz
Input/Output Connector	N-type, 50Ω unbalanced		SMA-type, 50Ω unbalanced
VSWR (Return Loss)	≤1.19 (≥21 dB, DC to 500 MHz) ≤1.22 (≥20 dB, 500 MHz to 1.2 GHz) ≤1.28 (≥18 dB, 1.2 GHz to 1.5 GHz) ≤1.37 (≥16 dB, 1.5 GHz to 2 GHz)	≤1.4 (≥15.6 dB, DC to 2 GHz) ≤2.0 (≥9.6 dB, 2 GHz to 6 GHz)	≤1.2 (≥20.8 dB, DC to 2 GHz) ≤1.6 (≥12.8 dB, 2 GHz to 12.4 GHz) ≤1.9 (≥10.2 dB, 12.4 GHz to 18 GHz)
Maximum Attenuation	100 dB	85 dB	70 dB
Step Size	10 dB step, 1 dB step		
Attenuation Accuracy	±0.2 dB (DC to 500 MHz, 1 to 10 dB) ±0.3 dB (DC to 500 MHz, 11 to 80 dB) ±0.5 dB (DC to 500 MHz, 81 to 100 dB) ±0.3 dB (500 MHz to 1 GHz, 1 to 10 dB) ±0.5 dB (500 MHz to 1 GHz, 11 to 80 dB) ±0.8 dB (500 MHz to 1 GHz, 81 to 100 dB) ±0.5 dB (1 GHz to 1.5 GHz, 1 to 10 dB) ±0.7 dB (1 GHz to 1.5 GHz, 11 to 80 dB) ±1.0 dB (1 GHz to 1.5 GHz, 81 to 100 dB) ±0.7 dB (1.5 GHz to 2 GHz, 1 to 10 dB) ±1.0 dB (1.5 GHz to 2 GHz, 11 to 80 dB) ±1.5 dB (1.5 GHz to 2 GHz, 81 to 100 dB)	±0.3 dB (DC to 4 GHz, 1 to 6 dB) ±0.3 dB (DC to 2 GHz, 7 to 10 dB) ±0.5 dB (DC to 2 GHz, 11 to 30 dB) ±0.7 dB (DC to 2 GHz, 31 to 70 dB) ±1.2 dB (DC to 2 GHz, 71 to 85 dB) ±0.5 dB (2 GHz to 4 GHz, 7 to 10 dB) ±0.7 dB (2 GHz to 4 GHz, 11 to 30 dB) ±1.2 dB (2 GHz to 4 GHz, 31 to 70 dB) ±1.5 dB (2 GHz to 4 GHz, 71 to 85 dB) ±0.5 dB (4 GHz to 6 GHz, 1 to 6 dB) ±0.7 dB (4 GHz to 6 GHz, 7 to 10 dB) ±0.9 dB (4 GHz to 6 GHz, 11 to 30 dB) ±1.6 dB (4 GHz to 6 GHz, 31 to 70 dB) ±1.8 dB (4 GHz to 6 GHz, 71 to 85 dB)	±0.4 dB (DC to 12.4 GHz, 1 to 4 dB) ±0.7 dB (DC to 12.4 GHz, 5 to 10 dB) ±0.9 dB (DC to 12.4 GHz, 11 to 30 dB) ±1.0 dB (DC to 2 GHz, 31 to 60 dB) ±1.2 dB (DC to 2 GHz, 61 to 70 dB) ±1.8 dB (2 GHz to 12.4 GHz, 31 to 60 dB) ±2.0 dB (2 GHz to 12.4 GHz, 61 to 70 dB) ±0.7 dB (12.4 GHz to 18 GHz, 1 to 4 dB) ±0.9 dB (12.4 GHz to 18 GHz, 5 to 10 dB) ±1.8 dB (12.4 GHz to 18 GHz, 11 to 30 dB) ±3.2 dB (12.4 GHz to 18 GHz, 31 to 60 dB) ±3.6 dB (12.4 GHz to 18 GHz, 61 to 70 dB)
Insertion Loss (Attenuation: 0 dB)	3.9 dB (DC to 500 MHz) 5.2 dB (500 MHz to 1 GHz) 6.2 dB (1 GHz to 1.5 GHz) 7.0 dB (1.5 GHz to 2 GHz)	1.7 dB (DC to 2 GHz) 2.4 dB (2 GHz to 4 GHz) 3.0 dB (4 GHz to 6 GHz)	1.5 dB (DC to 2 GHz) 3.5 dB (2 GHz to 12.4 GHz) 5.0 dB (12.4 GHz to 18 GHz)
Maximum Input	0.25 W (24 dBm)	1 W (30 dBm)	
Nominal Lifetime	5 million times (typ.)		
Switching Time	4 ms	20 ms	
Setting Methods	Manually (by rotary encoder) or by remote control (GPIB)		
GPIB	Can set all front panel controls except power switch. Can output the attenuation calibration value to the controller SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0		
Power Supply	AC 100 V $^{+10}_{-15}$ %, 50 Hz/60 Hz, ≤22 VA	AC 100 V $^{+10}_{-15}$ %, 50 Hz/60 Hz, ≤40 VA	AC 100 V $^{+10}_{-15}$ %, 50 Hz/60 Hz, ≤30 VA
Operating Temperature Range	0° to 50°C		
Dimensions and Mass	213 (W) × 88 (H) × 251 (D) mm, ≤4 kg	213 (W) × 88 (H) × 251 (D) mm, ≤5 kg	

Ordering Information

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MN63A	Programmable Attenuator
MN65A	Programmable Attenuator
MN72A	Programmable Attenuator

Model/Order No.	Name	
	Standard accessories	
	Power Cord:	1 pc
F0018	Fuse, 0.5 A (supplied with MN63A):	2 pcs
F0020	Fuse, 1 A (supplied with MN65A):	2 pcs
F0023	Fuse, 3.15 A (supplied with MN72A):	2 pcs
W0220AE	MN63A Operation Manual:	1 copy
W0223AE	MN65A Operation Manual:	1 copy
W0222AE	MN72A Operation Manual:	1 copy

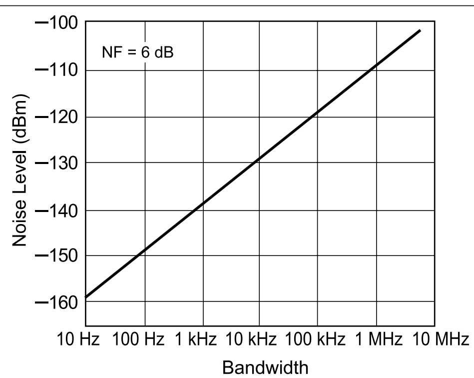
PRE-AMPLIFIER

MH648A

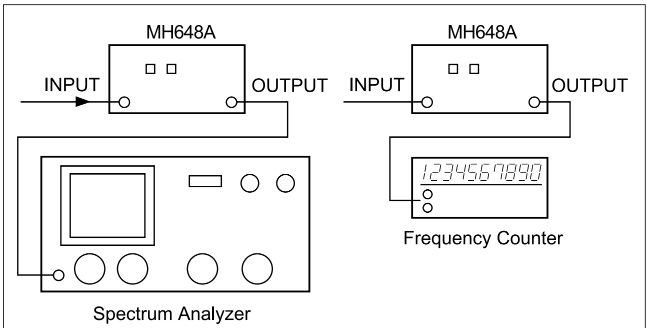
100 kHz to 1200 MHz

For Amplifying Low-Level Signals

The MH648A is a pre-amplifier for improving sensitivity in spectrum analyzers, field strength meters, frequency counters.



Noise Level Converted to Input Value vs. IF Bandwidth



Specifications

Frequency Range	100 kHz to 1200 MHz
Gain	30 dB ±1 dB (500 kHz to 800 MHz), 30 dB +1.5/–6 dB (100 kHz to 1200 MHz) ∗Input attenuator: 0 dB, 20° to 30°C
Gain Stability	±1.5 dB (100 kHz to 800 MHz) ±3 dB (800 MHz to 1200 MHz)
Noise Figure	≤6 dB (500 kHz to 800 MHz) ≤8 dB (100 kHz to 1200 MHz) ∗Input attenuator: 0 dB
Maximum Output	≥120 dBµV (+7 dBm) ∗Output at which the gain decreases 1 dB
Input Attenuator	0, 10, 20, 30 dB ±1.5 dB
Input/Output Connector	N (S)-type, 50Ω VSWR: ≤2.5 (500 kHz to 800 MHz),
Power Supply	AC: 100 V, 50 Hz/60 Hz, ≤10 VA DC: 21 V to 30 V, ≤120 mA
Operating Temperature Range	0° to 45°C
Dimensions and Mass	210 (W) × 95 (H) × 200 (D) mm, ≤3.5 kg

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MH648A	Pre-amplifier	
	Standard accessories	
J0025A	Coaxial Cable (S-5DWP · 5D-2W · S-5DWP), 1 m:	1 pc
	Power Cord:	1 pc
F0002	Fuse, 0.2 A:	3 pcs
W0261CE	MH648A Instruction Manual:	1 copy

EMI PROBE

MA2601B/MA2601C

5 MHz to 1000 MHz 1 MHz to 50 MHz

The MA2601B/C is a compact loop antenna to use with a spectrum analyzer or a field strength meter for EMI measurement.
The combination is used to locate noise sources and to compare relative noise source levels.

Features

- Exact detection of magnetic field components (because MA2601B/C is electrostatically shielded)
- Approximately flat magnetic-field detection characteristics in the range from 100 MHz to 1000 MHz (MA2601B)

Applications

- Sensing magnetic fields when it is connected to a spectrum analyzer.
- Noise immunity testing of electronic components or electrostatic shield-effect testing with using a signal generator

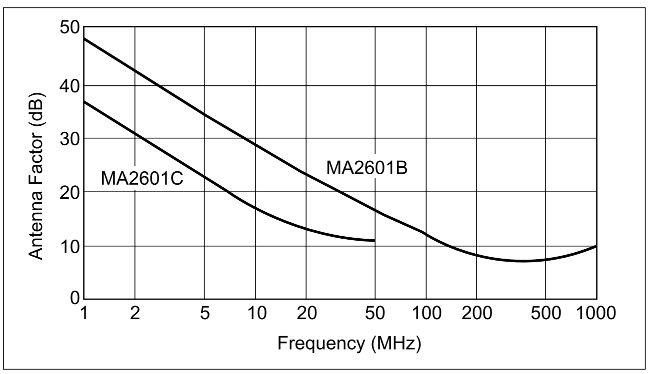


Fig. 1 Antenna Factor (for magnetic-field)

Specifications

Frequency Range	5 MHz to 1000 MHz (MA2601B) 1 MHz to 50 MHz (MA2601C)
Antenna Factor	Fig. 1
Connector	BNC-J
Dimensions	16 × 168 × 36 mm

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

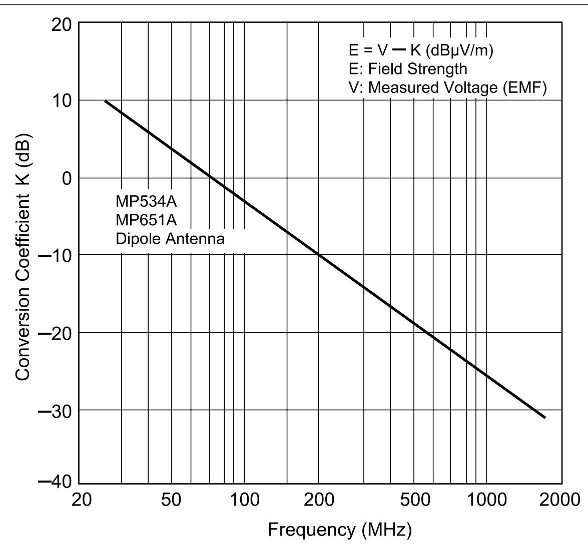
Model/Order No.	Name
	Main frame
MA2601B	EMI Probe
MA2601C	EMI Probe
	Standard accessories
	Coaxial Cord (N-P-55U · RG-55/U · 3CA-P2), 2 m: 2 pcs
W0626AE	MA2601B/C Operation Manual: 1 copy

DIPOLE ANTENNA
MP534A/B, MP651A/B, MP663A

25 MHz to 520 MHz   470 MHz to 1700 MHz   300 MHz to 1000 MHz

MP534A*   MP663A

*Tripod: Sold separately



Those half-wavelength dipole antennas are reference antennas, but the element length must be adjusted for each frequency to be measured.

Specifications

Model	MP534A/B	MP651A/B	MP663A
Antenna Type	Half-wavelength dipole		
Frequency Range	25 MHz to 520 MHz	470 MHz to 1700 MHz	300 MHz to 1000 MHz
Input Impedance	50Ω, N-type		
VSWR	≤2 (nominal)		
Average Relative Gain	0 dB (nominal)		
Maximum Input Power	1 W (25 MHz to 520 MHz) 10 W (250 MHz to 500 MHz)	10 W	
Front-to-back Ratio	0 dB		
Dimensions and Mass	200 × 370 × 1300 mm, ≤11 kg	50 × 70 × 500 mm, ≤2.5 kg	80 × 120 × 640 mm, ≤8 kg

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MP534A	Dipole Antenna	
MP534B	Dipole Antenna	
	Standard accessories	
J0118	Coaxial Cable (S-5DWPL · 5D-2W · S-5DWP), 10 m (supplied with MP534A):	1 pc
J0119	Coaxial Cable (N-LP-55U · RG-55U · N-P-55U), 10 m (supplied with MP534B):	1 pc
B0101	Carrying Bag:	1 pc
W0288CE	MP534A/B Instruction Manual:	1 copy
	Main frame	
MP651A	Dipole Antenna	
MP651B	Dipole Antenna	
	Standard accessories	
J0118	Coaxial Cable (S-5DWPL · 5D-2W · S-5DWP), 10 m (supplied with MP651A):	1 pc
J0119	Coaxial Cable (N-LP-55U · RG-55U · N-P-55U), 10 m (supplied with MP651B):	1 pc
W0289CE	MP651A/B Instruction Manual:	1 copy
	Main frame	
MP663A	Dipole Antenna	
	Standard accessories	
J0120	Coaxial Cable (N-P-55U · RG-55/U · N-P-55U), 10 m:	1 pc
B0102	Carrying Bag:	1 pc
B0400A	Tripod:	1 pc
B0127	Carrying Bag for Tripod:	1 pc
W0290CE	MP663A Instruction Manual:	1 copy
	Optional accessories	
MB9A	Tripod (for MP534A/B or MP651A/B)	
MB18A	Pole (for MP651A/B)	
B0403C	Carrying Bag for MB9A	

Composition

Model	MP534A	MP534B	MP651A	MP651B	MP663A
Pole	Supplied with MP534A/B, MB18B (sold separately)		MB18A (sold separately) Not required when used with MP534A/B		Supplied with MP663A
Tripod	MB9A (sold separately)		MB9A (sold separately) Not required when used with MP534A/B		Supplied with MP663A
Instruments used with	–	ML524B	–	ML524B	ML524B

DIPOLE ANTENNA
MA5612 Series

800 MHz to 6 GHz

The MA5612 series of 13 types of fixed-element length, half-wavelength dipole antennas covers the quasi-microwave and microwave frequency range of 800 MHz to 6 GHz now being used by popular mobile terminals.

Features

- Field Strength Measurement in Quasi-microwave and Microwave Bands
- For Propagation Tests and Transmission Power and Spurious Measurements of Equipment using Linear-type Antennas
- Reference Antenna for On-site Testing

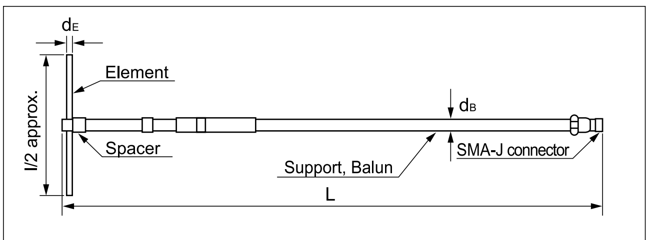
Specifications

Frequency Range	800 MHz to 6 GHz (Table 1)
Impedance	50 Ω (nominal)
Connector	SMA-J
VSWR	≤2.0 (specified frequency range)
Gain	2 dBi (nominal)
Mass	≤200 g (per antenna)

Table 1 Frequency Range

Model	Frequency Range
MA5612A1	800 MHz to 880 MHz
MA5612A2	880 MHz to 960 MHz
MA5612A3	1.4 GHz to 1.55 GHz
MA5612B1	1.55 GHz to 1.7 GHz
MA5612B2	1.7 GHz to 1.95 GHz
MA5612B3	1.95 GHz to 2.25 GHz
MA5612B4	2.25 GHz to 2.6 GHz
MA5612B5	2.6 GHz to 3 GHz
MA5612C1	3 GHz to 3.5 GHz
MA5612C2	3.5 GHz to 4 GHz
MA5612C3	4 GHz to 4.6 GHz
MA5612C4	4.6 GHz to 5.3 GHz
MA5612C5	5.3 GHz to 6 GHz

Dimensions



Model	Element (d_E)	Support, Balun (d_B)	Support, Balun (L)
MA5612A1/A2	ø2.5 mm	ø6 mm	300 mm
MA5612A3	ø2 mm		
MA5612B series	ø2 mm	ø6 mm	300 mm
MA5612C series	ø1.5 mm	ø5 mm	200 mm

Ordering Information

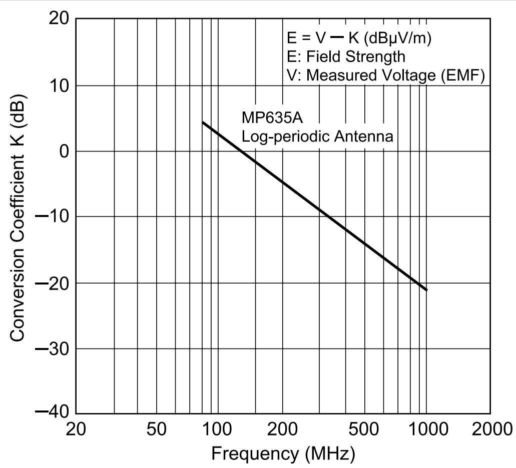
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MA5612 series	Dipole Antenna
	Standard accessories
W0698AE	MA5612A/B/C Operation Manual: 1 copy
	Optional accessories
J0605	Coaxial Adaptor (N-P · SMA-J)
J0602F	Coaxial Cord (SMA-P · 3D-2W · SMA-P, 2 GHz), 3 m
J0602G	Coaxial Cord (SMA-P · 3D-2W · SMA-P, 2 GHz), 5 m
J0602H	Coaxial Cord (SMA-P · 3D-2W · SMA-P, 2 GHz), 10 m
J0604F	Coaxial Cord (SMA-P · 3D-2W · N-P, 2 GHz), 3 m
J0604G	Coaxial Cord (SMA-P · 3D-2W · N-P, 2 GHz), 5 m
J0604H	Coaxial Cord (SMA-P · 3D-2W · N-P, 2 GHz), 10 m
DGM024-03000A	Coaxial Cord (SMA-P · DGM024 · SMA-P, 2 GHz), 3 m
DGM024-05000A	Coaxial Cord (SMA-P · DGM024 · SMA-P, 2 GHz), 5 m
DGM024-010000A	Coaxial Cord (SMA-P · DGM024 · SMA-P, 2 GHz), 10 m
MB9A	Tripod
MB18A	Pole
B0354	Antenna Retainer (for MB18A, 1 pc required for each antenna)
B0355A	Antenna Case (3 pcs of 1 pc each of types A to C)
B0355B	Antenna Case (12 pcs of 4 pcs each of types A to C)
B0356	Cable Bag
SFA-01XPJ-3	3 dB Fixed Attenuator (VSWR upgrade, SMA connector)
SFA-01XPJ-6	6 dB Fixed Attenuator (VSWR upgrade, SMA connector)

Note: When storing and transporting the antenna, use the dedicated antenna case and cable bag.

LOG-PERIODIC ANTENNA
MP635A, MP666A
80 MHz to 1000 MHz 200 MHz to 2000 MHz


Tripod sold separately



The gain remains roughly constant over a wide range so the element length does not require adjustment. Compared with dipole antennas, these antennas have a gain of 5 dB.

Specifications

Model	MP635A	MP666A
Frequency Range	80 MHz to 1000 MHz	200 MHz to 2000 MHz
Input Impedance	50Ω, N-type	
VSWR	≤2.5 (nominal)	
Average Relative Gain	5 dB (nominal)	
Maximum Input Power	10 W	
Front-to-back Ratio	≥15 dB	
Dimensions and Mass	200 × 200 × 1750 mm, ≤7 kg	ø140 × 900 mm, ≤5 kg

Composition

Model	MP635A	MP666A
Pole	Supplied with MB19A	Supplied with MB19A, MB18B (sold separately)
Tripod	MB19A (sold separately)	MB19A (sold separately), MB9A (sold separately, for MB18B)

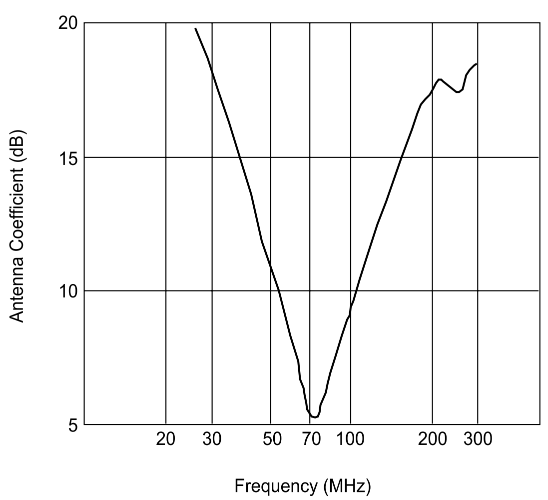
Ordering Information
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MP635A	Log-periodic Antenna	
	Standard accessories	
J0025B	Coaxial Cable (S-5DWP · 5D-2W · S-5DWP), 10 m:	1 pc
B0104	Carrying Bag:	1 pc
W0286CE	MP635A Instruction Manual:	1 copy
	Main frame	
MP666A	Log-periodic Antenna	
	Standard accessories	
J0025B	Coaxial Cable (S-5DWP · 5D-2W · S-5DWP), 10 m:	1 pc
B0104	Carrying Bag:	1 pc
W0426CE	MP666A Instruction Manual:	1 copy
	Optional accessories	
MB19A	Tripod (for MP635A/MP666A, with pole)	
MB9A	Tripod (for MP666A)	
MB18B	Pole (for MP666A)	

BICONICAL ANTENNA

BBA9106

30 MHz to 300 MHz



The element length does not require adjustment. The BBA9106 and MP666A combination is convenient for EMI measurement.

Specifications

Frequency Range	30 MHz to 300 MHz
Input Impedance	50Ω, N-type
Dimensions and Mass	520 × 700 × 1300 mm, <3 kg

Composition

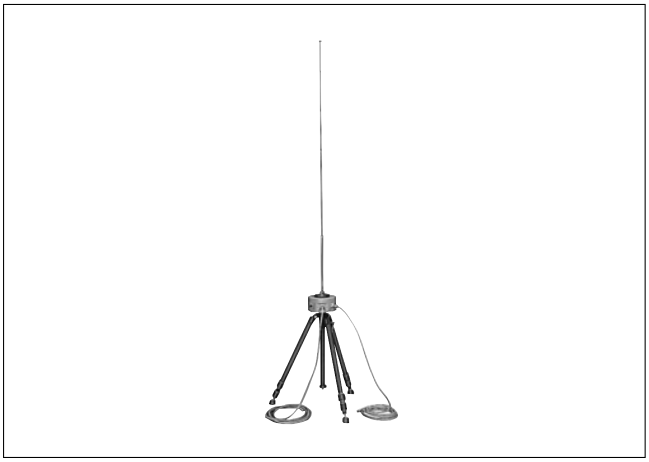
Pole	MB18A, MB18B
Tripod	MB9A

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
BBA9106/VHA9103	Biconical Antenna (with a Balun)
	Standard accessories
	BBA9106 Operation Manual: 1 copy
	Optional accessories
J0025B	Coaxial Cord (S-5DWP · 5D-2W · S-5D2W), 10 m
MB9A	Tripod
MB18B	Pole (MB18A can also be used.)
B0284	Mounting Hardware for Biconical Antenna (for MB18A/B)
BBA9106	Biconical Antenna (Element only)

ROD ANTENNA
MP415B
9 kHz to 30 MHz



The MP415B can be used with the Spectrum Analyzer.

Specifications

Frequency Range	9 kHz to 30 MHz
Impedance	50Ω
Connector	BNC
Power Supply	Required Band Selector separately
Dimensions and Mass	Rod length 0.3 to 2 m, ≤6 kg

Ordering Information
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MP415B	Rod Antenna	
	Standard accessories	
J0133K	Coaxial Cord (3CA-P2 · RG-55/U · 3CA-P2), 5 m:	1 pc
J0397	Control Cable, 5 m:	1 pc
W0493CE	MP415B Instruction Manual (supplied with MP415B):	1 copy
	Optional accessories	
	Tripod	
MB27A	Adaptor (N-P · BNC-J)	
J0040	Band Selector	

LOOP ANTENNA
MP414B
9 kHz to 30 MHz

The MP414B can be used with the Spectrum Analyzer.

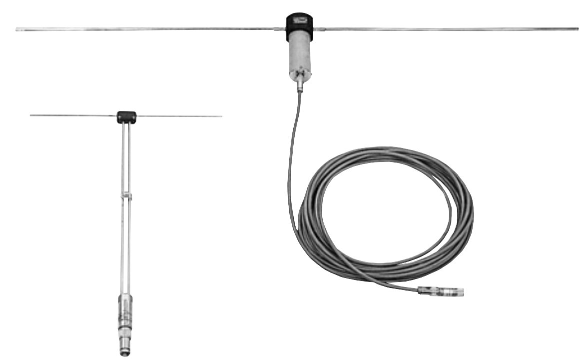
Specifications

Frequency Range	9 kHz to 30 MHz
Impedance	50Ω
Connector	BNC
Power Supply	Required Band Selector separately
Dimensions and Mass	616 × 616 mm, ≤8 kg

Ordering Information
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MP414B	Loop Antenna	
	Standard accessories	
J0133K	Coaxial Cord (3CA-P2 · RG-55/U · 3CA-P2), 5 m:	1 pc
J0397	Control Cable, 5 m:	1 pc
W0491AE	MP414B Operation Manual (supplied with MP414B):	1 copy
	Optional accessories	
	Tripod	
MB27A	Adaptor (N-P · BNC-J)	
J0040	Band Selector	

STANDARD DIPOLE ANTENNA
MP652B
30 MHz to 1000 MHz



Build-to order product

The MP652B Standard Dipole Antenna is an intermediate standard antenna for calibration of dipole antennas and field-strength meters used in precision measurements at 23 fixed frequencies over the 30 MHz to 1000 MHz range.
The MP652B antenna coefficients are calibrated so that when an antenna's major directional axis faces arriving plane waves, the antenna output voltage can be measured to determine the local field strength.
Once this standard field is established, the MP652B antenna and the dipole antenna under test are exchanged and the relative outputs are used to calculate the coefficient of the antenna under test.
To allow easy antenna changes during calibration, the set includes a dedicated antenna stand.

Features
- At frequencies below 250 MHz, the measurement deviation due to variations in the antenna altitude have been reduced by raising the impedance of the baluns.
- The impedance matching of the antennas to the detector has been improved by using a fixed attenuator.
- The dipole elements have a uniform diameter and are without discontinuities.
- The use of separate dipole elements for each frequency optimizes the repeatability of setups and measurements.
- The 30 MHz and 37 MHz dipoles employ a separable structure for easy handling.

Specifications

Frequencies	30, 37, 45, 55, 65, 75, 85, 100, 120, 150, 180, 200, 225, 250, 300, 350, 400, 500, 600, 700, 800, 900, 1000 MHz (23 frequencies)
Output Impedance	50Ω
VSWR	≤1.1
Directivity	Front-back ratio: 0 ±0.3 dB
Antenna Factor Accuracy	≤±1 dB*
Polarization	Plane polarized
Test Antennas	Half-wave dipoles

*: Measured with respect to Anritsu's in-house electric field standards, which are regularly calibrated to the standards of the Telecom Engineering Center (TELEC) Foundation.

Composition

Baluns	30 MHz to 85 MHz: 1 pc 100 MHz to 250 MHz: 1 pc 300 MHz to 400 MHz: 1 pc 500 MHz to 1000 MHz: 1 pc
Dipole Elements	For 23 frequencies
Coaxial Cable	15 m cable (S-5DWP·5D-2W·S-5DWP): 1 pc
Fixed Attenuator	10 dB: 1 pc
Packing Box	Holds baluns, Dipole elements, and Fixed attenuator Dimensions: 1600 (W) × 260 (H) × 250 (D) mm Mass: <30 kg (packed)
Packing Bag	Holds coaxial cable
Antenna Stand	Main unit, Antenna holder (3 pcs), Rope, Hammer, Post, Coupling bracket, Packing box

Ordering Information
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MP652B	Standard Dipole Antenna (Build-to order product)	
	Standard accessories	
B0081A	Packing Box (for MP652B):	1 pc
B0082A	Packing Bag (for coaxial cable):	1 pc
B0083	Antenna Stand (for MP652B):	1 set
W0291CE	MP652B Instruction Manual:	1 copy
	MP652B Test Result:	1 copy

SIGNAL GENERATOR
MG724E12/G12

MG724E12: 6.3 GHz to 7.8 GHz, MG724G12: 12 GHz to 13 GHz

For Maintaining and Adjusting Microwave Links

Build-to order product

The MG724E12/G12 are a compact lightweight microwave signal generator, designed for medium – and small – capacity microwave line repeater maintenance or adjustment. The instrument is best suited to measure AGC characteristics, squelch function, and signal-to-noise ratio. Its high signal purity and frequency stability also enable it to be used as a general-purpose signal source for microwave receiver adjustment on a production line.

Features

- High signal purity
- High frequency stability
- Wide output level range
- Small and Lightweight

Specifications

Model		MG724E12	MG724G12
Frequency Range		6.3 GHz to 7.8 GHz	12 GHz to 13 GHz
Frequency Accuracy		0.3%	
RF Output	Level*	–100 to –5 dBm (Max.: 0 dBm)	
	Level Accuracy*	±1.5 dB	
	VSWR*	≤1.7	
FREQ. CHECK Output		≥–5 dBm	
Output Connector		N-type	
SSB FM Noise		–95 dBc/Hz (10 kHz offset)	–75 dBc/Hz (10 kHz offset)
Power Supply		AC 100 V, 50 Hz/60 Hz, ≤10 VA	AC 100 V, 50 Hz/60 Hz, ≤30 VA
Dimensions and Mass		240 (W) × 135 (H) × 130 (D) mm, ≤4 kg	

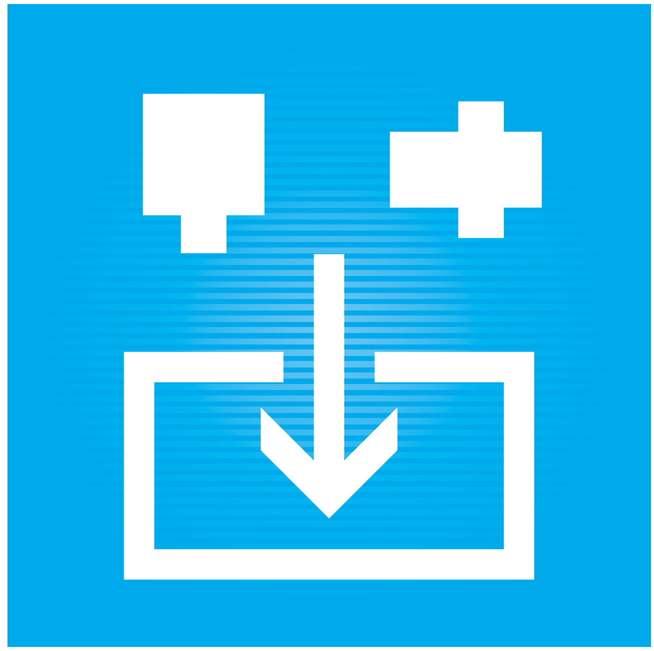
*: The value when measured at the end of the 2 m cable attached.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name	
	Main frame	
MG724E12	Signal Generator (build-to order product)	
MG724G12	Signal Generator (build-to order product)	
	Standard accessories	
J0114B	Coaxial Cord (UG-21D/U · RG-9A/U · UG-21D/U), 2 m:	1 pc
J0246	MX-913/U Connector Cap (N-type):	1 pc
	Power Cord:	1 pc
F0016	Fuse, 0.2 A (for MG724E1):	2 pcs
F0017	Fuse, 0.315 A (for MG724G1):	2 pcs
F0039	Fuse, 0.2 A (for MG724E1):	1 pc
F0042	Fuse, 0.8 A (for MG724G1):	1 pc
W0082CE	MG724[ ]12 Operation Manual:	1 copy
	Application equipment	
B0051	Front Cover	

Model designation
MG724[ ]12: With power supply



COMPONENTS

Fixed Attenuator 803
Fixed Attenuator for High Power Measurement........ 803
Termination.. 804
50Ω ↔ 75Ω Impedance Transformer........................ 804
Bias Tee 805
Phase Shifter... 806
T-Pad.. 807
Four-port Junction Pad... 807
CM Directional Coupler 808
Directional Coupler.. 808
50Ω Coaxial Switch 809
High-pass Filter 809
Band Pass Filter... 810
RF Fuse Holder.. 810
Fuse Element 810
32 Gbps LN Driver 811
9.5 - 11.5 GHz × 4 Frequency Multiplier.................. 814
50 Gb/s EA Driver Module 815
High Speed Digital ICs.. 817
Precision RF & Microwave Components.................. 818

FIXED ATTENUATOR
MP721 Series

DC to 12.4 GHz

MP721F

The MP721 Series Fixed Attenuator with attenuation values of 3, 6, 10, 20, 30, 40, 50, and 60 dBm is used to adjust level and improve impedance.
It supports frequencies of DC to 12.4 GHz with excellent attenuation frequency characteristics, attenuation accuracy and VSWR.

Specifications

Model	Attenuation	Attenuation Accuracy	VSWR
MP721A	3 dB	0.3 dB	1.25 (DC to 8 GHz) 1.35 (8 GHz to 12.4 GHz)
MP721B	6 dB		1.2 (DC to 8 GHz) 1.3 (8 GHz to 12.4 GHz)
MP721C	10 dB		
MP721D	20 dB	0.5 dB	
MP721E	30 dB		
MP721F	40 dB	1.0 dB (DC to 8 GHz) 1.5 dB (8 GHz to 12.4 GHz)	
MP721G	50 dB		
MP721H	60 dB		

Common Specifications

Maximum Allowable Power	2 W
Impedance	50Ω
Connector	N-type
Operating Temperature Range	0° to 50°C
Dimensions and Mass	21ø × 63.5 mm, ≤100 g

FIXED ATTENUATOR FOR HIGH POWER MEASUREMENT

DC to 9 GHz/12.4 GHz/18 GHz

J0063

Specifications

Model	J0063	J0078
Frequency Range	DC to 12.4 GHz	DC to 18 GHz
Attenuation	30 dB	20 dB
Attenuation Accuracy	±0.7 dB	±0.5 dB
VSWR (Max.)	1.06 + 0.02f (GHz)	1.15 (DC to 4.0 GHz) 1.20 (4.0 GHz to 8.0 GHz) 1.25 (8.0 GHz to 12.4 GHz) 1.40 (12.4 GHz to 18.0 GHz)
Maximum Allowable Power	10 W (40 dBm)	
Connector	N-type, 50Ω	

Model	J0395	B0472
Frequency Range	DC to 9 GHz	DC to 18 GHz
Attenuation	30 dB	30 dB
Attenuation Accuracy	±0.5 dB	±1.0 dB
VSWR (Max.)	1.2 (DC to 4.0 GHz) 1.3 (4.0 GHz to 9.0 GHz)	1.25 (DC to 8.0 GHz) 1.35 (8.0 GHz to 12.4 GHz) 1.45 (12.4 GHz to 18.0 GHz)
Maximum Allowable Power	30 W (44.7 dBm)	100 W (50 dBm)
Connector	N-type, 50Ω	

TERMINATION
MP752A/B
DC to 12.4 GHz

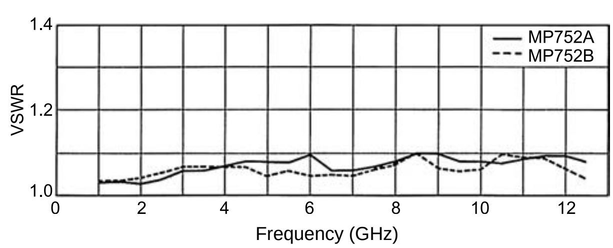
MP752A

MP752B

The MP752A/B Termination is a 50-Ω coaxial terminator with excellent VSWR across a frequency range of DC to 12.4 GHz.

Specifications

Model	MP752A	MP752B
Impedance	50Ω	
VSWR	1.15 (DC to 8 GHz), 1.20 (8 GHz to 12 GHz)	
Maximum Allowable Power	2 W	
Connector	N-P	N-J
Operating Temperature Range	0° to 50°C	
Dimensions and Mass	20ø × 48 mm, ≤80 g	19ø × 50 mm, ≤80 g



Characteristics

50Ω ↔ 75Ω IMPEDANCE TRANSFORMER
MP614B, MB-009
50 MHz to 1200 MHz DC to 2 GHz

MP614B

The MP614B is used over the range from 50 MHz to 1200 MHz mainly for changing the impedance of a measuring signal source such as a signal generator. It is a transformer type, so that it has a smaller loss than a resistance attenuator type, and does not lower the signal source level. When the output level of a signal generator is shown in a power unit as in dBm, the output level after impedance transforming by the MP614B will have a value which is obtained by subtracting the insertion loss (dB) of the impedance transformer from the output level of the signal generator.
The MB-009 is constructed so that the central connector will not be damaged if a 50Ω N-type plug is connected by mistake to the 75Ω side.

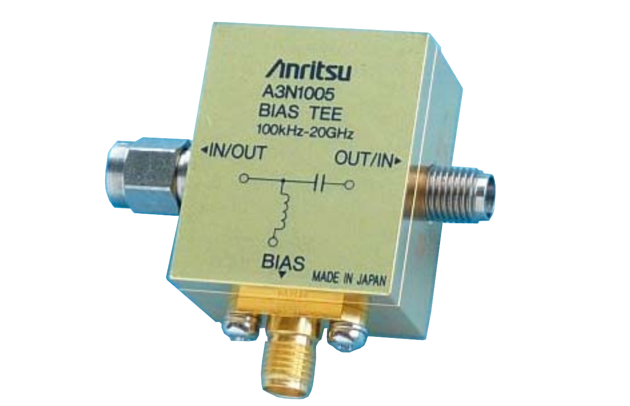
Specifications

Model	MP614B	MB-009
Frequency Range	50 MHz to 1200 MHz	DC to 2 GHz
Impedance Characteristics	VSWR: ≤1.2 (50 MHz to 600 MHz) ≤1.3 (≥600 MHz) ∗On the 75Ω side by terminating the 50Ω side	VSWR: ≤1.2 ∗On both sides of 50 and 75Ω
Connector	N-P (50Ω), NC-J (75Ω)	
Insertion Loss	≤1 dB (<600 MHz) ≤1.5 dB (≥600 MHz)	6.2 dB ±0.5 dB
Maximum Allowable Power	1 W	0.5 W
Operating Temperature Range	0° to 45°C	
Dimensions and Mass	21ø × 70 mm, ≤100 g	21ø × 65 mm

BIAS TEE

A3N1000 Series

8 kHz to 20 GHz



A3N1005

Features

Wide Bandwidth, High Current Rating , Low Insertion Loss

Applications

Testing for high frequency semiconductors
Optical and high speed communications

Absolute maximum ratings

Maximum Bias Voltage	±30 V(dc)
Maximum Bias Current	±0.5 A
Operating Temperature	0° to 60°C

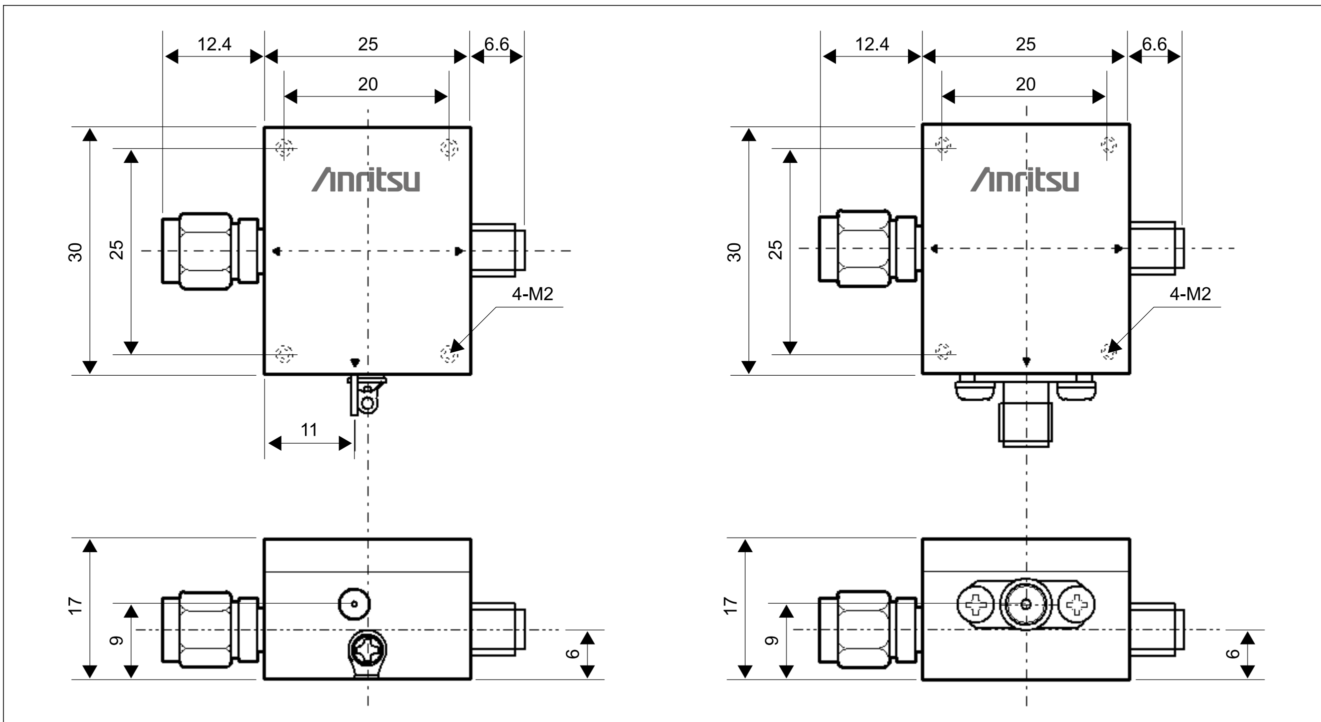
Specifications

Ta = 25°C, Zin = 50Ω, Zout = 50Ω

Items	Conditions	Min.	Typ.	Max.
Bandwidth	–3 dB	100 kHz		20 GHz
Insertion Loss	100 kHz		2 dB	3 dB
	200 kHz		0.5 dB	
	1 GHz		0.2 dB	
	10 GHz		1 dB	
	20 GHz		2 dB	3 dB
Return Loss	Within bandwidth	12 dB	20 dB	
Rise Time, Fall Time	*		18 ps	20 ps
Connectors		K		

* Rise/Fall time of A3N1000 series is calculated as follows.
$T_r, T_f = (T_m^2 - T_s^2 - T_i^2)^{1/2}$
Tm: Measurement value by Oscilloscope
Ts: Tr, Tf of Oscilloscope
Ti: Tr, Tf of Signal Generator

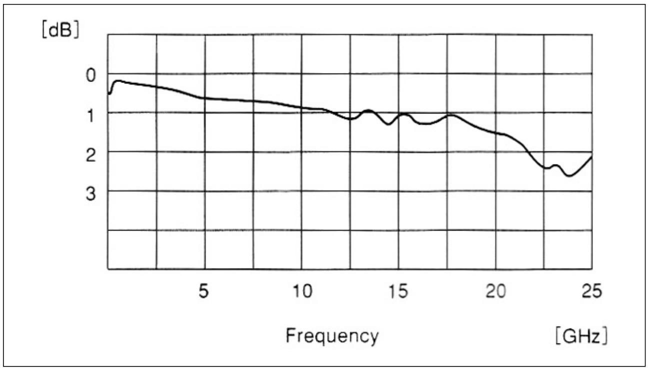
Dimensions



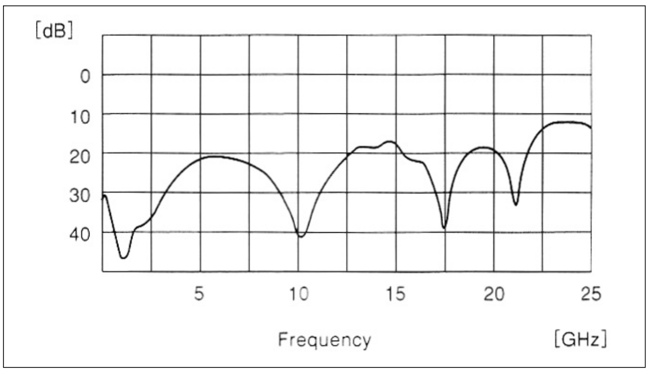
Model #	In/Out	Out/In	Bias
A3N1001	K-(m)	K-(f)	Soldering terminal
A3N1002	K-(f)	K-(m)	
A3N1003	K-(f)	K-(f)	
A3N1004	K-(m)	K-(m)	

Model #	In/Out	Out/In	Bias
A3N1005	K-(m)	K-(f)	SMA-(f)
A3N1006	K-(f)	K-(m)	
A3N1007	K-(f)	K-(f)	
A3N1008	K-(m)	K-(m)	

A3N1000 Series Bias Tee Typical Data



Insertion Loss

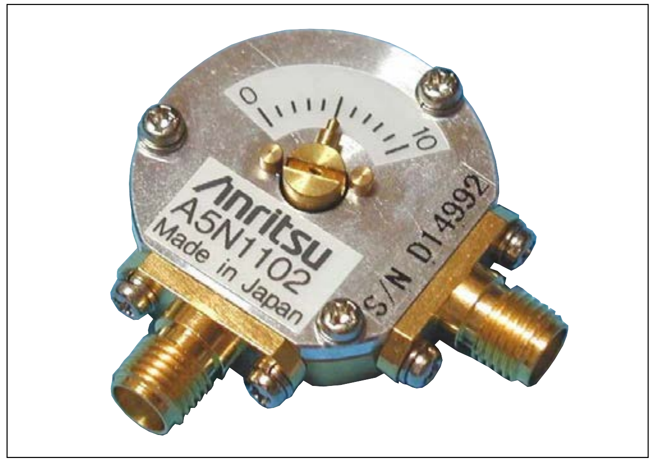


Return Loss

PHASE SHIFTER

A5N1102

DC to 11 GHz



The A5N1102 is a compact, half-fixed, phase shifter with mechanical delay circuit for adjusting the phase of high-speed digital circuits in the DC to 11 GHz band.

Features

Bandwidth: DC to 11 GHz
Low insertion loss: 1.2 dB max. (11 GHz)
Size: 35 × 35 × 8.5 mm
Weight: About 25 g

Specifications

Frequency range: DC to 11 GHz
Minimum delay Time: 320 ps (typ.)
Maximum delay Time: 430 ps (typ.)
Phase shift range: 40°/GHz (typ.)

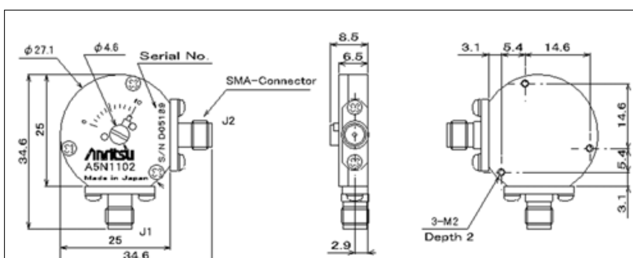
Functions

Adjustment angle: About 98°
Adjustment axis: Slot for screwdriver

Operating Environment

Operating temperature range: –5° to +70°C
Storage temperature: –20° to +75°C
Vibration: 10 Hz to 55 Hz, Total amplitude 1.5 mm
Shockproofing: 490 m/s^2

External Dimensions Diagram



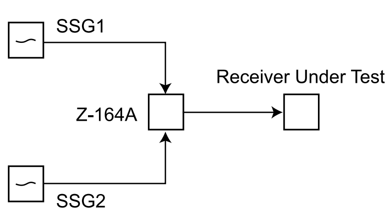
Mass: Approx. 25 g

T-PAD
Z-164A
DC to 1 GHz

The Z-164A is used as a matching pad for applying the mixed output of two signal generators to the input terminal of a receiver for measuring two-signal characteristics (such as the blocking and intermodulation characteristic) of the receiver.

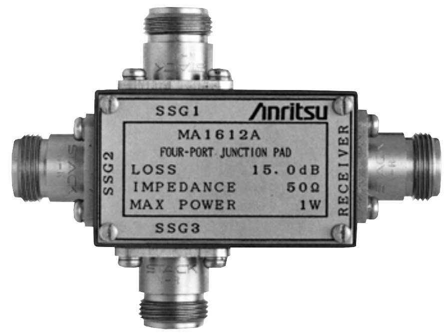
Specifications

Frequency Range	DC to 1 GHz
Insertion Loss	6 ±0.5 dB (voltage ratio)
Impedance Characteristics	50Ω VSWR: ≤1.3 (<500 MHz), ≤1.5 (≥500 MHz)
Connector	N (S)-J
Maximum Allowable Power	0.5 W
Operating Temperature Range	0° to 45°C



Connection for Measuring Two-signal Characteristics

FOUR-PORT JUNCTION PAD
MP659A, MA1612A
40 MHz to 1 GHz 5 MHz to 3 GHz

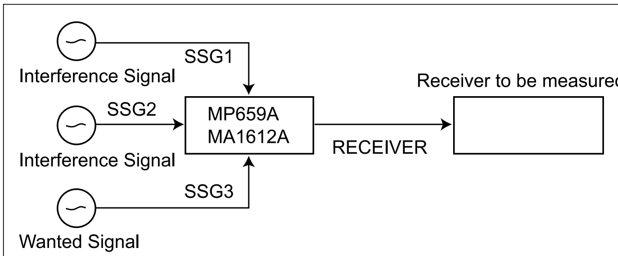


MA1612A

The MP659A and MA1612A are used as an impedance matching box applying the mixed output of three RF signal generators to a receiver input terminal for measurement of three-signal characteristics (such as receiver SINAD performance).

Specifications

Model	MP659A	MA1612A
Frequency Range	40 MHz to 1 GHz	5 MHz to 3 GHz
Insertion Loss	10.5 ±1 dB	15 ±1.0 dB (<1 GHz) 15 ±1.5 dB (≥1 GHz)
Impedance Characteristics	50Ω VSWR: ≤1.3 (<500 MHz) ≤1.5 (≥500 MHz)	50Ω VSWR: ≤1.4 (<1 GHz) ≤2.0 (≥1 GHz)
Connector	N (S)-J	
Isolation	SSG1-SSG2: ≥30 dB SSG1-SSG3: ≥30 dB SSG2-SSG3: ≥25 dB	SSG1-SSG2, SSG1-SSG3: ≥30 dB (<1 GHz) ≥25 dB (<2 GHz) ≥20 dB (≤3 GHz) SSG2-SSG3: ≥20 dB
Maximum Allowable Power	1 W	
Operating Temperature Range	0° to 50°C	



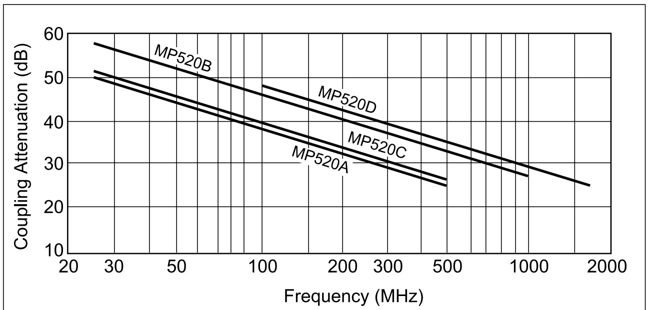
CM DIRECTIONAL COUPLER
MP520 Series
25 MHz to 1700 MHz

MP520A

This coupler is used in the measurement of fundamental frequency power and spurious power which supplies coaxial feeders in VHF and UHF bands. Various models are provided in accordance with feeder impedance and frequency. It is also capable of measuring the VSWR of antenna systems.

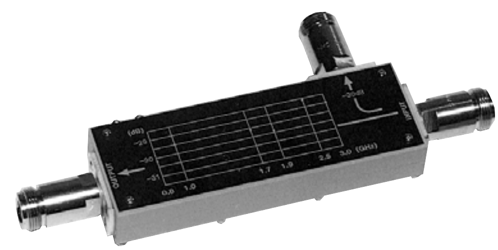
Specifications

Model	MP520A	MP520B	MP520C	MP520D
Frequency Range	25 MHz to 500 MHz	25 MHz to 1000 MHz	25 MHz to 500 MHz	100 MHz to 1700 MHz
Impedance	75Ω, NC-type connector		50Ω, N-type connector	
Coupling Attenuation	Approx. 38 dB at 100 MHz	Approx. 46 dB at 100 MHz	Approx. 40 dB at 100 MHz	Approx. 28 dB at 100 MHz
Directivity	≥20 dB			
Termination	50Ω, VSWR: ≤1.07			
Maximum Allowable Power	200 W			
Operating Temperature Range	0° to 45°C			
Dimensions and Mass	98 (W) × 56 (H) × 26 (D) mm, ≤400 g			
Accessories Supplied	Coaxial Cord (S-5DWP · 5D-2W · S-5DWP), 1 m: 1 pc Termination (50Ω): 1 pc			



Coupling Attenuation Characteristics

DIRECTIONAL COUPLER
MP654A
0.8 GHz to 3 GHz

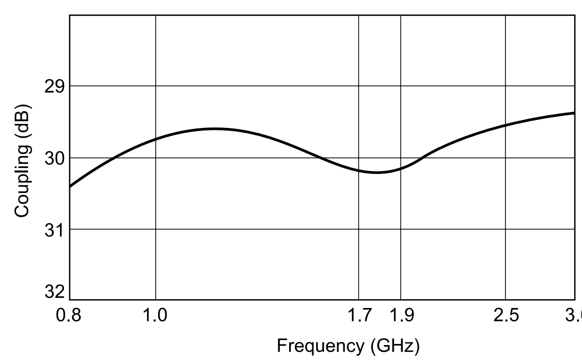


The MP654A is used to branch one part of the transmitted output for such measurements as those of fundamental wave and higher harmonic spurious characteristics using a spectrum analyzer. The MP654A is used for measuring personal radio transceivers and automobile telephones.

Specifications

Frequency Range	0.8 GHz to 3 GHz
Impedance	50Ω, N-type connector
Coupling	Approx. 30 dB*
Input Power (max.)	50 W

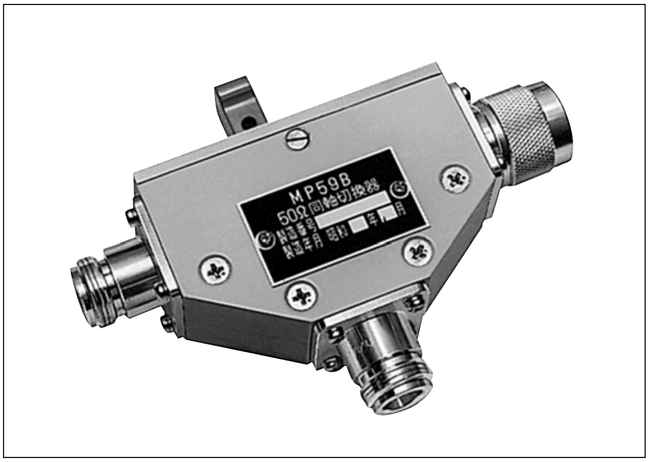
*: Calibration data reattached



50Ω COAXIAL SWITCH

MP59B

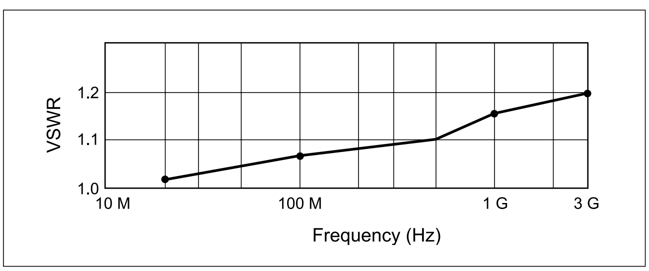
DC to 3 GHz



The MP59B 50Ω Coaxial Switch is used to switch signals in high-frequency measurement circuits.
Its low insertion loss and high isolation performance support all types of measurement.

Specifications

Frequency Range	DC to 3 GHz
Impedance	50Ω
Connector	Common: N-J, Switch: N-J, N-P
VSWR	≤1.2 (DC to 1 GHz), ≤1.5 (≥1 GHz)
Insertion Loss	≤0.2 dB (DC to 1 GHz), ≤0.5 dB (≥1 GHz)
Isolation	≥55 dB (DC to 1 GHz), ≥40 dB (≥1 GHz)
Maximum Allowable Power	100 W
Operating Temperature Range	0° to 45°C

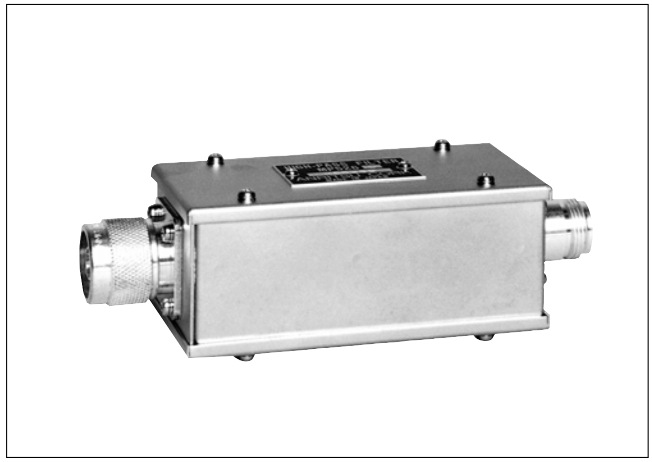


Characteristic

HIGH-PASS FILTER

MP526 Series

27, 60, 150, 250, 400 MHz bands



The MP526 series is for measuring the spurious characteristics with a field strength meter or a spectrum analyzer. Eliminating the fundamental signal by using a filter prevents the internal spurious of the field strength meter or spectrum analyzer due to an excessive input to facilitate measurement. The MP526A, B, C, D, and G are available to suit the five different frequency bands.

Specifications

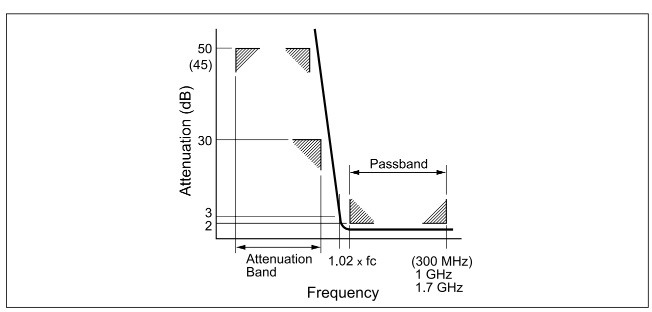
Model	MP526A	MP526B
Frequency Band	60 MHz	150 MHz
Attenuation Band	50 MHz to 80 MHz	120 MHz to 190 MHz
Cut-off Frequency (fc)	100 MHz	240 MHz
Attenuation Characteristics	≥50 dB (70 MHz) ≥30 dB (80 MHz)	≥50 dB (170 MHz) ≥30 dB (190 MHz)

Model	MP526C	MP526D
Frequency Band	250 MHz	400 MHz
Attenuation Band	200 MHz to 300 MHz	335 MHz to 520 MHz
Cut-off Frequency (fc)	400 MHz	670 MHz
Attenuation Characteristics	≥50 dB (280 MHz) ≥30 dB (300 MHz)	≥50 dB (470 MHz) ≥30 dB (300 MHz)

Model	MP526G
Frequency Band	27 MHz
Attenuation Band	26 MHz to 30 MHz
Cut-off Frequency (fc)	52 MHz
Attenuation Characteristics	≥45 dB (28 MHz), ≥30 dB (30 MHz)

Common Specifications

Passband	≥(1.02 × fc), ≤1 GHz, ≤1.7 GHz (400 MHz band), ≤300 MHz (27 MHz band)
Insertion Loss	≤2 dB in passband
Maximum Allowable Power	10 dBm
Characteristic Impedance	50Ω (nominal), Connector: N-type
Operating Temperature Range	0° to 45°C
Dimensions and Mass	51 (W) × 48 (H) × 138 (D) mm, ≤400 g



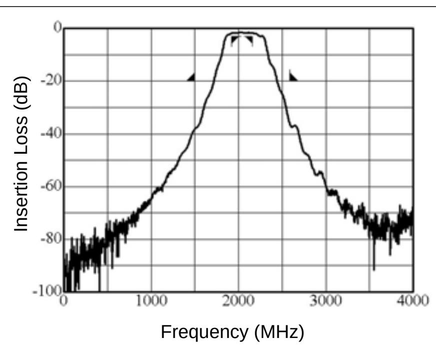
BAND PASS FILTER
MA2512A
1.92 GHz to 2.17 GHz

Build-to order product

When the signal generator outputs an IMT-2000 test signal, sometimes spurious signals generated by the circuits in the signal generator are an obstacle for tests. In this case, connect the MA2512A to filter these unwanted signals. The MA2512A has excellent amplitude ripple and group delay characteristics in the frequency band of IMT-2000, because the MA2512A does not degrade modulation accuracy of the signal generator.

Specifications

Pass Band	Frequency range: 1.92 GHz to 2.17 GHz Insertion loss: ≤3.5 dB Ripple: ≤0.2 dB (at 5 MHz bandwidth) Group delay: ≤1 ns (at 5 MHz bandwidth) Impedance: 50Ω Return loss: ≥15 dB
Filter Band	Frequency range: DC to 1.5 GHz, 2.58 GHz to 7 GHz Attenuation: ≥20 dB (<5 GHz), ≥10 dB (≥5 GHz)
I/O Connector	N-J
Maximum Allowable Power	1 W
Dimensions and Mass	148 (W) × 35 (H) × 31 (D) mm, ≤500 g



Frequency Characteristics

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MA2512A	**Main frame** Band Pass Filter (Build-to order product)
W1876AE	**Standard accessory** MA2512A Operation Manual: 1 copy

RF FUSE HOLDER
MP612A
DC to 1 GHz

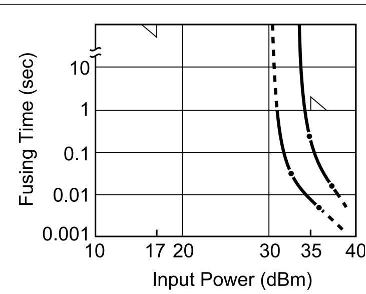
FUSE ELEMENT
MP613A

The MP612A RF Fuse Holder protects measuring instruments by preventing internal damage (parts burnout, etc.). The MP613A Fuse Element uses a vacuum-deposited metal resin film for low melting point and excellent high-frequency characteristics. The high fuse performance is designed to prevent damage even to 1/16 W small resistors commonly found in measuring instruments and offers superior protection for high-frequency measuring instruments, such as Frequency Counters and Spectrum Analyzers, against excessive input power or Signal Generators, against reverse input power.

Specifications

RF Fuse Holder	MP612A (without fuse elements)
Frequency Range	DC to 1 GHz
Impedance	50Ω unbalanced
VSWR	≤1.2 (50Ω termination)
Connector	N-P, N-J
Insertion Loss	≤0.5 dB
Rated Power	17 dBm (50Ω load)
Max. Fuse Rated Power	≤35 dBm (50Ω load)
Operating Temperature Range	0° to 45°C
Dimensions and Mass	20ø × 65 mm, ≤110 g

MP613A Fuse Element (5 pcs/set)



Fusing time (sec) and Input power (dBm) characteristics

32 Gbps LN DRIVER
AH34152A

Evaluations for Ultra High-speed and High-capacity Data Communication Systems

AH34152A

AH34152A Opt. 01

Features
High output voltage: 8 Vp-p (typ.)
Wideband: 50 kHz to 40 GHz
Variable output voltage: 4 Vp-p to 8 Vp-p
Variable cross point: 45 to 55%
Low power consumption: 1.7 W (typ.)
I/O interface: Single ended

Applications
Evaluations for 40G DQPSK/100G DP-QPSK optical modulators
Evaluations for high-speed semi-conductors

Absolute Maximum Ratings

Items	Symbols	Conditions	Min.	Max.
Input Voltage	Vin	NRZ		1 Vp-p
Supply Voltage	VG1		–3 V	1 V
	VC1	+0.5 V	0 V	+5 V
	VBT1	+2.5 V	0 V	+5 V
	VG2		–9 V	0 V
	VC2	+2.0 V	–3 V	+4 V
	VBT2	+7.0 V	0 V	+10 V
	DET_BIAS		0 V	+10 V
Operating Temperature	Tc		+5°C	+50°C
Storage Temperature	Tstg		–20°C	+85°C

Specifications

• Pulse Responses*1

Ta = 25°C, VC1 = +0.5 V, VBT1 = +2.5 V, VC2 = +2 V, VBT2 = +7 V, Zin = 50Ω, Zout = 50Ω

Items	Conditions	Min.	Typ.	Max.
Bit Rate	NRZ	32 Gbps		
Max. Output Voltage Swing	Vin = 0.5 Vp-p 32 Gbps	7 Vp-p	8 Vp-p	
Min. Output Voltage Swing			4 Vp-p	4.5 Vp-p
Additional Jitter*2			600 fs (rms)	
Rise Time/Fall Time	20 to 80%		11 ps	15 ps
Cross Point Adjustability		45%	50%	55%
Output Polarity			Non-inverted	

• Frequency Responses*3

Items	Conditions	Min.	Typ.	Max.
Voltage Gain	1 GHz	24 dB	26 dB	
Bandwidth	–3 dB (Low end)		50 kHz*4	100 kHz
	–3 dB (High end)	30 GHz	40 GHz	
Group Delay	40 MHz to 30 GHz		±100 ps	
Input Return Loss	40 MHz to 30 GHz		10 dB	
Output Return Loss	40 MHz to 30 GHz		10 dB	

*1: In the case of being measured in following conditions.
- Connect 30 cm K cable to the output of AH34152A.
- Measured by 86118A remote sampling head using 86107A precision time base manufactured by Agilent Technologies Inc.

*2: Jitter (add) = (Jitter $(out)^2$ – Jitter $(in)^2)^{1/2}$
*3: Reference value.
*4: In the case of being operated by Option 01 bias-board.

• Power Supplies

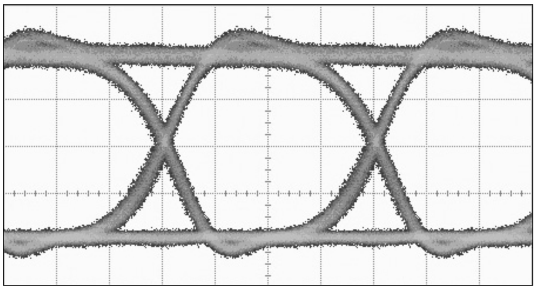
Items	Conditions	Min.	Typ.	Max.
Current Consumption	VG1	–5 mA	0 mA	
	VC1		0 mA	5 mA
	VBT1		50 mA	100 mA
	VG2	–30 mA	–5 mA	
	VC2	–20 mA	0 mA	
	VBT2		220 mA	320 mA
	DET_BIAS		0.1 mA	
Total Power Consumption			1.7 W	

Characteristics

• Eye Pattern

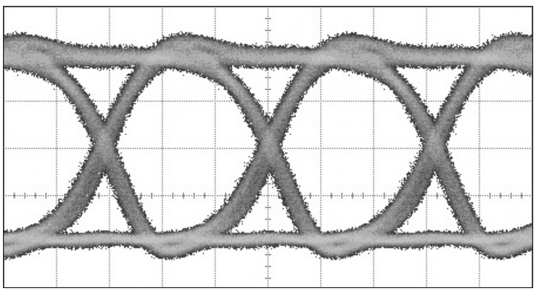
25 Gbit/s

Vout = 7.9 Vp-p, Jitter = 680 fs(rms)



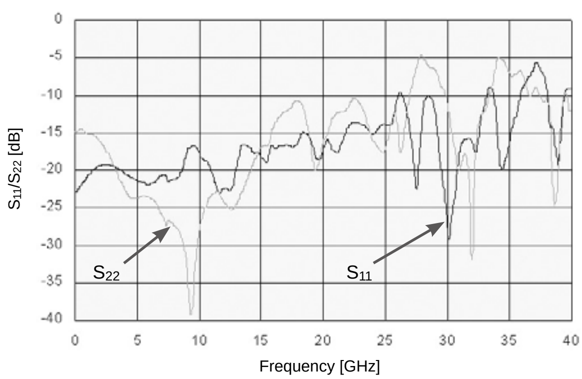
32 Gbit/s

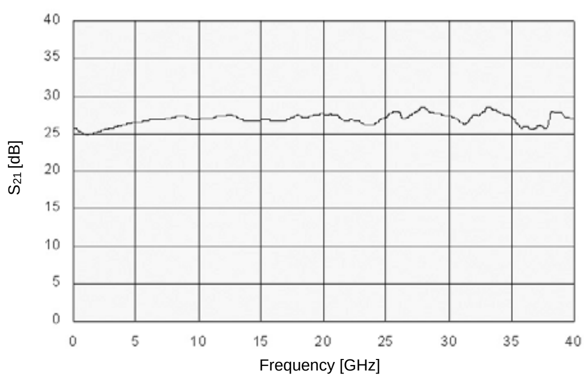
Vout = 7.9 Vp-p, Jitter = 980 fs(rms)



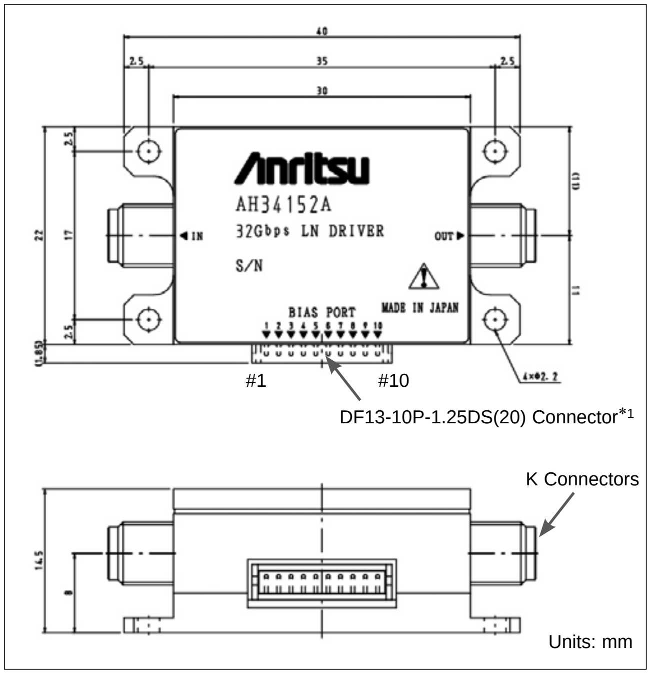
V: 2 V/div H: 10 ps/div

• S-parameters





Dimensions



#	Symbols	Supply Voltages	Functions	Remarks
1	GND	GND	Ground	
2	VG1	(–0.1 V)	1st Stage Gate Bias	*2, *3
3	VC1	+0.5 V	1st Stage Control Bias	*2, *3
4	VBT1	+2.5 V	1st Stage Drain Bias	*2, *3
5	DET_REF		Output of Detector Reference	
6	DET_BIAS	(= VBT2)	Detector Reference Bias	
7	VG2	(–2.0 V)	2nd Stage Gate Bias	Adjust Cross Point*2, *3
8	VC2	+2.0 V	2nd Stage Control Bias	*2, *3
9	VBT2	+7 V	2nd Stage Drain Bias	Adjust Output Voltage*2, *3
10	DET_OUT		Detector Output	
11	IN		RF Input Port	K Connector
12	OUT		RF Output Port	K Connector

∗1: Please supply bias voltages to the module through DF13-10S-1.25C connector.
∗2: Please be careful about turning powers on/off sequence because this module dosen't have sequence circuit inside.
∗3: Available accessory Option 01 Bias-board can contribute sequence-free power supplies and easy waveform adjustments.

AH34152A Opt. 01 Bias-board

Features
Power supply: +9 V/–7 V
Built-in power sequence circuit
Waveform adjustment
- Output voltage
- Cross point

Application
Supply bias voltage to AH34152A LN Driver

Absolute Maximum Ratings

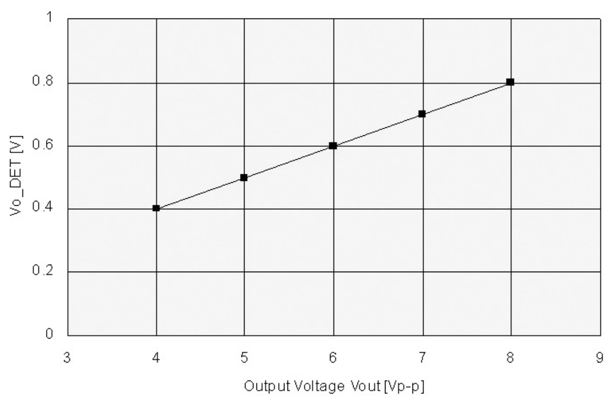
Items	Symbols	Conditions	Min.	Max.
Supply Voltage	V+	+9 V	0 V	+10 V
	V–	–7 V	–8 V	0 V
Operating Temperature	Tc		+5°C	+50°C
Storage Temperature	Tstg		–20°C	+85°C

Specifications
(Vo = 8 Vp-p, Duty: 50%)

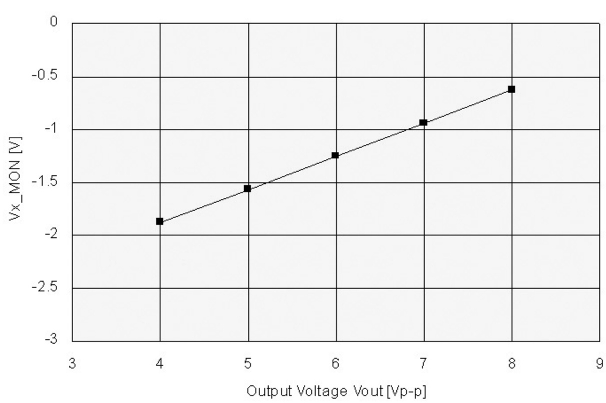
Items	Conditions	Min.	Typ.	Max.
Current Consumption	+9 V		300 mA	380 mA
	–7 V	–60 mA	–30 mA	
Total Power Comsumption			2.9 W	

Reference Charactristics

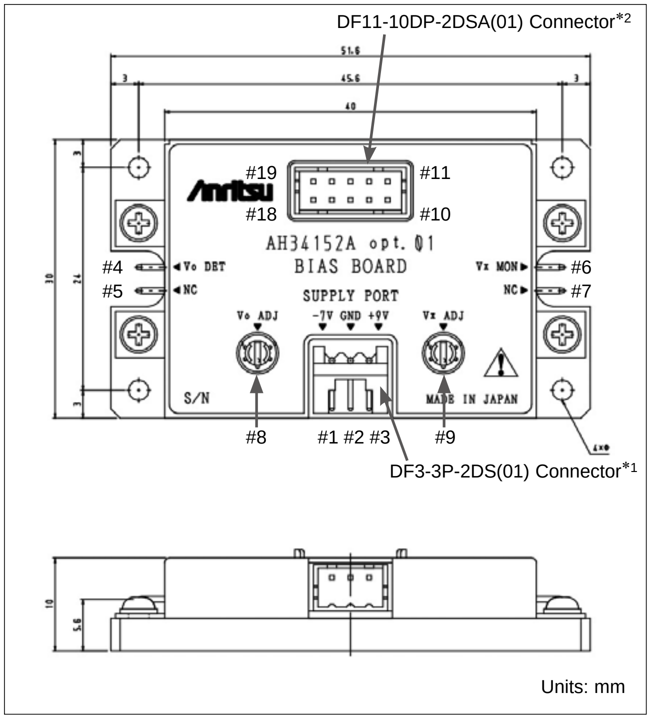
- **Vo_DET vs. Vout (Duty: 50%)**



- **Vx_MON vs. Vout (Duty: 50%)**



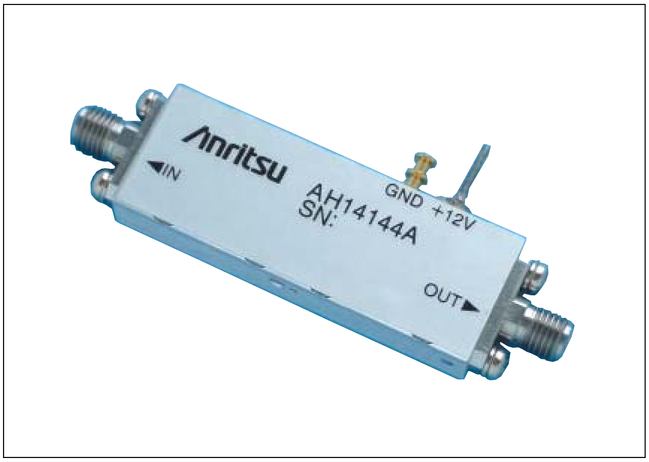
Dimensions



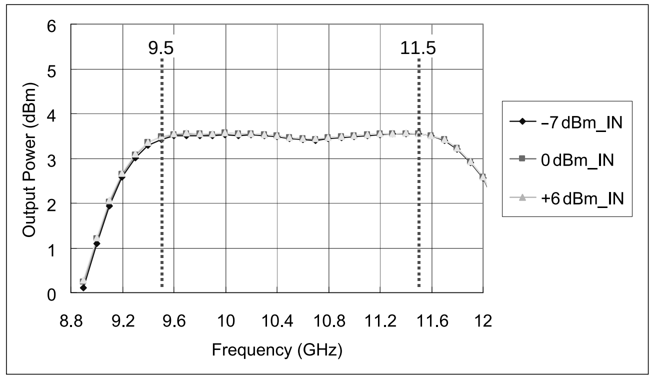
#	Symbols	Supply voltages	Functions	Remarks
1	V–	–7 V	DC Power Terminal	*3
2	GND	GND	Ground	
3	V+	+9 V	DC Power Terminal	*3
4	Vo_DET		Output Amplitude Detector Terminal	
5	(NC)			
6	Vx_MON		Cross Point Monitor Terminal	
7	(NC)			
8	Vo_ADJ		Output Amplitude Adjust Trimmer	
9	Vx_ADJ		Cross Point Adjust Trimmer	
10 to 19			Bias Terminals for AH34152A	*3

∗1: Please connect by attached F3-3S-2C cable or DF3-3S-2C connector.
∗2: Please connect to AH34152A driver by attached DF13-DF11 cable.
∗3: Don't have to care the sequence of plus and minus power ON/OFF because this bias board contains a sequence circuit.

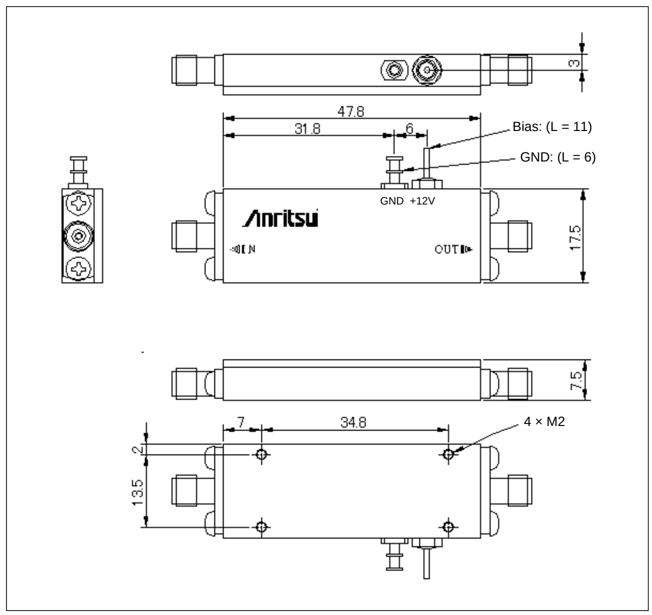
9.5 - 11.5 GHz × 4 FREQUENCY MULTIPLIER
AH14144A



Electrical Characteristics



Dimensions



Features

Output power: +3 dBm
Harmonics spurious: 34 dBc
Non-harmonics spurious: 60 dBc
Single supply: +12 V (125 mA)

Applications

R&D of optical communications
Microwave measurements

Absolute Maximum Ratings

Bias Voltage	+13 Vdc
Operating Temperature	0° to +60°C
Storage Temperature	–30° to +75°C

Specifications

Ta = 25°C, Vcc = +12 V, Zin = 50Ω, Zout = 50Ω

Items	Min.	Typ.	Max.
Input Frequency Range	2.375 GHz		2.875 GHz
Output Frequency Range	9.5 GHz		11.5 GHz
Input Power	–7 dBm		+6 dBm
Output Power	+2 dBm		+4 dBm
Power Flatness		0.5 dB	
Harmonics Spurious	34 dBc		
Non-Harmonics Spurious	60 dBc		
Input VSWR		1.4	1.8
Output VSWR		2.0	
Supply Current		125 mA	
Connectors		SMA	

50 Gb/s EA DRIVER MODULE

AH54147A

Features

High output voltage
Wideband
Adjustable amplitude & crossing
Bias tee built-in
Low power consumption (heatsink-free)

Applications

Evaluation of optical modulators
Evaluation of high speed semiconductors

Absolute Maximum Ratings

Items	Symbol	Conditions	Min.	Max.
Input Voltage	Vin	NRZ		1 Vp-p
Supply Voltage	V+	+6 V	0 V	+7 V
	V–	–5 V	–6 V	0 V
	Vx		–5 V	+5 V
	Vamp		0 V	+6 V
	Vofs		–5 V	+5 V
Offset Current	Iofs			250 mA
Operating Temperature	Tc		+5°C	+50°C
Storage Temperature	Tstg		–20°C	+85°C

Specifications

• Frequency Response

Tc = 30°C, V+ = +6 V, V– = –5 V, Zin = 50Ω, Zout = 50Ω

Items	Conditions	Min.	Typ.	Max.
Voltage Gain	2 GHz		20 dB	
Bandwidth	–3 dB (Low end)		50 kHz	
	–3 dB (High end)		50 GHz	
Gain Flatness	2 GHz to 40 GHz		±0.5 dB	
Group Delay	2 GHz to 40 GHz		±25 ps	
Input Return Loss	40 MHz to 40 GHz		–15 dB	
Output Return Loss	40 MHz to 40 GHz		–15 dB	

• Pulse Response*1

Items	Conditions	Min.	Typ.	Max.
Bit Rate	NRZ		50 Gb/s	
Maximum Output Voltage*2	Vin = 0.7 Vp-p 50 Gb/s	3.5 Vp-p	3.7 Vp-p	
Minimum Output Voltage*2				1 Vp-p
Jitter			500 fs (rms)	
Tf/Tf	20 to 80%		8 ps	
Eye Crossing Adjust*3	Bit Rate <45 Gbit/s	30%	50%	70%
	Bit Rate >45 Gbit/s	35%	50%	65%
Output Polarity			Non-invert	

∗1: The specifications are based on the measurement using the Agilent 86118A 70 GHz Remote sampling head and 86107A Precision time base. Moreover, the 50 cm V type semi-rigid coaxial cable is connected between the driver's output and the sampling head.
∗2: The output amplitude is adjusted by applying a positive voltage to the "Vamp" pin.
∗3: The eye crossing is adjusted by applying a positive or negative voltage to the "Vx" pin.

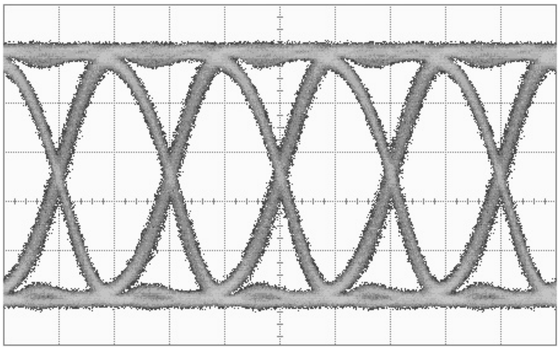
• Power Supply

Items	Conditions	Min.	Typ.	Max.
Supply Current	+6 V		170 mA	250 mA
	–5 V		20 mA	30 mA
Power Consumption			1.12 W	

Electrical Characteristics

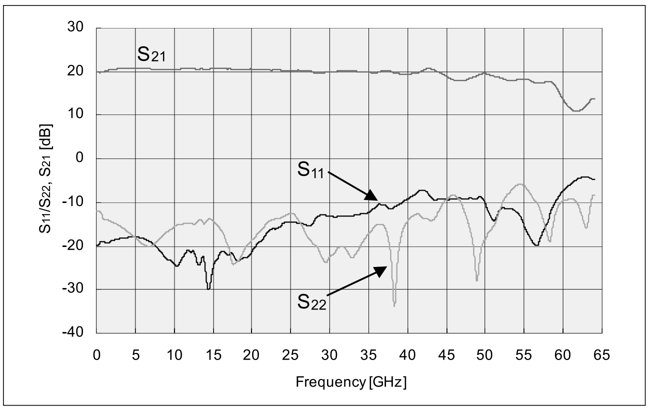
• Eye Diagram at 50 Gbit/s

Vout = 3.84 Vp-p, Jitter = 539 fs(rms)

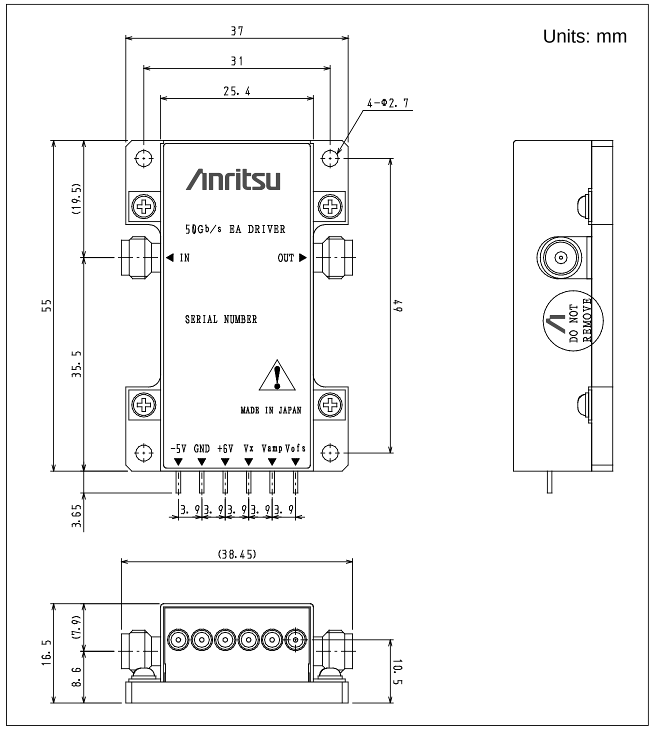


V: 800 mV/div H: 10 ps/div

• S-parameter



Dimensions

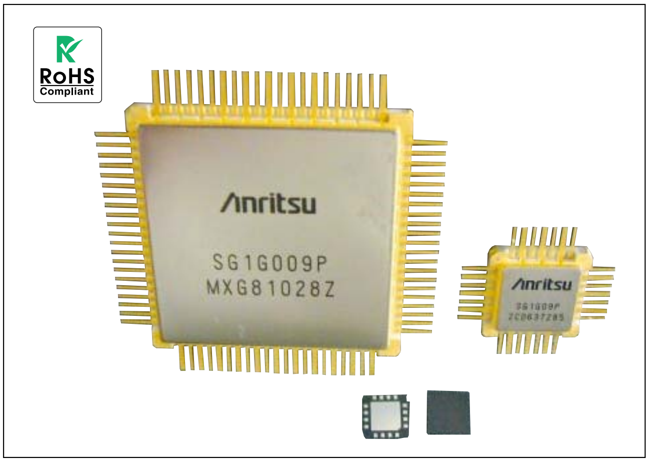


Symbol	Supply Voltage	Functions	Remarks
V–	–5 V	Negative Power Supply	
GND	GND	Ground	
V+	+6 V	Positive Power Supply	
Vx		Eye Crossing Adjustment	
Vamp		Output Amplitude Adjustment	
Vofs		Output Offset Adjustment	
IN		RF Input	V - female
OUT		RF Output	V - female

HIGH SPEED DIGITAL ICs

SG1G Series

>12.5 Gbit/s



Features

Excellent performance by InGaP/GaAs HBT process
RoHS compliant

Lineup

Model	Functions	Bit Rate/Frequency	Supply Voltage	Output Amplitude	Package
SG1G009P	16:1 Multiplexer	0.1 Gbps to 12.5 Gbps	+3.3 V/–5.2 V	1.1 Vp-p	Fig. 1
SG1G01P	1:16 Demultiplexer	0.1 Gbps to 12.5 Gbps	+3.3 V/–5.2 V	LVDS	Fig. 1
SG1G25P	1:16 Demultiplexer	0.1 Gbps to 14 Gbps	+3.3 V/–5.2 V	LVDS	Fig. 1
SG1G04P	Clock Selector	1.0 GHz to 12.5 GHz	–5.0 V	0.9 Vp-p	Fig. 2
SG1G09P	1:2 Clock Branch	DC to 15 GHz	–5.2 V	0.9 Vp-p	Fig. 2
SG1G21P	1:4 Clock Branch	DC to 15 GHz	–5.0 V	0.7 Vp-p	Fig. 2
SG1G23P-01	Differential Amplifier	DC to 14 GHz	–5.0 V	0.5 Vp-p	Fig. 3
SG1G27P	Ex OR	DC to 12.5 GHz	–5.0 V	0.8 Vp-p	Fig. 3

Foundry service is available as well.

Package Dimensions

Units: mm

Top View

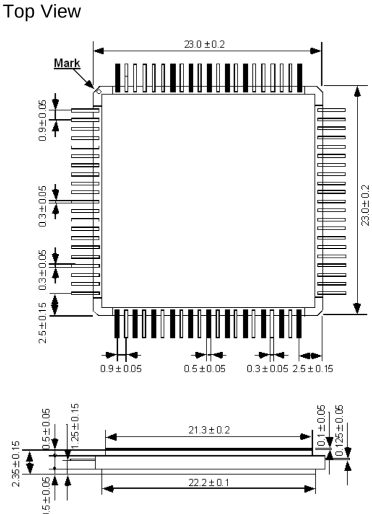


Fig. 1: AN84

Top View

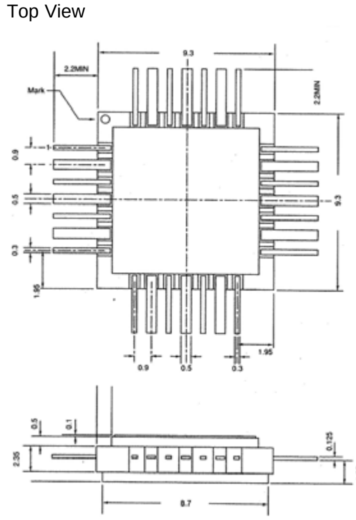


Fig. 2: AN28

Bottom View

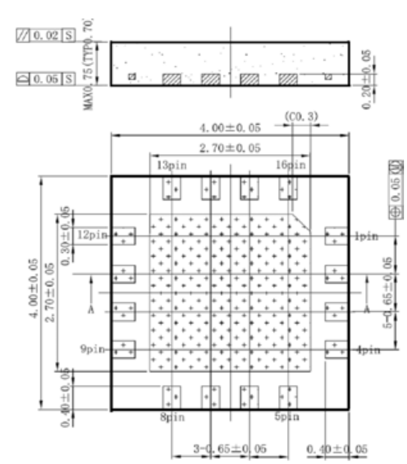


Fig. 3: QFN16

Precision RF & Microwave Components

The Industry Leader for High Frequency Components

Precision Components-Precision Measurements

Anritsu is a leader in the design and production of precision microwave components.

- Precision Coaxial Connector Systems to 110 GHz
- Precision Coaxial and Waveguide to Coax Adapters
- High Directivity SWR Autotesters and Bridges
- RF Detectors
- Precision Terminations and Air lines
- Precision Fixed Attenuators
- Precision Step Attenuators
- Precision Power Dividers and Splitters
- Precision Bias Tees
- Broadband Microwave Limiters

Connector Design Leadership

Anritsu is the leader of high frequency microwave connector technology and is driven by an ongoing commitment to exceed customer needs. Anritsu created and trademarked the K Connector® with coverage to 40 GHz, along with a complete family of 40 GHz test equipment. It was an immediate success and today is used on many commercial components, and test fixtures.

The V Connector® offers coaxial coverage to 65 GHz and uses a 1.85 mm geometry endorsed by the International Electrotechnical Commission (IEC). It mates with commercially available 2.4 mm connectors.

The W1 Connector™ provides mode-free performance to 110 GHz and uses a 1.00 mm coaxial connector front side interface.

Coaxial and Waveguide to Coax Adapters

A series of precision measurement adapters are available to adapt one connector type to another. Poor adapter VSWR (or poor return loss) can be a major source of measurement error and, therefore adapters must be carefully selected. Anritsu precision adapters typically have 6-12 dB better return loss than competitive units. Waveguide-to-Coax Adapters are available to 65 GHz.

Precision Terminations and Air Lines

Anritsu is recognized as the leader in the field of impedance standards. Anritsu air lines and terminations are unsurpassed for accuracy and impedance match. Not only do these products increase measurement accuracy, they also provide the only method of certifying the performance of SWR Autotesters, bridges, directional couplers, and other devices.

Precision Fixed Attenuators

Anritsu attenuators offer superior performance in a low cost package. The low VSWR (excellent return loss) minimizes signal reflections and simultaneously reduces ripple effects in the output frequency response. This assures flat, consistent attenuation characteristics regardless of other devices reflection characteristics. One of the simplest ways to improve impedance match is to insert a precision attenuator between the device under test and the source or RF detector. The 41K and 41V Series attenuators are specifically designed for such applications where accuracy is a basic requirement.

In addition to being available as individual units of 3, 6, 10, or 20 dB, the 41K and 41V Series Fixed Attenuators are also available in sets with certified calibration data. Available frequency ranges cover DC to 26.5, 40, or 65 GHz.

Many other attenuator applications have as their principal objective the reduction of power. Since the attenuator might not be inserted at a measurement point, the measurement precision discussed earlier is not required. In such a power-reducing system application, attenuators are often required in large quantities, making price an important consideration. The 43K Series includes models covering DC to 26.5 GHz, and DC to 40 GHz. All are available with 3, 6, 10, or 20 dB attenuation values. All have the Anritsu K Connectors and are compatible with SMA connectors.

Whatever your fixed attenuator needs might be, Anritsu provides the solution.

Precision Step Attenuators

Anritsu offers low loss, high precision step attenuators. These programmable step attenuators are available with 10 dB steps from 0 to 70 dB or 0 to 110 dB ranges. DC to 40 GHz frequency range ensures the broadest attenuation and frequency coverage available. Contact Anritsu for needs above 40 GHz or for custom step sizes.

Precision Power Dividers and Splitters

Anritsu produces precision V Connector® dividers and splitters to 65 GHz and precision K Connector® dividers and splitters to 40 GHz.

All Anritsu power dividers are 3-resistor symmetrical designs with excellent amplitude and phase tracking. Anritsu power splitters are 2-resistor designs, used to accurately split signals for ratio measurements.

Precision Bias Tees

Anritsu Bias Tees are used to combine DC and RF for active device measurements. Low RF throughline loss and low SWR ensure negligible effect on measurements from 50 kHz to 65 GHz.

Broadband Microwave Limiters

Anritsu broadband microwave limiters provide the widest frequency range available in a limiter. Designed to protect sensitive microwave equipment, these limiters incorporate unique single-side limiting to provide soft limiting characteristics over 10 MHz to 26.5 GHz.

High Directivity SWR Autotesters and Bridges

SWR Autotesters and SWR Bridges are directional measurement devices that separate the incident and the reflected signals of a device under test. The reflected component can then be compared to the incident signal to determine the difference between the device's impedance and its characteristic impedance.

An SWR bridge has a precision termination inside the bridge, eliminating the need for an external reference. An autotester further simplifies the user interface by incorporating a detector into the RF output that provides a DC output proportional to the DUT mismatch.

The directivity of the SWR Autotester or bridge is the measure of how well the incident and reflected signals can be separated. For example, 40 dB directivity means that the error signal in the output is 40 dB below a full reflection signal.

Anritsu's high directivity bridges and autotesters set the standards for reflection measurements. High directivity translates to accurate measurements. Anritsu high directivity bridges are available for GPC-7, 50½ and 75 ½ Type N. High directivity autotesters are available with GPC-7, Type N, and SMA, 3.5, K Connectors®, and V Connectors®.

RF Detectors

Just as directivity is the principal error contributor in reflection measurements, the impedance match of the signal source and RF detector is a significant error contributor in transmission measurements.

Anritsu offers a complete line of coaxial RF detectors covering from 100 kHz to 50 GHz with the lowest SWR available. The excellent impedance match of the detectors, along with that of the test port on the SWR Autotesters and bridges, minimize errors when making simultaneous transmission and measurements.

Calibration and Verification Kits

Anritsu offers calibration kits which contain all of the precision components and tools required to calibrate an Anritsu VNA in a connector style of your choice.

Specials

Anritsu also manufactures assemblies and components to meet specific customer requirements in both coaxial and waveguide structures. These include such components as Connectors, Bias Tee, Step Attenuator, Detector, Power Sensors, Waveguide, Coaxial Adapters, and RF Cables etc.

When requesting quotations on special assemblies, as a minimum please provide this information: frequency range, electrical characteristics, mechanical details and outline dimensions if any.

PERIPHERAL EQUIPMENT

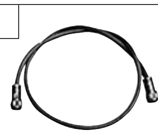
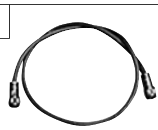
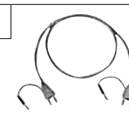
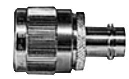
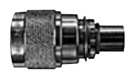
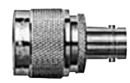
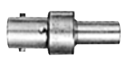
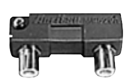
Coaxial Cords, Adapters 821
Dimensions of Waveguide Flanges........................... 823
Portable Test Rack... 824
F-Series Cabinets... 825
E-Series Cabinets 827

COAXIAL CORDS, ADAPTERS

List of Principal Coaxial Cables

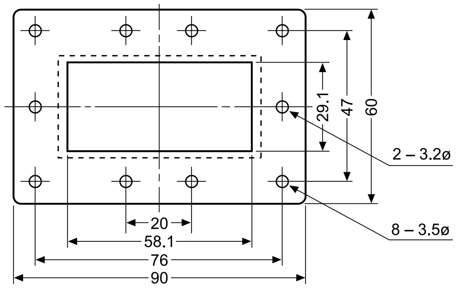
Coaxial cable	Characteristic impedance	Nominal attenuation (10 MHz)	Nominal capacitance	Finished diameter	Mass (g/m)	Suitable connector	Remarks
3C-2V	75 ±3 Ω (10 MHz)	0.042 dB/m	67 pF/m	5.8 mm	48	3C connector	Single outer conductor, PVC covered
3C-2W				6.5 mm	75		Double outer conductor, PVC covered
3C-2Z				3.8 mm	28	3C connector	Single outer conductor, No PVC covered
3C-2T		(0.013 dB/m, 1 MHz)		7.4 mm	110		Triple outer conductor, PVC covered
3C-2WS	75 ±1 Ω (10 MHz)	0.048 dB/m		6.6 mm	76	SP connector	Double outer conductor, PVC covered
5C-2V	75 ±3 Ω (10 MHz)	0.027 dB/m		7.8 mm	75	5A connector plug for 1 V type, connector for 1 V type	Single outer conductor, PVC covered
5C-2W				8.5 mm	110		Double outer conductor, PVC covered
5C-2Z				5.8 mm	48		Single outer conductor, No PVC covered
3D-2W	50 ±2 Ω (10 MHz)	0.047 dB/m	100 pF/m	6.4 mm	75		Double outer conductor, PVC covered
5D-2V		0.031 dB/m		7.5 mm	85	S connector	Single outer conductor, PVC covered
5D-2W				8.2 mm	120		Double outer conductor, PVC covered
RG-55/U	53.5 ±2.5 Ω (4 MHz)	0.0328 dBm	93.5 pF/m	5.25 mm	55	BNC	Double outer conductor, PE covered
RG-58/U				4.95 mm	50	BNC, N	Single outer conductor, PVC covered
RG-58A/U	50 ±2 Ω (10 MHz)	0.0427 dB/m					

	Impedance	Figure No.	Name			Order No.
			Item	Composition (connector · cable · connector)	Length	
Connecting cords	50 Ω	1	Coaxial cord	N-P · 5D-2W · N-P	1 m 2 m	J0576B J0576D
		2	Coaxial cord	3CA-P2 · TG-58A/U · 3CA-P2	1 m 2 m	J0133A J0133C
		3	Coaxial cord	3CA-P2 · TG-58A/U · Alligator clip	1 m	J0054A
		4	Coaxial cord	S-5DWP · 5D-2W · S-5DWP	1 m 2 m	J0025A J0025C
		5	Clip conversion pad	N-J · Clip		J0047
	75 Ω	6	Coaxial cord	3CV-P2 · 3C-2V · 3CV-P2	1 m 2 m	J0026A J0081
		7	Coaxial cord	SP-3CP · 3C-2WS · SP-3CP	1 m 2 m	J0028A J0028B
		8	Coaxial cord	SP-3CP · 3C-2WS · 3CW-P	1 m 2 m	J0029A J0029B
		9	Coaxial cord	P-5CP · 5C-2W · P-5CP	1 m 2 m	J0030A J0030B
	(balanced)	10	Balanced cord	I-214APS · C1UUS shielded connecting cord · I-214APS	1 m 2 m	J0032 J0033
		11	Balanced cord	M-214S · Shielded connecting cord · M-214S	1 m	J0050A
		12	CS1-MM2 shielded connecting cord		2 m	J0034
Conversion connectors	50 Ω	13	Coaxial adapter	N-P · N-P	–	J0038
		14	Coaxial adapter	N-J · N-J	–	J0039
		15	Coaxial adapter	N-P · BNC-J	–	J0040
		16	Coaxial adapter	N-J · BNC-J	–	J0044
		17	Coaxial adapter	N-J · BNC-P	–	J0043
	75 Ω	18	Coaxial adapter	NC-P · SP-3CJ	–	J0046
		19	Coaxial adapter	NC-P · BNC-J	–	J0055
		20	Coaxial adapter	SP-3CJ · 3C-P (BNC-P)	–	J0053
		21	Coaxial adapter	SP-3CP · 3C-J (BNC-J)	–	J0052
U-link	75 Ω	22	MP529A U-Link		–	–
Coaxial T-connector	50 Ω	23	Coaxial T-connector	S (N)-type	–	J0048

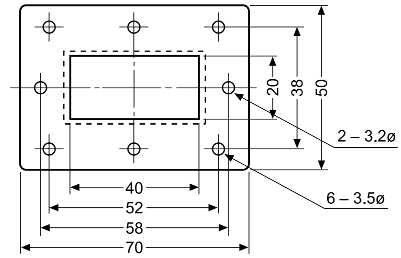
Order Number Item/Composition	J0576B/D 1  Coaxial cord 1 m/2 m N-P · 5D-2W · N-P	J0133A/C 2  Coaxial cord 1 m/2 m 3CA-P2 · RG-58A/U · 3CA-P2	J0054A 3  Coaxial cord 1 m 3CA-P2 · RG-58A/U · Alligator clip
J0025A/C 4  Coaxial cord 1 m/2 m S-5DWP · 5D-2W · S-5DWP	J0047 5  Clip conversion pad, N-J · clip	J0026A J0081 6  Coaxial cord 1 m/2 m 3CV-P2 · 3C-2V · 3CV-P2	J0028A/B 7  Coaxial cord 1 m/2 m SP-3CP · 3C-2WS · SP-3CP
J0029A/B 8  Coaxial cord 1 m/2 m SP-3CP · 3C-2WS · 3CW-P	J0030A/B 9  Coaxial cord 1 m/2 m P-5CP · 5C-2W · P-5CP	J0032 J0033 10  Balanced cord 1 m/2 m I-214APS · C1UUS shielded connecting cord · I-214APS	J0050A 11  Balanced cord 1 m, M-214S · shielded connecting cord · M-214S (compatible with I-214APS)
J0034 12  CS1-MM2 shielded connecting cord, 2 m	J0038 13  Coaxial adapter N-P · N-P	J0039 14  Coaxial adapter N-J · N-J	J0040 15  Coaxial adapter N-P · BNC-P
J0044 16  Coaxial adapter N-J · BNC-J	J0043 17  Coaxial adapter N-J · BNC-P	J0046 18  Coaxial adapter NC-P · SP-3CJ	J0055 19  Coaxial adapter NC-P · BNC-J
J0053 20  Coaxial adapter SP-3CJ · 3C-P (BNC-P)	J0052 21  Coaxial adapter SP-3CP · 3C-J (BNC-J)	MP529A 22  U-Link	J0048 23  Coaxial T-connector, 50 Ω, S (N) type

Dimensions of Waveguide Flanges

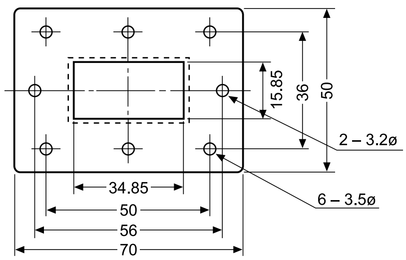
BRJ-4 (3.3 GHz to 4.9 GHz)



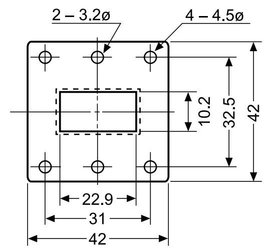
BRJ-6 (4.90 GHz to 7.05 GHz)



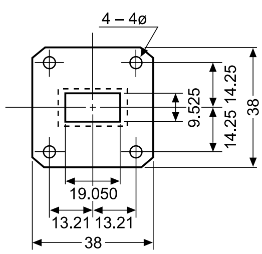
BRJ-7 (5.85 GHz to 8.2 GHz)



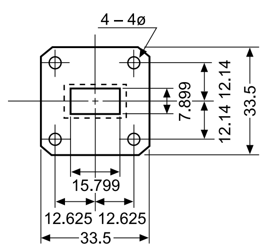
BRJ-10 (8.2 GHz to 12.4 GHz)



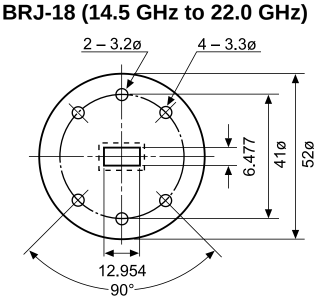
BRJ-120 (9.84 GHz to 15.0 GHz)



BRJ-140 (11.9 GHz to 18.0 GHz)



BRJ-18 (14.5 GHz to 22.0 GHz)



(Unit: mm)

PORTABLE TEST RACK
MB23B, MB24D

MB23B

MB24D

The MB23B and MB24D can be folded so they can be transported easily and used in places with space limitations. Metal fittings to accommodate both F-series and E-series cabinet designs are included.

MB23B
- By easy operation of the lever, the table can be inclined at five different angles for optimum instrument viewing ease.
- Thanks to Anritsu's exclusive construction, just a light touch of the lever is all it takes to move the angle safely up to 45°.

MB24D
- The table is fixed in a horizontal position.
- Since the rack can support up to 80 kg, several instruments may be stacked.

Specifications

Model	MB23B	MB24D
Folding capability	Yes	
Dimensions and Mass of instrument to be mounted	426 (W) × 350 (H) × 451 (D) mm, 40 kg	426 (W) × 550 (H) × 451 (D) mm, 80 kg
Tilt angle	–10°, horizontal, +15°, +30°, +45°	Fixed horizontally
Casters	Wheel diameter: ø102 mm, Stopper: At front wheel	Wheel diameter: ø125 mm, Stopper: At front wheel
Mass	≤16 kg	≤20 kg

Folded

MB23B

MB24D

Ordering Information

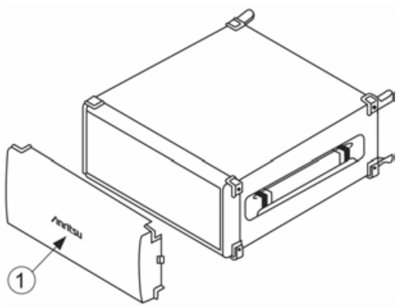
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MB23B	Portable Test Rack
MB24D	Portable Test Rack
	Optional accessories
J1339A	15 A 125 V Type A Cable Tap
J1340A	20 A 125 V Type A Cable Tap
B0585A	Movement Truck Fixation Angle
B0343	Safety Belt (1.5 m)

ACCESSORIES FOR F-SERIES CABINETS

Anritsu's F-series cabinet was designed using basic dimensions that conform to EIA and IEC racking specifications, permitting compatible equipment to be easily stacked up to form a system, or to be mounted on the EIA/IEC standard rack.
The accessories of the F-series cabinet are easy to mount and use, and blend with the design of the cabinet. The F-series can be identified by its green feet.

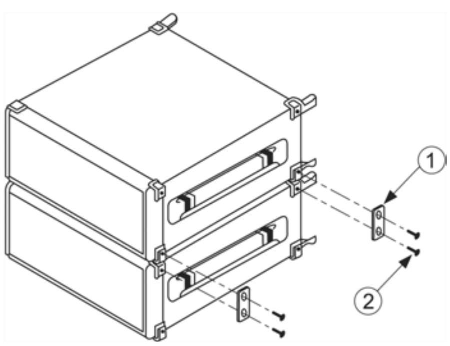
• Protective Cover
Protects front of cabinet



No.	Description	Quantity
①	Protective cover	1

Item	Order No.
Protective cover 1MW4U	B0329C
Protective cover 1MW5U	B0329D
Protective cover 3/4MW4U	B0329G
Protective cover 1/2MW2U	B0329L

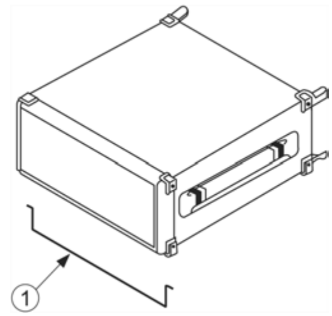
• Coupler
To mount two or more F-series cabinets in a stack



No.	Description	Quantity
①	Coupler	4
②	Screw	8

Item	Order No.
Coupler	B0332

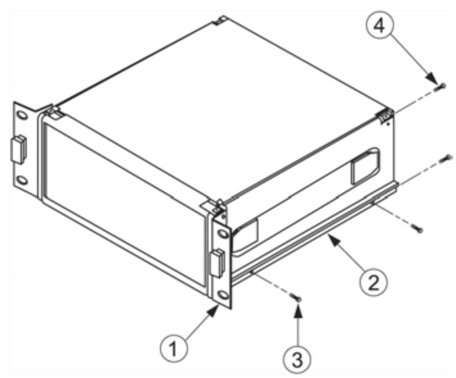
• Tilt Stand
Allows cabinet to be used at an angle



No.	Description	Quantity
①	–	1

Item	Order No.
Tilt stand 1MW450D	B0330A
Tilt stand 3/4MW450D	B0330B
Tilt stand 3/4MW350D	B0330C
Tilt stand 2/3MW350D	B0330D

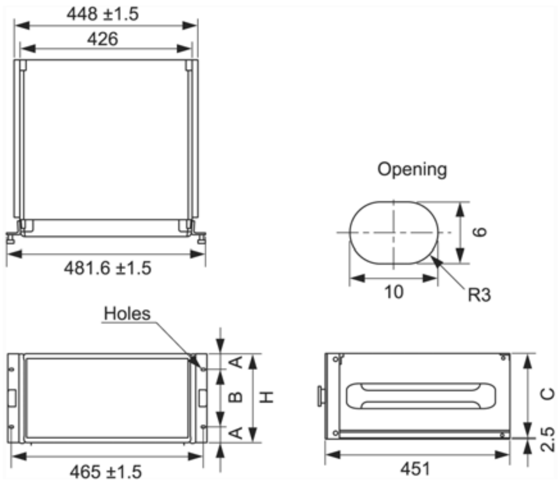
• Rack Mount Kit
The rack mount accessory is for use with 1MW450D cabinet.
For EIA/IEC standard rack



No.	Description	Quantity
①	Rack flange	2
②	Side rail	2
③	5NPS25S7 + SW	2
④	4NPS6S7 + SW	4

Item	Order No.
Rack mount kit 2U	B0333A
Rack mount kit 3U	B0333B
Rack mount kit 4U	B0333C
Rack mount kit 5U	B0333D

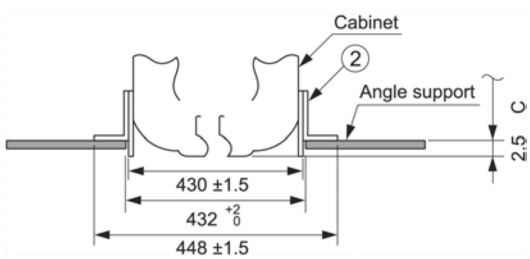
• F-series Cabinet Rack Mount Dimensions



Unit: mm

Cabinet height	H	A	B	C
2U	88	5.9	76.2	85.5
3U	132.5	37.7	57.1	130
4U	177	37.7	101.6	174.5
5U	221.5	37.7	146.1	219

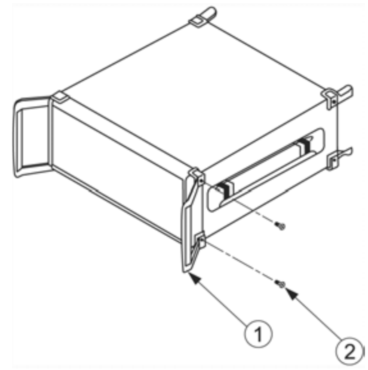
• Cabinet Angle Support Dimensions



Note: Merely attaching the equipment to the rack with rack mount kit does not provide enough support. Use either angle supports or shelves to provide the necessary support.

• Front Handle

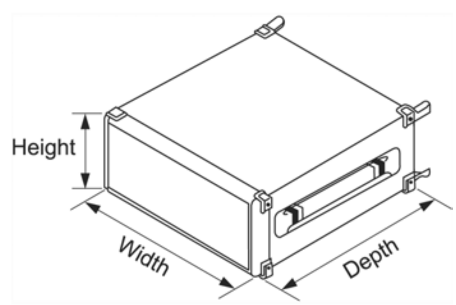
Protects the front section



No.	Description	Quantity
①	Front handle	2
②	Screw	4

Item	Order No.
Front handle 2U	B0331A
Front handle 3U	B0331B
Front handle 4U	B0331C
Front handle 5U	B0331D

• Symbol and Dimensions of F-series Cabinet



Width

Symbol	Dimension (mm)
1MW	426
3/4MW	320
2/3MW	284
1/2MW	213

Height

Symbol	Dimension (mm)
2U	88
3U	132.5
4U	177
5U	221.5
6U	266

Depth

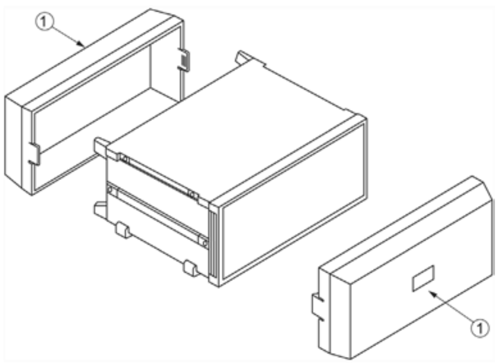
Symbol	Dimension (mm)
250D	251
350D	351
450D	451

Note: Knobs, handles, and feet are not included in cabinet external dimensions.

ACCESSORIES FOR E-SERIES CABINETS

Anritsu's E-series cabinet was designed using basic dimensions that conform to EIA and IEC racking specifications, permitting compatible equipment to be easily stacked up to form a system, or to be mounted on the EIA/IEC standard rack. Featuring a balanced design, the E-series cabinet accessories provide ease of mounting and use. The E-series cabinet can be identified by the four silver metal sections between its top and side surfaces.

● Front/rear Cover

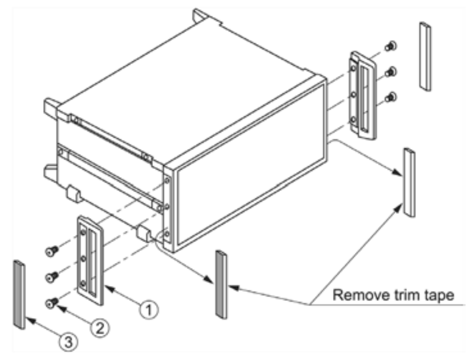


Protects front and back of cabinet.
Due to projections, the rear cover may not be usable with some equipment. Front handles and front cover cannot be used simultaneously.

No.	Description	Quantity
①	Front/rear cover	1

Item	Order No.
Front/rear cover 1MW2U	B0018
Front/rear cover 1MW3U	B0019
Front/rear cover 1MW4U	B0020
Front/rear cover 1MW5U	B0021
Front/rear cover 1MW6U	B0022
Front/rear cover 2/3MW2U	B0023
Front/rear cover 2/3MW3U	B0024
Front/rear cover 2/3MW4U	B0025
Front/rear cover 1/2MW2U	B0026
Front/rear cover 1/2MW3U	B0027

● Front Handle Kit



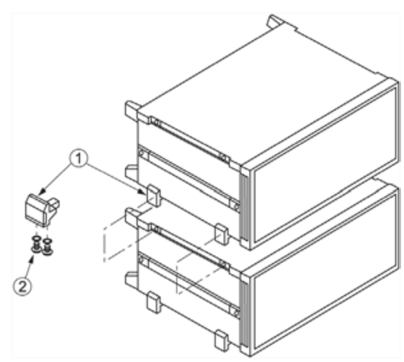
Front cover cannot be used.

No.	Description		Quantity
①	Front handle		2
②	Screw	2U to 3U*	4
		4U to 6U	6
③	Trim tape		2

*: Denotes height of cabinet

Item	Order No.
Front handle kit 2U	B0036
Front handle kit 3U	B0037
Front handle kit 4U	B0038
Front handle kit 5U	B0039
Front handle kit 6U	B0040

● Stacking Foot



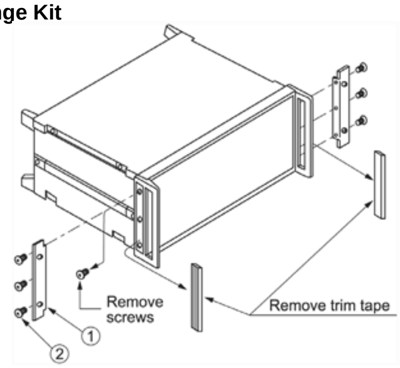
These one-touch lock feet replace the standard molded feet for use when stacking equipment of the same width and depth, and when mounting the equipment on a portable test rack.

No.	Description	Quantity
①	Stacking foot	4
②	Screw	8

Item	Order No.
Stacking feet	B0029

Note: By replacing the standard molded feet with stacking feet (B0029), the 1MW cabinet can be used with Anritsu's portable test racks MB23B and MB24D.

● **Rack Flange Kit**



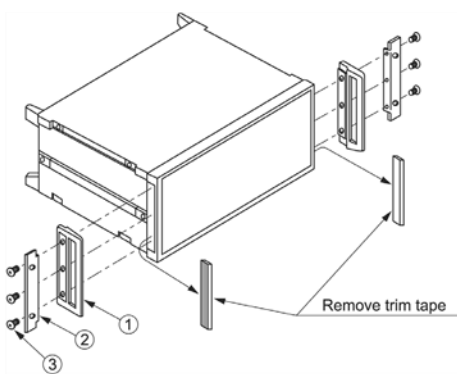
The rack mount accessory is for use with equipment having 1MW cabinet width providing front handles.

No.	Description		Quantity
①	Rack flange		2
②	Screw	2U to 3U	4
		4U to 6U	6

Item	Order No.
Rack flange kit 2U	B0046
Rack flange kit 3U	B0047
Rack flange kit 4U	B0048
Rack flange kit 5U	B0049
Rack flange kit 6U	B0050

Note: ● For 1MW cabinets
● When assembled, the panel width is suitable for 19-inch racks.
● For EIA/IEC standard rack

● **Rack Mount Kit**



The rack mount accessory is for use with equipment having 1MW cabinet width.

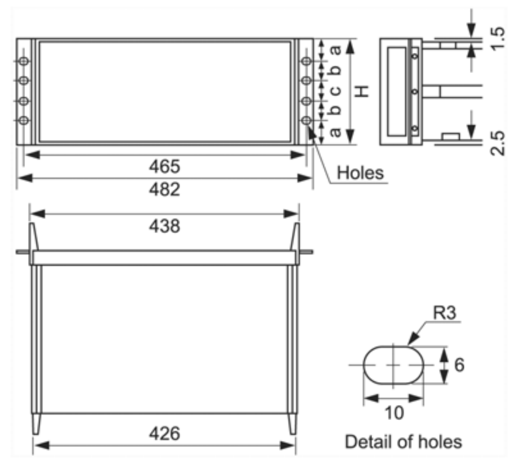
Note: Merely attaching the equipment to the rack with rack mount kit does not provide enough support. Use either angle supports or shelves to provide the necessary support.

No.	Description		Quantity
①	Front handle		2
②	Rack flange		2
③	Screw	2U to 3U	4
		4U to 6U	6

Item	Order No.
Rack mount kit 2U	B0041
Rack mount kit 3U	B0042
Rack mount kit 4U	B0043
Rack mount kit 5U	B0044
Rack mount kit 6U	B0045

Note: ● For 1MW cabinets
● When assembled, the panel width is suitable for 19-inch racks.
● For EIA/IEC standard rack

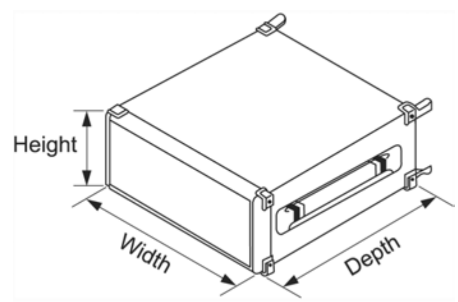
● **E-series Cabinet Rack Mount Dimensions**



Cabinet height	H (mm)	a	b	c
2U	88	5.9	–	76.2
3U	132.5	37.7	–	57.1
4U	177	37.7	–	101.6
5U	221.5	37.7	–	146.1
6U	266	37.7	57.1	76.2

Note: This space provides room to attach a flange for supporting the equipment.

● **Symbol and Dimensions of E-series Cabinet**



Width

Symbol	Dimension (mm)
1MW	426
3/4MW	320
2/3MW	284
1/2MW	213

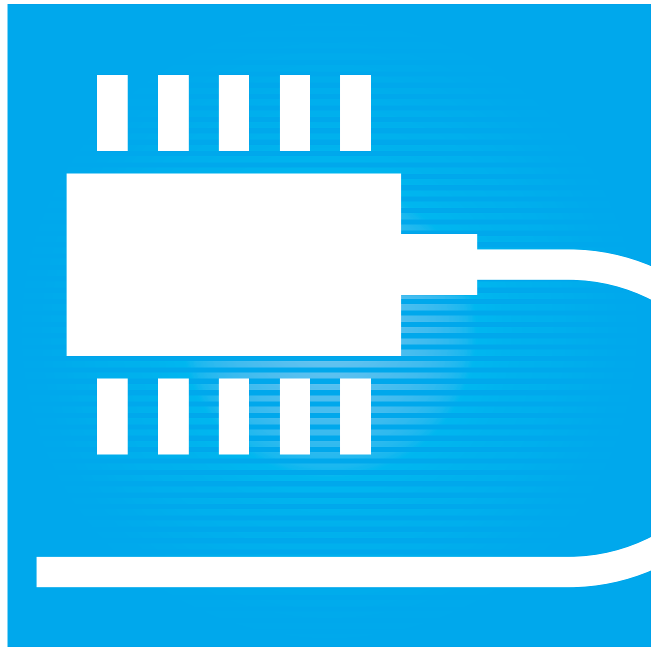
Height

Symbol	Dimension (mm)
2U	88
3U	132.5
4U	177
5U	221.5
6U	266

Depth

Symbol	Dimension (mm)
250D	251
350D	351
450D	451

Note: Knobs, handles, and feet are not included in cabinet external dimensions.

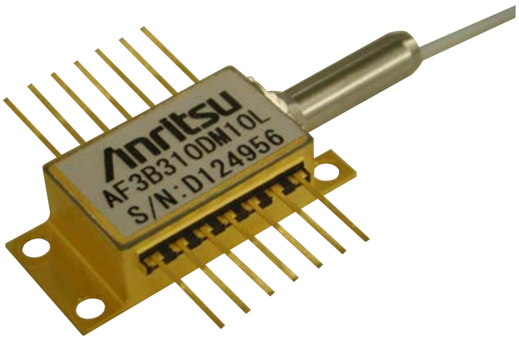


OPTICAL DEVICES

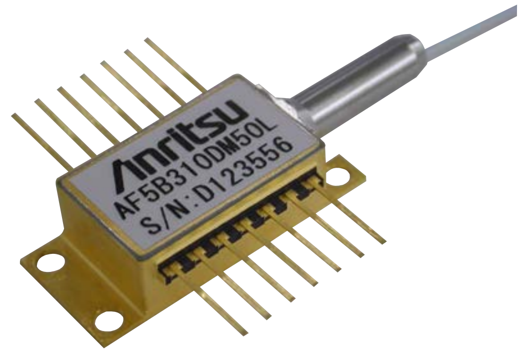
1.31/1.55 µm LD Module 830
1.48 µm LD Module 832
1.48 µm Cylindrical Module 836
1.55 µm SLD Module 838

1.31/1.55 µm LD MODULE

AF3B310DM10L/AF5B310DM50L



AF3B310DM10L



AF5B310DM50L

1.31 µm/1.55 µm laser diode modules designed for optical measurement and communication.
The laser is packaged in a 14-pin butterfly package with optical isolator, monitor photodiode and thermo-electric cooler (TEC).

Features

- High optical output: 100 mW/≤500 mA
- PMF output (fiber: ø0.9 mm)
- Built-in optical isolator
- Internal monitor PD and TEC

Absolute Maximum Ratings

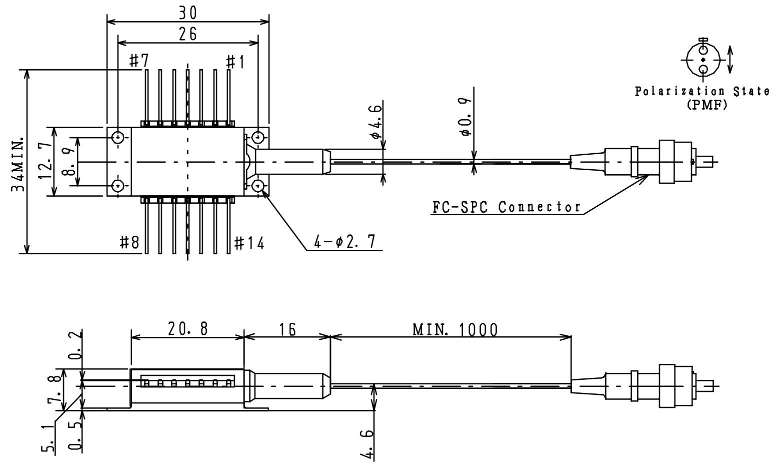
Item	Symbol	Rating Unit
LD Forward Current	I_F	900 mA
LD Reverse Voltage	V_R	2 V
PD Forward Current	I_{FD}	10 mA
PD Reverse Voltage	V_{RD}	20 V
Operating Case Temperature	T_C	–20° to +70°C
Storage Temperature	T_{stg}	–40° to +85°C
Cooler Current	I_C	2 A

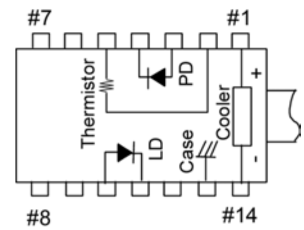
Optical and Electrical Characteristics (T_{LD} = 25°C, T_C = 25°C)

Item	Symbol	Test condition	AF3B310DM10L			AF5B310DM50L		
			Min.	Typ.	Max.	Min.	Typ.	Max.
Forward Voltage	V_F	I_F = 500 mA	–	2.0 mV	2.5 mV	–	2.0 V	2.5 V
Threshold Current	I_{th}		–	30 mA	60 mA	–	30 mA	60 mA
Optical Output Power	P_f	I_F = 500 mA	100 mW	–	–	100 mW	–	–
Center Wavelength	λ_C	I_F = 500 mA, RMS (–20 dB)	1295 nm	1310 nm	1325 nm	1535 nm	1550 nm	1565 nm
Spectral Width	$\Delta\lambda$	I_F = 500 mA, RMS (–20 dB)	–	4 nm	8 nm	–	5 nm	10 nm
Monitor Current	I_m	I_F = 500 mA, V_{RD} = 5 V	100 µA	400 µA	–	100 µA	400 µA	–
PD Dark Current	I_d	V_{RD} = 5 V	–	–	0.1 µA	–	–	0.1 µA
Tracking Error	ΔP_f	I_m = const, T_C = –20° to +70°C	–	–	0.5 dB	–	–	0.5 dB
Cooler Voltage	V_c	I_F = 600 mA, T_C = +70°C	–	–	3.2 V	–	–	3.2 V
Cooler Current	I_c	I_F = 600 mA, T_C = +70°C	–	–	1.2 A	–	–	1.2 A
Thermistor Resistance	R_{th}	T_{LD} = 25°C, B = 3900 ±100K	9.5 kΩ	10 kΩ	10.5 kΩ	9.5 kΩ	10 kΩ	10.5 kΩ
Optical Isolation	R_o	T_{LD} = 25°C	–	30 dB	–	–	30 dB	–
Extinction Ratio	Xp	I_F = 500 mA	17 dB	–	–	17 dB	–	–

Note: Polarization state of LD is aligned parallel to the slow axis.

Dimensions





Top View

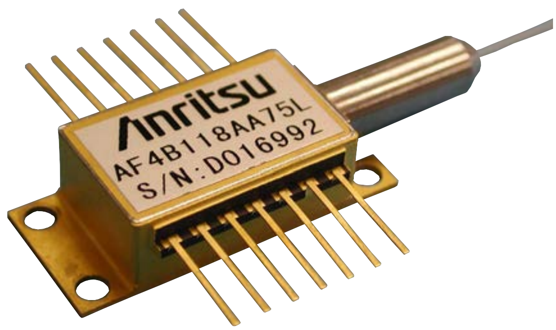
No.	Function	No.	Function
1	Cooler anode	8	NC
2	Thermistor	9	NC
3	PD anode	10	LD anode
4	PD cathode	11	LD cathode
5	Thermistor	12	NC
6	NC	13	Case
7	NC	14	Cooler cathode

Pin Configuration

1.48 µm LD MODULE
AF4B Series

Type A: 120 mW to 180 mW, Type B: 200 mW to 250 mW, Type C: 300 mW to 400 mW, Type D: 420 mW to 500 mW

RoHS Compliant



Type A

The AF4B Series is 1.48 µm high power laser diode modules designed for Er doped fiber amplifier. The laser is packaged in a 14-pin butterfly package with optical isolator, monitor photodiode and thermo-electric cooler (TEC).

Features

- **Optical Output**

Type A:
120 mW (I_F ≤500 mA) AF4B112AA75L/AF4B112AD75L
140 mW (I_F ≤550 mA) AF4B114AA75L/AF4B114AD75L
160 mW (I_F ≤600 mA) AF4B116AA75L/AF4B116AD75L
180 mW (I_F ≤600 mA) AF4B118AA75L/AF4B118AD75L

Type B:
200 mW (I_F ≤700 mA) AF4B120EA75L/AF4B120ED75L
220 mW (I_F ≤700 mA) AF4B122EA75L/AF4B122ED75L
250 mW (I_F ≤800 mA) AF4B125EA75L/AF4B125ED75L

Type C:
300 mW (I_F ≤1100 mA) AF4B130CA75L/AF4B130CD75L
350 mW (I_F ≤1400 mA) AF4B135CA75L/AF4B135CD75L
400 mW (I_F ≤1400 mA) AF4B140CA75L/AF4B140CD75L

Type D:
420 mW (I_F ≤1600 mA) AF4B142FA75L/AF4B142FD75L
460 mW (I_F ≤1700 mA) AF4B146FA75L/AF4B146FD75L
500 mW (I_F ≤1800 mA) AF4B150FA75L/AF4B150FD75L

- **Fiber**
  SMF output (UV coating fiber: ø0.25 mm)
  PMF output (UV coating fiber: ø0.25 mm)
- **14-pin Butterfly Package**
- **Built-in Optical Isolator**
- **Internal Monitor PD and TEC**
- **Low Power Consumption (type B, C)**
- **Operating Case Temperature 75°C (type A)**
- **Operating Case Temperature 70°C (type B, C, D)**

Absolute Maximum Ratings (T_{LD} = 25°C)

Item	Symbol	Rating					
		Type A	Type B	Type C			Type D
				AF4B130CA75L AF4B130CD75L	AF4B135CA75L AF4B135CD75L	AF4B140CA75L AF4B140CD75L	
LD Forward Current	I_F	1100 mA	1300 mA	1400 mA	1700 mA		2200 mA
LD Reverse Voltage	V_R	2 V					
PD Forward Current	I_{FD}	10 mA					
PD Reverse Voltage	V_{RD}	20 V					
Operating Case temperature	T_C	–20° to +75°C	–20° to +70°C				
Storage Temperature	T_{stg}	–40° to +85°C					
Cooler Current	I_C	2 A		5.8 A			

Optical and Electrical Characteristics (T_{LD} = 25°C, T_C = 25°C)

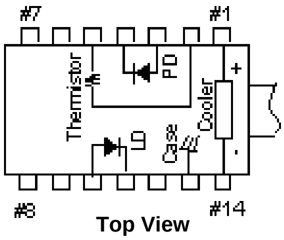
Item	Symbol	Test condition	Type A			
			AF4B112AA75L AF4B112AD75L	AF4B112AD75L AF4B114AD75L	AF4B116AA75L AF4B116AD75L	AF4B118AA75L AF4B118AD75L
Output Power	P_f		120 mW	140 mW	160 mW	180 mW
Forward Voltage	V_F	At Output Power	Max. 2.5 V			
Threshold Current	I_{th}		Max. 50 mA			
Forward Current (BOL)	I_F	At Output Power	Max. 500 mA	Max. 550 mA	Max. 600 mA	
Center Wavelength	λ_C	At Output Power	Min. 1460 nm, Typ. 1475 nm, Max. 1490 nm			
Spectral Width	$\Delta\lambda$	At Output Power RMS (–20 dB)	Typ. 4 nm, Max. 8 nm			
Monitor Current	Im	At Output Power V_{RD} = 5 V	Min. 100 µA, Typ. 400 µA, Max. 800 µA			
PD Dark Current	I_d	V_{RD} = 5 V	Max. 0.1 µA			
Tracking Error	Δ_{Pf}	I_m = const, Tc = –20° to +75°C	Max. 0.5 dB			
Cooler Voltage	V_C	IF = *EOL, Tc = 75°C	Max. 3.5 V			
Cooler Current	I_C	IF = *EOL, Tc = 75°C	Max. 1.2 A	Max. 1.4 A		
Thermistor Resistance	R_{th}	T_{LD} = 25°C B = 3900 ±100K	Min. 9.5 kΩ, Typ. 10 kΩ, Max. 10.5 kΩ			
Optical Isolation	R_O	T_{LD} = 25°C	Typ. 30 dB			
Extinction Ratio**	X_p	At Output Power	Min. 17 dB			

Item	Symbol	Test condition	Type B			Type C		
			AF4B120EA75L AF4B120ED75L	AF4B122EA75L AF4B122ED75L	AF4B125EA75L AF4B125ED75L	AF4B130CA75L AF4B130CD75L	AF4B135CA75L AF4B135CD75L	AF4B140CA75L AF4B140CD75L
Output Power	P_f		200 mW	220 mW	250 mW	300 mW	350 mW	400 mW
Forward Voltage	V_F	At Output Power	Max. 2 V			Max. 2 V		
Threshold Current	I_{th}		Typ. 70 mA, Max. 150 mA			Typ. 100 mA, Max. 150 mA		
Forward Current (BOL)	I_F	At Output Power	Max. 700 mA		Max. 800 mA	Max. 1100 mA	Max. 1400 mA	
Center Wavelength	λ_C	At Output Power	Min. 1460 nm, Typ. 1475 nm, Max. 1490 nm			Min. 1460 nm, Typ. 1475 nm, Max. 1490 nm		
Spectral Width	$\Delta\lambda$	At Output Power RMS (–20 dB)	Typ. 5 nm, Max. 10 nm			Typ. 5 nm, Max. 10 nm		
Monitor Current	Im	At Output Power V_{RD} = 5 V	Min. 100 µA, Max. 1000 µA			Min. 100 µA, Max. 2000 µA		
PD Dark Current	I_d	V_{RD} = 5 V	Max. 0.1 µA			Max. 0.1 µA		
Tracking Error	Δ_{Pf}	I_m = const, Tc = –20° to +75°C	Max. 0.5 dB			Max. 0.5 dB		
Cooler Voltage	V_C	IF = *EOL, Tc = 75°C	Max. 3.1 V			Max. 2.9 V	Max. 3.1 V	
Cooler Current	I_C	IF = *EOL, Tc = 75°C	Max. 1.3 A		Max. 1.5 A	Max. 2.7 A	Max. 3 A	
Thermistor Resistance	R_{th}	T_{LD} = 25°C B = 3900 ±100K	Min. 9.5 kΩ, Typ. 10 kΩ, Max. 10.5 kΩ			Min. 9.5 kΩ, Typ. 10 kΩ, Max. 10.5 kΩ		
Optical Isolation	R_O	T_{LD} = 25°C	Typ. 30 dB			Typ. 30 dB		
Extinction Ratio**	X_p	At Output Power	Min. 17 dB					

Item	Symbol	Test condition	Type D		
			AF4B142FA75L AF4B142FD75L	AF4B146FA75L AF4B146FD75L	AF4B150FA75L AF4B150FD75L
Output Power	P_f		420 mW	460 mW	500 mW
Forward Voltage	V_F	At Output Power	Max. 2.2 V		
Threshold Current	I_{th}		Typ. 70 mA, Max. 150 mA		
Forward Current (BOL)	I_F	At Output Power	Max. 1600 mA	Max. 1700 mA	Max. 1800 mA
Center Wavelength	λ_C	At Output Power	Min. 1460 nm, Typ. 1475 nm, Max. 1490 nm		
Spectral Width	$\Delta\lambda$	At Output Power RMS (–20 dB)	Typ. 5 nm, Max. 10 nm		
Monitor Current	Im	At Output Power V_{RD} = 5 V	Min. 100 µA, Max. 2000 µA		
PD Dark Current	I_d	V_{RD} = 5 V	Max. 0.1 µA		
Tracking Error	Δ_{Pf}	I_m = const, Tc = –20° to +75°C	Max. 0.5 dB		
Cooler Voltage	V_C	IF = *EOL, Tc = 75°C	Max. 3.5 V	Max. 3.7 V	Max. 4.0 V
Cooler Current	I_C	IF = *EOL, Tc = 75°C	Max. 3.1 A	Max. 3.2 A	Max. 3.5 A
Thermistor Resistance	R_{th}	T_{LD} = 25°C B = 3900 ±100K	Min. 9.5 kΩ, Typ. 10 kΩ, Max. 10.5 kΩ		
Optical Isolation	R_O	T_{LD} = 25°C	Typ. 30 dB		
Extinction Ratio**	X_p	At Output Power	Min. 17 dB		

*: EOL = BOL × 1.2
**: Only PMF

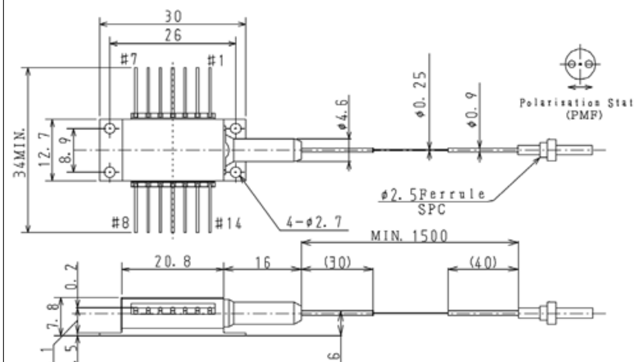
Pin Configuration



Top View

No.	Function	No.	Function
1	Cooler anode	8	NC
2	Thermistor	9	NC
3	PD anode	10	LD anode
4	PD cathode	11	LD cathode
5	Thermistor	12	NC
6	NC	13	Case
7	NC	14	Cooler cathode

Dimensions



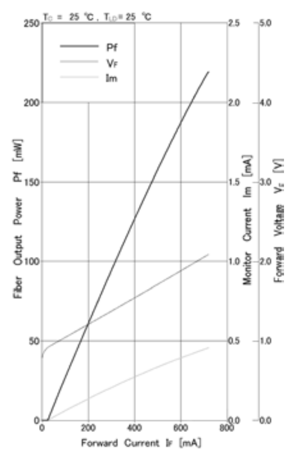
(Unit: mm)

Polarization state of LD is aligned parallel to the slow axis.

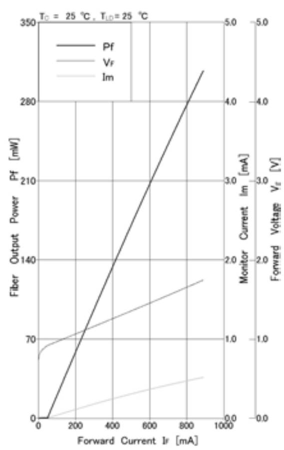
AF4B Series Typical Characteristics

- **Fiber Output Power/Monitor Current/Voltage-Forward Current Characteristics**

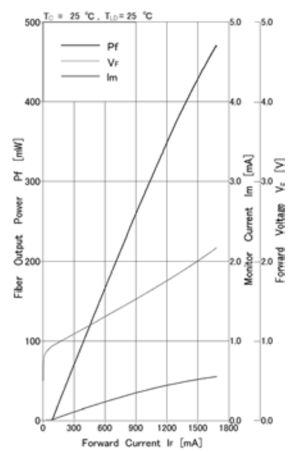
[AF4B118AA75L]



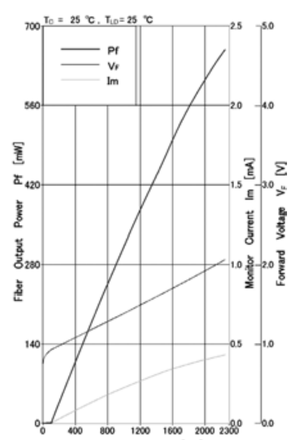
[AF4B125EA75L]



[AF4B140CA75L]

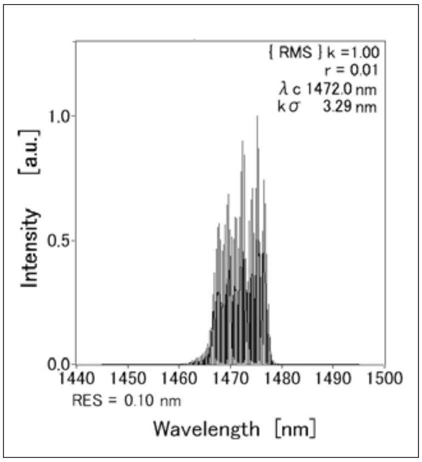


[AF4B150FA75L]

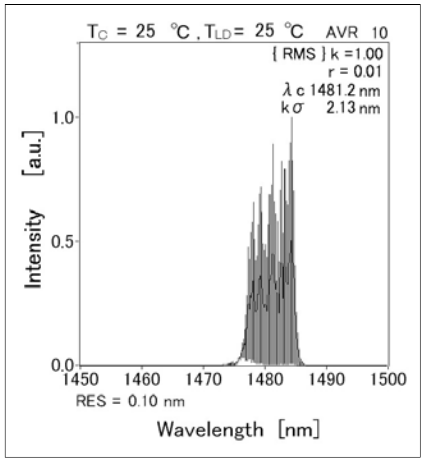


• **Emission Spectrum**

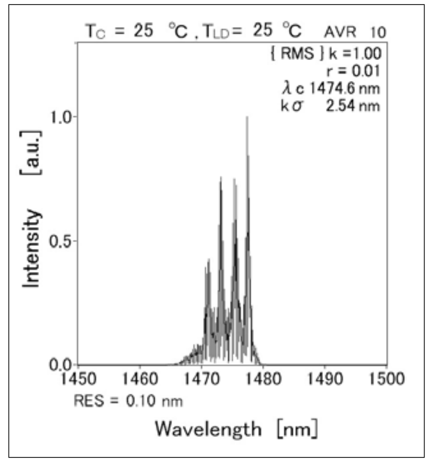
[AF4B118AA75L]



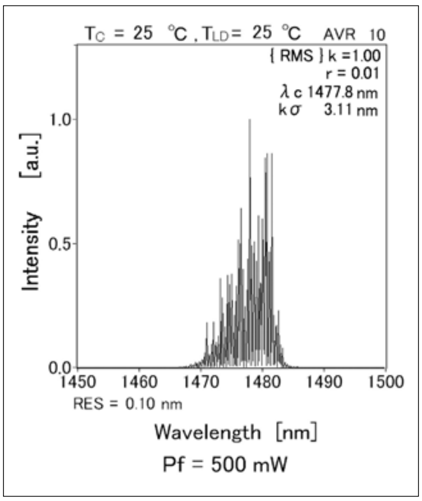
[AF4B125EA75L]



[AF4B140CA75L]



[AF4B150FA75L]



Ordering Information

Model: AF4B1 ### # ## #

Center Wavelength range
L: ±15 nm, M: ±20 nm, K: ±10 nm

Center Wavelength
75: 1475 nm, 80: 1480 nm,
70: 1470 nm, 65: 1465 nm

Fiber and Connector
A: SMF Ferrule, D: PMF Ferrule,
G: SMF FC/PC, K: PMF FC/PC

Optical Output Power

- **Type A**
  - 12A: 120 mW
  - 14A: 140 mW
  - 16A: 160 mW
  - 18A: 180 mW
- **Type B**
  - 20E: 200 mW
  - 22E: 220 mW
  - 25E: 250 mW
- **Type C**
  - 30C: 300 mW
  - 35C: 350 mW
  - 40C: 400 mW
- **Type D**
  - 42F: 420 mW
  - 46F: 460 mW
  - 50F: 500 mW

1.48 µm CYLINDRICAL MODULE

AF4Y108GA85J

RoHS Compliant

This LD is 1.48 µm high power laser diode module designed for Er doped fiber amplifier. The laser is packaged in a cylindrical package without isolator, monitor photodiode and thermoelectric cooler (TEC).

Features

- Uncooled (TEC less) coaxial module
- SMF Optical Output: 80 mW (I_f <400 mA) T_C = 70 deg.C
- Low power consumption (<1 W)

Absolute Maximum Ratings (T_C = 70 deg.C)

Item	Symbol	Rating
LD Forward Current	I_F	600 mA
LD Reverse Voltage	V_R	2.0 V
Operating Case Temperature*	T_C	–5° to +70°C
Storage Temperature	T_{stg}	–40° to +85°C

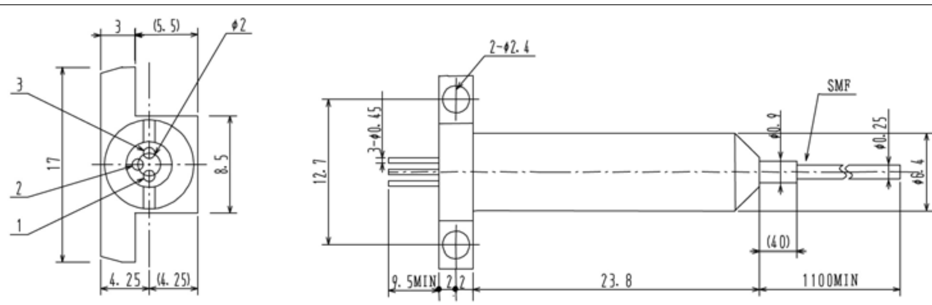
*: Wavelength begins to be distributed under the cut-off (1450 nm) when operated below 30 deg.C

Optical and Electrical Characteristics (T_C = 70 deg.C)

Item	Symbol	Test condition	Min.	Typ.	Max.
Threshold Current	I_{th}		–	45 mA	55 mA
Forward Current (BOL)	I_F	P_F = 80 mW	–	350 mA	400 mA
Center Wavelength*	λ_C	P_F = 80 mW, RMS (–20 dB)	1478 nm	–	1490 nm
Forward Voltage	V_F	P_F = 80 mW	–	1.4 V	1.8 V

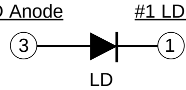
*: Center wavelength is measured under no reflected light condition

Dimensions



#3 LD Anode

#1 LD Cathode

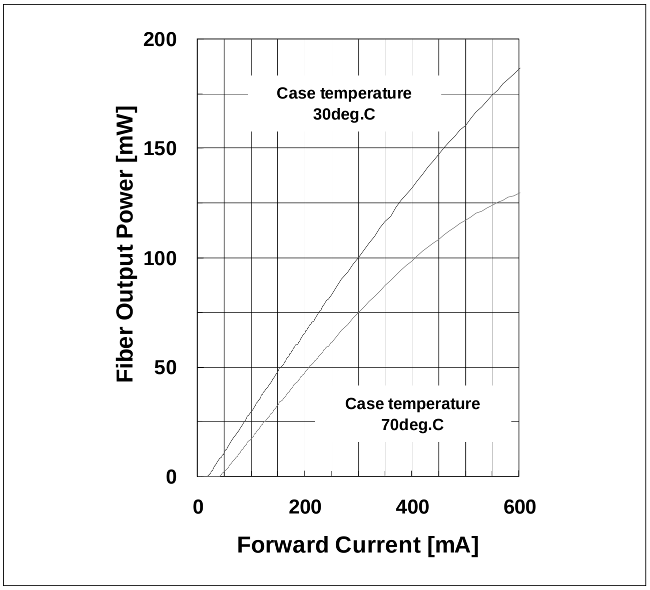


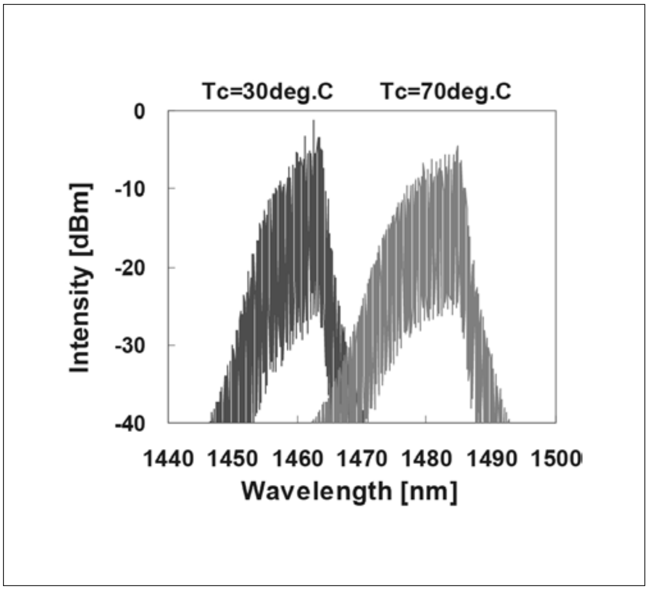
Lead polarity

No.	Function
1	LD Cathode
2	NC (Case)
3	LD Anode

Pin Configuration

IL Characteristics & Spectrum

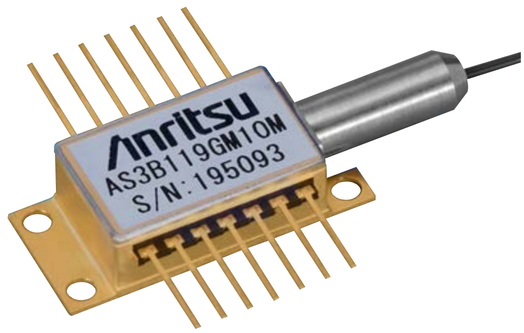




1.55 µm SLD MODULE

AS3B119GM10M/AS5B125EM50M/AS6B118GM50M

RoHS Compliant



AS3B119GM10M

The AS3B/5B/6B series are 1.55 µm SLD (Super-Luminescent Diode) modules developed as incoherent light sources for various optical measurements. The device emits incoherent light having wide spectral half width and high output power from PMF (polarization-maintaining fiber).

Applications

- Optical sensor
- Optical Coherent Tomography (OCT)
- Optical measurement

Features

- High optical output: 15 mW/≤400 mA (AS3B)
  25 mW/≤500 mA (AS5B)
  10 mW/≤350 mA (AS6B)
- Wide spectral half width: $\Delta\lambda$ = 55 nm (typ., AS3B)
  $\Delta\lambda$ = 60 nm (typ., AS5B)
  $\Delta\lambda$ = 70 nm (typ., AS6B)
- Built-in optical isolator
- Internal monitor PD and TEC

Absolute Maximum Ratings (T_{SLD} = 25 deg.C)

Item	Symbol	Rating		
		AS3B119GM10M	AS5B125EM50M	AS6B118GM50M
SLD Forward Current	I_F	480 mA	600 mA	420 mA
SLD Reverse Voltage	V_R	2 V		
PD Forward Current	I_{FD}	10 mA		
PD Reverse Voltage	V_{RD}	10 V		
Operating Case Temperature	T_C	–20° to +75°C		
Storage Temperature	T_{stg}	–40° to +85°C		
Cooler Current	I_C	2 A		

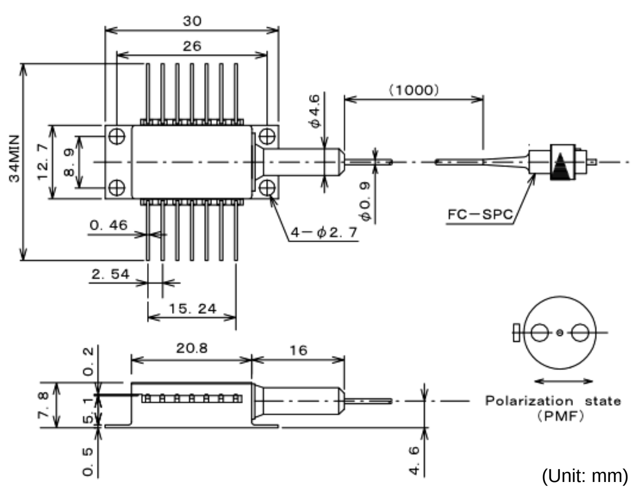
Optical And Electrical Characteristics (T_{SLD} = 25 deg.C, T_C = 25 deg.C)

Item	Symbol	Test condition	AS3B119GM10M			AS5B125EM50M			AS6B118GM50M		
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
Forward Voltage	V_F	*1	–	–	2.5 V	–	–	2.4 V	–	–	2.5 V
Forward Current (BOL)	I_F	*1	–	–	400 mA	–	–	500 mA	–	–	350 mA
Center Wavelength	λ_C	*1, –3 dB	1290 nm	1310 nm	1330 nm	1530 nm	1550 nm	1570 nm	1630 nm	1650 nm	1670 nm
Spectral Width	$\Delta\lambda$	*1, –3 dB	50 nm	55 nm	–	55 nm	60 nm	–	65 nm	70 nm	–
Spectral Ripple	M	*1, res = 0.1 nm	–	–	0.6 dB	–	–	0.6 dB	–	–	0.8 dB
Monitor Current	I_m	*1, V_{RD} = 5 V	100 µA	–	2000 µA	400 µA	–	2000 µA	100 µA	–	2000 µA
PD Dark Current	I_d	V_{RD} = 5 V	–	–	0.1 µA	–	–	0.1 µA	–	–	0.1 µA
Tracking Error	ΔP_f	I_m = const, T_C = –20° to +70°C	–	–	0.5 dB	–	–	0.5 dB	–	–	0.5 dB
Cooler Voltage	V_c	I_F = I_F (EOL), T_C = 75°C	–	–	3.5 V	–	–	3.5 V	–	–	3.5 V
Cooler Current	I_c	I_F = I_F (EOL), T_C = 75°C	–	–	1.2 A	–	–	1.2 A	–	–	1.2 A
Thermistor Resistance	R_{th}	T_{SLD} = 25°C, B = 3900 ±100K	9.5 kΩ	10 kΩ	10.5 kΩ	9.5 kΩ	10 kΩ	10.5 kΩ	9.5 kΩ	10 kΩ	10.5 kΩ
Optical Isolation	R_o	*2, T_{SLD} = 25°C	–	30 dB	–	–	30 dB	–	–	30 dB	–

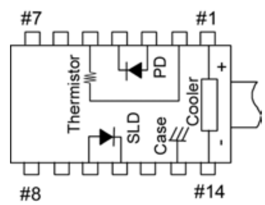
∗1: AS3B119GM10M (P_f = 15 mW), AS5B125EM50M (P_f = 25 mW), AS6B118GM50M (P_f = 10 mW)
∗2: AS3B119GM10M (λ = 1310nm), AS5B125EM50M (λ = 1550nm), AS6B118GM50M (λ = 1650 nm)

Note: I_F (EOL) = I_F (BOL) × 1.2
Polarization state of SLD is aligned parallel to the slow axis.

Dimensions



(Unit: mm)



Top View

No.	Function	No.	Function
1	Cooler anode	8	NC
2	Thermistor	9	NC
3	PD anode	10	SLD anode
4	PD cathode	11	SLD cathode
5	Thermistor	12	NC
6	NC	13	Case
7	NC	14	Cooler cathode

Pin Configuration

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