ANRITSU

Electronic Measuring Instruments

2009

Anritsu

ANRITSU

Electronic Measuring Instruments

Optical Measuring Instruments

- ACCESS Master
- Optical Time Domain Reflectometer
- Coherent OTDR
- OTDR Module
- Multi-Layer Network Test Platform
- OTDR/Chromatic Dispersion Application
- Polarisation Mode Dispersion Analyzer
- Optical Spectrum Analyzer
- Network Master Series
  Drop Cable Fault Locator Module
  Optical Channel Analyzer Module
- Light Source
- Loss Test Set
- Handheld Power Meter
- Optical Fiber Identifier
- All-Band Optical Component Tester
- Tunable Laser
- Noise-Free Tunable External Cavity Laser
- 8-Channel Modular Platform
- WDM Tunable Laser
- External Cavity Laser Module
- Full-band Tunable Laser
- Distributed Feed Back Laser
- Tunable Optical Channel Drop Unit
- Visual Fault Locator
- Handheld Fiber Inspection Microscope
- Patch Panel Fiber Microscope
- Bare Fiber Adapter

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Pulse Pattern Generators/Error Detectors

- Signal Quality Analyzer
- 43.5G MUX/43.5G DEMUX
- Bit Master (Eye Pattern Analyzer)

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IP/Network Measuring Instruments

- Data Quality Analyzer
- Network Performance Tester
- 40G SDH/SONET Analyzer
- SDH/SONET/PDH/T-Carrier Analyzer
- 10 GigE/SDH/SONET/OTN
- Ethernet Test Set
- All-In-One Field Tester

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Monitoring/Service Assurance

- Integrated OSS Service Assurance Solutions

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Mobile/Wireless Communications Measuring Instruments

- W-CDMA Signalling Tester
- W-CDMA Protocol Test System (PTS)/
  Protocol Conformance Test Toolkit
- W-CDMA Rapid Test Designer (RTD)
- SUPL Simulation Server
- Protocol Conformance Test System
- W-CDMA TRX/Performance Test System/
  W-CDMA RRM Test System
- Signalling Tester
- CDMA2000 Scenario Composer
- Radio Communication Analyzer
- Service Tester
- Shield Box
- Vector Signal Generator
- Digital Modulation Signal Generator
- Signal Analyzer
- Digital Mobile Radio Transmitter Tester
- Digital Broadcast Signal Analyzer
- Site Master
- Cable and Antenna Analyzer
- Cell Master
- BTS Master
- *Bluetooth* Test Set
- WLAN Test Set
- High Performance Handheld Spectrum
  Analyzer
- Spectrum Master
- VNA Master
- Area Tester
- Area Scanner
- Measuring Receiver

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Signal Analyzers/Spectrum Analyzers

- Signal Analyzer
- Spectrum Analyzer
- Economy Spectrum Analyzer
- Spectrum Master
- High Performance Handheld Spectrum
  Analyzer
- VNA Master

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Network Analyzers

- Microwave Vector Network Analyzer
- Microwave Multi-Port Balanced VNA
- Broadband and Millimeter Wave Vector
  Network Analyzer
- 4 Port Vector Network Analyzer Automatic
  Calibrator
- Vector Network Analyzer Automatic
  Calibrator
- VNA Master
- VNA and VNMS Calibration Kits
- VNA and VNMS Verification Kits
- Network Analyzer
- Reflection Bridge
- Transformer

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Signal Generators

- RF/Microwave Signal Generator
- Synthesized Signal Generator

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RF Microwave Measuring Instruments

- Microwave Frequency Counter
- Wideband Peak Power Meter
- Power Meter
- Calibration Receiver
- Resistance Attenuator
- Programmable Attenuator
- Pre-Amplifier
- EMI Probe
- Dipole Antenna
- Log-Periodic Antenna
- Biconical Antenna
- Rod Antenna
- Loop Antenna
- Standard Dipole Antenna
- Microwave Repeater Checker
- Signal Generator

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Components

- Fixed Attenuator
- Fixed Attenuator for High Power
  Measurement
- Termination
- T-Pad
- Four-port Junction Pad
- CM Directional Coupler
- Directional Coupler
- Branch
- Bias Tee
- 50 Ω ↔ 75 Ω Impedance Transformer
- 50 Ω Coaxial Switching Unit
- Phase Shifter
- RF Fuse Holder
- Fuse Element
- High-pass Filter
- Band Pass Filter

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Peripheral Equipment

- Portable Test Rack
- Coaxial Cord, Adapter
- Waveguide Flange
- F-Series Cabinet
- E-Series Cabinet

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Optical Devices

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

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OUTLINE OF ANRITSU CORPORATION

Since its founding in 1895, Anritsu has contributed to the development of the telecommunications industry by continuously pursuing Original and High Level technologies throughout its 110 year history. Anritsu has focused on the area of mobile and internet technologies, which have witnessed dramatic changes as we move towards the ubiquitous next-generation network or “NGN” that will connect every form of communication from digital to IP and wired to wireless.

Anritsu provides measurement and inspection solutions utilizing leading-edge wireless, optical, digital and IP measurement technologies for measuring and inspecting terminals, modules, electronic parts and other devices that constitute today’s telecommunications systems. To cope with the increasing scale and complexity of telecommunications networks, we also provide service assurance, wherein we collect and analyse a variety of data obtained by monitoring network status and service usage to improve the network efficiency and improve the quality of service. Anritsu has sales offices worldwide and R&D and manufacturing centers in Japan, the United States, England, Denmark, Italy and France, enabling us to devise prompt and effective responses to changing customer needs.

Anritsu will continue to provide solutions and services paving the way towards the NGN in every region of the world by striving to enhance existing technologies and creating new technological hybrids using our store of key technology know-how.

Anritsu will strive to solidify its role as an Intelligent Solution Creator by working together with customers to provide solutions that improve customer value and create new demand. By doing so, we may help to lay the foundation for the NGN by contributing to the creation of a safe and secure international community.

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: 14,049 million yen (as of March 31, 2008)**
- **Sales volume: 100,485 million yen (consolidated, year ended March 31, 2008)**
- **Employees: 3963 (consolidated, as of March 31, 2008)**

Sales Network

Anritsu Corporation (Japan)
Anritsu Company (U.S.A.)
Anritsu Electronics Ltd. (Canada)
Anritsu Eletronica Ltda. (Brazil)
Anritsu Company S.A. de C.V. (Mexico)
Anritsu EMEA Ltd. (U.K.)
Anritsu S.A. (France)
Anritsu GmbH (Germany)
Anritsu S.p.A. (Italy)
Anritsu AB (Sweden/Finland)
Anritsu A/S (Denmark)
Anritsu EMEA Ltd. Oficina de Representación en España (Spain)
Anritsu EMEA Ltd. Representation Office in Russia (Russia)
Anritsu EMEA Ltd. Dubai Liaison Office (United Arab Emirates)
Anritsu Company Ltd. (P.R. China)
Anritsu Company Inc. (Taiwan)
Anritsu Corporation, Ltd. (Korea)
Anritsu Pte. Ltd. (Singapore)
Anritsu Pte. Ltd. India Branch Office (India)
Anritsu Pty. Ltd. (Australia)

R&D and Manufactring

Anritsu Corporation (Japan)
Tohoku Anritsu Co. Ltd. (Japan)
Anritsu Company (U.S.A.)
Anritsu Instruments Company (U.S.A.)
Anritsu Ltd. (U.K.)
Anritsu A/S (Denmark)
Anritsu Solutions S.p.A (Italy)
Anritsu Instruments S.A.S (France)

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-0737	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, precision measurement business 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.

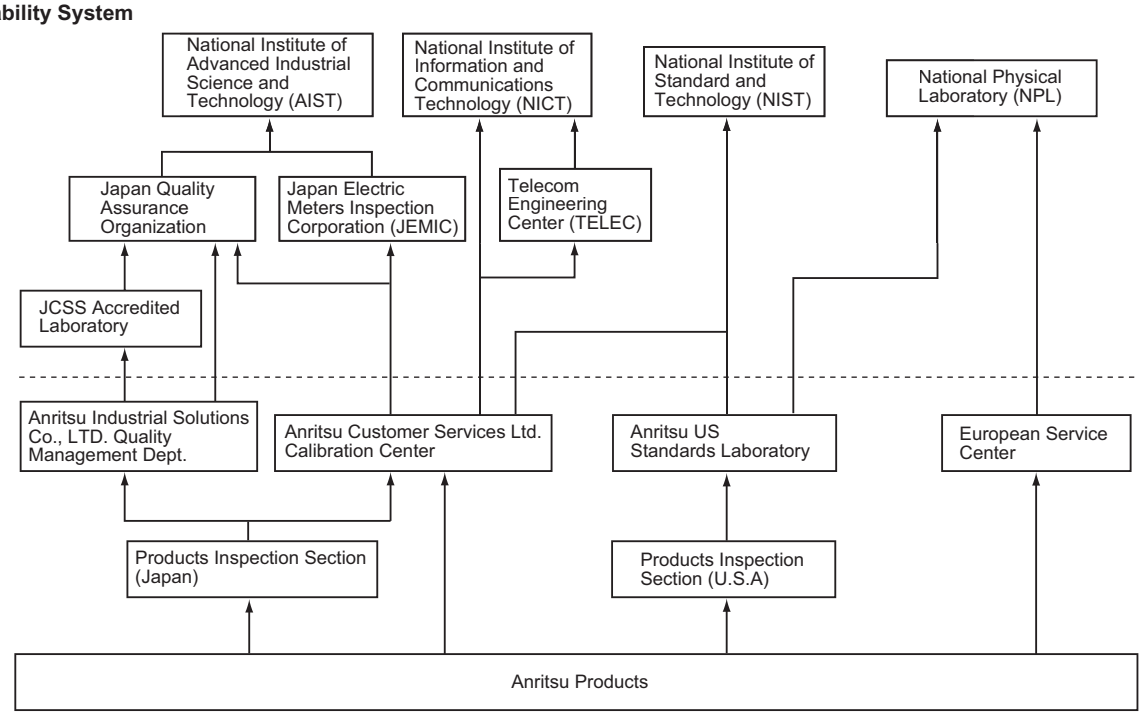
Parts Standardization and Improving Activities for Quality and Reliability

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 October 2007 to September 2008.

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

Ethernet
It is an equipment provided with the external control interface of having suited IEEE802.3.

Excellent Eco Product
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.

SALES, SHIPPING AND SERVICE INFORMATION

Anritsu

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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OPTICAL MEASURING INSTRUMENTS

PULSE PATTERN GENERATORS/ERROR DETECTORS

IP/NETWORK MEASURING INSTRUMENTS

MONITORING/SERVICE ASSURANCE

MOBILE/WIRELESS COMMUNICATIONS MEASURING INSTRUMENTS

SIGNAL ANALYZERS/SPECTRUM ANALYZERS

NETWORK ANALYZERS

SIGNAL GENERATORS

RF MICROWAVE MEASURING INSTRUMENTS

COMPONENTS

PERIPHERAL EQUIPMENT

OPTICAL DEVICES

A

B

C

F

J

M

MA

MB

MD

ME

MF

MG

MH

ML

MN

MP

MS

MT

MU

MW

MX

O

S

T

V

X

Z

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

MW90010A Coherent OTDR

The Anritsu 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 re-quires configuring a back-scatter detection system using up and down links. The C-OTDR 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, bend-ing loss, distances, breaks, etc., on-screen for waveform data analysis.

(For further information see page 42)

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

CMA5000a Multi-Layer Network Test Platform

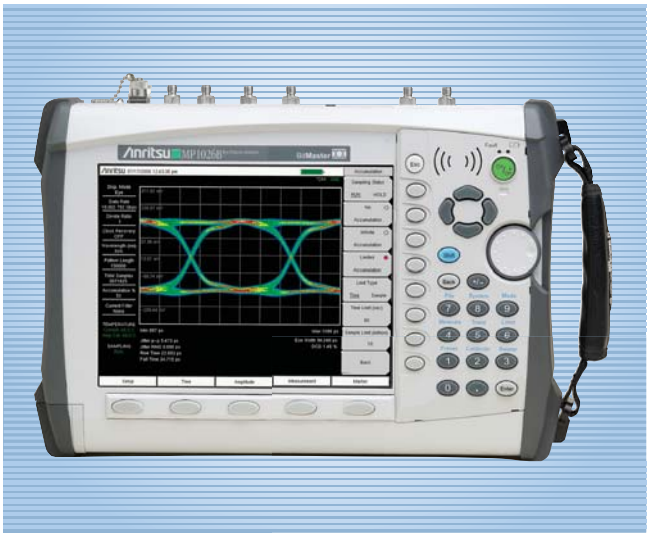
The CMA5000a Multi-Layer Network Test Platform has a full range of versatile modules and easy to use touch panel, supporting fast network rollout and maintenance at lower total cost.
The CMA5000a measurement modules support SONET/SDH, OTN, 10 Gigabit Ethernet, Gigabit Ethernet, DWDM, OTDR, ORL, PMD, and CD measurements. For field-testing, one unit supports all re-quired physical layer, data link layer, network layer, and transport layer measurement items.

(For further information see page 49)

Handheld Eye Pattern Measurements for Every Engineer

MP1026B Bit Master™

100 Mbps to 12.5 Gbps

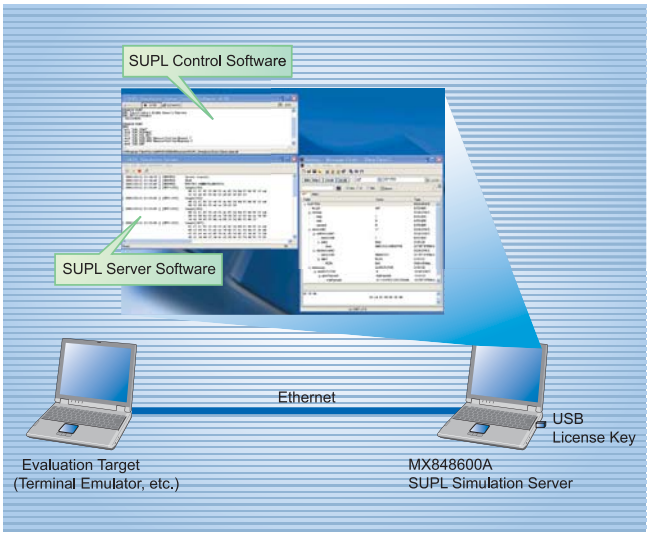


Anritsu Company introduces the Bit Master MP1026B Eye Pattern Analyzer, the first handheld solution for conducting physical layer (PHY) eye pattern measurements on the high speed interfaces at OC-192/STM-64, 10G Fibre Channel, and 10G Ethernet data rates. With two electrical channel inputs of 25 GHz bandwidth each, Bit Master offers eye pattern, pulse pattern, and mask compliance measurements for rates from 0.1 to 12.5 Gbps in a handheld, rugged, and battery-powered instrument. Nearly half the price of a benchtop sampling oscilloscope,
Bit Master is a cost-effective alternative for conducting eye pattern analysis anytime, anywhere.

(For further information see page 132)

SUPL Terminal Function Tests and Software Emulation

MX848600A SUPL Simulation Server



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*1/RRLP*2 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*3).

*1: User Plane Location Protocol
*2: Radio Resource LCS Protocol
*3: SUPL Enable Terminal

(For further information see page 225)

GCF and PTCRB Approved Test System for Protocol Conformance Testing

ME7832A Protocol Conformance Test System

The ME7832A Protocol Conformance Test System platform supports quick and easy 3GPP TS34.123 and TS51.010 protocol conformance tests of 3/3.5G mobile systems.

(For further information see page 228)

Wireless Test Suite Mobile Terminal General Verification Tool Package

MD8470A Signalling Tester

The MD8470A Signalling Tester simulates interactive base station operations and offers a test environment for various applications, such as voice and video calls, Web browsing/contents download, and messaging functions, to mobile terminal developers.
Adding the MX847015A Energy Management Test Simulator supporting network simulation for battery evaluation and the MX847016A Multi-cell Network Simulator supporting simulation between any two base stations to the MD8470A, offers the Wireless Test Suite as an included tool set.

(For further information see page 234)

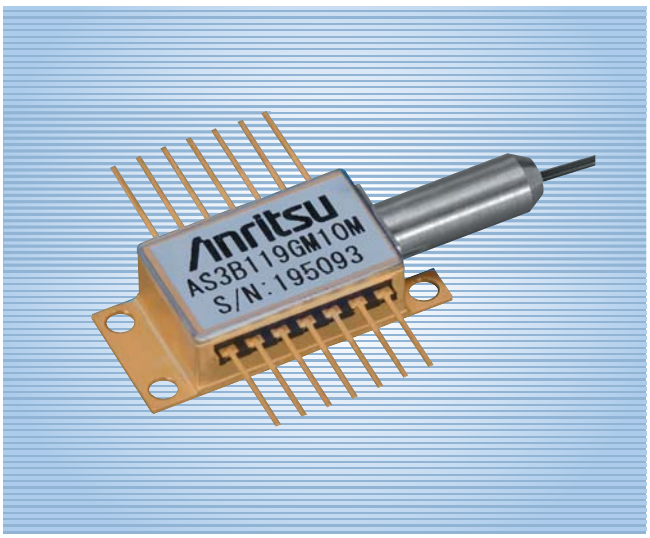
For High Speed Testing of 802.11 Wireless LAN Devices

MT8860C WLAN Test Set

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.

(For further information see page 368)

AS3B119GM10M/AS5B125EM50M/AS6B118GM50M 1.55 µm SLD MODULE



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).

(For further information see page 608)

OPTICAL MEASURING INSTRUMENTS

Selection Guide

Model \ Application		Optical power		Light source wavelength		Loss			Optical identification		Optical return loss measurement	Fiber evaluation		Laser diode testing	Eye Pattern Mask Compliance Testing	Others	Remarks
		Low level	Medium/high level	Spectrum	Wavelength	High-loss	High accuracy	Loss-wavelength	Identification	Loss		Fault location	Splice loss				
Light Source/LossTest Sets /Handheld Power Meter	CMA50 Series	√	√			√	√	√	√	√	√		√				0.85 to 1.625 µm
Light Source/ Handheld Power Meter	CMA5 Series	√	√			√	√	√	√	√			√				
Optical Spectrum Analyzer	MS9710B	√	√	√	√	√		√			√			√			0.6 to 1.75 µm
	MS9710C	√	√	√	√	√		√			√			√			
	MS9780A	√	√	√	√	√		√			√			√			
	CMA5000a OSA 400	√	√	√	√	√		√						√			1.25 to 1.65 µm
	CMA5000a OSA 425	√	√	√	√	√		√						√			
Optical Time Domain Reflectometer	MW9076 Series		√				√		√	√	√		√				1.31/1.45/1.55/1.625 µm (SM)
OTDR Module	MW9077A/A1/A2/B						√		√	√	√		√				1.31/1.55/1.625 µm (SM)
ACCESS Master	MT9083A		√				√		√	√	√	√	√				0.85/1.3 µm (MMF), 0.78/1.31/1.383/ 1.49/1.55/1.625/1.65 µm (SMF)
Coherent OTDR	MW90010A						√		√	√	√		√				1535.03 to 1565.08 nm
Network Master	MU909011A	√							√	√		√	√				0.78/1.55 µm (SM)
	MU909020A		√	√	√												CWDM network analyzer
Eye Pattern Analyzer	MP1026B														√		100 Mbit/s to 12.5 Gbit/s
Tunable Laser Source	Tunics Reference	√	√		√											√	Wide sweeping TLS – Models from E to U Bands
	Tunics Purity	√			√											√	ASE-freeTLS – Models from S to L Bands
	Tunics Plus	√	√		√											√	Sweeping TLS - Models from O to U Bands
	Osics ECL	√	√		√											√	Stepping TLS - Models from O to U Bands
	Osics DFB		√		√											√	DFB lasers - Models on O, C and L Bands
	Osics TLS		√		√											√	ITU-locked lasers - Models on C and L Bands
Optical Component Tester	MT9820A					√	√	√								√	Fast Insertion Loss measurement from 1250 to 1650nm
Tunable Filter	Xtract													√		√	Perfect extraction of a modulated WDM channel
PMD Analyzer	CMA5000a PMD															√	PMD measurement

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.

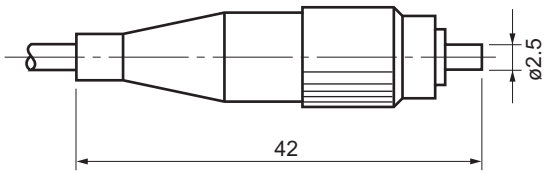
Model		Connector option number														
		24	25	26	27	31	32	33	37	38	39	40	41	42	43	47
		FC-APC key width 2.2 mm*1	FC-APC key width 2.0 mm*1	SC-APC*1	E-2000*2	EC*1	MU*2	LC*2	FC	ST	DIN 47256	SC	TOCP 172*3	HFS-13/A (GI)*3	HMS-10/A (SM)*2	HRL-10 (APC)*1
Adapter	MP92B						√	√	√	√	√	√	√	√	√	
	MA9001A								√	√	√	√	√	√	√	
	MA9001B						√	√	√	√	√	√	√	√	√	
	MA9004A								√	√	√	√	√	√	√	
	MA9005A						√	√	√	√	√	√	√	√	√	
	MA9005B						√	√	√	√	√	√			√	
	MA9008A						√	√	√	√	√	√			√	
	MA9013A								√*3	√*3	√*3	√*3		√*3	√*3	
Optical Spectrum Analyzer	MS9710B	√	√	√	√	√			√*4	√*4	√*4	√*4			√*4	√
	MS9710C	√	√	√	√	√			√*4	√*4	√*4	√*4			√*4	√
	MS9780A				√				√*4	√*4	√*4	√*4			√*4	
Optical Time Domain Reflectometer	MW9076B/B1	√	√	√					√*4	√*4	√*4	√*4			√*4	√
	MW9076D1								√*4	√*4	√*4	√*4			√*4	
OTDR Module	MW9077A/A1/A2/B							√	√							
ACCESS Master	MT9083A		√	√				√*4	√*4	√*4	√*4	√*4			√*4	
Network Master	MU909011A		√	√				√*4	√*4	√*4	√*4	√*4				
	MU909020A		√	√					√*4			√*4				
Coherent OTDR	MW90010A								√*4	√*4	√*4	√*4			√*4	
Optical fiber cord for baseband measurements									√*3							
Dummy fiber cord for optical loss measurements									√							
Mode Scrambler	MZ106C								√			√				

∗1: Ferrule type; APC (angled PC)
∗2: Ferrule type; PC
∗3: Ferrule type; Flat
∗4: Ferrule type; PC (user replaceable and cleanable)
∗5: It can use for Port A, Port B & C are PC type.

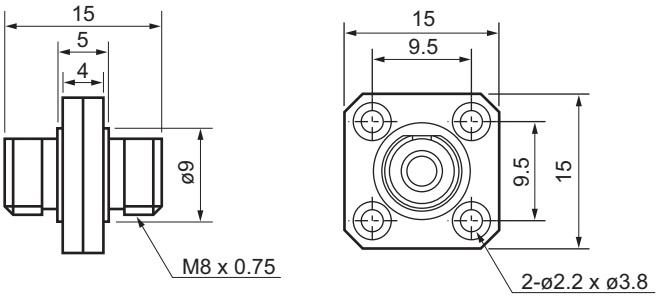
No marking: Ferrule type; Flat and PC.

Option 24: FC-APC key width 2.2 mm (angled convex)
Option 25: FC-APC key width 2.0 mm (angled convex)
Option 37: FC (flat, convex)

Plug

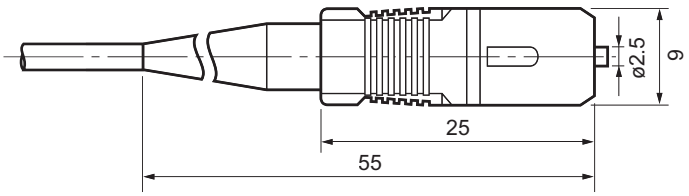


Adapter

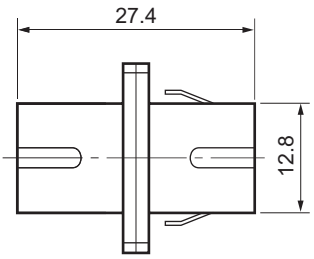


Option 26: SC-APC (angled convex)
Option 40: SC (flat, convex: PC)

Plug

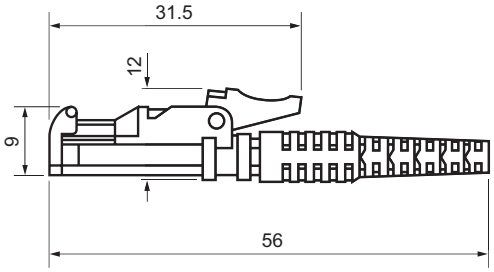


Adapter

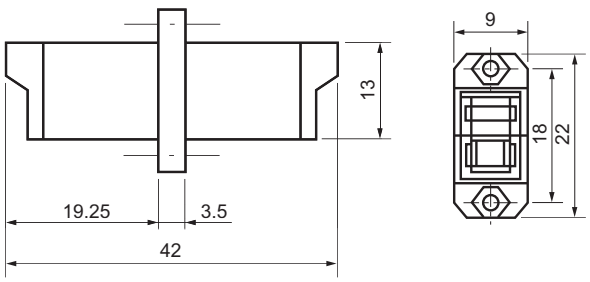


Option 27: E-2000 (convex: PC, angled convex: APC)

Plug

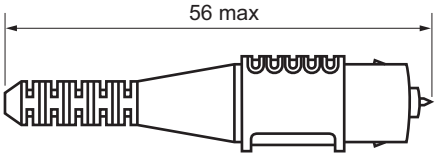


Adapter

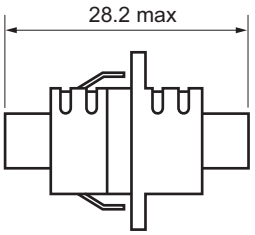


Option 31: EC (angled convex: APC)

Plug



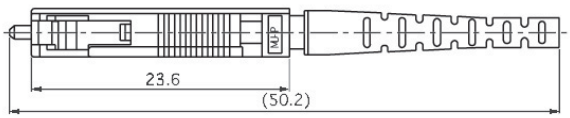
Adapter



Unit in mm

Option 32: MU

Plug



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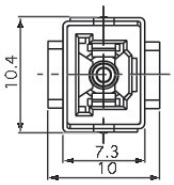
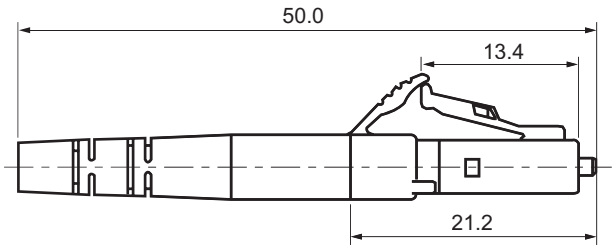
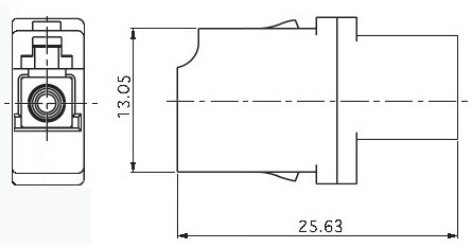


Option 33: LC

Plug

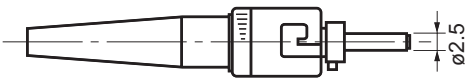


Adapter

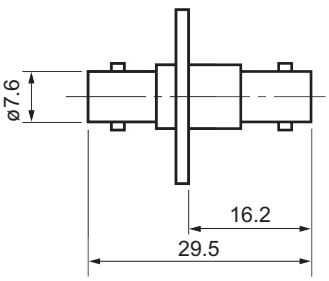


Option 38: ST (flat, convex: PC)

Plug

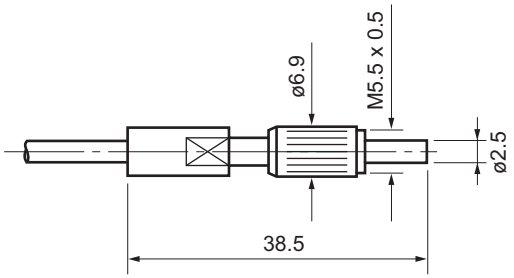


Adapter

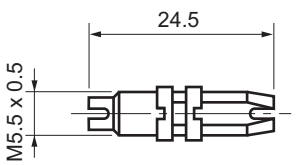


Option 39: DIN 47256 (flat, convex: PC)
Option 47: HRL-10 (angled convex)

Plug

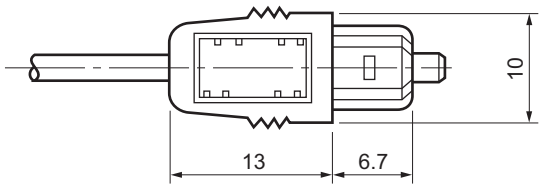


Adapter



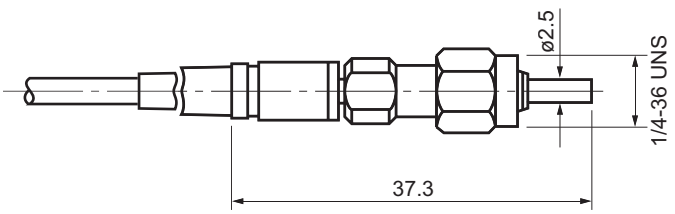
Option 41: TOCP 172 (flat)

Plug

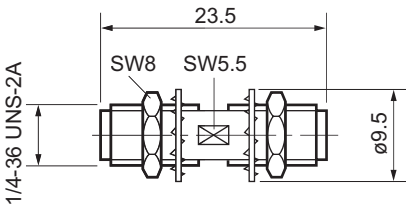


Option 42: HFS-13/A (GI, flat)

Plug

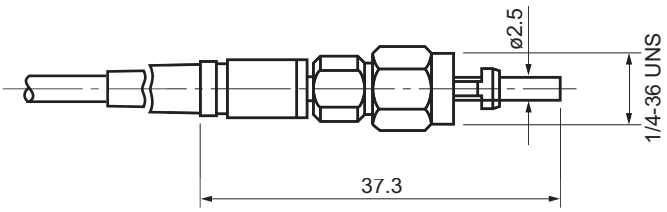


Adapter

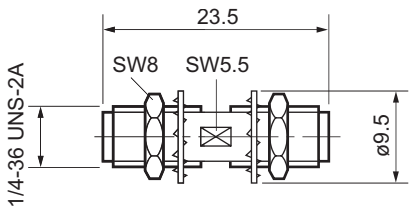


Option 43: HMS-10/A (SM, convex: PC)

Plug



Adapter



ACCESS MASTER™

MT9083A

0.85/1.3 µm (MMF), 0.78/1.31/1.383/1.49/1.55/1.625/1.65 µm (SMF)

CE

All-in-One Solution for Optical Fiber Construction and Maintenance of Access, FTTx, LAN and Metro Networks

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., as well as a notebook computer for evaluating the FTTx QoS. 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 MT9083A 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 MT9083A model for your needs.

Key Features

- Ready to test in less than 15 seconds and all day without recharging
- Specialized testing modes simplify operation
- High resolution and high dynamic range ensure thorough and complete fiber evaluation
- Intelligent analysis software identifies problem splices, connectors and even macrobends
- Rugged, sealed design provides years of service in the most challenging environments
- IP testing option verifies throughput, frame loss and point-to-point connectivity
- Test up to four 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

Designed with the Features that Matter Most

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 that things like performance, portability, reliability, easy operation and of course price are important.

• Quick Startup

The MT9083A is ready for measurement just 15 seconds after power-on 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 MT9083A typically provides up to 8 hours of operation on a single charge. This coupled with an optional car cord (for cigarette lighter operation) guarantees the MT9083A is ready when you are.

• Portable

With its light weight design and user friendly dimensions, the MT9083A is perfect for the outside plant environment and can easily be managed with one hand. The shoulder strap (part of the protector option) further increases portability when travelling from the truck to the testing site.

• Rugged

The MT9083A features a solid casework with no fans or vents to allow dust or moisture from entering the unit. In addition, the protector option (MT9083A-010) includes rubber bumpers and a display cover for additional protection from those minor mishaps.

• Generous Data Storage

With the ability to store up to 1,000 traces in internal memory and up to 30,000 via a USB device, the MT9083A offers plenty of storage for collecting and managing data.

• No Experience Required

With the MT9083A, the experience is built in. With specialized testing modes, automatic parameter selection, PASS/FAIL indicators as well as features to virtually eliminate the chance to get "bad" results, the MT9083A can make anyone seems like a 20 year veteran. Let it help you master your network.

• Easy "Drag and Drop" File Transfers

When the MT9083A is connected to a PC via a USB cable, the internal memory of the ACCESS Master can be directly accessed. Data can be selected, dragged and dropped into the PC memory, greatly simplifying file transfers. The MT9083A also supports use of USB memory sticks.

• Common OTDR Data Format

The MT9083A supports the universal Telcordia SR-4731 (issue 2) format making it compatible with not only legacy Anritsu and NetTest products, but with many other vendors data.

• 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.

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 1m (80 cm typical) and a sampling resolution of 5 centimeters allow the MT9083A to evaluate connections and troubleshoot central office, FTTx and intra-building faults with ease – providing a level of detail never before seen.

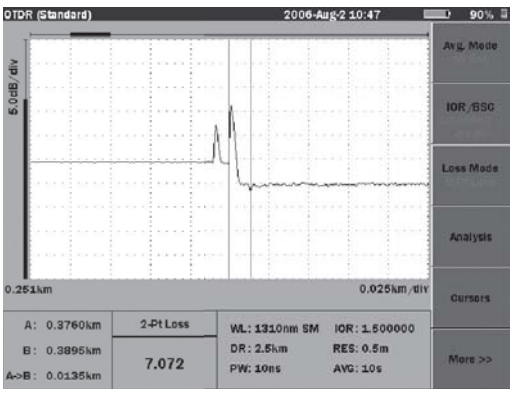


Fig. 1: With its high resolution optics, the MT9083A provides exceptional detail allowing users to quickly determine where the problem is – even when events are closely spaced.

• Extended Range Testing of 100+km Fibers

In addition to its superb high-resolution performance, the MT9083A also features up to 38.5dB of dynamic range allowing it to easily test 100+km spans making it a very useful tool for any network type.

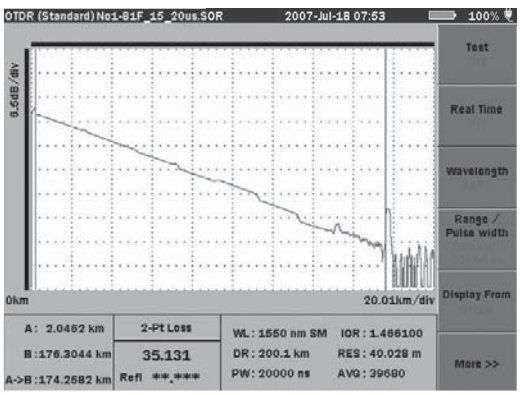


Fig. 2: Spans of over 100 km are also easily tested making the MT9083A the only tool you will need - for any network type.

• Supports Two Display Types

There are two types of 6.5-inch, TFT, color LCDs: the Standard type (MT9083A), offering easy viewing for working indoors, and the Enhanced type (MT9083A1), offering easy viewing for working both indoors and outdoors – even in direct sunlight.

Convenient Features

• Active Fiber Check

Not only can OTDR measurements be effected when the optical fiber is in-service but there is a potential risk of damage to the transmitter and OTDR receiver. To prevent these problems, the MT9083A verifies if light is present before starting measurement and will not transmit if it is. An onscreen warning and internal OTDR protection are also part of this useful feature.

• Waveform Comparison Function

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

• Integrated Macrobend Detection

With many technicians making the switch from copper installations to optical fiber, installation issues such as macrobends are bound to occur. To help prevent this, Anritsu has developed a macrobend detection feature for the MT9083A that will alert technicians when a possible macrobend is present. This provides a higher quality of service for the customer and eliminates costly troubleshooting for you.

• 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 MT9083A allowing technicians to easily assess a fiber's condition. Failing values are clearly highlighted in the event table alerting technicians of potential problems.

• Multiple Wavelengths and Models

With nine available wavelengths spanning both single mode and multimode, the ACCESS Master MT9083A is sure to meet your individual needs. Up to four of these wavelengths can be combined into a single optical output providing full spectrum characterization.

• Wavelengths for Today's Networks

Sometimes you just need more than the traditional 1310 and 1550 nm wavelengths to certify your next generation networks. The MT9083A offers a host of specialized wavelengths including1383 nm for water peak verification of CWDM carrying fibers, 1650 nm (with integrated filter) for live fiber troubleshooting, 1490 nm for verification of voice, data and IP based video services and 780 nm for in-service troubleshooting of FTTx networks - without the need for any additional filters.

A True All-in-One Tester

An OTDR, Optical Power Meter, Visible Light Source, and IP tester are built into Anritsu's compact, light-weight MT9083A 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

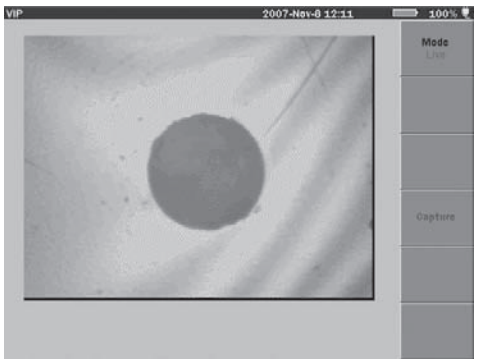
A Visible Light Source is useful for tracking down bad connections, splices and fiber management issues such as macrobends. The optional Visible Light Source is factory installed in the MT9083A and features up to 5 km (3 miles) of operation.

• 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 spreadsheet 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 MT9083A 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.



Optical Access Network QoS Evaluation Using IP Testing

Faults that cause drops in FTTx service speed are handled differently according to whether the cause is outside or inside the building. In addition, business users are starting to think about guaranteed bandwidth services and higher-speed gigabit services.
The MT9083A has a built-in IP Network Connection Check function that can be used for both optical fibers and optical access QoS evaluation.

• Connection and Ping Tests

The first step in testing a service is to verify continuity. The built-in IP Connection Test Function supports both PPPoE and DHCP services.

• FTTx Download Speed Evaluation

FTTx service performance is easily evaluated from the download throughput. Previous evaluation systems were always limited by the PC performance (CPU speed, memory size, OS, load) and never provided accurate measurements. Using the MT9083A Download Throughput Measurement function frees the results from the impact of PC performance and provides accurate results. This allows the causes of drops in FTTx service speeds to be pinpointed to the network side or the user's PC side.

• Throughput Measurement and Frame Counter

The MT9083A has a two-way throughput measurement function for efficient evaluation of guaranteed bandwidth services. When an MT9083A is connected to each end of the service, both the upload and download speeds can be evaluated. And since the built-in frame counter functions can be used to measure received frame types and to count error frames, network usage efficiency can be measured easily too.

• Gigabit Ethernet Support

The MT9083A has an optional built-in 1000Base-T electrical interface for evaluating Gigabit Ethernet throughput (up to full line rate) for verifying performance on increasing common Gigabit Ethernet service.

• Faults Identified

When issues are present, possible causes are displayed onscreen to help isolate the source of the problem.

Specifications

• MT9083A ACCESS Master

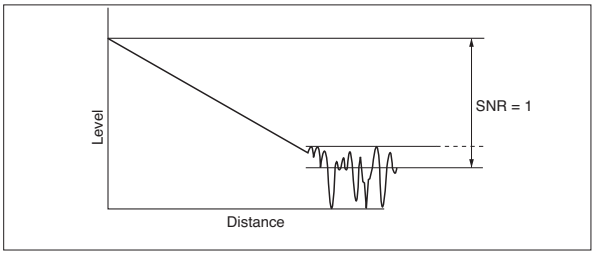
Item	General Specifications	
Dimensions and Mass	Without protector (option 010)	Size: 270 (W) x 165 (H) x 61 (D) mm 10.6 x 6.5 x 2.4 inches
		Weight: 2.2 kg (4.8 lbs) including battery
	With protector (option 010)	Size: 284 (W) x 200 (H) x 77 (D) mm 11.2 x 7.9 x 3 inches
		Weight: 2.9 kg (6.4 lbs) including battery
Display	6.5 inch TFT-LCD (640 x 480, with backlight, transparent type), enhanced indoor/outdoor optional	
Interface	USB 1.1, TypeA x1 (memory), Type B x1 (USB mass storage).	
Data Storage	Internal memory: 20 MB (up to 1000 traces), External memory (USB): up to 30,000 traces with 512 MB	
Power Supply	12 VDC, 100 to 240 VAC, Allowable input voltage range: 90 to 264 V, 50/60 Hz	
Battery	Type: Lithium ion Operating Time*1: 8 hours Recharge Time: <5 hours (power off)	
Power Saving Functions	Backlight off: disable/1 to 99 minutes Auto shutdown: disable/1 to 99 minutes	
Vertical Scale	0.05, 0.125, 0.25, 0.5, 1.25, 2.5, 5, 6.5 dB/div	
IOR Setting	1.000000 to 1.999999 (0.000001 steps)	
Units	km, m, kft, ft, mi	
Languages	user selectable (English, French, German, Spanish, Italian, Portuguese, Traditional Chinese, Simplified Chinese, Korean and Russian - contact Anritsu for availability of others)	
Sampling Points*2	Normal: 5001, High density: 20001 or 25001	
Sampling Resolution*3	5 cm (min)	
Reflectance Accuracy	Single mode: ±2 dB, multimode: ±4 dB	
Distance Accuracy	±1 m ±3 x measurement distance x 10^{-5} ± marker resolution (excluding IOR uncertainty)	
Distance Range	Single mode: 0.5, 1, 2.5, 5, 10, 25, 50, 100, 200 km (except 780 nm: 0.5, 1, 2.5 km) Multimode: 0.5, 1, 2.5, 5, 10, 25, 50, 100 km	
Testing Modes	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	

Item	General Specifications
Fiber Event Analysis	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: 20.0 to 70.0 dB (0.1 dB steps) - fiber end/break: 1 to 99 dB (1 dB steps) Number of detected events: up to 99 Macrobend detection
OTDR Trace Format	Telcordia universal. SOR, issue 2 (SR-4731)
Other Functions	Real time sweep*4: 0.15 second Loss modes: 2 point loss, dB/km, 2 point LSA, splice loss, ORL Averaging modes: timed (1 to 3600 seconds) 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
Environmental Conditions	Operating temperature and humidity: 0 to +40˚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 Class 2 Drip proof: IP51 (IEC 60529), JIS C 0920 TYPE I
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

*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 : Except 780 nm
*4 : Sampling mode normal. Except models 062, 068 -1 second or less

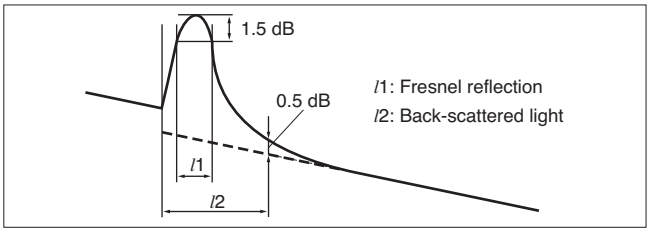
OTDR Specifications						
Model	Wavelength*6	Fiber Type	Pulsewidth	Dynamic Range*7,8	Deadzone (Fresnel)*9	Deadzone (Backscatter)*10
050	1310 ±30 nm	Single Mode (SMF) 10/125 µm ITU-T G.652	3, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 10000, 20000 ns	38.5 dB	≤1 m (80 cm typical)	≤5 m
051	1550 ±30 nm			37 dB		≤5.5 m
052	1650 ±5 nm			33.5 dB		≤6.5 m
053	1310/1550 ±30 nm			38/36.5 dB		≤5/5.5 m
054	1550 ±30/1650 ±5 nm			36/33.5 dB		≤5.5/6.5 m
055	1310/1550 ±30 nm, 1650 ±5 nm			37.5/36/33.5 dB		≤5/5.5/6 m
056	1310/1490/1550 ±30 nm			36/34.5/34.5 dB		≤6/6.5/6.5 m
057	1310/1550/1625 ±30 nm			36/34.5/31.5 dB		≤6/6.5/7.5 m
058	1310/1490/1550/1625 ±30 nm			34/32.5/32.5/29.5 dB		≤7/7.5/7.5/8.5 m
059	1310/1550/1625 ±30 nm, 1383 ±2 nm			34/32.5/29.5/33 dB		≤7/7.5/8.5/7.5 m
060	1490 ±30 nm			36.5 dB		≤5.5 m
061	1625 ±30 nm			33.5 dB		≤6.5 m
062	780 ±20 nm		1550 nm above 780 nm: 5, 10 ns	8 dB (10 ns)	≤1 m	≤7 m
068	780 ±20/1550 ±30 nm			8/36.5 dB	≤1 m 1550 nm: (80 cm typical)	≤7/5.5 m
063	1310/1550 ±30 nm, 850/1300 ±30 nm	HYBRID (SMF/MMF)	Same as SMF & MMF	38/36.5 dB, 28/27 dB	≤1 m (80 cm typical)	≤5/5.5 m, ≤4/5 m (3/4 m typical)
064	850/1300 ±30 nm	Multimode (MMF) 62.5/125 µm	3, 10, 20, 50, 100, 200, 500,1000, 2000, 4000 ns 850 nm: Not Support 1000, 2000, 4000 ns	28/27 dB		≤4/5 m (3/4 m typical)
065	850 ±30 nm			28 dB		≤4 m (3 m typical)
Laser*11 Safety	IEC Pub 60825-1:2001 Class1: option 051,052,060,062 IEC Pub 60825-1:2001 Class1 M: option 050, 053, 055, 056, 057, 058, 059, 063, 064, 065 21 CFR1040.10 Excludes deviations caused by conformance to Laser Notice N.50 (issued 27 May 2001)					

*6: 25˚C, Pulse width: 1 µs (all except 850, 1300, 780 nm), 850/ 1300 nm: 100 ns, 780 nm: 10 ns
*7: Pulse widths: 20 µs (Options 050 to 061, 063, 068 1310/ 1550 nm) at Distance range: 100 km
Pulse width: 4 µs (Options 063, 064 1300 nm) at Distance range: 25 km
Pulse width: 100 ns (Options 063, 065 850 nm) at Distance range: 25 km
Pulse width: 10 ns (Options 062, 068 780 nm) at Distance range: 2.5 km
Averaging: 180 seconds, SNR=1, 25˚C
*8: 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.

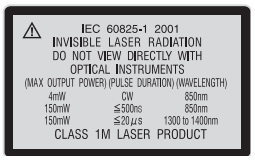


∗9: Pulse width: 3 ns (Options 050 to 061, 063, 064, 065, 068 1550 nm)
Pulse width: 5 ns (Options 062, 068, 780 nm)
Return loss: 40 dB, 25˚C (Refer to the figure below)

∗10: Pulse width 10 ns, return loss 55 dB, Deviation ±0.5 dB, 25˚C (all except 850/1300/780 nm)
Pulse width 10 ns, return loss 40 dB, Deviation ±0.5 dB, 25˚C (850/1300/780 nm)



∗11: 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.



THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO 50 DATED JULY 26 2001

Light Source and Power Meter Specifications – Standard on all models∗12			
Stabilized Light Source (through OTDR port)		Standard Integrated Power Meter∗13 (through OTDR port)	
Item	Specification	Item	Specification
Wavelength∗14	Same as OTDR	Maximum Input	+10 dBm
Spectral Width∗15	5 nm (1310 nm) ≤10 nm (1490/1550/1625 nm), ≤3 nm (1650 nm),≤1 nm (1383 nm)	Measurement Range	–50 to –5 dBm
Fiber Type	Same as OTDR	Fiber Type	Same as OTDR
Optical Connector	Same as OTDR	Optical Connector	Same as OTDR
Output Power∗15	–5 ±1.5 dBm	Accuracy∗18	±6.5%
Output Stability∗16	±0.1 dB	Supported Wavelengths	1310, 1550, 1625 nm plus * 1490 nm (056, 058, 060) * 1383 nm (059) * 1650 nm (050, 051, 053, 054, 055, 057, 061)
Modes of Operation∗17	CW, 270 Hz, 1 kHz, 2 kHz		
Laser Safety	Same as OTDR	Features	Store reference, loss table

Loss Test Set Specifications – Optional on all Models∗12, ∗13 Power meters (003, 004, 005 and 006)				
Option Number	MT9083A-003	MT9083A-006	MT9083A-004	MT9083A-005
Fiber Type	Single Mode: 10/125 µm (G.652), Multimode: 62.5/125 µm	Single Mode: 10/125 µm (G.652), Multimode: 62.5/125 µm ∗PC only for UPC connector	Single Mode:10/125 µm (G.652) ∗PC only for UPC connector	Single Mode: 10/125 µm (G.652)
Measurement Range∗19	–70 to +3 dBm∗20		–50 to +23 dBm	–43 to +30 dBm
Wavelength Range	750 to 1700 nm		1200 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 MA9005B adapters	Universal – uses JXXXX adapters (same as OTDR)		Universal – uses MA9005B adapters
Accuracy∗21	±5%			
Modulation	CW, 270 Hz, 1 kHz, 2 kHz			
Features	Store reference, loss table			

Visible Light Source (Option 002)	
Central Wavelength	650 nm ±15 nm (at 25˚C)
Optical Output	0 ±3 dBm (CW)
Output Optical Fiber	10/125 µm, SMF (ITU-T G.652)
Optical Connector	2.5 mm universal
Laser Safety∗22	IEC Pub 60825-1 Class 3R, IEC Pub 60825-1:2001 Class1: option 051,052,060,062 IEC Pub 60825-1:2001 Class1 M: option 050, 053, 055, 056, 057, 058, 059, 063, 064, 065 21 CFR1040.10 Excludes deviations caused by conformance to Laser Notice N.50 (issued 27 May 2001)
Environmental	Same as OTDR

∗12: Some models do not support built-in light source and power meter (See next page)
∗13: If option 003, 004 or 005 is ordered, the standard integrated power meter is not available
∗14: Option 059: 1383 ±20 m
∗15: CW, 25˚C
∗16: CW, 0˚ to 40˚C (±1˚C) difference between max/min. values over 1 minute, SM fiber, 2 m
∗17: Modulation +1.5% with 10 minute warm up
∗18: CW input, –20 dBm At 1550 nm, 23˚C ±2 Using Master FC connector
∗19: Peak power, subtract 3 dB for modulated tones
∗20: +3 to –60 dBm (Opion 006 @ 850 nm)
∗21: CW, model 003: At –10 dBm 1310/1550 nm,
At –10 dBm 850 nm, 25˚C
model 004/005: At 0 dBm 1310/1550 nm

∗22: Safety measures for laser products
This option complies with optical safety standards in Class 3R of 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 JULY 26 2001

Standard Light Source and Power Meter Built-in

LS: MT9083A standard built-in stabilized light source, OPM: MT9083A standard built-in optical power meter

Model	Optical Port	LS	OPM
MT9083A-050	1310 nm SM	√	√
MT9083A-051	1550 nm SM	√	√
MT9083A-052	1650 nm SM	√	—
MT9083A-053	1310/1550 nm SM	√	√
MT9083A-054	1550 nm SM	√	√
	1650 nm SM	√	√
MT9083A-055	1310/1550 nm SM	√	√
	1650 nm SM	√	√
MT9083A-056	1310/1490/1550 nm SM	√	√
MT9083A-057	1310/1550/1625 nm SM	√	√
MT9083A-058	1310/1490/1550/1625 nm SM	√	√
MT9083A-059	1310/1550/1625/1383 nm SM	√	√

Model	Optical Port	LS	OPM
MT9083A-060	1490 nm SM	√	√
MT9083A-061	1625 nm SM	√	√
MT9083A-062	780 nm SM	—	—
MT9083A-063	850/1300 nm GI	√	—
	1310/1550 nm SM	√	√
MT9083A-064	850/1300 nm GI	√	—
MT9083A-065	850 nm GI	√	—
MT9083A-068	780 nm SM	—	—
	1550 nm SM	√	√

Battery Pack

Battery	Lithium Ion secondary battery
Voltage, capacity	11.1 V, 4200 mAh
Dimensions and mass	53 (W) x 19 (H) x 215 (D) mm, 360 g typ.
Operating temperature	Charging: +5˚ to +30˚C
	Discharging: –20˚ to +60˚C
	Storage: –20˚ to +50˚C, ≤90%RH

AC Adapter: Z0933A

Rated AC input	100 to 240 Vac, 50/ 60 Hz
Rated DC output	12 Vdc, 3 A
Dimensions and mass	60 (W) x 34 (H) x 122 (D) mm, 305 g typ.
Environmental conditions	Operating temperature:
	0 to +40˚C, 20 to 80% R.H.
	Storage temperature:
	–20˚ to +80˚C, 10 to 95% R.H.

IP Testing Option

Model	MT9083A-001	MT9083A-011
Name	IP Network Connection Check Function	Gigabit Ethernet Upgrade
Measurement IF	10BASE-T/100BASE-TX : 1port	10BASE-T/100BASE-TX/1000BASE-T : 1 port
IF Speed	10M/100M Full, 10M/100M Half, Auto negotiation, Auto MDI/MDI-X	
Connectivity Check Connection mode VLAN	OK/NG Judgment PPPoE, DHCP, Manual VLAN setup is possible in the DHCP Mode and Manual Mode. Single VLAN tag is supported. VID: 1 to 4094, COS: 0 to 7	
Connection Test Ping Test Trace Route Test	Can be executed after the connection is established by using the Connectivity Check function. Number of times: 1 to 999, Timeout Threshold: 1 to 60 s Timeout Threshold: 2 to 60 s, Hops: 1 to 255	
Download throughput measurement Download file size Download throughput value	Can be performed after the connection is established by using the Connectivity Check function. The full wire rate is supported. Up to 1 GB Download file size [bits] / Download time [s]	
Throughput measurement Frame size Transmit Rate Transmit Duration Time Resolution Loss Tolerance	Can be performed after the connection is established by using the Connectivity Check function. 64, 128, 256, 512, 768, 1024, 1280, 1518, 9018, 9618 : The frame size 9018 and 9618 can be selected when the link speed is 1000M. 1 to 100% of the line band (100% at full-wire rate), in steps of 1% 5, 10, 15, 20, 30, 60, 180, 300 s 1% or 5% of the line band 0, 0.01, 0.1, 1, 5, 10%	
Counter measurement Measurement time Frame type	1 to 720 min, in steps of 1 min. All frame, Only PPPoE frame, Only VLAN frame	

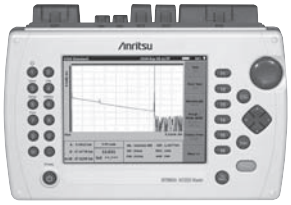
Ordering Information

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) and printed user's manual.

Model/ Order No.	Description
MT9083A	ACCESS Master base unit, Standard display
MT9083A1	ACCESS Master base unit, Enhanced display



Without Protector

With Protector

2) Select Optical Configuration

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

Model/Order No.	Wavelength	Application
MT9083A-050	1310 nm, single mode	General-purpose model for construction, maintenance and fault location
MT9083A-051	1550 nm, single mode	General-purpose model for construction, maintenance and fault location
MT9083A-052	1650 nm, single mode	In-service measurement – integrated filter to block transmissions
MT9083A-053	1310/1550 nm, single mode	General-purpose model for construction, maintenance and fault location
MT9083A-054	1550 nm & 1650 nm, SM	General-purpose models for construction, maintenance and fault location plus In-service measurement – integrated filter to block transmissions
MT9083A-055	1310/1550 nm & 1650 nm, SM	
MT9083A-056	1310/1490/1550 nm, SM	General-purpose plus 1490 nm for FTTx/PON applications
MT9083A-057	1310/1550/1625 nm, SM	General-purpose plus enhanced macrobend detection at 1625 nm
MT9083A-058	1310/1490/1550/1625 nm, SM	General purpose for any application or full spectrum characterization
MT9083A-059	1310/1383/1550/1625 nm, SM	General-purpose plus supports Water Peak testing at 1383 nm
MT9083A-060	1490 nm, single mode	FTTx/PON testing
MT9083A-061	1625 nm, single mode	Enhanced macrobend detection
MT9083A-062	780 nm, single mode	For troubleshooting live FTTx/PON networks
MT9083A-068	780 &1550 nm, single mode	For troubleshooting live FTTx/PON networks plus general testing
MT9083A-063	850/1300 nm MM, 1310/1550 nm SM	Best unit for contractors or anyone who installs or maintains hybrid networks
MT9083A-064	850/1300 nm, multimode	Multimode fiber model
MT9083A-065	850 nm, multimode	Multimode fiber model

3) Select Factory Installed Options

Must be added as separate, chargeable line items.

Model/Order No.	Description
MT9083A-010	Protector option (includes rubber bumpers, display cover and shoulder strap)
MT9083A-001	IP Network Connection Check Function
MT9083A-011	Gigabit Ethernet Upgrade (requires option MT9083A-001)

4)Select Loss Test Set Options

Optical Power Meter Must be added as separate, chargeable line items.	
Model/Order No.	Description
MT9083A-003	SMF Optical Power Meter (APC and UPC)
MT9083A-004	SMF Optical Power Meter (UPC only)
MT9083A-005	SMF High Power Optical Power Meter
MT9083A-006	SMF/MMF Optical Power Meter (UPC only)
Visible Light Source	
Model/Order No.	Description
MT9083A-002	Visible Laser Diode

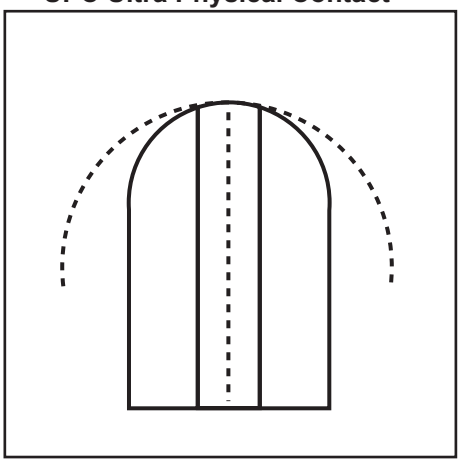
5) Select Connector Types

The ACCESS Master MT9083A can be optioned to feature up to three optical ports – single mode OTDR, multimode OTDR and an optical power meter (options -003, -004, -005 and -006). 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.

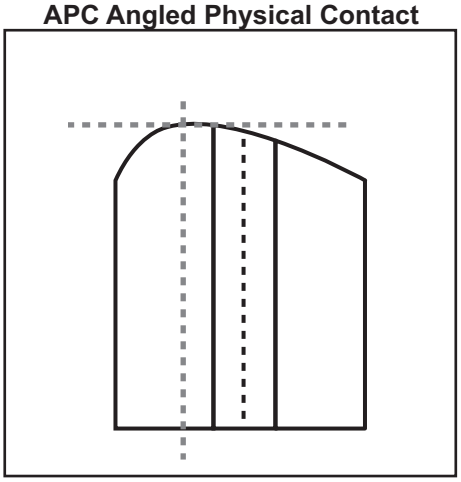
Optical Connectors One adapter type is provided for each port at no charge - must be added as separate line items. NOTE: FC-APC and SC-APC are not available for MM OTDR or optical power meter.			
Model/Order No.	Description	Model/Order No.	Description
MT9083A-025	FC-APC connector - single mode OTDR only (additional charge applies)	MT9083A-038	ST connector
MT9083A-026	SC-APC connector - single mode OTDR only (additional charge applies)	MT9083A-039	DIN connector
MT9083A-033	LC connector	MT9083A-040	SC connector
MT9083A-037	FC connector	MT9083A-043	HMS-10/A 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) MT9083A-053 with MT9083A-004 power meter option

Customer can specify “MT9083A-040 for the SM OTDR” port and “MT9083A-037 for the OPM” port at no charge.

2) MT9083A-063 with MT9083A-003 power meter option

Customer can specify “MT9083A-040 for the SM OTDR” port, “MT9083A-037 for the MM OTDR” port and “MT9083A-037 for the OPM” port at no charge.

3) MT9083A-053 with no options

Customer can specify “MT9083A-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	
W2839AE	Hardcopy MT9083A operation manual	
B0582A	Soft carrying case	
B0583A	Hard carry case for MT9083A - attaché style	
B0549	Hard carry case for MT9083A with handle and wheels	
Z0921A	Replacement battery pack for MT9083A	
Z0933A	Replacement AC charger/adapter	
Z0942A	External battery charger	
J1295	Car plug cord	
OPTION-545VIP	Connector video inspection probe (VIP) option	
NETWORKS	PC emulation software for data analysis and reporting	
MT9083A-ES210	12 month extended warranty	
MT9083A-ES310	24 month extended warranty	
Peripherals		
BL-80R2	Thermal printer kit (must also order BL-100W AC adapter, J1314 printer cable and BL-80-30 paper rolls)	
BL-100W	AC adapter for BL-80R2 printer	
J1314	Printer cable for BL-80R2 printer	
BL-80-30	Printer paper for BL-80R2 Thermal Printer (10 rolls/set)	
Retrofit Options for existing units – unit must be returned to authorized service center		
MT9083A-101	IP Network Connection Check Function (Retrofit)	
MT9083A-111	Gigabit Ethernet Upgrade (Retrofit - requires option MT9083A-001 or MT9083A-101)	
MT9083A-110	Protector Option (Retrofit)	
MT9083A-103	SMF/MMF Optical Power Meter (Retrofit)	
MT9083A-104	SMF Optical Power Meter (Retrofit)	
MT9083A-105	SMF High Power Optical Power Meter (Retrofit)	
MT9083A-102	Visible LD (Retrofit)	
Replacement Adapters		
Type	OTDR and Power meters (MT9083A-004 and MT9083A-006)	Power meter (MT9083A-005 only)
LC	J1270	MA9005B-33
FC	J0617B	MA9005B-37
Angled FC (AFC)	J0739A	N/A
ST	J0618D	MA9005B-38
DIN	J0618E	MA9005B-39
HMS-10A	J0618F	MA9005B-43
SC (UPC or APC)	J0619B	MA9005B-40

Basic Kits		
Model/Order No.	Z1093A	
Name	MT9083A1-053-BKIT	
Configurarion	Model	Name
	MT9083A1 MT9083A-053 MT9083A-010 B0582A	ACCESS Master SMF 1.31/1.55 µm OTDR Protector Soft carrying case
Model/Order No.	Z1094A	
Name	MT9083A1-063-BKIT	
Configurarion	Model	Name
	MT9083A1 MT9083A-063 MT9083A-010 B0582A	ACCESS Master MMF 0.85/1.3 µm & SMF 1.31/1.55 µm OTDR Protector Soft carrying case
Model/Order No.	Z1095A	
Name	MT9083A1-053-DKIT	
Configurarion	Model	Name
	MT9083A1 MT9083A-053 MT9083A-010 B0582A MT9083A-006 MT9083A-002 NETWORKS	ACCESS Master SMF 1.31/1.55 µm OTDR Protector Soft carrying case SMF/MMF Optical Power Meter Visible LD NetWorks/OTDR

Model/Order No.	Z1096A	
Name	MT9083A1-063-DKIT	
Configurarion	Model	Name
	MT9083A1 MT9083A-063 MT9083A-010 B0582A MT9083A-006 MT9083A-002 NETWORKS	ACCESS Master MMF 0.85/1.3 µm & SMF 1.31/1.55 µm OTDR Protector Soft carrying case SMF/MMF Optical Power Meter Visible LD NetWorks/OTDR
Model/Order No.	Z1097A	
Name	MT9083A1-053-CKIT	
Configurarion	Model	Name
	MT9083A1 MT9083A-053 MT9083A-010 B0582A MT9083A-004 MT9083A-002	ACCESS Master SMF 1.31/1.55 µm OTDR Protector Soft carrying case SMF Optical Power Meter Visible LD

Note: Specify the optical connector. -"5) Select connector Types"

OPTICAL TIME DOMAIN REFLECTOMETER

MW9076 Series

1.31/1.45/1.55/1.625 µm (SM)

CE

Simple Measurement of Chromatic Dispersion

Features

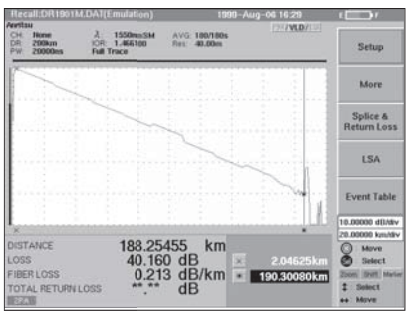
- 45 dB high dynamic range
- 8 m short dead zone
- Simple measurement of chromatic dispersion from one end of optical fiber
- Measurement in 10 s (Full-Auto mode), 0.15 s real-time sweep
- 5 cm high resolution, 50,000 sampling points
- 8.4 inch TFT-LCD color display

Model		MW9076B1	MW9076B	MW9076D1
Optical fiber		SM	SM	SM
Wavelength		1.31/1.55 µm ± 25 nm	1.31/1.55 µm ± 25 nm	1.31/1.45/1.55/ 1.625 µm ± 3 nm
Dynamic range		40.5/38.5 dB (typical value)	45/43 dB (typical value)	34.5/33.5/32.5/ 30.0 dB
Dead zone (Fresnel/ back-scattered)		1.6/8 m	1.6/8 m	3/25 m
Chromatic dispersion				√
Light source function			√	
Options	Visible LD	√	√	√
	Optical power meter	√	√	
	High power optical power meter	√	√	
	Optical channel selector	√	√	
Features		• High cost performance • Short dead zone • Low cost	• Highest class model • Wide dynamic range • Short dead zone	• Chromatic dispersion measurement • Four wavelengths • Wavelength accuracy: ±3 nm

Performance and Functions

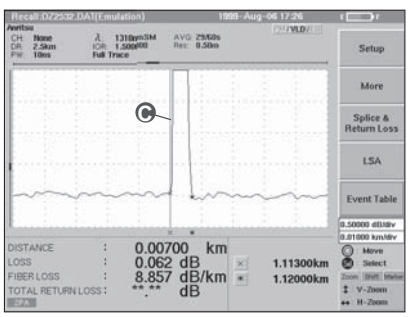
- **High Dynamic Range for Long Distance Fiber**

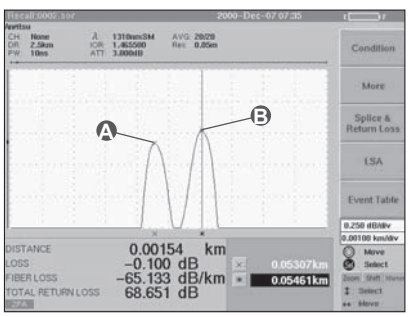
When using a wavelength of 1.55 µm, a point about 190 km distant can be measured.



- **Short Dead Zone**

Clearly measure up to near end by 8 m dead zone (back-scatter, SM unit)





• Chromatic Dispersion Measurement

The MW9076D1 has a built-in function for measuring chromatic dispersion even outdoors. The chromatic dispersion can be measured automatically over a wide range from 1300 to 1660 nm from one end of the fiber. The dispersion reproducibility is ±0.05 ps/(nm · km) * and the dynamic range is 30 dB. The MW9076D1 can be operated from an external PC using remote commands to measure the chromatic dispersion. For detail of the chromatic dispersion measurement, refer to the document of "product introduction MW9076 series Optical Time Domain Reflectometer".

∗: Measured with 25 km of 1.3 µm zero-dispersion fiber (ITU-T G.652) at 1550 nm.

• Fresnel Reflection

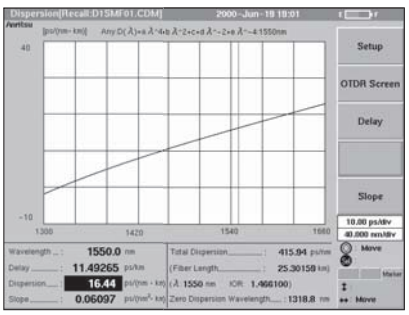
The far-end Fresnel reflection can be measured for four wavelengths (1310/1450/1550/1625 nm).

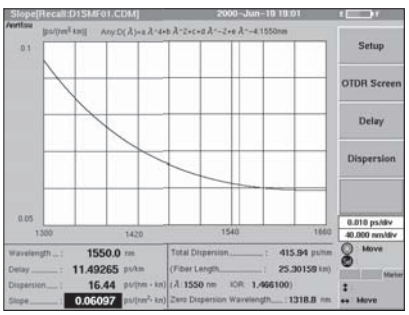
• Group Delay Characteristics

The fitting formula supports cubic or quintic Sellmeier, and polynomials can be applied to various types of fibers.

• Chromatic Dispersion Characteristics

The zero and total dispersion can be displayed along with the delay, dispersion and dispersion slope at 0.1 nm steps.





• High-speed Measurement

It takes only 10 seconds to measure and display the waveform and connection loss on one screen. Just one press of the Start key is all that is needed to make measurement.

• Full Automatic Mode

Measurement results are displayed by simply pressing the Start key. All complicated settings of distance range, pulse width, attenuator, and maker can be automatically executed. Measurement speed in this mode was significantly increased. When the wavelengths are set to ALL, wavelengths are automatically changed.

• Repeated Measurement

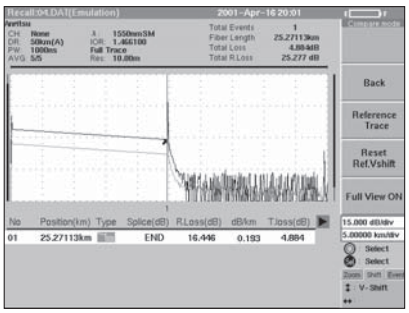
A series of operations, such as measurement, wavelength switching, data saving, optical channel switching, and next optical fiber measurement, can be executed automatically under preset measurement conditions. This mode is ideal for measuring a multi-core optical fiber.

• Waveform Comparison Function

Measured and saved data can be compared on the same screen. In addition, differences can be displayed as a waveform for simple observation of distance and level differences. This is useful for checking aging changes or comparing several fibers.

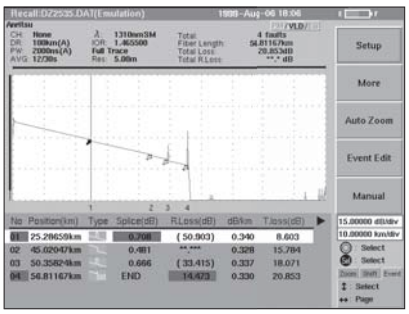
• Multi-wavelength Measurement and Group Display

When the Start button is pressed, The fibers are measured by multiple wavelength automatically and displayed on the screen. This simplifies analysis of fault locations like sections with loss due to fiber bending, which are hard to analyze using a single wavelength.



• Warning Level Setup Function

In automatic measurement mode, an event warning value can also be set in addition to a detection threshold value. For example, the threshold value can be set to the acceptance level, and warning value to a pass/rejection decision level. In this case, all events will be detected, and those exceeding the warning value are displayed in another color, therefore, enabling the operator to easily identify possible "borderline" events.



• Communication Light Check Function

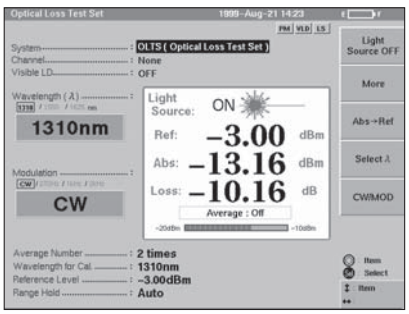
When measuring a fiber in service, there is a possibility of mis-measurement by an OTDR. To guard against the risk of mis-measurement, this check function checks for the presence of light other than the OTDR optical measurement pulse.

• Visible LD

A 635 nm visible LD option is available for the detection of breaks and loss points along the fiber to be measured.

• Light Source, Power Meter

Optical fiber loss can be measured using the optical power meter function and light source function. Two types of optical power meters are supported: One is measurement range of –70 to +3 dBm (MW9076B/B1-02 option), the other is measurement range of –50 to +23 dBm (MW9076B/B1-03 option).



∗ Light source function is mounted on MW9076B as standard. Power meter function is optional to MW9076B/B1.

• VGA Output Terminal
The VGA connector outputs the screen interface to a CRT monitor, which is very useful for production-line applications.

• Large Internal Memory
About 18 MB internal memory is provided as standard. The following table shows the number of waveforms which can be saved in each media.

Media	GR196	Analysis
FDD (1.4 MB)	123	67
PC-ATA card (256 MB)	16000	10600
Internal memory (18 MB)	1560	860

Number of data points: 5,000

MX907600A OTDR Emulation Software

• Emulation Function
Measured waveform data can be analyzed using a PC.

• Data Transmission Function
Data files recorded by the MW9076 series can be transferred to a PC via the RS-232C port.

• Both-end Measurement Function
A new waveform can be composed by averaging data measured at both ends of an optical fiber.

Specifications

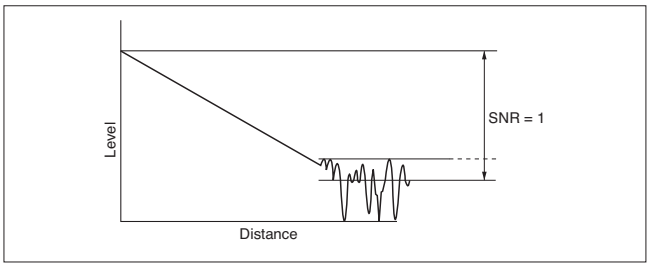
• Optical Time Domain Reflectometer (main frame)

Model	MW9076B	MW9076B1	MW9076D1
Wavelength	1310/1550 ±25 nm*1		1310/1450/1550/1625 ±3 nm*1
Measurable optical fiber	10/125 µm single-mode optical fiber (ITU-T G.652)		
Optical connector	FC, SC, DIN, HMS-10/A, ST (replaceable, PC type)		
Distance range	1, 2.5, 5, 10, 25, 50, 100, 200, 250, 400 km		
Pulse width	10, 20, 50, 100, 500, 1000, 2000, 4000, 10000, 20000 ns		
Dynamic range*2, *3 (S/N = 1)	42.5 dB (1.31 µm), 40.5 dB (1.55 µm) *Typical value: 45 dB (1.31 µm), 43 dB (1.55 µm)	38 dB (1.31 µm), 36 dB (1.55 µm) *Typical value: 40.5 dB (1.31 µm), 38.5 dB (1.55 µm)	34.5 dB (1.31 µm), 33.5 dB (1.45 µm), 32.5 dB (1.55 µm), 30.0 dB (1.625 µm)
Dead zone (back-scattered light)*4	≤8 m (1.31 µm), ≤9 m (1.55 µm)		≤25 m
Dead zone (Fresnel reflection)*5	≤1.6 m		≤3 m
Marker resolution	0.05 to 800 m		
Sampling resolution	0.05 to 80 m		
Sampling points*6	Quick mode: 5001, 6251 Normal mode: 20001, 25001 High mode: 40001, 50001		
Y-axis scale	0.25, 0.5, 1, 2.5, 5, 10, 15 dB/div (15 dB/div is indicated only at Auto and Full Auto measurement.)		
IOR settings	1.400000 to 1.699999 (0.000001 steps)		
Distance measurement accuracy	±1 m ±3 x measurement distance x 10^{-5} ±marker resolution (excluding uncertainty caused by fiber IOR)		±0.1 m ±3 x measurement distance x 10^{-5} ±marker resolution (excluding uncertainty caused by fiber IOR)
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, total return loss. Each event distance, connection loss, return loss, or reflection amount (displays in table format) Threshold values Connection loss: 0.01 to 9.99 dB (in 0.01 dB steps), Return loss: 20 to 60 dB (in 0.1 dB steps), Fiber-end: 1 to 99 dB (in 1 dB steps) Warning values Splice connection loss: 0.1 to 10 dB (in 0.01 dB steps), Connector connection loss: 0.1 to 10 dB (in 0.01 dB steps), Return loss: 10 to 50 dB (in 0.1 dB steps), Fiber loss: 0.01 to 10 dB (in 0.01 dB steps), Total loss: 0.1 to 60 dB (in 0.1 dB steps), Total return loss: 10 to 50 dB (in 0.1 dB steps), Average loss: 0.01 to 10 dB (in 0.01 dB steps) Number of detected events: Up to 99 Automatic setting: Distance range, pulse width, averaging count (time) Measurement time: ≤60 s (in full automatic measurement mode) Connection check: Automatic check of front panel connector connection quality Communication light check: Check for presence of communication light in optical fiber to be measured		
Manual measurement	Measurement items: Transmission loss and distance between 2 points, loss per unit length between 2 points, connection loss, return loss/reflection amount, total return loss, average loss Real-time sweep: 0.1 to 0.2 second or less*8		

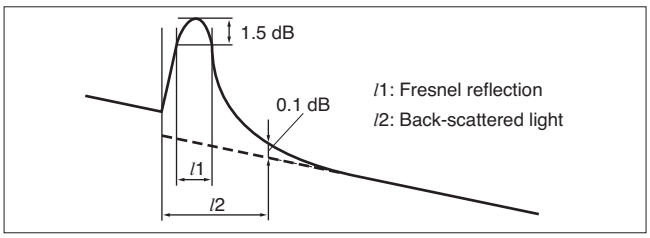
Continued on next page

Model	MW9076B	MW9076B1	MW9076D1
Optical loss measurement light source function	Applicable optical fibers: SM optical fiber (ITU-T G.652) Optical connectors: Shared with OTDR (same port) Light-emitting elements: FP-LD Center wavelength: 1310/1550 ±25 nm (MW9076B, CW, 25˚C) Spectrum width: ≤5/10 nm (MW9076B, CW, 25˚C) Output level accuracy: –3 ±1.5 dBm (CW, 25˚C, SM optical fiber: 2 m) Optical output short term stability: ≤0.1 dB [CW, at one point from –10˚ to +40˚C (±1˚C), Difference between maximum and minimum values in one min, SM optical fiber cable: 2 m] Output waveform: CW, 270 Hz, 1 kHz, 2 kHz (Modulated waves are square waves.) Modulation frequency: 270 Hz/1 kHz/2 kHz ±1.5% Laser safety specification: 21CFR Class 1, IEC 60825-1 Class 1	—	
Chromatic dispersion measurement	—		Wavelength range: 1300 to 1660 nm, Wavelength accuracy: ±0.5 nm*9 (typical), Zero-dispersion repeatability: ±0.6 nm (typical)*10, Dispersion repeatability: ±0.05 ps/(nm·km)*10 * Typical Dynamic range: 30 dB (4% Fresnel, typical)
Other functions	Waveform storage [Bellcore. SOR (GR-196-CORE, SR-4731) or Anritsu. Dat format, user selectable], waveform comparing function, print output (Centronics), repeated measurement function (A series of operations such as wavelength switching, waveform storage, and printing can be executed by pressing a single key.), relative distance set (zero cursor set), calendar clock, distance unit set (km, m, kf, f, mi), title input (up to 32 characters), remaining battery power display		
Laser safety specification	21CFR Class 1, IEC 60825-1 Class 1		
Power	≤35 W max. (at charging), 4 W (in standard state, MU250000A power consumption included.)		
Battery	Continuous operation: 6 h (typical value)*11		
Dimensions and mass	290 (W) × 194 (H) × 30 (D) mm (MW9076B/B1 main frame) 290 (W) × 194 (H) × 75 (D) mm (MU250000A Display Unit included) ≤1.4 kg ≤4.0 kg (MU250000A display unit and battery pack included)		290 (W) × 194 (H) × 77 (D) mm (MW9076D1 main frame) 290 (W) × 194 (H) × 122 (D) mm (with MU250000A Display Unit) ≤3.1 kg (MW9076D1 main frame only), ≤5.7 kg (with MU250000A Display Unit and battery pack included)
Environmental condition	Operating temperature and humidity: –10˚ to +40˚C, ≤85% (no condensation) Storage temperature and humidity: –20˚ to +60˚C, ≤85% Vibration: Conforming to MIL-T-28800E Class 3 Shock: 76 cm height, 6 surfaces, 8 corners*12 Dust-proofing: MIL-T-28800E Drip-proofing: MIL-T-28800E		
EMC	EN61326-1, EN61000-3-2		
LVD	EN61010-1		

∗1: At 25˚C, pulse width: 1 µs
∗2: At 25˚C, pulse width: SM 20 µs, Average 360 sec., 1 µs (1.3 µm), Average 180 sec.
∗3: 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.



∗4: Pulse width: 10 ns, return loss: SM 40 dB, deviation: ±0.1 dB (Refer to the figure right.)
∗5: Pulse width: 10 ns (Refer to the figure right.)
∗6: Either value is automatically selected in each mode, depending on the distance range.
∗7: Automatic measurement is a supporting function which enables to operate easier, it doesn't assure results. As there is a case of miss detection, please check a waveform data, either.
∗8: At quick mode
∗9: Compared value with internal wavelength data at chromatic dispersion measurement
∗10: Measured with 25 km of 1.3 µm zero-dispersion fiber (ITU-T G.652) at 1550 nm.
Not an error from absolute value but repeatability of measured results. Contact Anritsu Corporation in case of measuring ITU-T G.655 fiber.
∗11: At back light low brightness, measurement not executed.
∗12: Dropped on the floor of plywood thickness 5 cm fixed by concrete. Not applicable to the MW9076D1.



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 system, attach a wavelength filter or attenuator to Receiver of transmission system.
There is a possibility of damaging Receiver of transmission system because of high power pulse of OTDR.

• MU250000A Display Unit

Display	MU250000A Unit: 8.4 inch color, TFT-LCD (640 x 480 pixels, transparent type, with back light)
Interface	Serial interface: RS-232C-1 (115.2 kbps max.), with D-sub 9-pin connector RS-232C-2 (57.6 kbps max.), with mini-DIN 8-pin connector Printer interface: 8-bit parallel interface (Centronics), with D-sub, 25-pin connector Keyboard interface: IBM US ENGLISH (101 keys), 106 keys compatible, with mini-DIN 6-pin connector VGA output connector: Mini-DIN 10-pin connector
FDD	Built-in 3.5 inch (1.44 MB/720 KB)
Power supply	10 to 26.4 Vdc 100 to 250 Vac (rated), 50/60 Hz, ≤50 VA max. (Specific AC adapter is used.) Battery: CGR-B/802 Lithium ion battery pack can be used. (mounted in main frame)
Power	≤35 W
Dimensions and mass	290 (W) x 194 (H) x 45 (D) mm, ≤2.2 kg
Environmental conditions	Restricted by memory card specifications when a memory card is mounted. AC adapter: Depend on the conditions of AC adapter Operation temperature and humidity: –10˚ to +40˚C, ≤85% (no condensation), +5˚ to +40˚C, ≤80% (FDD is used.) Storage temperature and humidity: –20˚ to +60˚C, ≤85% Vibration: Conform to MIL-T-28800E Class 3 Shock: 76 cm height, 6 surfaces, 8 corners* Dust proofing: Conform to MIL-T-28800E Drip proofing: Conform to MIL-T-28800E
EMC	Same as MW9076 series
LVD	Same as MW9076 series

∗: Dropped on the floor of plywood (thickness 5 cm) fixed by concrete

• Battery Pack: Z0619 (CGR-B/802E)

Battery	Lithium ion secondary battery
Voltage, capacity	14.4 V, 3440 mAh (49.53 Wh)
Continuous drive time	See the MW9076 series specifications
Charging time	≤3 h (charge at the circumference temperature of 0˚ to +40˚C)
Dimensions and mass	134.5 (W) x 89.5 (H) x 20.5 (D) mm, ≤420 g

• AC Adapter: Z0695 (SA165A-2425V-3)

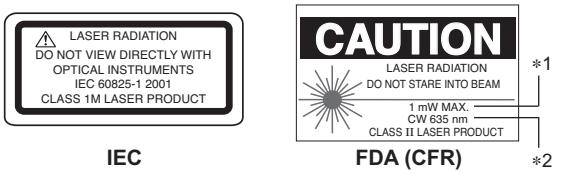
Rated AC input	100 to 240 Vac, 50/60 Hz
Rated DC output	24 Vdc, 2.5 A
Dimensions and mass	122 x 60 x 34 mm, ≤350 g
Safety specifications	UL, CSA, TÜVCB, CE, NORDIC, PSE
Environmental conditions	Operating temperature and humidity: 0˚ to +40˚C, 80% Storage temperature and humidity: –20˚ to +80˚C, 90%

• Visible Light Source: MW9076B/B1/D1-01

Central wavelength	635 ±15 nm (at 25˚C)
Optical output	–3.0 ±1.5 dBm
Output optical fiber	10/125 µm, SM (ITU-T G.652)
Optical connector	FC, SC, ST, DIN, HMS-10/A ∗Replaceable
Optical safety	IEC 60825-1 Class 1M, 21CFR Class 2
Environmental conditions	Same as MW9076 series
EMC	Same as MW9076 series
LVD	Same as MW9076 series

Safety Measures or Laser Products

This option complies with optical safety standards in Class 1M of the IEC 60825-1 and the FDA (21CFR1040.10, USA) in Class 2; the following descriptive labels are affixed to the product (FDA labels is only affixed to product for export to the USA).



The maximum output is indicated under ∗1, and the wavelength under ∗2.
Caution: Do not look directly into the laser beam.

• Optical power meter: MW9076B/B1-02, MW0976B/B1-03

Applicable optical fiber	10/125 µm, SM (ITU-T G.652)
Optical connector	FC, SC, ST, DIN, HMS-10/A ∗Replaceable
Wavelength range	1.2 to 1.7 µm
Measurement range	Option 02: +3 to –70 dBm (continuous light) 0 to –73 dBm (modulated light) Option 03: +23 to –50 dBm (continuous light) +20 to –53 dBm (modulated light)
Measurement accuracy	Option 02: ±5% (–10 dBm, 1.31/1.55 µm, continuous light) Option 03: ±5% (–10 dBm, 1.31/1.55 µm, continuous light)
Environmental conditions	Same as MW9076 series
EMC	Same as MW9076 series
LVD	Same as MW9076 series

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
	Optical Time Domain Reflectometer (main frame, requires display unit)
MW9076B	SMF 1.31/1.55 µm OTDR
MW9076B1	SMF 1.31/1.55 µm OTDR
MW9076D1	SMF 1.31/1.45/1.55/1.625 µm OTDR
	Standard accessories (main frame)
W1659AE	MW9076 Series Operation Manual: 1 copy
W1660AE	MW9076 Series Serial Interface Manual: 1 copy
	Connector Adapter∗1: 1 pc
Z0619	Lithium Ion Battery Pack: 1 pc
	Unit
MU250000A	Display Unit (8.4 inch TFT-LCD)
	Standard accessories (display unit)
Z0695	AC Adapter (SA165A-2524V-3, SINO-AMERICAN ELECTRONIC products)
Z0402	Front Cover
J0979	A-2 Power Cord∗2 (for Japan)
J0980	A-2 Power Cord∗2 (for USA, Canada, Taiwan)
J0981	B4 Power Cord∗2 (for UK, Malaysia, South Africa, Hong Kong)
J0982	C7 Power Cord∗2 (for Europe)
J0983	S3 Power Cord∗2 (for Oceania, China)
J1027	P4 Power Cord∗2 (for India)
J1028	D1 Power Cord∗2 (for Switzerland)
Z0403A	Belt with Hook
	Battery pack
Z0619	Lithium Ion Battery Pack
	Software
MX907600A	OTDR Emulation Software

Model/Order No.	Name
	Options
MW9076B/B1/D1-01	Visible LD (factory option)∗1
MW9076B/B1-02	Optical Power Meter (factory option)∗1, ∗3
MW9076B/B1-03	High Power Optical Power Meter (factory option)∗1, ∗3
MW9076B/B1-25	FC · APC Connector (angled PC type, factory option)
MW9076B/B1-26	SC · APC Connector (angled PC type, factory option)
MW9076B/B1/D1-37	FC Connector (user replaceable)
MW9076B/B1/D1-38	ST Connector (user replaceable)
MW9076B/B1/D1-39	DIN Connector (user replaceable)
MW9076B/B1/D1-40	SC Connector (user replaceable)
MW9076B/B1/D1-43	HMS-10/A Connector (user replaceable)
MW9076B/B1-47	HRL-10 Connector (factory option)
	Application parts
Z0321A	Keyboard (PS/2)
Z1046A	CF Card (256 MB)
J0057	Optical Adapter FC Type
J0635□∗4	Optical Fiber Cord [with FC-PC at both ends (SM)]
B0442	Soft Carrying Case [440 (W) x 310 (H) x 110 (D) mm]
Z0435	Soft Carrying Case [430 (W) x 300 (H) x 170 (D) mm]
Z0436	Hard Carrying Case (holds main frame and thermal printer)
J0617B	Replaceable Optical Connector (FC)
J0618D	Replaceable Optical Connector (ST)
J0618E	Replaceable Optical Connector (DIN)
J0618F	Replaceable Optical Connector (HMS-10/A, HFS-13/A)
J0619B	Replaceable Optical Connector (SC)
J0441	Total Internal Reflection Cord (SM)
J1039	Total Internal Reflection Cord (SC-PC)
J0654A	Serial Interface Cord (for remote control with IBM-PC/AT or J-310, 9 pin-9 pin)
J0655A	Serial Interface Cord (for PC-98 remote control, 9 pin-25 pin)
J0977	Serial Interface Cord (for connection with external optical channel selector)
J0978	VGA Conversion Cable (for external monitor)
J0952A	FC · PC-FC · APC(SG)-1M-SM (FC · APC closed width: 2 mm, conforms to seiko-giken)
J0953A	FC · PC-FC · APC(SI)-1M-SM (FC · APC closed width: 2.14 mm, conforms to SSI)
J0954A	SC · PC-SC · APC-1M-SM [return loss: >50 dB (SC · PC), >65 dB (SC · APC)]
Z0282	Ferrule Cleaner
Z0283	Ferrule Cleaning Tape (6 pcs/set)
Z0284	Adapter Cleaner (stick type, 200 pcs/set)
J1041A	1.31/1.55 LWPF Filter Cord (SC · PC), 1 m
SDC60-3020	Car Charger (adapter for car battery, DC 10 to 15 V)
	Peripherals
BL-80R2	High Speed Thermal Printer∗5
BL-100W	AC Adapter (for BL-80R2, AC 100 to 240 V)
DPU-414-31B	Thermal Printer∗6
PW-4007-U1	AC Adapter∗6
DPU-414-31B	Thermal Printer∗7
PW-4007-E1	AC Adapter∗7
J0614	Printer Connection Cable (for DPU-414)
	Supplies
BL-80-30	Printer Paper (for BL-80R2 thermal printer, 10 rolls/set)
TP411-28CL	Printer Paper (for DPU-414 Thermal printer, 10 rolls/set)

∗1: Specify one of FC, ST, DIN, SC or HMS-10/A. When the connector type is not specified, FC is supplied.
∗2: Specify one of A-2, B4, C7, S3, P4 or D1.
∗3: The optical power meter (Option 02) and high-level-input optical power meter (Option 03) cannot be mounted at the same time.
∗4: Specify the optical fiber length as A, B or C (A: 1 m, B: 2 m, C: 3 m)
∗5: Operates only with AC adapter, printing width: 72 mm, printing speed: approximately 13 s (manual measure-ment result with header), 0˚ to +40˚C, dimensions: 119 (W) x 77 (H) x 174 (D) mm, Sanei products (AC adapter and printer cable are sold separately.)
∗6: 120 VAC ±10 %, 60 Hz, 0˚ to +40˚C, Seiko products (printer cable: sold separately)
∗7: 230 VAC ±10 %, 50 Hz, 0˚ to +40˚C, Seiko products (printer cable: sold separately)

OPTICAL TIME DOMAIN REFLECTOMETER
CMA4500 Series

CE

Full Featured OTDR Designed for all Skill Levels – from a Novice Fault Locator to an Advanced Testing Expert

In addition to the CMA5000a, the CMA 4500 is also available as a full featured, cost effective solution for those who only require OTDR and Loss Test Set capabilities. This dedicated OTDR offers all of the features and benefits of the CMA5000a with an OTDR module, in a rugged, non-modular package.

You Can Have It All with The CMA4500

Highlights include a powerful PC based unit, large, high resolution color display that's easy to read, touch screen and hard key user interfaces and several optics options to cover any testing requirements from single mode to multimode, from 1 meter to 250 Km. Additional features include dual USB ports, a 10/100 Ethernet interface and an optional integrated CD-R/W drive for easy data transfer. Whether you're a first time user or industry veteran, the CMA4500 will take fiber installation, maintenance and documentation of your optical network to a new level.

Added Value through Performance

As added value, the CMA4500 can be equipped with a stabilized light source and power meter for complete end-to-end loss testing.

In addition, a Visual Fault Locator (VFL) option enables users to visually locate breaks within central offices and quickly identify specific fibers within a cable or splice tray. Round this out with the optional connector inspection microscope to reduce costly and timely troubleshooting of connector related issues and your CMA4500 quickly becomes the one tool you rely on to get your customers up and running.

Key Benefits

- All-in-one test set with fixed optics reduces complexity and equipment needed
- Increased network reliability through accurate fiber characterization
- Sophisticated analysis software provides consistent and accurate fiber characterization
- Dedicated testing modes simplify commonly performed tasks
- Full function OTDR - testing from fault location to advanced analysis
- Touch screen and hard key user interfaces ensure smooth and efficient operation
- Solutions for Metro, CWDM, ultra-long haul and PON based, fiber-to-the-premise (FTTP)

Specifications

Common Specifications (all CMA 4500)

Model	4500D
Processor	Ultra low power 733 MHz min.
RAM	256 MB
Operating System	Windows XP Pro (includes Windows Desktop)
Display	10.4 inch (26.4 cm) color XGA (1024 x 768) LCD with touchscreen interface
Internal Storage	20 GB (min) hard drive
Removable Storage (modular)	Optional: 3.5 inch, 1.44 MB floppy drive, CD-R/W
Interfaces	PS/2 (2), USB (2), 10/100 Ethernet, IrDA
Power Supply	Auto switching 92-132 VAC, 184-264 VAC (47-63 Hz)
Dimensions (H x W x D)	24.1 x 34.3 x 9.5 cm (9.5 x 13.5 x 3.75 inches)
Environmental Conditions	Operation: 0˚ to +45˚C (32˚ to 122˚F) Storage: –25˚ to +60˚C (–13˚ to 140˚F) Humidity: 95% max, non-condensing
Weight	5.4 kg including battery and optics

Continued on next page

Common Specifications (all CMA4500) *continued*

Battery Type	Li-Ion
Distance*1 Range	Single mode: 5, 20, 50, 75, 125, 250, 300 km Multimode: 5, 15, 20, 40, 64 km
Sampling Resolution*1	Single mode: 0.125, 0.5, 1, 2, 4, 8, 16 m Multimode: 0.125, 0.5, 1,2,4 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	Meets IEC60825-1 Class I and CDRH Class 1 Requirements (Eye Safe) 21 CFR 1040
Optical Connector	Single mode: Universal with UFC, USC, UST, AFC, ASC, DIN, LC Multimode: Universal with FC, SC, ST
Operating Modes	Fault Locate, Standard 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

Single Mode Models

Model	Wavelength*6	Optical fiber type	Pulse width*1	Dynamic Range (SNR = 1)*2	Deadzone (back-scattered)*3	Deadzone (Fresnel)*4
4500-25	1550±25 nm	Single Mode (8 to 10 µm)	5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 ns	37/36 dB	9/9 m	4/3.5 m
4500-35	1310±20 nm 1550±25 nm			40/40 dB	8/6 m	4/3 m
4500-36	1310±20 nm 1550±25 nm 1625±15 nm			40/40/40 dB	8/6/6 m	4/3/3 m
4500-45	1310±20 nm 1550±25 nm		5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 30000 ns	43/45 dB	10/10 m	5/5 m
4500-46	1310±20 nm 1550±25 nm 1625±15 nm			43/45/43 dB	10/10/10 m	6/5/5 m
4500-54	1550±25 nm			50 dB	10 m	5 m
4500-81	1310±20 nm 1383±3 nm 1550±25 nm		5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 ns	40/38/41 dB	8/9/6 m	4/5/3 m
4500-83	1310±20 nm 1383±3 nm 1550±25 nm 1625±15 nm			35/35/35/35 dB	8/9/6/6 m	4/5/3/3 m
4500-P1*5	1310±20 nm 1490±10 nm 1550±25 nm			40/40/40 dB	6.5 m	1.7 m
4500-P3*5	1310±20 nm 1490±10 nm 1550±25 nm 1625±15 nm			37/37/37/37 dB	6.5 m	1.7 m

∗1: Range dependent
∗2: SNR=1 with up to 256 k averages (typical, subtract approximately 2 dB of range to 98% peak noise. Bellcore TR-TSY-000196 Issue 2)
∗3: Deadzones measured on –45 dB reflections (typical)
∗4: Using Bellcore TR-TSY-000196 Issue 2 (typical)
∗5: For 4500-P1 and 4500-P3, the End-to-End Loss Accuracy for Class B PONs is ±0.75 dB (typical)
∗6: At 23˚C, 10 µs pulse width

Quad Single mode/Multimode and Multimode Models

Model	Wavelength*5	Optical fiber type	Pulse width*1	Dynamic Range (SNR=1)*2	Deadzone (back-scattered)*3	Deadzone (Fresnel)*4
4500-60	850±30 nm 1300±30 nm 1310±20 nm 1550±25nm	Multimode (50 µm), Single Mode (8 to10 µm)	Singlemode: 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 ns Multimode: 5, 20, 50, 100, 200, 500, 1000 ns	24/26/35/35 dB	7/8/10/10 m	5/5/5 m
4500-61		Multimode (62.5 µm), SingleMode (8 to 10 µm)		24/26/35/35 dB	7/8/10/10 m	5/5/5 m
4500-62				24/26/40/40 dB	7/8/10/10 m	5/5/5 m
4500-66	850±30 nm 1300±30 nm	Multimode (62.5 µm)	5, 20, 50, 100, 200, 500, 1000 ns	24/26 dB	5/7 m	2.5/2.5 m
4500-69		Multimode (50 µm)		24/26 dB	5/7 m	3/3 m

∗1: Wavelength and range dependent
∗2: SNR=1 with up to 256 k averages (typical, subtract approximately 2 dB of range to 98% peak noise. Bellcore TR-TSY-000196 Issue 2)
∗3: Deadzones measured on –45 dB reflections (typical)
∗4: Using Bellcore TR-TSY-000196 Issue 2 (typical)
∗5: At 23˚C, 10 µs pulse width
Single wavelength and other specialty wavelengths available upon request.

Loss Test Set Option Specifications (optional)

Stabilized Light Source*2	Type	Single Mode (8 to 10 µm)	Multimode (50 or 62.5 µm)
		Laser (same wavelength and specs as OTDR)	LED (850/1300±30 nm)
	Output	–8 dBm (min)	–25 dBm (min)
	Stability*1	±0.2 dB (8 hours)	±0.1 dB (8 hours)
	Modes of Operation	CW, 1 KHz, 2 KHz	
	Connector Type	Same as OTDR	
Power Meter	Detector Type	InGaAs	
	Wavelength Range	780-1800 nm	
	Calibrated Wavelengths	850, 1300, 1310, 1490, 1550, 1625 nm	
	Power Range	+20 to –55 dBm	
	Resolution	0.01 dB, 0.01 watts	
	Accuracy	±4% (+5 to –50 dBm) ±8% (+10 to +5 dBm, –50 to –55 dBm)	
	Linearity	±0.10 dB (+5 to –50 dBm)	
	Connector Type	Universal (uses LP-XX adapters)	
Visual Fault Locator	Wavelength	650±20 nm	
	Output	0 dBm into 9/125 µm fiber (max)	
	Transmission Modes	CW, 2 Hz	
	Connector Type	2.5 mm universal	
	Safety	IEC 60825-1 Class II, FDA (21 CFR 1040. 10 Class 2)	

∗1: at 23˚C
∗2: Quad models 4500-60, 4500-61, 4500-62 only feature single mode light sources.

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 4500 is a dedicated, non-modular OTDR featuring AC or battery operation, unique testing modes and a rugged, splash-proof exterior designed for field use. In addition, all CMA 4500 OTDRs feature: 10.4" high resolution (1024x768) color display with touch-screen interface, standard 20 GB hard drive (min), ultra-low power processor with 256 MB RAM, Windows XP operating system, Li-Ion battery, AC charger/adapter, user's manual, and various I/O interfaces including: USB (2), 10/100 Ethernet port, IrDA infrared port, PS/2 keyboard and mouse ports. Languages supported include: English, French, German, Spanish, Italian, Chinese (simplified), Chinese (traditional), and Korean. Also includes choice of Universal adapter (c) and line cord (d).

• Module Number:

4500D – __ __ – ___ – __ __ __ – __ __
A B C D

A = Wavelength and Dynamic Range options

25 = 1310/1550nm 37/36 dB	60 = 850/1300 nm 25 dB, 50 µm and 1310/1550 nm 35 dB
35 = 1310/1550 nm 40 dB	61 = 850/1300 nm 25 dB, 62.5 µm and 1310/1550 nm 35 dB
45 = 1310/1550 nm 43/45 dB	62 = 850/1300 nm 25 dB, 62.5 µm and 1310/1550 nm 40 dB
54 = 1550 nm 50 dB	66 = 850/1300 nm 25 dB, 62.5 µm
	69 = 850/1300 nm 25 dB, 50 µm
81 = 1310/1383/1550 nm 37 dB	P1*1 = 1310/1490/1550 nm 40 dB
83 = 1310/1383/1550/1625 nm 37 dB	P3*1 = 1310/1490/1550/1625 nm 37 dB

*Single wavelength units are available; contact Anritsu Sales for a comprehensive list of available options

B = Power Meter Light Source Options
0 = no options (Not available with P1 and P3 models)
2 = Power Meter, Light Source and VFL*1

*1: PON modules 4500-P1 and 4500-P3 are only available with power meter, light source and VFL options (option -2-)

C = Connector Options (For Quad 60, 61 or 62 refer to next section)

UFC = FC/UPC	AFC = FC/APC
USC = SC/UPC	ASC = SCAPC
UST = ST/UPC	AST = ST/APC

C = Connector Options for Quad units (60, 61 or 62) only
Select connector for each port. (a b c : a = SM port, b = MM port, c = PM port)

0 = none	
1 = UFC	5 = ASC
2 = USC	6 = AST
3 = UST	7 = DIN
4 = AFC	8 = LC

D = Line Cord Options

US = United States	UK = United Kingdom
AU = Australia	SW = Switzerland
EU = Europe	IT = Italy

CMA4500 – OTDR Connector Adapters

UNIV-FC	Handle-type Universal FC Adapter for Standard UPC Connectors
UNIV-AFC	Handle-type Universal FC Adapter for Angled APC Connectors
UNIV-SC	Handle-type Universal SC Adapter for Standard UPC or Angled APC Connectors
UNIV-ST	Handle-type Universal ST Adapter for Standard UPC Connectors
UNIV-FCSCST	SM and MM Port Set of FC/SC/ST Connector Adapters
UNIV-DIN	Handle-type Universal DIN Adapter for Standard UPC Connectors
UNIV-LC	Handle-type Universal LC Adapter for Standard UPC Connectors

CMA4500 – Accessories

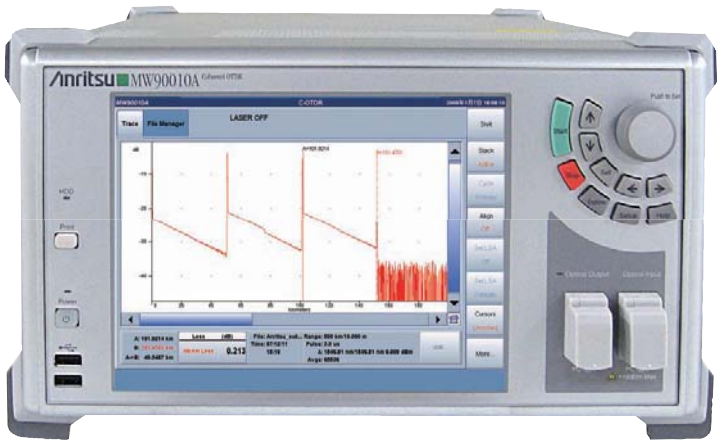
4500-BATT	Replacement Li-ION Battery
4500-MANUAL	Replacement User's Guide
4500-HARDCASE	CMA 4500 Hard Transit Case w/ handle & wheels
4500-SOFTCASE	CMA 4500 Soft Carry Case
OPTION-501CD-RW	Integrated CMA5000a/4500 CD/Read/Write Module
OPTION-502FLOPPY	Integrated CMA5000a/4500 Floppy Drive Module
4500-USBKEY	USB Keyboard with Trackball (US layout)
4500-USBKEY-EU	USB Keyboard with Trackball (EU layout)
4500-USBKEY-UK	USB Keyboard with Trackball (UK layout)
4500-USBKEY-GE	USB Keyboard with Trackball (German layout)
4500-USBFLOPPY	USB External Floppy Drive
4500-USBCDRW	USB External CD-R/W Drive
4500-AUTO	Cigarette Lighter Charger Adapter for CMA4500/5000
4500-ES213	CMA 4500 1 Year Extended Warranty
4500-ES313	CMA 4500 2 Year Extended Warranty
OPTION-511AC	CMA5000a/4500 AC Power Adapter (replacement "brick")
USB-DATA-1GB	1 GB USB Memory Stick for CMA 4500 & 5000a

COHERENT OTDR

MW90010A

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

NEW

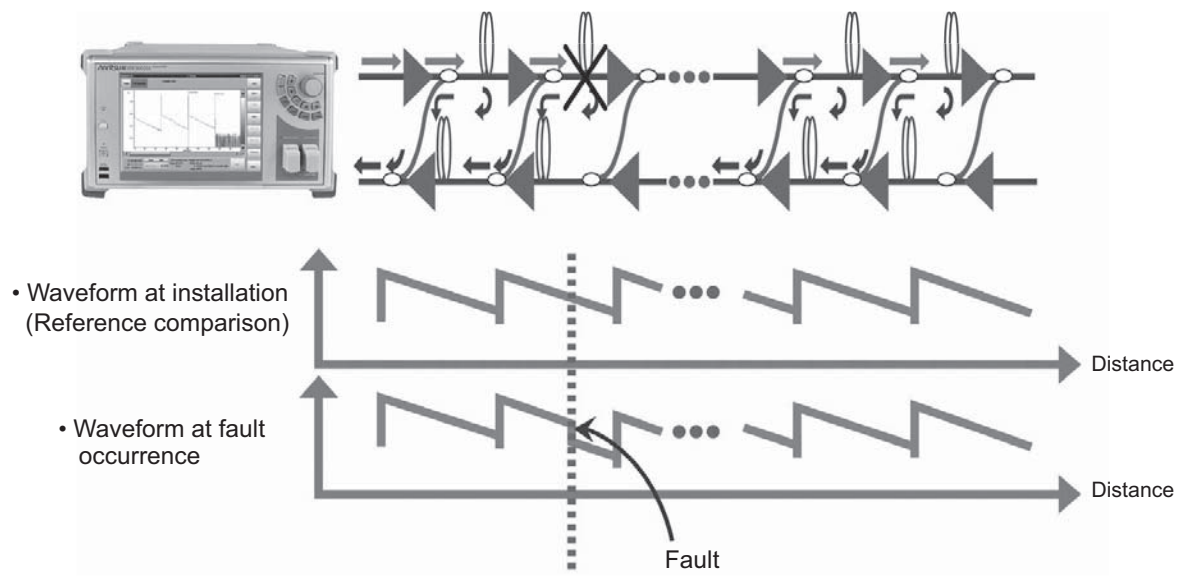


The Anritsu MW90010A Coherent OTDR (C-OTDR) is a measuring instrument for detecting faults in ultra-long optical submarine cables of up to 12,000 km including multiple repeaters (EDFAs). It is the ideal solution for evaluating new cables at service deployment as well as for troubleshooting in-service 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 C-OTDR 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 to 1565.08 nm
- Adjustable output power from 0 to +13 dBm

Application



• Measure submarine cables up to 12,000 km long with 10 m resolution

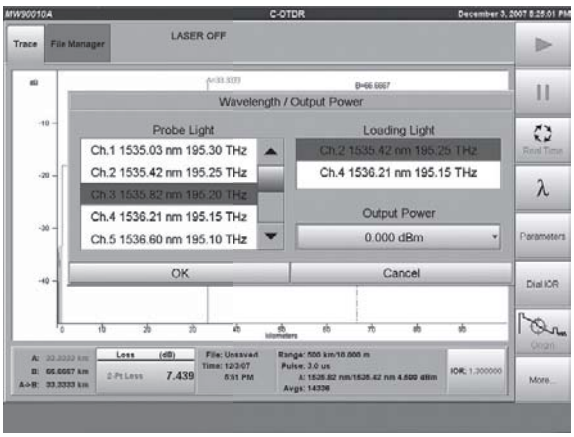
The MW90010A can capture data from up to 1.2 million points on the horizontal axis at a fixed resolution of 10 m with no dependency on measured distance. As a result, faults can be located with very high resolution even in fibers longer than 10,000 km.

• 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 and keyboard, and VGA OUT, makes measurement simple even for novice OTDR operators.

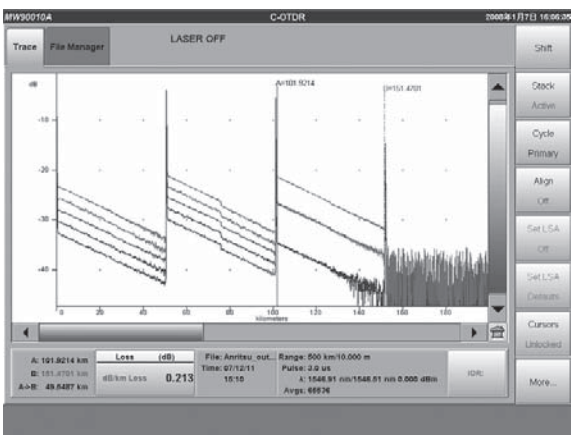


• Wide Dynamic Range

Typical optical submarine cables are designed with repeaters every 50 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.

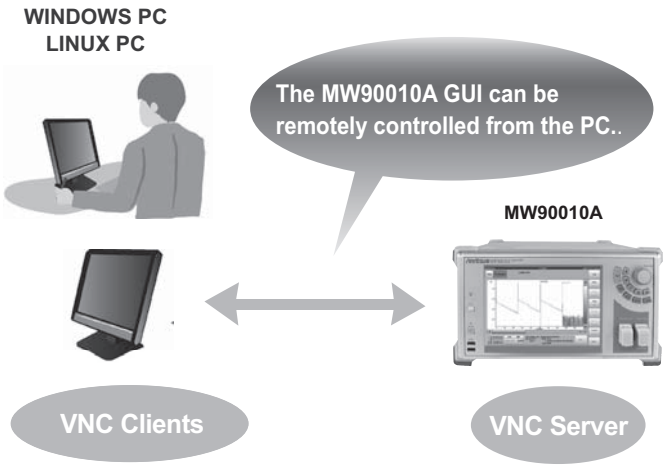
• Simultaneous Display of 8 Waveforms (max.)

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.



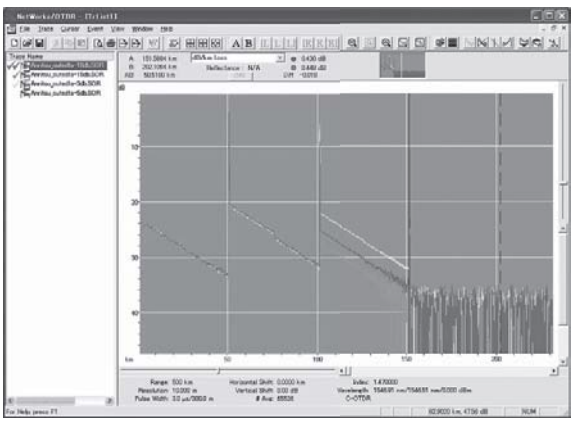
• Remote Operation Function

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.



• Waveform Analysis using Emulation Software

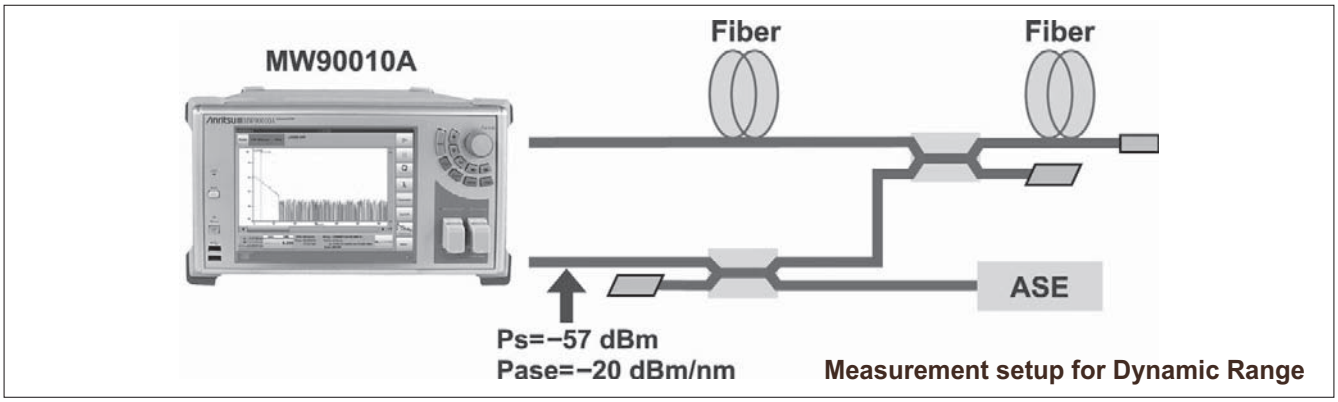
Waveform data measured and saved by the MW90010A can be analyzed on a PC running a Windows OS using the optional NETWORKS (version 4.1 or newer) emulation software (sold separately).



Specifications

MW90010A Coherent OTDR

Items	Specifications	Remarks	
Fiber under test	ITU-T G.653 (DSF)		
Optical connector	FC, SC, DIN, HSM-10/A, ST,LC	Replaceable, PC type	
Wavelength (Probe light)	1535.03 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 or –50 GHz	The loading wavelength can be selectable at +50 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 P7)	>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 x 10^{-6} x 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, 500 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 Gbyte) • 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	
Display	8.4 inch, XGA (1024 x 768) color LCD with touch panel		
Interface	USB (2 ports, REV1.1), Mouse (USB), Keyboard (PS/2), VGA		
Power supply	AC100 to 120/200 to 240 V, 50 to 60 Hz, ≤300 VA		
Dimensions and mass	320 (W) x 177 (H) x 451 (D) mm, <17 kg		
Enviromental conditions	Operating temperature and Humidity: +10˚ to +35˚C, <85% RH Storage temperature and Humidity: –10˚ to +50˚C, <85% RH Vibration: Conforms to MIL-STD-810D		
EMC	EN61326-1, EN61000-3-2		
LVD	EN61010-1		
Laser safety level*2	IEC Pub 60825-1: 2001 Class 1M: Optical Output Port Class 1: Monitor Port THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT 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: Laser safety: This product conforms to laser safety standards IEC 60825-1 and 21CFR1040.10 as indicated by the following attached labels.

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
W3030AE	MW90010A Operation Manual (CD-ROM version)

Model/order No.	Name
	Options (Optical Connector)
MW90010A-033∗1	LC 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

∗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.

Model/order No.	Name	Remarks
	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)	
J1413A	Replaceable optical connector (LC)	
J0057	Optical adapter FC type	
J0635	Optical fiber cord with FC-PC at both ends (SM, with FC-PC at both ends)	Specify the optical fiber length as A, B or C (A: 1 m, B: 2 m, C: 3 m)
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)	
Z1043A	LC adapter cap	Monitor Output Port optical connector cap. Specify exchangeable optical connectors (J1409A, J1410A, J1411A, J1412A, J1413A, J0617B) as a pair.
Z0397A	FC adapter cap	
Z0411A	ST adapter cap	
Z0412A	DIN adapter cap	
Z0413A	SC adapter cap	
Z0414A	HMS-10 adapter cap	

OTDR MODULE

MW9077A/A1/A2/B

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

CE Ethernet

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

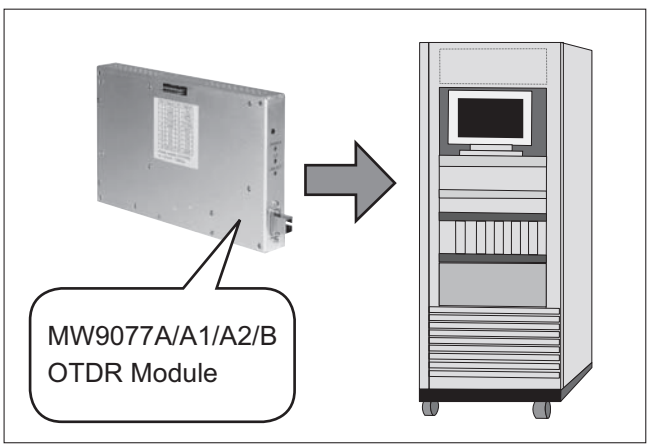
The MW9077A/A1/A2/B OTDR Module is ideal for monitoring optical fiber systems. In recent years, optical-fiber monitoring is being used in many fields including maintenance of optical-communications networks as well as security sensors, flood sensors and disaster-prevention systems, etc. The MW9077A/A1/A2/B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

Features

- Compact A5-size for monitoring optical fiber systems
- Wide operating temperature range
- High-performance successor to MW9076 series
- 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 OTDR Module is less than A5 size (200 x 130 x 25 mm). Even systems with severe space Limitations can use this module.



• Wide Operating Temperature Range

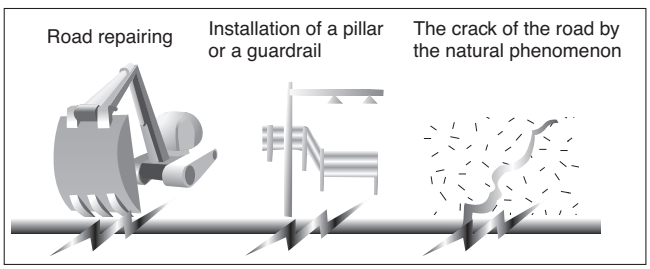
The system operating temperature is affected by various environmental factors, such as installation location, and monitored objects. In addition, the heat that the system generates itself influences the operation temperature. As a result, temperature of the monitoring system must also be monitored to assure reliability.
The MW9077A/A1 OTDR Module 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).

• High-performance Successor to MW9076 Series OTDR

The MW9077A/A1/A2/B OTDR Module is the successor to the MW9076 series Mini-OTDR. It has an event dead zone of 5m and a back-scattered dead zone of 20 m. The dynamic range is 41 dB (1310 nm) and 40 dB (1550 nm). The minimum sampling resolution is 5 cm.

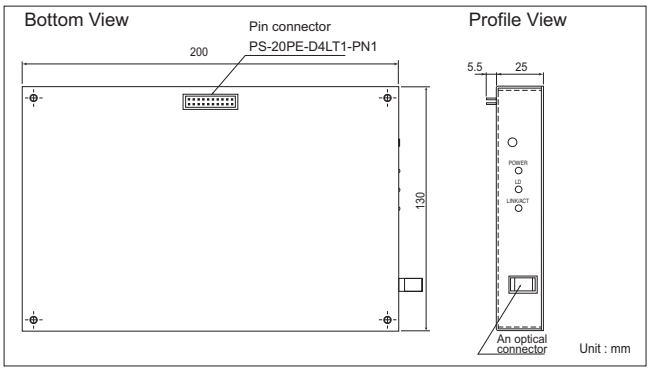
• Fast Data Transmission over Ethernet Interface

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 OTDR Module 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.

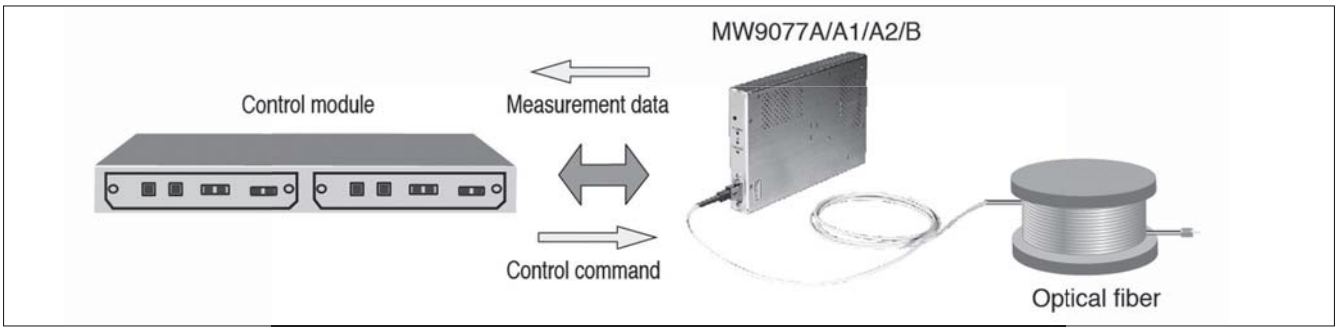


• Fast and Precision Operation from Controller

The MW9077A/A1/A2/B OTDR Module has a 10 Base-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 ±25 nm	1550 ±25 nm	1625 ±25 nm	1310/1550 ±nm
Fiber under test	10/125 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. 2m)			
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 x Measurement distance x 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 specification	21CFR Class 1, IEC Pub60825-1 Class 1			
Power	+12 Vdc ±1 V, 1.5 A max			
Interface	Ethernet interface*8: 10 Base with 20pin connector Serial interface: RS-232C : 115.2 kbps (The IP address is set using RS-232C)			
Dimensions and mass	200 (W) x 130 (H) x 25 (D) mm, ≤0.6 kg			

Continued on next page

Model	MW9077A	MW9077A1	MW9077A2*1	MW9077B
Environmental conditions	Operating temperature and humidity: –5˚ to +55˚C, ≤95% (no condensation) (MW9077A/A1/B) Operating temperature and humidity: –5˚ to +50˚C, ≤85% (no condensation) (MW9077A2) Storage temperature: –40˚ to +70˚C			
EMC	EN61326-1			

∗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 is support 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.

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 1.31/1.55 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-33*3	LC 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)
MW9077A/A1/A2/B-25*3	FC-APC Connector (Factory option, Fixed)
MW9077A/A1/A2/B-26*3	SC-APC 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

CE

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

NEW

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, ORL, PMD, and CD measurements.
For field-testing, one unit supports all required physical layer, data link layer, network layer, and transport layer measurement items.

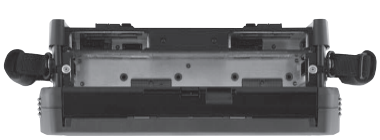
• Lower Total Cost of Ownership
One CMA5000a supports all measurements required for rolling out an optical network and maintenance follow-up. Multiple measurement modules can be set and operated simultaneously in one mainframe, eliminating the need for other single-function specialist measuring instruments 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.

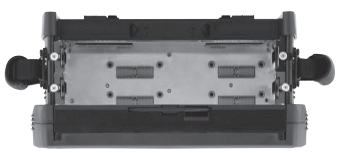
Module Specifications

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 10/100/1000 M Ethernet	SBA, MBA	1
XTA	SONET/SDH performance measurement DS1 to OC192/STM64 Jitter and Wander (up to 2.5G)	SBA, MBA	2
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

Item	Specification
Platform	SBA: 5000A-150-DC MBA: 5000A-250-DC
CPU/RAM	733 MHz Celeron/512 MB
Operating System	Windows® XP Pro SP2
Display	10.4” color XGA (1024 x 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	Auto-switching 100 to 240 Vac, 50/60 Hz 150 W
Dimensions and Mass	SBA: 371 (W) x 246 (H) x 140 (D) mm, 5.9 kg 14.6 (W) x 9.7 (H) x 5.5 (D) in 13 lbs MBA: 371 (W) x 246 (H) x 180 (D) mm, 6.81 kg 14.6 (W) x 9.7 (H) x 7.1 (D) in 15 lbs
Battery No.	SBA: 2 (one battery as standard accessory) ∗ MBA: 2 (two batteries as standard accessory)
Battery Type	Li-Ion
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

∗ : Additional 5000A-BATT Battery may be required depending on module configurations.

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Celeron® is a registered trademarks of Intel Corporation or its subsidiaries 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

OPTICAL TIME DOMAIN REFLECTOMETER

CMA5000a OTDR Module Series

Expansive Series of High Performance OTDR Modules for the CMA5000a Spanning Single Mode, Multimode and Hybrid Solutions

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.

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.

Benefits

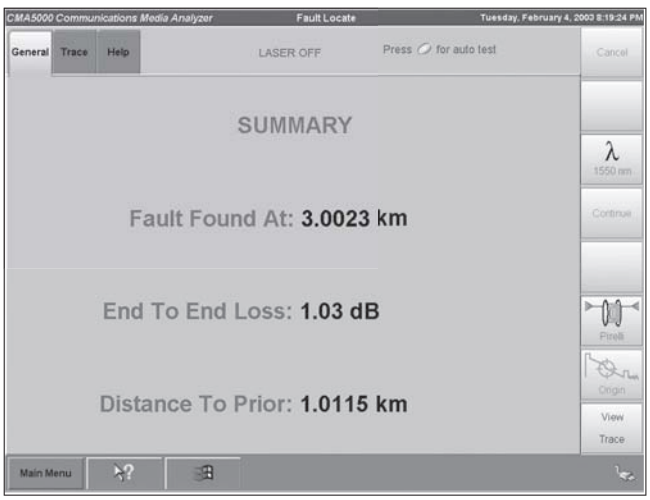
- Never obsolete – modular design allows new or additional modules to be added
- Sophisticated analysis software provides consistent and accurate fiber characterization
- Dedicated testing modes simplify commonly performed tasks
- Easy to use for any skill level - from fault location to advanced fiber analysis
- Touch screen and hard key user interfaces ensure smooth and efficient operation
- Solutions for all network types: Metro, CWDM, ultra-long haul and PON based, 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 850 nm, 1300 nm, 1310 nm, 1383 nm, 1490 nm, 1550 nm, 1625 nm and 1650 nm. Up to four 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.

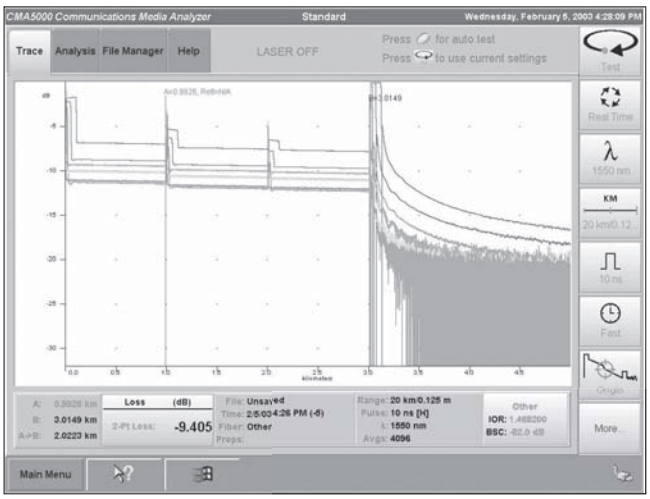
Dedicated, Ease to Use Software

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.



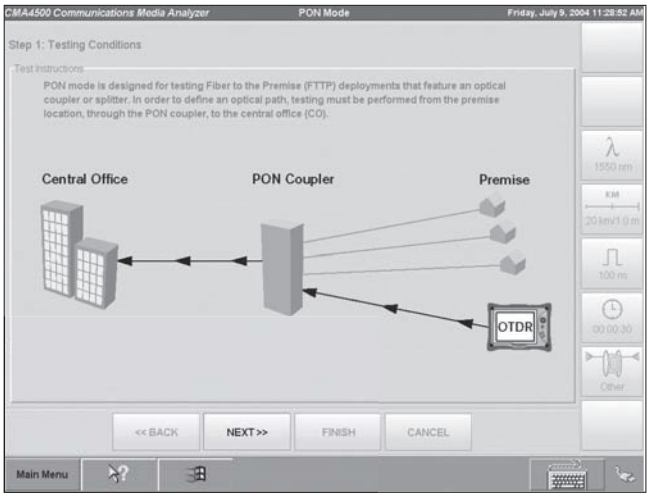
Classic OTDR – advanced testing

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

Exclusive PON mode for FTTx Networks

Challenging new architectures such as Fiber-To-The-x (FTTx) deployments that incorporate Passive Optical Networks (PON) are also easily addressed with our exclusive PON MODE solution featuring dead zones as small as 1 meter and the ability to classify splitters as large as 1X32.



PON Mode – Exclusive testing solution optimized for splitter based networks.

Reflectance and Optical Return Loss

With data rates increasing and video applications growing exponentially, reflectance and optical return loss (ORL) become key parameters that will make or break your network. To simplify testing these, Anritsu has developed a unique OTDR based, ORL application that provide continuous wave meter accuracy, combined with the trouble-shooting ability of an OTDR to add the expertise you need in testing today's demanding optical systems. Simply connect the fiber, enter your PASS/FAIL threshold and press test. If a test fails ORL, a quick press of our exclusive troubleshooting key presents a table listing the top three contributors to the failing ORL – complete with location. By identifying the problem connector, technicians will save hours of random troubleshooting time. The ORL option also functions as a 1 km single mode launch box increasing its value.

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

Single Mode Models

Model	Wavelength*6	Optical fiber type	Pulse width*1	Dynamic Range (SNR=1)*2	Deadzone (back-scattered)*3	Deadzone (Fresnel)*4
5225	1310±20 nm 1550±25 nm	Single Mode (8 to 10 µm)	5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 ns	37/36 dB	9/9 m	4/3.5 m
5235	1310±20 nm 1550±25 nm			40/40 dB	8/6 m	4/3 m
5236	1310±20 nm 1550±25 nm 1625±15 nm			40/40/40 dB	8/6/6 m	4/3/3 m
5245	1310±20 nm 1550±25 nm		5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 30000 ns	43/45 dB	10/10 m	5/5 m
5246	1310±20 nm 1550±25 nm 1625±15 nm			43/45/43 dB	10/10/10 m	6/5/5 m
5254	1550±25 nm			50 dB	10 m	5 m
5281	1310±20 nm 1383±3 nm 1550±25 nm		5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 ns	40/38/41 dB	8/9/6 m	4/5/3 m
5283	1310±20 nm 1383±3 nm 1550±25 nm 1625±15 nm			35/35/35/35 dB	8/9/6/6 m	4/5/3/3 m
5491*5	1310±20 nm 1490±10 nm 1550±25 nm			40/40/40 dB	6.5 m	1.7 m
5493*5	1310±20 nm 1490±10 nm 1550±25 nm 1625±15 nm			37/37/37/37 dB	6.5 m	1.7 m

∗1: Range dependent
∗2: SNR=1 with up to 256k averages (typical, subtract approximately 2 dB of range to 98% peak noise. Bellcore TR-TSY-000196 Issue 2)
∗3: Deadzones measured on –45 dB reflections (typical)
∗4: Using Bellcore TR-TSY-000196 Issue 2 (typical)
∗5: For 549x Modules, the End-to-End Loss Accuracy for Class B PONs is ± 0.75dB (typical)
∗6: At 23˚C, 10 µs pulse width

Quad Single Mode/Multimode and Multimode Models

Model	Wavelength*5	Optical fiber type	Pulse width*1	Dynamic Range (SNR=1)*2	Deadzone (back-scattered)*3	Deadzone (Fresnel)*4
5260	850±30 nm 1300±30 nm 1310±20 nm 1550±25 nm	Multimode (50 µm), Single Mode (8 to 10 µm)	Single Mode: 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000 ns Multimode: 5, 20, 50, 100, 200, 500, 1000 ns	24/26/35/35 dB	7/8/10/10 m	5/5/5/5 m
5261		Multimode (62.5 µm), Single Mode (8 to 10 µm)		24/26/35/35 dB	7/8/10/10 m	5/5/5/5 m
5262				24/26/40/40 dB	7/8/10/10 m	5/5/5/5 m
5266	850±30 nm 1300±30 nm	Multimode (62.5 µm)	5, 20, 50, 100, 200, 500, 1000 ns	24/26 dB	5/7 m	2.5/2.5 m
5269		Multimode (50 µm)		24/26 dB	5/7 m	3/3 m

∗1: Wavelength and range dependent
∗2: SNR=1 with up to 256k averages (typical, subtract approximately 2 dB of range to 98% peak noise. Bellcore TR-TSY-000196 Issue 2)
∗3: Deadzones measured on –45 dB reflections (typical)
∗4: Using Bellcore TR-TSY-000196 Issue 2 (typical)
∗5: At 23˚C, 10 µs pulse width
Single wavelength and other specialty wavelengths available upon request.

Common Specifications

Distance*1 Range	Single Mode: 5, 20, 50, 75, 125, 250, 300 km Multimode: 5, 15, 20, 40, 64 km
Sampling Resolution*1	Single Mode: 0.125, 0.5, 1, 2, 4, 8, 16 m Multimode: 0.125, 0.5, 1, 2, 4 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	Meets IEC60825-1 Class I and CDRH Class 1 Requirements (Eye Safe) 21 CFR 1040
Optical Connector	Single Mode: Universal with UFC, USC, UST, AFC, ASC Multimode: Universal with FC, SC, ST
Operating Modes	Fault Locate, Standard 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

Loss Test Set Option Specifications (optional)

Stabilized Light Source*2	Type	Single Mode (8 to 10 µm)	Multimode (50 or 62.5 µm)
		Laser (same wavelength and specs as OTDR)	LED (850/1300 ±30 nm)
	Output	–8 dBm (min)	–25 dBm (min)
	Stability*1	±0.2 dB (8 hours)	+0.1 dB (8 hours)
	Modes of Operation	CW, 1 kHz, 2 kHz	
	Connector Type	Same as OTDR	
Power Meter	Detector Type	InGaAs	
	Wavelength Range	780 to 1800 nm	
	Calibrated Wavelengths	850, 1300, 1310, 1490, 1550, 1625 nm	
	Power Range	Standard: +10 to –55 dBm CATV: +20 to –45 dBm	
	Resolution	0.01 dB, 0.01 watts	
	Accuracy	±4% (+5 to –50 dBm) ±8% (+10 to +5 dBm, –50 to –55 dBm)	
	Linearity	±0.10 dB (+5 to –50 dBm)	
	Connector Type	Universal (uses LP-XX adapters)	
Visual Fault Locator*3	Wavelength	650 ±20 nm	
	Output	0 dBm into 9/125 µm fiber (max)	
	Transmission Modes	CW, 2 Hz	
	Connector Type	2.5 mm universal	
	Safety	IEC 60825-1 Class II, FDA (21 CFR 1040. 10 Class 2)	

∗1: At 23˚C
∗2: Quad models 5260, 5261, 5262 only feature single mode light sources.
∗3: Visible Fault Locator not available on 5260, 5261 or 5262.

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 1310/1550 nm
35 = Singlemode, 40/40 dB dynamic range, dual-wavelength 1310/1550 nm
36 = Singlemode, 40/40/40 dB dynamic range, tri-wavelength 1310/1550/1625 nm
45 = Singlemode, 43/45 dB dynamic range, dual-wavelength 1310/1550 nm
46 = Singlemode, 43/45/43 dB dynamic range, tri-wavelength 1310/1550/1625 nm
54 = Singlemode, 50 dB dynamic range, single-wavelength 1550 nm
60 = Quad 24/26 dB 850/1300 nm 50 µm multimode and 35 dB 1310/1550 nm single mode
61 = Quad 24/26 dB 850/1300 nm 62.5 µm multimode and 35 dB 1310/1550 nm single mode
62 = Quad 24/26 dB 850/1300 nm 62.5 µm multimode and 40 dB 1310/1550 nm single mode
63 = Quad 24/26 dB 850/1300 nm 50 µm multimode and 40/40 dB 1310/1550 nm single mode
66 = Multimode 24/26 dB dynamic range, dual-wavelength 850/1300 nm, 62.5 µm
69 = Multimode 24/26 dB dynamic range, dual-wavelength 850/1300 nm, 50 µm
81 = Singlemode, 37 dB dynamic range, tri-wavelength 1310/1383/1550 nm
83 = Singlemode, 37 dB dynamic range, quad-wavelength 1310/1383/1550/1625 nm

• Module Number:

54 _ _ - _ _ _ - OTDR - _ _ _
A B C

A = Select an OTDR Module

91 = Singlemode, 40 dB dynamic range, tri-wavelength 1310/1490/1550 nm
93 = Singlemode, 37 dB dynamic range, quad wavelegth 1310/1490/1550/1625 nm

B = Select Meter, Light Source and VFL Options (-000, -001, -110 and -111 options not available with 5491 and 5493 models)
000 = No Meter, Light Source or VFL
001 = VFL Only (Not available on 5260, 5261 or 5262 module)
210 = +20 dBm Meter and Light Source
211 = +20 dBm Meter, Light Source and VFL

C = Select Connector (APC not available on multimode, for Quad 60, 61, 62 or 63 refer to next section)
UFC = FC/UPC AFC = FC/APC USC = SC/UPC
ASC = SC/APC UST = ST/UPC AST = ST/APC

C = Connector Options for Quad units (60, 61, 62, and 63 only)
Select connector for each port. (a b c : a = SM port, b = MM port, c = PM port)

0 = none 1 = UFC 2 = USC
3 = UST 4 = AFC 5 = ASC
6 = AST 7 = DIN 8 = LC

Example of Order Number and Specification

5236-210-OTDR-AFC	Singlemode, 40/40/40 dB dynamic range, tri-wavelength 1310/1550/1625 nm, Power Meter and Light Source with FC/APC connector
5266-001-OTDR-UFC	Multimode 24/26 dB dynamic range, dual-wavelength 850/1300 nm, 62.5 µm, VFL, with FC/UPC connector

OTDR/CHROMATIC DISPERSION APPLICATION

CMA5000a CD-OTDR

CE

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 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*1	±0.7 ps/nm*km or ± 4% (greater number)
λ_0 Accuracy	Typically ±10 nm
Number of Testing Wavelengths	6
Test Time	<4 minutes for 50 km
Number of Fibers Required	One

Continued on next page

OTDR Module Specifications

Fiber Type	Single-mode (Tri-wavelegth)
Center Wavelength	1310 ±20 nm 1550 ±20 nm 1625 ±15 nm
Spectral Width (RMS)	1310 nm: <15 nm 1550 nm: <15 nm 1625 nm: <15 nm
Dynamic Range*2	1310 nm: 38 dB 1550 nm: 38 dB 1625 nm: 38 dB
Initial Reflective Deadzone*3	1310 nm: 4 m 1550 nm: 4 m 1625 nm: 4 m
Initial Non-Reflective Deadzone*4	1310 nm: 9 m 1550 nm: 8 m 1625 nm: 9 m
Linearity	0.04 dB/dB
Pulsewidth*5	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	Meets IEC60825-1 Class I and CDRH Class 1 Requirements (Eye Safe) 21 CFR 1040
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

∗1: C- and L- bands
∗2: SNR=1 with up to 256k averages (typical, subtract approximately 2 dB of range to 98% peak noise. Bellcore TR-TSY-000196 Issue 2)
∗3: Using Bellcore TR-TSY- 000196 Issue (typical)
∗4: Deadzones measured on –45 dB reflections (typical)
∗5: Wavelength dependent
Specifications are subject to change without notice

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
AFC = FC/APC	ASC = SC/APC	AST = ST/APC

POLARISATION MODE DISPERSION ANALYZER

CMA5000a PMD

CE

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 testing
- 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&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

Polarization Mode Dispersion Module Specifications

Operating wavelengths	1250 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 Specifications

	1550	1550 HP	1310 & 1550	1550 & 1625	1550 C+L
Output power	+2 dBm	+11 dBm	–1 dBm	–2 dBm	–10 dBm
Related dynamic range*5	55 dB	64 dB	52 dB	51 dB	43 dB
Minimum Measurable PMD	0.06 ps	0.08 ps	0.06 ps	0.065 ps	0.035 ps
Battery operation	Yes, 9 h autonomy (30 h typ.)				

∗1: Typical Telecommunication fibers
∗2: Polarization Maintening 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

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

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

Optical Sources

All sources listed below come with a soft bag, universal fiber optic physical contacting MBA connector and operate on ACor 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 in 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 and 1550 nm Source MBA

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 and 1625 nm 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-Band Source

This is the ultra-broadband wavelength source offering 1550 nm operation and a minimum PMD measurement of 0.035 ps. It is targeted for very low PMD measurements.
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 the highest dynamic range.
It is targeted for ultra long haul PMD measurements as you can test more than 300 km of fibers.
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 Artifact

The PMD Artifact is a piece of bi-refringent fiber with 1 ps PMD. Reference: 5402-000-PMD

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 to 1650 nm

CE

Field Portable DWDM/CWDM Testers

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.

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.

Operating from 1250 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.

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.

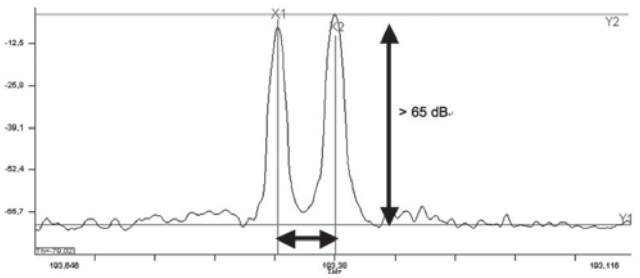


Fig 1: Two peaks at 50 GHz spacing with OSA 400. OSNR measurements are no longer limited by the OSA optical response.

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.

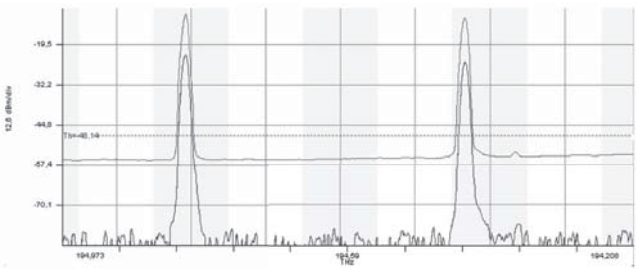


Fig 2: Input and Output EDFA curves display on the same graph for immediate analysis.

Unique Channel Drop Filter (OSA 400 only)

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 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	+20 to –70 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	
Polarizatin Dependent Loss*9, *10	±0.1 dB	
PDL + Repeatability*9	±0.15 dB	
Optical Resolution Bandwidth (FWHM)*2	<60, 100, 200 & 500 pm*12	<70 pm
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)	

∗1: Signal from +5 to –30 dBm from 15˚ to 30˚C
∗2: In C&L band (1530 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 to 1570 nm)
∗8: at –15 dBm in C band (1530 to 1570 nm)
∗9: at 1550 nm; at 23˚C ±2˚C
∗10: Typical
∗11: with the finest resoluion
∗12: ±10%
∗13: 45 nm scan
∗14: For FWM >150 pm

Channel Drop Features

Channel Drop Features	OSA 400	OSA 425
Spectral Range	1250 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

Operating Temperature	0˚ to +40˚C
Storage Temperature	–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

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 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 resoluion Optical Spectrum Analyzer covering 1250 to 1650 nm with channel selector for signals up to 40 Gbps
5525-000-OSA-XXX	OSA 425: Optical Spectrum Analyzer covering 1250 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

780/1550 nm (SMF)

CE

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 new 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, widescreen 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

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**

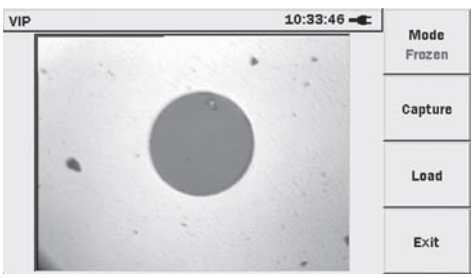
With its lightweight design and user friendly dimensions, the MT9090A is perfect for the outside plant environment and can easily be managed with one hand. The standard softcase with shoulder strap further increases portability when traveling from the truck to the testing site.

- **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.

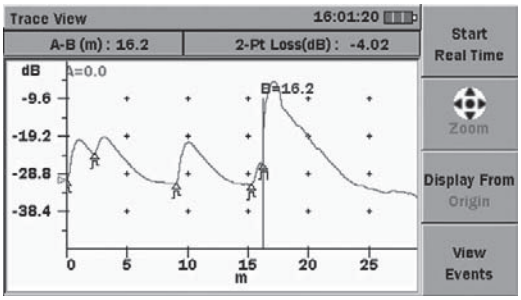
- **Video Inspection Probe Support**

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. 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.

• 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

An optional visible laser diode "red light" to visually troubleshoot splices, connectors and the fiber management is also available.

• Integrated Power Meter (through OTDR port)

The optional 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

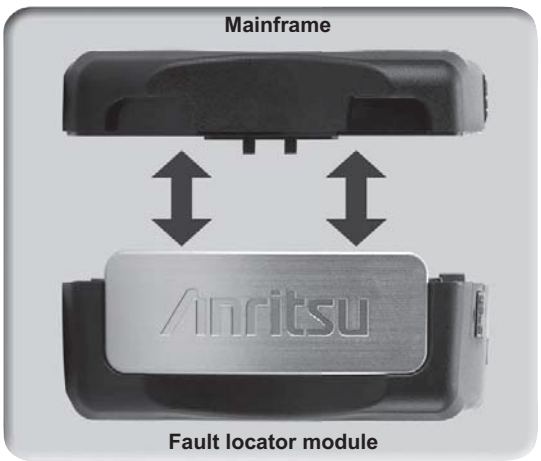
The MT9090A supports the universal Telcordia SR-4731 format making it compatible with not only legacy Anritsu and NetTest products, but with many other vendors data.

• 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.

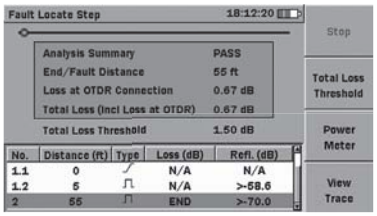
Step 1 – Connect fiber and power on

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 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

Dimensions and Mass	190 (W) x 96 (H) x 48 (D) mm (7.5"x3.8"x1.9") (Including mainframe and module) Weight (including mainframe, module and battery): <800 g (<2 lbs.)
Display	4.3 inch TFT-LCD (480 x 272, with backlight, transparent type)
Interface	USB 1.1, Type A x 1 (memory), Type B x 1 (USB mass storage)

Model	MU909011A, A1, A2, A3-052/062	MU909011A, A1, A2, A3-050/060
Wavelength*1	780 ±20 nm	1550 ±30 nm
Fiber Type	10/125 µm SMF (ITU-T G.652)	
Distance Range	1.0 km (3,000 ft) or 2.5 km (8,000 ft), MU909011A 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	
Deadzone	Fresnel: <1 m *3, Backscatter: <5 m *4	
Sampling Resolution	5 cm (Distance range 1.0 km), 10 cm (Distance range 2.5 km) and 50 cm (Distance range 10 km) (IOR=1.50000)	
Sampling Points	20001 (Distance range 1.0 km), 25001 (Distance range 2.5 km) and 20001 (Distance range 10 km)	
Data Storage	Internal memory: 40 MB (up to 2000 traces), External (USB): up to 30,000 traces with 1GB	
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	
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 cleaniness	
	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 Pub 60825-1: 2001 Class3R: MU909011A1/A3-050/060/052/062*9 (CW)	
Power Supply	9 VDC, 100 to 240 VAC, Allowable input voltage range: 90 to 264 V, 50/60 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 Pub 60825-1: 2001 Class1: MU909011A/A1/A2/A3-050/060/052/062*10	

∗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)
∗10: Class 1of IEC 60825-1 and the 21CFR1040.10.

∗9: Class 3R of IEC 60825-1 and the 21CFR1040.10.

THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO 50 DATED JULY 26 2001

THIS PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11 EXCEPT FOR DEVIATIONS PURSUANT TO LASER NOTICE NO 50 DATED JULY 26 2001

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) Select Mainframe

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

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

2) Select Module

Includes printed operation manual

Model/Order No.	Description
MU909011A	Drop Cable Fault Locator Module
MU909011A1	Drop Cable Fault Locator Module (with visible laser diode)
MU909011A2	Drop Cable Fault Locator Module (with Power Meter)
MU909011A3	Drop Cable Fault Locator Module (with visible laser diode and Power Meter)

3) Select Module Option

Model/Order No.	Description	Model/Order No.	Description
MU909011A-050	1550 nm, single mode,UPC	MU909011A-052	780 nm, single mode, UPC
MU909011A1-050	1550 nm, single mode, UPC, visible laser diode	MU909011A1-052	780 nm, single mode, UPC, visible laser diode
MU909011A2-050	1550 nm, single mode, UPC, power meter	MU909011A2-052	780 nm, single mode, UPC, power meter
MU909011A3-050	1550 nm, single mode, UPC, visible laser diode, power meter	MU909011A3-052	780 nm, single mode, UPC, visible laser diode, power meter
MU909011A-060	1550 nm, single mode, APC	MU909011A-062	780 nm, single mode, APC
MU909011A1-060	1550 nm, single mode, APC, visible laser diode	MU909011A1-062	780 nm, single mode, APC, visible laser diode
MU909011A2-060	1550 nm, single mode, APC, power meter	MU909011A2-062	780 nm, single mode, APC, power meter
MU909011A3-060	1550 nm, single mode, APC, visible laser diode, power meter	MU909011A3-062	780 nm, sinlge mode, APC, visible laser diode, power meter

4) 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)

5) Select Accessories

Must be added as separate line items.

Model/Order No.	Description
G0203A	AC adapter (Replacement)
G0202A	NiMH Battery Pack (Replacement)
B0600A	Hard Case
B0601A	Standard Soft Case
Z1023A	Strap
B0602A	Deluxe Soft Case (for MT9090A)
J1402A	Car plug cord
W2988AE	MU909011A OPERATION MANUAL (Hardcopy)
W2989AE	MU909011A OPERATION MANUAL (CD)
OPTION-545VIP	Connector Inspection Microscope Kit
MU909011A/A1/ A2/A3-ES210	12 month extended warranty (total 2 years warranty)
MU909011A/A1/ A2/A3-ES310	24 month extended warranty (total 3 years warranty)

6) Replacement Adaptors

Must be added as separate line items.

Model/Order No.	Description	Model/Order No.	Description
J1413A	LC (UPC: Models -050 and -052 only)	J0618E	DIN (UPC: Models -050 and -052 only)
J0617B	FC (UPC: Models -050 and -052 only)	J0619B	SC (UPC or APC: all models)
J0618D	ST (UPC: Models -050 and -052 only)	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 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

Model	MU909020A
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	+10 to –40 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
Polarization Dependant Loss	±0.3 dB
Power supply	9 VDC, 100 to 240 VAC
Battery	NiMH, Operating Time: 4 hours (typical)*4, Recharge Time:<3 hours (typical)*5, Operation Possible with 4 x AA alkaline: operating time depends on batteries type
Environmental Conditions	Operation: 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 +10 to –35 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.

1) Select Mainframe

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

2) 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

3) Select Connector Interface

Model/Order No.	Description
MU909020A-050	OCA with UPC optical connector
MU909020A-060	OCA with APC optical connector

4) 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)

5) Select Accessories
Must be added as separate line items.

Model/Order No.	Description
G0203A	AC adaptor (Replacement)
G0202A	NiMH Battery Pack (Replacement)
B0600A	Hard Case
B0601A	Standard Soft Case
Z1023A	Strap
B0602A	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)

6) Replacement Adaptors
Must be added as separate line items.

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

LIGHT SOURCES

CMA50 Series

850, 1300, 1310, 1490, 1550, 1625 nm

CE

Fast, Stable and Easy-to-use Light Source

Fast and easy-to-use, Anritsu's CMA50 line of Light Sources provides stable output for point–to–point attenuation measurements or modulated tones for easy fiber identification. Units are offered in a variety of wavelength combinations and connector options to meet any testing requirement from FTTx networks to long haul telephony links to multimode LAN, and CATV.
All CMA50 Light Sources feature our exclusive auto–wavelength switching mode that automatically alternates wavelengths and synchronizes with the CMA50 Power Meter Series, greatly reducing test time and virtually eliminating measurement errors. The lightweight, rugged design, assures units are built for the most demanding installation environments and will provide years of valuable service.

Key Benefits

- Up to 4 sources per unit, out of a single port
- High power and stable output for high dynamic range testing and accurate loss readings
- Auto–wavelength switching provides fast and accurate results
- Rugged design withstands years of use in the most challenging environments
- Visual Fault Location source option
- Powered with rechargeable battery pack or four standard AA batteries
- LAN Access and network testing option via RJ45 port
- Interchangeable optical connectors
- Three year warranty

Dual Wavelength Light Source

Model	50LS35	50LS83
Emitter Type	Laser Diode	LED
Wavelength (nm)*1	1310/1550 ±20 nm	850/1300 ±20 nm
Output Power	–7 dBm (G.652 Fiber)	–18 dBm (62.5/125 µm fiber)
Source Linewidth (FWHM)	<5 nm/<5 nm	<50 nm/<150 nm

Tri Wavelength Light Source

Model	50LS345	50LS356
Emitter Type	Laser Diode	Laser Diode
Wavelength (nm)*1	1310/1490/1550 ±20 nm	1310/1550/1625 ±20 nm
Output Power (G.652 Fiber)	–7 dBm for 1310 nm, 1490 and 1550 nm	–7 dBm for 1310 nm, 1550 and 1625 nm
Source Linewidth (FWHM)	<5 nm	<5 nm

Quad Wavelength Light Source

Model	50LS3456	50LS8335*2
Emitter Type	Laser Diode	LED on MM port, Laser Diode on SM port
Wavelength (nm)*1	1310/1490/1550/1625 ±20 nm	850/1300/1310/1550/ ±20 nm
Output Power	–7 dBm (G.652 Fiber)	–7 dBm (G.652 Fiber)/–18 dBm (62.5/125 m fiber)
Source Linewidth (FWHM)	<5 nm	<50 nm/<150 nm/<5 nm/<5 nm

*1: Typical specs at 23˚C

Continued on next page

*2: 50LS8335 unit has one port for Single Mode Fiber and one port for Multi Mode Fiber

General Specifications

Stability (1 hours)	±0.05 dB at 1310 and 1550 nm; ±0.15 dB at 1490 and 1625 nm
Output Modes	CW, 270, 1k, 2 kHz
Wavelength Identification	Compatible with CMA50 power meter or LTS for automatic recognition
Power	Rechargeable battery pack, 4 AA batteries or 110/220 V AC adapter
Auto Shutoff	After 10 minutes (Function can be disabled)
Connector Style	FC, SC, ST, DIN, LC
Operating Temperature Range	–10˚ to +50˚C
Storage Temperature Range	–40˚ to +60˚C
Dimensions	210 x 110 x 41.3 mm
Weight	<550 g (including batteries)
Warranty	3 Years
EMC	EN61326-1, EN55011
LVD	EN61010-1

Options

N Option Network Test	LAN access and Network level continuity and frame time delay through TCP/IP protocol over its built-in 10/100 Mbps Network Interface Card.
V Option Visual Fault Locator	Visible laser source at 650 nm allowing to visually detect a fiber fault Visual Fault Locator up to 5 km

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 CMA50 Light Source can be ordered with a choice of wavelengths (a) and connector options (d):

- **Model Number:**

50LS _____ - ____
A B

A = Wavelengths

35 = 1310/1550 nm	83 = 850/1300 nm
345 = 1310/1490/1550 nm	8335 = 850/1300/1310/1550 nm
356 = 1310/1550/1625 nm	3456 = 1310/1490/1550/1625 nm

B = Connector Options

UFC = FC/UPC	AFC = FC/APC
USC = SC/UPC	ASC = SC/APC
UST = ST/UPC	
ULC = LC/UPC	
UDN = DIN/UPC	

CMA50 – Light Source Additional Options (ordered as separate line items)

50-OPT-N = Network Test Option
This option enables the RJ45 connector to perform tests such as ping, delay, etc.
50-OPT-V = VFL Option
This option includes a visible (red) light source used for fiber identification and troubleshooting.

CMA50 – Light Source Notes

1. Customers that want different style connectors on MM/SM Light Source ports need to order an additional connector as a separate line item.

LOSS TEST SETS

CMA50 Series

850, 1300, 1310, 1490, 1550, 1625 nm

CE

Ideal for Bi-Directional Testing

Fast and easy-to-use, Anritsu's CMA50 line of Loss Test Sets is designed for both attenuation and power throughput measurements on fiber optic links. They are offered with common calibrated wavelengths and connector options to meet any testing requirement from FTTx networks to long haul telephony links to multimode LAN, and CATV.
CMA50 Loss Test Sets can make your measuring experience simple and error free with bi-directional testing option, pass or fail threshold analysis, large capacity for test results storage, and RJ45 interface Network Testing option. The light-weight, rugged design, assures units are built for the most demanding cable installation environments and will provide years of valuable service.

Key Benefits

- Up to 4 high power sources per unit, out of a single port
- EZTest one button bi-directional measurement option
- Pass/Fail indicators for in-field compliance
- Rugged design withstands years of use in the most challenging environments
- Stores up to 100,000 data sets (4 MB of user data)
- Visual Fault Locator source standard
- LAN Access and network testing option via RJ45 port
- File Transfer via USB port
- Three year warranty

Dual Wavelength Variant

Model	50LTS35	50LTS83
Emitter Type	Laser Diode	LED
Wavelength (nm)*1	1310/1550 ±20 nm	850/1300 ±20 nm
Output Power	–7 dBm (G.652 Fiber)	–18 dBm (62.5/125 µm fiber)
Source Linewidth (FWHM)	<5 nm/<5 nm	<50 nm/<150 nm

Tri Wavelength Variant

Model	50LTS345	50LTS356
Emitter Type	Laser Diode	Laser Diode
Wavelength (nm)*1	1310/1490/1550 ±20 nm	1310/1550/1625 ±20 nm
Output Power (G.652 Fiber)	–7 dBm for 1310 nm, 1490 and 1550 nm	–7 dBm for 1310 nm, 1550 and 1625 nm
Source Linewidth (FWHM)	<5 nm	<5 nm

Quad Wavelength Variant

Model	50LTS3456	50LTS8335*2
Emitter Type	Laser Diode	LED on MM port, Laser Diode on SM port
Wavelength (nm)*1	1310/1490/1550/1625 ±20 nm	850/1300/1310/1550/ ±20 nm
Output Power	–7 dBm (G.652 Fiber)	–7 dBm (G.652 Fiber)/ –18 dBm (62.5/125 µm fiber)
Source Linewidth (FWHM)	<5 nm	<50 nm/<150 nm/<5 nm/<5 nm

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Power Meter Port Specifications

Model	Standard	C Option
Wavelength of Operation	850, 1300, 1310, 1490, 1550, 1625 nm and all standard 1625 nm and all standard CWDM wavelengths	850, 1300, 1310, 1490, 1550, 1625 nm and all standard 1625 nm and all standard CWDM wavelengths
Measured Power Range*3	+5 to –65 dBm	+27 to –45 dBm
Calibration Accuracy*4	±0.2 dB	±0.2 dB
Linearity*5	±0.1dB	±0.1dB

*1: Typical specs at 23˚C
*2: 50LTS8335 unit has one port for Single Mode Fiber and one port for Multi Mode Fiber
*3: ±0.3 dB uncertainty from 900 nm to 1625 nm over operating temperature range
*4: NIST traceable. Calibrated at 23˚C, 1310 nm and –10 dBm power input
*5: At 23˚C excluding top 5 dB and bottom 10 dB

General Specifications

Modulation Modes	CW, 270, 1 k, 2 kHz modulation for fiber recognition
Stability (1 hours)	±0.05 dB at 1310 and 1550 nm; ±0.15 dB at 1490 and 1625 nm
Modulation Detection	270, 1 k, 2 kHz modulation recognition
Wavelength Recognition	Automatic recognition of calibrated wavelengths (when used in conjunction with a CMA50 light source or LTS)
Display Resolution	0.01 (dB/mW/µW/nW)
Visual Fault Locator	Visible laser source at 650 nm allowing to visually detect a fiber fault up to 5 km
Power	Rechargeable battery pack, 4 AA batteries or 110/220 V AC adapter
Auto shutoff	After 10 minutes (Function can be disabled)
Connector Style	FC, SC, ST, DIN, LC
Operating Temperature Range	–10˚ to +50˚C
Storage Temperature Range	–40˚ to +60˚C
Dimensions	210 x 110 x 41.3 mm
Weight	<550 g (including batteries)
Warranty	3 years
EMC	EN61326-1, EN55011
LVD	EN61010-1

Options

N Option Network Test	LAN access and network level continuity and frame time delay through TCP/IP protocol over its built-in 10/100 Mbps Network Interface Card.
B Option EZTest	One button multiple wavelength bi-directional measurement.
O Option ORL	Optical Return Loss (ORL) option allows the measurement of optical return loss readings required for high speed transmission systems.

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 CMA50 Loss Test is a combination of a Power Meter and a Light Source in the same unit. A Loss Test Set can be ordered with a choice for the Light Source desired wavelengths (a), bi-directional option (b), Power Meter detector type (c) and connector options (d).

• Model Number:

50LTS _____ __ __ - ____
A B C D

A = Wavelengths

35 = 1310/1550 nm	83 = 850/1300 nm
345 = 1310/1490/1550 nm	8335 = 850/1300/1310/1550 nm
356 = 1310/1550/1625 nm	3456 = 1310/1490/1550/1625 nm

B = Bi-directional, ORL Option
B = With Bidirectional
O = Optical Return Loss Option (Inclusive of Bidirectional Option)
X = Without Option

C = Wide Area Detector Type
S = Standard detector (+5 to –65 dBm)
C = CATV detector (+27 to –45 dBm)

D = Connector Options

UFC = FC/UPC	AFC = FC/APC
USC = SC/UPC	ASC = SC/APC
UST = ST/UPC	
ULC = LC/UPC	
UDN = DIN/UPC	

CMA50 – Loss Test Set Additional Options (ordered as separate line items)

50-OPT-N = Network Test Option
This option enables the RJ45 connector to perform tests such as ping, delay, etc.
50-OPT-V = VFL Option
This option includes a visible (red) light source used for fiber identification and troubleshooting.

CMA50 – Loss Test Set Notes

1. Customers that want different style connectors on the Power Meter and Light Source ports need to order an additional Power Meter connector as a separate line item.
2. Customers that want different style connectors on MM/SM Light Source ports need to order an additional connector as a separate line item.

HANDHELD POWER METERS

CMA50 Series

850, 1300, 1310, 1490, 1550, 1625 nm and all standard CWDM wavelengths

CE

Fast, Accurate and Easy-to-use

Fast, accurate and easy-to-use, Anritsu's CMA50 line of Power Meters is designed for attenuation and throughput measurements of fiber optic links. Units are offered with common calibration wavelength and connector options to meet any testing requirement from FTTx networks to long haul telephony links to multimode LAN, and CATV.
All CMA50 Power Meters feature large mass storage capacity, and pass or fail indicators for in field compliance. Plus our exclusive autowavelength switching mode eliminates user errors by synchronizing the CMA50 Series Power Meters with CMA50 Light Source.
The light–weight, rugged design, assures that they are built for the most demanding cable installation and maintenance environments and will provide years of valuable service.

Key Benefits

- Reasonable pricing puts high quality testing in every technician's hand
- Automatic wavelength recognition when used in conjunction with CMA 50 light sources
- High input power capacity enables characterization of RF TV optical signals
- Pass/Fail indicators for in–field compliance
- Stores up to 100,000 data sets (4 MB of user data)
- Visual Fault Locator source option
- LAN Access and network testing option via RJ45 port: Ideal for troubleshooting ONT/ONU in FTTx networks
- File Transfer via USB port
- Three year warranty

Optical Specifications

Model	Standard	C Option
Wavelength of Operation	850, 1300, 1310, 1490, 1550, 1625 nm and all standard CWDM wavelengths	850, 1300, 1310, 1490, 1550, 1625 nm and all standard CWDM wavelengths
Measured Power Range*1	+5 to –65 dBm	+27 to –45 dBm
Calibration Accuracy*2	±0.2 dB	±0.2 dB
Linearity*3	±0.1 dB	±0.1 dB

*1: ±0.3 dB uncertainty from 900 to 1625 nm over operating temperature range
*2: NIST traceable. Calibrated at 23˚C, 1310 nm and –10 dBm power input
*3: at 23˚C excluding top 5 dB and bottom 10 dB

Continued on next page

General Specifications

Modulation Detection	270, 1 k and 2 kHz modulation recognition
Wavelength Recognition	Automatic recognition of calibrated wavelengths (when used in conjunction with a CMA50 light source or LTS)
Display Resolution	0.01 (dB/mW/µW/nW)
Power	Rechargeable battery pack, 4 AA batteries or 110/220 V AC adapter
Auto shutoff	After 10 minutes (Function can be disabled)
Connector Style	FC, SC, ST, DIN, LC
Operating Temperature Range	–10˚ to +50˚C
Storage Temperature Range	–40˚ to +60˚C
Dimensions	210 x 110 x 41.3 mm
Weight	<550 g (including batteries)
Warranty	3 Years
EMC	EN61326-1, EN55011
LVD	EN61010-1

Options

N Option Network Test	LAN access and Network level continuity and frame time delay through TCP/IP protocol over its built–in 10/100 Mbps Network Interface Card.
V Option Visual Fault Locator	Visible laser source at 650 nm allowing to visually detect a fiber fault up to 5 km

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 CMA50 Power Meter can be ordered with a choice of detector types (c) and connector options (d):

• Model Number:

50PM __ - ____
A B

A = Wide Area Detector Type
S = Standard detector (+5 to –65 dBm)
C = CATV detector (+27 to –45 dBm)

B = Connector Options
FC = FC/UPC and FC/APC
SC = SC/UPC and SC/APC
LC = LC/UPC and LC/APC
DN = DIN/UPC and DIN/APC

CMA50 – Power Meter Additional Options (ordered as separate line items)

50-OPT-N = Network Test Option
This option enables the RJ45 connector to perform tests such as ping, delay, etc.
50-OPT-V = VFL Option
This option includes a visible (red) light source used for fiber identification and troubleshooting.

HANDHELD POWER METERS

CMA5 Series

850, 1300, 1310, 1490, 1550, 1625 nm

Economical, Accurate and Easy-to-use Handheld Units

The CMA5 Series Power Meters are economical, accurate and easy-to-use handheld units for attenuation and power throughput measurements on point-to-point fiber optic links.
Units feature a rugged design, built to withstand the difficult testing environment of fiber optic cable installation and maintenance. A large LCD display and a dual powering system including a 9V battery and an optional power adapter ensuring the CMA5 Series will adapt to any situation.
With no warm up time, fast response time, auto-zeroing capabilities and tone detection, the CMA5 Series helps reduce measurement time.
The CMA5 Power Meters are ideal for testing single-mode and multimode fibers in various types of applications, thanks to multiple wavelength calibration at 850/1300 nm for datacom testing needs, 1310/1550/1625 nm for all WDM testing, as well as 1490 nm for FTTx testing needs.
Its linear amplifier technology combined with InGaAs detector ensure long-time accuracy and all units come with a 3 year warranty.

Key Benefits

- Pocket-sized and rugged design
- Three-year warranty
- Multiple calibration wavelengths to address all network types: datacom, multimedia, WDM as well as FTTx
- High input power capacity enables optical amplifier characterization and multimedia/CATV measurements

Specifications

Model	5P100	5P200	5P100C	5P200C
Connector Adapter*1	FC, SC, ST	LC, FC, SC, ST	FC, SC, ST	LC, FC, SC, ST
Fiber Type	MM/SM		MM/SM	
Calibrated Wavelengths	850, 1300, 1310, 1490, 1550, 1625 nm		850, 1300, 1310, 1490, 1550, 1625 nm	
Power Range	+10 to –60 dBm		+23 to –50 dBm	
Guaranteed Specifications Power Range	+5 to –60 dBm (+10 to –50 dBm at 850 nm)		+23 to –40 dBm	
Accuracy*2	±0.2 dBm		±0.2 dBm	
Linearity*2	±0.2 dB		±0.2 dB	
Modulation Detect	2 kHz		2 kHz	
Stability (8 Hours)*3	±0.1 dB		±0.1 dB	
Warranty	3 years		3 years	
Auto-Zeroing	Yes		Yes	
Warm Up Time	0 s		0 s	

Continued on next page

Model	5P100	5P200	5P100C	5P200C
Connector Adapter*1	FC, SC, ST	LC, FC, SC, ST	FC, SC, ST	LC, FC, SC, ST
Display	LCD			
Power Supply	9 V battery or optional AC adapter			
Dimensions	145 x 75 x 25 mm*3			
Weight	250 g			
Operational Temperature Range	–10˚ to +50˚C			
Storage Temperature Range	–25˚ to +60˚C			
Relative Humidity	5% to 95% non-condensing			
EMC	EN61326-1, EN61000-3-2			

CMA5 Power Meter could be used in conjunction with CMA5 Light source as well as CMA50, the all-in-one Handheld tester.
*1: 5P100 and 5P200 connector adapters are different. LC is only available on 5P200 series.
*2: ±0.5 dB at 850 nm
*3: At 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.

The CMA5 Power Meters can be ordered with a choice of detector types (a) and connector options (b). The 5P200 includes the option for an LC connector style.

- **Model Number:**

5P100 __ - _____
A B

A = Wide Area Detector Type
blank = Standard detector (+5 to –60 dBm)
C = CATV detector (+23 to –40 dBm)
B = Connector Options
FC = FC/UPC and FC/APC
SC = SC/UPC and SC/APC
ST = ST/UPC and ST/APC

5P200 __ - _____
A B

A = Wide Area Detector Type
blank = Standard detector (+5 dBm to –60 dBm)
C = CATV detector (+23 dBm to –40 dBm)

B = Connector Options
FC = FC/UPC and FC/APC
SC = SC/UPC and SC/APC
ST = ST/UPC and ST/APC
LC = LC/UPC

CMA5 – Accessories (ordered as separate line items)

CMA5-POUCH	Carrying pouch w/shoulder strap
CMA5-BAT	9 V Battery
CMA5-AC	AC power adapter for CMA5 series
CMA5-AD-PM-FC	FC Power Meter connector adapter for 5P100
CMA5-AD-PM-SC	SC Power Meter connector adapter for 5P100
CMA5-AD-PM-ST	ST Power Meter connector adapter for 5P100
CMA5-AD-PM-ALL3	FC/SC/ST Power Meter connector adapters for 5P100

LIGHT SOURCES

CMA5 Series

850, 1300, 1310, 1550 nm

CE

Economical and Stable Laser Source

The CMA5 Series Light Sources provide an economical and stable laser source for use in point-to-point attenuation measurement. Units feature a rugged design, built to withstand the difficult testing environment of fiber optic cable installation and maintenance.
A dual powering system including a 9 V battery and an optional power adapter, ensure the CMA5 series will adapt to any situation. To further protect your investment, a 3 year warranty is standard.

Key Benefits

- Pocket-sized and rugged design
- Three-year warranty
- Up to two wavelengths on a single port to address all network types from datacom to WDM
- Interchangeable fiber-optic adapters

Dual Wavelength Light Source

Model	5L83	5L35
Emitter Type	Laser Diode	Laser Diode
Wavelength	850/1300 ±20 nm	1310/1550 ±20 nm
Output Power	–7 dBm (on MM fiber)	–7 dBm (on SM fiber)
Source Linewidth	<5 nm	<5 nm

General Specifications

Wavelength Accuracy at 25˚C	± 20 nm
Stability (8 hours)	±0.1 dB
Modulation	CW, 270 Hz, 1 kHz, or 2 kHz
Warranty	3 years
Warm Up time	0 s
Display	LED indicators
Power Supply	9 V battery or optional 9 V AC adapter
Battery Warning	Yes
Auto Shutoff	Yes
Output Connector	FC, SC, ST
Dimensions	145 x 75 x 25 mm
Weight	250 g
Operational Temperature Range	–10˚ to +50˚C
Storage Temperature Range	–25˚ to +60˚C
Relative Humidity	0% to 95% non-condensing
EMC	EN61326-1, EN61000-3-2

The CMA5 Light Sources are ideal for testing single-mode and multimode fibers as they are offered in a variety of wavelengths to meet testing applications from datacom with 850 nm and 1300 nm to WDM with 1310/1550/1625 nm wavelengths. Single and dual wavelength models are available and have only one output port.
Based on advanced technologies of precision laser control with modulation tones and no warm up time, the CMA5 Series helps reduce measurement time.

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 CMA5 Light Sources can be ordered with a choice of wavelengths (a) and connector options (b):

- **Model Number:**

5L ___ - ___
A B

A = Wavelengths
83 = 850/1300 nm
35 = 1310/1550 nm

B = Connector Options
FU = FC/UPC
SU = SC/UPC
TU = ST/UPC
FA = FC/APC
SA = SC/APC

CMA5 – Accessories (ordered as separate line items)

CMA5-POUCH	Carrying pouch w/shoulder strap
CMA5-BAT	9 V Battery
CMA5-AC	AC power adapter for CMA5 series
CMA5-AD-LS-FC	FC Light Source connector adapter
CMA5-AD-LS-SC	SC Light Source connector adapter
CMA5-AD-LS-ST	ST Light Source connector adapter
CMA5-AD-LS-ALL3	FC/SC/ST Light Source connector adapters

OPTICAL FIBER IDENTIFIERS
FI700 Series

CE

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

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

Fiber compatibility	Dual window single-mode	8 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	One 9 volt Alkaline battery
Operation	Approximately 10,000 readings
Operating temperature	–20˚ to +50˚C (–4˚ to 122˚ F)
Storage temperature	–40˚ to +60˚C (–40˚ to 140˚ F)
Humidity	0 to 90% non-condensing
Dimensions (L x W x D)	19.1 x 4.2 x 2.5 cm (7.5 x 1.3 x 1.0 inches)
Weight	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

ALL-BAND OPTICAL COMPONENT TESTER

MT9820A

1250 to 1650 nm

CE GPIB

Test solution for the characterization of optical components and modules

A Revolutionary Approach in Optical Testing

MT9820A has been designed to be the most versatile, compact and low price solution for customers who want to perform optical loss measurements over a wide wavelength range. It builds the bridge between the two previous traditional approaches: own built set-up based on step by step measurement, and complete integrated sweeping systems.
MT9820A adapts to any tunable laser source. Its compact format as well as its open architecture makes it the best mate of optical engineers and technicians who need a reliable low cost instrument to test or validate their design in a fast and accurate way.

Fast and Accurate Loss Measurement for Everyone

When it comes to measure optical transfer function, the sweeping method is the only fast and reliable solution. Sweeping measurement is not only faster than step by step measurement but also gives more sampling points and better wavelength accuracy. Nevertheless, most of tunable laser sources are still used in step by step mode because it is easier to implement in conjunction of power meters and a wavemeter. Building sweeping set-up is more difficult as it needs to do real time acquisition for power and wavelength measurements. The quality of the tunable lasers sources is also a key of success: mode hops, sweeping velocity, power flatness, wavelength accuracy… are various phenomenon that needs to be controlled in order to do reliable measurement.
MT9820A brings all these knowledge, controls and accurate measurement capabilities in a simple box that easily interface with customer tunable laser and PC.

A Tool That Adapt to Your Needs

Complete sweeping system usually offers good performances but with major drawbacks. The initial cost is very high and most of time includes the purchase of a new tunable laser source or PC. The architecture is also rigid and difficult to maintain and modify in mid and long term perspective.
MT9820A overcomes these difficulties by adapting to the existing installing base. Its compact format as well as its low price makes it best suitable for labs testing benches.

Continuous Sweep over Several Tunable Lasers

With its patented configuration, MT9820A is the unique solution on the market that allows you to sweep continuously over several lasers (up to 4) in order to achieve a fast full-range measurement.

MT9820A: High Performance in Real Time

MT9820A is an unique combination of high speed electronic and optical interferometry. Up to four real time measurements are now possible with ±5 pm wavelength accuracy. This allows the use of MT9820A during alignment and manufacturing process, but also for optical sensor analysis.

Specifications

General Characteristics	Laser inputs	2 to 4
	Detectors	2 to 4
Wavelength	Operating wavelength range	1250 to 1650 nm
	Absolute wavelength accuracy*1, *2	±5 pm
	Relative wavelength accuracy	±1 pm
Power	Detection range	Minimum input power on detectors: –60 dBm
		Maximum input power on detectors: 0 dBm
	Transfer function accuracy*3	±0.2 dB
	Dynamic range*4	>60 dB
Sampling Characteristics	Sampling Resolution	1, 2, 4, 8, 16, 32, 64, 128 pm
	Points per scan	Up to 200,000 with 1 detector operation Up to 50,000 with 4 detectors operation
	Measurement speed	From 10 to 100 nm/s
Interfaces	Optical connectors	Universal
	Interface with PC	USB
Environment	Operating temperature range	+10˚ to +40˚C
	Storage temperature range	–40˚ to +60˚C
	Power Supply	100 to 240 V (50 to 60 Hz)
	Dimensions (W x H x D) in mm3	335 x 110 x 320
	Weight	4 kg
EMC	EN61326-1, EN61000-3-2	
LVD	EN61010-1	

∗1: Except on O band.
∗2: For a scan >100 nm
∗3: For incident power on detectors> –30 dBm. Accuracy: ± 0.5 dB for power between –30 and –60 dBm.
∗4: >55 dB on models with 3 or 4 detectors

Tunable Laser Source Requirements

Remote control*5	GPIB
Output Power	Any value between 0.5 and 10 mW
Mode hops	No mode hop mode is highly desirable but the instrument is able to detect and operates with few mode hopes
Sweeping speed	From 10 to 100 nm/s.

PC Requirements

Operating system	Windows XP or 2000
Interfaces	USB port and GPIB interface card*5

∗5 : Remote operation through binary signal on rear side BNC input is provided as an alternative to GPIB.

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.

MT9820A has been designed to be the most versatile, compact and low price solution for customers who want to perform optical loss measurements over a wide wavelength range.

• Model Number

MT9820A-0 $\frac{\quad}{A}$ $\frac{\quad}{B}$

A = Laser inputs (A = 2, 3 or 4)
B = Detectors (B = 2, 3 or 4)

Example of Order Number and Specification

MT9820A-022	All-Band Optical component Tester - 2 laser inputs and 2 detectors
MT9820A-034	All-Band Optical component Tester - 3 laser inputs and 4 detectors

• Accessories

Use the following descriptions that correspond to the available accessories:

Description

• Handle-type universal SC adapter for standard UPC or angled APC connectors
• Handle-type universal FC adapter for standard UPC or angled APC connectors

TUNABLE LASER

Tunics Reference

1390 to 1650 nm

CE

The New Benchmark in Tunable Laser Sources

Highest Accuracy in the Industry

Tunics Reference is the new benchmark in tunable laser sources for test applications offering the best specifications for all types of DWDM measurements. This "gold standard" tunable laser features a ±25 pm wavelength accuracy with an automated built-in recalibration process, avoiding the need for an external wavelength meter. When higher wavelength accuracy is needed, a built-in Michelson-based wavelength meter could be added to reach an impressive ±5 pm absolute wavelength accuracy (IWM option).

High Output Power

Fast, reliable measurements of high performance telecommunication components and systems often present challenging power budget constraints, which only a high-power, yet low-noise source can resolve. While featuring the broadest tuning range in the industry, the Tunics Reference delivers optical power in excess of +10 dBm. This is a must when characterizing optical amplifiers and DWDM systems.

Largest Tuning Range in the Industry

In one single instrument, the Tunics Reference guarantees a tuning range of up to 160 nm at 0 dBm, covering multiple bands from 1390 to 1650 nm.

Sweeping and Step-by-Step Modes

The Tunics Reference features two operating modes. The sweeping mode delivers a continuous variation of the wavelength at a constant rate to enable a fast and uninterrupted measurement. In the step-by-step mode, the laser stops at the required wavelength to allow for long-term testing as well as in-process alignments.

Entirely Mode-Hop Free

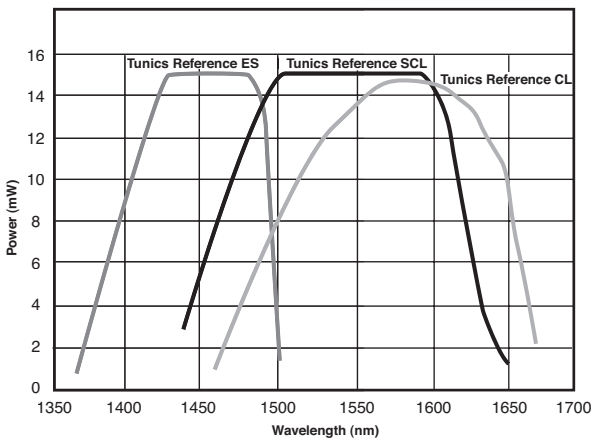
With continuous output power whether stepping or sweeping, Tunics Reference guarantees smooth spectral sweeps free of any mode hops over the entire (min. 150 nm) tuning range thanks to real-time optimization of the laser cavity alignment through the use of feedback loops.

High Stability

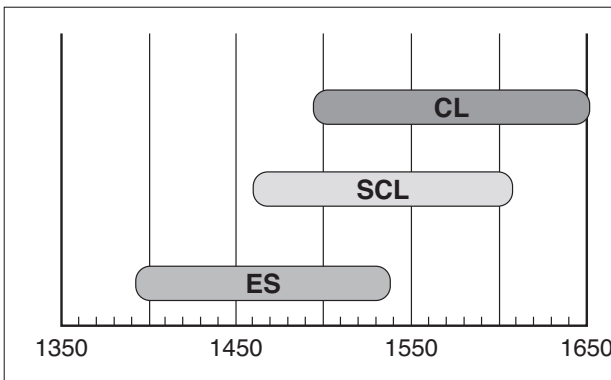
Offering ±1 pm/h wavelength stability (with IWM option, ±5 pm/h otherwise) Tunics Reference allows long-term testing such as thin-film growth monitoring.

Additional Features

- Tunics Reference provides both optical and electrical monitoring outputs. It is able to interface with wavelength meters (through RS-232C) to acheive their accuracy or with oscilloscopes for quick and easy spectral insertion loss characterization.
- Tunics Reference provides IEEE 488.2 interface along with SCPI commands.



Power vs wavelength typical performance.



Power vs wavelength typical performance.

Specifications

		Tunics Reference ES	Tunics Reference SCL	Tunics Reference CL
Tuning Characteristics	Wavelength range (mode hop free) • P = 0 dBm • P = 3 dBm • P = 6 dBm • P = 8 dBm • P = 10 dBm	1390 to 1540 nm 1410 to 1530 nm 1420 to 1520 nm 1440 to 1510 nm 1450 to 1510 nm	1460 to 1610 nm 1470 to 1590 nm 1480 to 1580 nm 1500 to 1580 nm 1520 to 1570 nm	1490 to 1650 nm 1510 to 1640 nm 1520 to 1630 nm 1540 to 1630 nm 1565 to 1615 nm
	Absolute wavelength accuracy*1, *7	±25 pm		
	Tuning repeatability (typ.)	±5 pm		
	Wavelength setting resolution	1 pm		
	Optical frequency fine tuning	±2 GHz		
	Tuning speed (typ.)	1 s (100 nm)		
Integrated Wavelength Meter Option (IWM)	Absolute wavelength accuracy*1 *8	±5 pm		
	Tuning repeatability (typ.)	±1 pm		
Sweeping-Mode Characteristics	Mode hop free range	Whole wavelength range for each specified power		
	Scan speed	Adjustable from 1 to 100 nm/s		
	Power flatness during scan (typ.)	±0.25 dB		
	Power repeatability from scan to scan (typ.)*2	±0.05 dB		
	Laser Output Characteristics	–		
	Power stability*3	±0.01 dB		
	Side mode suppression ratio*4	>45 dB		
	Signal to source spontaneous-emission ratio*5	>55 dB		
	Relative intensity noise*4, *6	–145 dB/Hz (typ.)		
	Spectral Width (FWHM)	150 kHz (typ.) (coherence control OFF), >100 MHz (coherence control ON)		
Interface	Optical connector	FC-APC		
	Output fiber	SMF-28™		
	Output isolation	35 dB		
	Return loss	60 dB		
	Remote control	RS-232C and IEEE-488.2		
	Low frequency modulation	10 kHz to 8 MHz		
	High frequency modulation	30 kHz to 1 GHz		
General Specifications	Operating temperature range	+18˚ to +35˚C (+60˚ to +85˚F)		
	Power supply	100 to 240 V (50 to 60 Hz)		
	Dimensions (W x H x D) in mm3	448 x 133 x 370		
	Weight	12.5 kg		
	EMC	EN61326-1, EN61000-3-2		
	LVD	EN61010-1		

Unless otherwise specified, specifications are given after 30 minute warm-up.

∗1: After self calibration, temperature remaining within ±3˚C from self-calibration temperature

∗2: Over 100 scans at constant temperature

∗3: Over one hour at a constant temperature and after 2 hour warm-up

∗4: Measured with 0 dBm output power

∗5: Spontaneous emission measured within a 0.1 nm bandwidth at ±1 nm from the signal

∗6: Measured at an electrical frequency of 100 MHz

∗7: Accuracy given at 3 sigma after automated self recalibration: the wavelength errors on the whole spectral range follow a normal distribution, with 99.7% of the values are inferior to 25 pm.

∗8: With M option: for operating temperature between +18˚ and +30˚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.

Tunics Referenceis the new benchmark in tunable laser sources for test applications, offering the best specifications for all types of DWDM measurements.

Model Number:
Tunics Reference ES
Tunics Reference SCL
Tunics Reference CL

Please specify the model name followed by the options.
Example: Tunics Reference SCL/M/IWM

• Options
Use the following code references that correspond to the available option:

Code	Description
M	Polarization maintaining output fiber (orientation TE in slow axis, in line with connector key)
IWM	Integrated Wavelength Meter (absolute wavelength accuracy: 5 pm)

• Accessories
Use the following descriptions that correspond to the available accessories:

Description
- LabView driver for Tunics Reference
- Fiber optic jumper FC-APC/FC-APC
- Fiber optic jumper FC-APC/FC-PC
- Polarization maintaining fiber optic jumper FC-APC/FC-APC
- Polarization maintaining fiber optic jumper FC-APC/FC-PC
- Carrying case

Each benchtop instrument is delivered as standard with a FC-APC/FC-PC fiber optic jumper.

TUNABLE LASER

Tunics Plus

1260 to 1640 nm

CE

General-Purpose Sweeping Tunable Laser

Tunics Plus is a general-purpose benchtop “work-horse” tunable laser, offering the basic features of the Tunics prime benchtop models.

Broad Spectral Coverage

With up to 150 nm of tuning range, Tunics Plus is available in six different versions from 1260 nm to 1640 nm.

High Output Power

Up to +8 dBm eases the power budget and provides high-dynamic range measurements.

Active Control for Mode-Hop-Free Operation

For ultimate performance, Tunics Plus features a proprietary active control that ensures perfect mode-hop-free operation and accurate wavelength sweep over its entire tuning range.

Wide, Fast and Truly Continuous Tunability

Extremely smooth scans up to 150 nm, with 1 pm resolution, allow a fine analysis over a wide spectral range.

Affordable Price

With its affordable price and state-of-the-art high-performance, Tunics Plus should equip the bench of each and every contributor in the field of optical fiber communications.

Wavelength Monitoring

By connecting part of the light to a wavelength meter, Tunics Plus is able to internally adjust the output wavelength to the required wavelength within the wavelength meter accuracy. This function can be activated from the keyboard or through GPIB. It is compatible with wavelength meters providing RS 232-C remote control (contact us for compatible wavelength meters list).

Sweeping Mode

This mode delivers a continuous variation of the wavelength at a constant rate to enable a fast and uninterrupted measurement.

Specifications

		Tunics Plus O	Tunics Plus E	Tunics Plus S	Tunics Plus CL	Tunics Plus S/WB	Tunics Plus CL/WB
Tuning Characteristics	Wavelength range (mode hop free) • P = 0 dBm • P = 3 dBm • P = 6 dBm • P = 8 dBm	 1260 to 1340 nm 1280 to 1320 nm	 1340 to 1430 nm 1380 to 1410 nm	 1430 to 1530 nm 1440 to 1500 nm 1450 to 1490 nm	 1525 to 1625 nm 1540 to 1620 nm 1560 to 1600 nm	 1390 to 1540 nm 1420 to 1520 nm 1440 to 1510 nm	 1490 to 1640 nm 1520 to 1630 nm 1540 to 1610 nm
	Absolute wavelength accuracy*1	±0.04 nm					
	Tuning repeatability (typ.)	±0.005 nm					
	Wavelength setting resolution	0.001 nm					
	Optical frequency fine tuning	±2 GHz					
	Tuning speed (typ.)	1s (100 nm)					
Laser Output Characteristics	Power stability*2	±0.01 dB					
	Side mode suppression ratio*3	>40 dB	>40 dB	>45 dB	>45 dB	>45 dB	>45 dB
	Signal to source spontaneous-emission ratio*4	>45 dB >50 dB from 1280 to 1320 nm	>45 dB >50 dB from 1380 to 1410 nm	>55 dB	>55 dB	>55 dB	>55 dB
	Relative intensity noise*3, *5	–145 dB/Hz (typ.)					
	Spectral Width (FWHM)	150 kHz (typ.) (coherence control OFF) >100 MHz (coherence control ON)					
Sweeping Mode Characteristics	Mode hop free range	Whole wavelength range for each specified power					
	Scan speed	Adjustable from 1 to 100 nm/s					
	Power flatness during scan (typ.)	±0.25 dB					
	Power repeatability from scan to scan (typ.)*6	±0.05 dB					
Interfaces	Optical connector	FC-APC					
	Output fiber	SMF-28™					
	Output isolation	35 dB					
	Return loss	60 dB					
	Remote control	RS-232 C and IEEE-488.1					
	Low frequency modulation	10 kHz to 8 MHz					
	High frequency modulation	30 kHz to 1 GHz					
Environment	Operating temperature range	+15˚ to +30˚C +60˚ to +85˚F					
	Power supply	100 to 240 V 50 to 60 Hz					
	Dimensions (W x H x D) in mm3	448 x 133 x 370					
	Weight	12.5 kg					
	EMC	EN61326-1, EN61000-3-2					
	LVD	EN61010-1					

Unless otherwise specified, specifications are given after 30 minutes warm-up.

∗1: After self calibration
∗2: Over one hour at a constant temperature and after 1 hour warm-up
∗3: Measured with 0 dBm output power
∗4: Spontaneous emission measured on a 0.1 nm bandwidth at ±1 nm from the signal
∗5: Measured at an electrical frequency of 100 MHz
∗6: Over 100 scans at constant temperature

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.
Tunics Plus is a general-purpose benchtop “work-horse” tunable laser, offering the basic features of the Tunics prime benchtop models.

Model Number:
Tunics Plus O or E or S or CL or S/WB or CL/WB

Please specify the model name followed by the options:
Example: Tunics Plus E/M

• Options

Use the following code references that correspond to the available options:

Code	Description
M	Polarization maintaining output fiber (orientation TE in slow axis, in line with connector key)

• Accessories

Use the following descriptions that correspond to the available accessories:

Description
- LabView driver for Tunics Plus
- Fiber optic jumper FC-APC/FC-APC
- Fiber optic jumper FC-APC/FC-PC
- Polarization maintaining fiber optic jumper FC-APC/FC-APC
- Polarization maintaining fiber optic jumper FC-APC/FC-PC
- Carrying case

Each benchtop instrument is delivered as standard with a FC-APC/FC-PC fiber optic jumper.

NOISE-FREE TUNABLE EXTERNAL CAVITY LASER

Tunics Purity

1430 to 1625 nm

CE

Patented Configuration for this Unique ASE-Noise-Free Tunable Laser Source

Tunics Purity provides full power ASE-noise-free emission. It features an ultra-stable self-aligned cavity, wide continuous tunability and multiple modulation possibilities.

ASE-Noise-Free Operation

A patented configuration ensures an intracavity filtering of the background broadband ASE noise. The equivalent full width at half maximum (FWHM) of this filtering is as narrow as 0.15 nm, which makes the residual ASE almost unnoticeable.

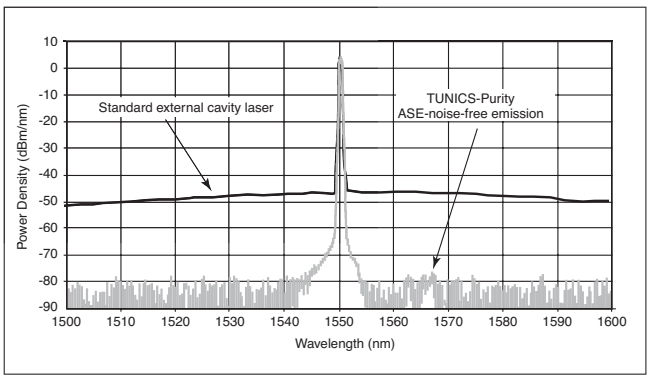
- Tunics Purity provides a pure ASE-noise-free operation with no compromise to other key features of state-of-the art tunable externalcavity laser-diodes.
- Tunics Purity provides up to +3 dBm output power and covers S-, C- and L-band.
- Tunics Purity offers a ±50 pm wavelength accuracy after internal referencing.

Ideal Source for Component Testing

Tunics Purity emits a pure high-power single-frequency laser line, enabling direct spectral measurements of filters and multiplexers with an unsurpassed dynamic range. This avoids complex set-ups requiring an additional tracking filter or the combination of an optical spectrum analyzer which often causes loss.

Multiple Modulation Possibilities

A full range of amplitude modulation capabilities and mode-locked operation satisfy any specific modulation requirement.



Specifications

		Tunics Purity S	Tunics Purity SC	Tunics Purity CL
Tuning Characteristics	Wavelength range • P = 0 dBm • P = 3 dBm	 1430 to 1530 nm 1450 to 1510 nm	 1470 to 1570 nm 1510 to 1570 nm	 1525 to 1625 nm 1560 to 1620 nm
	Mode hop spacing	>70 nm		
	Absolute wavelength accuracy	±0.05 nm		
	Tuning repeatability (typ.)	±0.005 nm		
	Wavelength setting resolution	0.001 nm		
	Optical frequency fine tuning	±2 GHz		
	Tuning speed (typ.)	1 s (100 nm)		
Laser Output Characteristics	Power stability*1	±0.01 dB		
	Power flatness*2	±0.1 dB		
	Signal to source spontaneous-emission ratio*3	>90 dB		
	Relative intensity noise*2, *4	–145 dB/Hz (typ.)		
	Spectral Width (FWHM)	150 kHz (typ.) (coherence control OFF), >100 MHz (coherence control ON)		
Interfaces	Optical connector	FC-APC		
	Output fiber	SMF-28™		
	Output isolation	35 dB		
	Return loss	60 dB		
	Remote control IEEE-488.1	Yes		
	Remote control RS-232C	Yes		
	Low frequency modulation	10 kHz to 8 MHz		
	High frequency modulation	30 kHz to 1 GHz		
General Specifications	Operating temperature range	+15˚ to +30˚C (+60˚ to +85˚F)		
	Power supply	100 to 240V, 50 to 60 Hz		
	Dimensions (W x H x D)	448 x 133 x 370 mm^3		
	Weight	12.5 kg		
	EMC	EN61326-1, EN61000-3-2		
	LVD	EN61010-1		

Specifications are given after 30 minutes warm-up.

∗1: Over two hours at a constant temperature
∗2: Measured at 0 dBm output power
∗3: Spontaneous emission measured within a 0.1 nm bandwidth at ±1 nm from the signal
∗4: Measured at an electrical frequency of 100 MHz

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.

Tunics Purity provides the latest breakthrough in external-cavity laser sources with full power ASE-noise-free emission. It features an ultra-stable self-aligned cavity, wide continuous tunability and multiple modulation possibilities.

Model Number:
Tunics Purity S or SC or CL

Please specify the model name followed by the options:
Example: Tunics Purity S/M

• Options
Use the following descriptions that correspond to the available option:

Code	Description
M	Polarization maintaining output fiber (orientation TE in slow axis, in line with connector key)

• Accessories
Use the following descriptions that correspond to the available accessories:

Description
- LabView driver for Tunics Purity
- Fiber optic jumper FC-APC/FC-APC
- Fiber optic jumper FC-APC/FC-PC
- Polarization maintaining fiber optic jumper FC-APC/FC-APC
- Polarization maintaining fiber optic jumper FC-APC/FC-PC
- Carrying case

Each benchtop instrument is delivered as standard with a FC-APC/FC-PC fiber optic jumper.

8-CHANNEL MODULAR PLATFORM

OSICS Mainframe

CE

Ideal for Multi-Channel Testing of DWDM Systems

The OSICS platform offers the highest flexibility and largest choice of plug-ins required in fiberoptic system testing, particularly for Dense Wavelength Division Multiplexing (DWDM). Up to 8 plug-in modules can be mixed and matched in a single OSICS mainframe, thus fulfilling all needs for applications requiring multi-wavelength sources.

OSICS features a complete line of modular sources including OSICS-ECL, tunable external cavity lasers with TUNICS technology; OSICS-DFB, distributed feedback laser diodes and OSICS-TLS, high power ITU-locked lasers.

OSICS Platform Specifications

OSICS mainframe	Dimensions (W x H x D)		448 x 133 x 370 mm^3
	Power supply		100 to 240 V, 50 to 60 Hz
	Control		Instrument front panel, RS-232C, and IEEE-488.2
	Weight (without any module)		8.1 kg
OSICS modules	Optical interface	ECL, DFB 1310	FC-APC connector on CorguideTM SMF-28 fiber
		DFB (C & L band), TLS	FC-APC connector on polarization maintaining fiber
	Output isolation		35 dB
	Return loss		60 dB
	Analog modulation	ECL, DFB	150 Hz to 1 GHz (external modulation)
	Digital modulation	ECL	500 Hz to 1 MHz (internal or external)
		DFB	1 Hz to 1 MHz (internal or external)
	Dimensions (W x H x D)		35 x 130 x 250 mm^3 (single slot)
	Weight		1 kg (0.7 kg for OSICS-DFB)
	Environment	Operating temperature range*1	+15˚ to +35˚C (+59˚ to +95˚F)
		Warm up time (room temperature)	2 hours max (1 hour typ.)
	EMC		EN61326-1, EN61000-3-2
	LVD		EN61010-1

*1: ECL module operates from +15˚ to +30˚C (+59˚ to 86˚F)

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 OSICS platform offers the highest flexibility and largest choice of plug-ins required in fiber-optic system testing, particularly for DWDM. Up to 8 plug-in modules can be mixed and matched in a single OSICS mainframe.

• Model Number:
OSICS mainframe

• Accessories
Use the following descriptions that correspond to the available accessories:

Description
- LabView driver for OSICS
- Fiber optic jumper FC-APC/FC-APC
- Fiber optic jumper FC-APC/FC-PC
- Polarization maintaining fiber optic jumper FC-APC/FC-APC
- Polarization maintaining fiber optic jumper FC-APC/FC-PC
- Carrying case

WDM TUNABLE LASERS

OSICS TLS

C and L Band

The Missing Link Between a Tunable Laser and a Fixed DFB

The OSICS-TLS modules are tunable laser sources with very high output power and very good wavelength accuracy based on the ITU-T grid. The wavelength could be tuned over 90 channels of the ITU-T grid by 50 GHz steps, covering around 35 nm in the C or L band. With +13 dBm (20 mW) output power as well as high power and wavelength stability, this is the ideal laser for WDM testing, with performance better or equal to a fixed wavelength DFB.

As part of the Osics family, this module has been designed to be used in all testing setups: high specs and low cost laser for every day lab applications to intensive field testing with multiple channels emulation. You can have as many as 8 OSICS TLS module in an OSICS mainframe and each module can be controlled from the front panel of the mainframe through an intuitive interface, or through the remote RS-232C and IEEE-488.2 interfaces.

Specifications

OSICS-TLS Model		Band C	Band L
Number of ITU channels		89 (50 GHz spacing)	92 (50 GHz spacing)
Wavelength range		196.1 to 191.70 THz (1528.77 to 1563.86 nm)	191.10 to 186.50 THz (1568.77 to 1607.47 nm)
Output power		20 mW (+13 dBm)	10 mW (+10 dBm)
Wavelength accuracy*1		±2.5 GHz	
Wavelength setting resolution		50 GHz	
Tuning speed (typ. between two channels)		≤100 ms	
Power stability*1		±0.5 dBm	
Spectral width (FWHM)		<10 MHz (typ.)	
Side Mode Suppression Ratio*1		>40 dB (typ.)	
Relative Intensity Noise*1, *2 (RIN)		>135 dB/Hz	
Operating temperature range		+15˚ to +35˚C (+59˚ to +95˚F)	
Interfaces	Optical interface	FC/APC connector on polarization maintaining fiber	
	Dimensions (W x H x D) and Weight	35 x 130 x 250 mm^3 (single slot), 1 kg	
Osics Platform Specifications	Dimensions (W x H x D) and Weight	448 x 133 x 370 mm^3 , 8.1 kg	
	Power supply	100 to 240 V, 50 to 60 Hz	
	Control	Instrument front panel, RS-232C, and IEEE-488.2	
	EMC	EN61326-1, EN61000-3-2	
	LVD	EN61010-1	

∗1: After warm-up
∗2: At a constant temperature

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 Osics-TLS modules are tunable laser sources with very high output power and very good wavelength accuracy based on the ITU-T grid.

- **Model Number:**

OSICS-TLS-C (C band)
OSICS-TLS-L (L band)

EXTERNAL CAVITY LASER MODULE

OSICS ECL

1260 to 1640 nm

CE

Low-Cost and Compact Tunable Laser

The ECL modules are high-performance External Cavity Lasers using Tunics technology which leads to a high output power over the whole tuning range.
The precision mechanism coupled to a stepper motor allows the wavelength to be tuned over more than 80 nm. Various wavelength range options are available to fulfill all needs in DWDM applications from 1260 to 1640 nm. The ECL 1560 and the ECL1600 offers more than +6 dBm at peak power. Each module can be controlled from the front panel of the mainframe or through the remote interface.
In addition, the modules and the mainframe offer a full suite of internal and external modulation capabilities.

Specifications

OSICS-ECL		ECL-1300	ECL-1400	ECL-1480	ECL-1560/P6	ECL-1600/P6
Wavelength range	P = 0 dBm	1260 to 1340 nm	1340 to 1430 nm	1440 to 1520 nm	1520 to 1600 nm	1560 to 1640 nm
	P = 6 dBm				1530 to 1580 nm	1570 to 1620 nm
Wavelength accuracy*1		±0.2 nm				
Wavelength stability*1, *2		±0.01 nm/h ±0.01 nm/24 h (typ.)				
Wavelength setting resolution		0.01 nm (0.001 nm optional)				
Tuning repeatability		±0.01 nm (typ.)				
Tuning speed		10 nm/s (typ.)				
Power stability*1, *2		±0.01 dB/h; ±0.01 dB/24 h (typ.)				
Spectral width (FWHM)		150 kHz (typ.) (coherence control OFF) >100 MHz (coherence control ON)				
Side mode suppression ratio*1		>45 dB				
Relative intensity noise*1, *3		>145 dB/Hz (typ.)				
EMC		EN61326-1, EN61000-3-2				
LVD		EN61010-1				

∗1: After warm-up, for 0 dBm output power.
∗2: At a constant temperature.
∗3: Measured at an electrical frequency of 100 MHz.

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 ECL modules are high-performance External Cavity Lasers using Tunics technology which leads to a high output power over the whole tuning range. The precision mechanism allows the wavelength to be tuned over more than 80 nm.

• Model Number:

ECL-1300
ECL-1400
ECL-1480
ECL-1560 / P6
ECL-1600 / P6

Please specify the model name followed by the options.
Example: ECL - 1560 / P6 / M / R

• Options

Use the following code references that correspond to the available option:

Code	Description
M	Polarization maintaining output fiber (orientation TE in slow axis, in line with connector key)
R	High resolution: 1 pm resolution (tuning speed changes to 3 nm/s)

• Accessories

Use the following descriptions that correspond to the available accessories:

Description
• LabView driver for OSICS
• FO Jumper FC-APC/FC-APC
• FO Jumper FC-APC/FC-PC
• Polarization maintaining FO Jumper FC-APC/FC-APC
• Polarization maintaining FO Jumper FC-APC/FC-PC

FULL-BAND TUNABLE LASER

OSICS ECL400

1250 to 1650 nm

CE

Tunable Laser Covering O, E, S, C, L and U Band in a Single Compact Unit

From 1250 to 1650 nm, the ECL-400 provides full telecom band coverage for the O, E, S, C, L and U bands in a single compact unit. With 0 dBm guaranteed power over the entire tuning range, the ECL-400 is the ideal tool for testing CWDM and WDM passive and active components.
The full-band laser is made of four ECL modules and one optical switch featuring Automatic Power Control. The ECL modules are high-performance External Cavity based on Anritsu's Tunics technology which leads to excellent optical power and wavelength stability.With a modular approach, users buy only the wavelength range they need today and keep the ability to extend it later on. The ECL-400 fits inside the classical 8 slot modular OSICS platform, a compact 3U format ideal for Research & Development and production testing. The remaining free slots could be utilized for any of the other OSICS modules, such as DFBs, TLS modules or additional ECL modules.

OSICS ECL Specifications

OSICS ECL	ECL-1300 Extended	ECL-1400 Extended	ECL-1480 Extended	ECL-1600 Extended
Wavelength Range*1	1250 to 1340 nm	1340 to 1430 nm	1430 to 1540 nm	1540 to 1650 nm
Output Power*1, *2	+0 dBm over all wavelength range			
Automatic Power Control Accuracy	±0.2 dB			
Wavelength Accuracy	±0.2 nm			
Wavelength Stability	±0.01 nm/h (±0.01 nm/24h typ.)			
Wavelength Setting Resolution	0.01 nm			
Tuning Repeatability	± 0.01 nm (typ.)			
Tuning Speed	10 nm/s			
Side Mode Suppression Ratio	>45 dB			
EMC	EN61326-1, EN61000-3-2			
LVD	EN61010-1			

*1: After warm-up
*2: At a constant temperature
Specifications are subject to change without notice.

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.

From 1250 to 1650 nm, the ECL-400 provides full telecom band coverage for the O, E, S, C, L and U bands in a single compact unit.
With 0 dBm guaranteed power over the entire tuning range, the ECL-400 is the ideal tool for testing CWDM and WDM passive and active components.

- **Model Number:**

OSICS-ECL400

DISTRIBUTED FEED BACK LASERS

OSICS DFB

C and L Band

CE

High Power DWDM Lasers

The DFB modules are high-performance Distributed Feed Back laser diodes. The user-defined wavelengths can be chosen on the ITU-T grid in the C- or L-band. OSICS-DFB offers more than +13 dBm of optical power coupled in a polarization maintaining fiber (except for module 1310) with a remarkable 5 pm wavelength stability over one hour. The internal wavelength calibration yields a 30 pm accuracy and the wavelength can be finely tuned over 1.8 nm (typ.) with the internal temperature control.

OSICS-DFB is also available at 1310 nm for channel monitoring in DWDM systems. Each module can be controlled from the front panel of the mainframe, or through the remote interface. The modules and the mainframe offer a full suite of internal and external modulation capabilities, and also feature a Brillouin effect suppression function.

Specifications

OSICS-DFB	C- and L-band	1310
ITU-T wavelength	1527.2 to 1610.05 nm*1	1310 nm ±25 nm
Wavelength tuning range	1.6 nm (1.8 nm typ.)	
Wavelength accuracy*2	±0.03 nm	
Wavelength stability*2, *3, *4	±0.005 nm/h (±0.005 nm/24 h typ.)	
Output power	+13 dBm	+3 dBm
Power stability*2, *3, *4	±0.01 dB/h (±0.01 dB/24 h typ.)	
Spectral width (FWHM)	<30 MHz	
Side mode suppression ratio*2	>40 dB	>32 dB
Relative intensity noise*2, *5	>145 dB/Hz (typ.)	
EMC	EN61326-1, EN61000-3-2	
LVD	EN61010-1	

∗1: The ITU-T wavelength is user-selected at time of order on the ITU-T grid, using the following format: OSICS-DFB-XXX.XX where XXX.XX is the frequency in THz.
∗2: After warm-up, for Pmax output power.
∗3: At a constant temperature.
∗4: Measured with an APC connector on the powermeter side
∗5: Measured at an electrical frequency of 100 MHz.

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 DFB modules are high-performance Distributed Feed Back laser diodes. The user-defined wavelengths can be chosen on the ITU-T grid in the C- or L-band. OSICS-DFB offers more than +13 dBm of optical power coupled in a polarization maintaining fiber (except for module 1310)

• Model Number:

OSICS-DFB-XXX.XX
where XXX.XX is the frequency in THz

• Accessories

LabView driver for OSICS
FO Jumper FC-APC/FC-APC
FO Jumper FC-APC/FC-PC
Polarization maintaining FO Jumper FC-APC/FC-APC
Polarization maintaining FO Jumper FC-APC/FC-PC

TUNABLE OPTICAL CHANNEL DROP UNIT

Xtract

1450 to 1650 nm

CE

Perfect and Unique Tool for Clean Signal Extraction

Xtract features a square flat-top tunable filter allowing clean DWDM optical channel extraction.

Ideal Tool for Channel Selection and Extraction from DWDM Signals

Xtract accurately isolates a DWDM channel for BERT or Q-factor measurements. It features automatic channel detection with a relative wavelength accuracy of ±15 pm.

Clean Channel Extraction

Xtract's square flat-top filter shape prevents any corruption of the data. This ensures proper signal conditioning before additional testing of the selected channel.

Covers all the Transmission Bands

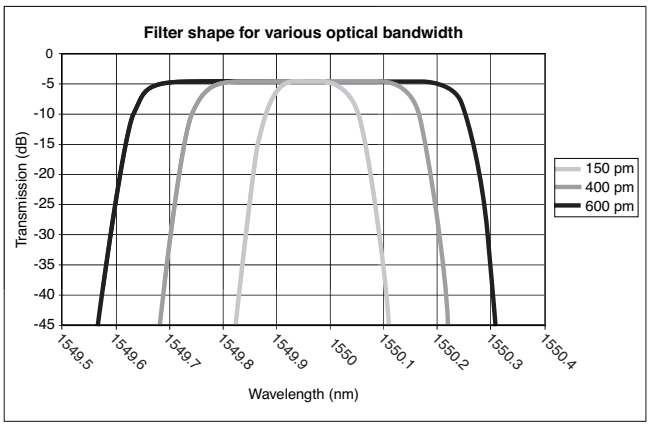
Xtract operates from 1450 to 1650 nm covering the E-, S-, C- and L-bands.

Ready for Next Generation DWDM Transport Systems

Xtract is suitable for systems with very high channel density as well as up to 40 Gb/s modulation rate. The fixed bandwidth of the filter, from 100 to 700 pm, is user-defined at the time of order.

Variable Bandwidth

Xtract offers a variable bandwidth as an option. Without altering the remarkable optical features of the filter, this capability enables you to adapt perfectly the filter bandwidth to the modulation of the signal. This allows you to validate complex simulations of your component and system designs with reliable results.



Xtract, Tunable Filter Specifications

Optical Specifications	Wavelength range	1450 to 1650 nm
	Autopositionning accuracy	±0.015 nm
	Wavelength resolution	0.005 nm
	Center wavelength linearity*1, *2	±0.05 nm
	Center wavelength stability*2, *3	<±0.05 nm
	Insertion loss*1	6 dB (5.5 dB typ.)
	Polarization dependent loss*4	±0.2 dB
Optical Bandwidth Specifications	Fixed optical bandwidth (FWHM)*5	From 100 to 700 pm (variable bandwidth optional)*6
	Flatness*7	0.2 dB
	Crosstalk*8	40 dB (50 dB typ.)
Interface	Optical connector	FC-APC on SMF-28TM fiber
General Specifications	Operating temperature range	+15˚ to +35˚C (+60˚ to +85˚F)
	Power supply	100 to 240 V (50 to 60 Hz)
	Dimensions (W x H x D)	448 x 133 x 370 mm^3
	Weight	10 kg
	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1

∗1: From 1500 to 1600 nm
∗2: After 2 hour warm-up at 23˚C ±2˚C
∗3: Over one hour
∗4: At 1500, 1550 and 1600 nm
∗5: Fixed bandwidth: user-defined at the time of order (optical bandwidth accuracy is ±10 pm at 1550nm), larger bandwidth available on customer request (up to 1 nm)
∗6: VBW option: optical bandwidth continuously variable from 150 to 650 pm (larger bandwidth available on customer request)
∗7: on a centered bandwidth BW = FWHM –150 pm, and for 150 pm <FWHM <700 pm
∗8: Measured 60 pm away from the –3 dB points

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.

Xtract is the only channel drop unit with a square flat-top filter shape and a variable bandwidth.
Tunable from 1450 to 1650 nm, it is the perfect tool for WDM designers who want toqualify their systems byindividual measurements on each channel.

- **Model Number:**

XTRACT XXX where XXX is the optical bandwidth in pm (to be chosen by customer)
XTRACT VBW with variable optical bandwidth

OPTICAL SPECTRUM ANALYZER
MS9710C
600 to 1750 nm

CE GPIB

High Performance for DWDM Optical Communications

The MS9710C is a diffraction-grating spectrum analyzer for analyzing optical spectra in the 600 to 1750 nm wavelength band. In addition to uses such as measurement of LD and LED spectra, it has functions for measuring the transmission characteristics of passive elements such as optical isolators, as well as NF/Gain of optical fiber amplifier systems.
In addition to its basic features, the superior stability and reliability of the diffraction grating (patent pending) offer the severe level and wavelength specifications particularly in the WDM band.
This analyzer has the dynamic range, reception sensitivity, and sweep speed requested by users, backed by Anritsu's high-level technology. The high sensitivity meets the exacting demands placed on today's measuring instruments. In particular, the excellent wavelength and level specifications fully meet the dense WDM requirements (1520 to 1620 nm).
The MS9710C Optical Spectrum Analyzer is the successor to the popular MS9710B but with improved functions and higher performance. The specifications have been upgraded for the important 1.55 µm band for WDM communications and have also been optimised to include the new requirements for L-band (1570 to 1620 nm) use. In addition to the high reliability and excellent basic performance, this analyzer has a full range of application functions to support accurate measurement in the fastest possible time.

Features
- Wavelength accuracy of ±20 pm (C-band) and ±50 pm (L-band)
- Dynamic range of 42 dB (0.2 nm from peak wavelength), 70 dB (1 nm from peak wavelength)
- WDM measurement of wavelength, level, and SNR for up to 300 channels

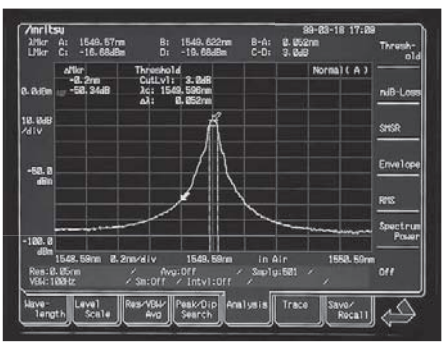
Performance and Applications
• 70 dB Dynamic Range

The dynamic range at 0.2 nm from the peak wavelength is better than 42 dB and is a high 58 dB min. at 0.4 nm from the peak, permitting high-accuracy measurement of DWDM systems with a 50 GHz (0.4 nm) channel spacing. The analyzer demonstrates its excellence in SNR measurement of WDM light sources, as well as in evaluation of narrow-band optical band pass filters.

Distance from peak wavelength	0.2 nm	0.4 nm	1 nm
Normal dynamic range mode	42 dB (45 dB typical)	58 dB	62 dB
High dynamic range mode	42 dB (45 dB typical)	60 dB	70 dB

High-dynamic range measurement example with DFB-LD spectrum passed via narrow-band Band-Pass Filter (BPF).

DFB-LD — Narrow-band BPF — MS9710C



• Relying on WDM Transmission

As a result of the need for increased transmission capacity, R&D into large-capacity transmission techniques is becoming more active, and Wavelength Division Multiplexing (WDM) is now in use. This WDM transmission technology requires quantitative measurement of the signal quality and wavelength transmission characteristics of each channel.
Measuring instruments for this purpose require highly-accurate wavelength and level measurements. Furthermore, accurate measurement of fiber-amplifier NF requires extremely good polarization dependant loss characteristics and level linearity specifications.
The MS9710C design achieves excellent wavelength and level specifications for this purpose in the 1520 to 1620 nm wavelength band and also in the extended band (L-band) to 1620 nm. In particular, the wavelength accuracy can be calibrated automatically using an optional internal reference wavelength light source; the post-calibration accuracy is better than ±20 pm.

Specifications for WDM Application

Mainframe, option	MS9710C	With Option 15*2
Wavelength accuracy*1	±20 pm (1530 to 1570 nm) ±50 pm (1520 to 1600 nm)	±20 pm (1520 to 1620 nm)
Wavelength resolution	50 pm (FWHM of internal optical BPF)	
Resolution accuracy	≤±3% (1530 to 1570 nm, resolution: 0.2 nm)	≤±3% (1520 to 1620 nm, resolution: 0.2 nm)
Level flatness to wavelength	±0.1 dB (1530 to 1570 nm) ±0.3 dB (1520 to 1620 nm)	±0.1 dB (1520 to 1620 nm)
	Resolution: 0.5 nm, ATT: off	
Polarization dependency	±0.05 dB (1550/1600 nm)	
Level linearity	±0.05 dB (1550 nm)	±0.05 dB (1550/1600 nm)
	–50 to 0 dBm (ATT: off), –30 to +20 dBm (ATT: on)	

∗1: After calibration with optical reference wavelength light source
∗2: L-band enhancement

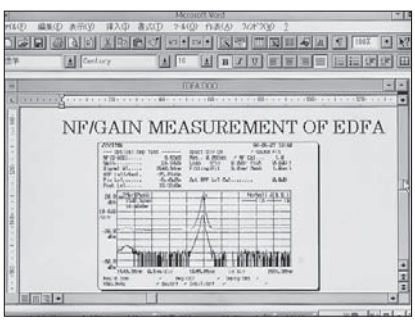
Full Function Lineup

In addition to its excellent basic functions, the MS9710C comes with a full lineup of other useful functions summarized in the following table.

Device analysis	For analyzing and evaluating waveforms of optical devices (DFB-LDs, FP-LDs, LEDs)
Waveform analysis	For waveform analysis by RMS and threshold methods; SMSR, half-width evaluation, WDM waveform analysis
Application measurement	EDFA NF and gain measurement, polarization mode dispersion measurement
Modulation, pulsed light measurement	Max. frequency range (VBW) = 1 MHz
Markers	Multimarkers: Marker function for max. 300 points Zone markers: For waveform analysis within zone Peak/dip search: Searches for a peak or dip
Power monitor	Also functions an optical power meter
Vacuum wavelength display	Converts displayed wavelength to value in vacuum
External interfaces	GPIB, RS-232C, VGA monitor output

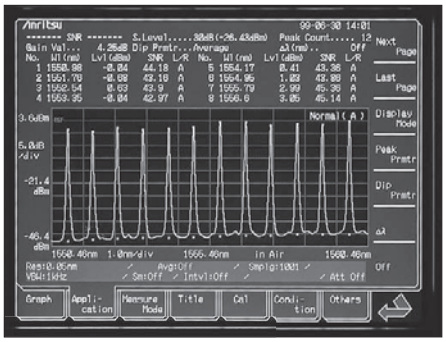
• 3.5 inch Internal FDD

In addition to saving and recalling measurement data, etc., waveforms saved to floppy disk can be easily and directly read by a personal computer.
The PC screen shown on the right is displaying an image of the MS9710C screen saved to floppy disk. Screen images can be saved to FD media and output as Windows® bitmap-format files. In addition, since the data can be output in text-file format, it can be manipulated easily using spreadsheet software.

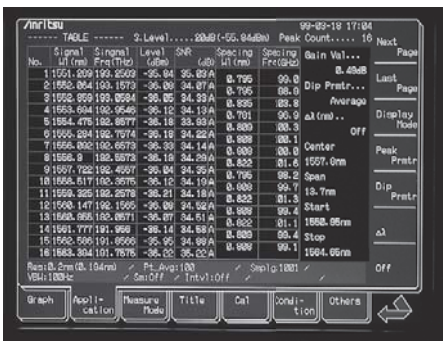


• Spectrum Analysis for WDM Communication Systems

The wavelength, level, and SNR of up to 300 WDM channels can be analyzed.
A new noise level left/right average function (shown below) has been added to SNR measurement. In addition, the noise level is normalized to a per nm figure. Accurate SNR measurement can be achieved due to the high-resolution accuracy of the MS9710C.

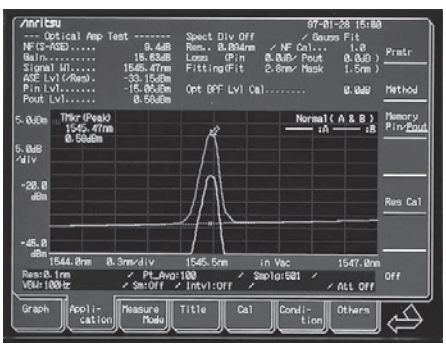


The measurement results described above can be switched to a table display that can be saved and recalled in text format. Both the wavelength and frequency are shown in the table.



• NF Measurement of Fiber Amplifier (EDFA)

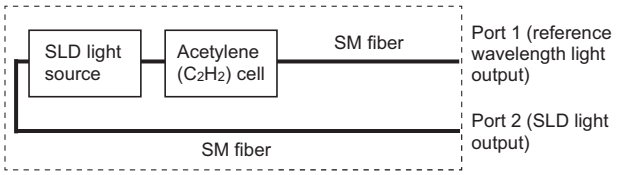
NF measurement by the optical method using an optical spectrum analyzer measures the light input to and output from the EDFA. NF is determined by the beat noise between the optical signal and the Amplified Spontaneous Emission (ASE) from the EDFA as well as by the beat noise between the ASE.
Since the MS9710C measures the ASE level with very high accuracy, three methods can be used to measure NF: 1. Pulse measurement (JIS: under discussion), 2. Level calibration using fitting, and 3. Polarization nulling. Moreover, measurement can be performed with the required dynamic range, level linearity, and polarization dependency.



• Convenient Light Source Option, Including Reference Wavelength Light Source for Better Accuracy

Any one of the Wavelength reference & SLD light source (Option 13), SLD light source (Option 14), Wavelength reference light source (Option 05), and White light source (Option 02) can be installed in the MS9710C.

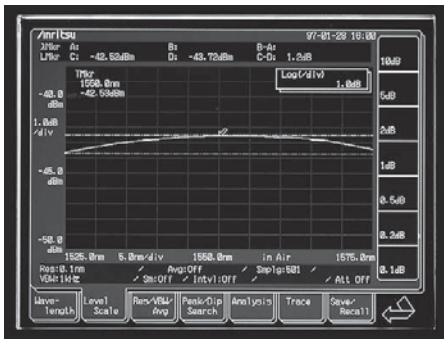
The block diagram of the SLD light source & Reference wavelength light source option is shown below. This option has two separate output ports: Port 1 for wavelength calibration, and the Port 2 for measuring transmission characteristics. When the MS9710C is calibrated automatically by inputting the reference wavelength light source, post-calibration wavelength accuracy in the 1520 to 1620 nm range is better than ±20 pm (Option 15). This is very useful in precision absolute measurement of the wavelengths of light sources used in WDM systems.



Block diagram of SLD light source & Reference wavelength light

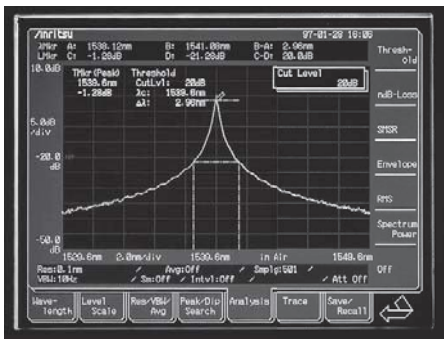
The following diagram shows the spectrum of the SLD light source output from Port 2.

When this light source is used instead of the earlier white light source for measurement of the wavelength transmission characteristics of optical receiver elements, it is possible to achieve a 20 dB wider dynamic range.



Spectrum of SLD light

The following figure is a measurement example of the transmission characteristics of an optical band pass filter using the SLD light source.



Measurement of optical bandpass filter

If this dynamic range is not required, a lower-cost white light source can be installed instead.

Specifications

Main frame, option		MS9710C	With Option 15 (L-band enhancement)
Applicable optical fiber		10/125 µm SM fiber (ITU-T G.652)	
Optical connector*1		User replaceable (FC, SC, ST, DIN, HMS-10/A), factory option (E2000, FC-APC, SC-APC, HRL-10)	
Wavelength	Measurement range	600 to 1750 nm	
	Accuracy	±20 pm (1530 to 1570 nm)*2, ±50 pm (1520 to 1600 nm)*2	±20 pm (1520 to 1620 nm)*2
		±200 pm (1530 to 1570 nm)*3 , ±300 pm (600 to 1750 nm)*3	
	Stability	±5 pm	
	Linearity	±20 pm (1530 to 1570 nm)	
	Resolution	0.05, 0.07, 0.1, 0.2, 0.5, 1.0 nm (RBW: 3 dB optical filter; transmission bandwidth)	
	Read resolution	5 pm	
	Resolution*4	≤±2.2% (1530 to 1570 nm, resolution: 0.5 nm) ≤±3% (1530 to 1570 nm, resolution: 0.2 nm) ≤±7% (1530 to 1570 nm, resolution: 0.1 nm) ≤±4% (1520 to 1530 nm, 1570 to 1620 nm, resolution: 0.5 nm) ≤±5% (1520 to 1530 nm, 1570 to 1620 nm, resolution: 0.2 nm) ≤±10% (1520 to 1530 nm, 1570 to 1620 nm, resolution: 0.1 nm)	≤±2.2% (1520 to 1620 nm, resolution: 0.5 nm) ≤±3% (1520 to 1620 nm, resolution: 0.2 nm) ≤±7% (1520 to 1620 nm, resolution: 0.1 nm)
		≤±7% (600 to 1520 nm, 1620 to 1750 nm, resolution: 0.5 nm) ≤±15% (600 to 1520 nm, 1620 to 1750 nm, resolution: 0.2 nm) ≤±30% (600 to 1520 nm, 1620 to 1750 nm, resolution: 0.1 nm)	

Continued on next page

Main frame, option		MS9710C	With Option 15 (L-band enhancement)
Level	Measurement range	–65 to +10 dBm (600 to 1000 nm, 0˚ to +30˚C, optical ATT: off) –85 to +10 dBm (1000 to 1250 nm, 0˚ to +30˚C, optical ATT: off) –90 to +10 dBm (1250 to 1600 nm, 0˚ to +30˚C, optical ATT: off) –75 to +10 dBm (1600 to 1700 nm, 0˚ to +30˚C, optical ATT: off) –55 to +10 dBm (1700 to 1750 nm, 0˚ to +30˚C, optical ATT: off) –60 to +10 dBm (600 to 1000 nm, +30˚ to +50˚C, optical ATT: off) –80 to +10 dBm (1000 to 1250 nm, +30˚ to +50˚C, optical ATT: off) –85 to +10 dBm (1250 to 1600 nm, +30˚ to +50˚C, optical ATT: off) –70 to +10 dBm (1600 to 1700 nm, +30˚ to +50˚C, optical ATT: off) –50 to +10 dBm (1700 to 1750 nm, +30˚ to +50˚C, optical ATT: off) –70 to +23 dBm (1100 to 1600 nm, 0˚ to +30˚C, optical ATT: on) –65 to +23 dBm (1100 to 1600 nm, +30˚ to +50˚C, optical ATT: on) [Resolution: ≥0.07 nm, VBW: 10 Hz, sweep average: 10 times]	
	Accuracy	±0.4 dB (1300/1550 nm, input: –23 dBm, resolution: ≥0.1 nm)	
	Stability	±0.02 dB (1 min, resolution: ≥0.1 nm, input: –23 dBm, no polarization fluctuation)	
	Flatness	±0.1 dB (1530 to 1570 nm, resolution: 0.5 nm, optical ATT: off) ±0.3 dB (1520 to 1620 nm, resolution: 0.5 nm, optical ATT: off)	±0.1 dB (1520 to 1620 nm, resolution: 0.5 nm, optical ATT: off)
	Linearity	±0.05 dB (1550 nm, –50 to 0 dBm, optical ATT: off) ±0.05 dB (1550 nm, –30 to +20 dBm, optical ATT: on)	±0.05 dB (1550/1600 nm, –50 to 0 dBm, optical ATT: off) ±0.05 dB (1550/1600 nm, –30 to +20 dBm, optical ATT: on)
Polarization dependency		±0.05 dB (1550/1600 nm), ±0.1 dB (1300 nm) ∗Setting resolution: ≥0.5 nm	
Dynamic range∗5		High-dynamic range mode (+20˚ to +30˚C): 70 dB (1 nm from peak wavelength), 60 dB (0.4 nm from peak wavelength), 42 dB (0.2 nm from peak wavelength) Normal mode (+20˚ to +30˚C): 62 dB (1 nm from peak wavelength), 58 dB (0.4 nm from peak wavelength), 42 dB (0.2 nm from peak wavelength)	
Optical return loss		≥35 dB (1300/1550 nm)	
Sweep		Sweep width: 0, 0.2 to 1200 nm Sweep speed (typical)∗6 : 0.5 s (normal dynamic mode, sweep width: 500 nm, VBW: 10 kHz, center wavelength: 1200 nm, sweep start to stop, no optical input, sampling point: 501)	
Display		6.4 inch, color TFT-LCD	
Memory		A/B (2 trace), 3.5 inch FDD (for MS-DOS® format)	
Printer		Internal (thermal type)	
Interface		GPIB, RS-232C, VGA output	
Operating conditions		Operating temperature: 0˚ to +50˚C (FDD: +5˚ to +50˚C), storage temperature: –20˚ to +60˚C, Relative humidity: ≤90% (no condensation, FDD: 20 to 80%) Shock: 30 G, 11 ms pulse, half sine	
Power		85 to 132 Vac/170 to 250 Vac, 47.5 to 63 Hz, 150 VA (max.)	
Dimensions and mass		320 (W) x 177 (H) x 350 (D) mm, ≤16.5 kg	
EMC		EN61326-1 EN61000-3-2	
LVD		EN61010-1	

∗1: One of these connector is attached. Please specify when ordering.
∗2: After WI cal (ref) at wavelength reference optical light source (Option 05/13), resolution: 0.05 to 0.2 nm
∗3: After WI cal (Ext) at DFB-LD and soon external optical light source
∗4: Actual screen resolution, 0˚ to +30˚C
∗5: Setting resolution: 0.05 nm, wavelength: 1550 nm, optical attenuator: off
∗6: Typical value for reference; not guaranteed specification

VBW, Sweep Speed, Minimum Light Reception Sensitivity∗1

VBW	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
Sweep speed (typ)	30 s	5 s	0.5 s	0.5 s	0.5 s	0.5 s
Minimum light reception sensitivity∗2	–90 dBm	–80 dBm	–70 dBm	–60 dBm	–50 dBm	–40 dBm

∗1: Data for reference (501 points no averaging; not guaranteed specifications)
∗2: RMS noise level (1250 to 1600 nm)

Note: Warm-up the MS9710C for about 5 min. to ensure stable operation. The above specifications were obtained 2 hours after power-on.

White Light Source (Option 02)

Optical output	≥–59 dBm/nm (multimode fiber input)∗1
Wavelength range	900 to 1600 nm
Operating temperature	+18˚ to +28˚C

∗1: –65 dBm (typ) measured with MS9710C (at 1 nm wavelength resolution) which has single-mode fiber at the input.

Wavelength Reference Light Source (Option 05)

Wavelength reference	1530 nm band Acetylene

Wavelength Reference & SLD Light Source (Option 13)

Wavelength range	1450 to 1650 nm
Output level	>–40 dBm/nm (1550 nm ±10 nm) >–60 dBm/nm (1450 to 1650 nm)
Output level stability*1	±0.04 dB (MS9710C setting resolution: 1 nm, no polarization change, constant temperature, measured for 20 min at 1550 nm)
Spectrum half width	>70 nm (typical: 90 nm)
Optical connector	User replaceable type (FC, SC, ST, DIN, HMS-10/A)
Operating temperature	0˚ to +40˚C
Wavelength reference	1530 nm band Acetylene

∗1: Measured after one hour warm-up

SLD Light Source (Option 14)

Wavelength range	1450 to 1650 nm
Output level	>–40 dBm/nm (1550 nm ±10 nm) >–60 dBm/nm (1450 to 1650 nm)
Output level stability*1	±0.04 dB (MS9710C setting resolution: 1 nm, no polarization change, constant temperature, measured for 20 min at 1550 nm)
Spectrum half width	>70 nm (typical: 90 nm)
Optical connector	User replaceable type (FC, SC, ST, DIN, HMS-10/A)
Operating temperature	0˚ to +40˚C

∗1: Measured after one hour warm-up

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	
MS9710C	Optical Spectrum Analyzer	
	Standard accessories	
	Optical Connector Adapter*1:	1 pc
	Power Cord, 2.5 m:	1 pc
Z0312	Printer Paper:	2 rolls
W1579AE	MS9710C Operation Manual:	1 copy
W1580AE	Remote Control Operation Manual:	1 copy
MX971003S	LabVIEW® Driver (RS-232C):	1 pc
MX971003G	LabVIEW® Driver (GPIB):	1 pc
B0329G	Front Cover:	1 pc
	Options	
MS9710C-02	White Light Source*2	
MS9710C-05	Wavelength Reference Light Source*2	
MS9710C-13	Wavelength Reference & SLD Light Source*2	
MS9710C-14	SLD Light Source*2	
MS9710C-15	L-band Enhancement*3	
MS9710C-25	FC-APC Connector*4	
MS9710C-26	SC-APC Connector*4	
MS9710C-27	E2000 Connector*4	
MS9710C-31	EC (Radial) Connector*4	
MS9710C-37	FC Connector*5	
MS9710C-38	ST Connector*5	
MS9710C-39	DIN Connector*5	
MS9710C-40	SC Connector*5	
MS9710C-43	HMS-10/A Connector*5	
MS9710C-47	HRL-10 Connector*4	
	Application parts	
J0654A	RS-232C Cable (9P-9P)	
J0655A	RS-232C Cable (9P-25P)	
J0007	GPIB Cable, 1 m	
J0617B	Replaceable Optical Connector (FC)	
J0618D	Replaceable Optical Connector (ST)	
J0618E	Replaceable Optical Connector (DIN)	
J0618F	Replaceable Optical Connector (HMS-10/A)	
J0619B	Replaceable Optical Connector (SC)	
J0635B	FC-PC · FC-PC 2M-SM (FC-PC optical fiber cord, 2 m, SM)	
Z0282	Ferrule Cleaner	
Z0283	Replacement Reel for Ferrule Cleaner (for Z0282)	
Z0284	Cleaner for Optical Adapter (stick type)	
B0330C	Tilt Stand	

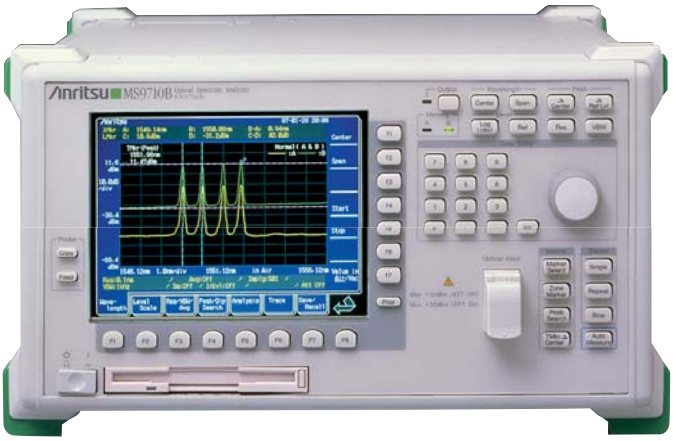
∗1: Specify the connector to be supplied as the standard connector when ordering the above options. If the connector is not specified, the FC connector (MS9710C-37) is supplied as standard.
∗2: Factory options; Two units cannot be installed simultaneously. Exchangeable-type optical connectors (FC, SC, ST, DIN, HMS-10/A) are supplied when specified at ordering. One conversion cord is supplied for connecting other optical connectors to the FC connector.
∗3: Specify the wavelength reference light source (Option 05 or Option 13).
∗4: Factory option
∗5: User replaceable

OPTICAL SPECTRUM ANALYZER
MS9710B

600 to 1750 nm

CE GPIB

For Evaluating LED/LD Spectra and Transmission Characteristics of Passive Elements



The MS9710B is a diffraction-grating spectrum analyzer for analyzing optical spectra in the 600 to 1750 nm wavelength band. In addition to uses such as measurement of LD and LED spectra, it has functions for measuring the transmission characteristics of passive elements such as optical isolators, as well as the NF/Gain of optical fiber systems.
In addition to its basic features, the superior stability and reliability of the diffraction grating (patent pending) easily pass the severe specifications required for precise measurement of WDM communications methods, particularly in the 1.55 µm band. This analyzer has the dynamic range, reception sensitivity, and sweep speed requested by users, backed by Anritsu's high-level technology. The high sensitivity meets the exacting demands placed on today's measuring instruments. In particular, the excellent wavelength and level specifications fully meet the dense WDM requirements in the 1.55 µm band.
In addition to having a much wider dynamic range, its compact portability (approx. 50% lighter) eliminates the large cumbersome image of earlier analyzers by perfectly combining portability with high performance. In addition to the high reliability and excellent basic performance, this analyzer has a full range of application functions to support accurate measurement in the fastest possible time.

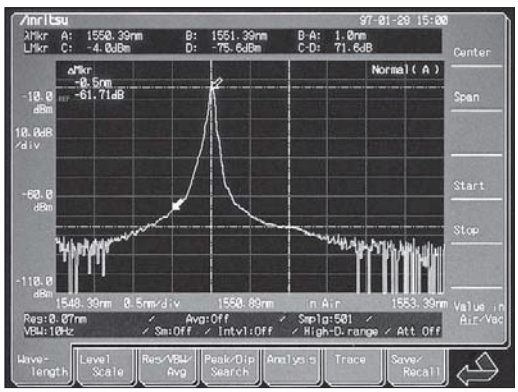
Features

- 70 dB Dynamic Range
- –90 dBm Guaranteed Optical Reception Sensitivity
- Internal 3.5 inch FDD (Windows®)
- Optical Pulse Measurement
- Full Range of WDM Application Functions

Performance and Functions

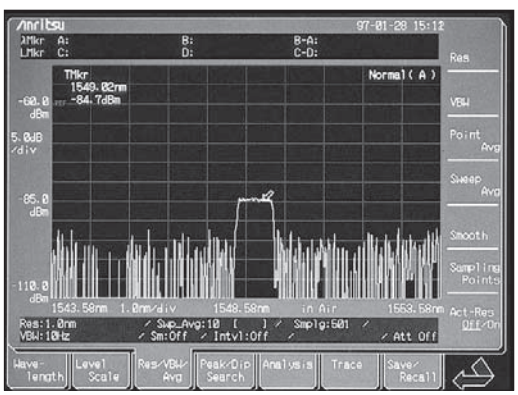
• 70 dB Dynamic Range

The measurement dynamic range of the MS9710B in the normal measurement mode at a wavelength 1 nm from the peak wavelength is 62 dB. In the high dynamic range measurement mode, better than 70 dB can be achieved. The analyzer demonstrates its excellence in SMSR measurement of DFB-LDs, as well as in evaluation of narrow-band optical band pass filters. (See top screen in adjoining column.)



• –90 dBm Guaranteed Optical Reception Sensitivity

The MS9710B has achieved an improved S/N over a wide range by taking thorough countermeasures to noise and stray light. The RMS noise level at wavelengths from 1250 to 1600 nm is –90 dBm max. The screen display below is the waveform obtained when measuring a 1.55 µm DFB-LD optical source of –85 dBm; only 25 seconds are required for the measurement. In addition, the S/N can be improved using sweep averaging.



• Full Function Lineup

In addition to its excellent basic functions, the MS9710B comes with a full lineup of other useful functions summarized in the following table.

Device analysis	For analyzing and evaluating waveforms of optical elements (DFB-LDs, FP-LDs, LEDs)
Waveform analysis	For waveform analysis by RMS and threshold methods; SMSR, half-width evaluation, WDM waveform analysis
Application measurement	EDFA NF and gain measurement, PMD measurement (See applications.)
Modulation, pulsed light measurement	Max. frequency range (VBW) = 1 MHz
Markers	Multimarkers: Marker function for max. 128 points (See applications.) Zone markers: For waveform analysis in zone Peak/dip search: Searches for a peak or dip
Power monitor	Also functions as optical power meter
Vacuum wavelength display	Converts displayed wavelength to value in vacuum
External interfaces	GPIB, RS-232C

• Relying on 1.55 µm Transmission Band

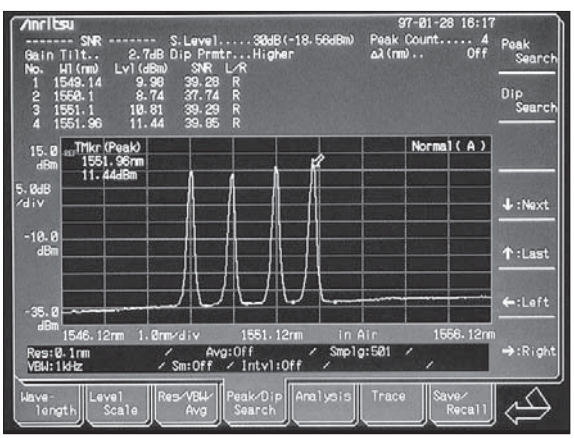
As a result of the need for increased transmission capacity, R&D into large-capacity transmission techniques is becoming more active and wavelength division multiplexing (WDM) is ready to use. This WDM transmission technology requires quantitative measurement of the wavelength transmission characteristics between each channel.

Measuring instruments for this purpose require more accurate wavelength and level measurement. Furthermore, accurate measurement of fiber-amplifier NF requires extremely good polarized light dependency and level linearity specifications. The MS9710B design has achieved excellent wavelength and level specifications for this purpose in the 1.53 to 1.57 µm wavelength band. In particular, the wavelength accuracy can be calibrated automatically using an optional internal reference wavelength light source — the post-calibration accuracy is better than ±0.05 nm. Evaluation of WDM systems requires measurement without repeated calibration at each measurement and the MS9710B achieves high-accuracy measurement with high repeatability.

Applications

• Spectrum Analysis for WDM Communication System

The wavelength characteristics for the gain, and signal to noise ratio (SNR) between each channel are difficult problems in WDM transmission technology. In evaluation, it is very important to measure this quantitatively. The MS9710B permits extremely quick and simple waveform analysis of up to 300 spectra. The waveform and level (SNR) of each peak exceeding the set threshold is displayed. The screen display below shows an example of the tilt gain.

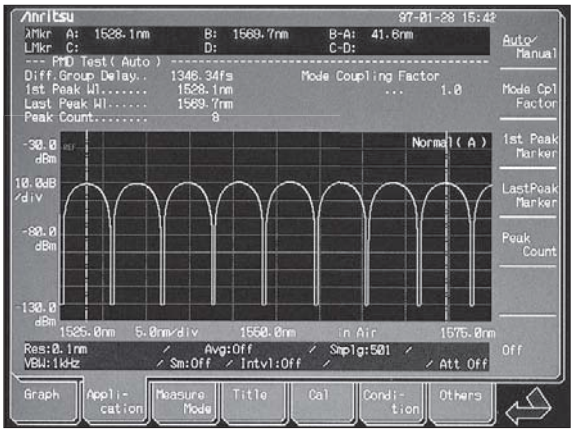


• Polarization Mode Dispersion

An important factor determining the upper limit of the transmission bit rate is the polarization mode dispersion (PMD). PMD is measured in the time and wavelength domains (see below). The MS9710B can be used as a fixed analyzer to perform simple and automated measurement in the wavelength domain and immediately computes the PMD by data processing from the measured waveform. The wavelength difference ($\lambda_2 - \lambda_1$) between the peak wavelength (λ_1) and the wavelength at the Nth peak (λ_2) are read directly, and the PMD is calculated from the following equation:

$$PMD = K \frac{N-1}{C} \times \frac{\lambda_1 \cdot \lambda_2}{\Delta\lambda}$$

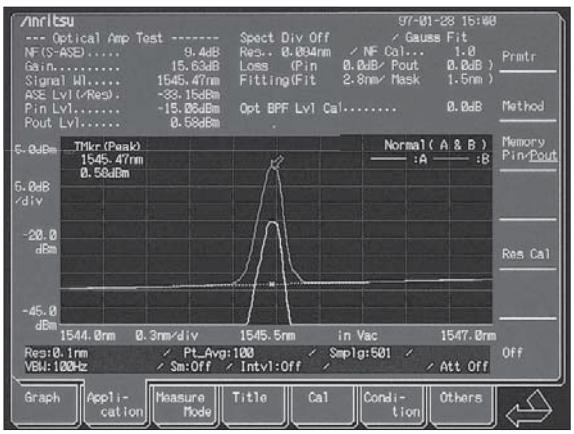
where: K is the mode coupling factor and C is the speed of light (m/s).



• NF Measurement of Fiber Amplifier (EDFA)

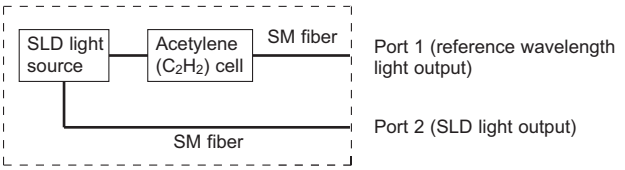
NF measurement by the optical method using an optical spectrum analyzer measures the light input and output to and from the EDFA. NF is determined by the beat noise between the optical signal and the amplified spontaneous emission (ASE) as well as by the beat noise between the ASE (see below).

Since the MS9710B measures the ASE level with very high accuracy, three methods can be used to measure NF: 1. Pulse measurement (JIS Method: under discussing), 2. Level calibration using fitting, and 3. Polarized light nulling. Moreover, measurement can be performed with the required dynamic range, level linearity, and polarization dependency.



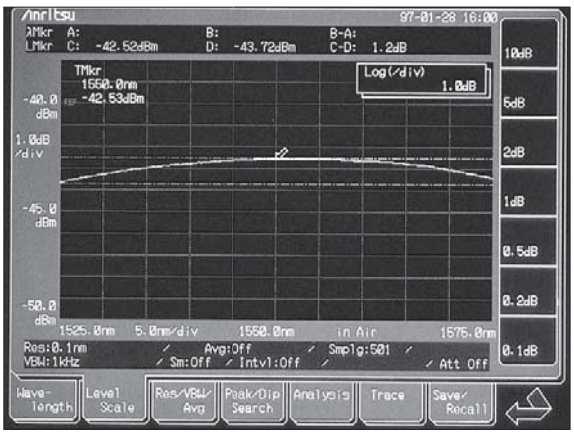
• Convenient Light Source Option (reference wavelength or white light) for better accuracy

The Wavelength reference & SLD light source (Option 13), SLD light source (Option 14), Wavelength reference light source (Option 05), and White light source (Option 02) can each be installed in the MS9710B. The block diagram of the SLD light source and reference wavelength light source option is shown below. This option has two separate output ports: Port 1 for wavelength calibration and Port 2 for measuring transmission characteristics. When the MS9710B is calibrated automatically by inputting the reference light for the wavelength, post-calibration wavelength accuracy in the 1.52 to 1.57 µm range is better than ±0.05 nm. This is very useful in precision absolute measurement of the wavelengths of light sources used in WDM systems.



Block diagram of SLD light source & reference wavelength light

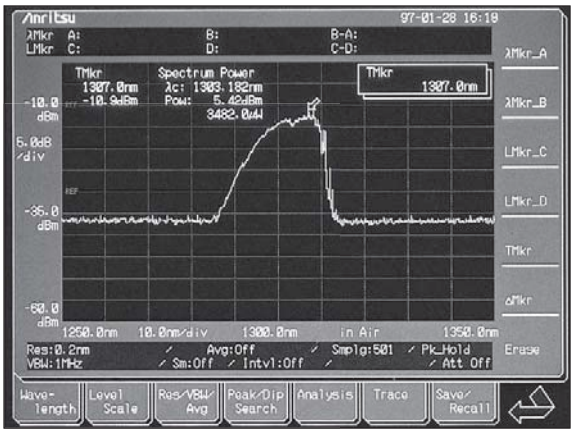
The following diagram shows the spectrum of the SLD light output from Port 2. When this light source is used instead of the earlier white light source for measurement of the wavelength transmission characteristics of optical receiver elements, it is possible to achieve a 20 dB wider dynamic range.



Spectrum of SLD light source

• Measurement of Modulated and Pulsed Light

The synchronization signal for the measured modulated/pulsed light is input to the external input trigger on the rear panel. With this analyzer, the data can be held by this sync signal. As a result, the spectrum of the modulated or pulsed light can be measured accurately without data loss. In addition, an optical source that does not have a sync signal can be measured in the same manner by setting an appropriate gate time. The waveform in the diagram on the right shows measurement of an optical pulse (OTDR's light source) with a pulse width of 1 µs and a duty cycle of 1%. However, for accurate spectrum measurement, the VBW must be set to a wider bandwidth than the modulation frequency of the measured light (see below). The maximum settable VBW in the MS9710B is 1 MHz. (Refer to the specifications page for the relationship between VBW, received light sensitivity and sweep time.)



Specifications

• MS9710B

Fiber	10/125 µm SM fiber (ITU-T G.652)
Optical connector*1	User replaceable: FC, SC, ST, DIN, HMS-10/A Factory option (not user replaceable): E-2000, EC (Radial), FC-APC, SC-APC, HRL-10
Wavelength	Range: 600 to 1750 nm Accuracy: ±0.2 nm (1530 to 1570 nm, after wavelength calibration) ±0.3 nm (600 to 1750 nm, after wavelength calibration) ±0.05 nm (1530 to 1570 nm, resolution: 0.07 to 0.2 nm, after calibration with wavelength reference light source option) ±0.1 nm (1530 to 1570 nm, resolution: 0.5 to 1 nm, after calibration with wavelength reference light source option) Stability: ±5 pm (smoothing: 11 points, 1 minute, at half-width center wavelength) Linearity: ±20 pm (1530 to 1570 nm) Resolution: 0.07, 0.1, 0.2, 0.5, 1 nm Resolution accuracy*2: ±≤2.2% (resolution: 0.5 nm, 1550 ±20 nm), ±≤7% (resolution: 0.5 nm, at other wavelength), ±≤3% (resolution: 0.2 nm, 1550 ±20 nm), ±≤15% (resolution: 0.2 nm, at other wavelength), ±≤7% (resolution: 0.1 nm, 1550 ±20 nm), ±≤30% (resolution: 0.1 nm, at other wavelength)
Level	Measurement range: –65 to +10 dBm (600 to 1000 nm, +10 to +30˚C, VBW: 10 Hz, sweep averaging: 10 times) –85 to +10 dBm (1000 to 1250 nm, +10 to +30˚C, VBW: 10 Hz, sweep averaging: 10 times) –90 to +10 dBm (1250 to 1600 nm, +10 to +30˚C, VBW: 10 Hz, sweep averaging: 10 times) –75 to +10 dBm (1600 to 1700 nm, +10 to +30˚C, VBW: 10 Hz, sweep averaging: 10 times) –55 to +10 dBm (1700 to 1750 nm, +10 to +30˚C, VBW: 10 Hz, sweep averaging: 10 times) –65 to +20 dBm (1100 to 1600 nm, attenuator: on) Accuracy: ±0.4 dB (1300/1550 nm, –23 dBm, resolution: ≥0.1 nm) Stability: ±0.02 dB (1550 nm, –23 dBm, resolution: ≥0.1 nm, 1 minute, constant temperature, no polarization shift) Linearity: ±0.05 dB (1550 nm, 0 to –50 dBm) Flatness: ±0.1 dB (1530 to 1570 nm)

Continued on next page

Polarization dependency	±0.05 dB (1.55 µm band, resolution: ≥0.5 nm), ±0.1 dB (1.3 µm band, resolution: ≥0.5 nm)
Dynamic range	70 dB (±1 nm, resolution: 0.07 nm, 1.55 µm band, high-dynamic range mode measurement, +20˚ to +30˚C) 60 dB (±0.5 nm, resolution: 0.07 nm, 1.55 µm band, high-dynamic range mode measurement, +20˚ to +30˚C) 62 dB (±1 nm, resolution: 0.07 nm, 1.55 µm band, normal mode measurement) 58 dB (±0.5 nm, resolution: 0.07 nm, 1.55 µm band, normal mode measurement)
Optical return loss	≥35 dB (1.3/1.55 µm band)
Sweep	Sweep width: 0, 0.2 to 1200 nm Sweep speed*3(typical): 0.5 s (sweep width: 500 nm, normal mode measurement, VBW: 10 kHz)
Display	6.4 inch color TFT-LCD
Memory	A, B (2 traces), 3.5 inch FDD (for Windows®)
Printer	Internal (thermal type)
Interface	GPIB, RS-232C
Main functions	Optical pulse measurement, power monitor, wavelength auto-calibration
Operating conditions	Operating temperature: 0˚ to +50˚C (FDD: +5˚ to +50˚C), storage temperature: –20˚ to +60˚C, Relative humidity: ≤90% (no condensation)
Power	85 to 132 Vac/170 to 250 Vac, 47.5 to 63 Hz, 150 VA (max.)
Dimensions and mass	320 (W) x 177 (H) x 350 (D) mm, ≤16.5 kg
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

∗1: One of these connector is attached. Please specify when ordering.
∗2: Actual screen resolution
∗3: Typical value for reference; not guaranteed specification

• White Light Source (Option 02)

Optical output	≥–59 dBm/1 nm (multimode/fiber input)*1
Wavelength range	900 to 1600 nm
Operating temperature	+18˚ to +28˚C

∗1: –65 dBm (typ.) measured with MS9710B (at 1 nm wavelength resolution) which has single mode fiber at the input

• Wavelength Reference Light Source (Option 05)

Wavelength reference	1.53 µm band Acetylene

• Wavelength Reference & SLD Light Source (Option 13)

Wavelength range	1450 to 1650 nm
Output level	>–40 dBm/nm (1550 nm ±10 nm) >–60 dBm/nm (1450 to 1650 nm)
Output level stability*1	±0.04 dB (MS9710B setting resolution: 1 nm, no polarization change, constant temperature, measured for 20 min at 1550 nm)
Spectrum half width	>70 nm (typical: 90 nm)
Optical connector	User replaceable type (FC, SC, ST, DIN, HMS-10/A)
Operating temperature	0˚ to +40˚C
Wavelength reference	1530 nm band Acetylene

∗1: Measured after one hour warm-up

• SLD Light Source (Option 14)

Wavelength range	1450 to 1650 nm
Output level	>–40 dBm/nm (1550 nm ±10 nm) >–60 dBm/nm (1450 to 1650 nm)
Output level stability*1	±0.04 dB (MS9710B setting resolution: 1 nm, no polarization change, constant temperature, measured for 20 min at 1550 nm)
Spectrum half width	>70 nm (typical: 90 nm)
Optical connector	User replaceable type (FC, SC, ST, DIN, HMS-10/A)
Operating temperature	0˚ to +40˚C

∗1: Measured after one hour warm-up

• VBW, Sweep Speed, Minimum Light Reception Sensitivity*1

VBW	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
Sweep speed (typ.)	30 s	5 s	0.5 s	0.5 s	0.5 s	0.5 s
Minimum light reception sensitivity*2	–90 dBm	–80 dBm	–70 dBm	–60 dBm	–50 dBm	–40 dBm

∗1: Data for reference; not guaranteed specifications
∗2: RMS noise level (1.25 to 1.6 µm)

Note: Warm-up to the MS9710B for about 5 minutes to ensure stable operation. The above specifications were obtained 2 hours after power-on.

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	
MS9710B	Optical Spectrum Analyzer	
	Standard accessories	
	Optical Connector Adapter*1:	1 pc
	Power Cord, 2.5 m:	1 pc
F0012	Fuse, 3.15 A (for 100/200 Vac system):	2 pcs
Z0312	Printer Paper:	2 rolls
W1283AE	MS9710B Operation Manual:	1 copy
W1284AE	Remote Control Operation Manual:	1 copy
MX971002S	LabVIEW® Driver (RS-232C):	1 pc
MX971002G	LabVIEW® Driver (GPIB):	1 pc
B0329G	Front Cover:	1 pc
	Options	
MS9710B-02	White Light Source*2	
MS9710B-05	Wavelength Reference Light Source*2	
MS9710B-06	Monitor Output	
MS9710B-10	Functional Addition (Frequency display, table display)	
MS9710B-13	Wavelength Reference & SLD Light Source*2	
MS9710B-14	SLD Light Source*2	
MS9710B-25	FC-APC Connector*3	
MS9710B-26	SC-APC Connector*3	
MS9710B-27	E2000 Connector*3	
MS9710B-31	EC (Radial) Connector*3	
MS9710B-37	FC Connector*4	
MS9710B-38	ST Connector*4	
MS9710B-39	DIN Connector*4	
MS9710B-40	SC Connector*4	
MS9710B-43	HMS-10/A Connector*4	
MS9710B-47	HRL-10 Connector*3	
	Application parts	
J0654A	RS-232C Cable, 9P-9P	
J0655A	RS-232C Cable, 9P-25P	
J0007	GPIB Cable, 1 m	
J0617B	Replaceable Optical Connector (FC)	
J0618D	Replaceable Optical Connector (ST)	
J0618E	Replaceable Optical Connector (DIN)	
J0618F	Replaceable Optical Connector (HMS-10/A)	
J0619B	Replaceable Optical Connector (SC)	
J0635B	FC·PC-FC·PC-2M-SM (FC·PC optical fiber cord, 2 m, SM)	
Z0282	Ferrule Cleaner	
Z0283	Replacement Reel for Ferrule Cleaner (for Z0282)	
Z0284	Cleaner for Optical Adapter (stick type)	
B0330C	Tilt Stand	

∗1: Specify the connector to be supplied as the standard connector when ordering the above options. If the connector is not specified, the FC connector (MS9710B-37) is supplied as standard.
∗2: Factory options; Two units cannot be installed simultaneously. Exchangeable-type optical connectors (FC, SC, ST, DIN, HMS-10/A) are supplied when specified at ordering. One conversion cord is supplied for connecting other optical connectors to the FC connector.
∗3: Factory option
∗4: User replaceable

OPTICAL SPECTRUM ANALYZER
MS9780A
600 to 1750 nm

CE GPIB

For Fibers with Core Diameters of 10, 50, and 62.5 µm

The MS9780A is a diffraction-grating spectrum analyzer for analyzing optical spectra in the 600 to 1750 nm wavelength band. Its input section has been redesigned to support fibers with core diameters of 50/62.5 µm; the input section of the MS9780A can be used to measure the spectra of LDs and LEDs, etc. In addition to uses such as measurement of LD and LED spectra, it has functions for measuring the transmission characteristics of passive elements such as optical isolators, as well as the NF/Gain of optical fiber amplifier systems. In addition to its basic features, the superior stability and reliability of the diffraction-grating (patent pending) capability easily passes the severe specifications required for the precise measurement of WDM communications methods, particularly in the 1.55 µm band.
This analyzer, which is backed by Anritsu's high-level technology, has the dynamic range, reception sensitivity and sweep speed requested by users. Its high sensitivity meets the exacting demands placed on today's measuring instruments. In particular, the excellent wavelength and level specifications fully meet the dense WDM requirements in the 1.55 µm band. In addition to the high reliability and excellent basic performance, this analyzer has a full range of application functions to support accurate measurement in the fastest possible time.

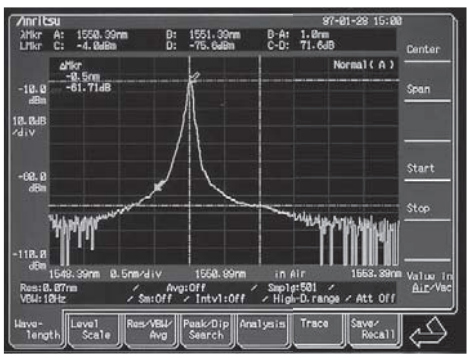
Features
- 70 dB Dynamic Range
- –90 dBm Guaranteed Optical Reception Sensitivity
- Optical Pulse Measurement
- Full Range of WDM Application Functions
- Tracking with Tunable Laser Source

Applications
• 70 dB Dynamic Range
The measurement dynamic range of the MS9780A in the normal measurement mode at a wavelength 1 nm from the-peak wavelength is 62 dB. In the high-dynamic range measurement mode, better than 70 dB can be achieved. The analyzer demonstrates its excellence in SMSR measurement of DFB-LDs, as well as in evaluation of narrow-band optical band pass filters.

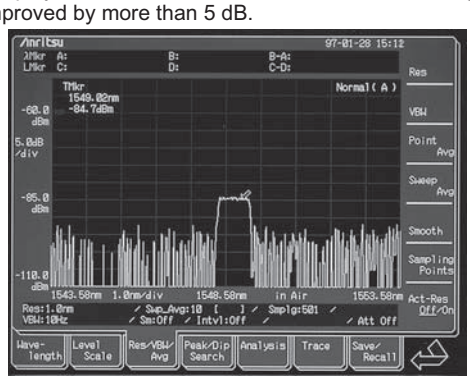
Measurement mode	Dynamic range (at SM fiber)	
	1 nm from peak	0.5 nm from peak
High dynamic range	70 dB	60 dB
Normal	62 dB	58 dB

Wide-dynamic range measurement example with DFB-LD spectrum passed via narrow-band BPF.

DFB-LD — Narrow-band BPF — MS9780A



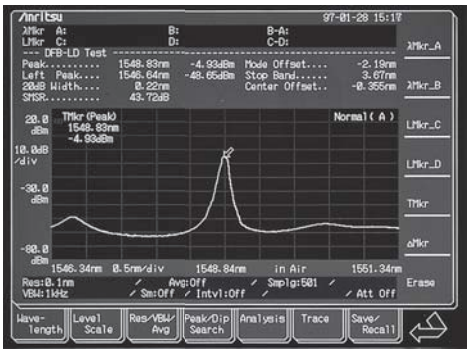
• –90 dBm Guaranteed Optical Reception Sensitivity
The MS9780A has achieved an improved S/N over a wide range by taking thorough countermeasures to noise and stray light. The RMS noise level at wavelengths from 1250 to 1600 nm is –90 dBm max. In addition, the S/N can be improved using sweep averaging. The screen display below shows the waveform after 10 averagings; the S/N is improved by more than 5 dB.



• Full Function Lineup

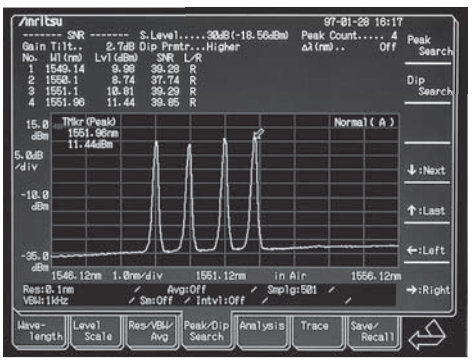
In addition to its excellent basic functions, the MS9780A comes with a full lineup of other useful functions summarized in the following table.

Device analysis	For analyzing and evaluating waveforms of optical elements (DFB-LDs, FP-LDs, LEDs)
Waveform analysis	For waveform analysis by RMS and threshold methods; SMSR, half-width evaluation, WDM waveform analysis
Application measurement	EDFA NF and gain measurement, PMD measurement (See applications.)
Modulation, pulsed light measurement	Max. frequency range (VBW) = 1 MHz (See applications.)
Markers	Multimarkers: Marker function for max. 128 points (See applications.) Zone markers: For waveform analysis in zone specified zone Peak/dip search: Searches for a peak or dip
Power monitor	Also functions as optical power meter
Vacuum wavelength	Converts displayed wavelength to value in display vacuum
External interfaces	GPIB, RS-232C



• Spectrum Analysis for WDM Communication Systems

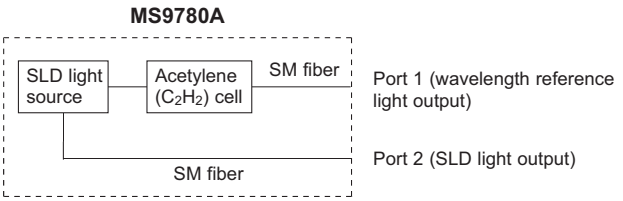
Difficult problems in WDM transmission technology are the wavelength characteristics for the gain, and signal to noise ratio (SNR) between each channel. In evaluation, it is very important to measure this quantitatively. The MS9780A permits extremely quick and simple waveform analysis of up to 128 spectra. The waveform and level (SNR) of each peak exceeding the set threshold is displayed. The screen display below shows an example of the tilt gain.



• Convenient Light Source Option (refer wavelength light) for Better Accuracy

Any one of the wavelength reference & SLD light source (Option 13), SLD light source (Option 14), wavelength reference light source (Option 05), and white light source (Option 02) can be installed in the MS9780A.

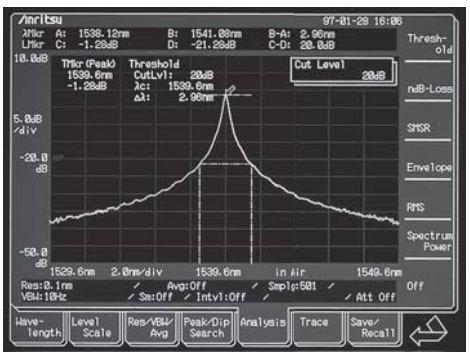
The block diagram of the wavelength reference & SLD light source option is shown below. This option has two separate output ports: Port 1 for wavelength calibration, and Port 2 for measuring transmission characteristics. When the MS9780A is calibrated automatically by inputting the reference light for the wavelength, post-calibration wavelength accuracy in the 1.52 to 1.57 µm-range is better than ±0.05 nm. This is very useful in precision absolute measurement of the wavelengths of light-sources used in WDM systems.



Block diagram of wavelength reference & SLD light

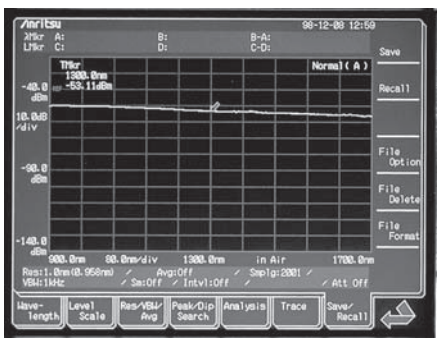
The following diagram shows the spectrum of the SLD light output from Port 2. When this light source is used instead of the earlier white light source for measurement of the wavelength transmission characteristics of optical receiver elements, it is possible to achieve a 20 dB wider dynamic range.

The following figure shows an example of measuring the transmission characteristics of optical band pass filter using the SLD light.



Measurement of optical band pass filter

If this dynamic range is not required, a lower-cost white light source can be installed instead. The following figure shows the spectrum of the white light source. When this light is used, transmission characteristics can be measured in wide range of 900 to 1750 nm.



Spectrum of white light source

Specifications

• MS9780A

Fiber	SM (9.5/125 µm), GI (50/125 µm)*1, GI (62.5/125 µm)*1
Wavelength	Range : 600 to 1750 nm Sweep width: 0, 0.2 to 1200 nm Accuracy: ±0.3 nm (600 to 1750 nm, after wavelength calibration with external light source) ±0.05 nm (1550 ±20 nm, resolution: 0.07 to 0.2 nm, after calibration with wavelength reference light source option)*2 ±0.1 nm (1550 ±20 nm, resolution: 0.5/1.0 nm, after calibration with wavelength reference light source option)*2 Stability: ±5 pm (1 minute)
Resolution	Setting: 0.07*2, 0.1, 0.2, 0.5, 1.0 nm Accuracy*2,*3: ±30% (1300/1550 nm, resolution: 0.1 nm), ±15% (1300/1550 nm, resolution: 0.2 nm), ±7% (1300/1550 nm, resolution: 0.5 nm)
Level	Measurement range (attenuator: off, 0˚ to +30˚C)*4: –65 to +10 dBm (600 to 1000 nm), –85 to +10 dBm (1000 to 1250 nm), –90 to +10 dBm (1250 to 1600 nm), –75 to +10 dBm (1600 to 1700 nm), –55 to +10 dBm (1700 to 1750 nm, +10˚ to +30˚C) Measurement range (attenuator: on, 0˚ to +30˚C): –65 to +20 dBm (1100 to 1650 nm) Accuracy*2: ±0.6 dB (1300/1500 nm, –23 dBm, resolution: ≥0.2 nm) Stability*2: ±0.1 dB (1550 nm, –23 dBm, resolution: ≥0.2 nm, 1 minute) Linearity*2: ±0.1 dB (1550 nm, –50 to 0 dBm) Polarization dependency*2: ±0.15 dB (1300/1500 nm, resolution: ≥0.5 nm) Dynamic range*2 Normal mode: 62 dB (±1 nm), 58 dB (±0.5 nm) ∗1550 nm, resolution: 0.07 nm Wide dynamic range mode: 70 dB (±1 nm), 60 dB (±0.5 nm) ∗1550 nm, resolution: 0.07 nm, 25˚ ±5˚C Return loss*2: 32 dB (1300/1550 nm)
Sweep	Sweep width: 0, 0.2 to 1200 nm Sweep speed (typical*5): 0.5 s (sweep width: 500 nm, normal mode measurement, VBW: 10 kHz)
Display	6.4 inch color TFT-LCD
Memory	A, B (2 trace), 3.5 inch FDD (for Windows®)
Printer	Internal (thermal type)
Interface	GPIB, RS-232C
Main functions	Optical pulse measurement, power monitor, wavelength auto-calibration
Operating conditions	Operating temperature: 0˚ to +50˚C (FDD: +5˚ to +50˚C), Storage temperature: –20˚ to +60˚C Relative humidity: ≤90% (no condensation)
Power	85 to 132 Vac/170 to 250 Vac, 47.5 to 63 Hz, 150 VA (max.)
Dimensions and mass	320 (W) x 177 (H) x 350 (D) mm, ≤16.5 kg
EMC	EN61326-1 EN61000-3-2
LVD	EN61010-1

∗1: The NA of GI fiber is 0.2 for a core diameter of 50/125 µm and 0.275 for 62.5/125 µm. However, the permissible NA is 0.1 due to the spectroscope limitations.
∗2: Connects to SM fiber (10/125 µm)
∗3: Effective resolution value
∗4: VBW: 10 Hz, sweep average: 10 times
∗5: Typical value for reference; not guaranteed specification

• White Light Source (Option 02)

Optical output	≥–59 dBm/1 nm (typical value: –55 dBm/1 nm)
Wavelength range	900 to 1600 nm
Operating temperature	+18˚ to +28˚C

• Wavelength Reference Light Source (Option 05)

Wavelength reference	1.53 µm band Acetylene

• Wavelength Reference & SLD Light Source (Option 13)

Wavelength range	1450 to 1650 nm
Output level	>–40 dBm/nm (1550 nm ±10 nm) >–60 dBm/nm (1450 to 1650 nm)
Output level stability*1	±0.04 dB (MS9710B setting resolution: 1 nm, no polarization change, constant temperature, measured for 20 min at 1550 nm)
Spectrum half width	>70 nm (typical: 90 nm)
Optical connector	User replaceable type (FC, SC, ST, DIN, HMS-10/A)
Operating temperature	0˚ to +40˚C
Wavelength reference	1530 nm band Acetylene

∗1: Measured after one hour warm-up

• SLD Light Source (Option 14)

Wavelength range	1450 to 1650 nm
Output level	>–40 dBm/nm (1550 nm ±10 nm) >–60 dBm/nm (1450 to 1650 nm)
Output level stability*1	±0.04 dB (MS9710B setting resolution: 1 nm, no polarization change, constant temperature, measured for 20 min at 1550 nm)
Spectrum half width	>70 nm (typical: 90 nm)
Optical connector	User replaceable type (FC, SC, ST, DIN, HMS-10/A)
Operating temperature	0˚ to +40˚C

∗1: Measured after one hour warm-up

• VBW, Sweep Speed, Minimum Light Reception Sensitivity*1

VBW	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
Sweep speed (typ.)	30 s	5 s	0.5 s	0.5 s	0.5 s	0.5 s
Minimum light reception sensitivity*2	–90 dBm	–80 dBm	–70 dBm	–60 dBm	–50 dBm	–40 dBm

∗1: Data for reference; not guaranteed specifications
∗2: RMS noise level (1.25 to 1.6 µm)

Note: Warm-up to the MS9780A for about 5 minutes to ensure stable operation. The above specifications were obtained 2 hours after power-on.

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	
MS9780A	Optical Spectrum Analyzer	
	Standard accessories	
	Optical Connector Adapter*1:	1 pc
	Power Cord, 2.5 m:	1 pc
F0012	Fuse, 3.15 A (for 100 Vac system):	2 pcs
Z0312	Printer Paper:	2 rolls
W1477AE	MS9780A Operation Manual:	1 copy
W1478AE	Remote Control Operation Manual:	1 copy
MX978001S	LabVIEW® Driver (RS-232C):	1 pc
MX978001G	LabVIEW® Driver (GPIB):	1 pc
B0239G	Front Cover:	1 pc
	Options	
MS9780A-02	White Light Source*2	
MS9780A-05	Wavelength Reference Light Source*2	
MS9780A-06	Monitor Output (VGA output)*3	
MS9780A-13	Wavelength Reference & SLD Light Source*2	
MS9780A-14	SLD Light Source*2	
MS9780A-27	E2000 Cconnector*3	
MS9780A-37	FC Connector*4	
MS9780A-38	ST Connector*4	
MS9780A-39	DIN Connector*4	
MS9780A-40	SC Connector*4	
MS9780A-43	HMS-10/A Connector*4	
	Application parts	
J0654A	RS-232C Cable (9P-9P)	
J0655A	RS-232C Cable (9P-25P)	
J0007	GPIB Cable, 1 m	
J0617B	Replaceable Optical Connector (FC)	
J0618D	Replaceable Optical Connector (ST)	
J0618E	Replaceable Optical Connector (DIN)	
J0618F	Replaceable Optical Connector (HMS-10/A)	
J0619B	Replaceable Optical Connector (SC)	
J0893B	FC · PC-FC · PC-2M-GI (50/125 µm)	
J0894B	FC · PC-FC · PC-2M-GI (62.5/125 µm)	
J0203	Optical Fiber Cord with Lens Attached to End (50 µm core diameter), 2 m	
J0204	Optical Fiber Cord with Lens Attached to End (200 µm core diameter), 2 m	
Z0282	Ferrule Cleaner (Cletop A type, 1 pc)	
Z0283	Tape for Ferrule Cleaner (6 pcs/set)	
Z0284	Cleaner for Optical Adapter (stick-type, 200 pcs/set)	
B0330C	Tilt Stand	

∗1: Specify the connector to be supplied as the standard connector when ordering the above options. If the connector is not specified, the FC connector (MS9780A-37) is supplied as standard.
∗2: Factory options; Two units cannot be installed simultaneously. Exchangeable-type optical connectors (FC, SC, ST, DIN, HMS-10/A) are supplied when specified at ordering. One conversion cord is supplied for connecting other optical connectors to the FC connector.
∗3: Factory option
∗4: User replaceable

Note:
Windows® is a registered trademark of Microsoft Corporation in the USA and other countries.
LabVIEW is a registered trademark of National Instruments.

VISUAL FAULT LOCATOR
VFL650

Compact and Cost-Effective Design

Now you can easily isolate high losses and faults in optical fiber cable with the VFL-650 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 to 3 Hz)
Range	>5 km
Power	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

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 and 1.25 mm connectors
VFL-650-ADPT = VFL 2.5 to 1.25 mm adapter (only)

HANDHELD FIBER INSPECTION MICROSCOPES
FS Series

Ideal for Field Use

The inspection of fiber optic connectors is now faster and easier using the FS Series handheld fiber inspection microscopes. The microscope allows the user to visually inspect connectors for cleanliness and damage. It’s a quick, dependable and safe way to ensure all your fiber optic connectors meet performance standards. All microscopes include internal laser safety filters to protect the user from possible eye damage. The FS Series microscopes have multiple applications and are ideal for installation, system qualification or maintenance in all environments, from multimode LAN’s and premise installations to single-mode telephony and CATV networks.

Features and Benefits
- 200x or 400x optics for either multimode or single-mode fiber
- Laser safety filters provide eye protection
- Universal connector adapter that fits 2.5 mm ferrules
- Fast and detailed inspection of a single-mode or multimode fiber connectors
- Ideal for a variety of applications including field, central office or laboratory environments

Specifications

Magnification	200x or 400x
LED rated life	100,000 hours
Safety filter	Built-in
Connector	2.5 mm Universal
Controls	Momentary on/off switch and focus
Power source	3 AAA alkaline batteries
Weight	0.5 kg (1.2 lbs.)
Dimensions (H x W x D)	22.2 x 3.2 x 3.2 cm (8.75 x 1.25 x 1.25 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.

The FS Series is a high quality inspection microscopes and can be ordered in 3 different model types.

• Model Number:

FS-200	Fiber Microscope with 200x optics
FS-200C	Fiber Microscope with 200x optics with coaxial illumination
FS-400C	Fiber Microscope with 400x optics with coaxial illumination

PATCH PANEL FIBER MICROSCOPES
FS-PP

CE

Portable Video Microscope

The FS-PP patch panel microscope kit is a portable, video microscope used to inspect fiber optic terminations. More specifically, the FS-PP is used to inspect installed connectors that are located inside hardware devices (routers, transceivers, etc.) or on the “back-side” of patch panels.

Features

- Single device multiple inspection applications
- Connectors - SC, FC, ST, 1.25 and 2.5 mm Universal
- Multiple test tips provide access to virtually any connector
- 530 micron field-of-view provides a wide area of inspection
- NiMH rechargeable battery
- Automatic shutoff

Specifications

Magnification	400x and 250x
Camera Type	1/3” CCD
Light Source	Red LED, internal to probe
Connectors	SC, FC, ST, 1.25 and 2.5 mm Universal
Lighting Technique	Coaxial
Focus Control	Adjustable, in-probe
Weight	.5 kg (1 lbs)
Power	Rechargeable, NiMH battery (9.6 V 1,650 mA-h) or AC power adapter (110 V and 220 V AC)
Battery life	3 hours continuous use

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.

FS-PP-KIT-??	Patch Panel Inspection Scope Kit with 200X Probe
FS-P5-KIT-??	Patch Panel Inspection Scope Kit with 200X/400X Probe
	Charger Option (??) = US, EU, UK,

Includes LCD handheld display, FSPP Probe, Operators Manual, Hard Transit Case, ST/FC/SC/1.25 mm and 2.5 mm universal Tip and choice of AC Adapter

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	9/125 µm
Multimode	62.5/125 or 50/125 µm
Pigtail length	1 m
Insertion loss (Typical)	<0.6 dB
Number of insertions	2000 min.
Back reflectance	<–50 dB

General Specifications

Operating temperature	–10˚ to +50˚C (14˚ to 122˚F)
Storage temperature	–40˚ to +60˚C (–40˚ to 140˚F)
Connector types	FC, ST, SC, D4, E2000, LC, DIN
Weight (with cable)	90 grams (3.2 oz)
Unit size (D x W x H)	35 x 35 x 32 mm (with suction cup) (1.375 x 1.375 x 1.25 inches)
Case size (D x W x H)	20 x 24 x 8 cm (8 x 9.5 x 3.5 inches)

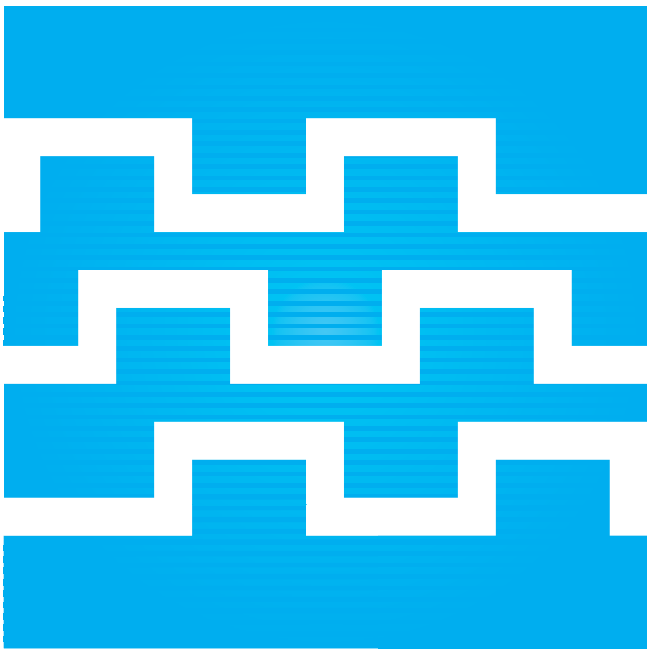
Package Includes

- FiberConnect
- Maintenance kit
- Magnetic stand
- Manual
- Cleaning brush
- Carrying case
- Index matching oil
- Spare pigtail
- 90 Day limited warranty

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 9/125 µm
X = 2 = Multimode 62.5/125 µm
X = 3 = Multimode 50/125 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)



PULSE PATTERN GENERATORS/ ERROR DETECTORS

Selection Guide

Model / Application	MP1800A Signal Quality Analyzer	MT1810A 4-Slot Chassis	MP1803A 43.5 Gbit/s MUX	MP1804A 43.5 Gbit/s DEMUX	MP1026B Eye Pattern Analyzer	Bit Rate (Gbit/s)
10 Gbit/s Optical Module, Device Test	√	√			√	9.8 to 12.5
GbE, SONET/SDH Optical Module, Device Test	√	√			√	0.1 to 12.5
10GE-PON Upstream Test	√					0.1 to 12.5
20 Gbit/s High Speed Interconnect Test	√					8 to 25
40 Gbit/s DQPSK Optical Module Test	√					8 to 25
100 GbE Module Test	√					8 to 28
40 Gbit/s Optical Module Test	√		√	√		25 to 43.5
Eye Pattern Analysis and Mask Compliance Testing					√	0.1 to 12.5

MP1800A/MT1810A Selection Guide

Category	Model Name/Function	10 Gbit/s Optical Module	10 Gbit/s EA, EML Module	PON OLT Upstream	4ch PPG (w/o Clock)	4ch ED	Electrical Device
Main Frame	MP1800A Signal Quality Analyzer			√	√		√
	MP1800A-014 Max. of 2 PPG and/or ED						√
	MP1800A-015 Max. of 4 PPG and/or ED			√	√		
	MP1800A-016 Max. of 6 PPG and/or ED						
	MT1810A 4 Slot Chassis	√	√			√	
	MT1810A-014 Max. of 2 PPG and/or ED		√				
	MT1810A-015 Max. of 4 PPG and/or ED	√				√	
Clock Generator	MU181000A 12.5 GHz Synthesizer						√
	MU181000B 12.5 GHz 4 Port Synthesizer			√			
	MU181000A/B-001 Jitter Modulation						√
	MU181800A 12.5 GHz Clock Distributor				√		
Pulse Pattern Generator (PPG)	MU181020A 12.5 Gbit/s PPG	√ × 2	√	√ × 3	√ × 4		√
	MU181020A-001 9.8 to 12.5 Gbit/s Built-in Clock	√ × 2	√				
	MU181020A-002 0.1 to 12.5 Gbit/s MU181000A or external clock source is required			√ × 3	√ × 4		√
	MU181020A-021/121 Differential Clock Output						
	MU181020A-030/130 Variable Data Phase Shift Parallel Syncing			√ × 3	√ × 4		
	MU181020A-010/110 Data Output 0.05 to 0.8 Vp-p	√ × 2		√ × 3	√ × 4		
	MU181020A-011/111 Data Output 0.25 to 2.5 Vp-p						
	MU181020A-012/112 Data Output 0.05 to 2.0 Vp-p						√
	MU181020A-013/113 Data Output 0.5 to 3.5 Vp-p		√				
Error Detector (ED)	MU181040A 12.5 Gbit/s ED	√	√	√		√ × 4	√
	MU181040A-001 9.8 to 12.5 Gbit/s Clock Recovery included	√	√				
	MU181040A-002 0.1 to 12.5 Gbit/s			√		√ × 4	√
	MU181040A-020/120 Clock Recovery						√
	MU181040A-030/130 Variable Clock Delay			√		√ × 4	√
Optical Interface	MU181600A Optical Transceiver (XFP)	√					
	MU181601A Optical Transceiver (SFP)						

SIGNAL QUALITY ANALYZER

MP1800A Series

CE

Small and Flexible Cost-efficient BER Test Solution

Excellent Eco Product

MP1800A

MT1810A

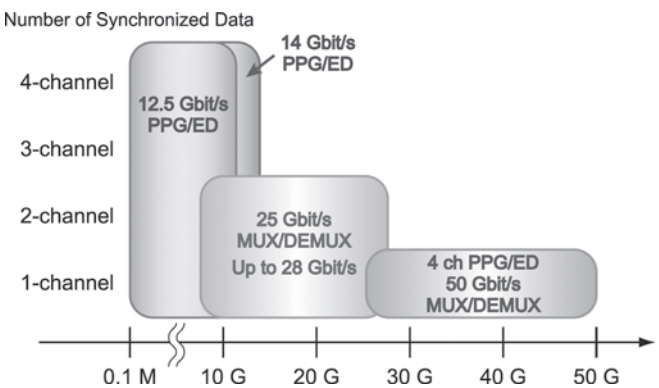
For detail and specification, refer to the data sheet.

MP1800A and MT1810A, Signal Quality Analyzer (SQA) series, are versatile Bit Error Rate Test Systems (BERTS) for serial and parallel test applications up to 28 Gbit/s. Optimized for both cost and functionality, SQA series offer a variety of high quality output waveform options, as well as several input varieties while maintaining a low entry price point.
SQA series offer suitable BERTS solution for XFP, SFP, PON modules up to 12.5 Gbit/s, High speed optical modules and Devices up to 28 Gbit/s, and devices for 43.5G and beyond in combination with MP1803A/04A/11A/12A, MUX and DEMUX.

Features

Wide Bandwidth 0.1 to 28 Gbit/s

- Supports 0.1 to 28 Gbit/s frequency band thru PPG/ED and MUX/DEMUX module selection
  - 8 to 28 Gbit/s:
    MU182020A/21A, MU182040A/41A
  - 0.1 to 14 Gbit/s:
    MU181020B, MU181040B
  - 0.1 to 12.5 Gbit/s:
    MU181020A, MU181040A (Option-002)
  - 9.8 to 12.5 Gbit/s:
    MU181020A, MU181040A (Option-001)



Excellent Cost-Effective 10 Gbit/s Configuration

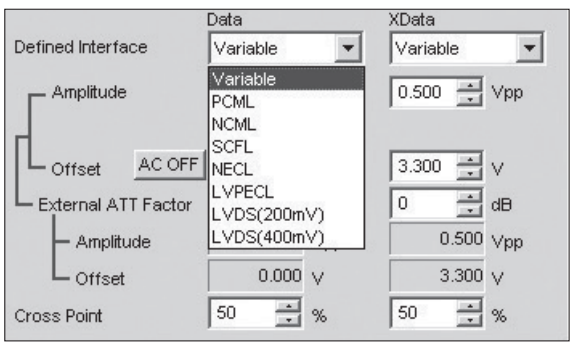
- The 12.5 Gbit/s PPG/ED module (Option-001) operates over a wide band of 10 Gbit/s from 9.8 to 12.5 Gbit/s for configuring a cost-effective measurement system.
  - MU181020A 12.5 Gbit/s PPG (Option-001)
    No synthesizer is required due to the built-in clock source and the following operating frequencies are also supported by the clock-division function.
    - 9.8 to 12.5 Gbit/s
    - 4.9 to 6.25 Gbit/s
    - 2.45 to 3.125 Gbit/s
    - 1.225 to 1.5625 Gbit/s
  - MU181040A 12.5 Gbit/s ED (Option-001)
    No external clock input is required due to the built-in clock recovery function.

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 to 3.5 Vp-p (MU181020A/B-013)
  High Amplitude: 0.5 to 3.5 Vp-p (MU182020A/21A-013)

Pull-down Menu for Selecting Installed Interfaces

- The required output level is easily set as shown below using the pull-down menus.



Jitter Addition

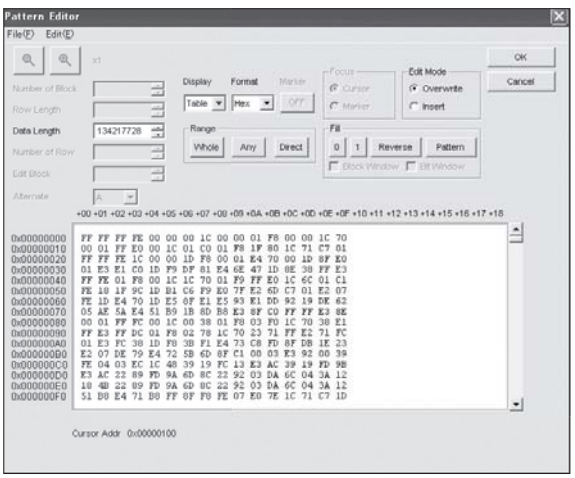
- The MU181000A/B Jitter Modulation Function (Option-001) offers a built-in function for adding sinusoidal jitter up to 80 MHz. Moreover, connecting an external modulation source to the input connector supports impression of any modulation factor.
  Internal sinusoidal jitter: 80 MHz max.

Differential Electrical Interfaces

- Both differential and single-ended interfaces are standard, and the 100 Ω differential interface required to receive LVDS signals is supported.

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 0s and All 1s 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. (1-bit resolution)
- 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)

Signal Quality Analysis

- Bit error rates can be classified according to the following conditions and BER can be analyzed by separation into Transition Error due to degraded Data Tr/Tf and Non-Transition Error due to baseline noise.
  - Insertion/Omission Errors:
    Insertion Error: Error where 1 written at bit that should be 0
    Omission Error: Error where 0 written at bit that should be 1
  - Transition/Non-Transition Errors:
    Transition Error: Error at 0→1 or 1→0 bit transition
    Non-Transition Error: Error at contiguous 0s or 1s bits
- Waveform quality can be analyzed quantitatively using versatile analysis functions.
  - Eye Margin
  - Eye Diagram
  - Q Measurement
  - Bathtub Measurement
  - ISI Analysis
  - Capture Function (128 Mbits)

Wideband Clock Recovery

- The MU181040A/B-020 options supports wideband clock recovery for use with the following.
  OC3/STM1, OC12/STM4, 1GFC, GbE,
  SATA1.5 Gb/s, 2GFC, OC48/STM16, PCI Express I, OTU1,
  SATA 3 Gb/s, XAUI, 4GFC, PCI Express II,
  SATA 6 Gb/s, OC192/STM64, 10GbE, 10GFC, G975FEC,
  OTU2, 10GbE w/FEC, 10GFC w/FEC
- The MU181040A-001 supports the standard 9.8 to 12.5 GHz clock recovery function.

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

Phase Shift Function

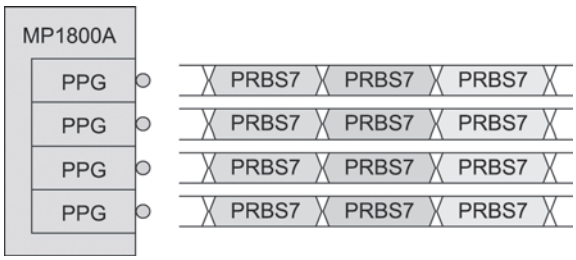
- The PPG/ED, MUX/DEMUX module phase shift function offers phase shifting over a wide range at all frequency bands. Additionally, the optimum phase value can be set using the high-resolution phase shift function.
  - PPG Data Phase Shift Function:
    Independent Mode
    MU181020A/B-030: ±1UI (1 mUI resolution)
    CH Synchronization or Combination Mode
    MU181020A/B-030: ±64UI (1 mUI resolution)
  - ED Clock Phase Shift Function:
    MU181040A/B-030: ±1UI (1 mUI resolution)
  - MUX Data Phase Shift Function:
    Independent Mode
    MU182020A/21A-030: ±2UI (2 mUI resolution)
    MU182020A/21A-031: ±2UI (2 mUI resolution)
    CH Synchronization or Combination Mode
    MU182020A/21A-030: ±64UI (2 mUI resolution)
    MU182020A/21A-031: ±64UI (2 mUI resolution)
  - DEMUX Clock Phase Shift Function:
    MU182040A/41A-030: ±2UI (2 mUI resolution)
    MU182040A/41A-031: ±2UI (2 mUI resolution)

Optical Interface

- Supports Two Optical Interface Types
  - MU181600A/01A
    Supported wavelengths and bit rates for SFP and XFP modules can 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 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.



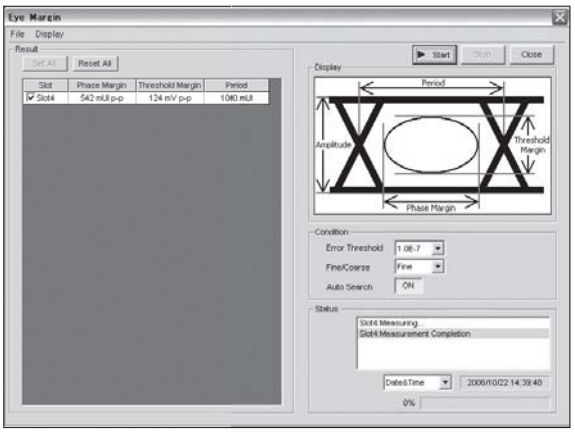
MP1800A Pattern Timing when Sending PRBS7 on All Channels (Pattern Sync)

Remote Control

- Control over GPIB, and Ethernet
- High backwards portability with MP1763, and MP1764 remote commands

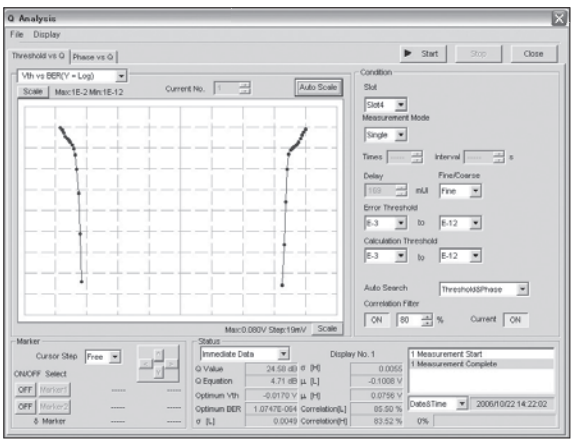
Eye Margin

For confirming DATA threshold and phase margins.



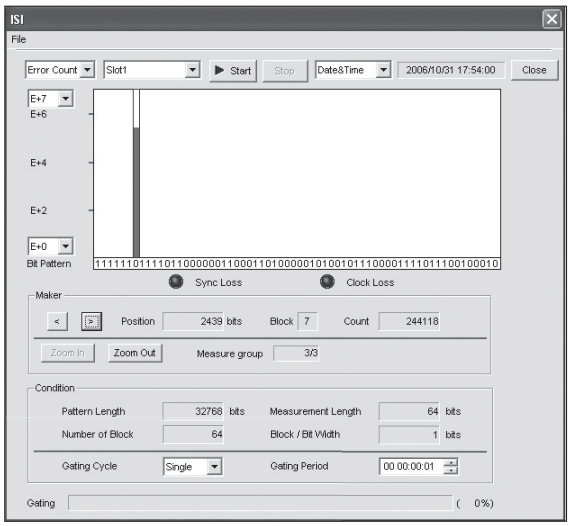
Q Measurement

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



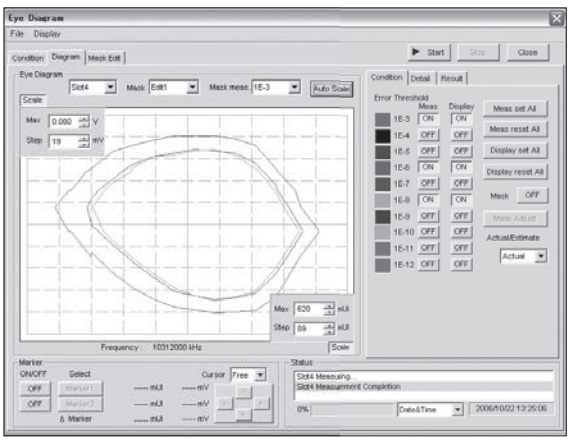
Bit Error Analysis using ISI

Used to confirm bit error rate in each specified block or bit position and for bit error rate correlation with inter-symbol interference.



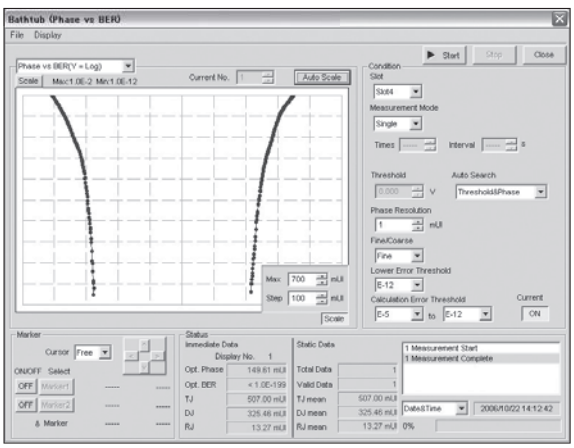
Eye Diagram

Used to obtain bit error rate contours linking specified bit error rate points.



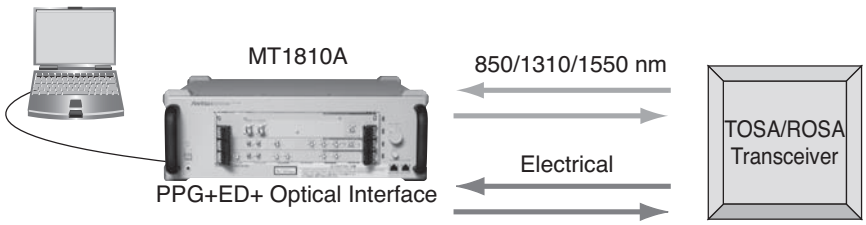
Bathtub

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



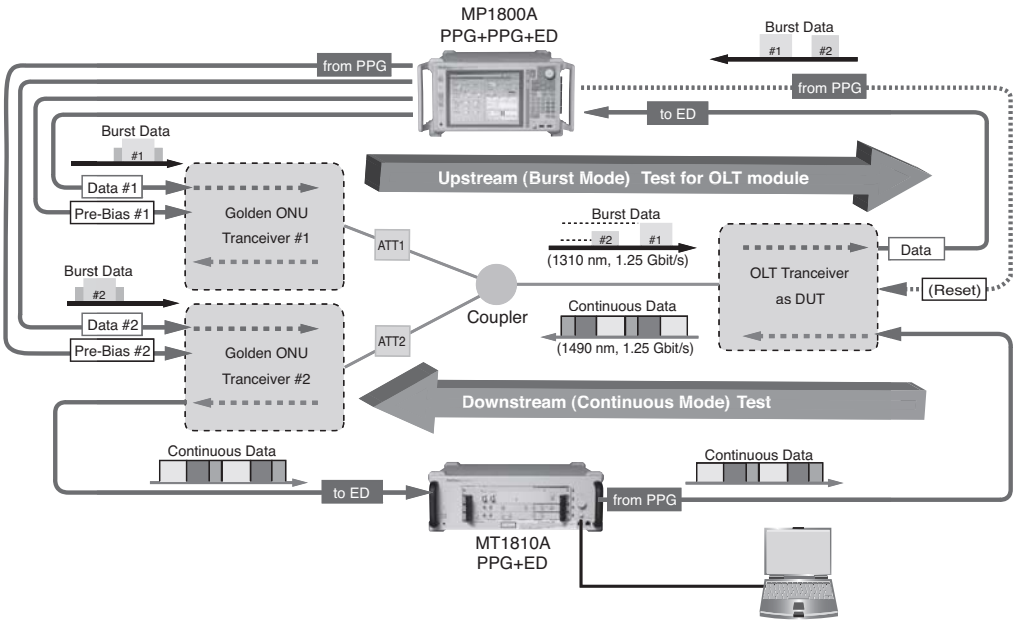
Applications

Application 1: Manufacturing Inspection of 10 Gbit/s Devices



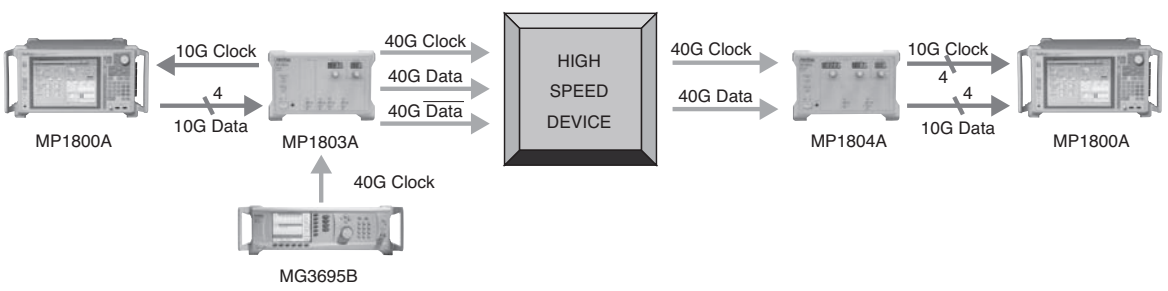
• A measurement system can be configured with no external clock source using the PPG 9.8 to 12.5 Gbit/s option. (MU181020A-001)
• Various wavelengths and bit rates can be defined by changing optical modules in the optical transceiver slot.

Application 2: 10 Gbit/s PON OLT Module Inspection



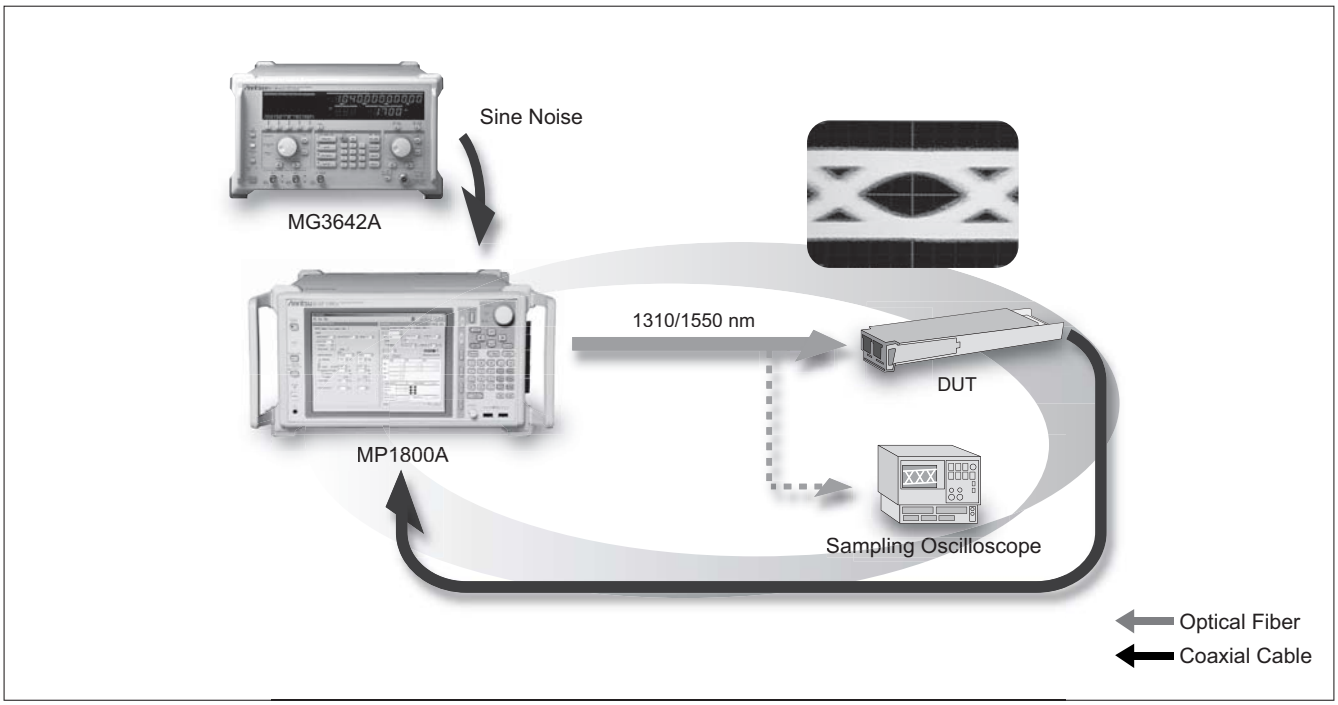
• Each PPG slot can output pre-bias and reset signals for the PON BER test. (Level: H: 0 V; L: –1 V)
• The PON OLT Upstream test can be performed at up to 12.5 Gbit/s using one MP1800A.

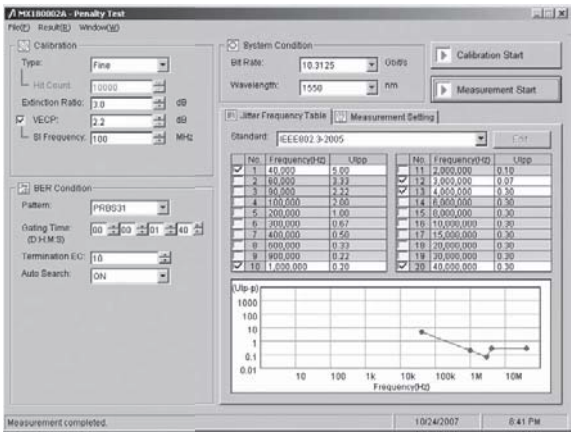
Application 3: Evaluation of 40 Gbit/s High-speed Devices



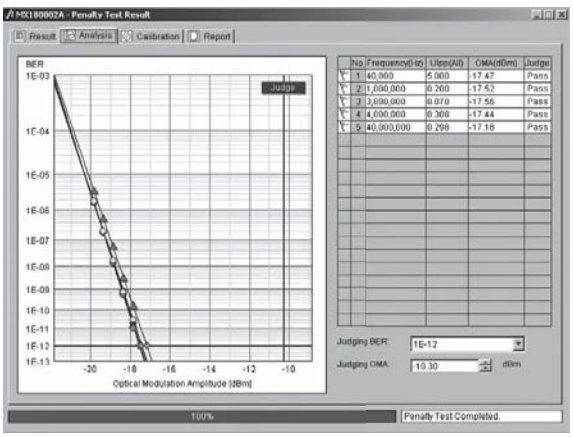
• A 4-channel PPG and 4-channel ED are used in combination with the Anritsu MUX/DEMUX to function as a 40 Gbit/s (up to 50 Gbit/s) BERTS.

Application 4: Stressed Receiver Conformance Test



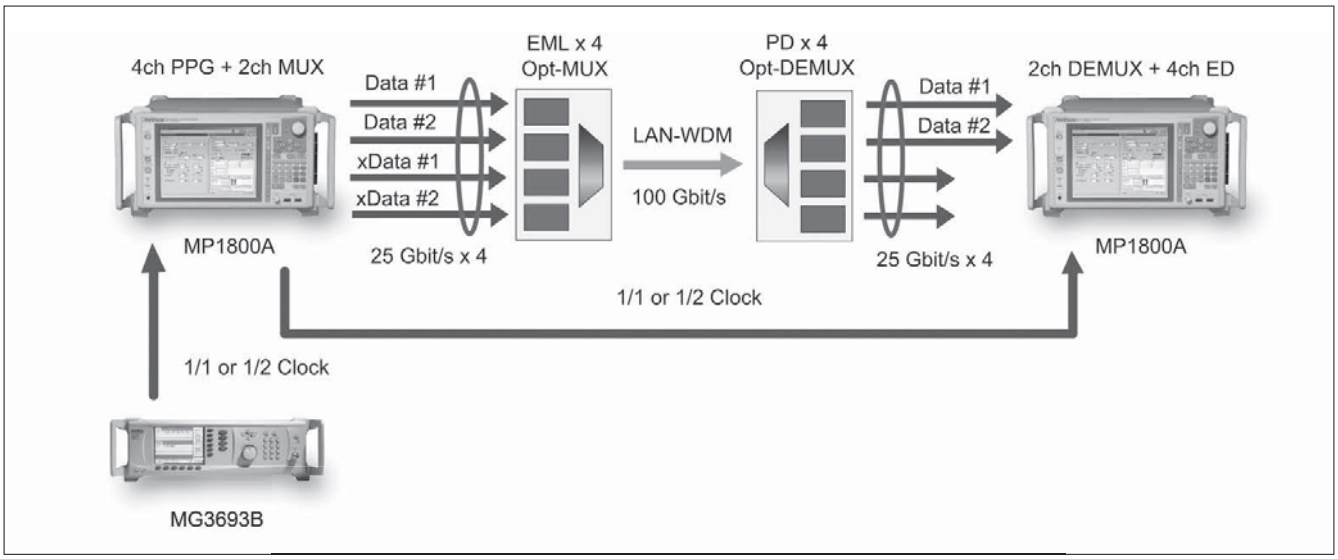


Power Penalty Settings Screen

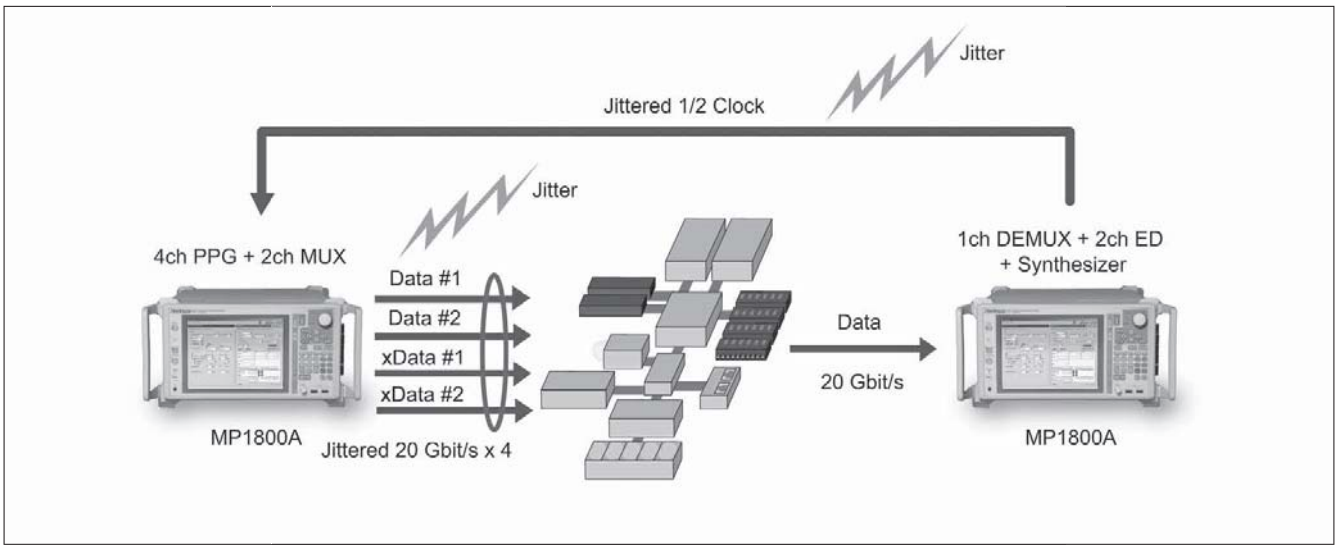


Power Penalty Results Screen (OMA vs.BER)

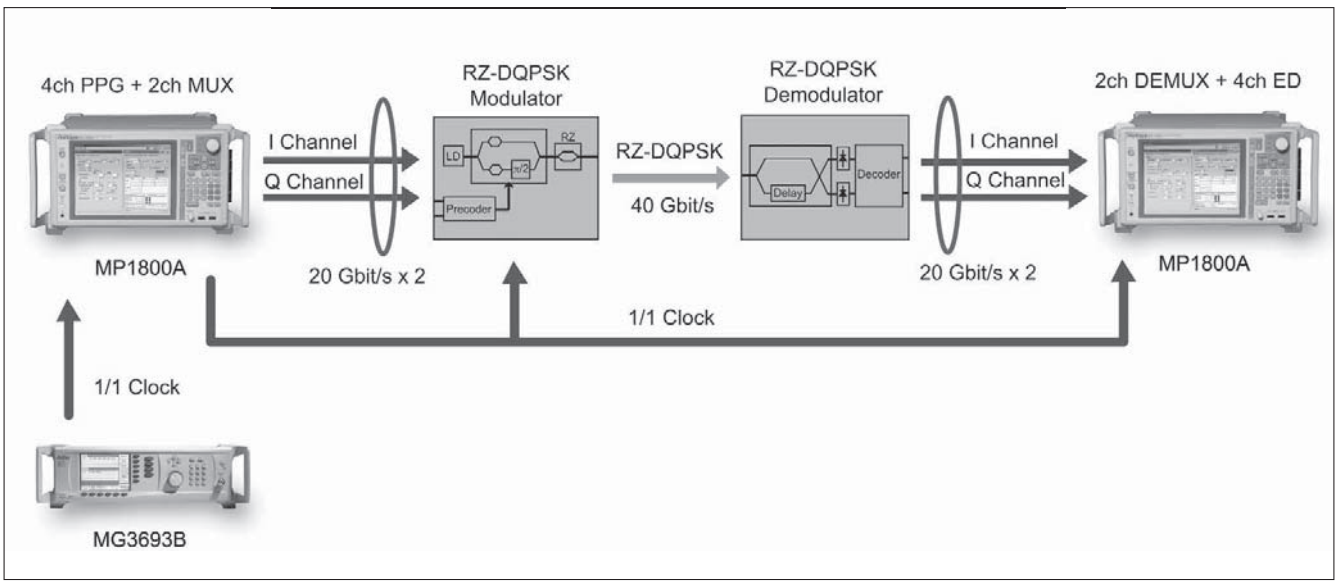
Application 5: 100 GbE EML/Optical Device Evaluation



Application 6: 20G Band Ultrafast Interconnect Evaluation



Application 7: 40G Band DQPSK Optical Module/Device 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

Model/Order No.	Name	
	Main Frame	
MP1800A	Signal Quality Analyzer	
	Standard Accessories	
J0491	Power Cable (13A):	1 pc
Z0306A	Wrist Strap:	1 pc
Z0541A	USB Mouse:	1 pc
B0329G	Front Cover for 3/4MW 4U:	1 pc
B0574A	MP1800A Side Protection Cover:	1 pc
MX180000A	Signal Quality Analyzer Control Software:	1 pc
Z0897A	MP1800A Operation Manual CD-ROM:	1 pc
—	Windows® CD-ROM:	1 pc
	Options	
MP1800A-001*1	GPIB	
MP1800A-101*2	GPIB	
MP1800A-002*1	LAN	
MP1800A-102*2	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	
	Optional Accessories	
J0008	GPIB Cable 2 m	
Z0917A	LAN Cable (CAT5, Straight), 5 m	
Z0922A	USB Keyboard	
B0588A	Rack Mount Kit	
B0576A	Blank Panel	
B0566A	Carrying Case	
W2745AE	MP1800A Operation Manual	
W2747AE	MP1800A Installation Guide	
W2749AE	MX180000A Operation Manual	
W2799AE	MP1800A Remote Control Operation Manual	
	Calibration Service	
MP1800A-190	25G Calibration of PPG and MUX	
	Maintenance Service	
MP1800A-ES310	Extended Three Year Warranty Service	
MP1800A-ES510	Extended Five Year Warranty Service	

• MT1810A

Model/Order No.	Name	
	Main Frame	
MT1810A	4-Slot Chassis	
	Standard Accessories	
J0491	Power Cable (13A):	1 pc
Z0306A	Wrist Strap:	1 pc
J1109B	LAN Cable (CAT5, Straight), 5 m:	1 pc
B0575A	MT1810A Front Protection Cover:	1 pc
Z0897A	MP1800A Operation Manual CD-ROM:	1 pc
MX180000A	Signal Quality Analyzer Control Software:	1 pc
	Options	
MT1810A-014	2-Slot for PPG and/or ED	
MT1810A-015	4-Slot for PPG and/or ED	
	Optional Accessories	
B0587A	Rack Mount Kit	
B0576A	Blank Panel	
B0591A	Carrying Case	
W2746AE	MT1810A Operation Manual	
W2748AE	MT1810A Installation Guide	
W2749AE	MX180000A Operation Manual	
W2799AE	MP1800A Remote Control Operation Manual	
	Calibration Service	
MT1810A-190	25G Calibration of PPG and MUX	
	Maintenance Service	
MT1810A-ES310	Extended Three Year Warranty Service	
MT1810A-ES510	Extended Five Year Warranty Service	

• MU181000A

Model/Order No.	Name	
	Unit/Module	
MU181000A	12.5 GHz Synthesizer	
	Standard Accessories	
J1349A	Coaxial Cable 0.3 m:	1 pc
	Options	
MU181000A-001*1	Jitter Modulation	
MU181000A-101*2	Jitter Modulation	
	Optional Accessories	
J1137	50 Ω Terminator	
J0127B	BNC Cable	
W2750AE	MU181000A/B Operation Manual	
	Maintenance Service	
MU181000A-ES310	Extended Three Year Warranty Service	
MU181000A-ES510	Extended Five Year Warranty Service	

• MU181000B

Model/Order No.	Name	
	Unit/Module	
MU181000B	12.5 GHz 4port Synthesizer	
	Standard Accessories	
J1349A	Coaxial Cable 0.3 m:	4 pcs
	Options	
MU181000B-001*1	Jitter Modulation	
MU181000B-101*2	Jitter Modulation	
	Optional Accessories	
J1137	50 Ω Terminator	
J0127B	BNC Cable	
W2750AE	MU181000A/B Operation Manual	
	Maintenance Service	
MU181000B-ES310	Extended Three Year Warranty Service	
MU181000B-ES510	Extended Five Year Warranty Service	

• MU181800A

Model/Order No.	Name
	Unit/Module
MU181800A	12.5 GHz Clock Distributor
	Optional Accessories
J1137	50 Ω Terminator
J1349A	Coaxial Cable 0.3 m
J1343A	Coaxial Cable 1.0 m
W2751AE	MU181800A/B Operation Manual
	Maintenance Service
MU181800A-ES310	Extended Three Year Warranty Service
MU181800A-ES510	Extended Five Year Warranty Service

• MU181800B

Model/Order No.	Name
	Unit/Module
MU181800B	14 GHz Clock Distributor
	Optional Accessories
J1137	50 Ω Terminator
J1349A	Coaxial Cable 0.3 m
J1343A	Coaxial Cable 1.0 m
W2751AE	MU181800A/B Operation Manual
	Maintenance Service
MU181800B-ES310	Extended Three Year Warranty Service
MU181800B-ES510	Extended Five Year Warranty Service

• MU181020A

Model/Order No.	Name	
	Unit/Module	
MU181020A	12.5 Gbit/s PPG	
	Standard Accessories	
J1137	50 Ω Terminator:	3 pcs
J1341A	SMA Cover Connector:	1 pc
	Options	
MU181020A-001	9.8 to 12.5 Gbit/s	
MU181020A-002	0.1 to 12.5 Gbit/s	
MU181020A-010*1	Variable Data Output (0.05 to 0.8 Vp-p)	
MU181020A-110*2	Variable Data Output (0.05 to 0.8 Vp-p)	
MU181020A-011*1	Variable Data Output (0.25 to 2.5 Vp-p)	
MU181020A-111*2	Variable Data Output (0.25 to 2.5 Vp-p)	
MU181020A-012*1	High Performance Data Output (0.05 to 2.0 Vp-p)	
MU181020A-112*2	High Performance Data Output (0.05 to 2.0 Vp-p)	
MU181020A-013*1	Variable Data Output (0.5 to 3.5 Vp-p)	
MU181020A-113*2	Variable Data Output (0.5 to 3.5 Vp-p)	
MU181020A-021*1	Differential Clock Output (0.1 to 2.0 Vp-p)	
MU181020A-121*2	Differential Clock Output (0.1 to 2.0 Vp-p)	
MU181020A-030*1	Variable Data Delay	
MU181020A-130*2	Variable Data Delay	
	Standard Accessories for Option-011/111	
J1359A	K(m)-K(f) Adapter:	2 pcs
	Standard Accessories for Option-012/112	
J1359A	K(m)-K(f) Adapter:	2 pcs
	Standard Accessories for Option-013/113	
J1359A	K(m)-K(f) Adapter:	2 pcs
	Standard Accessories for Option-021/121	
J1359A	K(m)-K(f) Adapter:	2 pcs
J1137	50 Ω Terminator:	1 pc
	Optional Accessories	
J1359A	K(m)-K(f) Adapter	
J1137	50 Ω Terminator	
J1342A	Coaxial Cable 0.8 m	
J1343A	Coaxial Cable 1.0 m	
J1360A	Measurement Kit	
W2752AE	MU181020A/B Operation Manual	
	Maintenance Service	
MU181020A-ES310	Extended Three Year Warranty Service	
MU181020A-ES510	Extended Five Year Warranty Service	

• MU181020B

Model/Order No.	Name
	Unit/Module
MU181020B	14 Gbit/s PPG
	Standard Accessories
J1137	50 Ω Terminator: 3 pcs
J1341A	SMA Cover Connector: 1 pc
	Options
MU181020B-002	0.1 to 14 Gbit/s
MU181020B-011*1	Variable Data Output (0.25 to 2.5 Vp-p)
MU181020B-111*2	Variable Data Output (0.25 to 2.5 Vp-p)
MU181020B-012*1	High Performance Data Output (0.05 to 2.0 Vp-p)
MU181020B-112*2	High Performance Data Output (0.05 to 2.0 Vp-p)
MU181020B-013*1	Variable Data Output (0.5 to 3.5 Vp-p)
MU181020B-113*2	Variable Data Output (0.5 to 3.5 Vp-p)
MU181020B-021*1	Differential Clock Output (0.1 to 2.0 Vp-p)
MU181020B-121*2	Differential Clock Output (0.1 to 2.0 Vp-p)
MU181020B-030*1	Variable Data Delay
MU181020B-130*2	Variable Data Delay
	Standard Accessories for Option-011/111
J1359A	K(m)-K(f) Adapter: 2 pcs
	Standard Accessories for Option-012/112
J1359A	K(m)-K(f) Adapter: 2 pcs
	Standard Accessories for Option-013/113
J1359A	K(m)-K(f) Adapter: 2 pcs
	Standard Accessories for Option-021/121
J1359A	K(m)-K(f) Adapter: 2 pcs
J1137	50 Ω Terminator: 1 pc
	Optional Accessories
J1359A	K(m)-K(f) Adapter
J1137	50 Ω Terminator
J1342A	Coaxial Cable 0.8 m
J1343A	Coaxial Cable 1.0 m
J1360A	Measurement Kit
W2752AE	MU181020A/B Operation Manual
	Maintenance Service
MU181020B-ES310	Extended Three Year Warranty Service
MU181020B-ES510	Extended Five Year Warranty Service

• MU181040A

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*1	Clock Recovery
MU181040A-120*2	Clock Recovery
MU181040A-030*1	Variable Clock Delay
MU181040A-130*2	Variable Clock Delay
	Standard Accessories for Option-001
J1341A	SMA Cover Connector: 2 pcs
	Standard Accessories for Option-002
J1341A	SMA Cover Connector: 3 pcs
J1359A	K(m)-K(f) Adapter: 2 pcs
J1137	50 Ω Terminator: 2 pcs
	Standard Accessories for Option-020/120
J1137	50 Ω Terminator: 1 pc
	Optional Accessories
J1359A	K(m)-K(f) Adapter
J1137	50 Ω Terminator
J1342A	Coaxial Cable 0.8 m
J1343A	Coaxial Cable 1.0 m
J1360A	Measurement Kit
W2753AE	MU181040A/B Operation Manual
	Maintenance Service
MU181040A-ES310	Extended Three Year Warranty Service
MU181040A-ES510	Extended Five Year Warranty Service

• MU181040B

Model/Order No.	Name
	Unit/Module
MU181040B	14 Gbit/s ED
	Options
MU181040B-002	0.1 to 14 Gbit/s
MU181040B-020*1	Clock Recovery
MU181040B-120*2	Clock Recovery
MU181040B-030*1	Variable Clock Delay
MU181040B-130*2	Variable Clock Delay
	Standard Accessories for Option-002
J1341A	SMA Cover Connector: 3 pcs
J1359A	K(m)-K(f) Adapter: 2 pcs
J1137	50 Ω Terminator: 2 pcs
	Standard Accessories for Option-020/120
J1137	50 Ω Terminator: 1 pc
	Optional Accessories
J1359A	K(m)-K(f) Adapter
J1137	50 Ω Terminator
J1342A	Coaxial Cable 0.8 m
J1343A	Coaxial Cable 1.0 m
J1360A	Measurement Kit
W2753AE	MU181040A/B Operation Manual
	Maintenance Service
MU181040B-ES310	Extended Three Year Warranty Service
MU181040B-ES510	Extended Five Year Warranty Service

• **MU182020A**

Model/Order No.	Name
	Unit/Module
MU182020A	25 Gbit/s 1ch MUX
	Standard Accessories
J1137	50 Ω Terminator: 5 pcs
J1341A	SMA Cover Connector: 4 pcs
J1359A	K(m)-K(f) Adapter: 2 pcs
	Options
MU182020A-001*1	28 Gbit/s Extension
MU182020A-101*2	28 Gbit/s Extension
MU182020A-002*1	Clock Input Band Switch
MU182020A-102*2	Clock Input Band Switch
MU182020A-010*1	Variable Data Output (0.25 to 1.75 Vp-p)
MU182020A-110*2	Variable Data Output (0.25 to 1.75 Vp-p)
MU182020A-011*1	Variable Data Output (0.5 to 2.5 Vp-p)
MU182020A-111*2	Variable Data Output (0.5 to 2.5 Vp-p)
MU182020A-013*1	Variable Data Output (0.5 to 3.5 Vp-p)
MU182020A-113*2	Variable Data Output (0.5 to 3.5 Vp-p)
MU182020A-021*1	Variable Clock Output (0.5 to 2.0 Vp-p)
MU182020A-121*2	Variable Clock Output (0.5 to 2.0 Vp-p)
MU182020A-030*1	25 Gbit/s Variable Data Delay
MU182020A-130*2	25 Gbit/s Variable Data Delay
MU182020A-031*1	28 Gbit/s Variable Data Delay
MU182020A-131*2	28 Gbit/s Variable Data Delay
	Standard Accessories for Option-002/102
J1359A	K(m)-K(f) Adapter: 2 pcs
	Standard Accessories for Option-020/120
J1359A	K(m)-K(f) Adapter: 1 pc
	Optional Accessories
J1137	50 Ω Terminator
J1342A	Coaxial Cable 0.8 m
J1343A	Coaxial Cable 1.0 m
J1359A	K(m)-K(f) Adapter
J1427A	Cable kit for 20A/40A (Tx/Rx, Opt16)
J1428A	Cable kit for 21A (Tx, Opt15/16)
J1439A	Coaxial cable (0.8 m, K connector)
J1448A	Cable kit for 20A/40A (Tx/Rx, Opt15)
J1449A	Measurement kit * J1349A x 2, J1342A x 2, J1343A x 1
J1450A	COAXIAL ATTENUATOR (3 dB) * 41KC-3
J1451A	COAXIAL ATTENUATOR (6 dB) * 41KC-6
J1452A	COAXIAL ATTENUATOR (10 dB) * 41KC-10
J1453A	COAXIAL ATTENUATOR (20 dB) * 41KC-20
J1454A	Power Divider * K240C
W3128AE	MU182020A/21A Operation Manual
	Maintenance Service
MU182020A-ES310	Extended Three Year Warranty Service
MU182020A-ES510	Extended Five Year Warranty Service

• **MU182040A**

Model/Order No.	Name
	Unit/Module
MU182040A	25 Gbit/s 1ch DEMUX
	Standard Accessories
J1137	50 Ω Terminator: 4 pcs
J1341A	SMA Cover Connector: 3 pcs
J1359A	K(m)-K(f) Adapter: 2 pcs
	Options
MU182040A-001*1	28 Gbit/s Extension
MU182040A-101*2	28 Gbit/s Extension
MU182040A-002*1	Clock Input Band Switch
MU182040A-102*2	Clock Input Band Switch
MU182040A-030*1	25 GHz Variable Clock Delay
MU182040A-130*2	25 GHz Variable Clock Delay
MU182040A-031*1	28 GHz Variable Clock Delay
MU182040A-131*2	28 GHz Variable Clock Delay
	Standard Accessories for Option-002/102
J1359A	K(m)-K(f) Adapter: 1 pc
	Optional Accessories
J1137	50 Ω Terminator
J1342A	Coaxial Cable 0.8 m
J1359A	K(m)-K(f) Adapter
J1427A	Cable kit for 20A/40A (Tx/Rx, Opt16)
J1429A	Cable kit for 41A (Rx, Opt15)
J1430A	Cable kit for 41A (Rx, Opt16)
J1439A	Coaxial cable (0.8 m , K connector)
J1448A	Cable kit for 20A/40A (Tx/Rx, Opt15)
J1449A	Measurement kit * J1349A x 2, J1342A x 2, J1343A x 1
W3129AE	MU182040A/41A Operation Manual
	Maintenance Service
MU182040A-ES310	Extended Three Year Warranty Service
MU182040A-ES510	Extended Five Year Warranty Service

• MU182021A

Model/Order No.	Name	
	Unit/Module	
MU182021A	25 Gbit/s 2ch MUX	
	Standard Accessories	
J1137	50 Ω Terminator:	9 pcs
J1341A	SMA Cover Connector:	6 pcs
J1359A	K(m)-K(f) Adapter:	4 pcs
	Options	
MU182021A-001*1	28 Gbit/s Extension	
MU182021A-101*2	28 Gbit/s Extension	
MU182021A-002*1	Clock Input Band Switch	
MU182021A-102*2	Clock Input Band Switch	
MU182021A-010*1	Variable Data Output (0.25 to 1.75 Vp-p)	
MU182021A-110*2	Variable Data Output (0.25 to 1.75 Vp-p)	
MU182021A-011*1	Variable Data Output (0.5 to 2.5 Vp-p)	
MU182021A-111*2	Variable Data Output (0.5 to 2.5 Vp-p)	
MU182021A-013*1	Variable Data Output (0.5 to 3.5 Vp-p)	
MU182021A-113*2	Variable Data Output (0.5 to 3.5 Vp-p)	
MU182021A-021*1	Differential Clock Output (0.5 to 2.0 Vp-p)	
MU182021A-121*2	Differential Clock Output (0.5 to 2.0 Vp-p)	
MU182021A-030*1	25 Gbit/s Variable Data Delay	
MU182021A-130*2	25 Gbit/s Variable Data Delay	
MU182021A-031*1	28 Gbit/s Variable Data Delay	
MU182021A-131*2	28 Gbit/s Variable Data Delay	
MU182021A-040*1	Emphasis Control*3	
MU182021A-140*2	Emphasis Control*3	
	Standard Accessories for Option-002/102	
J1359A	K(m)-K(f) Adapter:	2 pcs
	Standard Accessories for Option-021/121	
J1359A	K(m)-K(f) Adapter:	1 pc
	Optional Accessories	
J1137	50 Ω Terminator	
J1342A	Coaxial Cable 0.8 m	
J1343A	Coaxial Cable 1.0 m	
J1359A	K(m)-K(f) Adapter	
J1427A	Cable kit for 20A/40A (Tx/Rx, Opt16)	
J1428A	Cable kit for 21A (Tx, Opt15/16)	
J1439A	Coaxial cable (0.8 m , K connector)	
J1448A	Cable kit for 20A/40A (Tx/Rx, Opt15)	
J1449A	Measurement kit * J1349A x 2, J1342A x 2, J1343A x 1	
J1450A	COAXIAL ATTENUATOR (3 dB) * 41KC-3	
J1451A	COAXIAL ATTENUATOR (6 dB) * 41KC-6	
J1452A	COAXIAL ATTENUATOR (10 dB) * 41KC-10	
J1453A	COAXIAL ATTENUATOR (20 dB) * 41KC-20	
J1454A	Power Divider * K240C	
W3128AE	MU182020A/21A Operation Manual	
	Maintenance Service	
MU182021A-ES310	Extended Three Year Warranty Service	
MU182021A-ES510	Extended Five Year Warranty Service	

• MU182041A

Model/Order No.	Name	
	Unit/Module	
MU182041A	25 Gbit/s 2ch DEMUX	
	Standard Accessories	
J1137	50 Ω Terminator:	8 pcs
J1341A	SMA Cover Connector:	5 pcs
J1359A	K(m)-K(f) Adapter:	4 pcs
	Options	
MU182041A-001*1	28 Gbit/s Extension	
MU182041A-101*2	28 Gbit/s Extension	
MU182041A-002*1	Clock Input Band Switch	
MU182041A-102*2	Clock Input Band Switch	
MU182041A-030*1	25 GHz Variable Clock Delay	
MU182041A-130*2	25 GHz Variable Clock Delay	
MU182041A-031*1	28 GHz Variable Clock Delay	
MU182041A-131*2	28 GHz Variable Clock Delay	
	Standard Accessories for Option-002/102	
J1359A	K(m)-K(f) Adapter	1 pc
	Optional Accessories	
J1137	50 Ω Terminator	
J1342A	Coaxial Cable 0.8 m	
J1359A	K(m)-K(f) Adapter	
J1427A	Cable kit for 20A/40A (Tx/Rx, Opt16)	
J1429A	Cable kit for 41A (Rx, Opt15)	
J1430A	Cable kit for 41A (Rx, Opt16)	
J1439A	Coaxial cable (0.8 m , K connector)	
J1448A	Cable kit for 20A/40A (Tx/Rx, Opt15)	
J1449A	Measurement kit * J1349A x 2, J1342A x 2, J1343A x 1	
W3129AE	MU182040A/41A Operation Manual	
	Maintenance Service	
MU182041A-ES310	Extended Three Year Warranty Service	
MU182041A-ES510	Extended Five Year Warranty Service	

• MU181600A

Model/Order No.	Name	
	Unit/Module	
MU181600A*4	Optical Transceiver (XFP)	
	Standard Accessories	
J1355A	Semirigid Cable:	1 pc
J0541E	Fixed Attenuator (6 dB):	2 pcs
J0541A	Fixed Attenuator (10 dB):	2 pcs
	Optional Accessories	
J1137	50 Ω Terminator	
J1342A	Coaxial Cable 0.8 m	
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)	
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)	
Z0282	Ferrule cleaner	
Z0283	Ferrule cleaning tape (6 pcs/set)	
Z0284	Adapter cleaner (Stick type, 200 pcs/set)	
W2754AE	MU181600A/MU181601A Operation Manual	
	Maintenance Service	
MU181600A-ES310	Extended Three Year Warranty Service	
MU181600A-ES510	Extended Five Year Warranty Service	

• **MU181601A**

Model/Order No.	Name
	Unit/Module
MU181601A*5	Optical Transceiver (SFP)
	Standard Accessories
J0541E	Fixed Attenuator (6 dB): 1 pc
	Optional Accessories
J1137	50 Ω Terminator
J1343A	Coaxial Cable 1.0 m
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)
Z0282	Ferrule cleaner
Z0283	Ferrule cleaning tape (6 pcs/set)
Z0284	Adapter cleaner (Stick type, 200 pcs/set)
W2754AE	MU181600A/MU181601A Operation Manual
	Maintenance Service
MU181601A-ES310	Extended Three Year Warranty Service
MU181601A-ES510	Extended Five Year Warranty Service

• **MU181620A**

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 Option-011/012/013
J1137	50 Ω Terminator: 1 pc
	Standard Accessories for Option-011/013
J1404A	Semirigid Cable: 1 pc
	Standard Accessories for Option-012/013
J1405A	Semirigid Cable: 1 pc
	Optional Accessories
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
J1342A	Coaxial Cable 0.8 m
Z0282	Ferrule cleaner
Z0283	Ferrule cleaning tape (6 pcs/set)
Z0284	Adapter cleaner (Stick type, 200 pcs/set)
Z0916A	Ferrule side face cleaner
W2998AE	MU181620A Operation Manual
	Maintenance Service
MU181620A-ES310	Extended Three Year Warranty Service
MU181620A-ES510	Extended Five Year Warranty Service

• **MU181640A**

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	50 Ω Terminator: 1 pc
	Optional Accessories
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
J0893B	FC•PC-FC•PC-2M-GI (50/125)
J0894B	FC•PC-FC•PC-2M-GI (62.5/125)
J1342A	Coaxial Cable 0.8 m
Z0282	Ferrule cleaner
Z0283	Ferrule cleaning tape (6 pcs/set)
Z0284	Adapter cleaner (Stick type, 200 pcs/set)
Z0916A	Ferrule side face cleaner
W2999AE	MU181640A Operation Manual
	Maintenance Service
MU181640A-ES310	Extended Three Year Warranty Service
MU181640A-ES510	Extended Five Year Warranty Service

• **Software**

Model/Order No.	Name
MX180001A	SDH/SONET Pattern Editor
W2884AE	MX180001A Operation Manual
MX180002A	Stressed Eye Measurement Control Software
W2885AE	MX180002A Operation Manual
MX180003A	GbE/10 GbE Pattern Editor
W2886AE	MX180003A Operation Manual
MX180004A	PON Application Software
W2887AE	MX180004A Operation Manual
MX180005A	Jitter Application Software
W2926AE	MX180005A Operation Manual

∗1: Original order option
∗2: Upgrade option to original order
∗3: When the MU182021A-040 is installed and a Power Divider is connected externally by combining between each Data, an emphasis signal can be generated downstream of the Power Divider. An optional external attenuator can be added to the combined signal to help reduce waveform distortion or jitter caused by reflection, etc. When generating an emphasis signal as described above, or with using two PPGs modules (MU181020A/B) for the emphasis generation, we recommend using the following accessories.
K240C Power Divider
K120MM-20CM DC to 40 GHz, 50 Ω, 20 cm, K(m) to K(m)
41KC-3 Coaxial Attenuator (3 dB)
41KC-6 Coaxial Attenuator (6 dB)
41KC-10 Coaxial Attenuator (10 dB)
41KC-20 Coaxial Attenuator (20 dB)
∗4: The XFP module is sold separately. Note that Anritsu supports only XFP modules purchased from Anritsu.
∗5: The SFP module is sold separately. Note that Anritsu supports only SFP modules purchased from Anritsu.

43.5G MUX/43.5G DEMUX

MP1803A/MP1804A

25 to 43.5 Gbit/s

For R&D and Manufacturing of 40 Gbit/s Devices and Transmission Systems

MP1803A

MP1804A

Build-to order product

The MP1803A 43.5G MUX can multiplex a maximum of four data signal inputs (each transmission speed is maximum 10.875 Gbit/s) and generate a 43.5 Gbit/s multiplexed signal. It can also generate a 1/4 clock signal.
The MP1804A 43.5G DEMUX can de-multiplex the 43.5 Gbit/s data input into four signals. Its four output signal lines are brought to MP1800A with error detector modules and it enables to evaluate 43.5 Gbit/s high-speed data signal.

Features

- Adopting high resolution variable delay unit (Resolution: 0.1 ps)
- High resolution threshold voltage setting suitable for the Q factor analysis (Resolution: 0.001 V)
- Digital display
- For various applications with the remote control

Specifications

• MP1803A 43.5G MUX

Operation frequency	25 to 43.5 GHz (external)
Clock input	Input waveform: Sine or rectangular wave (duty: 50%), Input amplitude: 0.7 to 1.5 Vp-p, Connector: V
Data output	Number of outputs: 2 (DATA, $\overline{DATA}$), Output waveform: NRZ, Output amplitude: 2.0 ±0.2 Vp-p (AC coupled), Tr/Tf (20 to 80%, ≥38 Gbit/s): 10 ps (typ.), Pattern jitter: Less than 10 ps (P-P), Waveform distortion: ≤10%, Termination: 50 Ω/GND (with back termination), Connector: V Option01 Output amplitude: 1.0 to 2.6 Vp-p (AC coupled) 2 mV/step Output offset: V_{OH}: -2.0 to +2.6 V 1mV/step (Mark Ratio 1/2, Cross Point 50%) Cross point control: 30.0 to 70.0% 0.2%/step Tr/Tf (20 to 80% 43.5 Gbit/s): 9 ps (typ.) Waveform distortion:≤10% (43.5 Gbit/s 2.6 Vp-p) Termination: 50 Ω/GND (with back termination) Connector: V connector (Female)
Clock output	Number of outputs: 1 (CLOCK), Output amplitude: 0.7 to 1.6 Vp-p (AC coupled), Tr/Tf (20 to 80%, ≥38 Gbit/s): 5 ps (typ.), Waveform distortion: ≤10%, Phase adjust range: –70.0 to +70.0 ps (0.1 ps step), Termination: 50 Ω/GND (with back termination), Connector: V
1/4 data input	Number of inputs: 4 (D1, D2, D3, D4), Input amplitude: V_{IH} = 0 V ±0.07 V, V_{IL} = –1 V ±0.07 V, Termination: 50 Ω/GND, Connector: SMA
1/4 clock output	Number of outputs: 1 (CLOCK), Output amplitude: V_{OH} = 0 V ±0.40 V, V_{amp} = 1.40 V ±0.40 V, Phase adjust range: –70 to 70 ps (1 ps step), Termination: 50 Ω/GND, Connector: SMA
Sync. output	Number of outputs: 1 (1/64 clock output), Output amplitude: V_{OH} = 0 V ±0.2 V, V_{OL} = –1 V ±0.2 V Termination: 50 Ω/GND, Connector: SMA
Control interface	GPIB
Dimensions and mass	213 (W) x 132.5 (H) x 364 (D) mm, ≤10 kg
Power	AC 100 to 240 V, Frequency: 47 to 63 Hz, ≤100 VA
Operation temperature	+20˚ to +30˚C

• **MP1804A 43.5G DEMUX**

Operation frequency	25 to 43.5 GHz
Data input	Number of inputs: 1 (DATA), Input waveform: NRZ, Input amplitude: 0.1 to 1.0 Vp-p, Threshold voltage: –0.75 to +0.25 V (0.001 V step), Termination: 50 Ω/GND, Connector: V
Clock input	Number of inputs: 1 (CLOCK), Input waveform: Sine or rectangular wave (duty: 50%), Output amplitude: 0.7 to 1.5 Vp-p (AC coupled), Phase adjust range: –70 to +70 ps (0.1 ps step), Termination: 50 Ω/GND, Connector: V
1/4 data output	Number of outputs: 4, Output voltage: V_{OH} = 0 V ±0.2 V, V_{OL} = –1 V ±0.2 V, Termination: 50 Ω/GND, Connector: SMA
1/4 Clock output	Number of outputs: 4, Output voltage: V_{OH} = 0 ±0.25 V, V_{OL} = –1 ±0.25 V Phase adjust range: –70 to +70 ps (1 ps step), Termination: 50 Ω/GND, Connector: SMA
DEMUX Reset input	Number of inputs: 1 (1/64 clock output), Input voltage: V_{1H} = 0 ±0.1 V, V_{IL} = –1 ±0.1 V Termination: 50 Ω/GND, Connector: SMA
Control interface	GPIB
Dimensions and mass	213 (W) x 132.5 (H) x 364 (D) mm, ≤10 kg
Power	AC 100 to 240 V, Frequency: 47 to 63 Hz, ≤100 VA
Operation temperature	+20˚ to +30˚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	
MP1803A	43.5G MUX	
	Standard accessories	
J1090	Coaxial Cable (V120MM-30CM), 30 cm:	3 pcs
J0696E	Coaxial Cable (AA-165-1500), 1.5 m:	5 pcs
J1108	Coaxial Cable (V120MM-50CM), 50 cm:	1 pc
J1138	Coaxial Cable, 1.5 m:	1 pc
J1145	Terminator (V210):	4 pcs
J1137	Terminator (HRM-601):	6 pcs
J0008	GPIB Cable, 2.0 m:	1 pc
	Power Cord, 2.5 m:	1 pc
F0012	Fuse, 3.15 A (T3.15 250 V):	1 pc
Z0306A	Wrist Strap:	1 pc
W2031AE	MP1803A Operation Manual:	1 copy
W2032AE	MP1803A GPIB Remote Control Operation Manual:	1 copy
	Options	
MP1803A-01	2.6 V Data Output	
MP1803A-11	Extended Up to 48 Gbit/s	
W2156AE	MP1803A-01 Operation Manual	
W2157AE	MP1803A-01 GPIB Remote Control Operation Manual	
	Optional accessory	
B0523E	F 3U 1/2MW∗2 Rack Mount Kit	
	Main frame	
MP1804A	43.5G DEMUX	
	Standard accessories	
J1090	Coaxial Cable (V120MM-30CM), 30 cm:	2 pcs
J0696D	Semi-flexible Cable (AA-165-2000), 2 m:	1 pc
J0696E	Coaxial Cable (AA-165-1500), 1.5 m:	8 pcs
J1145	Terminator (V210):	2 pcs
J1137	Terminator (HRM-601):	9 pcs
J1144	Fixed Coaxial Attenuator (41V-6, for MUX-DEMUX connection):	1 pc
J0008	GPIB Cable, 2.0 m:	1 pc
	Power Cord, 2.5 m:	1 pc
F0012	Fuse, 3.15 A (T3.15 250 V):	1 pc
Z0306A	Wrist Strap:	1 pc
W2033AE	MP1804A Operation Manual:	1 copy
W2034AE	MP1804A GPIB Remote Control Operation Manual:	1 copy
	Option	
MP1804A-11	Extended up to 48 Gbit/s	

BIT MASTER™

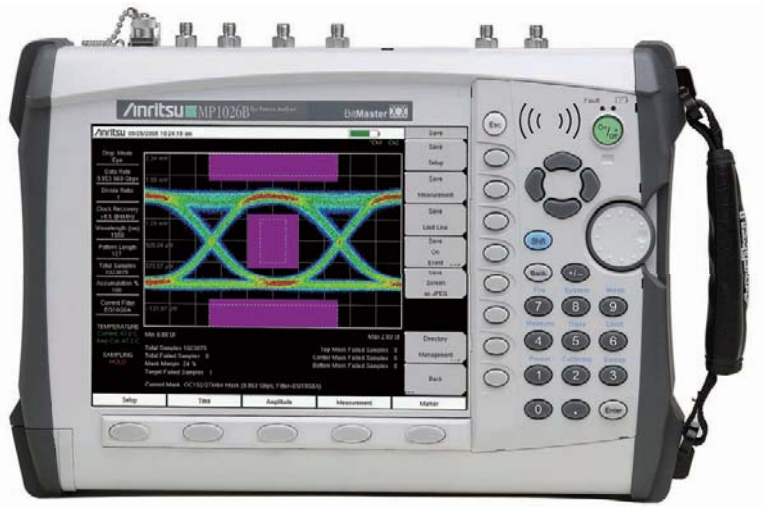
MP1026B Eye Pattern Analyzer

100 Mbps to 12.5 Gbps

CE Ethernet

Eye Pattern Measurements Just Got Personal

NEW



The rapid growth of the Internet is fueling the deployment of high speed next generation networks. Under tremendous pressure to accelerate deployment, engineers in design, manufacturing, and field organizations are using eye pattern measurements everyday to fine-tune, verify, and troubleshoot their designs. To complicate matters, deployment of new high-speed networks may require more sophisticated tools beyond optical time domain reflectometer (OTDR), optical power meter (OPM), optical spectrum analyzer (OSA), and bit error rate tester (BERT) to troubleshoot problems on-site.

Eye pattern measurements are typically performed with a general purpose sampling oscilloscope which is often a shared resource because of its expense and complexity. Engineers often waste their time waiting to get access to this shared resource despite the attempts of their managers to increase their productivity. The better approach is to equip every engineer with an affordable instrument, tailored for everyday use, that doesn't compromise on performance nor skimp on features. Every engineer's bench should have an eye pattern analyzer.

Anritsu introduces the Bit Master MP1026B Eye Pattern Analyzer that offers eye pattern measurements for data rates from 0.1 to 12.5 Gbps in a handheld, rugged, and battery-powered instrument. With outstanding performance for the size, the Bit Master offers two compelling reasons for design, manufacturing, and field engineers to consider this innovative new product. First, the Bit Master is typically one-half the cost of a general purpose sampling oscilloscope. Second, the Bit Master is a practical instrument that enables engineers to increase productivity by more freely conducting eye pattern; measurements on their network equipment and in their environment anytime, anywhere.

Key Features

- Eye pattern analyzer with two electrical channel inputs of 25 GHz bandwidth each
- Eye pattern and pulse pattern displays of high speed signals
- Optional 62.5 µm FC connection optical channel supports multimode 850, 1310 and 1550 nm wavelengths
- Optional internal clock recovery unit (CRU) with 25 mV typical sensitivity
- Optional Secure Data Operation available for classified environments
- Handheld eye pattern analyzer that can operate on battery power for nearly 3 hours
- Surprisingly affordable price

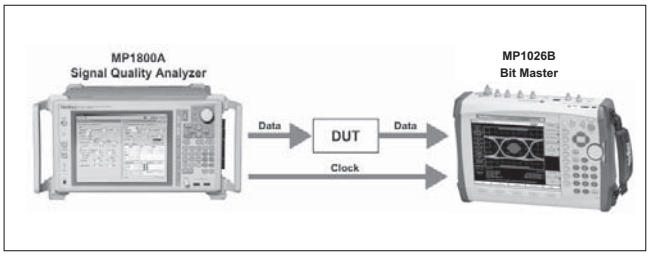
Eye Pattern Measurements on Every Bench

High speed circuits, transceivers, and transponders are vital transmitting components of the physical layer that routinely require engineers to measure eye patterns. Engineers believe that feedback from eye pattern measurements is insightful when trying to quickly isolating sources of eye closure. A more portable solution can increase engineering's productivity as eye pattern measurements are required in their everyday tasks.

Engineers not only perform eye pattern measurements at their benches, but they are routinely called to locations throughout the facility for consultation. For example, engineers can roam between manufacturing, customer service, test labs, and pre turn-up areas; however, their instruments limit how fast they can isolate problems and propose solutions. When equipped with the handheld Bit Master, engineers can freely roam their facility conducting eye pattern measurements without compromising performance and features for their everyday tasks.

Compliance Mask Testing

Compliance mask testing is an important part of verifying that high speed signals are meeting the standards with adequate margin for reliable operation in the field. Unfortunately, you pay a premium in terms of cost-of-test by using a general purpose sampling oscilloscope instead of the Bit Master, especially for 10 Gbps transmitters. When using the new MP1026B fully-integrated (Option 3) optical interface, the Bit Master conducts the same compliance mask test for typically half the cost of a general purpose sampling oscilloscope. With a single keystroke, the Bit Master reveals whether or not the transmitter is ready for deployment.



A typical manufacturing setup is shown in the above simplified diagram. The MP1800A provides the data and clock for the setup while the Bit Master measures the compliance mask and conducts eye and pulse pattern analysis. Using this exciting new product, suppliers of next generation network equipment can more profitably manufacture their high speed modules.

Trigger-less Pulse Pattern Measurements

Unlike the go/no-go results of a BERT, the Bit Master can easily inform an engineer on the root cause of eye closure at high data rates. Simply specify the pattern length and the Bit Master will measure the pulse pattern of high-speed repetitive signals without the need for a pattern trigger. At a glance, an engineer can determine whether the source of eye closure is related to any number of pulse parameters: rise time, fall time, delay, width, period, transition time, linearity, levels, preshoot, overshoot, ringing, settling time, droop, and longer-term wander. With all this portable measurement power, the Bit Master is a valuable tool to quickly identify the causes of eye closure during design and troubleshooting tasks.
The Bit Master is equipped with these insightful pulse pattern measurements so engineers can easily and affordably observe high speed signals. Using the Bit Master, one can quickly isolate undesirable pulse properties that limit performance or impact production yields. In addition, the Bit Master is uniquely capable of performing pulse pattern measurements anywhere, anytime.

Extend the Capabilities with Valuable Options

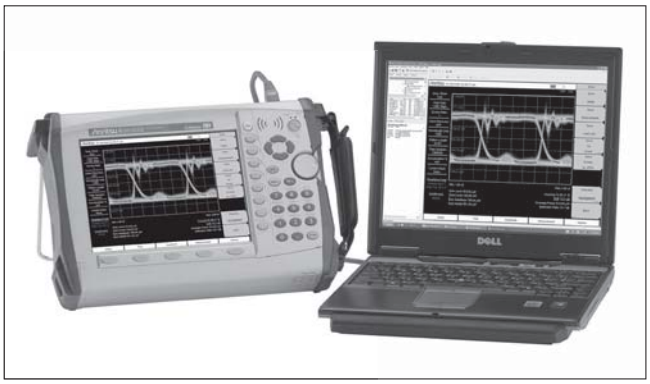
- **Popular Supported Data Rates**

The standard Bit Master offers up to 12.5 Gbps testing, which is sufficient for testing the popular data rates shown in the following table. For additional flexibility, optional internal clock recovery and optional external optical channel can simplify setups for these measurements.

Master Software Tools and Remote Programming

Each Bit Master ships with a test assistant: a copy of Anritsu's Master Software Tools for Windows® 2000/XP. This allows an operator to add the processing capabilities of a PC and this software utility to the MP1026B Eye Pattern Analyzer to form a powerful and flexible measurement solution. For automation, the Bit Master also supports remote programming via the Ethernet interface
Master Software Tools (MST)

- Powerful data management tool for storing and sifting through measurement results.
- Connect to a PC using USB2.0 (full-speed), Ethernet LAN, or Direct Ethernet
- Store an unlimited number of setups, traces, and JPEGs (limited only by PC memory)
- Post-processing histograms
- Add, edit, and manage masks using Master Software Tools
- Update with the latest firmware
- Remote programming via Ethernet

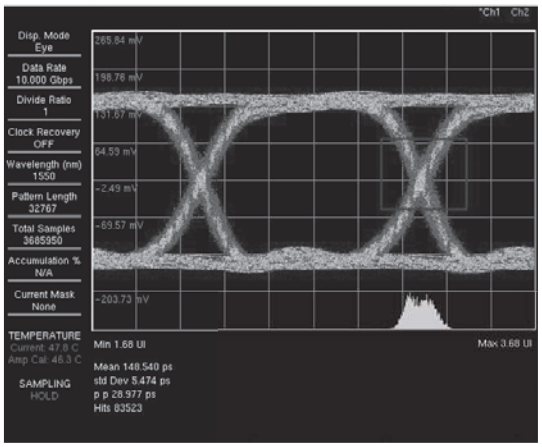


Ethernet	Fibre channel	SONET/SDH
1GE: 1.25 Gbps	1GFC: 1.0625 Gbps	OC-3/STM-1: 155.52 Mbps
2GE: 2.5 Gbps	2GFC: 2.125 Gbps	OC-12/STM-4: 622.08 Mbps
10GE for LX4 (10GBase-X): 3.125 Gpbs*1	4GFC: 4.25 Gbps*1	OC-48/STM-16: 2.488 Gbps
10GE (10GBase-W): 9.953 Gbps	8GFC: 8.5 Gpbs	OC-48/STM-16 + FEC (G.709): 2.666 Gbps
10GE (10GBase-R): 10.3125 Gbps	10GFC + FEC: 11.3 Gbps	OC-192/STM-64: 9.953 Gbps
10GE + FEC: 11.10 Gbps	10GFC: 10.51875 Gbps	OC-192/STM-64 + FEC (G.975): 10.664 Gbps
		OC-192/STM-64 + FEC (G7.09): 10.709 Gbps

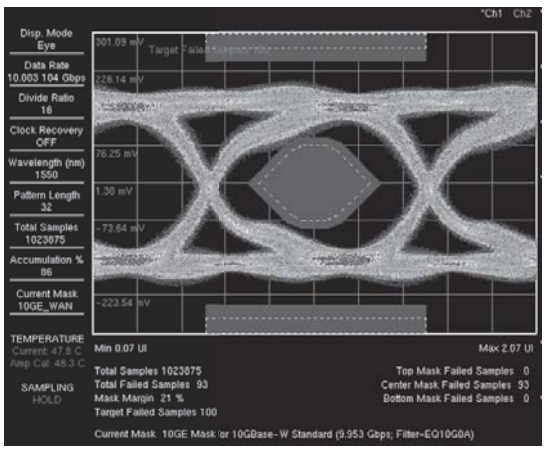
*1: 10GBase-X and 4GFC are also supported when supplied with clock; however, optional clock recovery does not currently support these data rates. Contact the factory for alternatives or use an external clock recovery circuit to support 4 GFC.

Typical Eye and Pulse Pattern Measurements

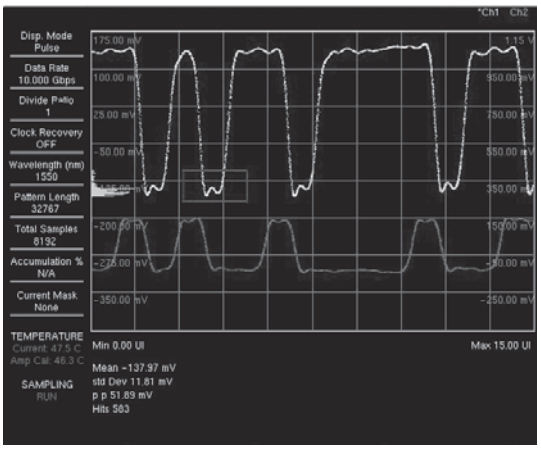
The Bit Master has plenty of powerful features to help extract information from measurement results. The following typical measurements highlight features available for precisely measuring eye pattern, amplitude and time parameters associated with high speed repetitive signals. With two electrical channels of 25 GHz (–3 dB bandwidth), the Bit Master has the requisite performance to tame 12.5 Gbps high speed testing. Give it a try and we think you'll agree.



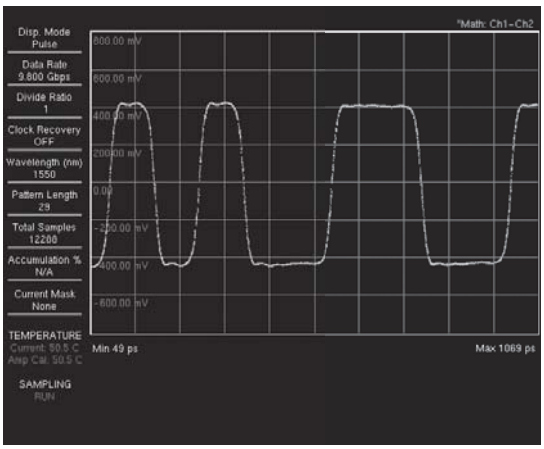
Infinite persistence eye pattern.
Use histograms to extract statistical data of eye pattern performance. For example, the time histogram in the lower right corner shows the jitter in the crossing point.



Mask Margin Compliance.
In the optical signal formats, these masks (here, HDMI) reveal go-no-go compliance with industry standard data specifications. The additional Mask Margin function in dashed lines show percentage margins from the specified mask border, a very useful feature.



Dual-trace overlay pulse pattern.
Use overlay and histogram to simultaneously display two traces and perform statistical analysis, respectively.



Differential signal measurements.
Use CH1 and CH2 inputs and trace math features to measure differential and common mode signals.
Note trace math indicator in upper right corner of this screen capture.

Clock Recovery (Option 2)

Bit Master extracts a clock from the high speed signal for more convenient measurements than using external references. The supported data rates and sensitivity are shown in the following table.

Description	Specification
Data rates	9.8 to 12.5 Gbps 0.1 to 2.7 Gbps
Sensitivity	25 mVp-p typical

Secure Data Operation (Option 007)

This special software function prevents the user from storing measurement setup information onto the internal file storage location. Setup and measurement information can be stored ONLY to the external Compact Flash memory module, or an external USB memory device. It is intended for measurements on highly secure data handling equipment and systems.
Although the last setup information is still automatically stored internally, this information can be overwritten with factory default setup information by holding down the Escape key while powering on the instrument.

Optical Interface with Internal O/E Conversion (Option 003)

For optical data testing, the Bit Master Option 003 provides an optical input supporting 750 to 1650 nm wavelengths. The electrical output of this optical input can be routed to one of the two standard electrical channels. This option gives the user the flexibility of having one optical and one electrical channel or two electrical channels. More than 9 GHz of bandwidth enables unfiltered optical eye measurements. Add an appropriate filter in series with the internal module to achieve a 4th order Bessel-Thomson receiver response for optical mask compliance test. Refer to the ordering information section for detailed availability of mask compliance accessories by protocols.

With standard built-in measurement software routines and option 003's optical conversion hardware, the Bit Master provides the complete solution for your optical measurements needs.

Performance Specifications

Standard measurement capabilities	Displays	Eye pattern display Pulse pattern display
	Measurements	Statistical (NRZ), histograms, mask compliance (OC192, 10GE, 10GE-LX4, plus user defined masks)
Horizontal system	Clock trigger frequency	0.1 to 12.5 GHz
	Clock trigger sensitivity	50 mVp-p, typical (>1 GHz) 200 mVp-p, typical (<1 GHz)
	Maximum clock trigger	2 Vp-p, max input before damage*1
	RMS jitter, RMS	5 to 12.5 GHz: 0.85 ps, typical; 1.35 ps, maximum*2 1 to 5 GHz: 1 ps, typical 0.1 to 1 GHz: 2 ps, typical
	Eye mode scale factor	1 UI minimum full scale
	Pattern mode scale factor	1 bit minimum full scale
Vertical system	Input range	±500 mV offset, minimum ±400 mV dynamic range, minimum ±2 V, maximum input before damage
	Amplitude accuracy (after internal Cal)	See Figure 1 for maximum amplitude accuracy values
	Bandwidth (–3 dB)	DC to 20 GHz, minimum DC to 25 GHz, typical Flatness: ±1 dB, typical
	Noise, RMS	1 mV, typ., 1.75 mV, maximum
Digital system	Sampling speed	100 ksamples/sec, typical

• Clock Recovery (Option 2)

Clock rates	9.8 to 12.5 GHz 0.1 to 2.7 GHz
Sensitivity	25 mVp-p, typical
Maximum input	2 Vp-p, maximum input before damage
Input levels	2 Vp-p, max input before damage
Jitter, RMS (additive)	8.5 to 12.5 Gbps: 10 mUI, typical; 20 mUI, maximum at 4 MHz loop BW 0.1 to 2.7 Gbps: 2 mUI, typical
Loop bandwidth (typical)	8.5 to 12.5 GHz Band: 1, 2, 4 or 8 MHz, typical 0.1 to 2.7 GHz Band: OC-48: 490 kHz, typical OC-12: 71 kHz, typical OC-3: 23 kHz, typical

*1: For clock trigger frequencies between 0.7 and 1.0 GHz, EMC emissions specifications are only guaranteed for a maximum input signal of 1.5 Vp-p.

*2: Under the condition of strong interfering RF signals, the maximum RMS jitter could be as high as 4 ps when the interfering signals are in the frequency bands 556 to 693 MHz and 900 to 1100 MHz, and as high as 7 ps when the interfering signals are in the band of 645 to 655 MHz.

Top view of the connector configuration for the Bit Master shows how one of its two electrical channels may be converted for an optical input, using the Option 3 Internal O/E Conversion. A signal pick-off (68231) serves to route a sampled signal for the Option 2 Clock Recovery.

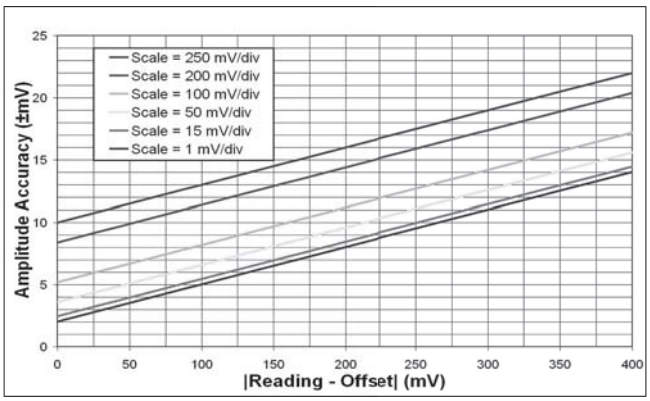


Figure 1: Amplitude accuracy for different scale values plotted against the values of reading minus offset. For example, for a 400 mVp-p signal with a 50 mV DC offset, setting the instrument scale to 50 mV/div and the offset to 50 mV results in the following readout accuracy values: ±8 mV for the +200 mV peak value and ±11 mV for the –200 mV peak value.

• Optical Interface via O/E Module OEC10G-1A (Option 3)

Multimode fiber input (accepts single mode, too)	62.5 µm with FC
Wavelength range	750 to 1650 nm
Unfiltered bandwidth (–3 dB electrical)	DC to 9.0 GHz typical
850 nm responsivity	0.5 A/W typical
850 nm conversion gain	225 V/W, typical
1310 nm responsivity	0.95 A/W typical
1310 nm conversion gain	420 V/W typical
1550 nm responsivity	0.9 A/W typical
1550 nm conversion gain	400 V/W typical
Optical noise	15 µW, typical
Optical sensitivity	–15 dBm, typical –8 dBm, typical for operation with CRU (opt 002)
Optical overload	+2 dBm, minimum +5 dBm, maximum input before damage
Optical power measurement accuracy	±0.35 dB, typical, for input levels between 0 dBm and –18 dBm
Electrical return loss	–10 dB, typical
Optical return loss	–30 dB, typical

General Specifications

Interfaces	Type K female Electrical In port (x2); ±2 V max input Type K female CRU In port; 2 Vp-p max input (with Option 002) Type K female CRU Out port (with Option 002) Type K female Clock In port: 2 Vp-p max input Optical FC connector for O/E In port (with Option 003) Type K female O/E Out port (with Option 003) RJ45 connector for Ethernet 10/100-Base T USB2.0 (full-speed) Compact Flash 2.5 mm 3-wire cellular headset connector
Environmental	MIL–PRF–28800F Class 2 Operating: –10˚ to +55°C, humidity 85% Storage: –51˚ to +71°C Altitude: 4600 meters, operating and non-operating
Safety	Conforms to EN61010–1 for Class 1 portable equipment
Electromagnetic compatibility	Meets European Community requirements for CE marking
Dimensions and mass	313 (W) x 211 (H) x 77 (D) mm (12W x 8H x 3D in.), <4 kg (<7.0 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
MP1026B	**Bit Master™ models*** Eye Pattern Analyzer (2-channel Electrical, 25 GHz BW) *Each instrument includes standard one-year warranty and Certificate of Calibration and Conformance
	Standard accessories
10580-00217	User's Guide
65729	Soft Carrying Case
3-2000-1567	Compact Flash Card (512 MB)
64343	Tilt Bail
2300-498	Master Software Tools CD-ROM
633-44	Rechargeable Li-Ion Battery
40-168	AC-DC Adapter
806-141	12 V DC Adapter
3-2000-1498	USB A–to mini B Cable, 10 feet (3.05 m)
2000-1371	Ethernet Cable, 7 feet (2.13 m)
3-806-152	Crossover Ethernet Cable
2000-1520-R	2 GB USB Memory Drive
	One year warranty (includes battery, firmware, and software)
	Options
MP1026B-002	Clock Recovery Unit Option (includes two loop cables)
MP1026B-003	Optical Interface Option (via external module which must be ordered separately)
MP1026B-007	Secure Data Operation

Model/Order No.	Name
	Option 002 Standard accessories (supplied with the option)
67065-1	Loop Cable from CRU OUT to <1 GHz CLK IN
67065-2	Loop Cable from CRU OUT to ≥1 GHz CLK IN
	Optional accessories
760-243-R	Transit Case
2000-1374	Dual External, Li-Ion Charger with Universal Power Supply
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
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)
J0635A	Optical Fiber Cable (SM, FC-SPC connector both ends), 1 m
J0635B	Optical Fiber Cable (SM, FC-SPC connector both ends), 2 m
J0635C	Optical Fiber Cable (SM, FC-SPC connector both ends), 3 m
	Literature
10580-00217	Bit Master User's Guide
10580-00218	Bit Master Programming Manual

Mask Compliance Filter Accessories

Filter model numbers	Part description	Bit rates supported	Standard supported
BTF155B	LowPass Filter, 155 Mbps	155.2 Mbps	OC-3/STM-1
BTF622B	LowPass Filter, 622 Mbps	622.08 Mbps	OC-12/STM-4
BTF1060B	LowPass Filter, 1060 Mbps	1062.5 Mbps	1GFC
BTF1250B	LowPass Filter, 1250 Mbps	1244.16 Mbps 1250 Mbps	OC-24/STM-8 1GE
BTF2125B	LowPass Filter, 2125 Mbps	2125 Mbps	2GFC
BTF2500B	LowPass Filter, 2500 Mbps	2488.32 Mbps 2500 Mbps 2666 Mbps	OC-48/STM-16 2GE & Infiniband OC-48/STM-16 + (G.709)
BTF3125B	LowPass Filter, 3125 Mbps	3125 Mbps	XAUI 10GBase-X
EQ10G0A	Equalizer, MP1026, 10 GHz	9.953 Gbps 10.3125 Gbps	10GE (10 GBase-W) & OC-192/STM-64 10GE (10 GBase-R)
EQ10G5A	Equalizer, MP1026, 10.5 GHz	10.51875 Gbps 10.664 Gbps 10.709 Gbps	10GFC OC-192/STM-64 + FEC (G.975) OC-192/STM-64 + FEC (G.709)
EQ11G0A	Equalizer, MP1026, 11 GHz	11.10 Gbps 11.3 Gbps	10GE + FEC10GFC + FEC

IP/NETWORK MEASURING INSTRUMENTS

Selection Guide

• Bit Rate/Interface

Bit rate/Interface	MP1590B	MP1591A	MP1595A	MD1230B	CMA 3000	CMA5000a GigE II	CMA5000a -XTA	CMA5000a -UTA
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	√	√	√				√ STS-1 electrical	
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/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								√
43018.413 Mbit/s: OTU-3			√					
10M/100M Ethernet	√	√		√	√	√		
Gigabit Ethernet	√	√		√	√	√		
10 Gigabit Ethernet	√	√		√				√

Measurement functions

Model / Measurement functions		MP1590B	MP1591A	MP1595A	MD1230B	CMA 3000	CMA5000a GigE II	CMA5000a -XTA	CMA5000a -UTA
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	√	√	√				√	√
	POS	√	√						
	Through mode	√	√	√		√		√	√
	Optical power measurements	√	√	√		√		√	√
	Jitter/wander measurements	√	√	√*1				√	
	Frequency offset	√	√	√		√		√	√
Ethernet	Packet capture	√	√		√				√
	Protocol decoding	√	√		√				√
	Protocol emulation	√	√		√				
	XENPAK measurements	√	√		√				
	RFC2544 Automatic test	√	√		√	√	√		√
	RFC2889 Automatic test	√	√		√				
	Through mode	√	√		√	√	√		
	Traffic map	√	√		√				√
	Traffic monitor	√	√		√	√	√		√
	Full wire rate transmission	√	√		√	√	√		√
	Packet BER measurement	√	√		√	√	√		√
	Latency	√	√		√	√	√		√
Remote Control		√	√	√	√	√	√	√	√

∗1: Requires separate MP1797A.

MD1230B Data Quality Analyzer
MP1591A Network Performance Tester

MD1230 Family

CE GPIB OPTION Ethernet OPTION

IP Testing Instruments Changing in Response to Applications for Metropolitan-area and Access Networks

MD1230B **MP1591A**

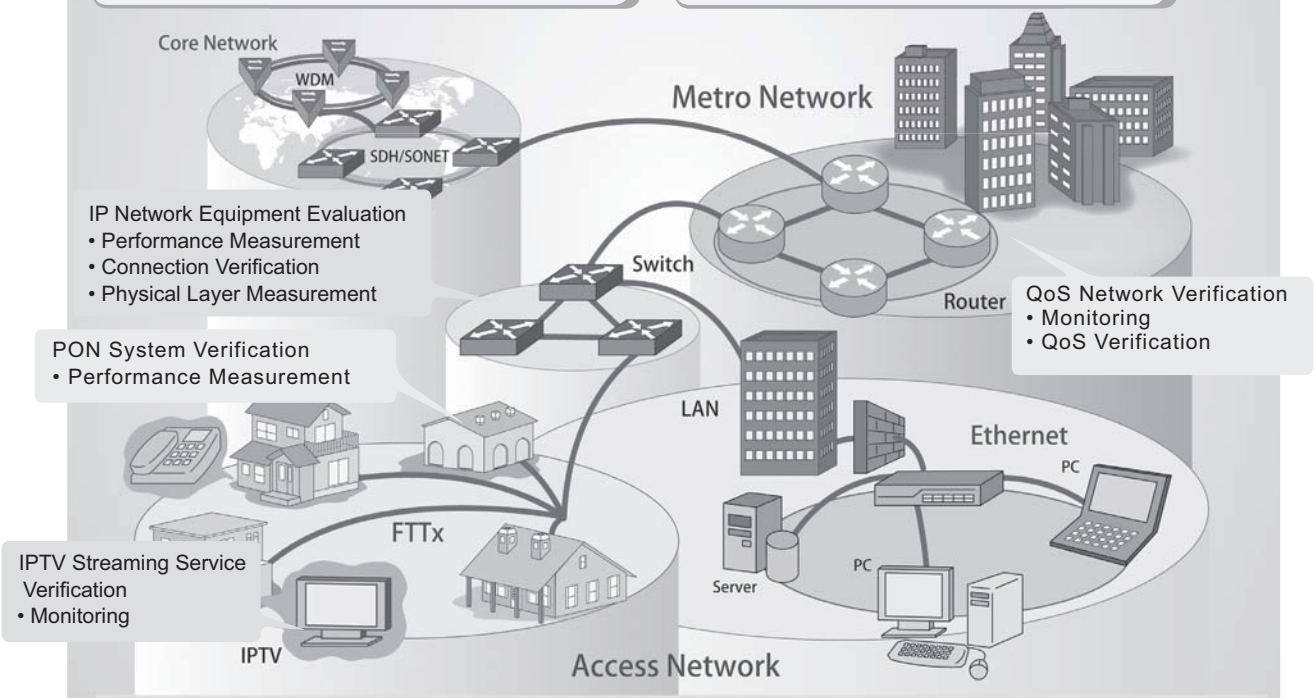
For detail and specification, refer to the data sheet.

The MD1230 family 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 MD1230 Family 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



• MD1230 Family

There are two models in the family: the compact and portable MD1230B with integrated screen, and the highly expandable rack-mounted MP1591A with remotely-controlled operation using an external PC.

MD1230B

5-slot Integrated Screen Model
Built-in Windows® XP operating system
Dimensions: 320 (W) x 177 (H) x 350 (D) mm
Mass: 15 kg max. (excl. options and modules)

MP1591A

Rack-mount 16-slot Model
Controlled by external PC
Supports Windows® XP and Windows® 2000 operating systems
Dimensions: 426 (W) x 596 (H) x 350 (D) mm
Mass: 28 kg max. (excl. options and modules)

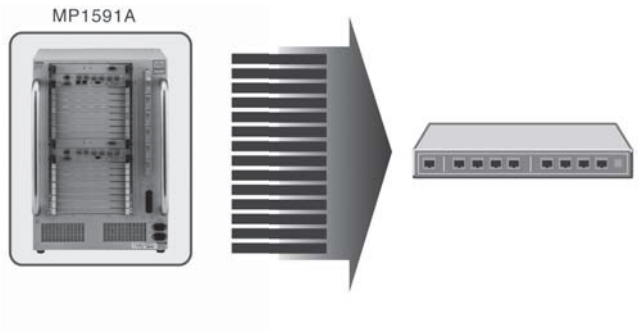
∗ Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

Application Examples

IP Network Equipment Evaluation

• High-Density Switch Performance Measurements

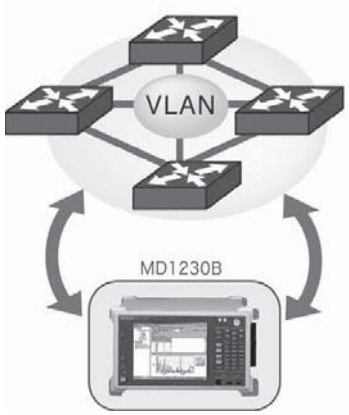
One MD1230B or MP1591A unit supports control and measurement of up to 60 or 128 ports, respectively. Therefore, all 48 ports of the highest-density 1U switch can be load-tested simultaneously, providing a small footprint, cost savings, and effective return on investment.



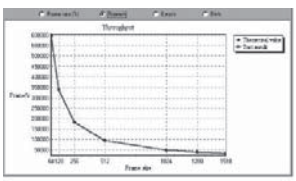
Automatic Switch Performance Measurement

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



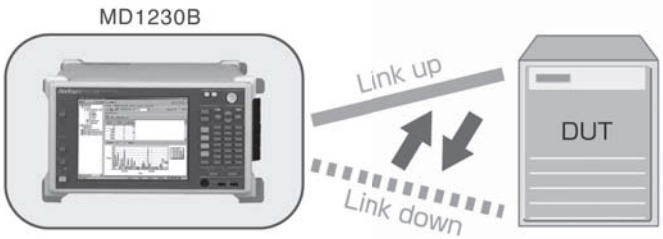
RFC2889 Result

• 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.

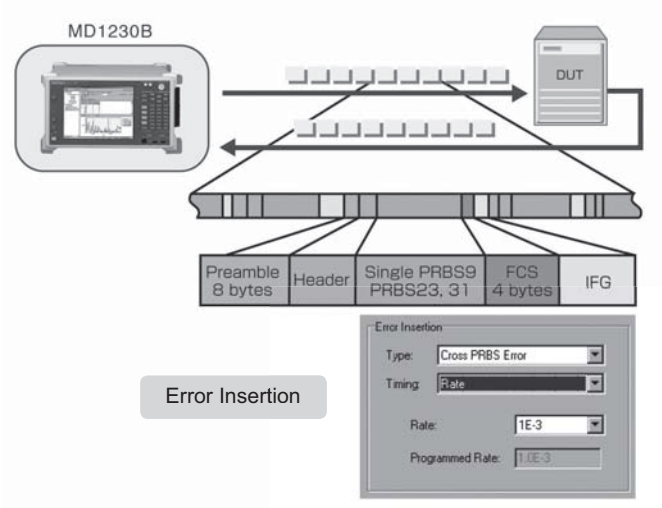
<Link Test>
Repeatedly forcing the link on and off permits verification of equipment operation during a Link Flap situation.

<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.



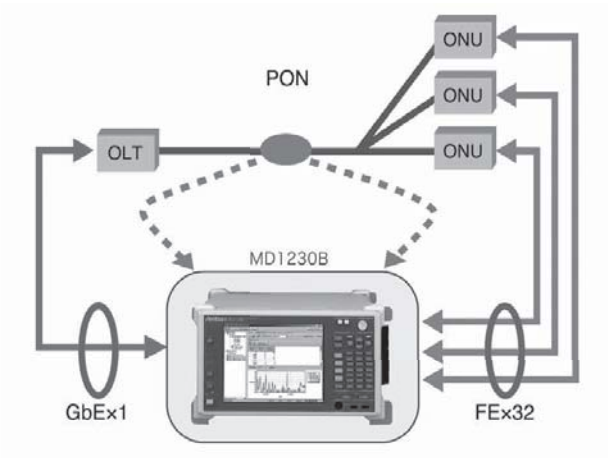
• Physical Layer Measurements

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-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

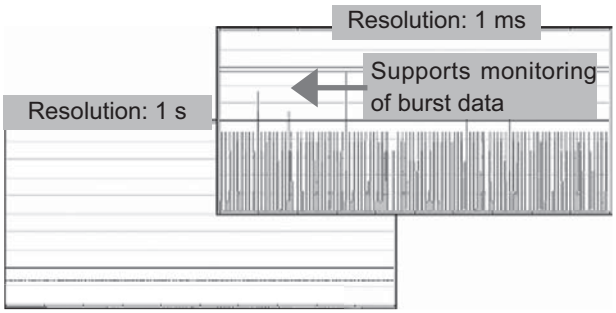
A single MD1230B or MP1591A unit can control a simultaneous end-to-end evaluation of a 32-branch PON system. Each unit also supports OAM analysis by capturing and decoding E-PON system frames for verification of PON functions.



IPTV Streaming Service Verification

• High-Resolution Traffic Monitor

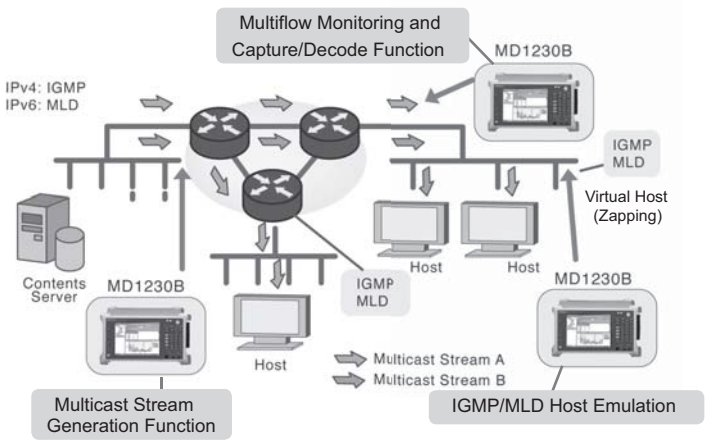
Previous measuring instruments (with 1-s resolution) are inadequate for analyzing burst data that can impact the quality of streaming services. However, the Application Traffic Monitor [Option-20] provides monitoring of burst data with 1 ms resolution for realtime oscilloscope-type analysis that could not be performed previously.

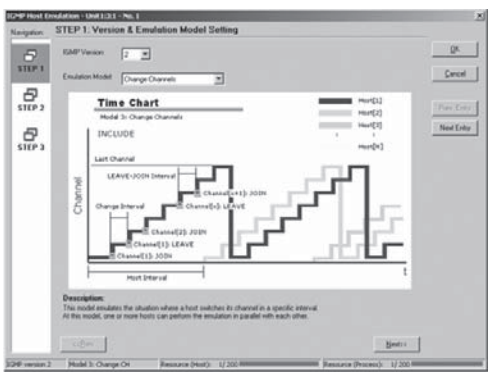


Same Traffic Monitored at Different Resolution

• 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.

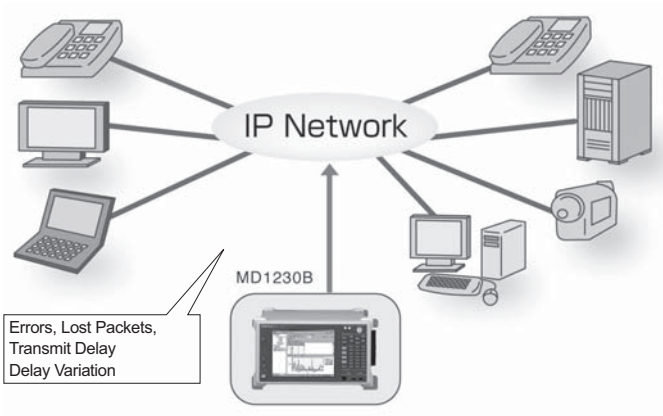




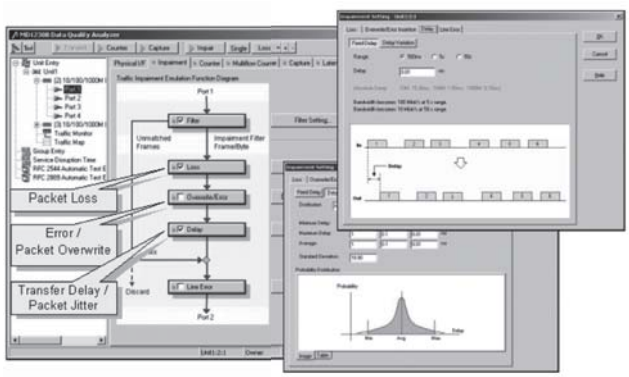
Multicast Host Emulation

<Multicast Host Emulation>
Multicast protocols that can be analyzed and emulated:
• IGMPv2/IGMPv3
• MLDv1/MLDv2 [Option-12]

• Traffic Impairment Emulator



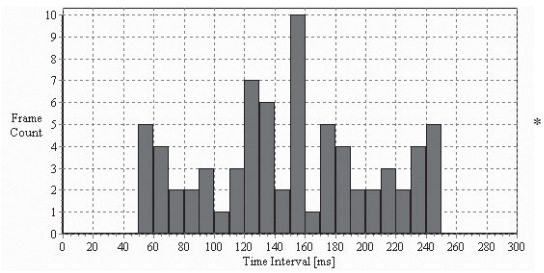
The Traffic Impairment Emulator [Option-17] emulates network faults to evaluate and verify service quality under hypothetical fault conditions.
Service quality can be checked by emulating packet loss, errors, and delays occurring in actual networks, such as IPTV and VoIP streams. In addition, because the effect of network faults can be varied in real time, different networks conditions can be emulated effectively.



<Traffic Impairment Emulator> *
The following effects can be inserted:
• Packet Loss
• Error/Packet Overwrite
• Delay (Transmission Delay 51.2 s *1 max.) /Packet Jitter

*: The Traffic Impairment Emulator uses Ports 1 and 2 of the MU120121A 10/100/1000M Ethernet Module or the MU120122A Gigabit Ethernet Module.
*1: When using 50-s range (guaranteed bandwidth: 10 Mbps)

• Delay Time Distribution (Packet Jitter)
Packet jitter impacting the quality of real-time services can be monitored.

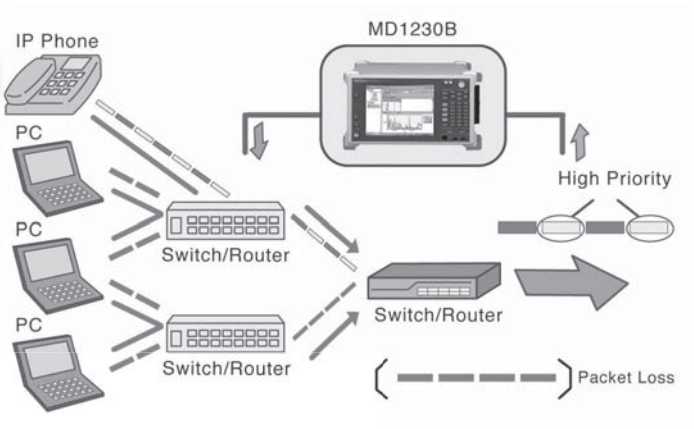


* When using test packets

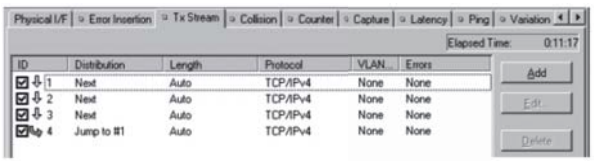
Latency Distribution

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.



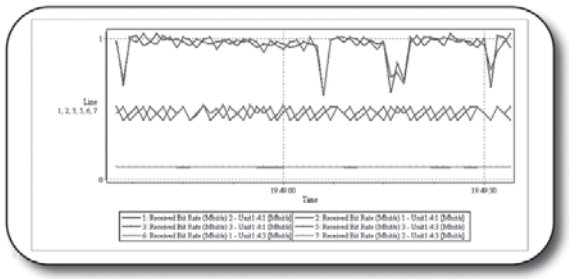
<Stream Generation>
Full-wire-rate, high-load traffic can be generated easily, something that is difficult to do intentionally on a real network. Using the stream editing functions supports frexible setting of QoS-related parameters.

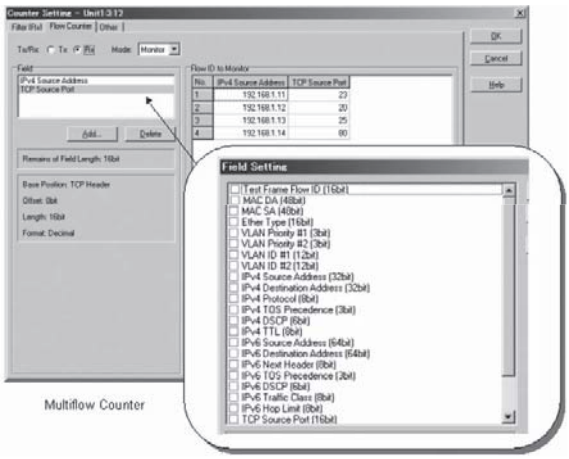


Stream Generation

<Multiflow Counter> *
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.

*: Using MU120131A 10/100/1000M Ethernet Module and MU120132A Gigabit Ethernet Module Multiflow Counter

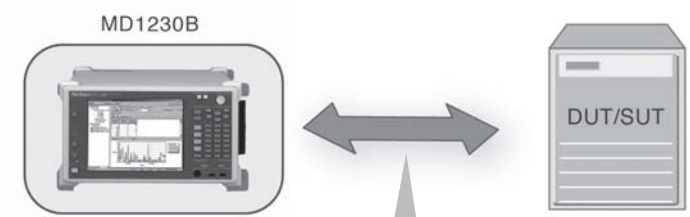




Flow Definitions (Priority Parameters)

• 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 801.1ag
CCM periodic send *; LBM/LTM response *; RDI addition *; LOC/AIS/RDI detection *; and OAM frame send and protocol analysis of captured frame

*: Enabled with MU120131A 10/100/1000M Ethernet Module, MU120132A Gigabit Ethernet Module, MU120121A 10/100/1000M Ethernet Module, and MU120122A Gigabit Ethernet Module

• Protocol Analysis

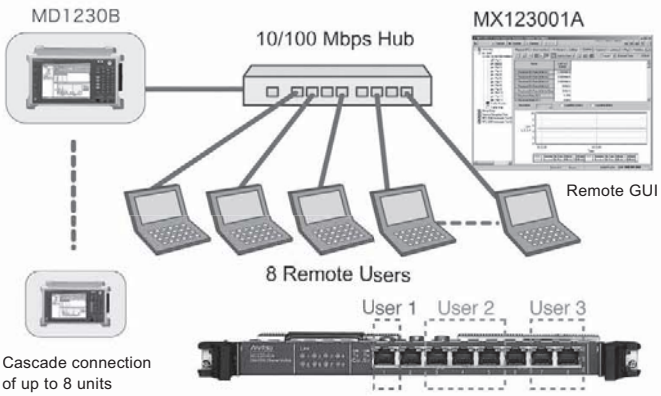
In addition to the standard protocol decoding functions, installing the Ethereal ®/Wireshark ® and Sniffer ® Technologies option [Option-04, MX123002A], supports more detailed analysis of captured data.

* 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 or MX159001B Control Software options in an external PC supports remote control of the MD1230B or MP1591A 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, while four cascade-connected MP1591A units can support 64 slots.

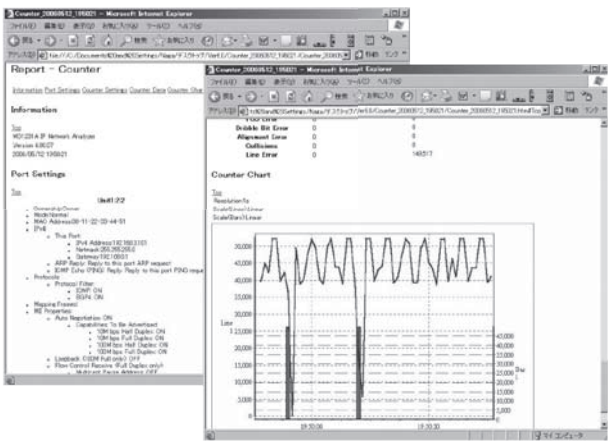


• Remote Control Command Interfaces

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-232, 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

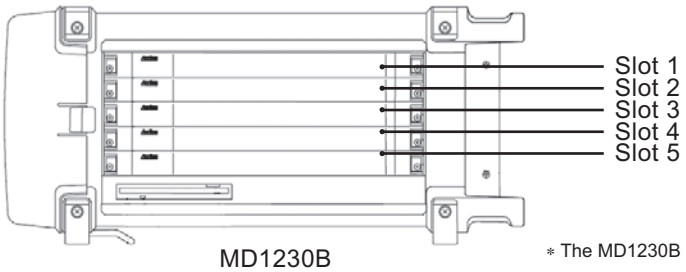
Model	MU120111A	MU120121A	MU120131A	MU120112A	MU120122A	MU120132A	MU120118B/C
Interface	10/100BASE-T	10/100/1000BASE-T		1000BASE-X, T	10/100/1000BASE-T 1000BASE-X	1000BASE-X	10GBASE-R
Ports (Connector)	8 (RJ-45)	4 (RJ-45)	12 (RJ-45)	2 (GBIC)	2 (RJ-45) 2 (SFP)	8 (SFP)	2 (XENPAK) / 1 (XENPAK)
Clock Variation		√	√ ∗1		√	√ ∗1	√ ∗2
Link Flap			√			√	
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		√ ∗8	√		√ ∗8	√	
Capture	√	√	√	√	√	√	√
Decode	√	√	√	√	√	√	√
Latency	√	√	√	√	√	√	√
Ping	√	√	√	√	√	√	√
Ping6 (Option-12)	√	√	√	√	√	√	√
Arrival Time Variation/Latency Variation	√ ∗3	√	√	√ ∗3	√	√	√ ∗3
Through Mode	√	√	√	√	√	√	√
Monitor Mode	√	√	√	√	√	√	√
Address Swap Mode	√	√	√	√	√	√	
Unframe BER Test	√	√	√	√	√	√	√ ∗4
Packet BER Test (Option-11)	√	√	√	√	√	√	√
Auto Negotiation Analysis (Option-15) ∗5				√	√	√	
Application Traffic Monitor (Option-20)		√	√	√	√	√	
Link Fault Signalling (Option-16)							√
XENPAK Test (Option-13)							√
Clock Measurement		√	√ ∗1		√	√ ∗1	
PoE (Module Option-2)			√				
PPPoE (Option-26)		√			√		
Ethernet OAM (Option-28)	√ ∗8	√	√	√ ∗8	√	√	√ ∗8
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) ∗6	√	√		√	√		√
BGP4+ (Option-19) ∗6	√	√		√	√		√
IGMPv2/IGMPv3	√	√	√	√	√	√	√
IGAP (Option-14)	√	√	√	√	√	√	√
MLD/MLDv2 (Option-12)	√	√	√	√	√	√	√
MLDA (Option-22) ∗6	√	√	√	√	√	√	√
PIM-SMv2 (Option-21) ∗7	√	√		√	√		√
MPLS (LDP/CR-LDP) (Option-08)	√	√		√	√		√
MPLS (RSVP-TE) (Option-09)	√	√		√	√		√
Other							
Traffic Impairment Emulator (Option-17) ∗8		√			√		

∗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: Supports only Arrival Time Variation Measurement
∗4: Requires XENPAK Test (Option-13)
∗5: Supports SX/LX/LH/ZX for GPIC or SX/LX/LE/LR for SFP
∗6: Requires IPv6 Expansion (Option-12)
∗7: Requires IPv6 Expansion (Option-12) when using IPv6 addresses.
∗8: Supported by ports 1 and 2. Electrical ports (10/100/1000BASE-T) for MU120121A and Optical ports (1000BASE-X) for MU120122A.
∗9: Supports OAM frame send and protocol analysis of captured frame only

Selection Guide

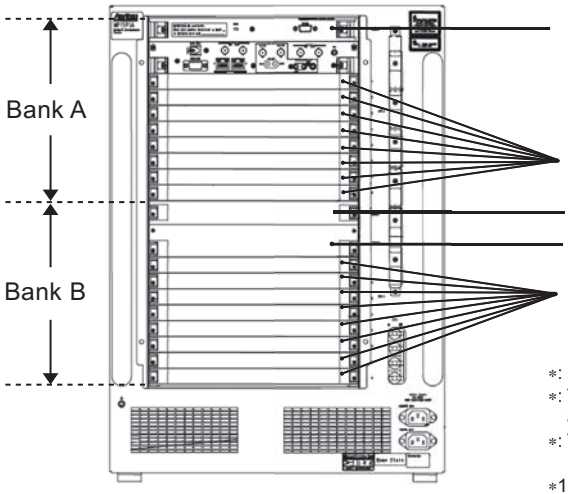
∗ Refer to the MP1590 Family Catalog for the units and options related to the MP1591A SDH/SONET/OTN/PDH/DSn and jitter functions.

Module Slots



MD1230B

∗ The MD1230B is a 5-slot model accepting up to five measurement modules.



MP1591A

∗: MP1591A control requires the MU159101A and MX159001B.
∗: The MP1591A slots are arranged in two banks (Bank A and Bank B) that can accept up to 16 measurement modules.
∗: There are restrictions on the combination of modules in the MP1591A. See the Installed Module Combination table for the possible combinations.
∗1: Dedicated slot for MU159101A Control Module when using Bank A
∗2: Dedicated slot for MU159101A Control Module when using Bank B
∗3: Dedicate slot for MU159103A Expansion Interface Module when using Bank B

Installed Module Combinations

Model/Order No.	Module Name	No. of Slots Required	No. of Ports	Mainframe			
				MD1230B		MP1591A	
				Max. No. Modules	Supported Slots	Max. No. Modules (Bank A/Bank B)	Supported Slots (Bank A/Bank B)
MU120111A	10/100M Ethernet Module	1	8	5	1-5	8	1-8
MU120112A	Gigabit Ethernet Module	1	2	5	1-5	8	1-8
MU120121A	10/100/1000M Ethernet Module	1	4	5	1-5	4	1-4
MU120122A	Gigabit Ethernet Module	1	4	5	1-5	4	1-4
MU120131A	10/100/1000M Ethernet Module	1	12	5	1-5	5	1-6
MU120132A	Gigabit Ethernet Module	1	8	5	1-5	6	1-6
MU120118B	10 Gigabit Ethernet Module	2	2	2	1-5	4(∗1)	1-8(∗2)
MU120118C	10 Gigabit Ethernet Module	2	1	2	1-5	4(∗1)	1-8(∗2)
MU159101A	Control Module	1	–	–	–	1	Dedicated Slot
MU159103A	Interface Module for Expansion Slot	1	–	–	–	1(∗3)	Dedicated Slot

∗ The restrictions on each bank of the MP1591A are as follows:
- Up to 64 ports are supported only when the MU120XXXX and MU159XXXX modules are installed.
- Up to 48 ports are supported only when the MU150XXXX and MU159XXXX module are installed. (Refer to the MP1590 Family catalog for details of the MU150XXXX module.

∗1: Up to 4 modules only when MP1591A Option-50 or -51 installed; 2 maximum when not installed
∗2: Restricted to slots 4 to 8 when MP1591A Option-50 or -51 not installed
∗3: MU159103A is for MP1591A Bank B. Not required for Bank A

Mainframe Options

Name	Model/Order No.	
	MD1230B	MP1591A
RS-232C Control	MD1230B-01	MX159001B-01
GPIB Control	MD1230B-02	MX159001B-02
Ethernet Control	MD1230B-03	MX159001B-03
Decode Module	MD1230B-04	–
Tcl Interface	MD1230B-06	–
OSPF Protocol	MD1230B-07	MU159101A-07
MPLS(LDP/CR-LDP) Protocol	MD1230B-08	MU159101A-08
MPLS(RSVP) Protocol	MD1230B-09	MU159101A-09
RFC2899 Benchmarking Test	MD1230B-10	MU159101A-10
Packet BER Test	MD1230B-11	MU159101A-11
IPv6 Expansion	MD1230B-12	MU159101A-12
XENPAK Test	MD1230B-13	MU159101A-13
IGAP Protocol	MD1230B-14	MU159101A-14
Auto Negotiation Analysis	MD1230B-15	MU159101A-15
Link Fault Signalling	MD1230B-16	MU159101A-16
Traffic Impairment Emulator	MD1230B-17	MU159101A-17
OSPFv3 Protocol *1	MD1230B-18	–
BGP4+ Protocol *1	MD1230B-19	–
Application Traffic Monitor	MD1230B-20	MU159101A-20
PIM-SMv2 Protocol *2	MD1230B-21	–
MLDA Protocol *1	MD1230B-22	–
Spanning Tree/Link Aggregation	MD1230B-23	–
PPPoE	MD1230B-26	–
Ethernet OAM	MD1230B-28	MU159101A-28
Expert Analysis Module *3	MX123002A	–

*1: Requires Option-12 IPv6 Expansion
*2: Requires Option-12 IPv6 Expansion when using IPv6 addresses
*3: Requires Option-04 Decode Module

Module Options

Name	Model/Order No.
Clock Measurement	MU120131A-01, MU120132A-01
PoE	MU120131A-02

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.

• MD1230B

Model/Order No.	Name	
	Main Frame	
MD1230B	Data Quality Analyzer	
	Standard Accessories	
J0017	Power Cord, 2.5 m: *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	
	Options	
MD1230B-01	RS-232C Control	
MD1230B-02	GPIB Control	
MD1230B-03	Ethernet Control	
MD1230B-04	MD1230B Decode Module	
MD1230B-06	Tcl Interface *12	
MD1230B-07	OSPF Protocol	
MD1230B-08	MPLS(LDP/CR-LDP) Protocol	
MD1230B-09	MPLS(RSVP) Protocol	
MD1230B-10	RFC2899 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 Signalling	
MD1230B-17	Traffic Impairment Emulator *17	
MD1230B-18	OSPFv3 Protocol *16	
MD1230B-19	BGP4+ Protocol *16	
MD1230B-20	Application Traffic Monitor	
MD1230B-21	PIM-SMv2 Protocol	
MD1230B-22	MLDA Protocol *16	
MD1230B-23	Spanning Tree/Link Aggregation	
MD1230B-26	PPPoE	
MD1230B-28	Ethernet OAM	
MU120131A-01	Clock Measurement	
MU120131A-02	PoE	
MU120132A-01	Clock Measurement	
	Software	
MX123001A	Data Quality Analyzer Control Software *12	
MX123001A-05	Data Quality Analyzer Control Software (5 licenses) *12	
MX123001A-08	Data Quality Analyzer Control Software (8 licenses) *12	
MX123001A-01	Remote Control Software for MD1230A-04 *13	
MX123001A-15	Remote Control Software for MD1230A-04 (5 licenses) *13	
MX123001A-18	Remote Control Software for MD1230A-04 (8 licenses) *13	
MX123002A	MD1230A Expert Analysis Module *15	
MX123003A	Remote Control Software for MX123002A *14	
MX123003A-05	Remote Control Software for MX123002A (5 licenses) *14	
MX123003A-08	Remote Control Software for MX123002A (8 licenses) *14	
	Software Options	
MX123001A-06	Tcl Interface *12	
MX123001A-07	RS-232C Control	
MX123001A-09	GPIB Control	
MX123001A-10	Ethernet Control	
	Optional Accessories	
G0105A	GBIC SX 850 nm *6	
G0106A	GBIC LX 1310 nm *6	
G0107A	GBIC LH 1310 nm *6	
G0108A	GBIC ZX 1550 nm *6	
G0124A	GBIC T(1000 BASE-T) *6	
G0181A	SFP SX 850 nm *7	
G0182A	SFP LX 1310 nm *7	
G0183A	SFP LE 1310 nm *7	
G0184A	SFP LR 1550 nm *7	
G0132	XENPAK(10 GBASE-SR) *8	
G0192A	XENPAK(10 GBASE-LR) *8	
G0193A	XENPAK(10 GBASE-ER) *8	
J1049A	Fixed Optical Attenuator (SC, 5 dB)	
J1049B	Fixed Optical Attenuator (SC, 10 dB)	
J1049C	Fixed Optical Attenuator (SC, 15 dB)	
MZ1221A	XAUI Extender *9	
MZ1222A	XENPAK Interface *10	
J1163A	XAUI Cable, 0.5 m	
J1164A	MDIO Cable, 0.5 m	
J0660B	Optical Fiber Cord (SM, SC-SC connector) , 2 m	
J0773B	Optical Fiber Cord (GI, SC-SC connector) , 2 m	
J1119B	Optical Fiber Cord (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 Cable (BNC-P620 • 3C-2WS • BNC-P620, 75 Ω) , 0.5 m *11	
J0775D	Coaxial Cable (BNC-P620 • 3C-2WS • BNC-P620, 75 Ω) , 2 m *11	
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 (3/4MW4U, 350D)	
B0530	Carrying Case caster for B0336C	
B0533	Carrying Case	
B0448	Soft Case	
B0593A	Blank Panel	
Z0849A	MD1230 /MP1590 Family Manual CD	
W1927AE	MD1230A/B Operation Manual	
W1928AE	MX123001A Control 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	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: GBIC modules sold as single units. Two can be mounted in MU120112A.
∗7: SFP modules sold as single units. Two can be mounted in MU120122A and eight in MU120132A.
∗8: XENPAK modules sold as single units. Two can be mounted in MU120118B and one in MU120118C. 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. G0192A and G0193A have “Only for APS” stickers attached.
∗9: 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)
∗10: MZ1222A supplied by a 1.8-V APS.
∗11: Required for synchronizing time between several units. MD1230B and MP1591A use BNC connectors; J0775B/D is required for connecting BNC connectors.
∗12: MD1230B-03 not required
∗13: Requires MD1230B-04 for main frame control. In addition, requires MX123001A for installing this software in PC.
∗14: Requires MD1230B-04 and MX123002A for main frame control. In addition, requires MX123001A and MX123001A-01 for installing this software in PC.
∗15: Requires separate MD1230B-04
∗16: Requires separate MD1230B-12
∗17: Only ports 1 and 2 of the 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.

• MP1591A

∗ There are restrictions on the combination of modules in the MP1591A. See the Installed Module Combination table for the possible combinations.

Model/Order No.	Name	
	Main Frame	
MP1591A	Network Performance Tester ∗3	
	Standard Accessories	
J1211	Shielded Power Cord, 3 m: ∗1	2 pcs
Z0917A	LAN Cable (Shielded CAT5e) , 5 m: ∗1	1 pc
J1221B	RS-232C Crossover Cable: ∗1	1 pc
Z0847A	MD1230/MP1590 Family Software CD: ∗1, ∗2	1 pc
	Plug-in Modules	
MU159101A	Control Module	
MU159103A	Interface Module for Expansion Slot	
MU120111A	10/100M Ethernet Module	
MU120112A	Gigabit Ethernet Module ∗4	
MU120118B	10 Gigabit Ethernet Module ∗5	
MU120118C	10 Gigabit Ethernet Module ∗5	
MU120121A	10/100/1000M Ethernet Module	
MU120122A	Gigabit Ethernet Module ∗6	
MU120131A	10/100/1000M Ethernet Module	
MU120132A	Gigabit Ethernet Module ∗6	
	Options	
MP1591A-50	10GbE Slot Expansion for Bank A	
MP1591A-51	10GbE Slot Expansion for Bank B	
MU159101A-07	OSPF Protocol	
MU159101A-08	MPLS(LDP/CR-LDP) Protocol	
MU159101A-09	MPLS(RSVP) Protocol	
MU159101A-10	RFC2899 Benchmarking Test	
MU159101A-11	Packet BER Test	
MU159101A-12	IPv6 Expansion	
MU159101A-13	XENPAK Test	
MU159101A-14	IGAP Protocol	
MU159101A-15	Auto Negotiation Analysis	
MU159101A-16	Link Fault Signalling	
MU159101A-17	Traffic Impairment Emulator ∗17	
MU159101A-20	Application Traffic Monitor	
MU159101A-28	Ethernet OAM	
MU120131A-01	Clock Measurement	
MU120131A-02	PoE	
MU120132A-01	Clock Measurement	
	Software	
MX159001B	Network Performance Tester Control Software	
MX159001B-05	Network Performance Tester Control Software (5 licenses)	
MX159001B-08	Network Performance Tester Control Software (8 licenses)	
	Software Options	
MX159001B-01	RS-232C Control	
MX159001B-02	GPIB Control	
MX159001B-03	Ethernet Control	
	Optional Accessories	
G0105A	GBIC SX 850 nm ∗7	
G0106A	GBIC LX 1310 nm ∗7	
G0107A	GBIC LH 1310 nm ∗7	
G0108A	GBIC ZX 1550 nm ∗7	
G0124A	GBIC T(1000 BASE-T) ∗7	
G0181A	SFP SX 850 nm ∗8	
G0182A	SFP LX 1310 nm ∗8	
G0183A	SFP LE 1310 nm ∗8	
G0184A	SFP LR 1550 nm ∗8	
G0132	XENPAK(10 GBASE-SR) ∗9	
G0192A	XENPAK(10 GBASE-LR) ∗9	
G0193A	XENPAK(10 GBASE-ER) ∗9	
J1049A	Fixed Optical Attenuator (SC, 5 dB)	
J1049B	Fixed Optical Attenuator (SC, 10 dB)	
J1049C	Fixed Optical Attenuator (SC, 15 dB)	
MZ1221A	XAUI Extender ∗10	
MZ1222A	XENPAK Interface ∗11	
J1163A	XAUI Cable, 0.5 m	
J1164A	MDIO Cable, 0.5 m	
J0660B	Optical Fiber Cord (SM, SC-SC connector) , 2 m	
J0773B	Optical Fiber Cord (GI, SC-SC connector) , 2 m	
J1119B	Optical Fiber Cord (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 Cable (BNC-P620 • 3C-2WS • BNC-P620, 75 Ω) , 0.5 m ∗12	
J0775D	Coaxial Cable (BNC-P620 • 3C-2WS • BNC-P620, 75 Ω) , 2 m ∗12	
J0845A	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	
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	
B0571A	Blank Panel ∗13	
B0572A	Blank Panel ∗14	
B0593A	Blank Panel ∗15	
B0590A	Rack Flange ∗16	
Z0849A	MD1230 /MP1590 Family Manual CD	
W2735AE	MP1591A Operation Manual	
W2421AE	MX159001B Operation SDH Edition Manual	
W2422AE	MX159001B Operation SONET Edition Manual	
W2423AE	MP1590B/MP1591A Remote Control Operation Manual	
W1928AE	MX123001A Control Software Operation Manual	
W1929AE	MD1230A Remote Control Operation Manual	
W1931AE	Ethernet Module Operation Manual	

∗1: Supplied with main frame
∗2: CD includes installer, release notes and operation manual and cannot be purchased separately
∗3: MU159101A and MX159001B required to control MP1591A.
∗4: Requires GBIC module (sold separately) . In addition, operation with non-Anritsu modules not guaranteed.
∗5: Requires XENPAK module (sold separately) . In addition, operation with non-Anritsu modules not guaranteed.
∗6: Requires SFP modules (sold separately. In addition, operation with non-Anritsu modules not guaranteed.
∗7: GBIC modules are sold as single units. Two can be mounted in MU120112A.
∗8: SFP modules are sold as single units. Two can be mounted in MU120122A and eight in MU120132A.
∗9: XENPAK modules sold as single units. Two can be mounted in MU120118B and one in MU120118C.
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. G0192A and G0193A have “Only for APS” stickers attached.
∗10: 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)
∗11: MZ1222A supplied by a 1.8-V APS.
∗12: Required for synchronizing time between several units. MD1230B and MP1591A use
BNC connectors; J0775B/D is required for connecting BNC connectors.
∗13: Blanking panel for MP1591A CPU slot
∗14: Blanking panel for MP1591A DCS slot
∗15: Blanking panel for MP1591A Slot 1 to Slot 16
∗16: Rack-mount kit for MP1591A
∗17: Only ports 1 and 2 of the the MU120121A/122A support the MU159101A-17 Traffic Impairment Emulator option. Moreover, only MU120121A/122A models shipped after March 7, 2008 with the "Supports Opt.17" sticker support the option.

Other

• Software Upgrade Service

Model/Order No.	Name
	Software Upgrade Service
MD1230B-40	Annual Software Upgrade Service
MP1591A-40	Annual Software Upgrade Service

∗ Option for latest version of the MD1230 Family's modules and software.
MD1230B-40 must be purchased separately to use software upgrade service in second year following bundled free 1-year period from MD1230B purchase.
MP1591A-40 must be purchased separately to use software upgrade service for the first year. (MP1591A-40 not bundled free with MP1591A.)
Available for 1-year periods only and no combinations of several multi-year contracts.

• 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, MP1591A-ES210, MU120111A-ES210, MU120112A-ES210, MU120118B-ES210, MU120118C-ES210, MU120121A-ES210, MU120122A-ES210, MU120131A-ES210, MU120132A-ES210, MU159101A-ES210, MU159103A-ES210

***-ES310 : MD1230B-ES310, MP1591A-ES310, MU120111A-ES310, MU120112A-ES310, MU120118B-ES310, MU120118C-ES310, MU120121A-ES310, MU120122A-ES310, MU120131A-ES310, MU120132A-ES310, MU159101A-ES310, MU159103A-ES310

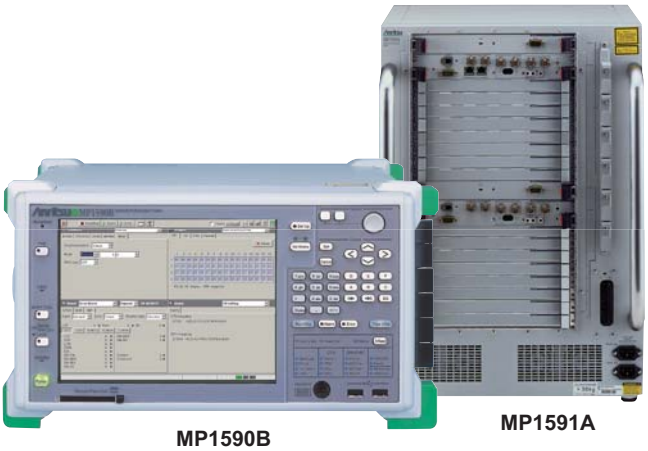
***-ES510 : MD1230B-ES510, MP1591A-ES510, MU120111A-ES510, MU120112A-ES510, MU120118B-ES510, MU120118C-ES510, MU120121A-ES510, MU120122A-ES510, MU120131A-ES510, MU120132A-ES510, MU159101A-ES510, MU159103A-ES510

MP1590B Network Performance Tester
MP1591A Network Performance Tester

MP1590 Family

CE GPIB OPTION Ethernet OPTION

All-In-One Next-Generation Network Testing
SDH/SONET/OTN/PDH/DSn/Jitter/EoS/Ethernet/IP Analyzer



MP1590B MP1591A

For detail and specification, refer to the data sheet.

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, Anritsu's MP1590 family supports performance, jitter, and EOS measurements of networks, equipment and devices with SDH/SONET/OTN/PDH/DSn interfaces. The MD1590 family 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.

Features

- An all-in-one instrument for measuring SDH/SONET/OTN/PDH/DSn/Jitter performance
- Supports EoS (VCAT, LCAS, Differential Delay) measurements
- Supports 10/100/1000M, Gigabit, and 10 Gigabit Ethernet measurements
- One unit (MP1591A) supports measurement of up to 128 Ethernet ports

MP1590 Family Main Frame

There are two models in the family: the compact and portable MP1590B with integrated screen, and the highly expandable rack-mounted MP1591A with remotely-controlled operation using an external PC.

MP1590B

6-slot Integrated screen model
Built-in Windows® XP operating system
Dimensions: 320 (W) x 177 (H) x 350 (D) mm
Mass: 13 kg max. (excl. options and units)

MP1591A

Rack-mount 16-slot model
Controlled by external PC
Supports Windows® XP and Windows® 2000 operating systems
Dimensions: 426 (W) x 596 (H) x 350 (D) mm
Mass: 28 kg max. (excl. options and units)

*: Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

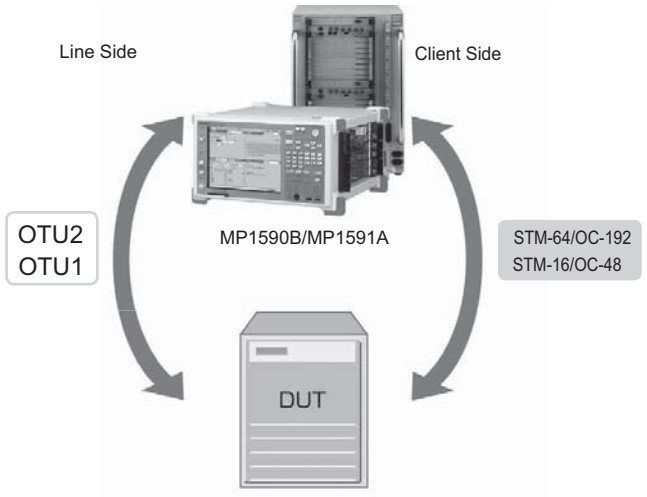
Main Applications
SDH/SONET/OTN/PDH/DSn Performance Measurements

The MP1590B and MP1591A support ITU-T and Telcordia compliance tests of 1.5M to 10.7G SDH/SONET/OTN/PDH/DSn equipment. The following functions can be used to evaluate the performance of networks, equipment, and devices supporting these standards:

- 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

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/MP1591A 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.



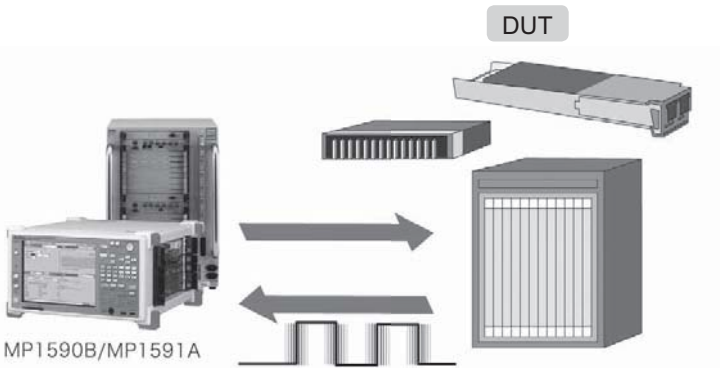
SDH/SONET/OTN Jitter Measurements

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 and MP1591A support 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 and MP1591A support optical, electrical and electrical differential (10G band only) interfaces, network equipment jitter as well as device and optical module jitter can be measured. In the 10G band, jitter measurement of 10.3 Gbit/s transfers used by 10G Ethernet can be measured.

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/MP1591A.



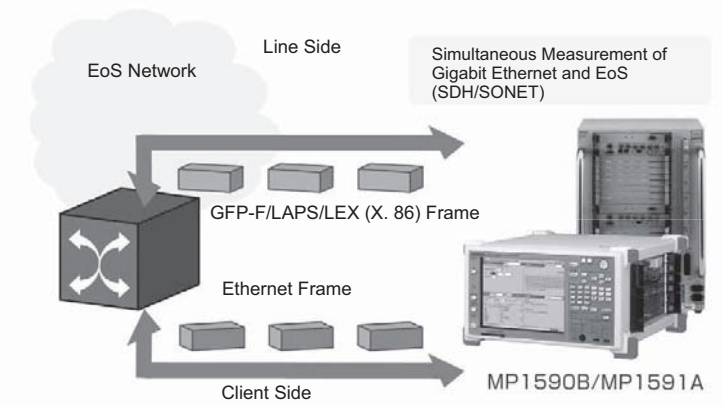
When required, a high-accuracy jitter measurement option can be installed in the MP1590B/MP1591A to perform high-accuracy and high-repeatability measurements with calibration based on Appendix VIII of the April 2005 ITU-T O.172 standard. But even without this option, jitter measurement is still in full compliance with the April 2005 ITU-T O.172 standards.

∗: The high-accuracy jitter measurement option can be added to the main frame before delivery. But it cannot be added after.

EoS (Ethernet over SDH/SONET) Measurements

The MP1590B and MP1591A support the following measurements for next-generation SDH/SONET:

- 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/MP1591A 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.

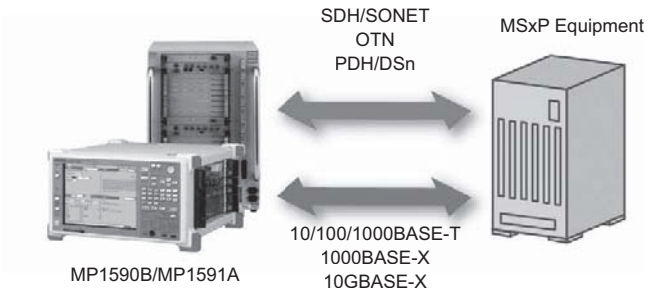
Load Tests
- Stream Generation
- Variable Tx Clock Offset

Traffic Measurement
- Various Counters
- Packet Jitter/Latency
- Through Mode
- Frequency Measurement

Packet Analysis
- Packet Capture/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 and MP1591A support 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 MSxP equipment used in combination with SDH/SONET/OTN/PDH/DSn plug-in modules.
By taking advantage of the Ethernet module functions listed on the right, they can also be used as genuine IP testers for Ethernet interfaces. See the MD1230 family catalog for the individual Ethernet module specifications.

The MP1590B/MP1591A support 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/Decode

Auto-measurement
- RFC2544/RFC2889 Auto-measurement

Ethernet Unit Functions

Model	MU120111A	MU120121A	MU120131A	MU120112A	MU120122A	MU120132A	MU120118B/C
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)
Clock Variation		√	√ *1		√	√ *1	√ *2
Link Flap			√			√	
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		√ *6	√		√ *6	√	
Capture	√	√	√	√	√	√	√
Decode	√	√	√	√	√	√	√
Latency	√	√	√	√	√	√	√
Ping	√	√	√	√	√	√	√
Ping6 (Option-12)	√	√	√	√	√	√	√
Arrival Time Variation/Latency Variation	√ *3	√	√	√ *3	√	√	√ *3
Through Mode	√	√	√	√	√	√	√
Monitor Mode	√	√	√	√	√	√	√
Address Swap Mode	√	√	√	√	√	√	
Unframe BER Test	√	√	√	√	√	√	√ *4
Packet BER Test (Option-11)	√	√	√	√	√	√	√
Auto Negotiation Analysis (Option-15) *5				√	√	√	
Application Traffic Monitor (Option-20)		√	√	√	√	√	
Link Fault Signalling (Option-16)							√
XENPAK Test (Option-13)							√
Clock Measurement		√	√ *1		√	√ *1	
PoE (Module Option-02)			√				
Ethernet OAM (Option-28)	√ *7	√	√	√ *7	√	√	√ *7
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) *6		√			√		

*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: Supports only Arrival Time Variation Measurement
*4: Requires XENPAK Test (Option-13)
*5: Supports SX/LX/LH/ZX for GPIC or SX/LX/LE/LR for SFP
*6: Supported by ports 1 and 2. Electrical ports (10/100/1000BASE-T) for MU120121A and optical ports (1000BASE-X) for MU120122A.
*7: Supports OAM frame send and protocol analysis of captured frame only

SDH/SONET/OTN/PDH/DSn/Jitter/EoS Interface List

Typical Configuration				For SDH/SONET/OTN/ PDH/DSn Performance Measurement		For SDH/SONET/OTN/Jitter Measurement				For EoS Measurement	For Ethernet Measurement
Model/Slot Position	MP1591A	MP1590B	Slot1	MU150100A	MU150100A	MU150100A	MU150100A	MU150100A	MU150101A	MU150101A	Blank
			Slot2								Blank
			Slot3	MU150135A	Blank	MU150121A	MU150121B	MU150121B	Blank	Blank	Blank
			Slot4	Blank	Blank	MU150123A	MU150123B	MU150124B	Blank	Blank	Blank
			Slot5	Blank	Blank	MU150125A	MU150125A	MU150125A	MU150125A	Blank	Blank
			Slot6	Blank	Blank					Blank	Blank
			Slot7	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank
			Slot8	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank

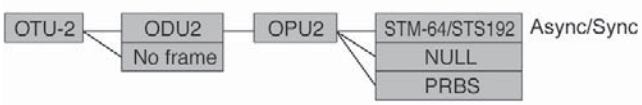
Item	Bit Rate		Interface								
Performance Measurement	PDH/DSn	1.5 to 139 Mbit/s	Electrcal	√	√	√	√	√	√	√	
	SDH/ SONET	52 to156 Mbit/s	Electrcal• Optical	√	√	√	√	√	√	√	
		622 to 2488 Mbit/s	Optical	√	√	√	√	√	√	√	
		9953 Mbit/s	Electrcal	√	√	√	√	√			
			Electrcal differential				√	√			
			Optical	√		√	√	√			
	OTN	2666 Mbit/s	Optical	√ *2	√ *2	√ *2	√ *2	√ *2	√ *2	√ *2	
		10.7 Gbit/s	Electrcal	√ *2	√ *2	√ *2	√ *2	√ *2			
			Optical	√ *2		√ *2	√ *2	√ *2			
	Others	10.3 Gbit/s	Electrcal	√ *1	√ *1	√ *2	√ *2	√ *2			
			Electrcal differential				√ *2	√ *2			
			Optical	√ *1		√ *2	√ *2	√ *2			
	Ethernet	10 Mbit/s to 10 Gbit/s	Electrcal• Optical	√ *3	√ *3	√ *3	√ *3	√ *3	√ *3	√ *3	√ *3
	EoS	156 to 2488 Mbit/s	Optical						√ *2	√ *2	
Jitter Measurement	PDH/DSn	1.5 to 139 Mbit/s	Electrcal								
	SDH/ SONET	52 Mbit/s	Electrcal			√	√	√	√		
		156 Mbit/s	Electrcal• Optical			√	√	√	√		
		622 to 2488 Mbit/s	Optical			√	√	√	√		
		9953 Mbit/s	Electrcal			√	√				
			Electrcal differential				√				
			Optical			√	√				
	OTN	2666 Mbit/s	Optical			√ *2	√ *2	√ *2	√ *2		
		10.7 Gbit/s	Electrcal			√ *2	√ *2				
			Optical			√ *2	√ *2				
	Others	10.3 Gbit/s	Electrcal					√ *2			
			Electrcal differential					√ *2			
			Optical					√ *2			

∗1: Requires addition of separate option and another external clock source
∗2: Requires addition of separate option
∗3: Supports installation of Ethernet units in blank slots but with restrictions on position and number. See the Selection guide for more details.

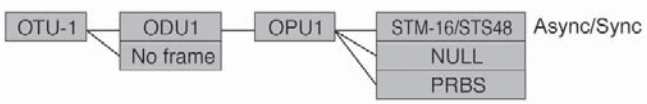
Supported Mappings

• OTN Mappings

OTU-2 (10.71 Gbit/s) Mapping structure

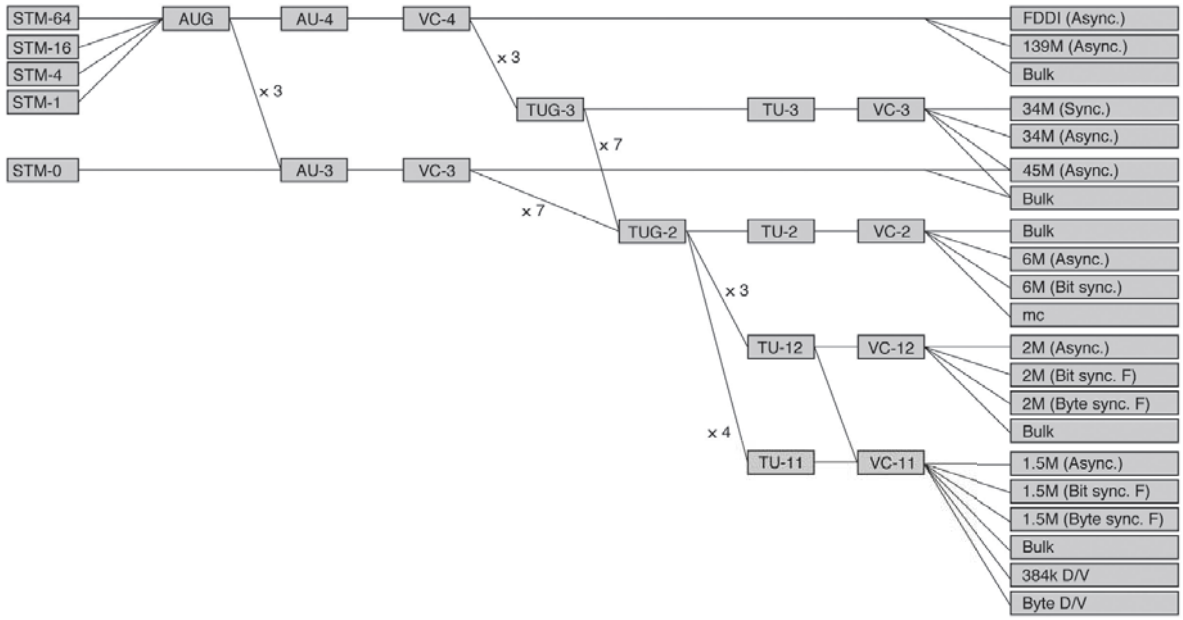


OTU-1 (2.66 Gbit/s) Mapping structure

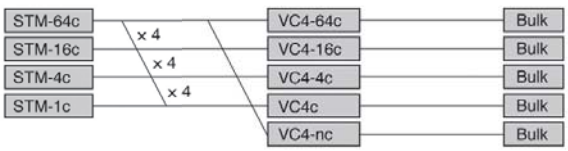


• **SDH Mapping**

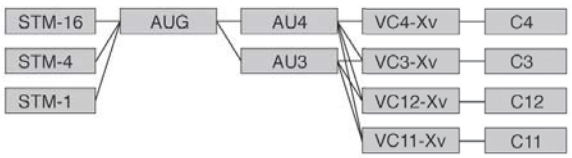
SDH Mapping structure



SDH Concatenation mapping structure

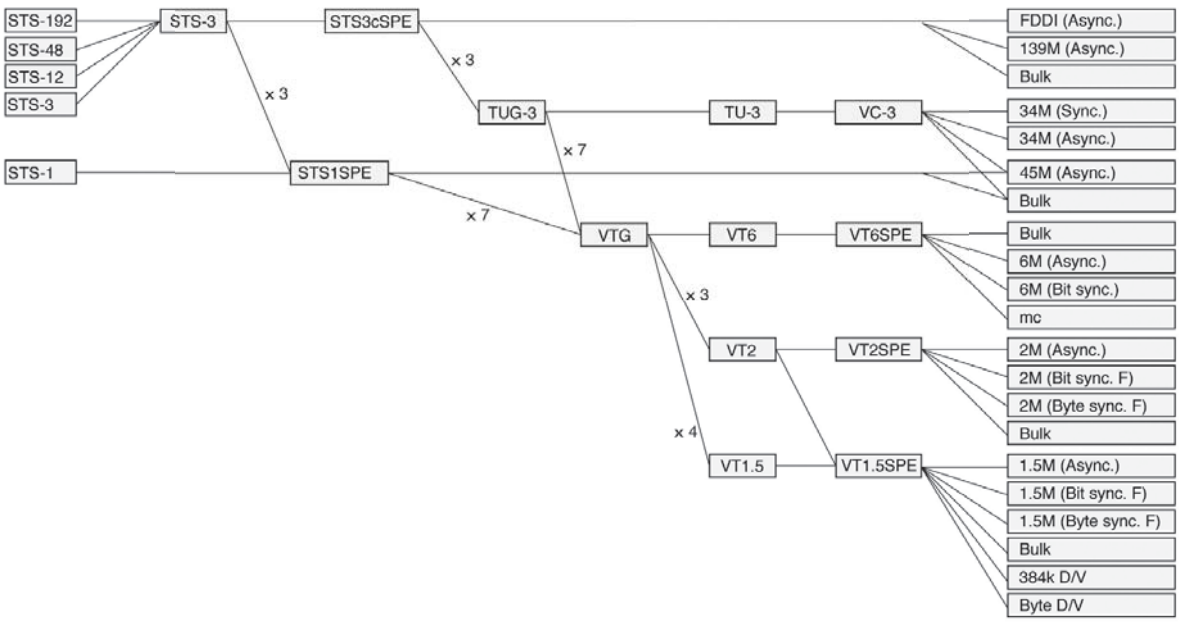


SDH Virtual concatenation mapping structure



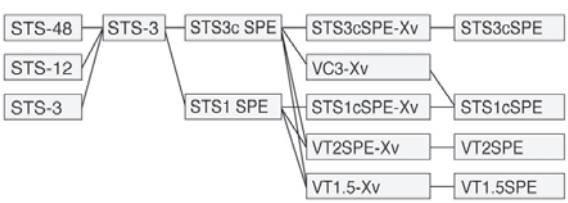
• **SONET Mapping**

SONET Mapping structure



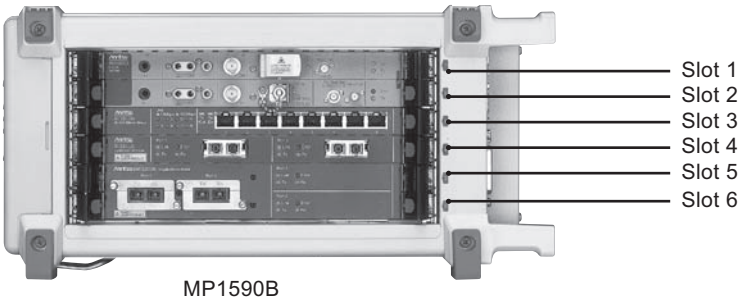
SONET Concatenation mapping structure

SONET Virtual concatenation mapping structure

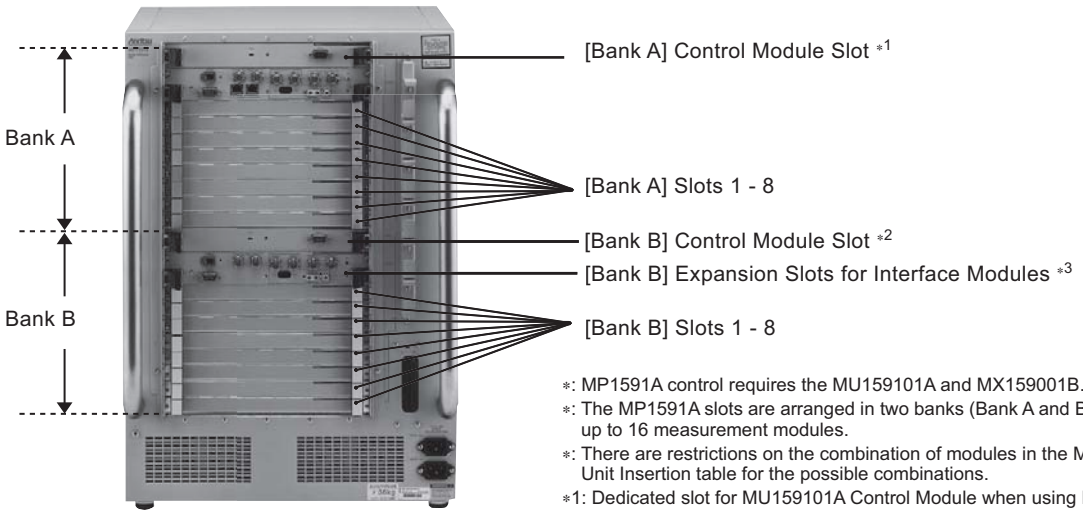


Selection Guide

Unit Insertion Positions



MP1590B



MP1591A

*: MP1591A control requires the MU159101A and MX159001B.
*: The MP1591A slots are arranged in two banks (Bank A and Bank B) that can accept up to 16 measurement modules.
*: There are restrictions on the combination of modules in the MP1591A. See the Plug-in Unit Insertion table for the possible combinations.
*1: Dedicated slot for MU159101A Control Module when using Bank A
*2: Dedicated slot for MU159101A Control Module when using Bank B
*3: Dedicate slot for MU159103A Expansion Interface Module when using Bank B

Plug-in Unit Insertion Table

Model/Order No.	Module Name	No. of Slots Required	No. of Ports	Mainframe				Current Consumption (A)*5
				MP1590B		MP1591A		
				Max. No. Modules	Supported Slots	Max. No. Modules (Bank A/Bank B)*1	Supported Slots (Bank A/Bank B)	
MU120111A	10/100M Ethernet Module	1	8	4	3-6	8	1-8	5.5
MU120112A	Gigabit Ethernet Module	1	2	4	3-6	8	1-8	5.5
MU120121A	10/100/1000M Ethernet Module	1	4	2	3-6	4	1-4	19
MU120122A	Gigabit Ethernet Module	1	4	2	3-6	4	1-4	19
MU120131A	10/100/1000M Ethernet Module	1	12	2	3-6	5	1-6	15
MU120132A	Gigabit Ethernet Module	1	8	2	3-6	6	1-6	13
MU120118B	10 Gigabit Ethernet Module	2	2	1	4-6	4*2	1-8*3	19
MU120118C	10 Gigabit Ethernet Module	2	1	1	4-6	4*2	1-8*3	10
MU150100A	10/10.7G Unit	2	–	1	1-2	1	1-2	12
MU150101A	2.5/2.6G EoS Unit	2		1	1-2	1	1-2	7
MU150121A	10/10.7G Optical Unit (Tx)	1		1	3	1	3	0.5
MU150121B	10/10.7G Optical/Electrical Unit (Tx)	1		1	3	1	3	0.5
MU150123A	10/10.7G Optical Unit (Rx Wide)	1		1	4	1	4	0.5
MU150123B	10/10.7G Optical/Electrical Unit (Rx Wide)	1		1	4	1	4	0.5
MU150124B	10.3G Optical/Electrical Unit (Rx Wide)	1		1	4	1	4	0.5
MU150135A	10/10.7G Optical Unit(XFP)	1		1	3	1	3	0.4
MU150125A	10/10.7G Jitter Unit	2		1	5-6	1	5-6	2
MU159101A	Control Module	1		–	–	1	Dedicated Slot	–
MU159103A	Interface Module for Expansion Slot	1		–	–	1*4	Dedicated Slot	–

*1: There are limits on each bank for the MP1591A as follows:
- Only inserted MU120XXXX and MU159XXXX units support configuration up to 64 ports.
- Only inserted MU150XXXX and MU159XXXX units support configurations up to 48 ports.

*2: Value when MP1591A Option-50 and -51installed. Up to 2 units when not installed.
*3: Limited to slots 4 to 8 when MP1591A Option-50 and 51 not installed.
*4: Only inserted in Bank B of MP1591A. Not required for Bank A.
*5: Ensure that the total current consumption for all plug-in units inserted in the MP1590B does not exceed 38 A.

Mainframe Options

Name	Model/Order No.	
	MP1590B	MP1591A
RS-232C Control	MP1590B-01	MX159001B-01
GPIB Control	MP1590B-02	MX159001B-02
Ethernet Control	MP1590B-03	MX159001B-03
OSPF Protocol	MP1590B-07	MU159101A-07
MPLS(LDP/CR-LDP) Protocol	MP1590B-08	MU159101A-08
MPLS(RSVP) Protocol	MP1590B-09	MU159101A-09
RFC2899 Benchmarking Test	MP1590B-10	MU159101A-10
Packet BER Test	MP1590B-11	MU159101A-11
IPv6 Expansion	MP1590B-12	MU159101A-12
XENPAK Test	MP1590B-13	MU159101A-13
IGAP Protocol	MP1590B-14	MU159101A-14
Auto Negotiation Analysis	MP1590B-15	MU159101A-15
Link Fault Signalling	MP1590B-16	MU159101A-16
Traffic Impairment Emulator	MP1590B-17	MU159101A-17
Application Traffic Monitor	MP1590B-20	MU159101A-20
Ethernet OAM	MP1590B-28	MU159101A-28
High Precision Jitter Analysis	MP1590B-30	MU159101A-30
10GbE Slot Expansion for Bank A	–	MP1591A-50
10GbE Slot Expansion for Bank B	–	MP1591A-51

Plug-in Unit Options

	Model/Order No.	Name	MU120131A	MU120132A	MU150100A	MU150101A	MU150121A/21B	MU150123A/23B	MU150124B	MU150135A	MU150125A
Ethernet Unit	MU120131A/32A-01	Clock Measurement	√	√							
	MU120131A-02	PoE	√								
SDH/SONET/OTN/PDH/ DSn/Jitter/EoS Unit	MU150100A/01A/21A/21B-01	Wave length 1.31 μm			√	√	√				
	MU150100A/01A/21A/21B-02	Wave length 1.55 μm			√	√	√				
	MU150100A/01A/21A/21B-03	Wave length 1.31/1.55 μm			√	√	√				
	MU150100A/01A/21A/21B-04	Optical Output Power Adjustable			√	√	√				
	MU150100A/25A-05	OTU1/OTU2			√						√
	MU150101A-05	OTU1				√					
	MU150123A/23B-05	OTU2						√			
	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									√
	MU150100A-07	10/10.7G Minus Option			√						
	MU150100A-08, MU150125A-06	10.3G			√						√
	MU150100A-09	Insert/Extract			√						
	MU150100A/01A/21A/21B/23A/23B/24B-38	ST Connector			√	√	√	√	√		
	MU150100A/01A/21A/21B/23A/23B/24B-39	DIN Connector			√	√	√	√	√		
	MU150100A/01A/21A/21B/23A/23B/24B-40	SC Connector			√	√	√	√	√		
	MU150100A/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.

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.

• MP1590B

Model/Order No.	Name	
	Main Frame	
MP1590B	Network Performance Tester	
	Standard Accessories	
J0491	Shield Power Cord, 2.6 m *1	1 pc
F0105	Fuse, 10 A*1	2 pcs
E0010	Side Cover*1	1 pc
B0329G	Front Cover (for 3/4MW4U) *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	1pc
J0747C	Fixed Optical Attenuator (15 dB, FC connector)*6	1 pc
J1003N	Semi-rigid Cable (136.6 mm) *7	2 pcs
J1003P	Semi-rigid Cable (96 mm) *7	1 pc
J1003Q	Semi-rigid Cable (75 .6 mm) *8, *9	1pc/2 pcs
J1003R	Semi-rigid Cable (55 .3 mm) *7	1 pc
J1003S	Semi-rigid Cable (56 .5 mm) *6	1 pc
J1003T	Semi-rigid Cable (67 mm) *10	2 pcs
J1383A	Semi-rigid Cable (105 .7 mm) *11	1 pc
J1384A	Semi-rigid Cablev (90 mm) *11	1 pc
J0500A	Semi-rigid Cable 50 cm *10	1 pc
J0994	Terminator (50 Ω) *10	1 pc
	Plug-in Units	
MU150100A	10/10.7G Unit *12	
MU150101A	2.5/2.6G Eos Unit *12	
MU150121A	10/10.7G Optical Unit (Tx) *12	
MU150121B	10/10.7G Optical/Electrical Unit (Tx) *12	
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	
MU150135A	10/10.7G Optical Unit (XFP) *13	
MU120111A	10/100M Ethernet Module *31	
MU120112A	Gigabit Ethernet Module *14, *31	
MU120118B	10 Gigabit Ethernet Module *15, *31	
MU120118C	10 Gigabit Ethernet Module *15, *31	
MU120121A	10/100/1000M Ethernet Module *31	
MU120122A	Gigabit Ethernet Module *16, *31	
MU120131A	10/100/1000M Ethernet Module *31	
MU120132A	Gigabit Ethernet Module *16, *31	
	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 Signalling	
MP1590B-17	Traffic Impairment Emulator *32	
MP1590B-20	Application Traffic Monitor	
MP1590B-28	Ethernet OAM	
MP1590B-30	High Precision Jitter Analysis *20	
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*17	
MU150100A-08	10.3G	
MU150100A-09	Insert/Extract*17	
MU150100A-38	ST Connector*18	
MU150100A-39	DIN Connector*18	
MU150100A-40	SC Connector*18	
MU150100A-43	HMS-10/A Connector*18	
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*19	
MU150101A-38	ST Connector*18	
MU150101A-39	DIN Connector*18	
MU150101A-40	SC Connector*18	
MU150101A-43	HMS-10/A Connector*18	
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*18	
MU150121A-39	DIN Connector*18	
MU150121A-40	SC Connector*18	
MU150121A-43	HMS-10/A Connector*18	
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*18	
MU150121B-39	DIN Connector*18	
MU150121B-40	SC Connector*18	
MU150121B-43	HMS-10/A Connector*18	
MU150123A-05	OTU2	
MU150123A-38	ST Connector*18	
MU150123A-39	DIN Connector*18	
MU150123A-40	SC Connector*18	
MU150123A-43	HMS-10/A Connector*18	
MU150123B-05	OTU2	
MU150123B-38	ST Connector*18	
MU150123B-39	DIN Connector*18	
MU150123B-40	SC Connector*18	
MU150123B-43	HMS-10/A Connector*18	
MU150124B-38	ST Connector*18	
MU150124B-39	DIN Connector*18	
MU150124B-40	SC Connector*18	
MU150124B-43	HMS-10/A Connector*18	
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	
	Software	
MX159001B	Network Performance Tester Control Software*21	
MX159001B-05	Network Performance Tester Control Software (5 licenses)	
MX159001B-08	Network Performance Tester Control Software (8 licenses)	
	Software Options	
MX159001B-01	RS-232C Control	
MX159001B-02	GPIB Control	
MX159001B-03	Ethernet Control	
	Optional Accessories	
G0105A	GBIC SX 850 nm*22	

Model/Order No.	Name
G0106A	GBIC LX 1310 nm*22
G0107A	GBIC LH 1310 nm*22
G0108A	GBIC ZX 1550 nm*22
G0124A	GBIC T (1000 BASE-T)*22
G0181A	SFP SX 850 nm*23
G0182A	SFP LX 1310 nm*23
G0183A	SFP LE 1310 nm*23
G0184A	SFP LR 1550 nm*23
G0132	XENPAK (10 GBASE-SR)*24
G0192A	XENPAK (10 GBASE-LR)*24
G0193A	XENPAK (10 GBASE-ER)*24
G0194A	1310nm XFP Module*25
G0195A	1550nm XFP Module*25
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)
J0617B	Replaceable Optical Connector (FC-PC)
J0747B	Fixed Optical Attenuator (10dB, FC Connector)
J0747C	Fixed Optical Attenuator (15dB, FC Connector)
J0747D	Fixed Optical Attenuator (20dB, FC Connector)
J1049A	Fixed Optical Attenuator (SC, 5 dB)
J1049B	Fixed Optical Attenuator (SC, 10 dB)
J1049C	Fixed Optical Attenuator (SC, 15 dB)
J1376A	Fixed Optical Attenuator (5 dB, LC connector)
MZ1221A	XAUI Extender*26
MZ1222A	XENPAK Interface*27
J1163A	XAUI Cable, 0 .5 m
J1164A	MDIO Cable, 0 .5 m
J0635A	Optical Fiber Cable (SM, FC-SPC connector both ends), 1 m
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 Cord (SM, SC-SC connector), 2 m
J0773B	Optical Fiber Cord (GI, SC-SC connector), 2 m
J1344A	Optical Fiber Cord (Simplex, SM, LC-LC connector), 1 m
J1327B	Optical Fiber Cord (Simplex, SM, LC-LC connector), 2 m
J1119B	Optical Fiber Cord (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	Optical Fiber Cord (Simplex, SM, LC-FC connector), 1 m
J1003N	Semi-rigid Cable (136.6 mm)
J1003P	Semi-rigid Cable (96 mm)
J1003Q	Semi-rigid Cable (75 .6 mm)
J1003R	Semi-rigid Cable (55 .3 mm)
J1003S	Semi-rigid Cable (56 .5 mm)
J0776D	Coaxial Cable (BNC-P-3W · 3D-2W · BNC-P-3W, 50 Ω), 2 m
J0322B	Coaxial Cable (11SMA · SUCOFLEX104 · 11SMA), 1 m
J0696A	Coaxial Cable (AA-165-500), 0.5 m
J1268	Semiflexible Coaxial Cable
J1349A	Coaxial Cable, 0.3 m
J1173	6020180 Power Divider
J0845A	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
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	1310nm XFP Kit*28
Z0990A	1550nm XFP Kit*29
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)
B0336C	Carrying Case (3/4MW4U, 350D)
B0530	Carrying Case caster for B0336C
B0448	Soft Case
B0593A	Blank Panel
B0588A	Rack Mount Kit*30
Z0849A	MD1230 /MP1590 Family Manual CD
W2420AE	MP1590 B 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	Ethernet Module Operation Manual
W2424AE	MU150100A Specifications Operation Manual
W2425AE	MU150101A Specifications Operation Manual
W2426AE	MU150125A Specifications Operation Manual
W2427AE	MU150121/2/3/34A Specifications Operation Manual
W2589AE	MU150121B/123B Specifications Operation Manual
W2590AE	MU150124B Specifications Operation Manual
W2870AE	MU150135A Operation Manual

∗1: Supplied with main frame.
∗2: CD includes installer, release notes and operation manual.
∗3: Supplied with MU150100A, MU150101A, MU150121A/B, MU150123A/B, and MU150124B.
∗4: Two pieces of MU150100A, and MU150101A.
∗5: Supplied with MU150123A/B, and MU150124A.
∗6: Supplied with MU150100A, and 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 MU150121B.
∗11: Supplied with MU150135A.
∗12: One of Option-01, 02, 03 required.
∗13: Requires XFP module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
∗14: Requires GBIC module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
∗15: Requires XENPAK module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
∗16: Requires SFP modules (sold separately. In addition, operation with non-Anritsu modules not guaranteed.
∗17: MU150100A-07 factory installed only. MU150100A-07 and MU150100A-09 cannot both be installed simultaneously.
∗18: Exchangeable.
∗19: Requires one of MU150101A-11 or MU150101A-12.
∗20: MP1590B-30 option can be added to the main frame before delivery. But it cannot be added after.
∗21: MP1590B-03 not required.
∗22: GBIC modules sold as single units. Two can be mounted in MU120112A.
∗23: SFP modules sold as single units. Two can be mounted in MU120122A and eight in MU120132A.
∗24: XENPAK modules sold as single units. Two can be mounted in MU120118B and one in MU120118C. 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. G0192A and G0193A have "Only for APS" stickers attached.
∗25: XFP modules sold as single units. One can be mounted in MU150135A.
∗26: 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)
∗27: MZ1222A supplied by 1.8-V APS.
∗28: G0194A and J1344A included in Z0989A.
∗29: G0195A, J1344A, and J1376A included in Z0990A.
∗30: Rackmount Kit for MP1590B.
∗31: Order additional J1349A when Ethernet unit is installed simultaneously in SDH/SONET/OTN/PDH/DSn unit and jitter unit configurations.
∗32: 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.

• MP1591A

Model/Order No.	Name	
	Main Frame	
MP1591A	Network Performance Tester*1	
	Standard Accessories	
J1211	Shielded Power Cord, 3 m*2	2 pcs
Z0917A	LAN Cable (Shielded CAT5e), 5 m *2	1 pc
J1221B	RS-232C Crossover Cable*2	1 pc
Z0847A	MD1230/MP1590 Family Software CD*2, *3	1 pc
J0617B	Replaceable Optical Connector (FC-PC)*4, *5	1 pc/2 pcs
J0747B	Fixed Optical Attenuator (10 dB, FC connector)*6	1 pc
J0747C	Fixed Optical Attenuator (15 dB, FC connector)*7	1 pc
J1003N	Semi-rigid Cable (136.6 mm)*8	2 pc
J1003P	Semi-rigid Cable (96 mm)*8	1 pc
J1003Q	Semi-rigid Cable (75 .6 mm)*9, *10	1 pc/2 pcs
J1003R	Semi-rigid Cable (55 .3 mm)*11	1 pc
J1003S	Semi-rigid Cable (56 .5 mm)*7	1 pc
J1003T	Semi-rigid Cable (67 mm)*11	2 pcs
J1383A	Semi-rigid Cable (105 .7 mm)*12	1 pc
J1384A	Semi-rigid Cable (90 mm)*12	1 pc
J0500A	Semi-rigid Cable 50 cm*11	1 pc
J0994	Terminator (50 Ω)*11	1 pc
J0775B	Coaxial Cable (BNC-P620 • 3C-2WS • BNC-P620, 75 Ω), 0.5 m*13	1 pc
	Plug-in Units	
MU159101A	Control Module	
MU159103A	Interface Module for Expansion Slot	
MU150100A	10/10.7G Unit*14	
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	
MU150135A	10/10.7G Optical Unit(XFP)*15	
MU120111A	10/100M Ethernet Module*37	
MU120112A	Gigabit Ethernet Module*16, *37	
MU120118B	10 Gigabit Ethernet Module*17, *37	
MU120118C	10 Gigabit Ethernet Module*17, *37	
MU120121A	10/100/1000M Ethernet Module*37	
MU120122A	Gigabit Ethernet Module*18, *37	
MU120131A	10/100/1000M Ethernet Module*37	
MU120132A	Gigabit Ethernet Module*18, *37	
	Options	
MP1591A-50	10GbE Slot Expansion for Bank A	
MP1591A-51	10GbE Slot Expansion for Bank B	
MU159101A-07	OSPF Protocol	
MU159101A-08	MPLS(LDP/CR-LDP) Protocol	
MU159101A-09	MPLS(RSVP) Protocol	
MU159101A-10	RFC2899 Benchmarking Test	
MU159101A-11	Packet BER Test	
MU159101A-12	IPv6 Expansion	
MU159101A-13	XENPAK Test	
MU159101A-14	IGAP Protocol	
MU159101A-15	Auto Negotiation Analysis	
MU159101A-16	Link Fault Signalling	
MU159101A-17	Traffic Impairment Emulator*38	
MU159101A-20	Application Traffic Monitor	
MU159101A-28	Ethernet OAM	
MU159101A-30	High Precision Jitter Analysis*22	
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*19	
MU150100A-08	10.3G	
MU150100A-09	Insert/Extract*19	
MU150100A-38	ST Connector*20	
MU150100A-39	DIN Connector*20	
MU150100A-40	SC Connector*20	
MU150100A-43	HMS-10/A Connector*20	
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*21	
MU150101A-38	ST Connector*20	
MU150101A-39	DIN Connector*20	
MU150101A-40	SC Connector*20	
MU150101A-43	HMS-10/A Connector*20	
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*20	
MU150121A-39	DIN Connector*20	
MU150121A-40	SC Connector*20	
MU150121A-43	HMS-10/A Connector*20	
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*20	
MU150121B-39	DIN Connector*20	
MU150121B-40	SC Connector*20	
MU150121B-43	HMS-10/A Connector*20	
MU150123A-05	OTU2	
MU150123A-38	ST Connector*20	
MU150123A-39	DIN Connector*20	
MU150123A-40	SC Connector*20	
MU150123A-43	HMS-10/A Connector*20	
MU150123B-05	OTU2	
MU150123B-38	ST Connector*20	
MU150123B-39	DIN Connector*20	
MU150123B-40	SC Connector*20	
MU150123B-43	HMS-10/A Connector*20	
MU150124B-38	ST Connector*20	
MU150124B-39	DIN Connector*20	
MU150124B-40	SC Connector*20	
MU150124B-43	HMS-10/A Connector*20	
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	
	Software	
MX159001B	Network Performance Tester Control Software*23	
MX159001B-05	Network Performance Tester Control Software (5 licenses)	
MX159001B-08	Network Performance Tester Control Software (8 licenses)	
	Software Options	
MX159001B-01	RS-232C Control	
MX159001B-02	GPIB Control	
MX159001B-03	Ethernet Control	
	Optional Accessories	
G0105A	GBIC SX 850nm*24	
G0106A	GBIC LX 1310nm*24	
G0107A	GBIC LH 1310nm*24	
G0108A	GBIC ZX 1550nm*24	
G0124A	GBIC T (1000 BASE-T)*24	
G0181A	SFP SX 850nm*25	

Model/Order No	Name
G0182A	SFP LX 1310nm*25
G0183A	SFP LE 1310nm*25
G0184A	SFP LR 1550nm*25
G0132	XENPAK (10 GBASE-SR)*26
G0192A	XENPAK (10 GBASE-LR)*26
G0193A	XENPAK (10 GBASE-ER)*26
G0194A	1310 nm XFP Module*27
G0195A	1550 nm XFP Module*27
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)
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 Attenuator (SC, 5 dB)
J1049B	Fixed Optical Attenuator (SC, 10 dB)
J1049C	Fixed Optical Attenuator (SC, 15 dB)
J1376A	Fixed Optical Attenuator (5 dB, LC connector)
MZ1221A	XAUI Extender*28
MZ1222A	XENPAK Interface*29
J1163A	XAUI Cable, 0.5 m
J1164A	MDIO Cable, 0.5 m
J0635A	Optical Fiber Cable (SM, FC-SPC connector both ends), 1 m
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 Cord (SM, SC-SC connector), 2 m
J0773B	Optical Fiber Cord (GI, SC-SC connector), 2 m
J1344A	Optical Fiber Cord (Simplex, SM, LC-LC connector), 1 m
J1327B	Optical Fiber Cord (Simplex, SM, LC-LC connector), 2 m
J1119B	Optical Fiber Cord (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	Optical Fiber Cord (Simplex, SM, LC-FC connector), 1 m
J1003N	Semi-rigid Cable (136 .6 mm)
J1003P	Semi-rigid Cable (96 mm)
J1003Q	Semi-rigid Cable (75 .6 mm)
J1003R	Semi-rigid Cable (55 .3 mm)
J1003S	Semi-rigid Cable (56 .5 mm)
J0775B	Coaxial Cable (BNC-P620 · 3C-2WS · BNC-P620, 75 Ω), 0.5 m *30
J0775D	Coaxial Cable (BNC-P620 · 3 -2WS · BNC-P620, 75Ω), 2 m*30
J0776D	Coaxial Cable (BNC-P-3W · 3 D-2W · BNC-P-3W, 50Ω), 2 m
J0322B	Coaxial Cable (11 SMA · SUCOFLEX104 · 11 SMA), 1 m
J0696A	Coaxial Cable (AA-165 -500) 0 .5 m
J1349A	Coaxial Cable, 0.3 m
J1268	Semiflexible Coaxial Cable
J1173	6020180 Power Divider
J0845A	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
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*31
Z0990A	1550 nm XFP Kit*32
Z0282	Ferrule Cleaner
Z0283	Ferrule Cleaner Replacement Tape
Z0284	Adapter Cleaner
Z0838A	Stick Cleaner 1.25 mm (250 pcs/set)
B0571A	Blank Panel *33
B0572A	Blank Panel *34
B0593A	Blank Panel *35
B0590A	Rack Flange*36
Z0849A	MD1230 /MP1590 Family Manual CD
W2735AE	MP1591 A 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	Ethernet Module Operation Manual
W2424AE	MU150100A Specifications Operation Manual
W2425AE	MU150101A Specifications Operation Manual
W2426AE	MU150125A Specifications Operation Manual
W2427AE	MU150121/2/3/34A Specifications Operation Manual
W2589AE	MU150121B/123B Specifications Operation Manual
W2590AE	MU150124B Specifications Operation Manual
W2870AE	MU150135A Operation Manual

∗1: MU159101A and MX159001B required to control MP1591A.
∗2: Supplied with main frame.
∗3: CD includes installer, release notes and operation manual.
∗4: Supplied with MU150100A, MU150101A, MU150121A/B, MU150123A/B, and MU150124B.
∗5: Two pieces of MU150100A, and MU150101A.
∗6: Supplied with MU150123A/B, and MU150124A.
∗7: Supplied with MU150100A, and MU150101A.
∗8: Supplied MU150125A.
∗9: Supplied with MU150121A/B, MU150123A/B, and MU150124B.
∗10: One piece of MU150123A/B, and MU150124B, and two pieces of MU150121A/B.
∗11: Supplied with MU150121B.
∗12: Supplied with MU150135A.
∗13: Supplied with MU159103A.
∗14: Requires any one of Option-01, 02, 03.
∗15: Requires XFP module (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
∗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 modules (sold separately). In addition, operation with non-Anritsu modules not guaranteed.
∗19: MU150100A-07 is factory installed only. MU150100A-07 and MU150100A-09 cannot both be installed simultaneously.
∗20: Exchangeable.
∗21: Requires either MU150101A-11 or /MU150101A-12.
∗22: MU159101A-30 option can be added to the main frame before delivery. But it cannot be added after.
∗23: MX159001B-03 not required.
∗24: GBIC modules sold as single units. Two can be mounted in MU120112A.
∗25: SFP modules sold as single units. Two can be mounted in MU120112A and eight in MU120132A.
∗26: XENPAK modules sold as single units. Two can be mounted in MU120118B and one in MU120118C.
G0192A and G0193A only supported by MU120118A/B/C units with "With APS" sticker attached. DO NOT install in MU120118A/B/C without “With APS” seal. G0192A and G0193A have “Only for APS” stickers attached.
∗27: XFP modules sold as single units. One can be mounted in MU150135A.
∗28: 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)
∗29: MZ1222A supplied by 1.8-V APS.
∗30: Required for synchronizing time between several units.
∗31: G0194A and J1344A included in Z0989A.
∗32: G0195A, J1344A, and J1376A included in Z0990A.
∗33: Blanking panel for MP1591A CPU slot.
∗34: Blanking panel for MP1591A DCS slot.
∗35: Blanking panel for slot 1 to slot 8 of MP1591A Bank A/B.
∗36: Rackmount Kit for MP1591A.
∗37: Order additional J1349A when Ethernet unit is installed simultaneously in SDH/SONET/OTN/PDH/DSn unit and jitter unit configurations.
∗38: Only ports 1 and 2 of the the MU120121A/122A support the MU159101A-17 Traffic Impairment Emulator option. Moreover, only MU120121A/122A models shipped after March 7, 2008 with the "Supports Opt.17" sticker support the option.

Other

Software Upgrade Service

Model/Order No.	Name
	Software Upgrade Service
MP1590B-40	Annual Software Upgrade Service
MP1591A-40	Annual Software Upgrade Service

∗: Option for latest versions of main frame, plug-in units and software. Purchased annually; no multi-year contracts. Can also be purchased at any time after main-frame purchase.

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, MP1591A-ES210, MU159101A-ES210, MU159103A-ES210, MU150100A-ES210, MU150101A-ES210, MU150121A-ES210, MU150121B-ES210, MU150123A-ES210, MU150123B-ES210, MU150124B-ES210, MU150135A-ES210, MU150125A-ES210, MU120111A-ES210, MU120112A-ES210, MU120118B-ES210, MU120118C-ES210, MU120121A-ES210, MU120122A-ES210, MU120131A-ES210, MU120132A-ES210

***-ES310 : MP1590B-ES310, MP1591A-ES310, MU159101A-ES310, MU159103A-ES310, MU150100A-ES310, MU150101A-ES310, MU150121A-ES310, MU150121B-ES310, MU150123A-ES310, MU150123B-ES310, MU150124B-ES310, MU150135A-ES310, MU150125A-ES310, MU120111A-ES310, MU120112A-ES310, MU120118B-ES310, MU120118C-ES310, MU120121A-ES310, MU120122A-ES310, MU120131A-ES310, MU120132A-ES310

***-ES510 : MP1590B-ES510, MP1591A-ES510, MU159101A-ES510, MU159103A-ES510, MU150100A-ES510, MU150101A-ES510, MU150121A-ES510, MU150121B-ES510, MU150123A-ES510, MU150123B-ES510, MU150124B-ES510, MU150135A-ES510, MU150125A-ES510, MU120111A-ES510, MU120112A-ES510, MU120118B-ES510, MU120118C-ES510, MU120121A-ES510, MU120122A-ES510, MU120131A-ES510, MU120132A-ES510

40G SDH/SONET ANALYZER

MP1595A

1.5 Mbit/s to 43 Gbit/s

CE Ethernet

40/43G Flagship Model
All-in-One Multibit Rate Analyzer

For detail and specification, refer to the data sheet.

The spread of rich-content broadband services supporting HDTV broadcasting, Video on Demand, online gaming, etc., and demanding high data throughput is driving progress towards introduction of next-generation 40G core networks. Anritsu has developed its MP1595A 40G SDH/SONET Analyzer as the ideal all-in-one measurement solution for assuring the quality of these ultra-high-speed networks.

STM-256/OC-768, OTU3 Support

Just one MP1595A Analyzer provides full 40/43G 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, 9953.28 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 Generation and Measurement

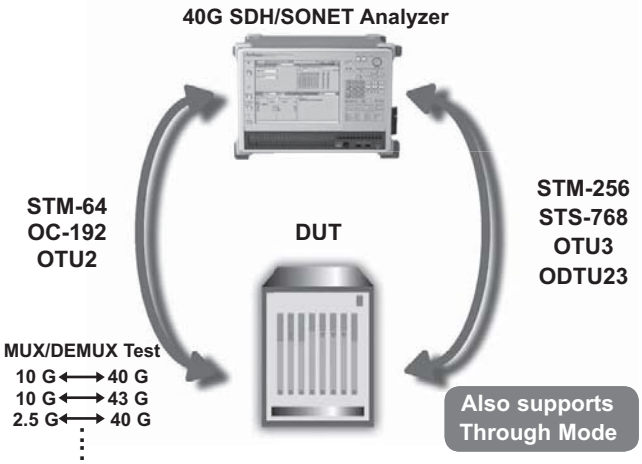
Combination with the MP1797A 40/43G Jitter Analyzer supports high-performance jitter generation and measurement for STM-256/OC-768 (39.813G) and OTU3 (43.018G), as well as jitter tolerance and jitter transfer measurements.

Key Measurement Applications

SDH/SONET/OTN Measurement Solutions

The following measurement solutions required by 40/43G 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

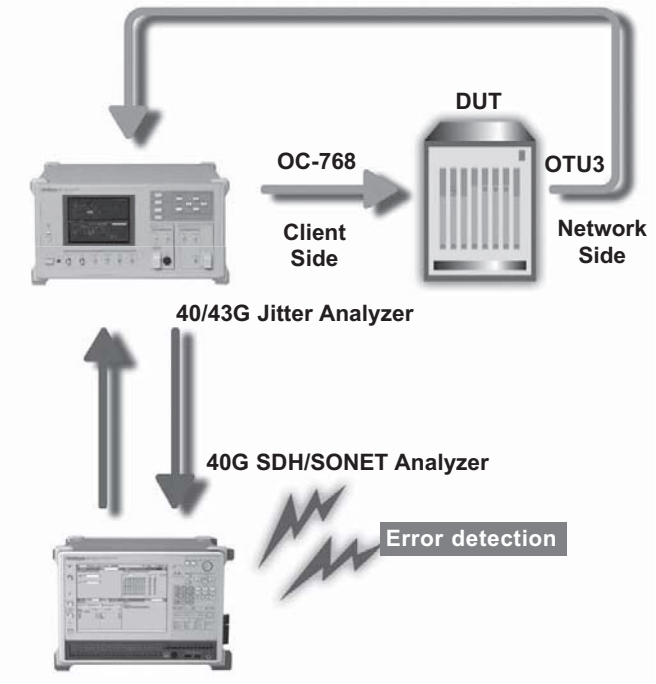


A single MP1595A unit supports a wide range of bit rates from 1.5M to 43G, offering an efficient measurement test platform for MUX/DEMUX equipment with 2.5G and 10G interfaces as well as 40/43G transmission equipment and networks.

40/43G Jitter Measurement

Combination with the MP1797A 40/43G Jitter Analyzer supports the following 40/43G jitter measurements for verifying the quality of transmission systems.

- Jitter Generation Measurement
- Jitter Tolerance Measurement
- Jitter Transfer Measurement



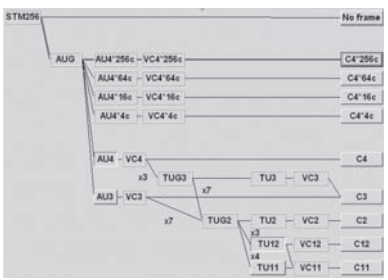
Jitter Tolerance Measurement Example

Mapping Support

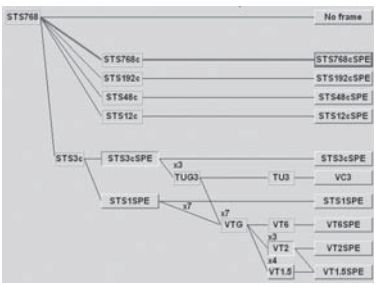
Mapping Support (SDH/SONET)

Concatenation mappings from STM-1c/ STS-3c to STM-256c/ STS-768c can be set. In addition, using the MP1595A with either the MP1590B Interface 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 1.5 to 10G.

Note: For the MU150100A functions, see the separate MP1590B catalog.



SDH Mapping

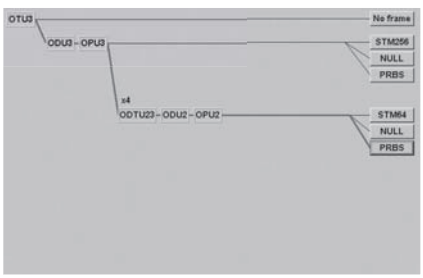


SONET Mapping

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.



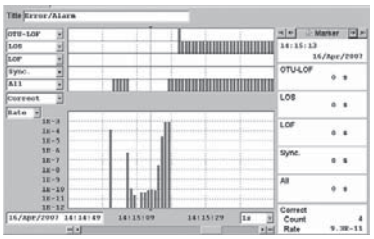
OTN Mapping

*Note: Only 40/10G STM-256c/STS-768c, STM-64c/STS-192c Mapping can be used at the OTU3 SDH/SONET setting.

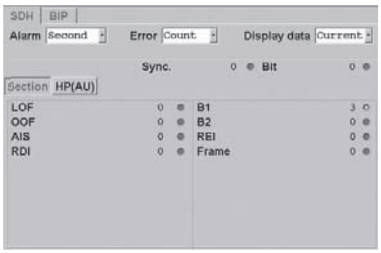
SDH/SONET, OTN Measurement Functions

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.



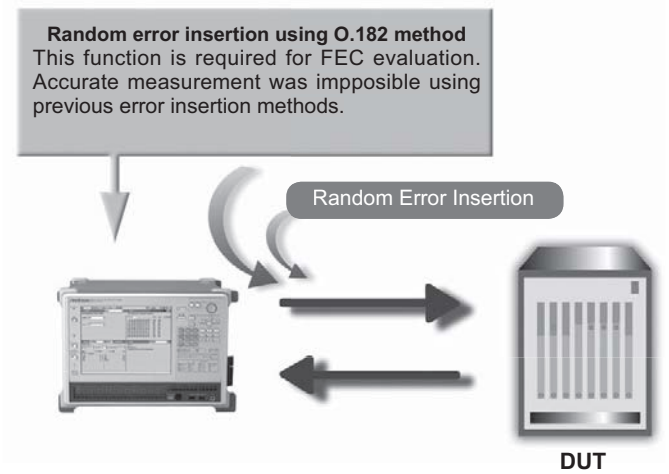
Error/Alarm Measurement Example (monitoring)



Error/Alarm Measurement Example (result)

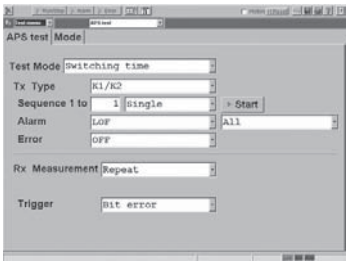
FEC Measurement Function using ITU-T O.182 Random Error

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.

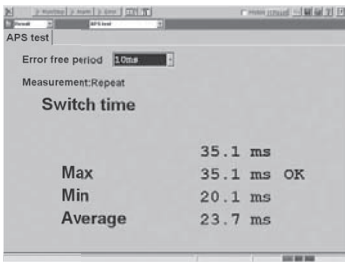


APS Measurement Function

The Automatic Protection Switch (APS) test verifies the switching time with 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)

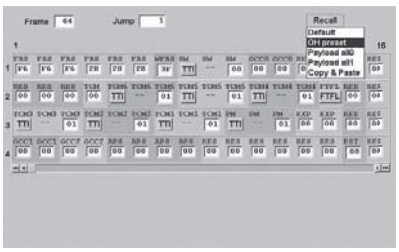


APS Measurement Example

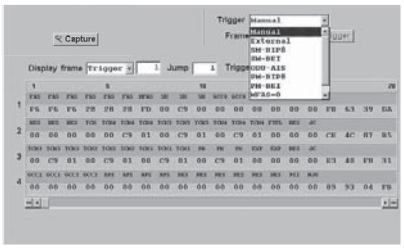
Frame Memory/Capture Function

(MU150140A-10 Frame Memory/Capture 40/43G)

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



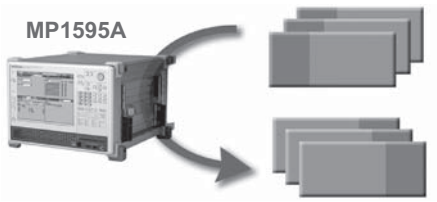
Frame Capture

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.

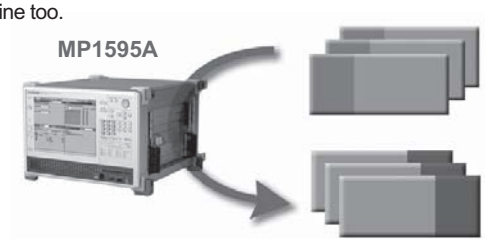
Transparent Mode

This mode loops-back and outputs the received signal as is. And random error insertion is useful for emulating transmission paths.



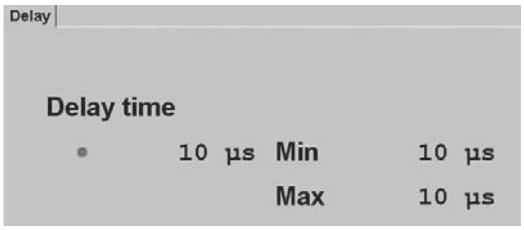
Overhead Overwrite

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

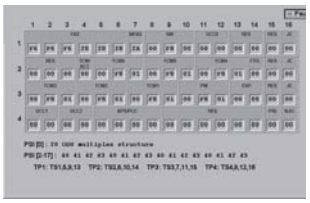
Network delay times are directly related to network quality and this function can measure payload data transmission delays with µs accuracy.



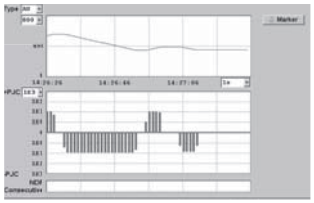
Delay Measurement Function Example

Monitoring Function

A versatile line of monitoring functions, including errors/alarms, pointers, OH, etc., supports comprehensive network monitoring.



OH Monitoring



Pointers Monitoring

Jitter Test Solution

Anritsu is targeting the new 40G market based on long practical experience and know-how in tel-communications. The MP1595A and MP1797A Jitter Analyzer are high-performance solutions incorporating this knowledge for 40/43G jitter measurements.

MP1797A Jitter Analyzer

The MP1797A Jitter Analyzer supports jitter measurements of both 39.813 and 43.018 Gbit/s SDH/SONET (ITU-T O.172) and OTN signals (ITU-T O.173) . It provides a high-performance jitter measurement solution when used in combination with the MP1595A.

∗Note: For details of the MP1797A specifications, Please consult us.

Measurement Items

- Jitter Generation Measurement
- Jitter Tolerance Measurement
- Jitter Transfer Measurement

Electrical I/F for MP1595A (MU150142A)

The MP1797A and MP1595A are combined with this unit, and provides an electrical interface. To use this unit with the MP1595A, use the MP1797A optical interface to execute the various performance tests. In addition, the performance of 40G devices, etc., can be evaluated just with the MP1595A using the differential electrical interface of the MU150142A . (In this case, a separate 40G clock source is required.

High Performance Support for 40G Era and Beyond

Low Intrinsic Jitter

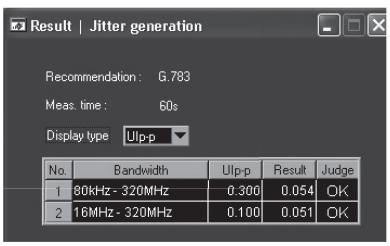
The measuring instrument intrinsic jitter is very low.

40/43G 50 mUIp-p (typ) [16M-320M]
40/43G 60 mUIp-p (typ) [80k-320M]

Measurement Condition

- 40G: STM-256c-Bulk PRBS23
  STS-768c-Bulk PRBS23
- 43G: OTU3-Bulk PRBS23

Due to the low intrinsic jitter, the true perfomance of the DUT can be measured.



Jitter Generaiion Measurement Example

Wide Optical Input Range and low Input Level Dependency

Optical input levels from –10 to 0 dBm are supported and the 10 dB measurement range eliminates adjustments because the DUT signal can be input directly.
The VSR-specified output (0 to +3 dBm) allows plenty of margin.

High-Reproducibility Jitter Measurement without Input Level Dependency

A full range of measurement solutions for 40/43G ultra-high-speed SDH/SONET/OTN networks is supported, including .

Wide Dynamic Range

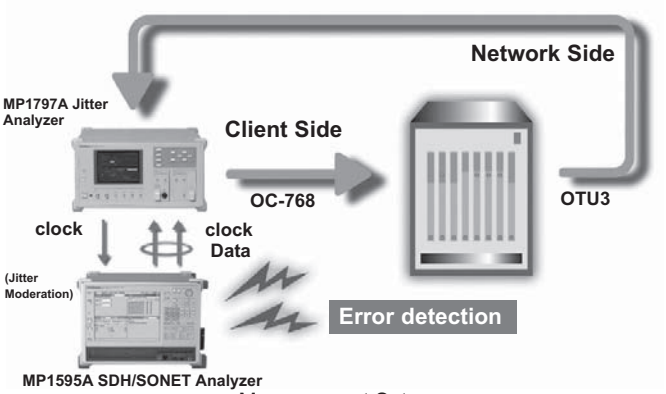
Jitter transfer can be measured with a wide dynamic range of 55 dB (typ) at 320 MHz, exceeding the ITU-T specification of 38 dB at 320 MHz by a large margin and supporting high-accuracy and high-reproducibility measurement.

±100 ppm Frequency Offset

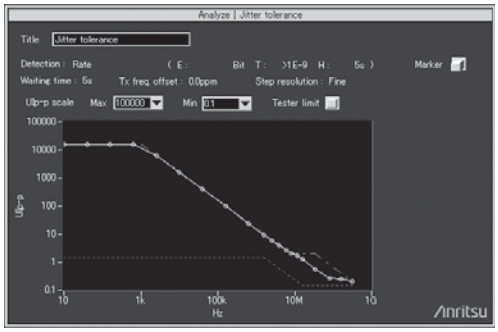
The frequency can be offset by ±100 ppm for 40/43G measurement, allowing stress testing to verify DUT performance limits.

40/43G Jitter Measurement Function

This section introduces a jitter measurement setup using the MP1595A and MP1797A. This measurement uses the bundled MX179701B software to perform comprehensive automatic measurement via GPIB.



Measurement Setup

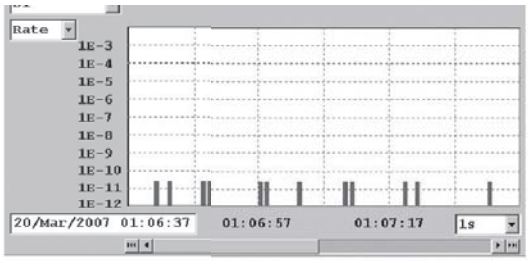


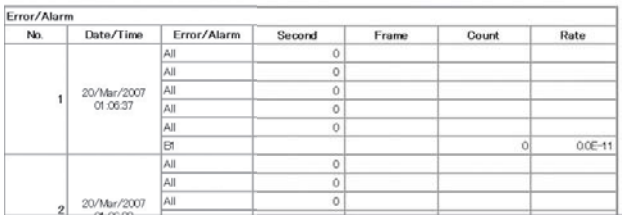
Jitter Tolerance Measurement Example

Other Useful Functions

Reporting Function

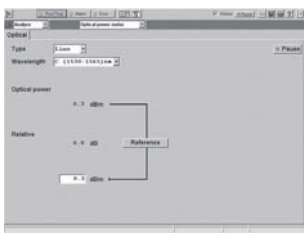
Measurement results can be saved in various formats. Outputting results including graphs, measurements, etc., in HTML is convenient for creating reports.



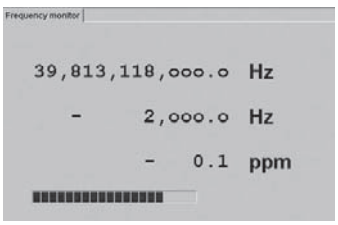


Optical Level/Frequency Monitoring

Optical level and frequency monitoring functions are standard, making it easy to verify the input signal.



Optical Level Monitoring



Frequency Monitoring

MP1590B Compatibility

The MU150100A for the MP1590B can be used to make measurements at 10G and below, maximizing the MP1595A investment efficiency. The same GUI as the MP1590B greatly reduces required training.

Remote Control

The optional MX159501A Remote Control Software package 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	Sield power cord 2.6 m (13A):	1 pc
J0670A	Power cord L type (C7), 2.5 m:	1 pc
F0105	Fuse 10 A:	2 pcs
B0482	Front Cover (3/4MW5U):	1 pc
J1003S	Semirigid Cable, 56.5 mm*1:	1 pc
J1003N	Semirigid Cable, 136.6 mm*1:	1 pc
J0635A	Optical Fiber Cable (SM, FC-SPC connector both ends), 1 m*2:	1 pc
J0617B	Replaceable Optical Connector (FC-PC)*2:	1 pc
J1383A	Semirigid Cable, 105.7 mm*3:	1 pc
J1384A	Semirigid Cable, 90.0 mm*3:	1 pc
	Units/Modules	
MU150100A	10/10.7G Unit	
MU150135A	10/10.7G Optical Unit (XFP)	
MU150140A	40/43G Unit	
MU150141A	40G Optical Unit	
MU150141B	40/43G Optical Unit	
	Software	
MX159501A	40G SDH/SONET Analyzer Control Software	
	Options	
MP1595A-01	RS-232C	
MP1595A-02	GPIB	
MP1595A-03	LAN	
MU150140A-05	OTU3	
MU150140A-06	ODTU23*4	
MU150140A-10	Frame Memory / Capture (40/43G)	
MU150141A-40	SC Connector	
MU150141B-40	SC Connector	
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	
MU150100A-08	10.3G*5	
MU150100A-09	Insert/Extract	
MU150100A-38	ST Connector	
MU150100A-39	DIN Connector	
MU150100A-40	SC Connector	
MU150100A-43	HMS-10/A Connector	
	Optional accessories	
B0483	Carrying Case	
B0593A	Blank Panel	
G0194A	1310 nm XFP Module	
G0195A	1550 nm XFP Module	
J0008	GPIB cable, 2 m	
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	

Model/Order No.	Name
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	Replaceable Optical Connector (ST)
J0796B	Replaceable Optical Connector (DIN)
J0796C	Replaceable Optical Connector (SC)
J0796D	Replaceable Optical Connector (HMS-10/A)
J0796E	Replaceable Optical Connector (FC)
J0845A	Balanced Cable (BANTAM 3P/BANTAM 3P), 6 ft
J1003N	Semirigid Cable, 56.5 mm
J1003S	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
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*6
Z0990A	1550 nm XFP Kit*7
W2869AE	MP1595A Operation Manual
W2937AE	MX159501A Operation SDH Edition Manual
W2938AE	MX159501A Operation SONET Edition Manual
W2939AE	MP1595A Remote Control Operation Manual
W2870AE	MU150135A Specifications Operation Manual
W2871AE	MU150140A Specifications Operation Manual
W2872AE	MU150141A/B Specifications Operation Manual

∗1 : Supplied with MU150140A
∗2 : Supplied with MU150141A or MU150141B
∗3 : Supplied with MU150135A
∗4 : Requires separate MU150140-05 OTU3 option.
∗5 : External clock source is required.
∗6 : Z0989A includes G0194A and J1344A.
∗7 : Z0990A includes G0195A, J1344A, and J1376A.

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.

SDH/SONET/PDH/T-CARRIER ANALYZER

CMA5000a – XTA

1.5 Mbps up to 10 Gbps

CE

"All-in-one" Module: from 1.5 Mbps to 10 Gbps

The XTA (eXtended Transport Analysis) Application module is a field portable SONET/SDH analyzer for testing networks from 1.5 Mbps to 10 Gbps. It can provide a multitude of test measurements including Jitter & Wander and Next Generation SONET/SDH and enables installation and maintenance professionals to rely on one compact solution. Thanks to its open architecture, the XTA can easily be updated by software or hardware and so protects your investment for the future.
The compact size of the XTA Application module conveniently fits into the CMA5000a Multi-Layer Network Test Platform using a small bay adapter-thus reducing cost and overall weight.

Interfaces and Signal Specifications

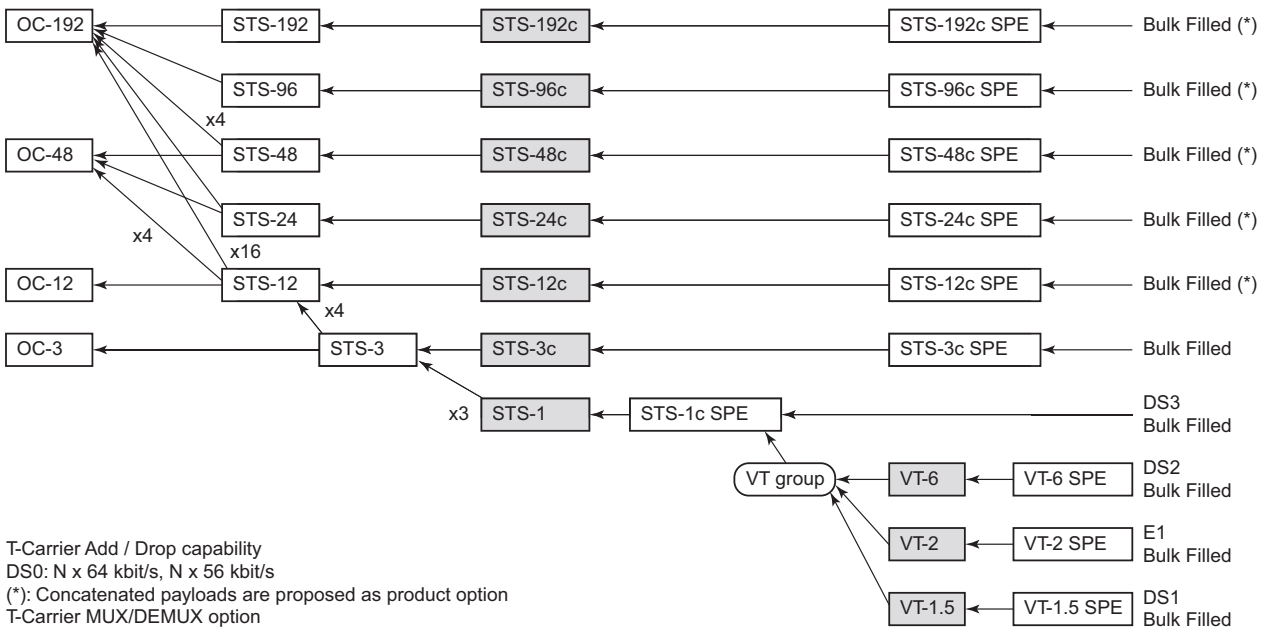
Signals				XTA Modules			
SDH/PDH	SONET/T-Carrier	Rate (Mb/s)	Interfaces	XTA 622	XTA 2.5	XTA 10-1310	XTA 10-1550
STM64	OC-192	9953.280	Optical 1550 nm*1	–	–	–	√
STM16	OC-48	2488.320		–	√	√	√
STM4	OC-12	622.080		√	√	√	√
STM1	OC-3	155.520		√	√	√	√
STM64	OC-192	9953.280	Optical 1310 nm*1	–	–	√	–
STM16	OC-48	2488.320		–	√	√	√
STM4	OC-12	622.080		√	√	√	√
STM1	OC-3	155.520		√	√	√	√
STM1	STS-3	155.520	Electrical*2	√	√	√	√
–	STS-1	51.840		√	√	√	√
E4	–	139.264		√	√	√	√
E3	–	34.368		√	√	√	√
E1	–	2.048		√	√	√	√
–	DS3	44.736		√	√	√	√
–	DS1	1.544		√	√	√	√

*1: SC/PC connectors
*2: BNC 75 Ω connectors (except for DS1 Bantam 100 Ω)

Interfaces and Signal Specifications (continued)

Optical Transmitter			155.520 to 2488.320 Mbit/s	9953.280 Mbit/s
	Wavelength	1310 nm	1290 to 1330 nm	1290 to 1330 nm
		1550 nm	1529 to 1570 nm	1530 to 1565 nm
	Output Power	1310 nm	–2 to +2 dBm	+1 to +5 dBm
		1550 nm	–1 to +2 dBm	–1 to +2 dBm
	Extinction Ratio		8.2 dB minimum	8.2 dB minimum (1550 nm) 6.0 dB minimum (1310 nm)
Optical Receiver		155.520 to 622.080 Mbit/s	2488.320 Mbit/s	9953.280 Mbit/s
	Wavelength	1270 to 1570 nm	1270 to 1570 nm	1527 to 1570 nm and 1290 to 1330 nm
	Sensitivity (min)	–28 dBm (at 10^{-10} BER)	–28 dBm (at 10^{-10} BER)	–15 dBm (at 10^{-12} BER)
	Saturation	–8 dBm	–8 dBm	–1 dBm
Clock Synchronization	Clock Reference	• Internal stratum 3 clock generation • External 2.048 MHz reference clock: 75 Ω BNC connector, 0.5 to 4 Vp-p signal amplitude • Timed from 2.048 Mbit/s received signal • External 1.544 MHz reference clock: 75 Ω BNC connector, 0.5 to 4 Vp-p signal amplitude • Timed from 1.544 Mbit/s received signal • Timed from SDH/SONET received signal • External 10 MHz reference clock: 75 Ω BNC connector, 0.5 to 4 Vp-p signal amplitude		
	Clock Output	• 155.520 MHz frequency signal synchronous with transmitted SDH/SONET signal, 50 Ω connector, AC coupled, 600 mV amplitude		
DCC Signals	The CMA5000a XTA modules support the drop and insert of DCC channels from SONET/SDH.			
	Rates	D1-D3 DCC channel at 192 Kbit/s and D4-D12 DCC channel at 576 Kbit/s		
	Connector	DB 15		
SONET/SDH Frame Formats and Mapping	SONET format	Telcordia GR-253		
	SDH format	ITU-T G.707		

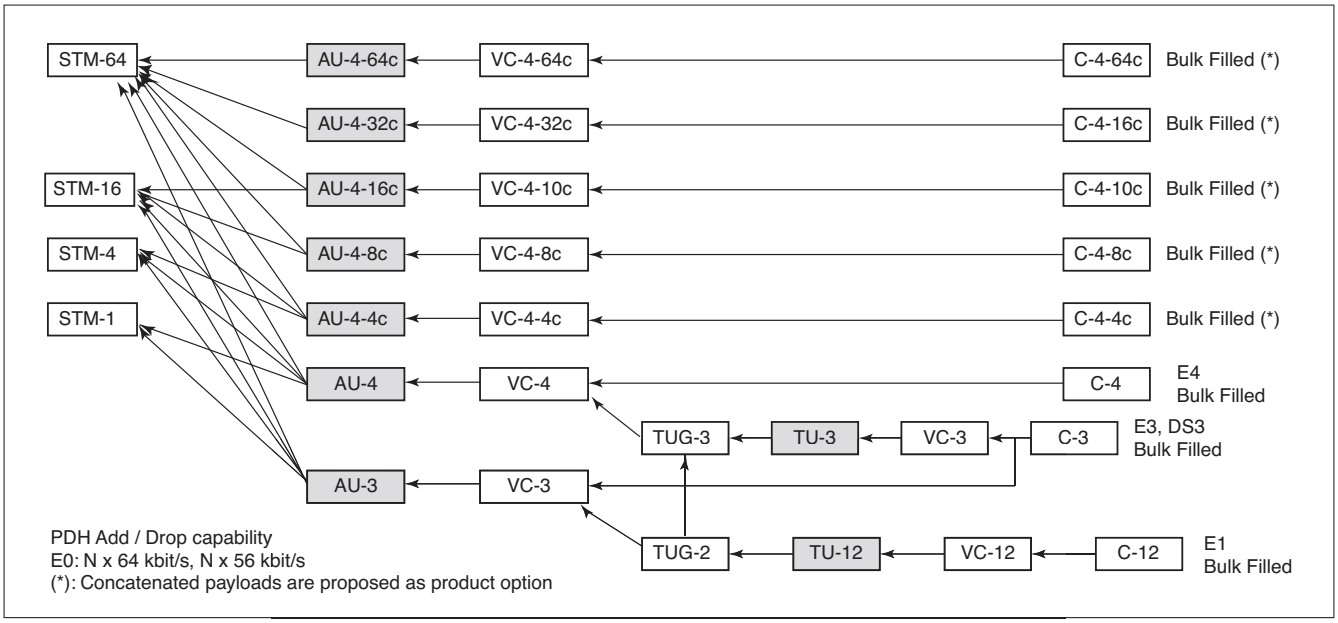
SONET Mappings



T-Carrier Add / Drop capability
DS0: N x 64 kbit/s, N x 56 kbit/s
(*): Concatenated payloads are proposed as product option
T-Carrier MUX/DEMUX option

Interfaces and Signal Specifications (continued)

SDH Mappings



PDH/DSn Signal	Unframed Format	Framed Format
E1	PRBS	G.704
E3	PRBS	G.751
E4	PRBS	G.751
DS1	PRBS	ANSI T1.107 (SF and ESF)
DS3	PRBS	ANSI T1.107 (C-bit and M-13)

Test Pattern	PRBS Patterns	PRBS: $2^9 - 1$, $2^{11} - 1$, $2^{15} - 1$, $2^{20} - 1$, QRSS, $2^{23} - 1$, $2^{29} - 1$, $2^{31} - 1$ inverted and non-inverted
	Word Patterns	All “1” pattern, all “0” pattern, alternative “01” pattern, user-defined 2 bytes word pattern, 1 in 8, 2 in 8, 3 in 24, QRSS patterns for DS1 signal

Network Emulation

SONET/SDH Overhead Editors	SONET Frames	TOH Editor	All bytes of TOH (STS-1/STS-3) are programmable except B1/B2 and Z0 J0: (Trace Identifier) programmable 62 bytes ASCII sequence, CRLF added or programmable 15 bytes ASCII sequence, CRC (E.164) added or programmable byte
		POH Editor (STS)	C2, G1, F2, H4, Z3, Z4, N1 J1: (Trace Identifier) programmable 62 bytes ASCII sequence, CRLF added or programmable 15 bytes ASCII sequence, CRC (E.164) added or programmable byte
		POH Editor VT (POH)	V5, Z6, Z7 J2: (Trace Identifier) programmable 62 bytes ASCII sequence, CRLF added or programmable 15 bytes ASCII sequence, CRC (E.164) added or programmable byte
	SDH Frames	SOH Editor	All bytes of SOH (STM-1) are programmable except B1/B2 J0: (Trace Identifier) programmable 15 bytes ASCII sequence, CRC (E.164) added or programmable 62 bytes ASCII sequence, CRLF added or programmable byte
		POH Editor	VC4 and VC3 POH: C2, G1, F2, H4, F3, K3, N1 J1: (Trace Identifier) programmable 15 bytes ASCII sequence, CRC (E.164) added or programmable 62 bytes ASCII sequence, CRLF added or programmable byte
			VC12 POH: V5, N2, K4 J2: (Trace Identifier) programmable 15 bytes ASCII sequence, CRC (E.164) added or programmable 62 bytes ASCII sequence, CRLF added or programmable byte

Network Emulation (continued)

Error Addition	SONET/DSn	A1/A2, B1, B2, REI-L, B3, REI-P, V5, REI-V, PRBS, Word, transmission errors, FAW, SFAW, FPS, CRC-6, Parity P, Parity CP, code errors (BPV, EXZ)
	SDH/PDH	A1/A2, B1, B2, MS-REI, B3, LP-B3, HP-REI, V5, LP-REI, PRBS, Word, transmission errors FAW, CRC4, REI, code errors (BPV, EXZ)
	Error control	Programmable number or rate
Alarm Addition	SONET/DSn	LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, SLM-P, UNEQ-P, RDI-P, LOM-V, AIS-V, LOP-V, SLM-V, UNEQ-V, RDI-V, TIM-V, LSS, LPS, AIS, LOMF, RAI
	SDH/PDH	LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-SLM, HP-TIM, HP-UNEQ, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-SLM, LP-UNEQ, LP-TIM, LP-RDI, LSS, LPS, AIS, LOMF
	Alarm Control	On steady-state or programmable number of frames
Voice Add/Drop (Option)	SONET/DSn	Supports adding and dropping of a selected 64 kb/s voice channel (carried in a DSn signal) to an external hand-set (μ-Law)
	SDH/PDH	N/A
Stress Function	Pointer Movement	Pointer movement generation on SONET and SDH frames: • Pointer set to any value with or without NDF • Positive and negative movements • Pointer sequences (ITU-T G.783, Telcordia GR-253)
	Frequency Shift	Programmable frequency offset: –100 to +100 ppm in 0.1 ppm steps for SONET/SDH –100 to +100 ppm in 0.1 ppm steps for PDH/T-Carrier
	APS (K1/K2)	Automatic Protection Switch messages (K1/K2) are user-programmable MSP Linear (ITU-T G783) and MSP-Ring (ITU-T G841) are supported
	SDH Through Mode	SOH overwrite K1, K2, S1, A1, A2, J0, M1 recalculated; error addition: B1, B2, MS-REI Transmission; alarm addition: LOF, MS-AIS, MS-RDI; APS simulation
	SONET Through Mode	TOH overwrite K1, K2, S1, A1, A2, J0, M1 recalculated; error addition: B1, B2, REI-L transmission, alarm addition: LOF, AIS-L, RDI-L; APS simulation
	DS1 Loop Codes	Loop Codes generation on DS1 frames: DS1 SF: Loop Up, Loop Down DS1 ESF: Line Loop Back Activate, Payload Loop Activate, Line Loop Back Deactivate, Payload Loop Loop Back Deactivate, Universal Loop Back Deactivate

Measurement Capabilities

Path Analysis	Signal Qualification	• Power meter • Frequency meter
	Error Analysis	SONET/DSn A1/A2, B1, B2, REI-L, B3, REI-P, V5, REI-V, PRBS, Word, FAW, SFAW, FPS, CRC-6, MAW, Parity P, Parity CP, code errors (BPV, EXZ)
		SDH/PDH B1, A1/A2, B2, MS-REI, B3, HP-REI, LP-B3, LP-REI, V5, PRBS, Word, FAW, CRC4, BPV, code errors (BPV, EXZ)
	Alarms Analysis	SONET/DSn LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, LOP-P, SLM-P, UNEQ-P, RDI-P, LOM-V, AIS-V, LOP-V, SLM-V, UNEQ-V, RDI-V, TIM-V, LSS, LPS, AIS, RAI, LOMF
		SDH/PDH LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-SLM, HP-UNEQ, HP-TIM, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-SLM, LP-UNEQ, LP-TIM, LP-RDI, LSS, LPS, AIS, LOMF
	Pointer Movement Analysis	XTA modules track all the SONET/SDH pointers movements information: • Pointer value • Number of positive and negative pointer movements • Number of pointer movement with NDF
	Quality Analysis	SONET/DSn 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	Realtime display of the following information: • J0, J1 and J2 Path Trace messages (ASCII sequence) • S1 (synchronization status) • C2/V5 (signal label)
		SONET/SDH: • 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

Measurement Capabilities (continued)

Round Trip Delay	• Measurement possible at each path level • Resolution: 100 ns • Range: 0 to 2 sec (depending on path level) • Result: Tmax, Tmin, Tavr, Tcurrent and	
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.821, G.826, G.828	
Structure Scan	• Complete signal mapping auto discovery (including Mix Payload)	
Troublescan	• Continuous VC4/SPEs scanning for alarms and errors detection	
General Information	• The XTA hardware is a double size plug-in module compatible with the CMA5000a Multi-Layer Network Test Platform (small, medium or large bay adapters). • AC power: 100 to 250 VAC via CMA5000a platform	
	Environmental specifications	Operating Temperature: 0° to +40°C Storage Temperature: –20° to +70°C Humidity: 10% to 80%
	Safety	Electrical: EN 61010-1 Optical: EN 60825-1 and 21 CFR 1040.10
	Warranty	1 year standard
	EMC	EN61326-1, EN61000-3--2
	LVD	EN61010-1
	CMA5000a platform features are detailed in the CMA5000a platform specifications sheet.	

XTA Application: Jitter and Wander Option

Interfaces and Signal Specifications*1

Jitter/Wander Generation and Analysis Interfaces				XTA Modules	
Interfaces	SONET/DSn	SDH/PDH	Rate (Mb/s)	XTA 622	XTA 2.5G
Optical 1550 & 1310 nm*2	OC-48	STM16	2488.320	–	√
	OC-12	STM4	622.080	√	√
	OC-3	STM1	155.520	√	√
Electrical*3	STS-3	STM1e	155.520	√	√
	STS-1	–	51.840	√	√
	–	E4	139.264	√	√
	–	E3	34.368	√	√
	–	E1	2.048	√	√
	DS3	–	44.736	√	√
	DS1	–	1.544	√	√

Jitter Generation

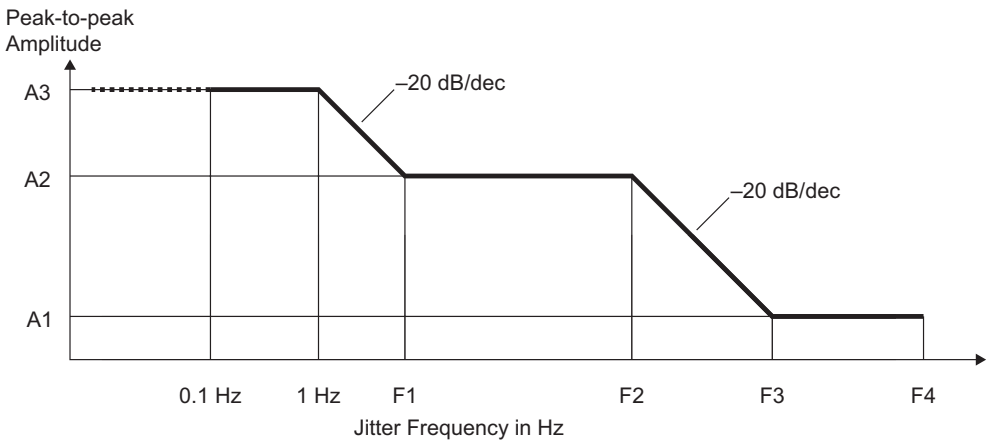
Jitter Generation Characteristics	Tx Signals	Sinusoïdal jitter generation at all bit rates included in the XTA module configuration
	Amplitude Range	Up to 240 000 UI*4
	Frequency Range	0.1 Hz to 20 MHz*4
	Frequency Shift	Programmable frequency offset –100 to +100 ppm in 0.1 ppm steps For PDH/T-Carrier and SONET/SDH

∗1: All the general specifications of the XTA modules are described in the CMA5000a extended Transport Analysis Application datasheet
∗2: SC/PC connectors
∗3: BNC 75 Ω connectors (except for DS1 Bantam 100 Ω)
∗4: Depending on the XTA module configuration

XTA Application: Jitter and Wander Option (continued)

	Amplitude (UI)			Frequency (KHz)			
SONET/SDH Jitter Generation Characteristics	Interfaces	A3	A2	A1	F1	F2	F3	F4
	OC-48/STM16	240000	240	0.75	1	4	1.300	20000
	OC-12/STM4	60000	60	0.75	1	16	1.300	5000
	OC-3/STM1	15000	15	0.75	1	65	1.300	–*1

*1: Not defined



Jitter frequency and amplitude can be programmed within the range specified above.

	Interfaces	Amplitude (UI)			Frequency (Hz)			
		A3	A2	A1	F1	F2	F3	F4
PDH/T-Carrier Jitter Generation Characteristics	STS-3/STM1e	15000	150	0.75	100	500	100K	1300K
	STS1	5200	52	1	100	10000	520K	1000K
	E4	15000	150	0.75	100	500	100K	3500K
	E3	3500	35	1	100	10000	350K	800K
	E1	200	20	1	10	1000	20K	100K
	DS3	4500	45	1.12	100	10000	400K	–
	DS1	160	16	1	10	1000	16K	40K

Jitter Measurement

Jitter Analyzer Characteristics	Rx Signals		Jitter measurement at all bit rates included in the XTA module configuration Signal Qualification ensures that the incoming signal is in acceptable operating range before starting a jitter measurement, by checking: • Optical/electrical power • Frequency shift (up to 100 ppm)
	Alarms and Errors Analysis		Alarms and errors are analyzed in real time during the jitter measurement: • SDH alarm events: LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, HP-RDI, TU-AIS, LP-RDI, AIS, LSS, HITS • SONET alarm events: LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, RDI-P, AIS-V, RDI-V, AIS, LSS, HITS • SDH error events: B1, B2, MS-REI, B3, V5, HP-REI, LP-REI, LSS • SONET error events: B1, B2, REI-L, REI-P, V5, REI-V, LSS
	Optical Sensitivity		The optical input power must be in the range of –8 to –13 dBm for accurate measurement
	Measurement Ranges	Amplitude	• Peak to Peak: 0 to 128 UI p-p • RMS*1: 0 to 64 UI rms
		Maximum resolution	• Peak to Peak: 0.001 UI p-p • RMS*1: 0.001 UI rms
	Built-in Filters		Range from 10 Hz to 20 MHz • High-Pass filters at 20 dB/dec for HP1, HP2 and HPrms • Low pass filters at 60 dB/dec for LP
	Amplitude Results		• Positive Peak, Negative Peak, Peak to Peak, RMS*1 • Current and maximum values are displayed in numerical or graphical form

*1: RMS: Root Mean Square

Jitter Measurement (continued)

	Interfaces	HP1 Hz (20 dB/dec)	HP2 KHz (20 dB/dec)	LP KHz (60 dB/dec)	HPrms KHz (20 dB/dec)
Jitter Measurement Filters Characteristics	OC-48/STM16	5000	1000	20000	12
	OC-12/STM4	1000	250	5000	12
	OC-3/STM1	500	65	1300	12
	STS-3/STM1e	500	65	1300	12
	STS-1	100	20	400*1	12
	E4	200	10	3500	12
	E3	100	10	800	12
	E1	20	18	100	12
	DS3	10	30	400*1	12
	DS1	10	8	40*1	12

*1: At 20 dB/dec
Filters with frequency break points

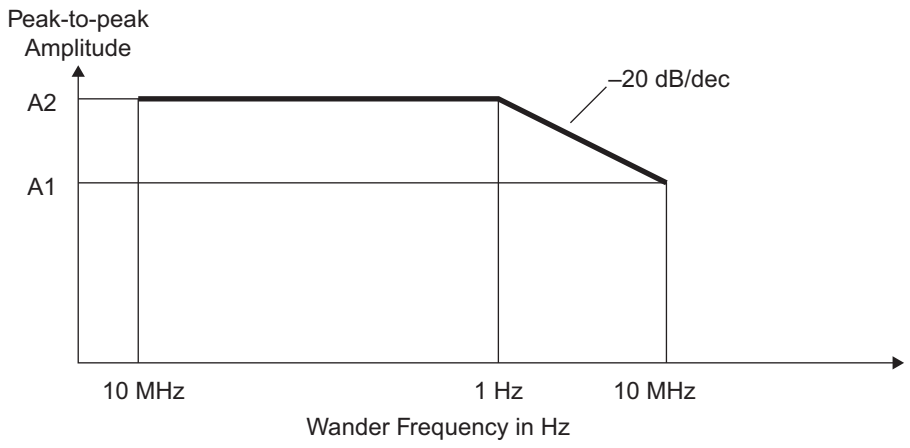
Jitter Hits	The jitter measurement counts the number of seconds with hits (jitter exceeding a user specified threshold)	
	Results	'Hit second' count is displayed numerically Each second with a jitter hit is recorded in the 'Event Log' file
Jitter Tolerance	An optimized algorithm increases jitter amplitude until occurrence of an error in the received signal. A fast tolerance mode is also available. It allows a more rapid assessment of the jitter performance of the system under test.	
	User Selectable Mask	The jitter Tolerance measurement is automatically performed and compared with predefined standard masks: • PDH: ITU-T G.823 low and high Q masks • T-Carrier: ITU-T G.824 and Telcordia GR.499 masks, category 1 and 2 • SDH: ITU-T G.825 masks • SONET: Telcordia GR.253 masks Independent transmit and receive tributaries can be selected
	Results	The results are displayed in a graph with masks or a table with a clear PASS/FAIL message
Jitter Transfer	Jitter Transfer measurement defines the ratio between the output jitter amplitude and the input jitter amplitude versus the jitter frequency for a given bit rate	
	Jitter Transfer Pass Masks	Jitter Transfer measurement is automatically performed and compared with ITU-T G.741, G.742, G.783 and Telcordia GR.253, GR.499 specifications
	Frequency	Up to 20 MHz
	Results	The results are displayed in tabular format or plotted on a graph showing the gain versus frequency. The pass mask is displayed on the graph as well as the results
Jitter Pointer Analysis	Compliance with recommendation ITU-T G.783. Pointer sequences are programmable	
	Results	The unit generates pointer sequences and simultaneously analyzes the output jitter of the device under test. Results are displayed in a numerical or graphical form

Wander Generation

Wander Generation Characteristics	Tx Signals	Sinusoïdal wander generation at all bit rates included in the XTA module configuration		
	Amplitude Range	Up to 100 µs*1		
	Frequency Range	10 µHz to 10 Hz*1		
	Frequency Shift	Programmable frequency offset (only with internal clock reference) –100 to +100 ppm in 0.1 ppm steps For PDH/T-Carrier and SONET/SDH		
SONET/T-Carrier Wander Generation Characteristics	Interfaces	Bit Rate Mbit/s	A2 in UIFrom 10 µHz to 1 Hz	A1 in UI at 10 Hz
	OC-48	2488.320	240 000	24 000
	OC-12	622.080	60 000	6000
	OC-3	155.520	15 000	1500
	STS-3	155.520	15 000	1500
	STS-1	51.840	5200	520
	DS3	44.736	4500	450
	DS1	1.544	160	16

*1: Depending on the XTA module configuration

Wander Generation (continued)



Wander amplitude mask for SONET/SDH

	Interfaces	Bit Rate Mbit/s	A2 in UI From 10 µHz to 1 Hz	A2 in UI From 10 µHz to 1 Hz
SDH/PDH Wander Generation Characteristics	STM16	2488.320	240 000	24 000
	STM4	622.080	60 000	6000
	STM1	155.520	15 000	1500
	STM1e	155.520	15 000	1500
	E4	139.264	15 000	1500
	E3	34.368	3500	350
	E1	2.048	200	20

Wander Measurement

Wander Analyzer Characteristics	Rx Signals	Wander measurement at all bit rates in SONET/SDH included in the XTA module configuration Signal Qualification ensures that the incoming signal is in acceptable operating range before starting a wander measurement, by checking: • Optical/electrical power • Frequency shift (up to 100 ppm)
	Alarms and Errors Analysis	Alarms and errors are analyzed in real time during the jitter measurement • SDH alarm events: LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, HP-RDI, TU-AIS, LP-RDI, AIS, LSS • SONET alarm events: LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, RDI-P, AIS-V, RDI-V, AIS, LSS • SDH error events: B1, B2, MS-REI, B3, V5, HP-REI, LP-REI, LSS • SONET error events: B1, B2, REI-L, REI-P, V5, REI-V, LSS
	TIE (Time Interval Error)	Sample rate up to 100/s Low pass filter at 10 Hz
	MTIE (Maximum Time Interval Error)	Measurement range: from 1 µs up to 1s Resolution: 0.1 ns
	MRTIE (Maximum Relative Time Interval Error)	If the reference clock is unavailable when analysing wander signals, the MTIE analysis may have a superimposed frequency offset. This offset is removed in MRTIE analysis.
	TDEV (Time DEViation)	Measurement range: 10^5 ns Resolution: 0.01 ns
	Reference Clock Signal	• External: for wander analysis with XTA modules, it is recommended to provide a reference clock with very high accuracy*1, *2 • Internal frequency: stratum 3 (10 MHz)
	Results	TIE, MTIE, MRTIE, TDEV are displayed in a graphical and tabular result presentation Calculation of MTIE and TDEV are in real time Frequency offset is displayed Graphical mode is user adjustable with cursor and zoom In/Out

*1: No external reference clock source is required for jitter measurement
*2: External 2 MHz - 75 Ω BNC connector, External 1.5 MHz - 75 Ω BNC connector

XTA Application: Next Generation Monitoring Option

Interfaces and Signal Specifications*1

	Interfaces	SONET/SDH	Rates (Mb/s)	HO Path	XTA Modules		
					XTA 10G	XTA 2.5G	XTA 622
Interfaces available for the “Next-Generation SONET/SDH” option	Optical 1550 nm and 1310 nm*2	OC-192	9953.280*3	STS-3-c SPE STS-1-SPE	√	–	–
		OC-48	2488.320		√	√	–
		OC-12	622.080		√	√	√
		OC-3	155.520		√	√	√
		STM-64	9953.280*3	VC-4 (AU-4) VC-3 (AU-3)	√	–	–
		STM-16	2488.320		√	√	–
		STM-4	622.080		√	√	√
		STM-1	155.520		√	√	√
	Electrical	STS-3	155.520	STS-3-c SPE	√	√	√
		STS-1	51.840	STS-1-SPE	√	√	√
		STM-1	155.520	VC-4 (AU-4)	√	√	√
				VC-3 (AU-3)			

*1: All the general specifications of the XTA modules are described in the CMA5000a extended Transport Analysis Application datasheet
*2: SC/PC Connectors
*3: For the OC-192 / STM-64 interface, the wavelength is 1550 or 1310 nm

ITU-T and ANSI Recommendations	Virtual Concatenation (VCAT)	ITU-T: G.707, G.783, G.806 ANSI: T1.105
	Link Capacity Adjustment Scheme (LCAS)	ITU-T: G.7042 ANSI: Refers to G.7042

Virtual Concatenation (VCAT) Monitoring

VCAT Monitoring Characteristics	High Order Concatenation	SONET: STS-3-c SPE, STS-1-SPE SDH: VC-4 (AU-4), VC-3 (AU-3)
	Overhead Analysis	Real time display of the following information: • J1 path trace message of all the containers (ASCII sequence) • C2 signal label of all the containers (interpretation in text format)
	Group Overview	• All the VCAT containers are automatically broken down by group • Alarm detection for all group members: LOM, OOM1, OOM2, SOM • Error detection for all group members: CRC-8 • CTRL field interpretation for all group members: NORM (Normal), DNU (Do Not Use), EOS (End of Sequence)

Differential Delay Analysis

Differential Delay Analysis Characteristics	Differential Delay	• Analysis of the differential delay of all group members (maximum delay: 224 ms) • Displays in real time of the pointer values of all group members: shows graphically the acceleration and showing down of each group member

LCAS Protocol Monitoring

LCAS Monitoring Characteristics	LCAS Monitoring	Display the LCAS activity by decoding in text format the value of the CTRL field of all group members: • ADD, REMOVE, FIXED, NORM, DNU, EOS • LCAS activity displayed in an "Event Log" window with a time stamp

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 CMA5600 XTA module is a test module for T-Carriers/PDH and SONET/SDH technologies up to 10 Gbps (depends on the module). It is a double (2-bay) module and can be used in either an SBA and MBA.
Select base module and additional testing options below.

5663-000-XTA	CMA5000a XTA 10G-1310 nm module. Test Module for T-Carriers/PDH and SONET/SDH technologies up to 10Gig It provides: *Optical interfaces at 1310 nm for OC192 and STM64 *Optical interfaces at 1310 and 1550 nm for OC3/12/48 and STM1/4/16 *Electrical interfaces for DS1, DS3, STS1, STS3, and E1, E3, E4, STM1
5663-101-XTA	Concatenation option for XTA 10G-1310 nm module
5663-151-XTA	T-Carrier Package (T-carrier MUX/DEMUX and Voice Add/Drop (μ-Law))
5663-201-XTA	Tandem Connection Monitoring option for XTA 10G-1310 nm module
5663-239-XTA	Remote Commands for XTA-10G 1310 nm module *T-Carrier Package/ATM/VCAT Monitoring options are not supported by remote commands
5663-401-XTA	ATM option for XTA 10G-1310 nm module
5663-501-XTA	Virtual Concatenation Monitoring option (VCAT, LCAS, Diff.Delay) for High Order Path for XTA 10G-1310 nm module

5665-000-XTA	CMA5000a XTA 10G-1550 nm module. Test Module for T-Carriers/PDH and SONET/SDH technologies up to 10Gig It provides: *Optical interfaces at 1550 nm for OC192 and STM64 *Optical interfaces at 1310 and 1550 nm for OC3/12/48 and STM1/4/16 *Electrical interfaces for DS1, DS3, STS1, STS3, and E1, E3, E4, STM1
5665-101-XTA	Concatenation option for XTA 10G-1550 nm module
5665-151-XTA	T-Carrier Package (T-carrier MUX/DEMUX and Voice Add/Drop (μ-Law))
5665-251-XTA	High Optical Sensitivity option for STM64/OC-192 interfaces (-24 dBm @ 10-12 BER)
5665-201-XTA	Tandem Connection Monitoring option for XTA 10G-1550 nm module
5665-239-XTA	Remote Commands for XTA-10G 1550 nm module *T-Carrier Package/ATM/VCAT Monitoring options are not supported by remote commands
5665-401-XTA	ATM option for XTA 10G-1550 nm module
5665-501-XTA	Virtual Concatenation Monitoring option (VCAT, LCAS, Diff.Delay) for High Order Path for XTA 10G-1550 nm module

5616-000-XTA	CMA5000a XTA 2.5G module. Test Module for T-Carriers/PDH and SONET/SDH technologies up to 2.5Gig It provides: *Optical interfaces at 1310 and 1550 nm for OC3/12/48 and STM1/4/16 *Electrical interfaces for DS1, DS3, STS1, STS3, and E1, E3, E4, STM1
5616-101-XTA	Concatenation option for XTA 2.5G module
5616-151-XTA	T-Carrier Package (T-carrier MUX/DEMUX and Voice Add/Drop (μ-Law))
5616-201-XTA	Tandem Connection Monitoring option for XTA 2.5G module
5616-239-XTA	Remote Commands for XTA-2.5G module *T-Carrier Package/ATM/VCAT Monitoring/Next-Gen options are not supported by remote commands
5616-301-XTA	Tx (generation) & Rx (analysis) Jitter and Wander pkg up to 2.5G Must be ordered with the 5616-000-XTA*1
5616-351-XTA	Tx (generation) Only Jitter and Wander pkg up to 2.5G Must be ordered with the 5616-000-XTA
5616-401-XTA	ATM option for XTA 2.5G module
5616-501-XTA	Virtual Concatenation Monitoring option (VCAT, LCAS, Diff.Delay) for High Order Path for XTA 2.5G module
5616-601-XTA	Next Generation SONET/SDH Tx & Rx for High Order paths (VC4, STS3c, STS1): VCAT, LCAS, GFP-F, GFP-T, EoS*1

5604-000-XTA	CMA5000a XTA 622 module. Test Module for T-Carriers/PDH and SONET/SDH technologies up to 622 Mbit/s It provides: *Optical interfaces at 1310 and 1550 nm for OC3/12 and STM1/4 *Electrical interfaces for DS1, DS3, STS1, STS3, and E1, E3, E4, STM1 *Concatenation for OTA 622 Module *Tandem Connection Monitoring *Tx (generation) & Rx (analysis) Jitter and Wander package up to 622 Mb/s
5604-151-XTA	T-Carrier Package (T-carrier MUX/DEMUX and Voice Add/Drop (μ-Law))
5604-239-XTA	Remote Commands for XTA-622 module *T-Carrier Package/ATM/VCAT Monitoring options are not supported by remote commands
5604-401-XTA	ATM option for XTA 622 module
5604-501-XTA	Virtual Concatenation Monitoring option (VCAT, LCAS, Diff.Delay) for High Order Path for XTA 622 module

*1: Option 301 (J&W Tx & Rx) and Option 601 (Next-Generation) cannot be installed together on the same XTA-2.5Gig module.

10 GigE/SDH/SONET/OTN

CMA5000a-UTA

CE

Testing 10 GigE, SDH/SONET and OTN networks with one single module

The last few 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

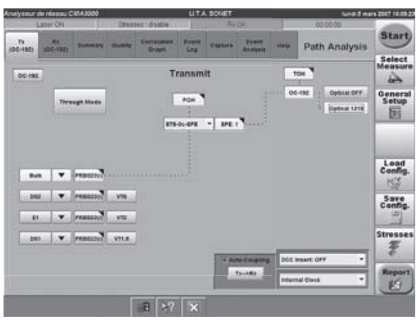
All the UTA applications are based on the same graphical user interface. The users will greatly benefit from this feature as it significantly reduces the time of training with a new application.

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.

SDH/SONET and 10 GigE Applications

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 100ns resolution, network availability and performance evaluation. The UTA application characterizes 10 Gbps SONET/SDH networks down to the tributary level (DS1/E1).



Specifications

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 100 Ω	E1 (2.048 Mb/s)/DS1 (1.544 Mb/s)
	BNC 75 Ω	2.048 MHz/1.544 MHz/10 MHz
Clock Output	BNC 75 Ω	10 MHz
	SMA 50 Ω	Line rate divided by 16: - 644.53 MHz (for LAN-PHY) - 622.06 MHz (for WAN-PHY)

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Optical Interfaces*3, 4					
Interfaces	Wavelength	Output Power	Reach	Overload	Sensitivity
10GBASE-SR/SW	840 to 860 nm	–7.3 to –1.0 dBm	300 m	–1 dBm	–11 dBm
10GBASE-LR/LW	1290 to 1330 nm	–8.2 to +0.5 dBm	10 km	+0.5 dBm	–12.6 dBm
10GBASE-ER/EW	1530 to 1565 nm	–4.7 to +4 dBm	40 km	–1 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 (enable/disable) with configurable PRIORITY (0-7) / CFI (enable/disable) / ID (0-4095) fields. • Payload content: PRBS or User Defined pattern.
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

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

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 and 127 bytes • Frames with size between 128 and 255 bytes • Frames with size between 256 and 511 bytes • Frames with size between 512 and 1023 bytes • Frames with size between 1024 and 1518 bytes • Jumbo frames • Average frame size (bytes)

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

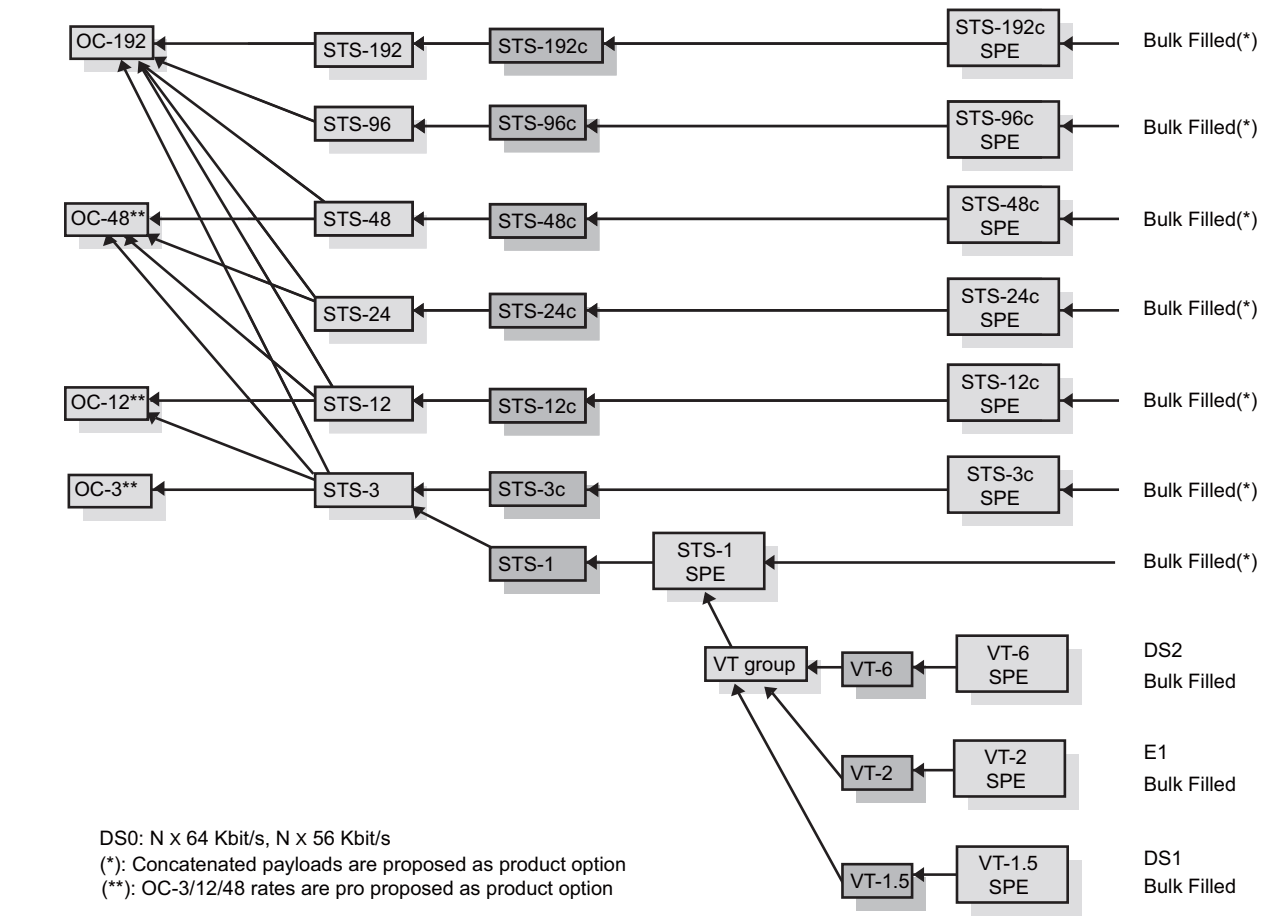
Interfaces and Signal Specifications		
Signal	Port/Connector	Format
STM-64 / OC-192 (9953.280 Mb/s)	One XFP port*1	- STM-64: as per ITU-T G.707 - OC-192: as per Telcordia GR-253-Core
Clock Input	Bantam 100 Ω	E1 (2,048 Mb/s) / DS1 (1,544 Mb/s)
	BNC 75 Ω	2.048/1.544/10 MHz
Clock Output	BNC 75 Ω	2.048/1.544 MHz
	SMA 50 Ω	622.08 MHz (with STM-4/16/64), 155.52 MHz (with STM-1)
Data Communication Channel	DB-15 connector	D1-D3: 192 Kb/s channel D4-D12: 576 Kb/s channel

Optical Interfaces*2, 3					
Interfaces	Wavelength	Output Power	Reach	Overload	Sensitivity
SR1 / I64.1	1290 to 1330 nm	–6 dBm / –1 dBm	10 km (SMF)	–1 dBm	–11 dBm
IR2 / S64.2	1530 to 1565 nm	–1 dBm / +2 dBm	40 km (SMF)	–1 dBm	–14 dBm
LR2/P1L1-2D2	1530 to 1565 nm	0 dBm / +4 dBm	80 km (SMF)	–9 dBm	–24 dBm

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

∗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.

SONET Mappings



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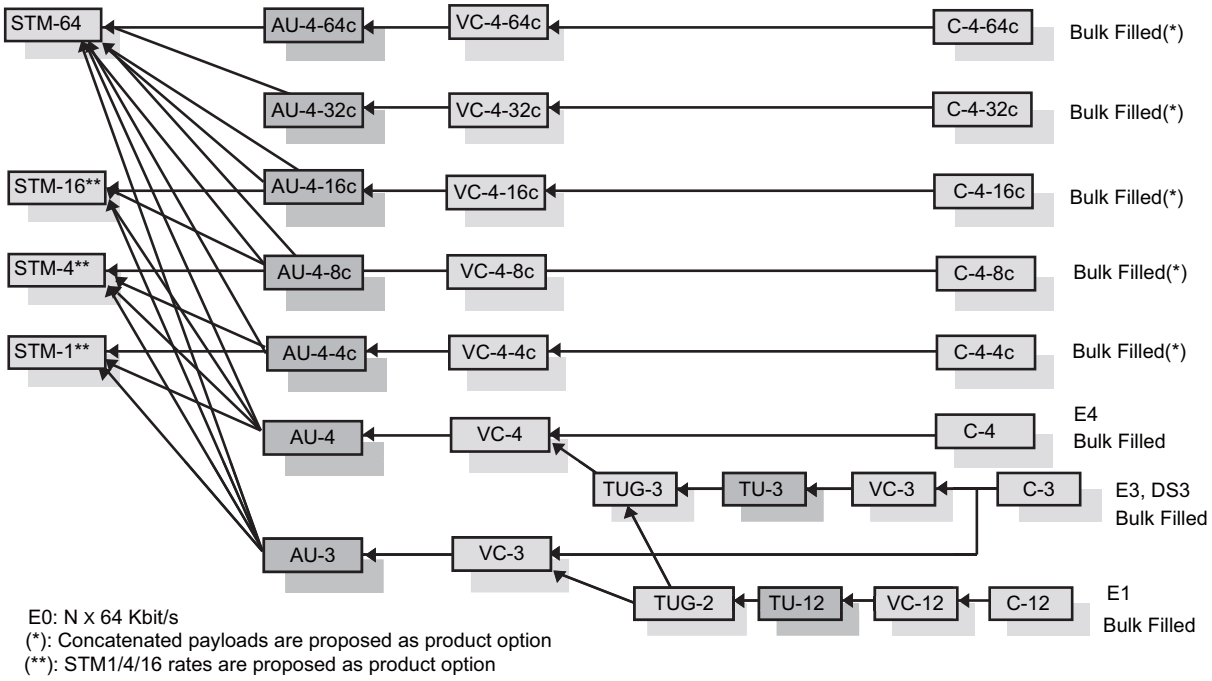
SDH Mappings



E0: N x 64 Kbit/s
(*): 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 sec (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 recommandations, 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 Appliication

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: o Pointer set to any value with or without NDF o Positive and Negative movements o 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)

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
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)

Note: For best performance, the CMA5000a platform must have 512M RAM when using UTA with more than one application.

ETHERNET TEST SET

CMA5000a Gigabit Ethernet Module II

Accelerating the Deployment of Ethernet Services

The CMA5710 Gigabit Ethernet application is a single slot module that can be used in any CMA5000a. The Gigabit Ethernet test module enables testing of 10/100/1000 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

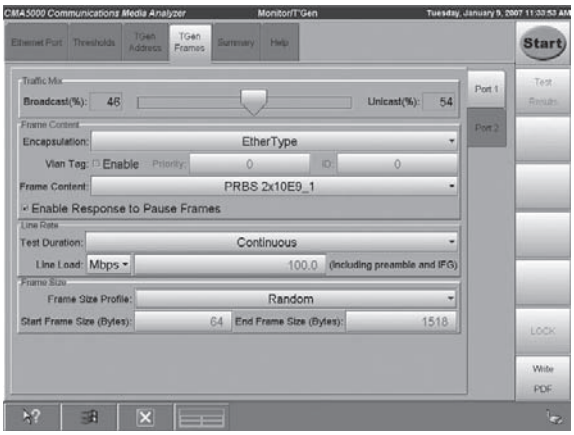


Fig.2: User defined traffic mix provides emulation of real world traffic

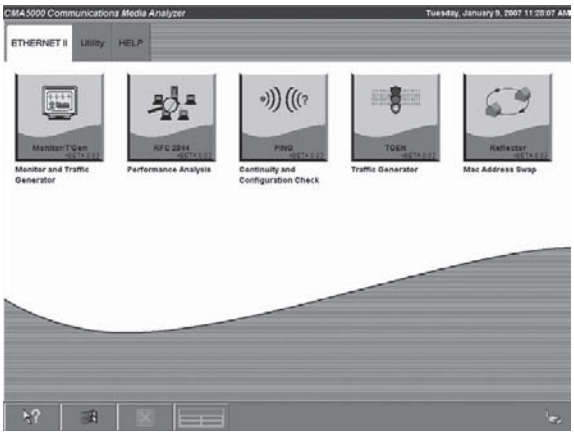


Fig.4: Targeted application modes provide the required tests for each test application

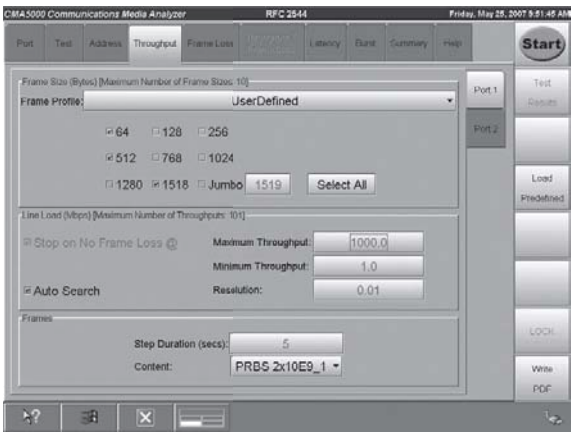


Fig. 3: Quick and automated RFC 2544 testing.

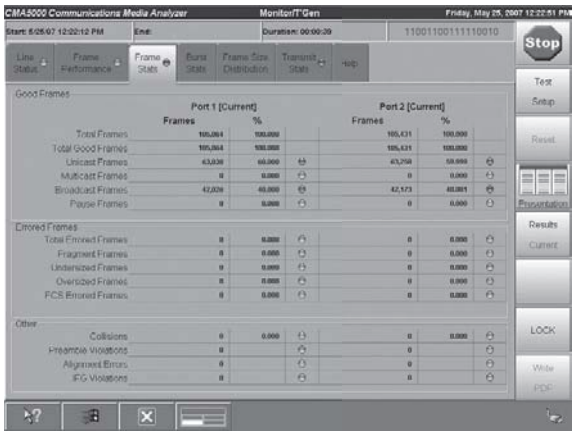


Fig.5: Intuitive test results in both a tabular and graphical display.

Specifications

General	
Ports	2 electrical 10/100/1000M 2 optical (SFP) 1000M (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
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

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 (cont'd)	
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 (10/100 Mbps half duplex only) • Preamble violations • Alignment errors • IFG violations
Frame Distribution Statistics	• Total valid/good frames • 64 to 127 byte frames • 128 to 255 byte frames • 256 to 511 byte frames • 512 to 1023 byte frames • 1024 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, Mulitcast, Broadcast frames • Pause frames • Errored frames • Fragment frames • Undersized, oversized frames • FCS errored frames • IFG violations • Preamble violations • Alignment errors

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

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
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
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)	
Staistics 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 Staistics	• Bert, Errored Second, Error Free Second
Sequence Stats	• Sequence Errors, Frame Loss, Sequence sync Loss

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 Number:
5710-000-GIGE
Base GigE II module

• CMA5000a Gigabit Ethernet SFP Options

5710 - __ __ __ - GIGE

085 = 850 nm SFP Transceiver
013 = 1300 nm SFP Transceiver
015 = 1550 nm SFP Transceiver

ALL-IN-ONE FIELD TESTER
CMA 3000

Installation and Maintenance of Mobile-Access and Fixed-Access Networks, Transmission Networks and Switching.

Field Testing Has Never Been Easier

CMA 3000 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 x 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 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.

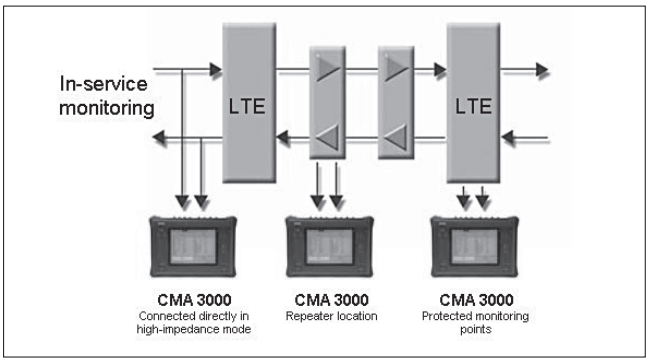


Figure 1: The CMA 3000 allows you to perform in-service monitoring of 2 Mbps lines.

The instrument's two inputs allow instant monitoring of both sides of a line and comparison of simultaneously recorded results.

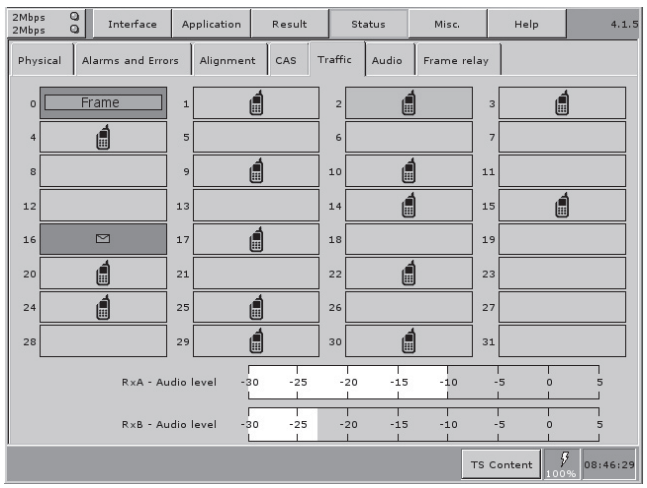


Figure 2: Fast overview of traffic channel time slots.

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.

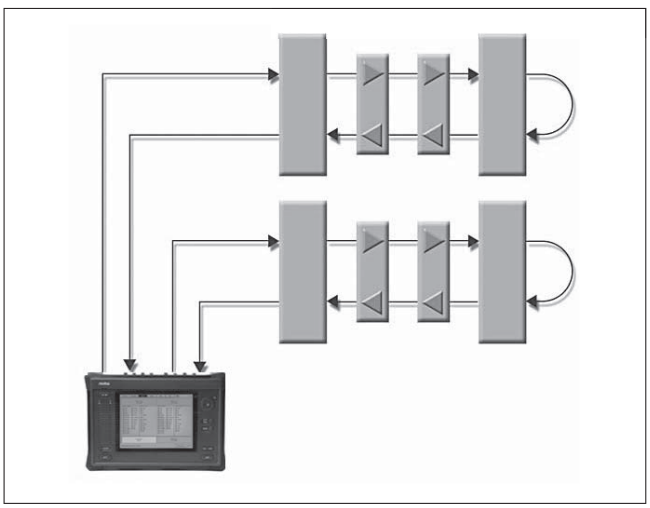


Figure 3: Simultaneous out-of-service testing of up to two 2 Mbps lines with CMA 3000.

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.

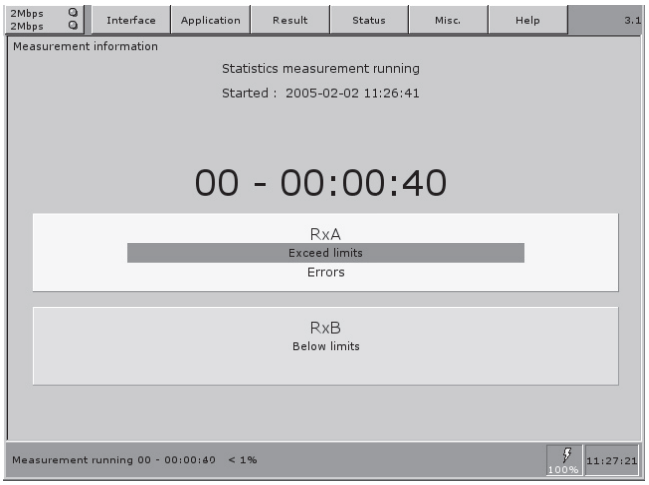


Figure 4: The Measurement Summary function gives you an OK/Questionable/not-OK indication.

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.

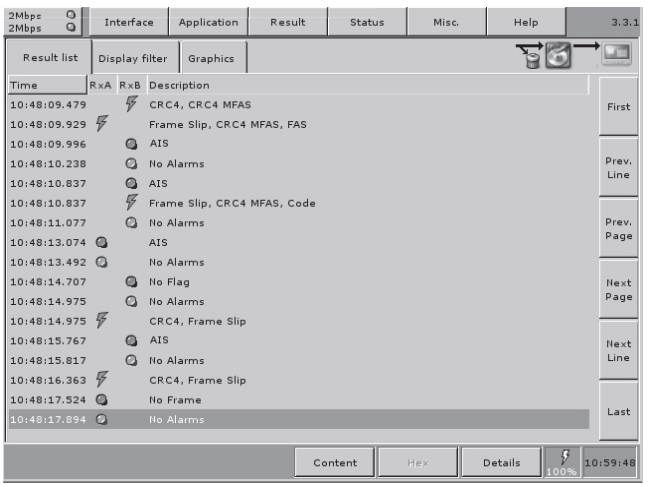


Figure 5: CMA 3000 gives you a log of errors and alarms with high-resolution time stamps.

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.

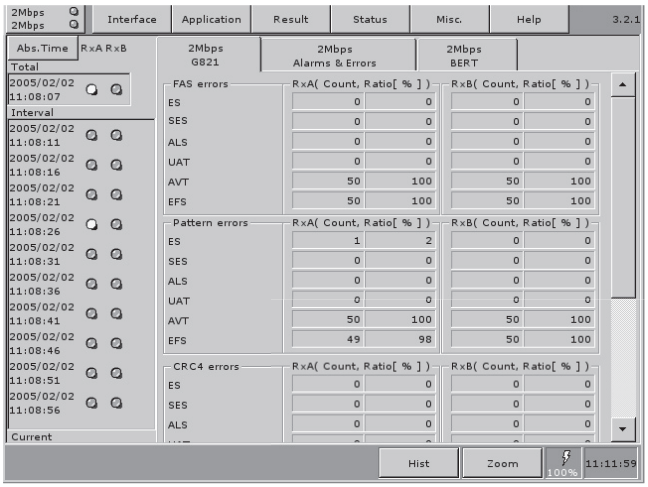


Figure 6: With the CMA 3000 you have comprehensive error performance statistics.

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.

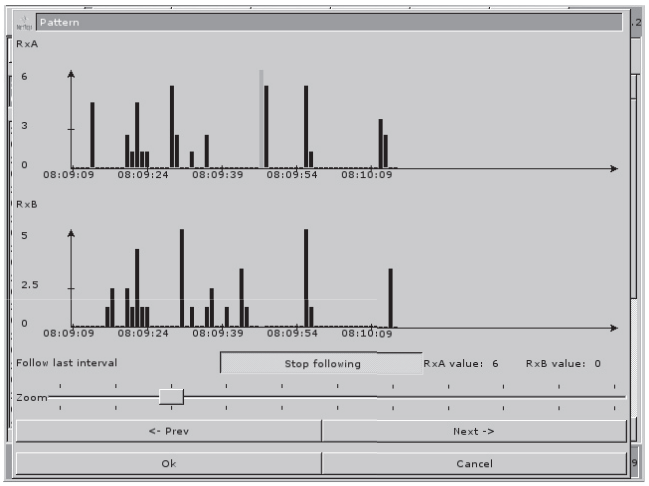


Figure 7: The CMA 3000 histograms facilitate the overview of a statistical measurement.

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: • 75 Ω (unbalanced), 120 Ω (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 signaling bits may be generated
	BER test patterns	Pattern generation: • Unframed of framed n x 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 1s, 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: +3 to –70 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: • 75 Ω (unbalanced), 120 Ω (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 x 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: +3 to –66 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

Continued on next page

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 10/100. 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 (1x6) 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
	Compact Flash	The instrument is equipped with one Compact Flash socket
Miscellaneous	Display	8 1/4" active TFT display with VGA resolution (640 x 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 to 240 V AC, 50 to 60 Hz Output: 18 V DC, max. 3.4 A
	Mechanical	Basic instrument: • Dimensions: Approx. 23 x 33 x 7.5 cm (H x W x D) • Weight: Approx. 3.3 kg
	Environmental	Operating temperature: 0˚ to +40˚C Storage temperature: –25˚ to +60˚C EMC: EN300 386 (205) V1.3.3, LVD: EN60950-2006/95/EEC
	Standard accessories	• User's Guide • LiIon battery • Mains adapter with mains cable • Stylus
	Options	• SDH test options • Frame relay test option • Abis protocols – ETSI and vendor specific*1 • Vendor specific GPRS Abis PCU protocols*1 • GPRS Gb interface protocol decode (requires Frame relay test option) • SS7 protocols*1 • ISDN protocols*1 • ISDN PRI call emulation protocols*1 • V-series interface measurement option • Ethernet 10/100 interface measurement option • Ethernet 10/100/1000 interface measurement option • IP over Ethernet measurement option (requires Ethernet interface measurement option) • Ethernet multistream option (requires Ethernet interface measurement option) • VoIP test options (requires Ethernet interface measurement option) • VoIP SIP Call emulator (requires Ethernet interface measurement option) • VoIP Voice quality measurement (requires Ethernet interface measurement option) • E3 interface testing • ATM over SDH test option (requires SDH test option) • ATM over E1/E3 test option (ATM over E3 requires E3 test option)
	Additional accessories	• Carrying case • Carrying soft bag • Instrument carrying strap • Extra LiIon battery • Ear phones • Telephone set • Measurement cables
	Service products	• Factory calibration

*1: Please contact your local Anritsu representative for details on available protocols

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 SW 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 SW 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 are two basic SDH options for the CMA 3000:
• 015807xx SDH Test Option Incl. STM-1 Electrical Interface
  o Supports optional optical modules for STM-1 and STM-4
• 015897zz Enhanced SDH Test Option Incl. STM-1 Electrical Interface
  o Supports optional optical modules for STM-1, STM-4 and STM-16

xx = 00 and zz = 08: Factory installed at initial delivery of instrument
xx = 80 and zz = 80: Post installed at factory after initial delivery of instrument
xx = 90 and zz = 90: Field installed by customer

When ordering SDH options you must always order one of the above basic options.
They include the hardware needed to carry the optical modules.

Please also order as relevant:
• SW driver and optical modules (one or two) 015xxxYY
  o YY = 00 For port A, Factory installed
  o YY = 01 For port B, Factory installed
  o YY = 90 For port A, Field installed
  o YY = 91 For port B, Field installed
• Cables for optical modules (minimum two)

Ethernet Options

Two Ethernet options are available:
• 015861xx Ethernet 10/100 Electrical – Internal module
• 015870xx Ethernet 10/100/1000 – Plug-on (“GigE”) module (attached to the rear of the CMA 3000 Basic instrument
The two modules offer the same Ethernet testing functions.
The 015870xx plug-on “GigE” module offers the same 10/100 electrical interface as the internal module 015861xx.
In addition it has optical interface as well as 1000 Mbps electrical interface.
The 015870xx plug-on “GigE” module should be ordered when 1000 Mbps is or will be required.

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 SW delivery option for field installation of SW options
7. Check for correct ordering codes for field installation of V-series interface or 10/100 Ethernet options
8. Include Serial Number when ordering options for field installation

Ordering Information

Model/Order No.	Name	Required Basic SW	Required P/N
	CMA 3000 Basic Instrument		
0053100X	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 and User´s guide 09108600 YY = 12: China - includes power cable 01453398 and User´s guide 09108600 YY = 13: China - includes power cable 01453198 and User´s guide 09108600		
	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 10/100 Electrical Interface Test Option, Factory installed at initial delivery of instrument		
01586180	Ethernet 10/100 Electrical Interface Test Option, Post installed at factory after initial delivery of instrument	V2.10 or higher	
01586191	Ethernet 10/100 Electrical Interface Test Option, Field installed by customer • For instruments delivered after September 2005 and • For instruments with 015835xx V-Series Interface Measurement Option installed regardless of age Serial number information required	V2.10 or higher	
01586192	Ethernet 10/100 Electrical Interface Test Option and basic instrument hardware upgrade, Field installed by customer Serial number information required For instruments delivered before September 2005, without the 015835xx V-Series Interface Measurement Option installed	V2.10 or higher	
01587000	Ethernet 10/100/1000 Interface Testing incl 2 RJ-45 Electrical Ports, Factory installed at initial delivery of instrument		
01587080	Ethernet 10/100/1000 Interface Testing incl 2 RJ-45 Electrical Ports, Post installed at factory after initial delivery of instrument	V2.34 or higher	
01587090	Ethernet 10/100/1000 Interface Testing incl 2 RJ-45 Electrical Ports, Field installed by customer The module can be equipped with two optical modules:	V2.34 or higher	
015941XX	850 nm (SX) (one module)		015870xx
015942XX	1310 nm (LX) (one module)		015870xx
015943XX	1550 nm (ZX) (one module)		015870xx
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 Note: XX = 00 Factory installed XX = 90 Field installed. Please specify serial No of the target instrument	V3.31 or higher	015870xx
01583300	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	
01580700	SDH Test Option Incl. STM-1 Electrical Interface, Factory installed at initial delivery of instrument		
01580780	SDH Test Option Incl. STM-1 Electrical Interface, Post installed at factory after initial delivery of instrument		
01580790	SDH Test Option Incl. STM-1 Electrical Interface, Field installed by customer		
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 Up to two of the following modules can be installed in the SDH Test Option	V3.50 or higher	
015845YY	SW driver and optics for STM-1 1310 nm, short haul, LC connector		015807XX or 015897XX
015846YY	SW driver and optics for STM-1/4 1310 nm, short haul, LC connector		015807XX or 015897XX
015990YY	SW driver and optics for STM-1/-4/-16 1310 nm, short haul, LC connector	V3.50 or higher	015897XX
015847YY	SW driver and optics for STM-1 1310 nm, long haul, LC connector		015807XX or 015897XX
015848YY	SW driver and optics for STM-1 1550 nm, long haul, LC connector		015807XX or 015897XX
015849YY	SW driver and optics for STM-1/4 1310 nm, long haul, LC connector		015807XX or 015897XX
015850YY	SW driver and optics for STM-1/4 1550 nm, long haul, LC connector		015807XX or 015897XX

Model/Order No.	Name	Required Basic SW	Required P/N
015991YY	SW driver and optics for STM-1/-4/-16 1310 nm, long haul, LC connector	V3.50 or higher	015897XX
015993YY	SW driver and optics for STM-1/-4/-16 1550 nm, long haul, LC connector	V3.50 or higher	015897XX
	Note: Includes the software needed to support them YY = 00 For port A, Factory installed YY = 01 For port B, Factory installed YY = 90 For port A, Field installed by customer YY = 91 For port B, Field installed by customer		
	Cables for Optical Modules		
01460190	Cable, optical, singlemode LC to SC-PC, 3 meter		
01463190	Cable, optical, singlemode LC to Radiall VFO, 3 meter		
01463290	Cable, optical, singlemode LC to FC-APC, 3 meter		
01463390	Cable, optical, singlemode LC to DIN4726, 3 meter		
01463498	Cable, optical, singlemode LC to FC-PC, 3 meter		
01463590	Cable, optical, singlemode LC to E-2000, 3 meter		
01463698	Cable, optical, singlemode LC to E-2000 APC, 3 meter		
01463798	Cable, optical, singlemode LC to ST-PC, 3 meter		
01464090	Cable, optical, singlemode LC to LX.5, 3 meter		
01463890	Cable, optical, singlemode LC to LC, 3 meter		
01468990	Cable, optical, multimode SC to LC, 3 meter		
01468890	Cable, optical, multimode LC to LC, 3 meter		
01463990	Optical Attenuator 10 dB LC to LC		
	V- Series Interface		
01583500	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 • For instruments delivered after September 2005 and • For instruments with 015861xx 10/100 Ethernet Board Option installed regardless of age Serial number information required	V2.10 or higher	015861xx
01583592	V-Series Interface Option and basic instrument hardware upgrade. Field installed by customer • For instruments delivered before September 2005, without the 015861xx Ethernet 10/100 option installed. Serial number information required	V2.10 or higher	
	Connection Cables for V-Series Interface Option		
01442290	RS-530 DCE/DTE		015835xx
01442390	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
01558600	Data Interface Connector Box		015835xx
01448200	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)		
01445890	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		
	SW Delivery Options When ordering field-installed SW 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	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 (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 that P/N 015861xx or 015870xx option is installed.	V3.40 or higher	015861xx or 015870xx
083029xx	GPRS Gb interface protocol decode for CMA 3000 Requires that P/N 083084xx - Frame Relay test option is installed.		083084xx
083084xx	Frame Relay Test		

Model/Order No.	Name	Required Basic SW	Required P/N
083030xx	Frame Relay Decode Requires that P/N 083084xx - Frame Relay test option is installed.		083084xx
083086xx	Tandem Connection Monitoring	V2.10 or higher	
083087xx	ATM layer measurement - over E1/E3 ATM over E3 requires that P/N 015833xx - E3 Interface option is installed.	V3.10 or higher	015833xx
083088xx	ATM layer measurement - over SDH Requires that P/N 015807xx - SDH test option incl STM-1e is installed.	V3.00 or higher	015807xx
083089xx	IP over Ethernet measurement Requires that P/N 015861xx or 015870xx option is installed.	V3.10 or higher	015861xx or 015870xx
083333xx	Ethernet multistream option Requires that P/N 015861xx or 015870xx option is installed.	V3.30 or higher	015861xx or 015870xx
	CMA 3000 Software Kits for Updating to Latest Release		
08309190	WLD Please specify serial number of target instrument The SW is delivered on a CD-ROM		
08309195	WLD Please specify serial number of target instrument The SW is delivered on a CD-ROM and on a USB memory stick		
	Miscellaneous		
07030499	Carrying Case Important Note: Can only be used if the CMA 3000 is NOT equipped with the 015870xx Ethernet 10/100/1000 Interface Testing option		Not for 015870xx
07030599	Carrying Case - Full Size Has room for a CMA3000 equipped with the 015870xx Ethernet 10/100/1000 Interface Testing option		
070306WW	Softbag WW = 90: When ordered separately. WW = 99: When ordered together with an instrument.		
09108200	CMA 3000 User's Guide (Latest Release) NB: This item is **NOT** for sale in China		
09108600	CMA 3000 User's Guide (Latest Release) with label for the Chinese market NB: This item is **ONLY** for sale in China		
84703600	USB Memory stick (64 Mbytes)		
84501600	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		
01467890	Clock in/clock out cable		
	SW Delivery Options When ordering field-installed SW 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	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.		
	VoIP Call Emulation SW Options for CMA 3000 Requires basic VoIP Functionality option 083354xx. Note: for one license		
083355xx	SIP call emulator option	V3.40 or higher	083354xx
083356xx	Voice quality measurement option	V3.40 or higher	083354xx 083355xx
	ISDN Call Emulation SW 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

Model/Order No.	Name	Required Basic SW	Required P/N
	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	
	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 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 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	

MONITORING/SERVICE ASSURANCE

INTEGRATED OSS SERVICE ASSURANCE SOLUTIONS

MasterClaw™ Service Assurance Platform

Introduction

Network operators and service providers offering wireless-, 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.

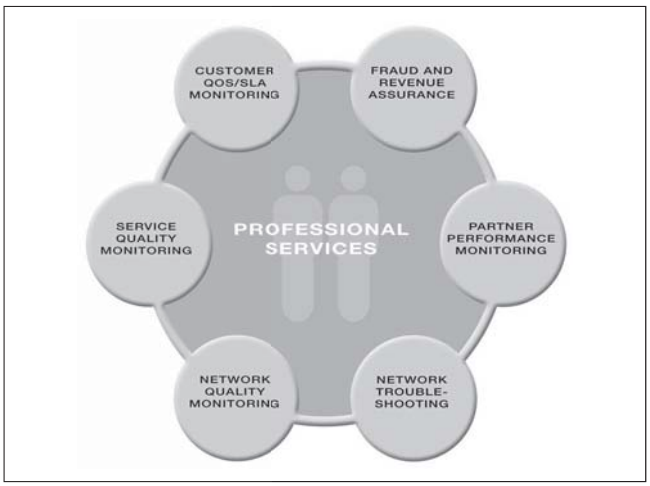


Figure 1 Core Solution Areas

The underlying framework for the OSS solution portfolio is Anritsu's service assurance platform MasterClaw™. MasterClaw is a probe based non-intrusive monitoring system designed to provide full end-to-end monitoring of converged networks, making MasterClaw the leading service and network monitoring system for GSM, GPRS, UMTS (including support for HSPA), VoIP/SS7 and IMS/NGN networks. 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. The integrated application suite makes MasterClaw a powerful tool for a broad set of users ranging from Network and Service Operations personnel to Product Managers and Account Managers.

MasterClaw™ System Overview

MasterClaw integrates network monitoring, troubleshooting as well as service and customer quality monitoring of converged networks. 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. For wireless operators this implies an integrated monitoring of not only the circuit switched and packet switched core domains, but also the RAN/UTRAN 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:

- **Data Acquisition Layer**
  This layer consists of MasterClaw monitoring probes, which gathers and stores data and provides a first level data correlation.
- **Data Processing Layer**
  This layer consists of MasterClaw servers and applications, which collect, correlate and store aggregated data from multiple probes as well as provide data for external 3rd party OSS systems.
- **Data Presentation and Reporting Layer**
  A secure Web interface gives flexible access to a set of integrated applications providing MasterClaw users real-time and historical access to all levels of information; from detailed signaling data to aggregated service quality statistics presented as Key Performance Indicators (KPIs) or Key Quality Indicators (KQIs).

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.

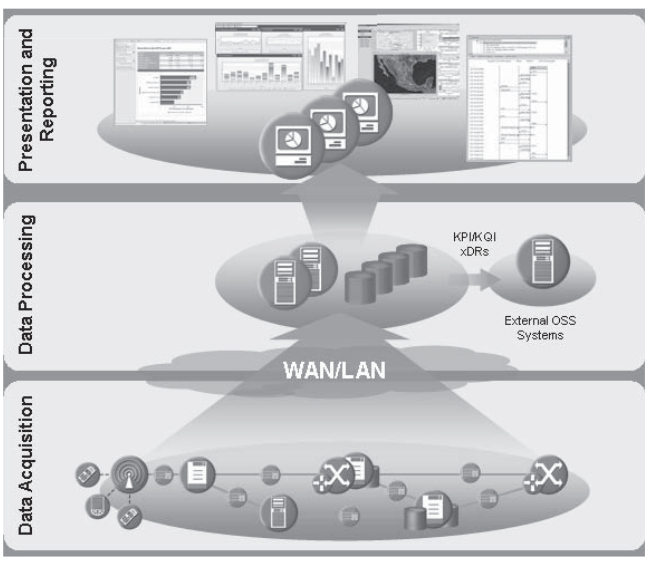


Figure 2 MasterClaw's distributed system architecture

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 based on Linux and builds on open technologies such as Java, SQL, Corba, SNMP and Web services. This implies that integration with other OSS systems is easy, 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 Acquisition - Intelligent Probes

• 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 flexible 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
- Media streams

The figure below illustrates the overall probe application architecture, which includes a set of distributed functions for collection, decoding, analysis and temporary storage of network data. After pre-filtering of the collected signaling and user plane data the CSDRs (Call Sequence Data Records), statistics, counters as well as raw signaling PDUs are created and stored on local hard disks capable of keeping data for several weeks, where the exact time is dependent on the traffic volume, customer requirements, etc. The local storage capability is also a central piece in making the overall solution redundant, as the probes can continue collecting data, despite temporarily loss of data connection to the central part of the system.

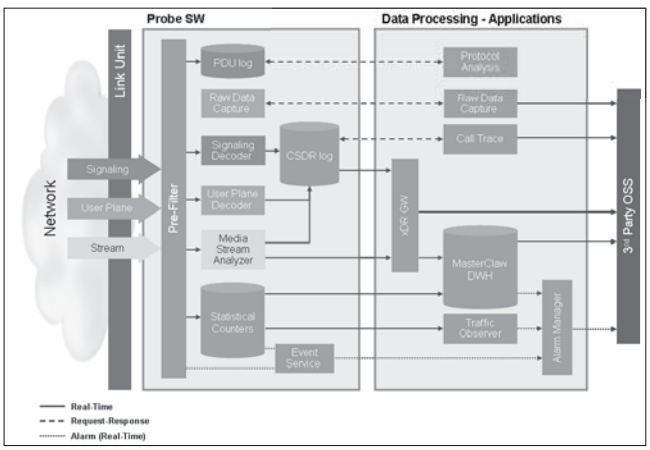


Figure 3 SW and HW architecture of MasterClaw probes, with selective applications

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 many days after an event or chain of events has occurred.

• Media Stream Analysis

The MasterClaw probes can be equipped with special software for analysis of different types of voice and video media streams. Those, so called Media Stream Probes, are for example used for real-time voice quality monitoring where the quality of live customer voice streams are rated according to MOS (Mean Opinion Score).
By using an efficient predictive voice quality assessment algorithm, MasterClaw can monitor every single call in even the largest back-bone networks. MasterClaw incorporates Psytechnics' Speech IP Monitor (PSI) algorithm that computes an accurate MOS value in real-time based on the RTP header information. Apart from RTP derived voice quality measurements, MasterClaw also capture possible MOS information in the extended reports exchanged over the RTCP protocol.
For classic PCM based networks MasterClaw supports full waveform based voice quality assessment analysis in accordance to ITU P.561, P.562 and P.563.

• HW Architecture

As depicted in Figure 3, any MasterClaw probe consists of a CPU platform that runs the probe applications, and one or more front end link units, as illustrated below. The link unit ensures efficient physical connection to the monitored network links and performs low level filleting functions.

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 Gbit/s Optical, E1/T1 ATM or TDM, STM1/OC3 SDH/SONET, E1/T1 Frame Relay etc.
Figure 4 illustrates the classic MasterClaw probe which is based on a sub-racks architecture which can accommodate up to 10 probes each. As multiple link units can be connected to the same probe application platform one sub-rack can be configured to support any combination protocols.

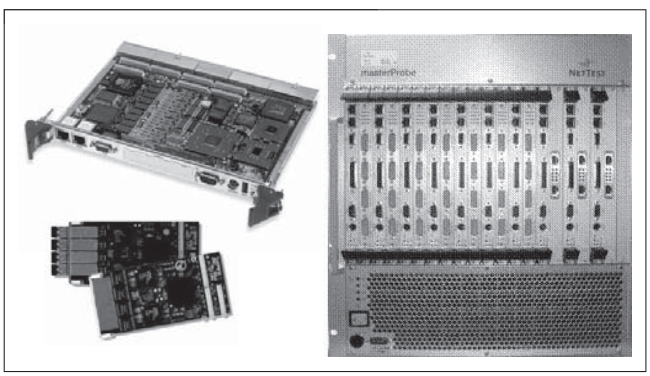


Figure 4 MasterClaw 84x0 sub-rack based probes, with link units, CPU boards

If additional CPU capacity is required for 84x0 sub-rack based probes, a so called Probe Booster server can be added that increases the processing and storage capacity of the probe even further. This provides full investment protection as network operators and service providers migrate to next generation all IP infrastructure.
For 1 Gbit/s, and future 10 Gbit/s, all IP networks Anritsu provides a high performance Ethernet probe. This platform is for example recommended for Media Stream Analysis. The high speed probe, as depicted below, is based on a multi processor and multi core CPU platform that uses dedicated line interface cards for optimal performance.

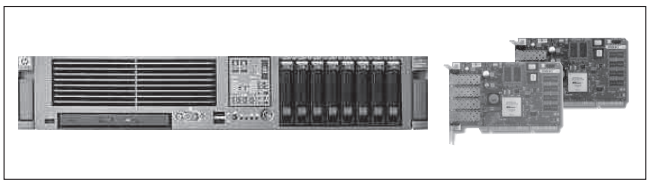


Figure 5 MasterClaw high performance probe for Gigabit networks and Media Stream Analysis

The probes (data acquisition layer) interwork with the central MasterClaw servers making up the data processing layer via TCP/IP over Ethernet.

• 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.

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.
As illustrated above, dedicated server applications facilitate fundamental and mission critical trouble shooting 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 Warehouse
The hub for MasterClaw integrated network-service-customer-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.
The DWH supports 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, the DWH may incorporate data from other sources 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 systems via open APIs.
A dedicated xDR gateway server facilitates configurable and flexible export of various types of data records, xDRs, to external OSS systems, such as revenue assurance, fraud- and security management systems. Additionally, the flexibility in the output format also allows the xDR information to be used for a wide range of non-OSS related applications such as location based services, tracking services etc. The xDR gateway provides a reliable feed of high qualitative data records that can be scaled to several 100 millions data records per day.
Finally, any network performance or correlated service quality alarm handled by the alarm manager can be exported northbound to accommodate integration with traditional fault management systems. A number of different technologies may be used for the integration including ASCII files, SNMP and Corba, where MasterClaw offers a fully defined MIB (Management Information Base). Anritsu is also a part of IBM's partner network and offers pre-integrated solutions with IBM's Tivoli Netcool solution.

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.

Figure 6 MasterClaw quick application launch portal

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. A roaming partner manager has different needs compared to the operational network manager.

Figure 7 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:

- Probe and server performance
- DWH performance and data availability
- Communication and bandwidth availability between probes and the central part of the system, the Data Processing Layer.

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 DWH platform comes with a set of Oracle native system utilities for management and administration of the DBs.

The OSS Application Suite

The secret behind Anritsu's unique service assurance solution is the seamless integration between traditional network monitoring and trouble shooting 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

• Call and Session Tracing

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.

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.

In a VoIP or IMS based NGN network environment MasterClaw allows for end-to-end cross domain tracing e.g., H323/SIP/ISUP calls and H323/RTP/SIP sessions across the SS7 and IMS network domains where decoding is made on several layers including the IP, UDP, SIP, Diameter, MEGACO/H248, ISUP and MTP.

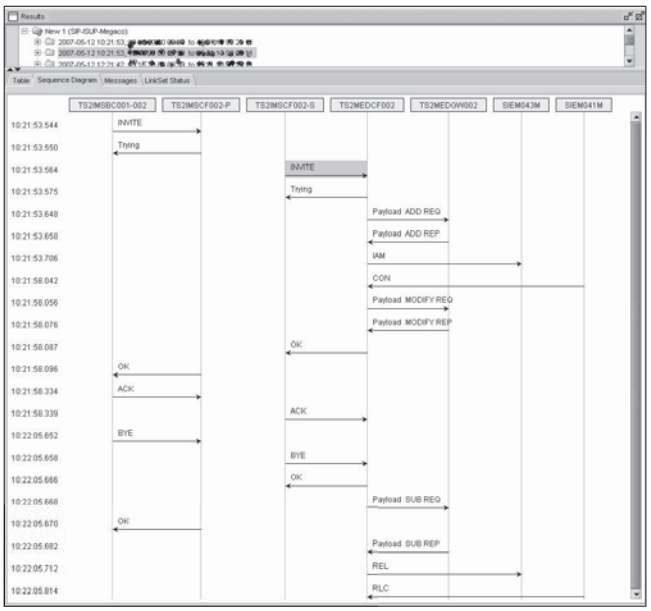


Figure 8 Correlation of SIP-ISUP-MEGACO provides e2e view across the IMS and legacy SS7 domains

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 call and session 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 Call and Session Trace application.

• IP Service Troubleshooting

To allow for efficient analysis and debugging of wireless data services the Call and Session 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.

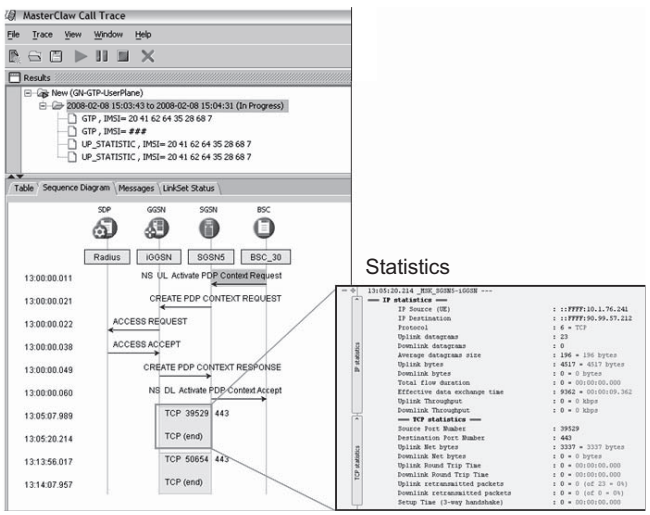


Figure 9 IP Service Troubleshooting with user plane tracing and statistics

IP Service Troubleshooting tool integrates IP flow statistics in the Call and Session 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.
In case of special needs, also a dedicated data capture feature allows for advanced captures of the datagrams 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)

• Protocol Analysis

The MasterClaw Protocol Analysis 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.

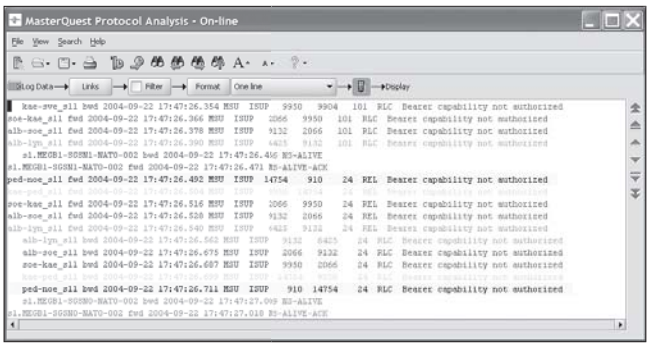


Figure 10 Protocol Analysis result

Thanks to the locally stored signaling data in the probes, troubleshooting can not only be made in real-time but also made on already captured historical data. This is of course a tremendous advantage during fault location and route-cause analysis. Features, such as advanced filter functions, alternative display formats, conditioned color coding, online protocol references, etc. makes the troubleshooting applications extremely user friendly and efficient to use.

• Link and Message KPI

To further ease the problem analysis and root-cause analysis, MasterClaw provides an advanced Link and Message based DWH solution offering reports based on link counters, message counters and link load counters. The Link and Message solution is a versatile data warehouse application that can be applied to any protocol or network technology giving access to thousands of counters from different protocol layers.

• Alarm Manager

As a part of the core application set MasterClaw also includes an Alarm Manager. The Alarm Manager receives alarms from multiple sources in the system: probe generated alarms or performance and QoS related alarms generated by the Traffic Observer or any of the KPIs/KQIs handled by the DWH. Alarms may be configured in different ways (severity, coloring, etc.) and thresholds may be configured according to the type of day (week-day, weekend-day, holiday) and the time of that day. When an alarm occurs it is possible to drill down into the alarm, thereby automatically launching e.g. reports with pre-selected parameters.

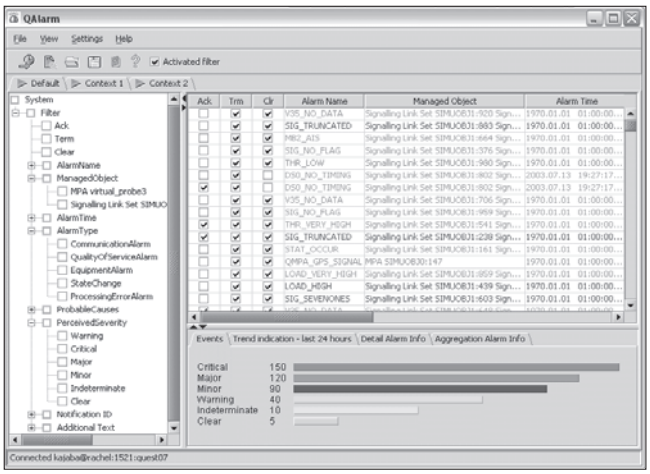


Figure 11 MasterClaw Alarm Manager

Data warehouse KPI alarms can be created and customized using a general web based application applicable to all existing data warehouse KPI applications available in MasterClaw. When dealing with alarms based on KPIs, MasterClaw has unique capabilities that enable operators to monitor every single aspect of its services and network quality:

- Customizable KPI definition for alarm generation; the operator can define custom KPI alarms using the available dimensions and the basic fact data loaded in the data warehouses.
- Automatic threshold calculation; given any KPI alarm, thresholds can be defined as "self learning" enabling the system to adapt thresholds to the historical trend of the KPI.

Any internal MasterClaw alarm can be propagated to external fault management systems via for example SNMP.

Integrated Service Quality and Performance Monitoring

Are the network resources used properly? How are my services performing? How do my customers perceive the service quality? Are the customers getting the agreed service? Are my interconnect partners delivering the agreed service? These are just a few examples of questions that a network operator or service provider needs to answer in order to maintain the customer satisfaction, minimize the operational costs and hence secure the revenue.

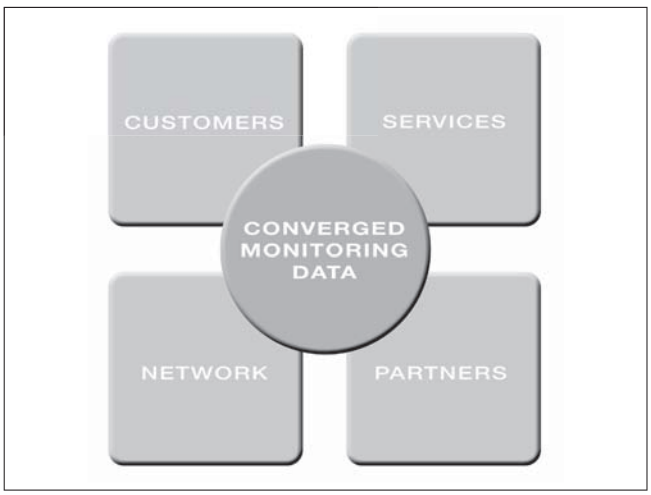


Figure 12 MasterClaw's Integrated Service Quality and Performance Monitoring Framework

MasterClaw's integrated service assurance solution provides an integrated monitoring universe, feeding a wide range of different user categories, including operational network personnel, product managers, service quality managers, account managers, partner managers, with vital operational and business information. Building on the same converged data acquired from the network, MasterClaw offers powerful reporting capabilities across Network, Service, Customer and Partner domains in both real-time and via KPI- and KQI reports. In addition to this MasterClaw allows for definition of service level targets enabling both internal- and external SLAs.

• Understanding Quality of Service Metrics

Although voice is a legacy service that is the very foundation for most operators' business, the voice service can serve as a good example of how technology convergence, and new access technologies dramatically increase the complexity of the underlying value chain and hence the overall complexity of the service. Basic network oriented KPIs, such as Connection Success Rate, is excellent to monitor individual network segment's performance, but a single KPI only provides a limited picture of the overall service experience, as perceived by the end-user. Only by aggregating data from several sources and correlating quality of service metrics from different domains can the overall end-to-end quality of service be determined.

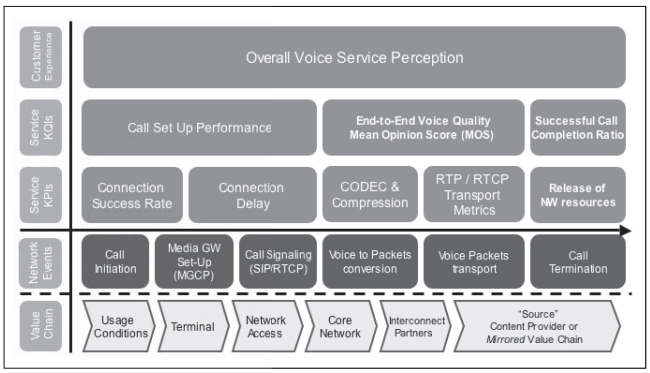


Figure 13 Service Quality Components in a traditional Voice Service

• 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.

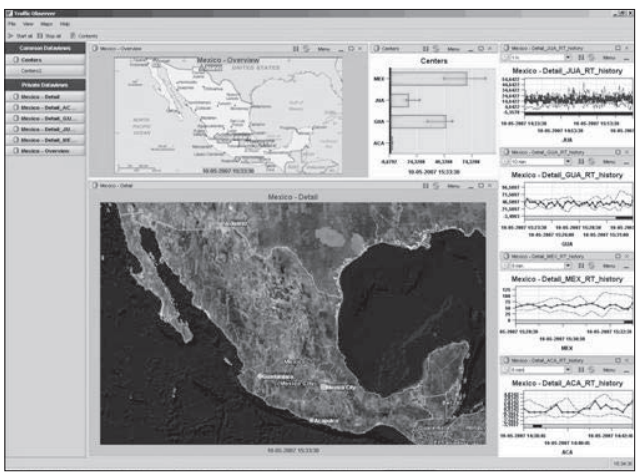


Figure 14 Traffic Observer provides real-time overview of the network and service performance

The Traffic Observer application provides instant overview of the performance and service level via a powerful intuitive GUI making it to an essential tool for the fast paced working environment of many network- and service operation centers. 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 and interactive analytical support that apart from four main operational domains: Network, Service, Customer and Partners (c.f. Figure 12), also covers Device centric analysis.

Supported by MasterClaw's rich DWH 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.

Insight's reports are designed to enable users to intuitively focus on the most important data, by smart sorting and filtering functions. To further support the user in his analysis, Insight offers an online encyclopedia that provides context (report) aware online help. Providing advice on business and work process related questions, the encyclopedia empowers the users of Insight and allows intuitive support for non-technical personnel.

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.

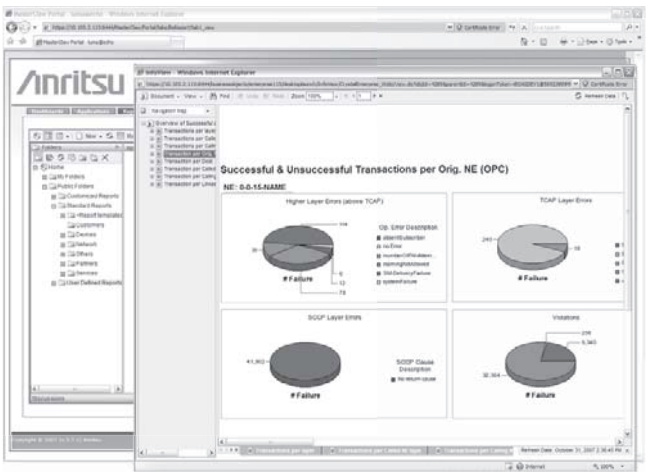


Figure 15 MasterClaw Insight has an intuitive user interface with interactive clickable reports

The figure below depicts the principle components of Insight and its touch points with MasterClaw. As illustrated, Insight draws upon data provided, by the MasterClaw DWHs, but third party data sources can of course also be integrated. When used on top of MasterClaw's DWH infrastructure, users can seamlessly drill from high level summary- or overview down to underlying reports, and eventually down to individual data records for specific calls or sessions.

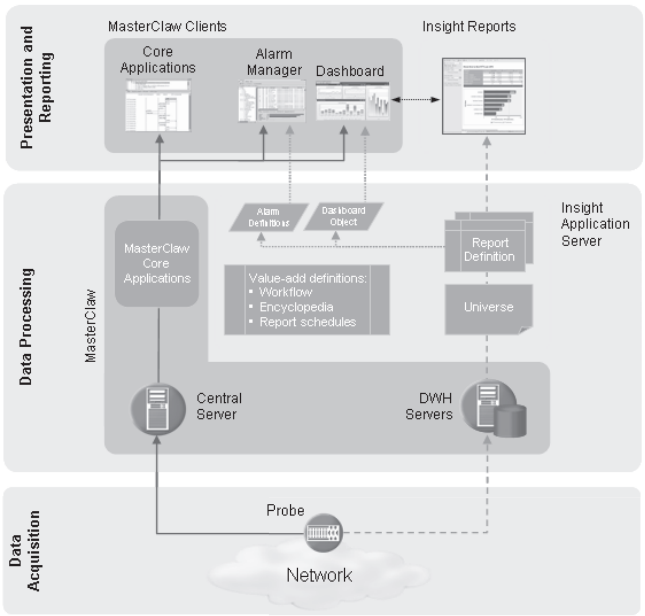


Figure 16 Principle architecture of MasterClaw and Insight

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
- Online encyclopedia
- Predefined MasterClaw dashboard objects and alarms
- General and context specific discussion forums

• 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's possible to understand the end-to-end perceive service quality. There are different KQI reports 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 which 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.

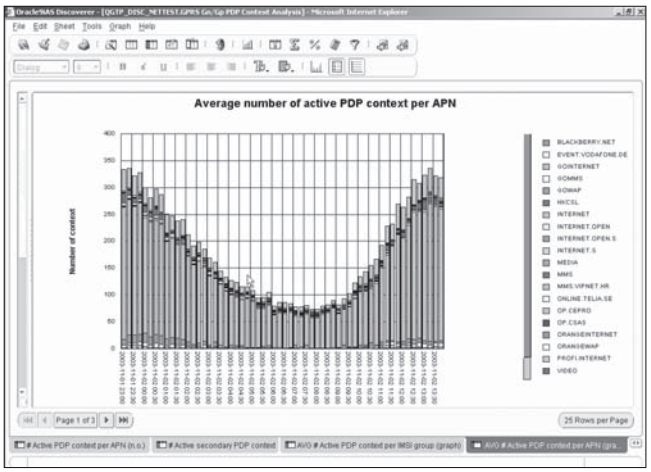


Figure 17 Service usage profile per service category

• Customer QoS/SLA Monitoring

In today's highly competitive environment an important way of gaining competitive advantage is to build an understanding of how the end users perceive the service quality. Aggregating the data on the basis of different types of customer identity parameters MasterClaw provides a customer centric view of Quality of Service information. Customer centric reports allows for targeted monitoring and follow-up of individual larger customers. Directly linked to this is the ability to define and follow-up on customer specific Service Level Agreements. Thanks to the simplicity in the user interface of MasterClaw, where different user categories can design their own personal view, account managers can have dedicated real-time QoS and performance reports for particular important accounts.

The business intelligence data is a powerful tool for active account management, where not only the service level can be closely monitored, but an individual corporate customer's usage profile can be monitored too. This makes it possible to do targeted promotion activities, to up-sell or cross-sell new products, and hence increase the revenue.

As enterprises can not be treated as monolith organizations made up by users with identical needs and behaviors, MasterClaw supports a hierarchical modeling of the customer, allowing for monitoring and reporting on three different levels:

- MAC Group
  The entire enterprise or VIP customer
- MAC Subgroup
  Department or user category within the enterprise
- MAC
  Individual user within the customer's organization

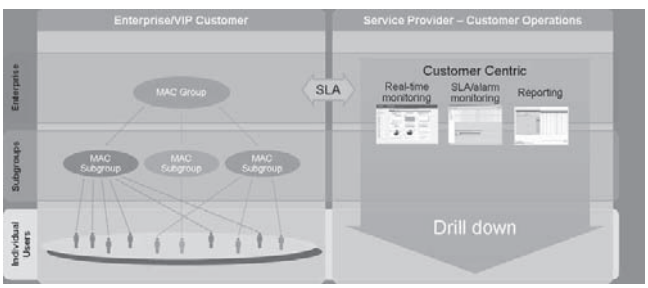


Figure 18 Customer centric monitoring in MasterClaw

• Partner Performance Monitoring

Dedicated KPIs and KQIs allows for monitoring of roaming partners, interconnect partners and partners providing content and services. These reports form the base for SLA follow-up in relation to the underlying agreements, as well as they 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.

Fraud and Revenue Assurance

As a part of the MasterClaw OSS solution Anritsu offers a set of applications in the fraud, security and revenue assurance area. All these applications have been designed to protect the operators' network and revenue.

The MasterClaw real-time Fraud Sentry application assists operators and service providers detecting call related fraud caused by subscribers. Based on the signaling data the application can generate alarms if e.g. a call is made from a blacklisted number, if the duration of a call exceeds a predefined threshold, or if a grey listed customer makes too many calls within a given period.

In addition to the internal MasterClaw applications, Anritsu cooperates with a number of major vendors in the fraud and revenue assurance area where the flexible xDR GW is used to provide a reliable high-volume feed of data records for billing verification, fraud analysis, SMS spam detection, etc.

Device Monitoring

During the last couple of years the number of different mobile device models has virtually exploded. Although the new device models with their new capability sets is a prerequisite for the future revenue growth for many wireless service providers, the wide array of device types constitutes a major operational challenge. Not only has the devices a determining influence on the service quality perceived by the end-user, but the wide diversity in device models also is a major source for network and service inter-working problems.

Anritsu's Device Monitoring application is a targeted MasterClaw Insight application that provides device centric service quality monitoring and device tracking within UMTS networks.

The Device Monitoring allocation provides dedicated analytical support for analysis of:

- Which device models customers are using
- Service usage vs. handset models
- Handset adoption treads
- Device performance and problem profiling
- Detection of underperforming handsets and list customers that have those handsets

The application also enables wireless service providers to make analysis on how many customers that have devices with a certain capability profile (e.g. the percentage of subscribers with high resolution screen devices). The application also offers the ability to map end-users and devices, and hence support analytical queries such as which device type is subscriber X using.

The Device Monitoring application provides unparalleled support for proactive problem prevention, by its ability to detection of underperforming devices and devices running old software versions in near real-time. And when integrated with device management applications, the application enables automatic push and update of device software and device parameters.

Professional Services

Deployment of new technology puts additional stress on most organizations. To optimize the return on the investments both in infrastructure technology and in the MasterClaw service assurance solutions, Anritsu provides a holistic professional service portfolio supporting our customers in all the phases; from early assessment of available technologies, products and test strategies, to dedicated after sales support of the deployed solutions.

Figure 19 Anritsu's Professional Service Portfolio

• Advisory

Building on our extensive experience with service assurance solutions in a converged technology, our Advisory services include a set of services which gives our customer access to our knowledge and highly skilled experts.

Solution Definition

Includes benchmarking of the current operational status, service monitoring strategy definition, third party advisory, migration strategies, OSS deployment advice and advisory to support solutions procurement.

Network and Service Audit

An independent expert audit of the network and service performance. Based on root cause and business impacts analysis the service, Anritsu recommends a set of operations improvements. The audit covers aspects such as: resource utilization, working methodologies, roaming and interconnect analysis, voice and data service performance, and GSM/GPRS/UMTS access analysis.

Best Practice Consultancy

The Best Practice Consultancy service is an interactive "workshop-style", expert-to-expert consultancy, working on Customer's specific operational and business needs to enhance system usage and capabilities.

Service Assurance Consultancy

Includes activities such as definition of service assurance strategies, third party advisory, migration strategies and OSS procurement and deployment advisory.

• Deployment

From solution design and configuration through to project management and OSS integration, Anritsu is with you for the entire process, constantly focusing on achieving optimal solutions and rapid deployment. The core services include: Project Management, Solution Design Delivery, services that are designed to minimize the cost and time of the Deployment of our MasterClaw solutions.
In addition to these services Anritsu offers a set of advanced Deployment services:

OSS Systems Integration

This service covers activities for integration of the MasterClaw system into other OSS systems. It includes integration with systems such as: billing platforms, fraud detection systems, fault management systems, Service Quality Management platforms and CRM/SLA systems.

Case Solution Configuration

Includes options for solution configuration in scripts, reports, system views workflows, etc., optimizing the benefits of the MasterClaw system for particular customer needs and usage scenarios.

• Management

Coaching

To support new users to maximize the value of a MasterClaw service assurance solution, Anritsu provides coaching service that gives users direct access to on-site expertise and guidance.

Support

Our Support services include 24*7 helpdesk support and update/upgrade services, as well as remote management and a variety of long-term onsite support options.

System Administration

We manage the fundamental administration and operation of the MasterClaw system and other OSS-related products. Offering the advantages of converting fixed costs into variable costs without sacrificing service quality, the System Administration service allows you to free-up resources for other more important tasks.

• Training

Anritsu is a fully independent training partner. Our tailored training program not only covers the different solution areas in our OSS portfolio, it also covers the entire range of technologies used in today's converged networks such as VoIP, IMS, UMTS, GPRS, SS7 and IP.

Key Benefits

- Maximize return on your investments
- Access to unbiased expert competence
- Turns your MasterClaw solution into a vital tool gaining uniquely competitive advantages

MOBILE/WIRELESS COMMUNICATIONS MEASURING INSTRUMENTS

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	W-CDMA	HSDPA	HSUPA	HSPA Evolution	CDMA2000 1X	1xEV-DO	GSM/GPRS	EGPRS	TD-SCDMA	W-LAN (11a/b/g/n)	Mobile WiMAX	Fixed WiMAX	*Bluetooth*	ISDB-T	DVB-T/H	XG-PHS	Advanced PHS	R&D	Manufacture	Maintenance/Service	R&D	Manufacture	Construction/Service
MD8480C W-CDMA Signalling Tester		√	√	√	√			√	√										√					
MX785201A Protocol Test System (PTS)		√	√	√				√	√										√					
MX785220A Protocol Conformance Test Toolkit		√	√	√				√*1											√					
MX786201A Rapid Test Designer (RTD)		√	√	√				√											√					
ME7832A Protocol Conformance Test System		√	√	√				√	√										√					
ME7873F/ME7874F W-CDMA TRX/Performance Test System W-CDMA RRM Test System		√	√	√				√*1											√					
MD8470A Signalling Tester		√	√	√		√	√	√	√	√									√					
MX702600B CDMA2000 Scenario Composer						√	√												√					
MT8820B/MT8815B Radio Communication Analyzer		√	√	√	√	√	√	√	√	√								√	√	√	√			
MT8510B Service Tester		√						√*2												√	√			
MA8120E Shield Box*3	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			
MG3700A Vector Signal Generator	√	√	√	√		√	√	√	√	√	√	√		√	√	√	√	√	√	√		√	√	
MG3681A Digital Modulation Signal Generator		√	√			√	√	√											√	√		√	√	
MS2690A/MS2691A/MS2692A Signal Analyzer	√	√	√	√	√			√	√	√		√					√		√	√		√	√	
MS8609A/MS8608A Digital Mobile Radio Transmitter Tester		√	√			√	√	√		√	√								√	√	√	√	√	√
MS8901A Digital Broadcast Signal Analyzer															√							√	√	√
MS2717B/MS2718B/MS2719B Economy Spectrum Analyzer		√	√			√	√	√		√	√	√	√										√	√
MT8852B *Bluetooth* Test Set														√					√	√				
MT8860C WLAN Test Set											√*4								√	√				
MT8212B Cell Master						√	√																√	√
MT8222A BTS Master		√	√			√	√	√		√		√	√										√	√
MS2721B/MS2723B/MS2724B Spectrum Master		√	√			√	√	√		√		√	√		√	√							√	√
ML8720C W-CDMA Area Tester		√	√	√				√	√															√
ML8740B Area Scanner		√	√	√				√	√															√

∗1: Measurement items for InterRAT Handover are available.
∗2: GSM only
∗3: Freuency range: 800 to 2500 MHz
∗4: 11b/g only

W-CDMA SIGNALLING TESTER

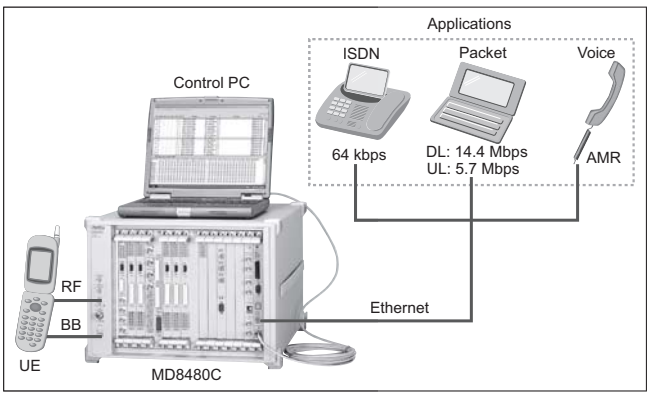
MD8480C

CE GPIB

All-in-One Solution for W-CDMA/HSPA and GSM/GPRS/EGPRS 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*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 W-CDMA/HSPA and GSM/GPRS/EGPRS 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
∗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 Release 7 (HSPA Evolution and HSPA)
- Full HSDPA/HSUPA Support for All UE Categories
- Data Throughput Test (DL 14.4 Mbps/UL 5.7 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
- Inter/Intra-RAT Handover UE Protocol Sequence Tests
- HSPA/EGPRS Packet Data Communications Tests
- Inter-RAT HO Packet Data Communications Tests (Ping, FTP, Browsing)
- 3G/3.5G UE Coding/Decoding Function Tests (RF/BB)
- Applications Tests, including Voice and Packet
- Data Throughput Monitoring Test

Additional Options (Hardware)

• W-CDMA Base Station [MU848072C1 BTS Unit]*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: Low-profile 1-slot type. Same functions as previous MU848072C BTS unit.

• 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 also adds an interface for connecting an external digital simulator to support baseband evaluation of W-CDMA/HSPA chipsets and UE reference design boards.

• 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-03 Additional RF Unit 2 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.*1

*1: 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-03 Additional RF Unit 2]

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 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 (MU848072C1 – 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)*2

This option supports the HSPA Evolution functions, including CPC (Continuous Packet Connectivity). This option requires the HSDPA (MU848072C-01) and HSUPA (MU848072C-02).

*2: Also requires future options to enable the 64QAM for HSDPA, 16QAM for HSUPA, and 2x2 MIMO functionalities.

• W-CDMA Ciphering
MX848041C Ciphering

This option*3 adds support for ciphering functions to KASUMI (3GPP standards integrity ciphering algorithm).

• HSDPA Ciphering
MX848041C-10 HSDPA Ciphering

This option*3 adds supports for ciphering functions to KASUMI (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 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-02 or MD8480C-03).

• 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. 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.

• Voice Codec Function
MX848062C Multimedia Interface Software*3

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*3

This option adds the ANSI-C code for the Adaptive Multi Rate - Wideband (AMR-WB) speech codec (Release 6) specified in 3GPP TS26.173 to the MIS.

*3: 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]**[*1]

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 (MX848041C/MX848045C) related functions.

- **HSDPA 1-year Support Service [MD8480C-SS122, MD8480C-SS123]**[*1]

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 (MX848041C-10) related functions. (These contracts also require the MD8480C-SS120/SS121 contracts.)

- **HSUPA 1-year Support Service [MD8480C-SS124, MD8480-C-SS125]**[*1]

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 (MX848041C-10) related functions. (These contracts also require the MD8480C-SS120/SS121 contracts.)

∗1: For contract details, see the appended materials.

- **MD8480C 1-year Package Support Service [MD8480C-SS150, MD8480C-151]**[*2]

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 (MX848041C/MX848045C) related functions.

- **MD8480C 2-year Package Support Service [MD8480C-SS250, MD8480C-251]**[*2]

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 MX848041C/MX848045C) related functions.

∗2: 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]**[*3]

This service extends the MD8480C standard 1-year warranty to 2 years.

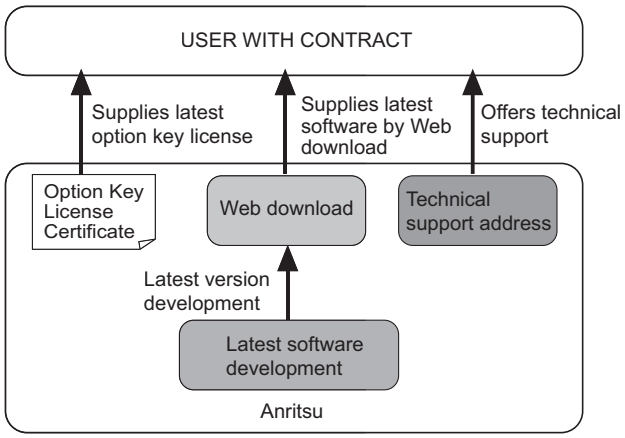
- **3-year Extended Warranty Service [MD8480C-ES310]**[*3]

This service extends the MD8480C standard 1-year warranty to 3 years.

- **5-year Extended Warranty Service [MD8480C-ES510]**[*3]

This service extends the MD8480C standard 1-year warranty to 5 years.

∗3: 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 to 480 ksps
CCCH/DCCH/DTCH	FACH		
MCCH/MSCH/MTCH			
DCCH + DTCH	DCH	DPDCH	7.5 to 960 ksps
		DPCCH	
	HS-DSCH[*1]	HS-PDSCH[*1]	240 ksps x 15 code
		HS-SCCH	30 ksps x 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 to 120 ksps
DCCH/DTCH	DCH	DPDCH	15 to 960 ksps
		DPCCH	15 ksps
	E-DCH*2	E-DPDCH*2	15 to 960 ksps x 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 to 3000 MHz Rx: 350 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: 50 Ω, VSWR: ≤1.3 Downlink 1: SMA type, Impedance: 50 Ω, VSWR: ≤2.0 Downlink 2*2: SMA type, Impedance: 50 Ω, VSWR: ≤2.0 Uplink: SMA type, Impedance: 50 Ω, 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)
	Chip rate	3.84 MHz
	Modulation band limit	Root Nyquist roll off (α = 0.22)
	EVM	≤7% rms (1 ch)

Continued on next page

Receiver	Frequency resolution	100 kHz
	Input level range	Main: –30 to +40 dBm Uplink: –50 to +20 dBm
	Modulation	BPSK
Others	Ambient temperature (operating)	0˚ to +40˚C
	Ambient temperature (storage)	–40˚ to +70˚C
	Power	100 to 120/200 to 240 Vac, 50 to 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 350-2700 MHz" label attached to MD8480C front panel.
Units with no label are 350 to 550 MHz, 700 to 1100 MHz and 1400 to 2200 MHz.
They are expandable using the Z0901A/B or Z0912A/B MD8480C Modification for HSUPA/EGPRS.
∗2: With MD8480C-03 Additional RF units. MD8480C-03 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.

Additional Function	Hardware Options									Software Options															Software Support Service				CD-ROM	Web Access Key
	MU848072C1	MU848072C-01	MU848072C-02	MD8480C-03	MU848060C	MU848060C-01	MU848055C	MU848077C	Z0901A	MX848001A-01 MX848041A-01*1	MX848001C-11 MX848041C-11*1	MX848001A-02 MX848041A-02*1	MX848001A-03 MX848041A-03*1	MX848001A-04 MX848041A-04*1	MX848001A-05 MX848041A-05*1	MX848001A-06 MX848041A-06*1	MX848001A-07 MX848041A-07*1	MX848001C-12 MX848041C-12*1	MX848001C-30 MX848041C-30*1	MX848041C	MX848041C-10	MX848045C	MX848062C	MX848062C-001	MD8480C-SS120 MD8480C-SS121	MD8480C-SS122	MD8480C-SS123	MD8480C-SS124 MD8480C-SS125	MD8480C-SS150/151 MD8480C-SS250/251	Z0904A Z0905A	MC0011A
2BTS Handover (W-CDMA)	1																							√				√*3	√*4
3BTS Handover (W-CDMA)	2																							√				√*3	√*4
4BTS Handover (W-CDMA)	3																							√				√*3	√*4
HSDPA 1 BTS		1																						√	√			√*3	√*4
2BTS Handover (HSDPA)	1	2																						√	√			√*3	√*4
3BTS Handover (HSDPA)	2	3																						√	√			√*3	√*4
4BTS Handover (HSDPA)	3	4																						√	√			√*3	√*4
HSUPA 1 BTS			1						√															√		√	√*2	√*3	√*4
2BTS Handover (HSUPA)	1		2						√															√		√	√*2	√*3	√*4
3BTS Handover (HSUPA)	2		3						√															√		√	√*2	√*3	√*4
4BTS Handover (HSUPA)	3		4						√															√		√	√*2	√*3	√*4
HSPA Evolution (Release 7)		1	1						√									√						√			√*2	√*3	√*4
Hard Handover (HHO)	1			1					√			√												√				√*3	√*4
Inter System (GSM/GPRS) Handover				1	1				√			√												√				√*3	√*4
Inter System (EGPRS) Handover				1	1	1			√			√												√				√*3	√*4
Intra System (EGPRS) Handover				1	2	2			√															√				√*3	√*4
Baseband Interface (W-CDMA)								√																√				√*3	√*4
Tx Diversity (1RF, W-CDMA)	1									√														√				√*3	√*4
Tx Diversity (2RF, W-CDMA)	1			1					√	√														√				√*3	√*4
Tx Diversity (1RF HSDPA)	1	2								√	√													√	√			√*3	√*4
Tx Diversity (2RF HSDPA)	1	2		1					√	√	√													√	√			√*3	√*4
Ciphering (W-CDMA)																				√*1				√				√*3	√*4
Ciphering (GSM/GPRS)				1	1				√													√*1		√				√*3	√*4
Ciphering (HSDPA/HSUPA)		1	1						√											√*1	√			√	√	√	√*2	√*3	√*4
Router Connection													√											√				√*3	√*4
FR, HR Speech																							√	√				√*3	√*4
AMR-WB																							√	√	√			√*3	√*4
Message Encoder/Decoder																	√							√				√*3	√*4
CSD (W-CDMA)							√									√								√				√*3	√*4
CSD (GSM)				1	1		√		√					√										√				√*3	√*4
GSM Frequency Hopping				1	1				√						√									√				√*3	√*4
DTM (Dual Transfer Mode)				1	1				√										√					√				√*3	√*4
Support Service (W-CDMA/GSM)																								√				√*3	√*4
Support Service (HSDPA)		1																						√	√			√*3	√*4
Support Service (HSUPA)			1																					√		√	√*2	√*3	√*4
User Required Configuration																													

∗1: The MX848041A-01, MX848041C-11, MX848041A-02, MX848041A-03, MX848041A-04, MX848041A-05, MX848041A-06, MX848041A-07, MX848041C-12 or MX848041C-30 must be ordered when the unit/option is used with the MX848001A-01, MX848001C-11, MX848001A-02, MX848001A-03, MX848001A-04, MX848001A-05, MX848001A-06, MX848001A-07, MX848001C-12 or MX848001C-30.

∗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 web site.

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
MU848071C	L2
MU848072C1	BTS Unit
MU848073C	Timing Generator (1- slot type)
	Standard accessories
J0491	Shielded Power Cord (13 A): 1 pc
J1251	Twisted-pair Cable (Cross over): 1 pc
J0127A	Coaxial Cord (BNC-P · ERG58A/U · BNC-P), 1.0 m: 1 pc
J0576B	Coaxial Cord (N-P · 5D-2W · N-P), 1.0 m: 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
A0013	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 (BNC-P · RG58A/U · BNC-P), 1 m
T0004	Ferrite Core (SFC-5)
	Hardware options
MU848055C	ISDN/CSD
MU848060C	TDMA2
MU848060C-01	EGPRS (R99)
MU848072C1	BTS Unit
MU848072C-01	HSDPA
MU848072C-02	HSUPA
MU848077C	Baseband Interface Unit
MD8480C-03	Additional RF Unit 2
	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)
MX848001C-30	DTM (R99) (license document)
MX848041C	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)
MX848041C-10	HSDPA Ciphering (license document)
MX848041C-11	HSDPA Tx Diversity for Ciphering (license document)
MX848041C-12	HSPA Evolution (Release 7) for Ciphering (license document)
MX848041C-30	DTM (R99) for Ciphering (license document)
MX848045C	GSM/GPRS 2 Ciphering (CD-ROM, license document)
MX848062C	Multimedia Interface Software (license document)
MX848062C-001	AMR-WB (license document)
	Software CD-ROM
Z0904A	MD8480C Software CD-ROM (CD-ROM)
Z0905A	MD8480C Software CD-ROM with Ciphering (CD-ROM)

Model/Order No.	Model Name
	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
Z0745A	MD8480C Upgrade (upgrade MD8480A/B to MD8480C, 1RF)
Z0745B	MD8480C Upgrade (upgrade MD8480A/B to MD8480C, 2RF)
Z0746A	MD8480C Upgrade (upgrade MD8480A/B to MD8480C, 1RF, for Asia Oceania)
Z0746B	MD8480C Upgrade (upgrade MD8480A/B to MD8480C, 2RF, for Asia Oceania)
Z0772	MD8480C Baseband Interface (adds MU848077C, and updates MU848072C → MU848072C1, for Asia Oceania)
Z0807	MD8480C Baseband Interface (adds MU848077C, and updates MU848072C → MU848072C1)
Z0901A	MD8480C Modification for HSUPA/EGPRS (1RF) [MD8480C Main frame upgrade (for Asia Oceania) Updates MU848072C → MU848072C1 (expands built-in RF unit and changes fan)]
Z0901B	MD8480C Modification for HSUPA/EGPRS (2RF) [MD8480C Main frame upgrade (for Asia Oceania) Updates MU848072C → MU848072C1 (expands built-in RF unit, Additional RF unit updates MD8480B-02 → MD8480C-03 and changes fan)]
Z0903A	TDMA2 Upgrade [changes MU848060B → MD848060C (for Asia Oceania)]
Z0912A	MD8480C Modification for HSUPA/EGPRS (1RF) [MD8480C Main frame upgrade Updates MU848072C → MU848072C1 (expands built-in RF unit and changes fan)]
Z0912B	MD8480C Modification for HSUPA/EGPRS (2RF) [MD8480C Main frame upgrade Updates MU848072C → MU848072C1 (expands built-in RF unit, Additional RF unit updates MD8480B-02 → MD8480C-03 and changes fan)]
Z0913A	TDMA2 Upgrade (changes MU848060B → MD848060C)
	Application parts
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)
J1264	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)
P0019	TEST USIM001 (for W-CDMA)
P0035B	W-CDMA/GSM Test USIM (for W-CDMA/GSM, different authentication key from P0019)

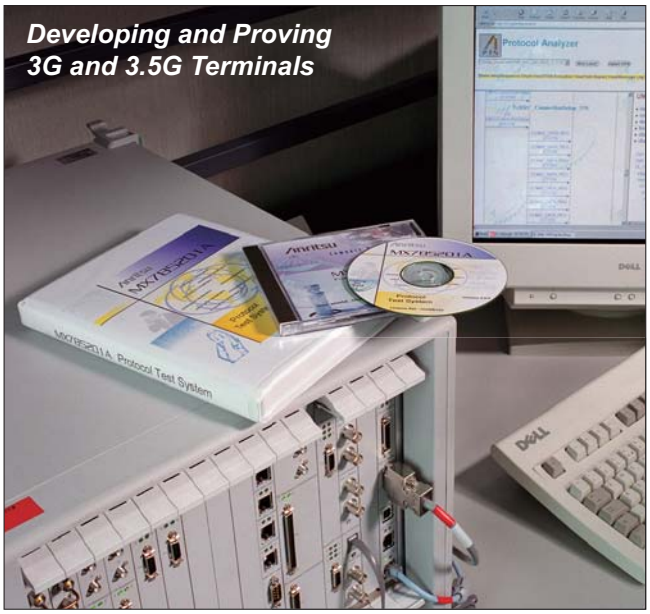
MD8480C requires PC*1 and Microsoft Visual C++ Version 6.0, .NET or Visual Studio 2005*2.

∗1: The PC is for controlling the MD8480C. It must meet the following specifications:
OS: Windows 2000 (SP4)/XP (SP2)
CPU: Pentium III 1.6 GHz min.
Memory: 512 MB min.
Interfaces: RS-232C, Ethernet, 10BASE-T/100BASE-Tx, CD-ROM drive

∗2: Microsoft Visual C++ Version 6.0, .NET or Visual Studio 2005 is the standard edition.

W-CDMA PROTOCOL TEST SYSTEM (PTS)
MX785201A

PROTOCOL CONFORMANCE TEST TOOLKIT
MX785220A



The MX785201A PTS (Protocol Test System) is a verification tool for 3G wireless products. 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 development tools.

Features

- W-CDMA protocol test capability including HSPA
- 3GPP Standard compliant development tool
- Common user interface across Anritsu development tools
- InterRAT capability for 2G/3G testing
- Environment supporting TTCN test case execution
- TTCN test libraries for development, integration and conformance testing

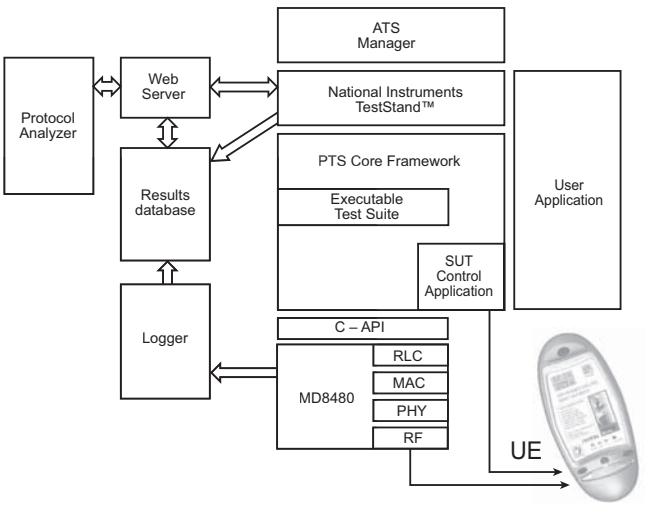
PTS

The MX785201A PTS software is combined with the MD8480 W-CDMA Signalling Tester to make a system providing an environment to exercise Layer 3 and Layer 2 signaling protocols defined within the Third Generation Partnership Project (3GPP).
The PTS software component runs on a Windows 2000/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

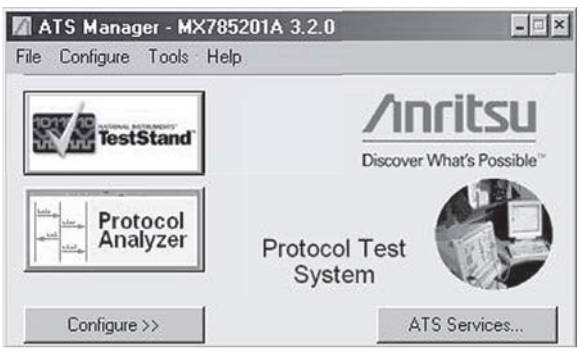


PTS Core Software

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 Protocol Test System supports the Layer 1 and Layer 2 parameter sets defined in the 3GPP specification TS34.108.

- **ATS Manager**



The ATS Manager provides a user interface that allows configuration of the MX785201A 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 MX785201A 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 MX785201A PTS uses the National Instruments TestStand runtime 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 (Tree and Tabular Combined Notation). Created TTCN tests are compiled to an Executable Test Suite (ETS) which interfaces to the MX785201A PTS via the GCI Management Interface and the GCI Operational Interface. These provide an open, standardized interface to TTCN based executable test suites. The MX785201A PTS has been developed to work with the Telelogic Tau TTCN Test Suite.
The GCI framework provided by the MX785201A 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

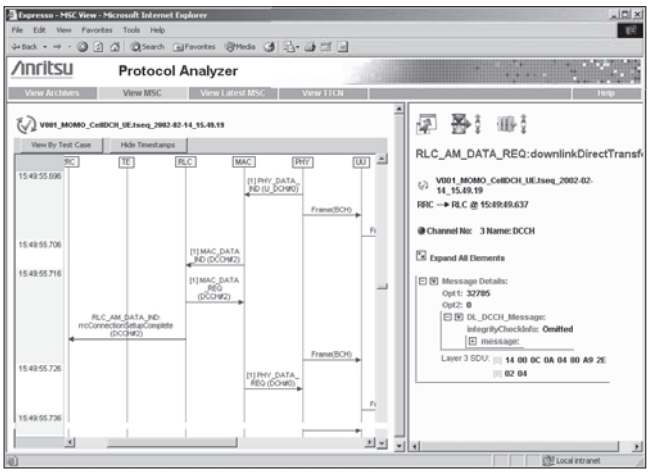
A thin RRC is provided to load NAS messages into RRC direct transfer messages and unload NAS messages from RRC direct transfer messages transparently.

• SUT Control Application

The MX785201A 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 TS25.322 Radio Link Control Protocol Specification and TS25.321 Medium Access Control Specification are supplied as part of MD8480.

• Terminal Equipment (TE)

The TE is an optional software component available as part of the MD8480 in the MX785201A PTS. It supports a number of features including voice AMR 12.2k Codec, ISDN, IP and PPP.

• Layer 1

The MX785201A PTS provides a physical Layer 1 through the MD8480 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 preconformance 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

• MX785X01A-42 IP Driver

The IP Driver Option allows data and application testing to be performed in virtually any signaling environment or scenario using automated tests controlled via TTCN running on the MX785201A PTS. The IP Driver provides access to User-Plane packet data and routes that data through a PC onto a conventional data network.
Key features include multiple primary and secondary PDP contexts with single UE support. Traffic Flow Templates routing for secondary context is also supported. All protocols run over IPv4 and fully flexible IP address allocation is supported.

• MX786201A-43 Full RTD Option for Existing PTS License

The Rapid Test Designer (RTD) Option provides a quick and easy method of developing test cases to run on the PTS. It provides a graphical, point and click interface to a broad library of procedural building blocks that can be placed on the screen to assemble more complex tests. The library contains composite functions that move the UE into a desired state to start the test, and elemental functions that allow the testing of detailed behaviour. This allows the test creator to focus on specific problem areas using his knowledge of 3GPP networks rather than test concepts.
The RTD's procedural building blocks are integrated with an expert system that guides the user through the complexity of the 3GPP protocols when setting the parameters for a particular test. Anritsu provides comprehensive catalogues of common network settings that can be used to quickly produce working test scenarios. The tool also provides interactive error checking on the procedures and parameters and will pick up many potential problems and mistakes made during test design. 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.

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
MX785201A	PTS Core Software Single Cell ETS Framework
	Options
MX785201A-10	Multi-Cell Capability (SHO)
MX785201A-11	Multi-Cell (Inter-frequency) Capability (HHO)
MX785201A-12	Multi-RAT (FDD/GSM) Capability
MX785201A-14	Multiple MD8480 Support
MX785201A-35	Conformance Test USIM
MX785201A-40	Ciphering
MX785201A-41	OCNS
MX785201A-42	IP Driver
MX786201A-43	Full RTD Option for Existing PTS License
	Libraries
MX785201A-31	TTCN Integration Library Source Code
	Support
MX785201A-01	National Instruments TestStand™
MX785201A-20	Software Update and Maintenance Contract
MX785201A-21	Training Course (2 days)
MX785201A-23	Installation & Commissioning (1 day)
	Conformance Test Toolkit options
	Main frame
MX785220A	TS34.123 Protocol Conformance Test Toolkit Core Software
	Band options
MX785220A-01	Frequency Band 1 Coverage for TS34.123 Toolkit
MX785220A-02	Frequency Band 2 Coverage for TS34.123 Toolkit
MX785220A-03	Frequency Band 3 Coverage for TS34.123 Toolkit
MX785220A-04	Frequency Band 4 Coverage for TS34.123 Toolkit
MX785220A-05	Frequency Band 5 Coverage for TS34.123 Toolkit
MX785220A-06	Frequency Band 6 Coverage for TS34.123 Toolkit
MX785220A-07	Frequency Band 7 Coverage for TS34.123 Toolkit
MX785220A-08	Frequency Band 8 Coverage for TS34.123 Toolkit
MX785220A-09	Frequency Band 9 Coverage for TS34.123 Toolkit
	Work Item options
MX785220A-10	TS34.123 Conformance Test Cases for Rel 99 (Work Item 010)
MX785220A-12	TS34.123 Conformance Test Cases for Rel 99 (Work Item 012)
MX785220A-13	TS34.123 Conformance Test Cases for Rel 4/5 (Work Item 013)
MX785220A-14	TS34.123 Conformance Test Cases for HSDPA (Work Item 014)
MX785220A-24	TS34.123 Conformance Test Cases for DSAC/Network Sharing (Work Item 024)
MX785220A-25	TS34.123 Conformance Test Cases for HSUPA (Work Item 025)
MX785220A-47	TS34.123 Conformance Test Cases for InterBand (Work Item 047)
MX785220A-49	TS34.123 Conformance Test Cases for MBMS (Work Item 049)
	Support
MX785220A-20	Annual Software update and Maintenance Contract

Note that libraries and options require the underlying core functionality to be present to function fully.

W-CDMA RAPID TEST DESIGNER (RTD)
MX786201A

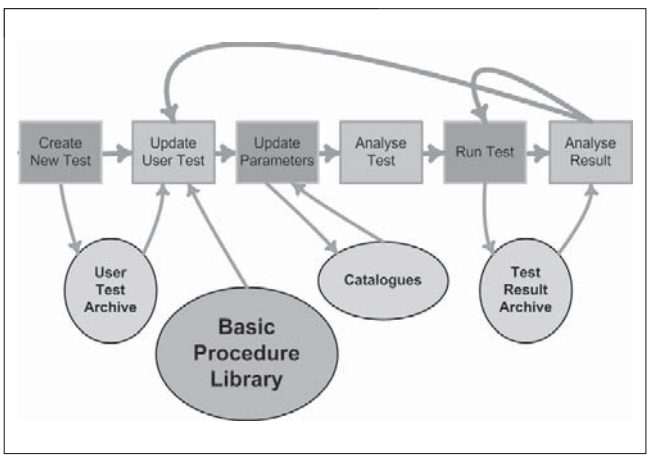
The Rapid Test Designer (RTD) is a revolutionary new tool which speeds up the testing of UMTS Terminals significantly by greatly simplifying the way in which tests are created, executed and analyzed.
The RTD presents an intuitive and interactive graphical environment for designing test cases, coupled with an expert system that guides the user through the complexity of the 3GPP protocols.
It provides a graphical interface to a broad library of procedural building blocks that can be placed on the screen to assemble the tests. The building blocks can be configured through the setting of parameters. The procedure library contains many standard procedures that can be used as they are or with minor changes to parameters to guide the UE into the desired test state. This allows the test creator to focus on specific problem areas using knowledge of 3GPP networks rather than test concepts.
Anritsu provides catalogues of common network settings that can be used to produce test scenarios that work "out of the box," or as a starting point for customer specific configurations. There is also a reference library with a selection of tests that can be used as the basis for user tests. The tool also provides interactive error checking on procedures and parameters that will pick up many potential problems and mistakes as early as possible during test design. 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**
- **Interoperability Testing**
- **Generating variants**
- **Application Testing**
- **Regression Testing**
- **Pre-conformance Testing**
- **Prototyping Testing**
- **HW and SW Integration**
- **SW Development**

The RTD has an integrated Protocol Analyzer to show the decoded results of the message exchanges between the RTD System and the UE under test. This revolutionary test tool hides much of the complexity of testing 3GPP protocols and allows the user to concentrate on testing specific functions and protocols within the UE without having to be an expert on all the protocol layers. Because of the intuitive graphical interface, users do not need to learn a specialist test language, or have a detailed knowledge of how to drive the system simulator.
The RTD System is built upon Anritsu's many years of experience in testing 3GPP protocols with the leading UE vendors and operators. The RTD system consists of a Personal Computer running a Windows operating system, connected to the Anritsu MD8480 W-CDMA Signalling Tester (system simulator). The RTD is also available as an upgrade for existing users of Anritsu's MD8480 and MX785201 (PTS) products.

RTD Overview

The RTD has been designed to support the iterative test process, which cycles between Design, Test Analysis, Test Execution and Results Analysis. The RTD consists of a set of core tools designed to support this process, together with a number of optional components that allow the RTD to easily support specialized testing activities. In addition to test and system simulator control procedures, the RTD provides support for a set of procedures similar to those defined in 3GPP standards, giving broad coverage of the various Layer 3 Signalling protocols. Each procedure includes associated system simulator configuration, timers, and appropriate parameters.
Support is provided for soft & hard handovers, compressed mode, RRC state transitions, radio bearer reconfigurations, InterRAT selections and reselections and InterRAT handovers, including to and from GSM (circuit switched) and GPRS (packet switched).
A wide selection of 34.108 RABs are supported with CS AMR rates from 4.75 to 12.2 kbps and PS data rates including HSPA with the appropriate MD8480. For GSM voice calls, both EFR and AMR traffic channels are supported. A tool providing the ability for a user to define a custom radio bearer means that the RTD can also be used in a development laboratory for sophisticated RAB creation.
Users can also create their own set of defined procedures and watch points for key variables to speed up the development and debugging of test cases. Users can also create interactive tests that use the content of messages or the behavior of the equipment under test to determine the flow of the test. This provides a new way of testing UEs that combines the best features of script based and network emulator based testing methodologies.

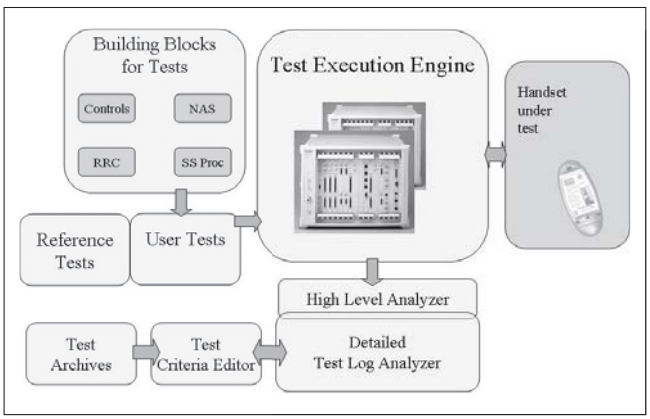


The Iterative test process, which cycles between Design, Test Analysis, Test Execution and Results Analysis

Tools within the RTD

The RTD provides the ability to:

- **Create and modify a "User Test" by selecting "procedure" blocks from a procedure picker panel in the RTD Tool and dropping and linking them onto a graphical canvas.**
- **Modify particular parameters of a procedure from defaults, as required; alternately re-use sets of parameters from a user-defined catalogue.**
- **Check that the test and parameters selected make sense ("analyze" the test).**
- **Run the User Test on the MD8480, displaying a message sequence chart as the test progresses, and store a detailed log of the test run for later use.**
- **Analyze the test result using the criteria editor to select result logs that display particular characteristics, then, ultimately, view the test result using the RTD Protocol Analyzer to show the detailed message sequence and view the contents of individual messages.**



RTD – An Integrated Development Environment for UE Testing

Procedures

In addition to test control and system simulator control procedures, the RTD provides support for a set of procedures similar to those defined in 3GPP standards. The procedures are divided into the following groups:

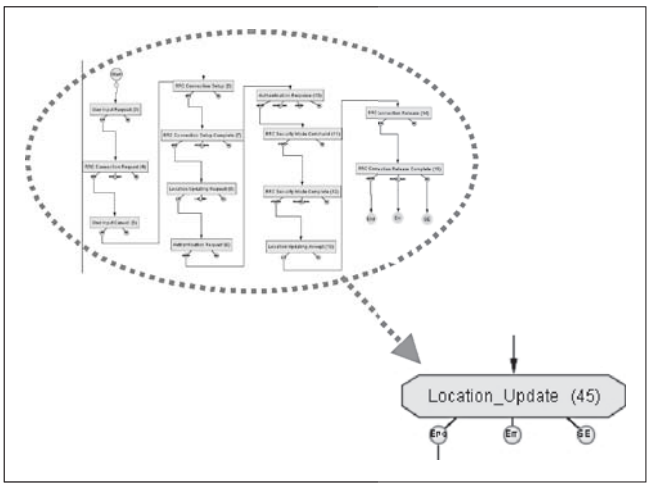
- **Controls**
- **System Simulator Procedures**
- **NAS SM Procedures**
- **NAS CC Procedures**
- **NAS MM Procedures**
- **NAS GMM Procedures**
- **RR Procedures**
- **RRC Procedures**
- **SMS Procedures**
- **Supplementary Services Procedures**
- **TX Diversity Procedures**

Controls – these include Start, End, loops and branches for logical test development.
System Simulator Procedures – used to configure and re-configure the System Simulator including the settings in each cell (i.e. power and frequencies).
NAS SM Procedures – includes activation, modification and de-activation of a PDP context.
NAS CC Procedures – includes alerting, connection, acknowledgement and modification of standard and emergency calls.
Also includes hold, reject, retrieve and status of UE.
NAS MM Procedures – includes Location updating and authentication procedures.
NAS GMM Procedures – includes GPRS attach, detach and routing area update request, accept, complete and reject.
GMM information, status and identity.
PTMSI reallocation, Authentication and Ciphering procedures.

RR Procedures – includes Channel Request, Immediate Assignment and Reject. Paging Request Type 1, Assignment Command and Complete, Channel Mode Modify, Acknowledge, Channel Release and Disconnect. Intersystem Handover To UTRAN, RR Cell Change Order, Handover Complete and Failure, RR Status.
RRC Procedures – includes RRC Connection Request, Setup, Setup Complete, Reject. RRC Connection Release and Complete. RRC Security Mode Command and Complete, RRC Signalling Connection Release Indication. RRC Radio Bearer Setup, Setup Complete, Reconfiguration, Reconfiguration Complete. RRC Transport Channel Reconfiguration, Reconfiguration Complete. RRC Radio Bearer Release and Complete. RRC Paging 1 and 2. RRC UE Capability Enquiry, UE Capability Information and Confirmation. RRC Measurement Control Report and Failure. RRC Counter Check and Response. RRC Status, RRC Physical Channel Reconfiguration and Complete, RRC Handover from UTRAN Command.
SMS Procedures – includes CP ACK, Error and Data to and from UE.
Supplementary Services Procedures – include the facilities and release to and from the UE
TX Diversity Procedures – includes the configuration, setup and release for TX Diversity.

Graphical Test Case Editor

As well as being able to construct tests using the procedures from the library the tool includes the ability to create user defined compound procedures to simplify the way tests look and are created.

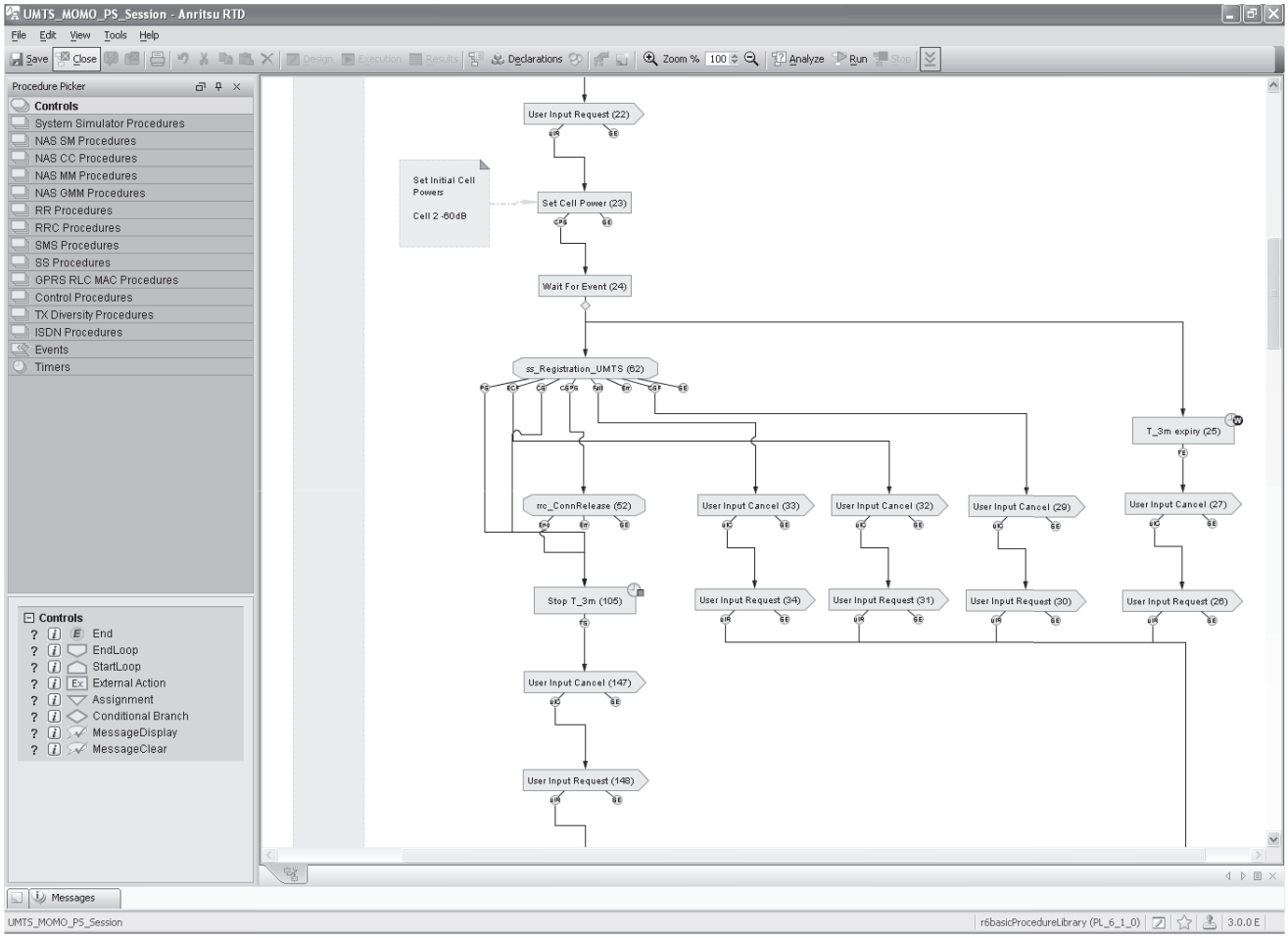


There are also Loops, Delays, including waiting for events, Interactive dialogs and Free form notes to construct a test.
The RTD provides "Drag and Drop" selection of procedures, guidance on available procedures suitable at any point in the test, Addition/deletion of graphical test constructs, group selection as well as Online help for the procedures and links to the relevant 3GPP standards.

Parameter Editor

The Parameter Editor allows the user to parameterize procedures and provides the following features:

- Guidance on suitable catalogue entries for a procedure
- Modification of the catalogue entries to be used
- Ability to override values selected from catalogue entries
- Ability to revert parameter values back to original catalogue based configuration
- Type and range validation of parameters
- Matching of incoming messages, which enables procedures that handle responses or events from the UE to make decisions based upon the content of the messages received. (The test can branch on specific content of individual information elements within the message. Omitted values and "don't cares" are also supported).



Creating and annotating a complex multi-path test in the Graphical Test Case Editor

Test Analysis

Checks the test for simple errors and provides the following features:

- Correct procedure connectivity checking
- Parameterization completeness checking
- Parameter validation
- Warnings and error reports linked to the test

Message Editor

The Message Editor allows editing of air interface messages and System Simulator configuration messages that are to be sent by a procedure and provides the following features:

- Editing of message values
- Reverting messages back to their default values
- Collapsible tree presentation of the test
- Element name and type display
- Node highlighting
- Structure, type and range validation of a message

Reference Library

A comprehensive selection of reference tests are included with the RTD allowing the user to quickly become familiar with the capability of the tool. These tests are annotated enabling easy identification of logical and functional blocks so that they may be re-used by “cutting and pasting” into a new test.

The benefits are:

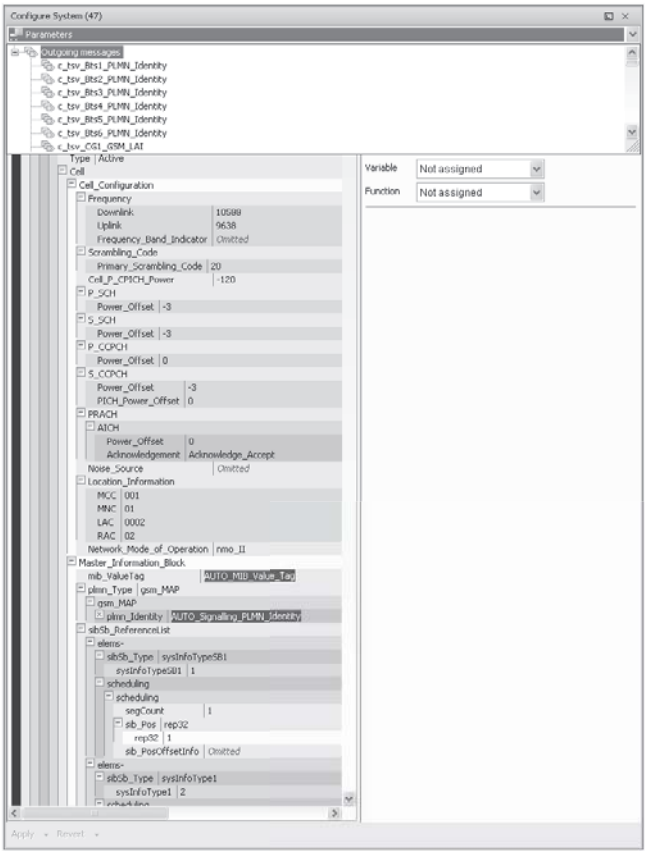
- Tests have been proven on certified terminals
- Tests can be used as a basis for custom tests
- The Library provides a basis for a complete test suite.

Tests included in the Reference Library include:

- Utility Tests allowing information to be gathered from the UE such as IMEI and IMSI.
- Simple location tests and circuit switched lifecycle tests that exercise the basic call processes of a UE with AMR and EFR calls.
- Basic packet switched calls allowing GSM and UMTS packet calls at different data rates.
- InterRAT handover, Idle mode and reselection tests.

IOT and Custom Libraries

To maximize revenue, Network Operators must ensure that UEs stay on their own network or preferred roaming partners' networks and perform better than their competitors. As well as aesthetics, the UEs chosen to perform specific applications must also provide a reliable and friendly user experience. Where possible UEs will be selected to work in harmony with the network. Although a great deal of testing is done in the field, the RTD provides an environment that can simulate many different types of network and scenarios that might occur on a network. Libraries are available for the RTD with comprehensive test scenarios that have been requested by Network operators to simulate their networks and competitive networks. This allows UEs to be evaluated in a laboratory environment before deployment on the network. Anritsu is also able to provide custom libraries to users, making use of the knowledge base it has built up with the evolution of the 3GPP specifications and UE developments.



Easy to understand and change ASN.1 values in the tree structure based Parameter Editor

Test Criteria Editor & Analyzer

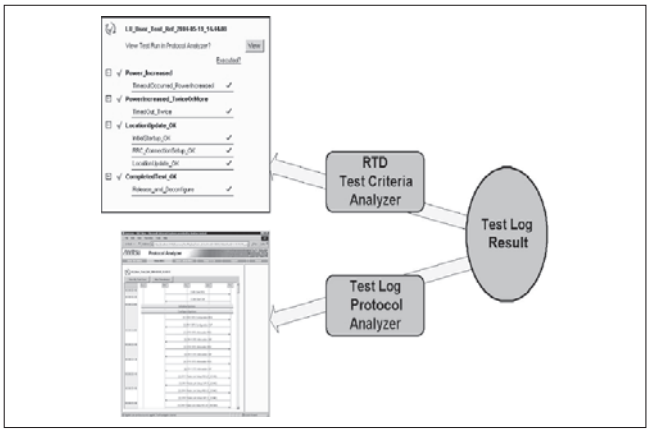
RTD defines the success or failure of a test execution at a high level by the means of test criteria. Test criteria are defined as the route taken through the procedures making up an RTD test, the content of incoming messages and the time between significant events. After running a test, the RTD uses the logs generated to match the criteria specified against the actual test performance and report on the success or failure of each criterion. This also allows new criteria to be defined and quickly checked against old test results.

Test Execution Engine

RTD tests can be run immediately after they have been checked for simple errors (Analyzed). No compilation is necessary, and the test is run directly from within the integrated environment. During execution, a progress log from the test being run is displayed in a status window, and progress through the test is shown graphically by highlighting the blocks as they execute in a different colour. At any time during execution, the user can edit parameters (these changes are picked up by the test case dynamically) or cancel execution.

Test Log (Protocol) Analyzer

The RTD has an integrated protocol analyzer, which logs all Layer 3, Layer 2 and Layer 1 message exchanges between the RTD and the System Under Test. These messages are decoded to show the name and content of each field, and displayed using the RTD Protocol Analyzer. The RTD Protocol Analyzer also provides:



Test Criteria Analyzer for fast, high level analysis and Protocol Analyzer for detailed analysis of test logs

- Direct launch to test results from within the RTD
- Message Sequence Charts of test runs
- Full and collapsible sequence views at procedure level, with pre and post filtering of log files
- Display of test message contents sent or received by the RTD
- Naming and displaying of protocol layer information elements at Layer 1, 2, and 3
- Textual display of enumerated field values
- Decoding and displaying of MIB/SIB embedded bit strings
- Collapsible tree presentation of message contents
- Open Protocol Data Units in separate windows for ease of comparison
- Timestamps against individual messages
- Management of test log archives

Test Archive Manager

RTD stores tests in test archives. The Archive Manager is provided to allow the user to manipulate tests within the archives.

Catalogue Manager

The catalogues provide a convenient way of managing sets of parameters that are used frequently. The Catalogue Manager is used to manipulate and maintain entries. Entries can also be stored into the catalogue when editing a test.

Getting the Latest RTD Information

As the RTD is continuously tracking the 3GPP standards and is being updated regularly, the exact functionality in the product at any specific moment of time is subject to change. For full details of the exact functionality currently available and planned, please contact your local Anritsu Sales office to request the RTD (MX786201A) data sheet, specification and roadmap documents. For the latest information about the RTD, please visit the Anritsu website (www.anritsu.com).

Ordering Information

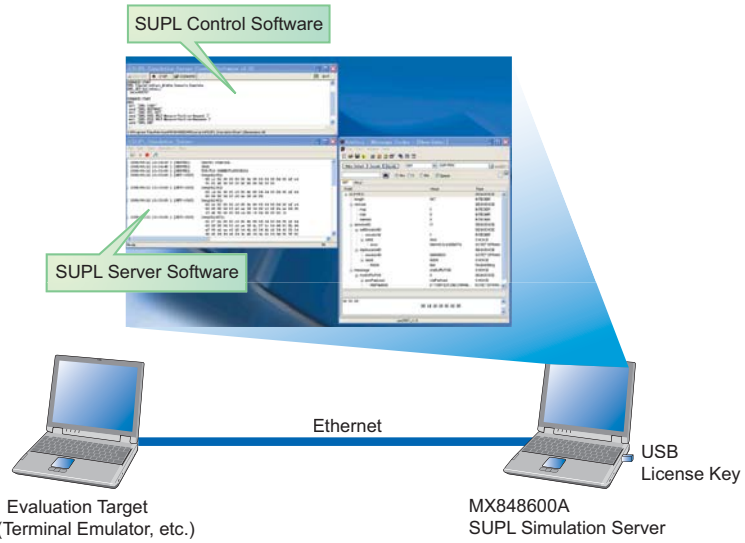
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MX786201A	Rapid Test Designer (RTD)
	Options
MX786201A-12	Multi-RAT FDD/GSM Capability
MX786201A-14	Multiple MD8480 Support
MX786201A-40	Ciphering
MX786201A-45	RTD Test Creation and Editing Tools
MX786201A-46	RTD Run Time Engine
MX786201A-47	RTD with 1x Run Time Engine and 3x Test Creation and Editor Licenses
	AT&T Library Options
MX786201A-100	AT&T IOT Library Subscription and Support (12 months)
MX786201A-101	AT&T IOT Library Package 1
MX786201A-102	AT&T IOT Library Package 2
MX786201A-103	AT&T IOT Library Package 3
MX786201A-104	AT&T IOT Library Package 4
MX786201A-105	AT&T IOT Library Package 5
MX786201A-106	AT&T IOT Library Package 6
	TMO USA Library Options
MX786201A-200	T-Mobile USA Library Subscription and Support (12 months)
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
MX786201A-204	T-Mobile USA UMTS Protocol Library Package 4
MX786201A-205	T-Mobile USA UMTS Protocol Library Package 5
	Support
MX786201A-20	Software Update and Maintenance Contract
MX786201A-21	Training Course (2 days)
MX786201A-22	Premium Support
MX786201A-23	Installation & Commissioning
MX786201A-24	Training Course (5 days)

SUPL SIMULATION SERVER
MX848600A

SUPL Terminal Function Tests and Software Emulation

NEW



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
- Full 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

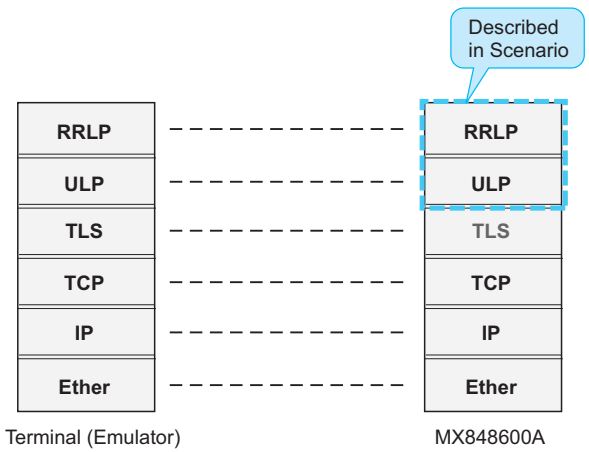
Key Applications
- Terminal Emulator (OS, Middleware, etc.) SUPL Function Evaluation
- 2G/3G Terminal A-GPS Function Tests, Performance Tests
- ULP/RRLP Normal/Abnormal Sequence Tests
- TLS Normal Sequence Test
- Assistance Data Parameter Variation Test

Full 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 TS44.031 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 is supported by supplying a PEM-format CA certificate and private key file to the SET side.

∗6: The TLS abnormal tests are not supported and neither is client authentication.



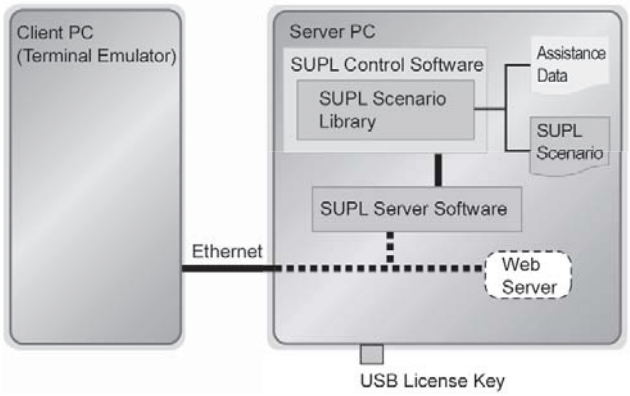
Efficient SUPL Terminal Emulation Environment

• 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 to deliver objective and highly reliable SUPL Location Platform tests*.

*: Only one evaluation target (SET) can be connected to the SUPL simulation server. However, tests can also be run on one PC.

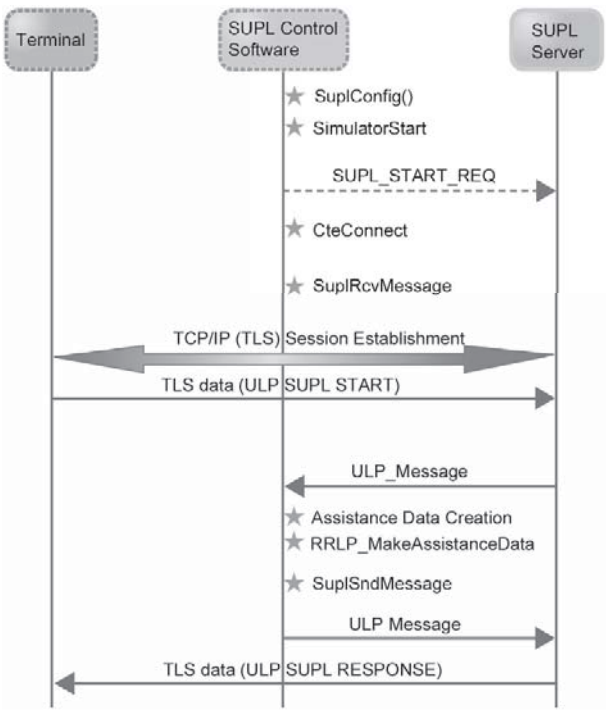
Any IP address can be set in the SUPL Server software and when the MX848600A is installed in the same PC running a Web server as shown below, application tests, etc., using position results can also be performed.



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.

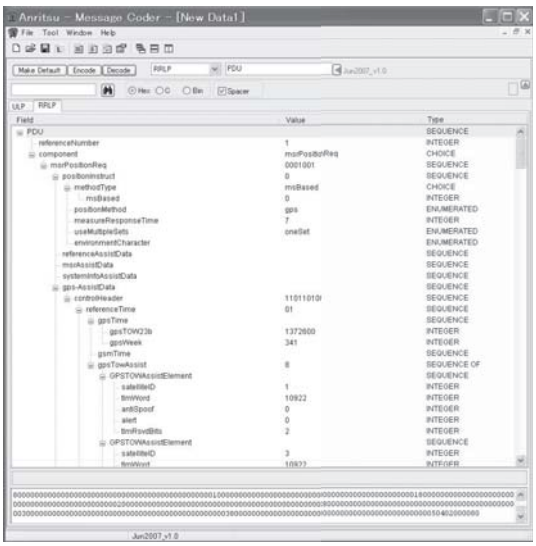
• External Control Function for 24/7 Testing

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

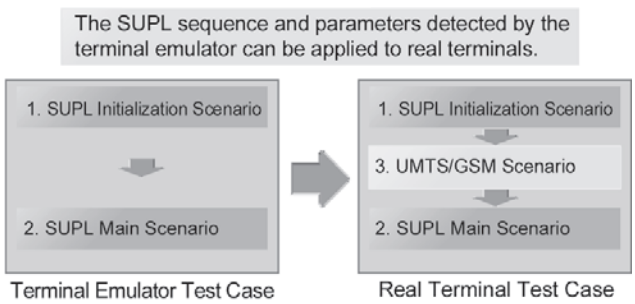
Not only does the SUPL control software support scenario execution, it also encodes the GPS Almanac and Ephemeris data defined in the assistance data file in ASN.1 format and sends the assistance data to the terminal. In addition, the SUPL server software displays and saves the communications log with 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)

PROTOCOL CONFORMANCE TEST SYSTEM
ME7832A

CE

GCF and PTCRB Approved Test System for Protocol Conformance Testing

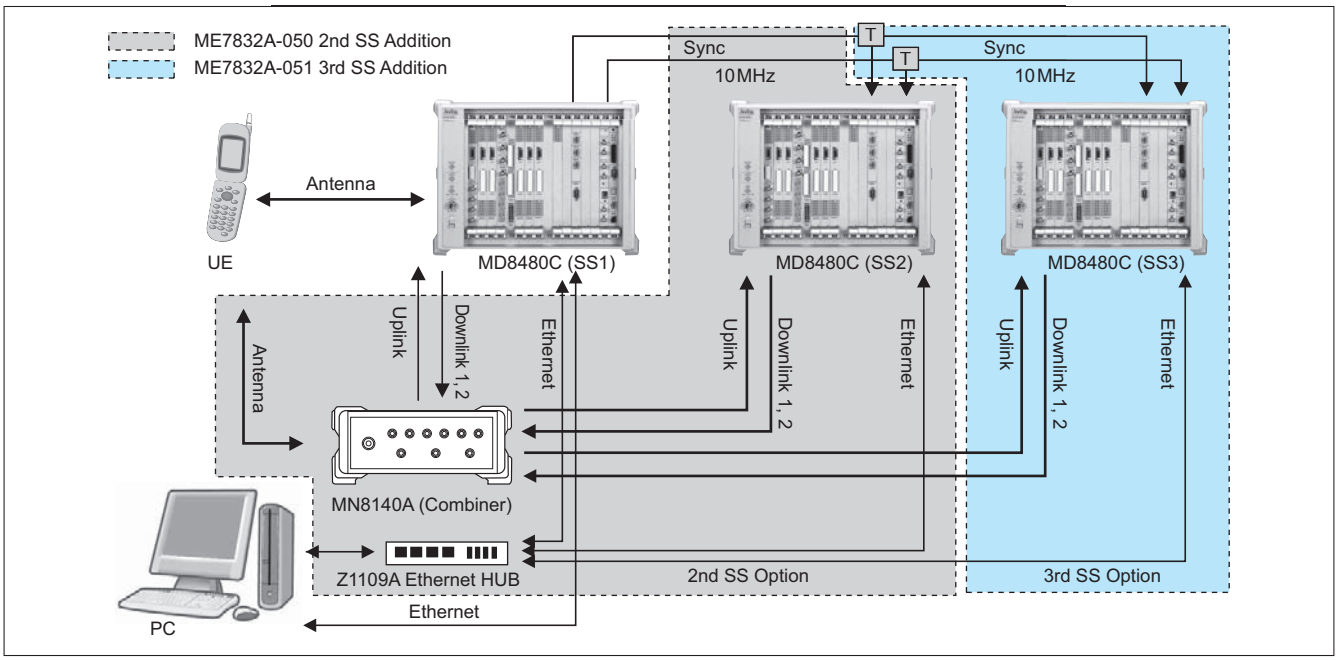
NEW

The ME7832A Protocol Conformance Test System platform supports quick and easy 3GPP TS34.123 and TS51.010 protocol conformance tests of 3/3.5G mobile systems.

- **Largest GCF and PTCRB approved Test Cases**
- **3GPP FDD bands supporting most terminals worldwide**
- **Work Item options supporting 3GPP Rel-99 to Rel-6**
- **Expandable to three System Simulators and RF Combiner**
- **High test efficiency with reliable automation and easy GUI**
- **Initial setup and training support**

Overview

The standard ME7832A configuration has one System Simulator (SS) and a PC.
More SS options can be added according to the target test cases and number of measurement. Anritsu provides on-site initial setup, including cable connections, and calibration.



Flexible Options

Frequency band (FDD) and Work Item (WI) options can be customized to UE functions and markets for optimum return on investment.

Frequency Band Options

Band (FDD)	Frequency [MHz]	Approval Body	Option
Band I	2100 (EU)	GCF	ME7832A-011
Band II	1900 (US)	PTCRB	ME7832A-012
Band III	1800 (EU)		ME7832A-013
Band IV	1700/2100 (US)	PTCRB	ME7832A-014
Band V	850 (US)	PTCRB	ME7832A-015
Band VI	800 (JPN)	GCF	ME7832A-016
Band VIII	900 (EU/ASIA)	GCF	ME7832A-018
Band IX	1700 (JPN)	GCF	ME7832A-019

Work Item (WI) Options

Work Item	Work Item Name	Option
WI-010/012	R99/R99 Enhancements	ME7832A-071
WI-013	Rel-4/Rel-5 Enhancements	ME7832A-072
WI-047	Inter-Band (I-V)	ME7832A-073
WI-014	HSDPA Rel-5	ME7832A-074
WI-024	Rel-6 Enhancements (DSAC/Network Sharing)	ME7832A-075
WI-025	Enhanced UL Rel-6 (HSUPA)	ME7832A-076
WI-049	MBMS	ME7832A-077

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
ME7832A	**Main frame** Protocol Conformance Test System
	Options
ME7832A-011	3GPP Band I Addition
ME7832A-012	3GPP Band II Addition
ME7832A-013	3GPP Band III Addition
ME7832A-014	3GPP Band IV Addition
ME7832A-015	3GPP Band V Addition
ME7832A-016	3GPP Band VI Addition
ME7832A-018	3GPP Band VIII Addition
ME7832A-019	3GPP Band IX Addition
ME7832A-050	2nd SS Addition [Includes second SS (MD8480C), Combiner Unit and Ethernet HUB]
ME7832A-051	3rd SS Addition [Includes third SS (MD8480C)]
ME7832A-071	3GPP WI-010/012 Toolkit
ME7832A-072	3GPP WI-013 Toolkit
ME7832A-073	3GPP WI-047 Toolkit
ME7832A-074	3GPP WI-014 Toolkit
ME7832A-075	3GPP WI-024 Toolkit
ME7832A-076	3GPP WI-025 Toolkit
ME7832A-077	3GPP WI-049 Toolkit
	System Support Service (for Renewal)
ME7832A-SS100	1 Year Support Service
ME7832A-SS110	1 Year Support Service (Frequency Band)
ME7832A-SS150	1 Year Support Service (2nd SS)
ME7832A-SS151	1 Year Support Service (3rd SS)
ME7832A-SS171	1 Year Support Service (WI-010/012)
ME7832A-SS172	1 Year Support Service (WI-013)
ME7832A-SS173	1 Year Support Service (WI-047)
ME7832A-SS174	1 Year Support Service (WI-014)
ME7832A-SS175	1 Year Support Service (WI-024)
ME7832A-SS176	1 Year Support Service (WI-025)
ME7832A-SS177	1 Year Support Service (WI-049)

W-CDMA TRX/PERFORMANCE TEST SYSTEM
ME7873F

W-CDMA RRM TEST SYSTEM
ME7874F

CE

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 TS34.121 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 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 User Equipment (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 June 2008

∗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 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 are also supported, making this system the optimum test solution for high-speed data communications terminals.

New Technology Test Bench

• Supports National Frequency Bands

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 (1.7/2 GHz), and Band V (850 MHz) used in the USA, Band VI (800 MHz), Band IX (1.7 GHz) and Band XI (1.5 GHz) used in Japan, are also supported.
Moreover, Band III (1.8 GHz) and Band VIII (900 MHz) used by W-CDMA services offered mainly by GSM operators in Europe, are supported as well. Since the options can be chosen for each frequency band as required, the test system can be configured to support the specific frequency band or combination of frequency bands required by individual users, allowing the required equipment investment to be kept to a minimum.

Stable and Reliable Measurement

• 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*
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.

∗: Patent applied for

• Continuous Testing of Multiple Terminals

This system can test up to four mobile terminals continuously and the power supply and serial control line can be switched automatically using a terminal switching unit.
Test preparations for multiple units can be completed at one time, simplifying progress management after starting tests.

• 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.

• Support Service

Anritsu offers a support service contract to update the system software to the latest version, maximizing return on investment, and keeping work targets on schedule. This charged service contract provides users with the most recent software version updates matching the latest changes to the 3GPP standards as well as information about 3GPP trends and consultation and technical support for troubleshooting test problems. In addition, the service allows users to maintain their system with the latest version of the GCF and PTCRB approved test cases.

• 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 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)	

*: 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, 50 Ω
Max. Input Level	33 dBm (2 W) 37 dBm (5 W, no path switching)
Reference Oscillator	Uses MS8609A Digital Mobile Radio Transmitter Tester (MS8609A-01 High-Stability Reference Oscillator) as reference Supports input of external reference signal Frequency: 10/13 MHz (selectable), BNC connector
Frequency Range	As defined by 3GPP Operating Band I, II, III, IV, V, VI, VIII, IX, XI
Temperature Range	15˚ to 35˚C (operating), 0˚ to 50˚C (storage)*1
Power	100 to 120 or 200 to 240 Vac ME7873F : 50/60 Hz, ≤3100 VA*2 ME7873F (with Option 10, 21, 22, 23, 24, 25, 26, 28, 29, 41) : 50/60 Hz, ≤3300 VA*2 ME7874F : 50/60 Hz, ≤3000 VA*2
Dimension	1710 (W) x 1597 (H) x 797 (D) mm*3
Mass	ME7873F : ≤600 kg*4 ME7873F (with Option 10, 21, 22, 23, 24, 25, 26, 28, 29, 41) : ≤660 kg*4 ME7874F : ≤600 kg*4
EMC	EN61326 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.
<Reference Value>
ME7873F/ME7874F Max. Power Consumption: 50/60 Hz, ≤3500 VA

*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.

Operating Environment

Controller (PC)

CPU	Pentium 4 (2.4 GHz or higher, Hyper-Threading/Dual-Core: Unusable) or Pentium M (1.6 GHz or higher)
OS	Microsoft Windows 2000 Professional SP4 Microsoft Windows XP Professional SP2 (Japanese or English version) Note: Support services are not applicable to Microsoft Windows XP Professional SP3. For Windows XP, select the Visual Effects tab on the Performance Options dialog box, then select the "Adjust for best performance" option button.
Main Memory (RAM)	Windows 2000: 512 MB or more Windows XP: 1 GB or more
HDD	10 GB of free space
Drive	DVD-ROM Drive (for installing software and version upgrades)
Display	1024 x 768 Resolution min.
Ethernet I/F	100BASE-TX
GPIB I/F	One of following National Instruments products (PCMCIA-GPIB + is not supported) PCMCIA-GPIB (PCMCIA-Bus) PCI-GPIB (PCI-Bus)
Sentinel Connector I/F	Requires at least one free USB connector
Browser Software	Internet Explorer 5.5 or Netscape Communicator 4.73 or later (Japanese or English version)

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
MG3692B	Synthesized Signal Generator
MG3700A	Vector Signal Generator*1
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
	Standard accessory
	ME7873F Operation Manual (CD-ROM): 1 set
	Options
ME7873F-10	RRM Test Addition
ME7873F-70	WI-013 Toolkit (TRx/Performance)*2
ME7873F-72	WI-013 Toolkit (RRM)*2
ME7873F-74	WI-014 Toolkit*2
ME7873F-75	WI-024 Toolkit
ME7873F-76	WI-025 Toolkit
ME7873F-77	WI-049 Toolkit
ME7873F-78	WI-076 Toolkit
MX787190F	MCTS Integration Software
MX787103F-09	JAPAN TRCC TEST*3
MN7462A-01	4 Antenna Connections*5
ME7419B	Mobile Radio Switching Unit
Z0788	Additional Accessory Kit for Power Supply
	Frequency band options*4 (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
	(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)

∗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: When configuring system, requires at least one frequency band option
∗5: Please order with the order for MN7462A. Addition after the system delivery is not possible

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
	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
ME7419B	Mobile Radio Switching Unit
Z0788	Additional Accessory Kit for Power Supply
	Frequency band options*4
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

In addition to the above, use of the ME7873F requires the following customer-supplied parts.

1. Fading Simulator
   A fading simulator is required for the performance tests.
   Elektrobit Wideband Radio Channel Simulator PROPSim C2
2. PC and Peripheral Parts
   The PC and other peripherals are used to install test software for controlling the ME7873F. Refer to the previous page for the operating environment.
3. Peripheral Parts
   GPIB Card
   Recommended Part:
   National Instruments
   778034-02 PCMCIA-GPIB (Windows 2000) (for PCMCIA card slot)
   778032-01 PCI-GPIB (Windows 2000) (for PCI slot)
4. DC Power Supply
   One of the following models is required when using the ME7873F or ME7874F to control a power supply.
   In addition, rack-mounting requires a rack-mount kit from the maker.
   Keithley
   2303 or 2306-PJ plus rack-mount kit
   Agilent
   66311 plus rack-mount kit
   Consult the power supply maker for details of the supported power supply accessory kit.
5. Temperature Chamber
   The following model is required when using the ME7873F or ME7874F to control the temperature chamber.
   Temperature Chamber:
   ESPEC SH241

Contact your Anritsu sales representative for details.

SIGNALLING TESTER

MD8470A

CE

On-the-Bench Global Mobile Communications Network for Wireless Application Developers

Excellent Eco Product

Mobile terminal applications are becoming increasingly important in today's global wireless communications market.
Success now depends on the ability to bring attractive mobile terminals to market ahead of the competition as well as on basic technology advances. Because it can quickly test a wide range of applications, the MD8470A Signalling Tester accelerates development of mobile terminals and services when time-to-market is critical.

Features

- All-in-one platform supporting functional testing of mobile terminal applications, including voice and video calling, content download, messaging
- Simple call processing testing
  W-CDMA/HSDPA/HSUPA: Voice/Video/Packet/SMS/MMS
  GSM/GPRS/EGPRS: Voice/Packet/SMS/MMS
  CDMA2000 1X/1xEV-DO Rev. A:
  Voice (echo back)/Packet/SMS/MMS
  TD-SCDMA: Voice/Packet/SMS
- Multiple communication systems
  (W-CDMA/HSDPA/HSUPA, GSM/GPRS/EGPRS, CDMA2000 1X/1xEV-DO Rev. A, TD-SCDMA)
- Wide frequency coverage (400 MHz to 2.7 GHz)

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

- **All-in-one platform for functional testing of mobile terminal applications, including voice and video calling, content download, messaging**

The MD8470A Signalling Tester is the optimum solution for developing attractive mobile terminals by supporting application development, such as voice calling, packet communications including browsing/content download, video calling, SMS/MMS messaging, and End-to-End UE testing (with single MD8470A).
The MD8470A is an effective tool for configuring an integrated simulation environment for application development.
And the built-in PPP server, Ethernet, ISDN, handset and serial I/O interfaces also support various data communication services.

Call Processing using Simple Operations

- W-CDMA/HSDPA/HSUPA: Voice/Video call/Packet/SMS/MMS
- GSM/GPRS/EGPRS: Voice/Packet/SMS/MMS
- CDMA2000 1X/1xEV-DO Rev. A: Voice/Packet/SMS/MMS
- TD-SCDMA: Voice/Packet/SMS

The MD8470A Signalling Tester supports basic call processing for W-CDMA/HSDPA/HSUPA (Voice call/Video call/Packet communications/SMS/MMS), GSM/GPRS/EGPRS (Voice call/Packet communications/SMS/MMS), CDMA2000 1X/1xEV-DO Rev. A (Voice call (echo back)/Packet communications/SMS/MMS) TD-SCDMA (Voice call/Packet communications/SMS).
The simulation environment required for testing application tests is implemented by simple operations.

Multiple Communication Systems Support

- W-CDMA/HSDPA/HSUPA
- GSM/GPRS/EGPRS
- CDMA2000 1X/1xEV-DO Rev. A
- TD-SCDMA

The MD8470A complies with the GSM/GPRS/EGPRS, W-CDMA/HSDPA/HSUPA, CDMA2000 1X/1xEV-DO Rev. A and TD-SCDMA standards regulating the world's major 2.5G, 3G and 3.5G mobile communication systems.
Seamless coverage of a wide frequency band (400 to 2700 MHz) supports development of multiband mobile terminals and future expanded frequency band.

Platform Architecture

- Base station functions are simulated by installing communication system hardware and control software.
- The user interface (displayed on a 10.4-inch screen) is based on Windows XP Professional, so simulations can be controlled without a remote PC.
- The small-footprint chassis [426 (W) x 221.5 (H) x 281 (D) mm] is ideal for configuring an on-the-bench personal simulation environment.

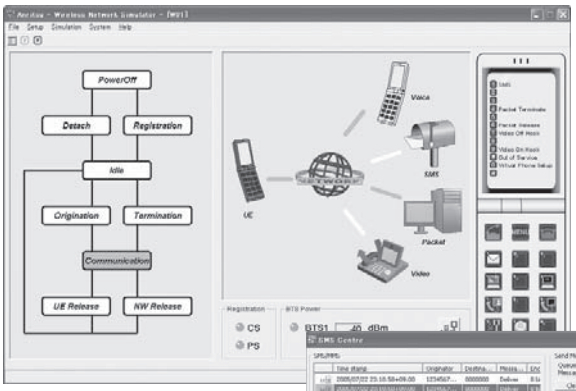
Windows® is a registered trademark of Microsoft Corporation in the USA and other countries.

MX847010A W-CDMA/GSM Simulation Kit

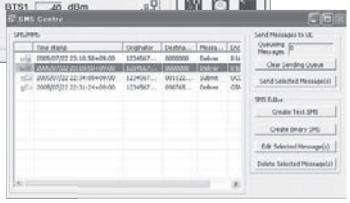
- **Simple Application Testing**

WNS: Wireless Network Simulator

The WNS is a software application for simulating an interactive mobile network on the MD8470A Signalling Tester.*1
WNS activates the required communication bearers based on requests by the mobile terminal, so application developers can easily implement an End-to-End test environment.
Developers use the Windows-based GUI to set basic call processing parameters and display the call processing status.
In addition, call origination and termination is controlled using a WNS virtual terminal.



WNS (Wireless Network Simulator)



SMSC (SMS Centre)

Main Functions of WNS/SMSC

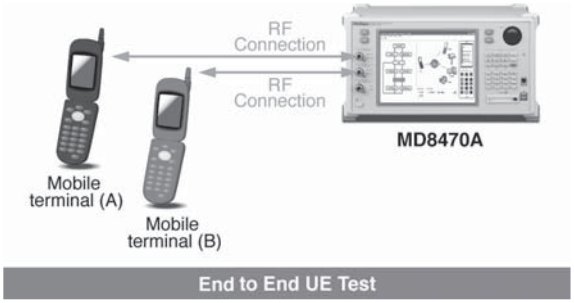
Supported bearers	W-CDMA/HSDPA*2/ HSUPA*3	Voice (MO/MT), Packet (MO/MT), PPP (Built-in server) Packet (MO), Video Call [Loopback] (MO/MT), MultiCall
	GSM/GPRS/EGPRS*4	Voice (MO/MT), Packet (MO/MT)
Setup parameters	Common	Client IP address setting, Server IP address setting, Router connection setting RF Level setting
	W-CDMA/HSDPA*2/ HSUPA*3	Band setting: Band I, II, III, IV, V, VI, VII, VIII, IX, X, Not Specified Channel setting Registration Type setting Activation Time setting: Voice, Packet, Video, MultiCall Packet Window Size setting Packet Rate setting: DL64k/UL64k, DL128k/UL64k, DL384k/UL64k, DL384k/UL128k, DL384k/UL384k, DL1.8M/UL384k, DL3.6M/UL384k, DL7.2M/UL384k, DL1.8M/UL1.46M, DL1.8M/UL2.0M, DL3.6M/UL1.46M, DL3.6M/UL2.0M, DL7.2M/UL1.46M, DL7.2M/UL2.0M, DL HS-Auto/UL384k, DL HS-Auto/UL HS-Auto Video Phone setting: ISDN/Loopback
	GSM/GPRS/EGPRS*4	Frequency Band setting: GSM450, GSM480, GSM850, P-GSM900, E-GSM900, R-GSM900, DCS1800, PCS1900, ARFCN (CCH, TCH) Slot setting: DL1/UL1, DL1/UL3, DL1/UL4, DL2/UL1, DL2/UL3, DL3/UL1, DL4/UL1, DL1/UL2, DL2/UL2, DL3/UL2 GPRS Coding Scheme setting: CS1, CS2, CS3, CS4 EGPRS Modulation and Coding Scheme setting DL: MCS1, MCS2, MCS3, MCS4, MCS5, MCS6, MCS7, MCS8, MCS9 UL: MCS1, MCS2, MCS3, MCS4, MCS5, MCS6, MCS7, MCS8, MCS9
	USIM	USIM Parameter setting: MCC, MNC, IMSI, Test USIM_MODE, K, RAND, AUTN, IK
Other functions	Edit and transmission of SMS (CS/PS)/Display of received SMS (7-bit ASCII/Unicode/Binary) SMS Status Report function SMS Continuous sending function SMS External transfer function MMS Transmission/Reception function*5 State transition diagram for call processing/CS/PS Attach status indicator BTS Output power setting by GUI (1 dB step) Emergency calling Access Class Barred (R99) (Normal/Barred/Emergency) Out-of-service setting Packet Preservation setting function RRC Status Change setting (Cell DCH ⇔ Cell FACH ⇔ Cell PCH) MO/MT (manual and auto answer) operation by virtual terminal International telephone number function Show ID/Hide ID/Unknown ID/Payphone call settings DTMF checking by tone and display	

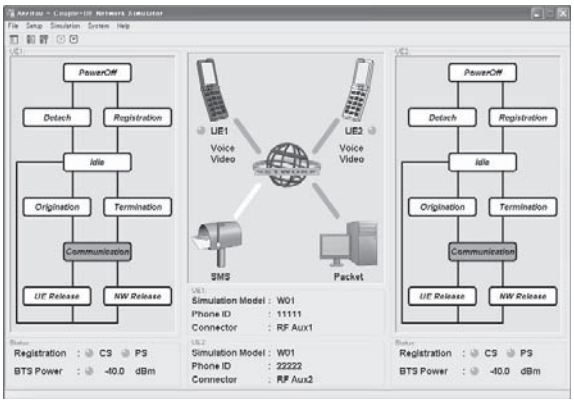
∗1: The WNS is not guaranteed to operate normally with every mobile terminal model
∗2: Requires MX847010A-11 HSDPA Software
∗3: Requires MX847010A-12 HSUPA Software
∗4: Requires MX847010A-01 EGPRS Software
∗5: Requires separate MMS application server

• Simple End-to-End UE Test Environment

CNS: Couple-UE Network Simulator

By using the Couple-UE Network Simulator (CNS)*1 and additional hardware options, one MD8470A unit supports the network simulation required for voice and video calls and SMS/MMS transfer between two mobile terminals (even different operators.)*2
Previous testing required two MD8470A units, but this CNS offers a space-saving solution with just one MD8470A, helping efficient development of mobile terminal applications.





CNS (Couple-UE Network Simulator)

CNS (Couple-UE Network Simulator) End-to-End UE Tests

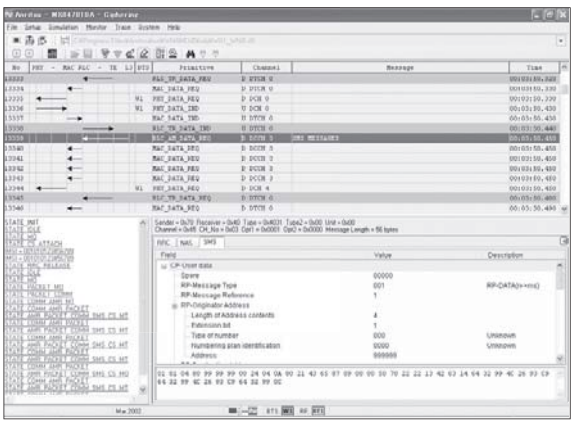
	Required Hardware	Supported End-to-End UE Tests
W-CDMA End-to-End UE Test	MD8470A-02: Second RF Option MU847010B: W-CDMA Signalling Unit x 2	End-to-End voice call test End-to-End video call test End-to-End SMS, MMS*3 test
GSM End-to-End UE Test	MD8470A-02: Second RF Option MU847020B: GSM Signalling Unit x 2	End-to-End voice call test End-to-End SMS, MMS*3 test
W-CDMA/GSM End-to-End UE Test	MD8470A-02: Second RF Option MU847010B: W-CDMA Signalling Unit MU847020B: GSM Signalling Unit	End-to-End SMS, MMS*3 test

∗1: Requires Version 4.00 or later MX847010A W-CDMA/GSM Simulation Kit
∗2: The CNS is not guaranteed to operate normally with every mobile terminal model
∗3: Requires separate MMS application server

• Simulation Control by Scenarios

W-CDMA, GSM/GPRS/EGPRS Execution and Analysis of Simulations

The MD8470A Signalling Tester runs simulations by loading edited and compiled scenarios into the dedicated control software and executing them. The information controlled during simulations, protocol messages, and user data exchanged between the mobile terminal under test and MD8470A are logged in real time. After the test, simulation results can be analyzed using the protocol message decode function (RRC, NAS [RR, CC, MM, GMM, SM], SMS, SS [Supplementary Service], Config) and filtering function.



Simulation control software

Control Software Support Functions

Function	Description
Scenario Execution	Reads and executes compiled DLL scenarios
Real-time Trace	Displays signalling messages and user data during simulation in real time
Trace Log Save/Load	Saves (Binary/Text/Packet/H.245/Throughput) and recalls (Binary only) traced log data
Trace Display Filtering	Displays trace filtered by channel and primitive classification
Message Decode and Analysis	Translates and displays traced messages (RRC, NAS*, SMS, SS, Config)
Scenario Library Function	Provides C library function for scenario creation
External Control Function	Provides DLL library allows external application to control MX847010A control software

∗: Supports RR, CC, MM, GMM, and SM

MX847010A-11 HSDPA Software
MX847010A-12 HSUPA Software

• Testing Application Functions Using HSDPA/HSUPA

Global mobile communications markets are increasingly adopting 3G technologies and 3.5G mobile communication systems supporting high-speed packet data transmission. Since HSDPA/HSUPA systems offer much faster data download speeds, the performance of mobile terminals must be verified in environments with high-speed packet data rates. The MD8470A Signalling Tester with MX847010A-11 HSDPA Software*, MX847010A-12 HSUPA Software* and MU847010B W-CDMA/HSPA Signalling Unit* supports HSDPA/HSUPA communication systems. Functional testing of applications using HSDPA/HSUPA packet data communications is performed by connecting to a server.

*: Requires Version 6.00 or later of MX847010A W-CDMA/GSM Simulation Kit

• Supports All UE Categories

New hardware supports high-speed HSDPA/HSUPA BTS functions for all UE categories specified in 3GPP Release5 and Release6 with processing power for verifying data throughput performance.

3GPP TS25.306 Categories

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 2ms TTI EDCH	TB-Sizes within 10ms E-DCH TTI	TB-Sizes within 2ms 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

• Simple Application Testing for HSDPA/HSUPA

GUI-based simulation (WNS) supports HSDPA/HSUPA application test environments. Easy-to-use GUI operation allows users to set HSDPA (1.8M, 3.6M, 7.2M, HS-Auto*), and HSUPA (1.46M, 2.0M, HS-Auto*) rates (See Packet Rate Setting on Page 12 for details).

*: Rate setting determined by mobile terminal category and CQI value

MX847010A-01 EGPRS Software

• Testing Application Functions Using EGPRS

The MD8470A Signalling Tester with MX847010A-01 EGPRS Software* and MU847020B GSM Signalling Unit supports GUI-based simulation (WNS) for EGPRS packet data communications, the high-speed GPRS 2.5G mobile communications system.
Functional testing of applications using EGPRS packet data communications is performed by connecting to a server.

*: Requires Version 4.00 or later of MX847010A W-CDMA/GSM Simulation Kit

MX847010A-01 EGPRS Software Specification

Layer1	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
Layer2, 3	Broadcasting Control Channel	BCCH/CCCH, PBCCH/PCCH
	ARQ Type	Type 1
	Window size	64 to 192
Standard		3GPP Release99

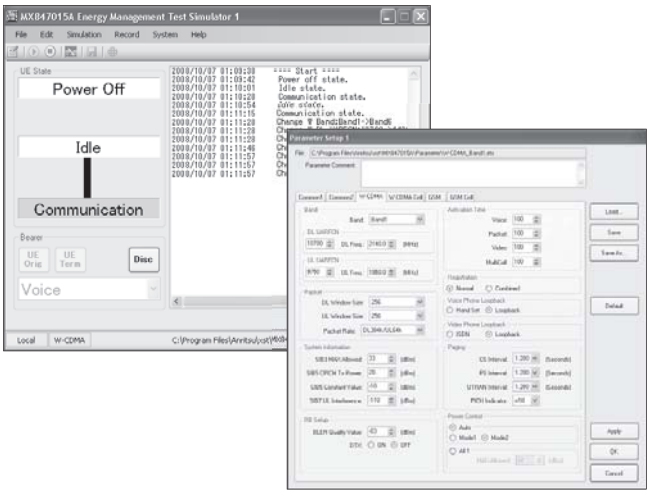
MX847015A Energy Management Test Simulator

- **Evaluating Mobile UE Battery Life at Continuous Standby and Talk**

MX847015A Energy Management Test Simulator (ETS)

The MX847015A Energy Management Test Simulator (ETS) is a software application that runs on the MD8470A to interactively simulate base station operations supporting W-CDMA/HSDPA/HSUPA and GSM/GPRS/EGPRS communications bearers.

It offers a graphical user interface (GUI) to evaluate current consumption for battery life at continuous standby and talk without the need to create complex test scripts. Various network parameters related to current consumption and test conditions can be configured flexibly. When used in combination with the MX847015A-01 Parallel Phone Test Software option, the current consumption of two mobile terminals can be measured simultaneously for efficient results collection and statistical analyses.



Energy Management Test Simulator (ETS)

Key Energy Management Test Simulator Applications

- Evaluation environment of battery life at continuous standby and talk
- Evaluation environment of battery life based on GSM Association “Battery Life Measurement Technique” reference
- Measurement environment of current consumption in multimedia-services environment using high-speed packet data
- Evaluate management software for current consumption and charging on mobile terminal
- Evaluation environment of mobile terminal thermal heating at max. Uplink power transmission

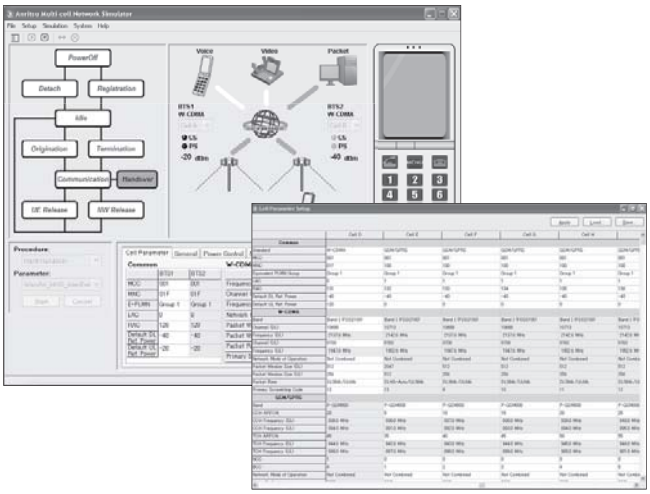
For details of this option, refer to the MX847015A catalog.

MX847016A Multi-cell Network Simulator

- **Mobile Service Quality and Call Connectivity Tests during Handover**

MX847016A Multi-cell Network Simulator (MNS)

The MNS software application runs on the MD8470A to simulate an interactive 2-Cell environment. Since the bearer starts in accordance with requests from the mobile terminal connected to the MD8470A, call processing for each service type is achieved easily in a 2-Cell environment. Tests of handover as the mobile terminal moves between cells as well cell selection and reselection to register with a suitable cell can be performed. The GUI-based operations can set various network and communication parameters flexibly using system configuration setting for two base stations, cell parameter setting for up to 10 cells and test condition setting for cell switching.



Multi-cell Network Simulator (MNS)

Key Multi-cell Network Simulator Applications

- Verify mobile terminal service quality and call connectivity at handover
- Verify roaming services between national carriers
- Perform pre-verification before field tests
- Perform comprehensive verification at integration tests of UMTS mobile terminal
- Evaluate throughout performance at switching between cells supporting different data rates, as well as mobile terminal user interface (UI)
- Verify call connectivity by simulating various carrier networks

For details of this option, refer to the MX847016A catalog.

Supported Functions

● W-CDMA/HSDPA/HSUPA Test Functions

MU847010B W-CDMA/HSPA Signalling Unit and MX847010A W-CDMA/GSM Simulation Kit are required.

Function	Description	WNS	CNS	Sample Scenario
Location registration		○	○	○
UE originated/terminated voice call (Loopback)	Performs loopback communication test	—	—	○
UE originated/terminated voice call (Handset)	Performs handset communication test	○	—	○
UE originated/terminated voice call (End-to-End UE test)	Performs End-to-End voice call test between two UE	—	○	○*1
Emergency Call	Performs Emergency Call test with or without Test SIM	○	—	○*2, *3
Voice call released		○	○	○
UE originated/terminated video call (Loopback)	Performs loopback communication test	○	—	○
UE originated/terminated video call (End-to-End UE test)	Performs End-to-End video call test between two UE	—	○	○*1
Video call released		○	○	○
Caller ID Setting	Performs Show ID/Hide ID/Unknown ID/Payphone/International call settings	○	—	—
UE originated W-CDMA packet call	Performs application tests utilizing packet data communications by connecting to server	○*4	○	○*4
UE terminated W-CDMA packet call	Performs application tests utilizing packet data communications by connecting to server	○	—	—
W-CDMA packet call released from UE		○	○	○
W-CDMA packet call released from NW (Network)		○	—	○
UE originated HSDPA packet call	Performs application tests utilizing packet data communications by connecting to server*5, *7	○*6	○*6	○*6
UE terminated HSDPA packet call	Performs application tests utilizing packet data communications by connecting to server*5, *7	○*6	—	○*6
HSDPA packet call released from UE	*5, *7	○*6	○*6	○*6
HSDPA packet call released from NW	*5, *7	○*6	—	○*6
UE originated HSUPA packet call	Performs application tests utilizing packet data communications by connecting to server*7, *8	○*22	○*22	○*2, *21
HSUPA packet call released from UE	*7, *8	○*22	○*22	○*2, *21
HSUPA packet call released from NW	*7, *8	○*22	—	—
Packet Preservation	Releases RRC Connection while maintaining PDP Context	○	—	—
RRC Status Change	The mobile RRC Status can be changed during packet data communications (Cell DCH ⇔ Cell FACH ⇔ Cell PCH).	○	○	—
Multiple PDP Context	Performs Multi Session packet communications test	—	—	○
IPv6	Data supporting IPv6 can be sent and received.	—	—	△
UE originated PPP packet call	Performs PPP (Built-in server/Serial) packet data communication test	○*9	○*9	○
UE terminated PPP packet call	Performs PPP (Serial) packet data communication test	—	—	○
PPP packet call released from UE	Performs PPP (Built-in server/Serial) packet data communication test	○*9	○*9	○
PPP packet call released from NW	Performs PPP (Built-in server/Serial) packet data communication test	○*9	—	○
UE originated/terminated Unrestricted Digital Information	*10	—	—	○*2
Unrestricted Digital Information released from UE	*10	—	—	○*2
Unrestricted Digital Information released from NW	*10	—	—	○*2
Multi call	Performs packet and voice call test simultaneously*11	○	○	—
SMS transmission/reception	Performs SMS (7bit-ASCII, Unicode, Binary) test*12	○	○	○
SMS transmission/reception (End-to-End UE test)	Performs End-to-End SMS test between two UE	—	○	—
Continuous SMS Sending	Performs continuous sending of multiple SMS messages to UE*12	○	○	—
MMS transmission/reception	Performs MMS transmission/reception test*13	○	○	—
MMS transmission/reception (End-to-End UE test)	Performs End-to-End MMS test between two UE*13	○*1	○	—
Cell Broadcast SMS	Performs W-CDMA Cell Broadcast test	—	—	○
Supplementary service	Offers various sample scenarios of supplementary service such as Multiparty/Call waiting/USSD	—	—	○*2
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	○	—	—
Out of service Setting	Sets BTS Power output to OFF and sets UE to outside NW condition	○	—	—
Ciphering Function Testing	Performs call processing test with W-CDMA ciphering function*14	—	—	△
Inter-system Handover (InterRAT)	Performs W-CDMA/HSDPA*20 ⇔ GSM/GPRS/EGPRS*15 Inter-RAT tests (Cell Reselection/Voice/Packet)*16 (The W-CDMA/HSDPA/HSUPA ⇔ GSM/GPRS/EGPRS InterRAT test using the MNS easy-to-use GUI requires the MX847016A Multi-cell Network Simulator)	—	—	○
Intra-system Handover	Performs Cell Selection/Reselection and Soft Handover/Inter-frequency Hard Handover/Intra-frequency Hard Handover (Voice/Video Call/Packet/Multi-call) tests between two W-CDMA/HSDPA*20/HSUPA*23 cells*24 (The MX847016A Multi-cell Network Simulator is required)	—	—	—

○ : Can be supported by WNS, CNS or sample scenarios
△ : Can be supported by creating scenarios

● **GSM/GPRS/EGPRS Test Functions**

MU847020B GSM Signalling Unit and MX847010A W-CDMA/GSM Simulation Kit are required.

Function	Description	WNS	CNS	Sample Scenario
Location registration		○	○	○
UE originated/terminated voice call (Loopback)	Performs loopback communication test	—	—	○
UE originated/terminated voice call (Handset)	Performs handset communication test	○	—	○
UE originated/terminated voice call (End-to-End UE test)	Performs End-to-End voice call test between two UE	—	○	△*1
Emergency Call	Performs Emergency Call test with or without Test SIM	○	—	○*2, *3
Voice call released		○	○	○
Caller ID Setting	Performs Show ID/Hide ID/Unknown ID/Payphone/International call settings	○	—	—
UE originated GPRS packet call	Performs application tests utilizing packet data communications by connecting to server	○	○	○
UE terminated GPRS packet call	Performs application tests utilizing packet data communications by connecting to server	○	—	—
GPRS packet call released from UE		○	○	○
GPRS packet call released from NW		○	—	—
UE originated EGPRS packet call (Class 12)	Performs application tests utilizing packet data communications by connecting to server*15	○	○	○
UE terminated EGPRS packet call	Performs application tests utilizing packet data communications by connecting to server*15	○	—	—
EGPRS packet call released from UE	*15	○	○	○
EGPRS packet call released from NW	*15	○	—	—
Packet Preservation	Releases RRC Connection while maintaining PDP Context	○	—	—
Multiple PDP Context	Performs Multi Session packet communications test (GPRS/EGPRS*15)	—	—	△
IPv6	Data supporting IPv6 can be sent and received.	—	—	△
DTM (Dual Transfer Mode)	Performs Dual Transfer Mode (Class5/9/11) for GSM (CS: Voice) and GPRS/EGPRS*15 (PS: Packet communications)*17	—	—	○
UE originated/terminated Circuit Switched Data (CSD) call	Performs GSM circuit switched data (CSD) communication test	—	—	○
Circuit Switched Data call released from UE	Performs GSM circuit switched data (CSD) communication test	—	—	○
Circuit Switched Data call released from NW	Performs GSM circuit switched data (CSD) communication test	—	—	○
SMS transmission/reception	Performs SMS (7bit-ASCII, Unicode, Binary) test*12	○	○	○
SMS transmission/reception (End-to-End UE test)	Performs End-to-End SMS test between two UE	—	○	—
Continuous SMS Sending	Performs continuous sending of selected multiple SMS messages to UE*12	○	○	—
MMS transmission/reception	Performs MMS transmission/reception test*13	○	○	—
MMS transmission/reception (End-to-End UE test)	Performs End-to-End MMS test between two UE*13	○*1	○	—
Cell Broadcast SMS	Performs GSM Cell Broadcast test*18	—	—	○
Supplementary service	Offers various sample scenarios of supplementary service such as Multiparty/Call waiting/USSD	—	—	○*2
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	○	—	—
Out of service Setting	Sets BTS Power output to OFF and sets UE to outside NW condition	○	—	—
Ciphering Function Testing	Performs call processing test using GSM/GPRS ciphering function*19	—	—	△
Inter-system Handover (InterRAT)	Performs W-CDMA/HSDPA*20 ⇔ GSM/GPRS/EGPRS*15 Inter-RAT tests (Cell Reselection/Voice/Packet)*16 (The W-CDMA/HSDPA/HSUPA ⇔ GSM/GPRS/EGPRS InterRAT test using the MNS easy-to-use GUI requires the MX847016A Multi-cell Network Simulator)	—	—	○
Intra-system Handover	Performs Cell Selection/Reselection and Inter-frequency Hard Handover (Voice Call/Packet) tests between two GSM/GPRS/EGPRS*15 cells*25 (The MX847016A Multi-cell Network Simulator is required)	—	—	—

○: Can be supported by WNS, CNS or sample scenarios
△: Can be supported by creating scenarios

∗1: Two MD8470A units
∗2: Provided by web download service of MD8470A support service (MX847010A-20)
∗3: Supported only with Test SIM
∗4: Can change rate (DL: 64 kbps, 128 kbps, 384 kbps)
∗5: Requires MX847010A-11 HSDPA Software option and MU847010B W-CDMA/HSPA Signalling Unit
∗6: Supports HSDPA Category 6 (3.6 Mbps), Category 8 (7.2 Mbps) and Category 12 (1.8 Mbps)
∗7: Supports HSDPA/HSUPA functions for all UE categories specified in 3GPP Release5 and Release6
∗8: Requires MX847010A-12 HSUPA Software option and MU847010B W-CDMA/HSPA Signalling Unit
∗9: Supports only PPP (Built-in server) packet data communication test
∗10: Uses ISDN interface option (MU847090B)
∗11: See Service Interruption Testing on Page 17 for details
∗12: Uses SMSC (SMC Centre)
∗13: Requires separate MMS application sever
∗14: Requires W-CDMA Ciphering Software option (MX847011A)
∗15: Requires EGPRS Software option (MX847010A-01)
∗16: Requires MD8470A-02 Second RF Option, MU847010B W-CDMA/HSPA Signalling Unit, and MU847020B GSM Signalling Unit
∗17: DTM Test requires MU847020B GSM Signalling Unit
∗18: Uses CBC (Cell Broadcast Centre)
∗19: Requires MX847021A GSM/GPRS Ciphering Software Option
∗20: Requires HSDPA Software option (MX847010A-11)
∗21: Supports HSUPA Category 5 (2.0 Mbps)
∗22: Supports HSUPA Category 3 (1.46 Mbps) and Category 5 (2.0 Mbps)
∗23: Requires HSUPA Software option (MX847010A-12)
∗24: Requires MD8470A-02 Second RF Option, and two sets of MU847010B W-CDMA/HSPA Signalling Unit
∗25: Requires MD8470A-02 Second RF Option, and two sets of MU847020B GSM Signalling Unit

MX847030A CDMA2000 Simulation Kit

• Flexible Simulation Environment Using Scripts

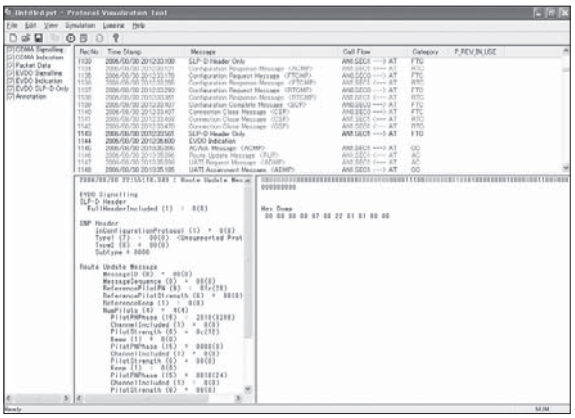
The MX847030A CDMA2000 Simulation Kit supports CDMA2000 1X/1xEV-DO defined in the 3GPP2 standards.
The operation of CDMA2000 Base stations and PPP negotiation procedures during data communications can be fully defined using a Perl script. The flexible network simulation function enables verification of various CDMA2000 1X/1xEV-DO terminal connections, including voice and data communications, handoff and hybrid operation. An API offers flexible control of the radio condition, protocol message transmission/reception, and data communications condition.

• Logging and Decoding Analysis Functions

Protocol messages exchanged between the mobile terminal and the MD8470A Signalling Tester during simulation are logged in real time, with built-in support for decoding protocol messages. CDMA2000 protocols and PPP protocols can all be logged and traced.

• Supporting BCMCS, 1xEV-DO Revision A

The MX847030A supports 1X Release C, BCMCS, 1xEV-DO Revision A simulation. In addition, support for QoS — a 1xEV-DO Revision A function — has been added as a world first.
This supports video-phone services over VoIP, as well as all next-generation IP and interactive services based on high-speed data throughput communications in an on-the-bench environment that greatly reduces development costs.



Simulation Control Software (Protocol Visualization Tool)

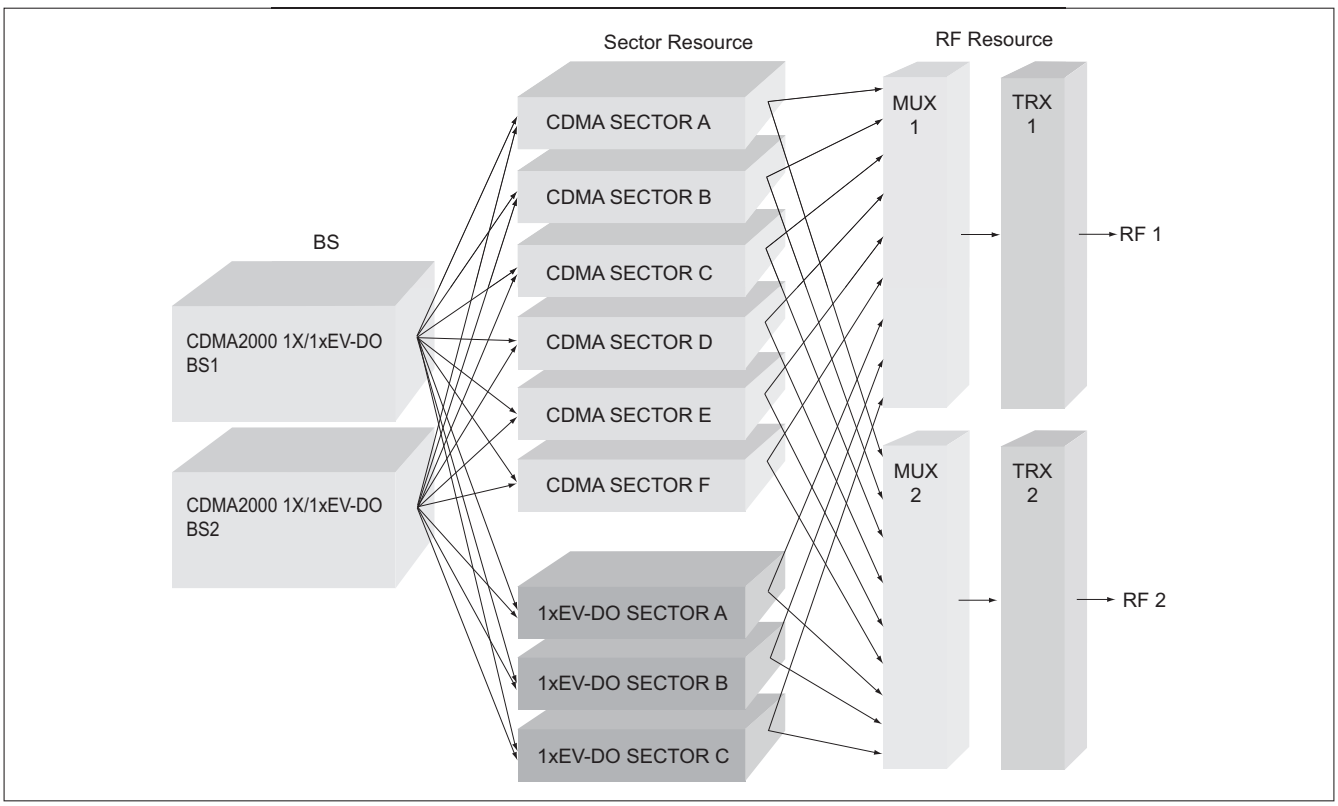
Handoff Test with Multi Sector/Multi Carrier

The MX847030A-01 Multi Sector/Multi Carrier software supports simulation with multiple sectors (1X : 6 max.,1xEV-DO: 3 max.) and multiple carriers (1X/1xEV-DO: 2 max.). These resources can be configured dynamically to support various handoff tests, such as Soft, Softer, Hard, Idle, and Access handoff.
The MD8470A Signalling Tester offers a multi-sector/multi-carrier environment in an all-in-one instrument and greatly improves the efficiency of development verification, interoperability tests and pre-field testing.
Various handoff tests can be performed using several sets of MD8470A simultaneously with multiple carriers (max. 2 → 4*) .

*: When using two sets together

PPP Simulation Function

The MX847030A CDMA2000 Simulation Kit includes a simulation function for PPP negotiations — the packet transmission connection protocol. Using this function, one script handles simulation of both CDMA2000 signalling and PPP simultaneously. The resulting common log makes it easy to troubleshooting problems.
Using the all-in-one MD8470A Signalling Tester with optional MX847030A-01 Multi Sector/Multi Carrier Software supports easy configuration of PPP and data communication tests during handoff operations.



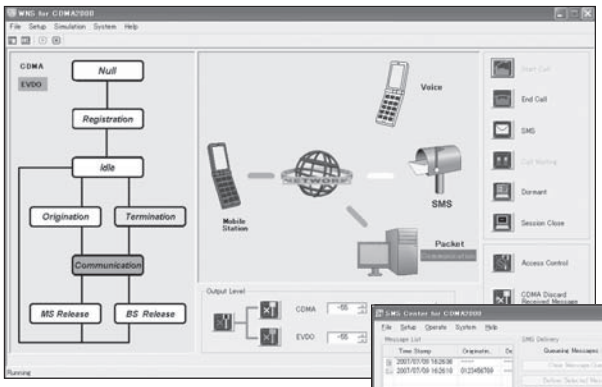
Max. Configuration with one set

• Easy Application Testing

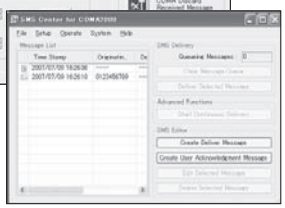
WNS: Wireless Network Simulator

The Wireless Network Simulator (WNS) application software simulates interactive base station operations on the MD8470A Signalling Tester*1.
An application test environment is easily configured because the bearer starts in response to requests from the mobile terminal connected to the MD8470A Signalling Tester. Basic communications parameters can be set by simple GUI-based operations.
The call status is displayed graphically and calling and answering operations are performed at a virtual terminal. In addition, WNS supports the network functions required for simulating the increasingly popular Multimedia Messaging Service (MMS).
Configuring a system combining an MMS test server with a WAP gateway supports MMS Submit and MMS Notification/MMS Retrieval function tests using the WNS interactive test environment. Setting the test system permits MMS tests using loopback as well as MMS Tx/Rx tests between terminals*2.

*1: Operation not guaranteed for all mobile terminal models
*2: Requires two MD8470A units



WNS (Wireless Network Simulator)



SMSC (SMS Center)

Main WNS/SMSC Functions*3

Bearer	CDMA2000 1X/1xEV-DO	Voice Call (Call/Answer), Packet Communications
Setting parameters	Common	IP Address Setting (Client/1X/1xEV-DO)
	1X	Band Class Setting Channel Setting SID/NID Setting Physical Channel Setting Dormant Timer Setting Packet Connection Release Timer Setting
	1xEV-DO	Band Class Setting Channel Setting Sector ID Setting Dormant Timer Setting Packet Connection Release Timer Setting Session Close Timer Setting
	SMS	Communications Setting (Paging Channel, Traffic Channel)
	Mode	Simulation Setting (1X Only, 1xEV-DO Only, 1X/1xEV-DO Hybrid)
Other functions	SMS Edit and Sent/Received SMS Display (7-bit ASCII/Unicode/Shift-JIS/Binary) SMS Continuous Send Function SMS Forward Function EMS Tx/Rx Function MMS Tx/Rx Function*4 Connection Status Transition Display/Attach Status Display Base Station Tx Power Setting (1-dB steps) Access Control Function (PSIST/ACCT) Out-of-Cell (Out-of-Range) Function (Lost Network) Calling/Answering using Virtual Terminal (manual and Automatic) Call Waiting/Multi Party Call Function Caller ID Function Caller ID Function (Multi Party Call) Dormant Function 1xEV-DO Session Close Function Non-Responsive Base Station Function	

*3: 1xEV-DO Rev. A is not supported. Use it or the MX847031A CDMA2000 AppEase software to create test scenarios.
*4: Requires separate MMS application server

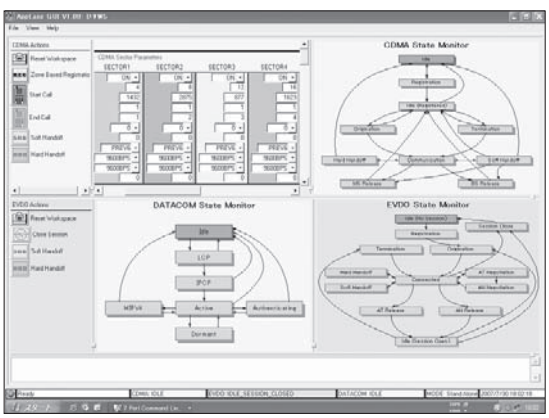
• MX847031A CDMA2000 AppEase

For Efficient Network Simulation Including Handoff and Automation

The CDMA2000 AppEase software application provides flexible simulation of various network conditions by setting various parameters. Various handoff tests, hybrid operation tests, system determination, etc., can be performed easily in multi-sector and multi-carrier environments. Each function is remotely controlled using APIs, offering strong support for automating test systems.

- Supports communication functions, such as voice, packets, SMS/EMS/MMS, etc.
- Supports handoff tests, such as Soft, Hard, Idle, etc., as well as 1X/1xEV-DO hybrid operation tests.
- Supports throughput performance tests for high-speed packets.
- Supports test system automation using APIs.
- Provides integrated simulation environment, including PPP, Mobile IP.

*: Read the MX847031A catalog for details.



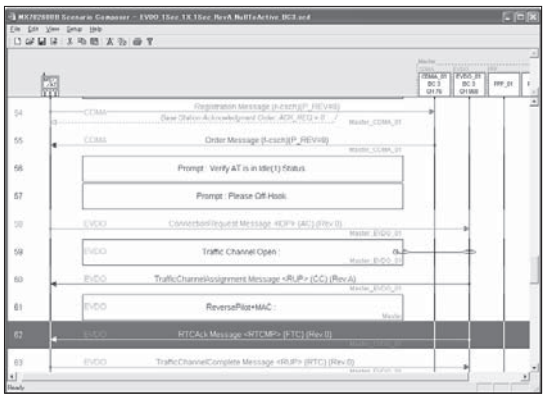
• MX702600B CDMA2000 Scenario Composer

For Rigorous Verification of Protocol Behavior

The MX702600B Scenario Composer software is for editing protocol sequence in ladder diagram format to create test cases required to test CDMA2000 terminal protocol. Test sequences emulating quasi-normal and abnormal conditions are easily created by simple operations, greatly cutting times needed for development of test sequences for improving connection quality. Various functions support efficient editing and modification operation.

- Offers flexible setting for 1X sectors and 1xEV-DO sectors as well as channel configuration in accordance with the test objectives.
- Supports editing and setting of Overhead Messages for each sector
- Supports editing of transmitted and received protocol message
- Supports definition of network operations, including PPP sequence.
- Offers easy test sequence re-use using copy and paste functions.

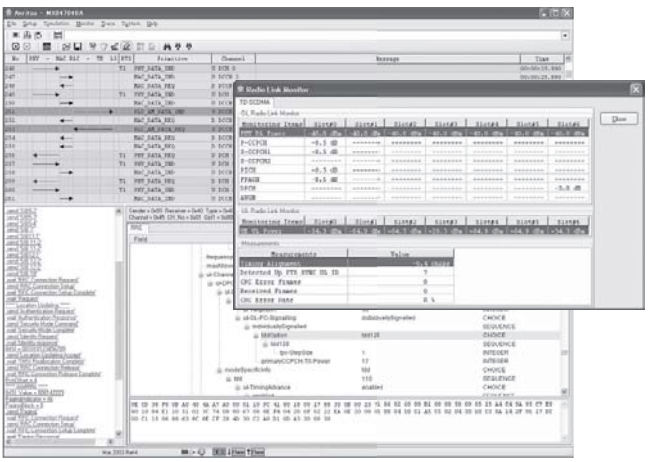
*: Read the MX702600B catalog for details.



MX847040A TD-SCDMA Simulation Kit

• Flexible TD-SCDMA Network Simulation

The MD8470A Signalling Tester with the MU847040A TD-SCDMA Signalling Unit and the MX847040A TD-SCDMA Simulation Kit provides a flexible, repeatable and highly integrated TD-SCDMA network simulation environment for TD-SCDMA technology developers. This new solution allows users to perform extensive testing to create quality devices, protocols, user equipment, and applications for TD-SCDMA systems.



Simulation Control Software

Features

- Flexible physical layer configuration
- Message encode/decode tool and programming library to support efficient test scenario creation
- Protocol message and user data logging at each layer
- Protocol message analysis support for various messages including RRC, NAS [RR, CC, MM, GMM, SM], SMS, SS [Supplementary Service] and CONFIG
- Powerful logging data sorting, searching and filtering for effective troubleshooting
- Monitoring function for DL channel power, UL power, timing alignment and CRC errors

Specifications

• Supported TD-SCDMA Downlink Channels

Channel	Logical Channel	Transport Channel	Physical Channel	Symbol Rate
Common	BCCH	BCH	P_CCPCH	80 ksps
			DwPTS	
			FPACH	80 ksps
			PICH	80 ksps
	PCCH	PCH	S_CCPCH	80 ksps
	CCCH/DCCH/DTCH	FACH		
Dedicated	DCCH + DTCH	DCH	DPCH x 8	80 ksps

• Supported TD-SCDMA Uplink Channels

Channel	Logical Channel	Transport Channel	Physical Channel	Symbol Rate
Common			UpPTS	
	CCCH	RACH	PRACH	80 to 320 ksps
Dedicated	DCCH/DTCH	DCH	DPCH x 2	80 to 1280 ksps

• Supported Bearer Services

Service	Data rate	DL Physical Channel	UL Physical Channel
Protocol (Standalone DCCH)		1xDPCH (80 ksps)	1xDPCH (80 ksps)
Voice Call (GSM-AMR)	12.2 kbps	2xDPCH (80 ksps)	1xDPCH (160 ksps)
Packet Switched Data	32 kbps	8xDPCH (80 ksps)	1xDPCH (640 ksps)
	64 kbps	8xDPCH (80 ksps)	1xDPCH (640 ksps)
Reference Measurement Channel	12.2 kbps	2xDPCH (80 ksps)	1xDPCH (160 ksps)
	64 kbps	8xDPCH (80 ksps)	1xDPCH (640 ksps)

Hardware/Software Options

• Hardware

W-CDMA/HSPA Signalling Unit (MU847010B)
This hardware unit simulates the operation of W-CDMA base stations.

GSM Signalling Unit (MU847020B)
This hardware unit simulates the operation of GSM/GPRS base stations.

ISDN Interface Unit (MU847090B)
This unit enables the ISDN interface. A video call communication test is performed with a mobile terminal under test by connecting a video call terminal to the ISDN interface.

Second RF Option (MD8470A-02)
This hardware unit supports simulation using two RF signals.
It is required when running End-to-End UE tests and InterRAT testing with one MD8470A unit.

CDMA2000 1X Signalling Unit (MU847030A)
This hardware unit simulates operation of CDMA2000 1X base stations.

CDMA2000 1xEV-DO Signalling Unit (MU847032A)
This hardware unit simulates operation of CDMA2000 1xEV-DO base stations.

TD-SCDMA Signalling Unit (MU847040A)
This hardware unit simulates operation of TD-SCDMA base station.

• Software

W-CDMA/GSM Simulation Kit (MX847010A)
This software is required for use with W-CDMA and GSM/GPRS. The kit includes libraries for scenario programming, control software for scenario execution and tracing/analysis, sample scenarios for basic call processing, and user manuals.
(Microsoft Visual C++.net Standard 2003 or Microsoft Visual Studio 2005 Standard Edition* is separately required for scenario compiling. Also, in case Visual C++.net Standard 2003 or Visual Studio 2005 Standard Edition is installed in the MD8470A's built-in PC, a CD or DVD drive with a USB interface is separately required.)

*: Version 5.00 or later of the MX847010A W-CDMA/GSM Simulation Kit is required

Energy Management Test Simulator (MX847015A)
The ETS is a software application that runs on the MD8470A to interactively simulate base stations supporting the W-CDMA/HSDPA/HSUPA and GSM/GSM/EGPRS bearers. It has an easy-to-use GUI for evaluating the battery life of mobile terminals at continuous standby and talk without the need to create complex test scripts by offering flexible setting of network parameters related to current consumption and test conditions.

Parallel Phone Test Software for ETS (MX847015A-01)
Adding the MX847015A-01 Parallel Phone Test Software option and the required hardware supports independent battery life evaluation environment of two mobile terminals connected to one MD8470A, offering a high-productivity test environment.

Multi-cell Network Simulator (MX847016A)
The MNS software simulates interactive base station operations for a 2-Cell W-CDMA/W-CDMA, GSM/GSM, and W-CDMA/GSM environment to support cell selection, cell reselection and handover tests for each service. The easy-to-use GUI supports simple setting of network parameters without needing to create complex test scripts.

HSDPA Software (MX847010A-11)
This software is required for HSDPA simulation. HSDPA testing is supported by combining the MX847010A W-CDMA/GSM Simulation Kit with the MU847010B W-CDMA/HSPA Signalling Unit.

HSUPA Software (MX847010A-12)
This software is required for HSUPA simulation. HSUPA testing is supported by combining the MX847010A W-CDMA/GSM Simulation Kit with the MU847010B W-CDMA/HSPA Signalling Unit.

EGPRS Software (MX847010A-01)
This software is required for EGPRS simulation. EGPRS testing is supported by combining the MX847010A W-CDMA/GSM Simulation Kit with the MU847020B GSM Signalling Unit.

W-CDMA Ciphering Software (MX847011A)
This software is required to test the W-CDMA ciphering function. It supports the standard ciphering algorithm in 3GPP.

GSM/GPRS Ciphering Software (MX847021A)
Software required for testing GSM/GPRS ciphering function, supporting GSM A5/1, A5/2 and A5/3 ciphering algorithms plus GPRS GEA/1, GEA/2 and GEA/3 ciphering algorithms.

CDMA2000 Simulation Kit (MX847030A)
This software is required for CDMA2000 simulation. It includes the scripting interface, control software for script execution and tracing/analysis, sample scenarios for basic call processing, and user manuals.

Multi Sector/Multi Carrier (MX847030A-01)
This software is required for performing handoff tests under conditions emulating multi-carriers (2 max.) and multi-sectors (1X: 6 max; 1xEV-DO: 3 max).

CDMA2000 AppEase (MX847031A)
This software supports basic call processing and various handover tests in a multi-sector/multi-carrier environment.
In addition to setting various network parameters at the GUI, an automated test system is easily configured using the Anritsu-provided AppEase API.

TD-SCDMA Simulation Kit (MX847040A)
This software is required for use with TD-SCDMA. The kit includes libraries for scenario programming, control software for scenario execution and tracing/analysis and user manuals.
(Microsoft Visual C++.NET Standard 2003 is required for compiling scenarios. Also, installing Visual C++.NET Standard 2003 in the built-in PC, requires a CD or DVD drive with a USB interface.)

CDMA2000 Scenario Composer (MX702600B)
This software increases the productivity of test scenario creation and editing. Test sequences created using the editor can be converted to Perl test sequences and output for execution at the MX847030A.

• Software Maintenance Contract

MX847010A Support Service (One year) (MX847010A-20)
This contract covers response to inquiries from users, and maintenance releases.MX847010A-20 is the software maintenance contract for MX847010A.

MX847030A Support Service (1 year) (MX847030A-20)
This contract supports user troubleshooting and software maintenance releases. It is the software maintenance contract for the MX847030A.

MX847031A Support Service (1 year) (MX847031A-20)
This contract supports user troubleshooting and software maintenance releases. It is the software maintenance contract for the MX847031A.

MX847040A Support Service (1 year) (MX847040A-20)
This contract supports user troubleshooting and software maintenance releases. It is the software maintenance contract for the MX847040A.

MX702600B Support Service (1 year) (MX702600B-SS110)
This contract supports user troubleshooting and software maintenance releases. It is the software maintenance contract for the MX702600B.

Configurations

● **W-CDMA/HSDPA/HSUPA, GSM/GPRS/EGPRS**

Configurations \ Hardware/Software Options		MD8470A	MD8470A-02	MU847010B	MU847010B	MU847020B	MU847020B	MU847090B	MX847010A	MX847010A-01	MX847010A-11	MX847010A-12	MX847010A-20	MX847011A	MX847021A	MX847015A	MX847015A-01	MX847016A	Remarks
Single Configuration (1BTS)	W-CDMA	√		√				√*1	√				√	√*1					
	W-CDMA/HSDPA	√		√				√*1	√		√		√	√*1					
	W-CDMA/HSDPA/HSUPA	√		√				√*1	√		√	√	√	√*1					
	GSM/GPRS	√				√			√				√		√*1				
	GSM/GPRS/EGPRS	√				√			√	√			√		√*1				
	W-CDMA • GSM/GPRS	√		√		√		√*1	√				√	√*1	√*1				
	W-CDMA/HSDPA/HSUPA • GSM/GPRS/EGPRS	√		√		√		√*1	√	√	√	√	√	√*1	√*1				
End-to-End UE Test Configuration	End-to-End UE*2 (W-CDMA/W-CDMA)	√	√	√	√				√				√						*3, *4
	End-to-End UE*2 (GSM/GSM)	√	√			√	√		√				√						*3, *5
	End-to-End UE*2 (W-CDMA/GSM)	√	√	√		√			√				√						*3, *6
	End-to-End UE*2 (W-CDMA/W-CDMA, GSM/GSM, W-CDMA/GSM)	√	√	√	√	√	√		√				√						*3, *7
Handover Test Configuration (2BTS)	W-CDMA 2-Cell (Intra-system Handover)	√	√	√	√				√				√	√*1				√	
	W-CDMA/HSDPA/HSUPA 2-Cell (Intra-system Handover)	√	√	√	√				√		√	√	√	√*1				√	
	GSM/GPRS 2-Cell (Intra-system Handover)	√	√			√	√		√				√		√*1			√	
	GSM/GPRS/EGPRS 2-Cell (Intra-system Handover)	√	√			√	√		√	√			√		√*1			√	
	W-CDMA ⇔ GSM/GPRS InterRAT	√	√	√		√			√				√	√*1	√*1			√	
	W-CDMA/HSDPA/HSUPA ⇔ GSM/GPRS/EGPRS InterRAT	√	√	√		√			√	√	√	√	√	√*1	√*1			√	
	W-CDMA 2-Cell, GSM/GPRS 2-Cell, W-CDMA ⇔ GSM/GPRS InterRAT	√	√	√	√	√	√		√				√	√*1	√*1			√	
	W-CDMA/HSDPA/HSUPA 2-Cell, GSM/GPRS/EGPRS 2-Cell, W-CDMA/HSDPA/HSUPA ⇔ GSM/GPRS/EGPRS InterRAT	√	√	√	√	√	√		√	√	√	√	√	√*1	√*1			√	
UE Battery Test Configuration (Single)	W-CDMA	√		√				√*1	√				√			√			
	W-CDMA/HSDPA/HSUPA	√		√				√*1	√		√	√	√			√			
	GSM/GPRS	√				√			√				√			√			*3
	GSM/GPRS/EGPRS	√				√			√	√			√			√			*3
UE Battery Test Configuration (Parallel Phone)	W-CDMA Parallel Phone	√	√	√	√			√*1	√				√			√	√		
	W-CDMA/HSDPA/HSUPA Parallel Phone	√	√	√	√			√*1	√		√	√	√			√	√		
	GSM Parallel Phone	√	√			√	√		√				√			√	√		*3
	GSM/GPRS/EGPRS Parallel Phone	√	√			√	√		√	√			√			√	√		*3
	W-CDMA + GSM Parallel Phone	√	√	√		√		√*1	√				√			√	√		
	W-CDMA/HSDPA/HSUPA + GSM/GPRS/EGPRS Parallel Phone	√	√	√		√		√*1	√	√	√	√	√			√	√		
	W-CDMA/HSDPA/HSUPA Parallel Phone GSM/GPRS/EGPRS Parallel Phone	√	√	√	√	√	√	√*1	√	√	√	√	√			√	√		

W-CDMA/HSDPA/HSUPA Test Configuration: Runs simulation corresponding to W-CDMA/HSDPA/HSUPA 1BTS
GSM/GPRS/EGPRS Test Configuration: Runs simulation corresponding to GSM/GPRS/EGPRS 1BTS
W-CDMA/HSDPA/HSUPA/GSM/GPRS/EGPRS Test Configuration:
Includes functions for test configurations for both W-CDMA/HSDPA/HSUPA and GSM/GPRS/EGPRS

∗1: Optional
∗2: End-to-End UE tests performed by a MD8470A (CNS: Couple-UE Network Simulator)
∗3: Minimum configuration
∗4: End-to-End voice call, video call, SMS, and MMS tests (Requires separate MMS application server)
∗5: End-to-End voice call, SMS, and MMS tests (Requires separate MMS application server)
∗6: End-to-End SMS and MMS tests (Requires separate MMS application server)
∗7: See ∗4, ∗5, ∗6 for supported End-to-End tests

Wireless Test Suite

The MX847015A Energy Management Test Simulator supporting network simulation for battery evaluation and the MX847016A Multi-cell Network Simulator supporting simulation between any two base stations to the MD8470A, offers the Wireless Test Suite as an included tool set.

• Wireless Test Suite Composition

Wireless Test Suite WG

Z1157A*1	Wireless Test Suite WG
MD8470A	Signalling Tester
MX847010A-20	MX847010A Support Service (One Year)

Wireless Test Suite WW

Z1158A*2	Wireless Test Suite WW
MD8470A	Signalling Tester
MX847010A-20	MX847010A Support Service (One Year)

Wireless Test Suite GG

Z1159A*3	Wireless Test Suite GG
MD8470A	Signalling Tester
MX847010A-20	MX847010A Support Service (One Year)

*1, 2, 3: WTS package options at new purchase.
See the table below for configurations of these options.

		Z1157A	Z1158A	Z1159A
MD8470A-02	Second RF Option	√	√	√
MU847010B	W-CDMA/HSPA Signalling Unit	√	√	
MU847010B	W-CDMA/HSPA Signalling Unit		√	
MU847020B	GSM Signalling Unit	√		√
MU847020B	GSM Signalling Unit			√
MX847010A	W-CDMA/GSM Simulation Kit	√	√	√
MX847015A	Energy Management Test Simulator	√	√	√
MX847015A-01	Parallel Phone Test Software for ETS	√	√	√
MX847016A	Multi-cell Network Simulator	√	√	√
J1261C	Ethernet Cable (Shield type, Cross), 1 m	√	√	√
P0035B	W-CDMA/GSM Test USIM	√	√	√

• CDMA2000 1X/1xEV-DO

Units/Options/Software / Configuration	MU847030A CDMA2000 1X Signalling Unit	MU847032A CDMA2000 1xEV-DO Signalling Unit	MD8470A-02 Second RF Option	MX847030A CDMA2000 Simulation Kit	MX847030A-01 Multi Sector/ Multi Carrier
CDMA2000 1X Test Configuration	Required			Required	
CDMA2000 1X + Multi Sector/ Multi Carrier Test Configuration	Required		Required	Required	Required
CDMA2000 1X/1xEV-DO Test Configuration	Required	Required	Required	Required	
CDMA2000 1X/1xEV-DO + Multi Sector/ Multi Carrier Test Configuration	Required	Required	Required	Required	Required

- CDMA2000 1X Test Configuration: Simulate CDMA2000 1X with one carrier and one sector
- CDMA2000 1X + Multi Sector/Multi Carrier Test Configuration: Simulate CDMA2000 1X with multi carrier and multi sectors
- CDMA2000 1X/1xEV-DO Test Configuration: Simulate CDMA2000 1X/1xEV-DO with one carrier and one sector
- CDMA2000 1X/1xEV-DO + Multi Sector/Multi Carrier Test Configuration: Simulate CDMA2000 1X/1xEV-DO with multi carrier and multi sectors

• TD-SCDMA

Options/Units/Software	MD8470A Signalling Tester	MU847040A TD-SCDMA Signalling Unit	MX847040A TD-SCDMA Simulation Kit	MX847040A-20 MX847040A Support Service (1 year)
TD-SCDMA Test Configuration	Required	Required	Required	Required

TD-SCDMA Test configuration: Ability to run TD-SCDMA BTS simulation

Specifications

• MD8470A Signalling Tester

Transmitter Characteristic	Frequency range: 400 to 2700 MHz Frequency setting resolution: 100 Hz Output level range: –120 to –18 dBm (RF Main) Level setting resolution: 0.1 dB Output level accuracy: ±3 dB (Output level: ≥–50 dBm, 18 to 28˚C) Modulation accuracy: ≤7%rms (when MU847010A/B is mounted) Phase error: ≤4˚rms (when MU847020A/B is mounted)
Receiver Characteristic	Frequency range: 400 to 2700 MHz Frequency setting resolution: 100 Hz Maximum input level: +34 dBm (Average) Reference setting range: –30 to +20 dBm (RF Main)
External Interface	RF Main/RF Aux1/RF Aux2: N type connector, Impedance: 50 Ω Call Proc. Serial I/O A to D: D-Sub 9-pin connector, RS-232C, Serial interface for data communications Call Proc. Ethernet A to D: RJ-45 connector, 10BASE-T, Ethernet interface for data communications ISDN 0: RJ-45 connector (Option), ISDN interface for data communications (I.430) Handset: Modular jack, Handset interface (incl. the dedicated handset)
Reference Oscillator	10 MHz Buff Output Frequency: 10 MHz Level: TTL level Connector: BNC type Startup characteristics: ≤±5 x 10^{-8} (5 minutes after power-on, reference to 24 hours after power-on) Aging rate: ≤±1 x 10^{-8}/day, ±1 x 10^{-7}/year (reference to 24 hours after power-on) Temperature characteristics: ≤±2 x 10^{-8}
External Reference Input	10 MHz Ref Input Frequency: 10 MHz (±0.5 ppm) Level: ≥0 dBm Impedance: 50 Ω Connector: BNC Type
Built-in Personal Computer	OS: Windows XP Professional operating system CPU: Mobile Intel Pentium 4 processor 1.7 GHz HDD: 40 GB Memory: 512 MB
User Interface	Display: Color TFT LCD monitor, 10.4 inch, XGA Headphone: 3.5-mm headphone jack Microphone: 3.5-mm microphone jack USB: USB1.1 (Front panel), USB2.0/1.1 (Rear panel) RS-232C: D-Sub 9-pin connector PCMCIA: Type I, II compliant (Front, Rear panel) Keyboard: PS/2 Mouse: PS/2 VGA: Mini D-Sub 15-pin connector Ethernet 0/1: RJ-45 connector (10BASE-T, 100BASE-TX)
Dimensions	426 (W) x 221.5 (H) x 281 (D) mm ∗Excluding protrusions
Mass	≤17 kg (when all options)
Power Supply	100 to 120 V/200 to 240 Vac (–15%/+10%, Max.: 250 V), 47.5 to 63 Hz, ≤300 VA
Operating Temperature	+5˚ to +40˚C, Humidity ≤95% (no condensation)
Storage Temperature	–20˚ to +65˚C, Humidity ≤95% (no condensation)
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

• MX847010A W-CDMA/GSM Simulation Kit, MU847010A W-CDMA Signalling Unit, MU847020B GSM Signalling Unit

W-CDMA	Transmitter characteristic	Frequency range: 400 to 2700 MHz Frequency setting resolution: 100 Hz Channel: CPICH, P-CCPCH, SCH, PICH, DPCH, S-CCPCH, AICH, OCNS Modulation accuracy: ≤7%rms (when MU847010A/B is mounted)
	Receiver characteristic	Frequency range: 400 to 2700 MHz Input level range: –60 to +34 dBm
	Function	Transmitter: Possible to transmit channels compliant with 3GPP (CPICH, P-CCPCH, S-CCPCH, SCH, PICH, AICH, DPDCH + DPCCH) Receiver: Possible to receive channels compliant with 3GPP (PRACH, DPCCH, DPDCH)
GSM	Transmitter characteristic	Frequency range: 400 to 2700 MHz Frequency setting resolution: 100 Hz Phase error: ≤4˚rms (when MU847020A/B is mounted)
	Receiver characteristic	Frequency range: 400 to 2700 MHz Input level range: –40 to +34 dBm
	Function	Transmitter: Possible to transmit channels compliant with GSM standard (DL-CCH, DL-TCH) Receiver: Possible to receive channels compliant with GSM standard (UL-CCH, UL-TCH)

• MX847030A CDMA2000 Simulation Kit, MU847030A CDMA2000 1X Signalling Unit, MU847032A CDMA2000 1xEV-DO Signalling Unit

1X	Transmitter characteristics	Frequency range: 400 to 2700 MHz Frequency setting resolution: 100 Hz Channel*: Sync, Pilot, PCH, BCCH, CCCH, FCH, DCCH, SCH, QPCH, OCNS, SCCH Channel level setting range: –30 to 0 dB, 0.25 dB step (Relative level for Ior) Sector level setting range: –30 to 0 dB, 0.1 dB step (Relative level for Ior) AWGN level setting range: –20 to +12 dB (Relative level for Ior) Waveform Quality: ≥0.99 (Only Pilot, AWGN OFF)
	Receiver characteristics	Frequency range: 400 to 2700 MHz Input level range: –60 to +34 dBm Channel*: ACH, EACH, FCH, DCCH, SCH, SCCH
	Applied standard	CDMA2000 1X Release 0, A, C
	Protocol revision	PREV6, PREV7, PREV9/10 (non-EVDV)
	Service options	SO1, SO3 (EVRC), SO6 (SMS), SO14, SO15 (LSPD), SO25 (FCH), SO33 (HSPD), SO36, SO68 (EVRC-B), SO32768
	Data communications	Transparent IP data transmission/Simple IP/Mobile IP PPP Simulation: LCP/IPCP/PAP/CHAP
	Functions	Transmitter: 3GPP2-compliant channels Receiver: 3GPP2-compliant channels
1xEV-DO	Transmitter characteristics	Frequency range: 400 to 2700 MHz Frequency setting resolution: 100 Hz Channel*: Pilot, MAC, Control, Traffic Sector level setting range: –30 to 0 dB, 0.1-dB step (Relative level for Ior) AWGN level setting range: –20 to +12 dB (Relative level for Ior) Waveform Quality: ≥0.99 (Only Pilot, AWGN OFF)
	Receiver characteristics	Frequency range: 400 to 2700 MHz Input level range: –60 to +34 dBm Channel*: Access, Traffic
	Standard	CDMA2000 1xEV-DO Revision 0, A, BCMCS
	Data communications	Transparent IP data transmission/Simple IP/Mobile IP PPP Simulation: LCP/IPCP/PAP/CHAP
	Functions	Transmitter: 3GPP2-compliant channels Receiver: 3GPP2-compliant channels

*: Restrictions on combination of frame duration, rate, and channel combination

• MX847040A TD-SCDMA Simulation Kit, MU847040A TD-SCDMA Signalling Unit

Transmitter characteristic	Frequency range: 400 to 2700 MHz Frequency setting resolution: 100 Hz Channel: P-CCPCH, S-CCPCH, DwPCH, PICH, FPACH, DPCH Modulation accuracy: ≤7%rms (when MU847010A/B is mounted)
Receiver characteristic	Frequency range: 400 to 2700 MHz Input level range: –50 to +34 dBm Channel: UpPCH, PRACH, DPCH
Function	Transmitter: Possible to transmit channels compliant with 3GPP Receiver: Possible to receive channels compliant with 3GPP

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
MD8470A	Signalling Tester
	Standard accessories
	Power Cord, 2.6 m
Z0741	MD8470A Operation Manual (CD-ROM)
	Keyboard (Japanese or English)*1
G0134	Mouse
A0013	Handset
MX847000A	Platform Software
	Units/Options
MD8470A-02	Second RF Option
MU847010B	W-CDMA/HSPA Signalling Unit
MU847020B	GSM Signalling Unit
MU847030A	CDMA2000 1X Signalling Unit
MU847032A	CDMA2000 1xEV-DO Signalling Unit (requires MD8470A-01/02, MU847030A)
MU847040A	TD-SCDMA Signalling Unit
MU847090B	ISDN Interface Unit
	Upgrade option
Z0863A/B	MU847020B Upgrade
Z0931A/B	MU847020B Upgrade
Z0991A/B	MU847010B Upgrade-11
Z0992A/B	MU847010B Upgrade-12
Z0993A/B	MU847010B Upgrade-22
Z0994A/B	RF Unit Upgrade-11
Z0995A/B	RF Unit Upgrade-12
Z0996A/B	RF Unit Upgrade-22
Z0716A/B	Retrofit Option
	Software
MX847010A	W-CDMA/GSM Simulation Kit*2
MX847010A-01	EGPRS Software
MX847010A-11	HSDPA Software
MX847010A-12	HSUPA Software
MX847015A	Energy Management Test Simulator
MX847015A-01	Parallel Phone Test Software for ETS
MX847016A	Multi-cell Network Simulator
MX847011A	W-CDMA Ciphering Software
MX847021A	GSM/GPRS Ciphering Software
MX847030A	CDMA2000 Simulation Kit (requires MU847030A)
MX847030A-01	Multi Sector/Multi Carrier (requires MD8470A-01/02, MU847030A, MX847030A)
MX847031A	CDMA2000 AppEase (requires MU847030A, MX847030A)
MX847040A	TD-SCDMA Simulation Kit*2
Z0728	Software Installation Kit
MX702600B	CDMA2000 Scenario Composer
MX847010A-20	MX847010A Support Service (One year)
Z0714	English OS Option
Z0715	Japanese OS Option
Z0728	Software Installation Kit
	Tool package option
Z1157A	Wireless Test Suite WG
Z1158A	Wireless Test Suite WW
Z1159A	Wireless Test Suite GG
	Warranty service
MD8470A-90	Extended Three Year Warranty Service
MD8470A-91	Extended Five Year Warranty Service
MX847010A-20	MX847010A Support Service (1 year)
MX847030A-20	MX847030A Support Service (1 year)
MX847031A-20	MX847031A Support Service (1 year)
MX847040A-20	MX847040A Support Service (1 year)
MX702600B-SS110	MX702600B Support Service (1 year)

Model/Order No.	Name
	Application parts
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
J1262A	RS-232C Cable (Straight), 2 m
J1262B	RS-232C Cable (Cross), 2 m
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
J1263	W-CDMA Interface Cable
J1264	N-SMA Adapter
J1265	Adapter (Serial Connector)
J0658	Adapter (SMA, L Type)
B0543	Carrying Case
B0329D	Front Cover for 1MW 5U
Z0749	MN8110B + Inch Screw Cable
J1287	HDD-SUB15P Cable (Milli-Inch)
P0035B	W-CDMA/GSM TEST USIM

*1: Selected by OS option
*2: P0035B W-CDMA/GSM TEST USIM supplied by this option

CDMA2000 SCENARIO COMPOSER

MX702600B

Best Scenario Creation Efficiency and Test Quality

The MX702600B CDMA2000 Scenario Composer software application greatly increases the speed and efficiency of creating and modifying test scenarios for the MX847030A CDMA2000 Simulation Kit used with the MD8470A Signalling Tester. Tests sequences created using the editor are converted to Perl script and output for execution on the MX847030A.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

• Intuitive Test Sequence Creation with Image of Standard

It is common for mobile communication standards to show the protocol sequence in ladder diagram. The MX702600B can create and edit test sequences as images designed as a ladder sequence.
Users can create customized test sequences for running on the MX847030A without knowledge of Perl, the MX847030A description method or interface.

• Easy-to-Operate

Test sequences are easily edited using a mouse and keyboard, and work efficiency is greatly increased by various useful functions, such as copy/paste for sequences and messages.

• Full Range of Sample Sets

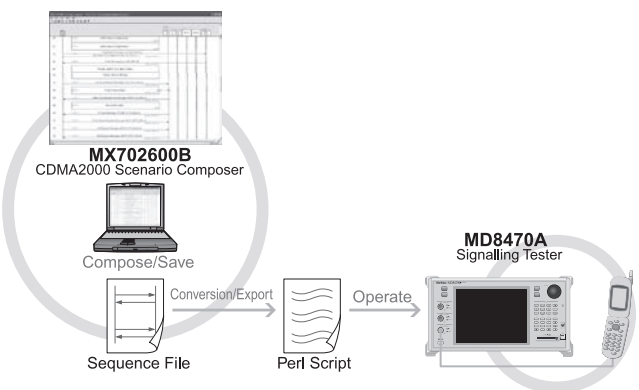
A full range of sample sets for standard test sequences are included. Development time is cut dramatically by editing these samples to create new scenarios. Sample sets are available for voice and data communications and each type of handoff test; more will made available via the Anritsu download website in the future.

• Defined PPP Server Operation

The MX702600B can describe the PPP server operation as a ladder sequence. In addition, since the MX847030A has a built-in function for simulating PPP server, there is no need to provide an external PPP server and normal and quasi-normal test sequences can be created for testing data communications of mobile terminals.

- The Export function converts the MX702600B-created test sequence into a Perl script for running on the MX847030A CDMA2000 Simulation Kit installed in MD8470A Signalling Tester. The converted Perl script is operated using the MX847030A PVT (Protocol Visualization Tool).

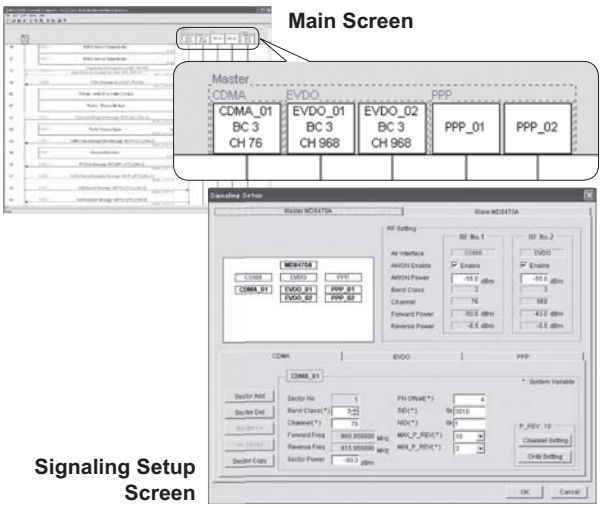
- Since Scenario Composer can export Perl scripts for a batch of test cases to a single file, there is no need for other Perl modules and they can be executed as is by the MX847030A.



• Signalling Setup Function

This function supports batch setting of parameters ranging from the configuration of the RF environment to the Overhead Message (OHM) for each type of Base Station at the Signaling Setup window.

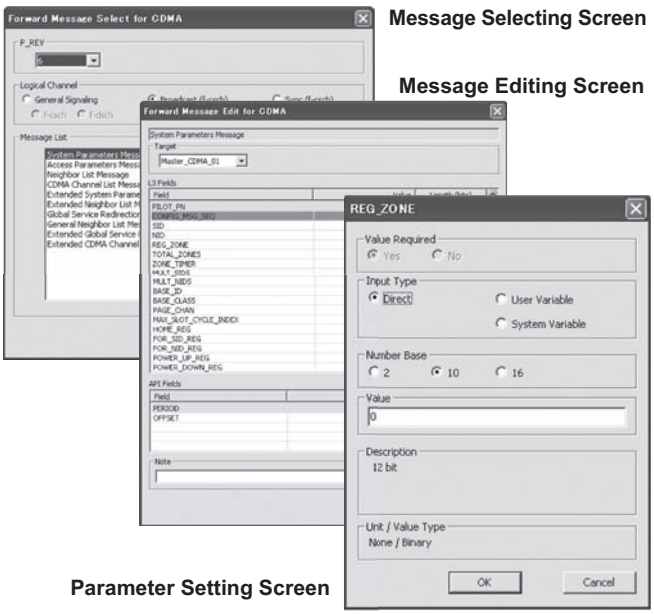
- Automatic allocation of RF resources using sector setting
- Batch setting of common parameters by system variables
- The Overhead Message (OHM) used in each sector can be selected.
- Support for CDMA2000 1X/1xEV-DO Multi-carrier (2 max.)/Multi-sector (1X: 6 max.; 1xEV-DO: 3 max.)
- Expansion to four carriers by linking two MD8470A units



• Message Editing Function

Each parameter in the Layer3-Field of send and receive messages can be edited. Parameters that can be set at the field comply with the 3GPP2 standard.

The following diagram shows an example of the operation when adding a message. Messages can be edited and added easily by selecting the message and performing the parameter input operation. The displayed message name and parameter name comply with the 3GPP2 standard.



Reference Standard

The MX702600B CDMA2000 Scenario Composer specifications are based on the 3GPP2 (3rd Generation Partnership Project 2) and Request For Comments (RFC).

Number	Name
C.S0005-0	Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems - Release 0
C.S0005-A	Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems - Release A, Addendum 2
C.S0005-C	Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems - Release C
C.S0024-0	cdma2000 High Rate Packet Data Air Interface Specification
C.S0024-A	cdma2000 High Rate Packet Data Air Interface Specification
C.S0054-0	cdma2000 High Rate Broadcast-Multicast Packet Data Air Interface Specification
C.S0057-A	Band Class Specification for cdma2000 Spread Spectrum Systems

Note: No guarantee of proper operation for 1X Release D.

Operating Environment

MX702600B Scenario Composer operates under the following environment

PC	IBM-PC/AT or compatible
CPU	1 GHz Pentium III or better
Main Memory	256 MB or more
Display	1024 x 768 pixels or better
OS	Microsoft Windows XP Professional Service Pack 2 or later
Hard Disk	At least 20 MB of free space on boot disk
USB	USB Version 1.1/2.0

Scenario Composer Perl scripts operate under the following environment

Signalling Tester	MD8470A Signalling Tester
Simulation Kit	MX847030A CDMA2000 Simulation Kit Version 2.0 or later
Other	The MD8470A hardware and software configuration differ according to the test contents. See the MX847030A CDMA2000 Simulation Kit Catalog for the configuration

Option

MX702600B-SS110 1 Year Support Service

This software maintenance contract provides support services, such as downloads of the latest software, support for customer enquiries, and maintenance releases.

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
	Software
MX702600B	CDMA2000 Scenario Composer
	Standard accessories
	MX702600B Install CD-ROM License Key (USB 1.1)
W2821AW	MX702600B Operation Manual [Japanese] (CD-ROM)
W2822AE	MX702600B Operation Manual [English] (CD-ROM)
	Option
MX702600B-SS110	1 Year Support Service

RADIO COMMUNICATION ANALYZER

MT8820B

30 MHz to 2.7 GHz

CE GPIB

The One Box Tester Supporting W-CDMA/HSPA/HSPA Evolution, GSM/GPRS/EGPRS, CDMA2000 1X/1xEV-DO Rev. A, TD-SCDMA/HSDPA

Excellent Eco Product

• Supports Multi-Communication Systems

The MT8820B platform covers a frequency range of 30 MHz to 2.7 GHz. When the dedicated optional measurement software and hardware is installed, the major Tx and Rx characteristics of W-CDMA/HSPA/HSPA Evolution, GSM/GPRS/EGPRS, CDMA2000 1X (IS-2000), CDMA2000 1xEV-DO Rev. A, PHS/Advanced PHS and TD-SCDMA/HSDPA terminals can be measured using a single MT8820B 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 MT8820B main frame, two different mobile terminals can be connected and tested simultaneously with a single MT8820B 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.

• Manufacturer Test Suite

Manufacturer Test Suite is the ideal solution for making RF adjustments and RF parametric tests on mobile terminal production lines. The basic configuration consists of signal generator and signal analyzer functions without call processing, supporting RF adjustments and RF parametric tests in the test mode (mobile controlled by external PC). Installing the call processing software option supports RF parametric tests while controlling the mobile terminal at call processing. Adding the adjustment software option shortens the time required for RF adjustment by using the chipset adjustment function. Combining Manufacturer Test Suite with the Parallelphone Measurement option offers the perfect solution for production lines.

Development Test Suite (DTS)

Measurement software	System	Description
MX882000C	W-CDMA	Tx and Rx measurements of mobile terminals including call processing (requires MT8820B-001 and MX882050C)
MX882000C-011	HSDPA	Tx and Rx measurements of mobile terminals including call processing (requires MT8820B-001, MX882000C and MX882050C)
MX882000C-021	HSUPA	Tx and Rx measurements of mobile terminals including call processing (test loop mode) (requires MT8820B-001, MX882000C, MX882000C-011 and MX882050C)
MX882000C-031	HSPA Evolution	Tx and Rx measurements of mobile terminals including call processing (requires MT8820B-001, MX882000C, MX882000C-011, MX882000C-021 and MX882050C)
MX882001C	GSM/GPRS	Tx and Rx measurements of mobile terminals including call processing (requires MT8820B-002)
MX882001C-011	EGPRS	Tx and Rx measurements of mobile terminals including call processing (requires MT8820B-002 and MX882001C)
MX882002C	CDMA2000 1X	Tx and Rx measurements of mobile terminals including call processing (requires MT8820B-003)
MX882003C	CDMA2000 1xEV-DO Rev. 0	Tx and Rx measurements of 1xEV-DO Rev. 0 mobile terminals including call processing (requires MT8820B-003, MT8820B-004 and MX882002C)
MX882005C	PHS	Tx and Rx measurements of mobile terminals including call processing, Tx and Rx measurements of base stations without call processing (requires MT8820B-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 MX882005C)
MX882006C	CDMA2000 1xEV-DO Rev. 0	Tx and Rx measurements of 1xEV-DO Rev. 0 mobile terminals including call processing (requires MT8820B-003, MT8820B-005 and MX882002C)

Continued on next page

MX882006C-011	CDMA2000 1xEV-DO Rev. A	Tx and Rx measurements of 1xEV-DO Rev. A mobile terminals including call processing (ETAP) (requires MT8820B-003, MT8820B-005, MX882002C and MX882006C)
MX882007C	TD-SCDMA	Tx and Rx measurements of TD-SCDMA mobile terminals including call processing (requires MT8820B-001)
MX882007C-011	TD-SCDMA/ HSDPA	Tx and Rx measurements of TD-SCDMA mobile terminals including call processing (requires MT8820B-001 and MX882007C)

Manufacturer Test Suite (MTS)

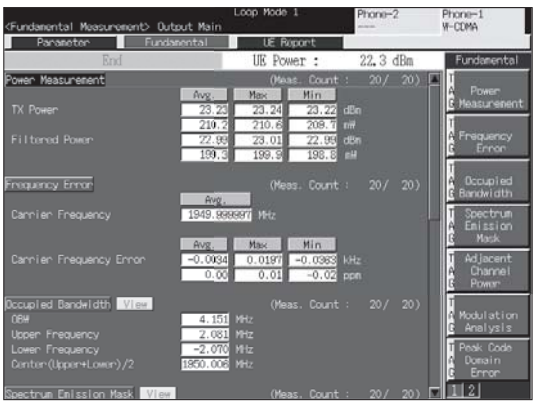
Measurement software	System	Description
MX882030C	W-CDMA	Tx and Rx measurements of mobile terminals without call processing (requires MT8820B-031)
MX882030C-011	HSDPA	Tx and Rx measurements of mobile terminals without call processing (requires MT8820B-031 and MX882030C)
MX882030C-021	HSUPA	Tx and Rx measurements of mobile terminals without call processing (requires MT8820B-031, MX882030C and MX882030C-011)
MX882031C	GSM/GPRS	Tx and Rx measurements of mobile terminals without call processing (requires MT8820B-032)
MX882031C-011	EGPRS	Tx and Rx measurements of mobile terminals without call processing (requires MT8820B-032 and MX882031C)

∗ For W-CDMA terminal connectivity, contact Anritsu sales representative. Please refer to catalog for details.

Transmitter Measurements

• Output Power

The MT8820B 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 MT8820B 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.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA – USA).

• 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

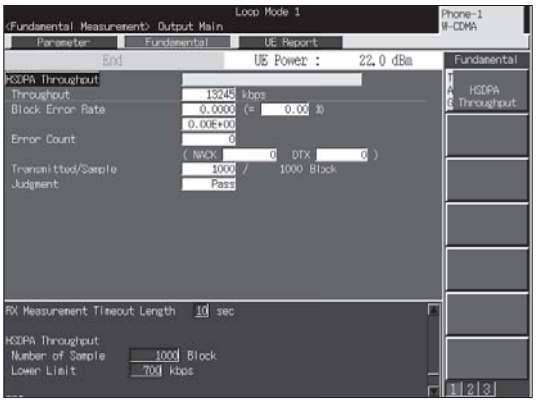
Adjacent channel power is measured according to each communication system.
In W-CDMA, the power can be measured in ±5, ±10 MHz from center frequency. In GSM, the power of 25 points can be measured in ±2 MHz from center frequency.

• Spectrum Waveform Display

MT8820B 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.

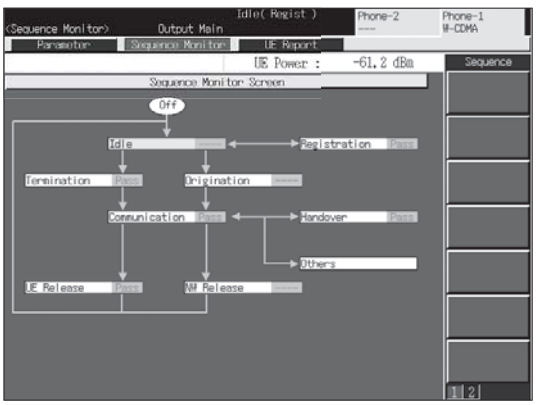


Example of Error Rate Measurement (HSPA Evolution)

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.



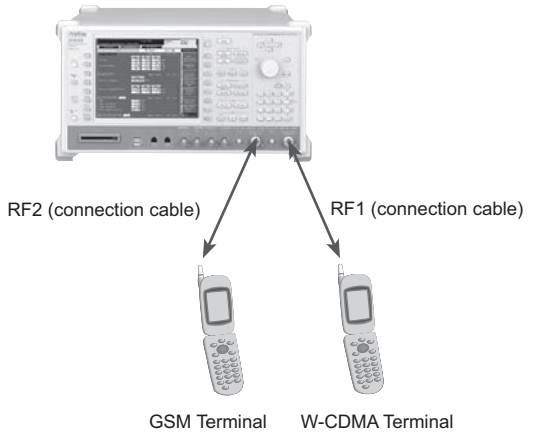
Example of Sequence Monitor (W-CDMA)

• Mobile Terminal Report Monitor

The mobile terminal status can be displayed as a periodic report sent by the mobile terminal to the MT8820B. 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

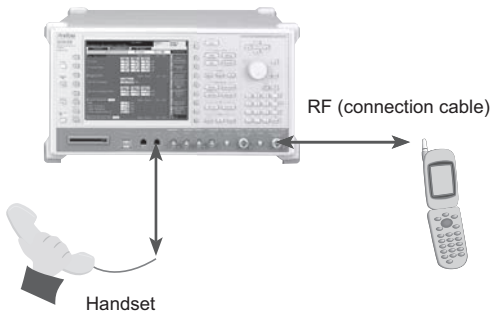
Installing the Parallelphone Measurement option supports simultaneous measurement of two terminals using the second RF, AF, GPIB, or Ethernet port of a single MT8820B unit.



Real-time Voice Encoding and Decoding

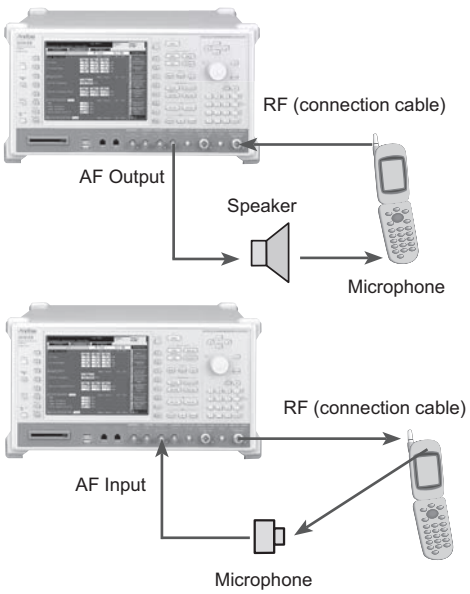
• End-to-End Communications Test

This supports the end-to-end communications test between a handset connected to the RJ11 connector on the MT8820B and a mobile terminal.



• Audio Transmitter Measurement

The tone signal from the MT8820B 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 MT8820B to demodulate the uplink RF signal and measure the level, frequency, and distortion of the demodulated tone signal.

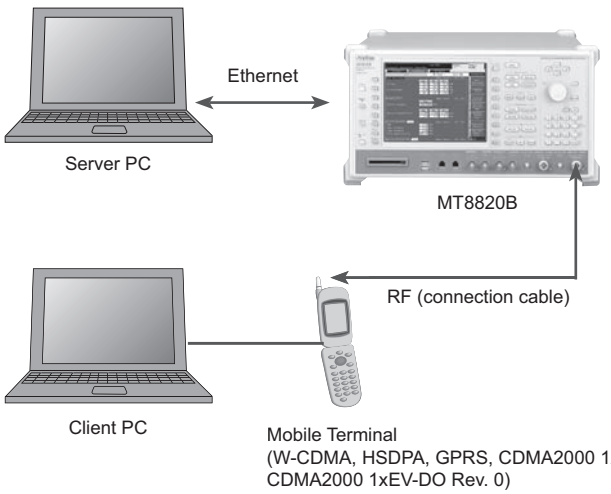


∗ Requires MT8820B-011, MX882000C-001 or MX882001C-001

Packet Communication Data Transfer Test

• End-to-End Data Transfer Tests

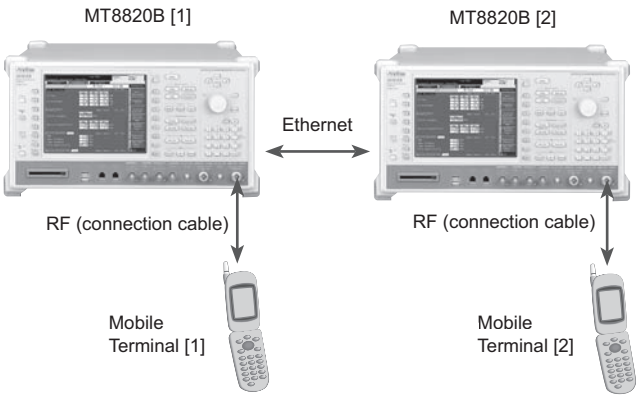
The External Packet Data option supports data transfer to/from external equipment via the Ethernet port. End-to-end data transfer between an application server connected to the MT8820B and the mobile terminal (W-CDMA, HSDPA, GPRS, CDMA2000 1X, CDMA2000 1xEV-DO Rev. 0) or client PC connected to the mobile terminal can be tested using the External Packet Data option (MX882050C-002, MX882051C-002, MX882050C-011, MX882001C-002, MX882002C-002, MX882003C-002, MX882006C-002).



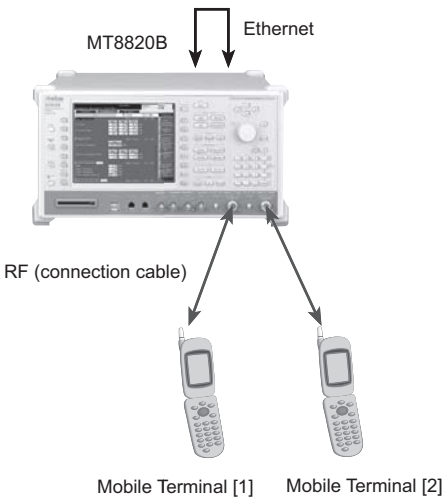
Sample MT8820B connection

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 back panel of the MT8820B. End-to-end video communication can be tested with two MT8820B units or a single MT8820B configured with Parallelphone Measurement.



Sample MT8820B connection: when MT8820B is two sets



Sample MT8820B connection: when MT8820B is one set (Parallelphone measurement correspondence)

∗ Requires MX88205xC-003 or MX882007C-003

CDMA2000 1X/1xEV-DO Synchronous Function

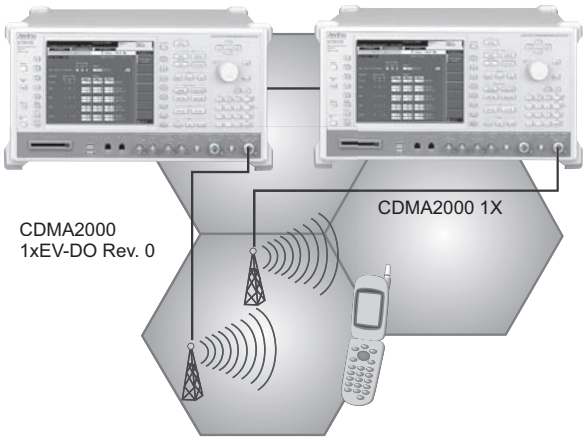
• CDMA2000 1X/1xEV-DO Hybrid Terminal Function Tests

By using the MX882002C and MX882003C (MX882006C) with two MT8820B units or one MT8820B 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.

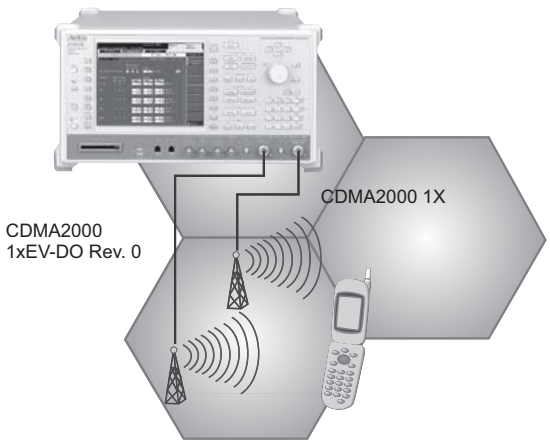
∗1: Parallelphone is the registered trademark of Anritsu Corporation

∗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 MX882006C-011 option supports the UE-connection test with ETAP only.



Sample MT8820B connection: when MT8820B is two sets



Sample MT8820B connection: when MT8820B is one set (Parallelphone measurement correspondence)

GPIB Control

• Batch Readout Command for Measured Results

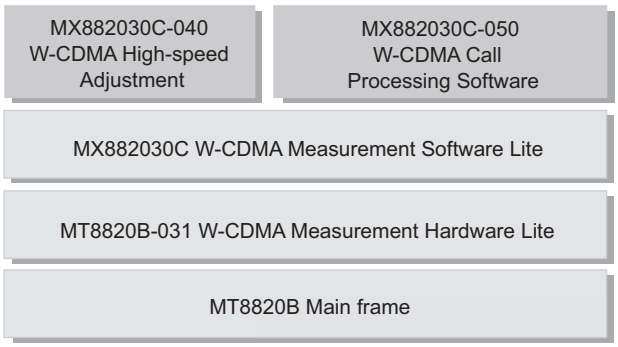
All results obtained by batch measurement can be read out with the single command: “ALLMEAS?”. If required, only desired measurement results can be read out using a command such as “ALLMEAS? MOD” (modulation analysis).

The reduced number of GPIB commands cuts the overhead of both the MT8820B 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.

Manufacturer Test Suite

• Basic Configuration

Call processing functions are not required for RF adjustments, and are only rarely required for RF parametric tests.
Consequently, the basic configuration* of Manufacturer Test Suite offers signal generator and signal analyzer functions without call processing, and is ideal for making RF adjustments and RF parametric tests in the test mode (mobile controlled by external PC).



Example of Manufacturer Test Suite Options Stack

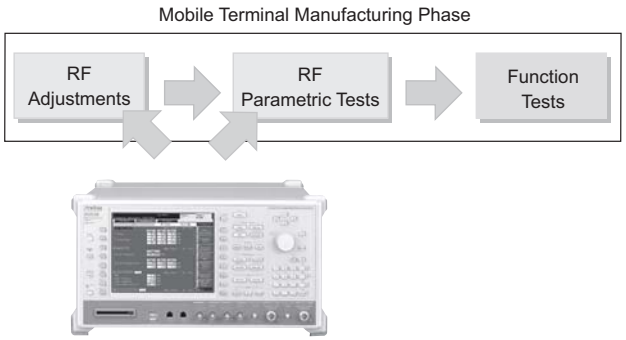
*: Manufacturer Test Suite supports W-CDMA/HSDPA/HSUPA and GSM/GPRS/EGPRS.
*: Manufacturer Test Suite does not support real-time processing functions, such as external packet data and video phone tests.

• RF Adjustments

The basic configuration with signal generator and signal analyzer functions supports RF adjustments using traditional adjustment methods. Installing the adjustment software option cuts the RF adjustment time because the chipset adjustment function is used.

• RF Parametric Tests

The RF parametric tests control the mobile terminal in the test mode or with call processing. The basic configuration performs RF parametric tests in the test mode but installing the call processing software option adds support for RF parametric tests with call processing.



Target Phase of Manufacturer Test Suite

Specifications

• MT8820B Radio Communication Analyzer

General	Frequency range: 30 to 2700 MHz Max. input level: +35 dBm (Main) Main I/O Impedance: 50 Ω VSWR: ≤1.2 (<1.6 GHz), ≤1.25 (1.6 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 x 10^{-8} (at 10 min after startup referenced to frequency 24 h after startup) Aging rate: ≤±2 x 10^{-8}/day, ≤±1 x 10^{-7}/year (referenced to frequency 24 h after startup) Temperature characteristics: ≤±5 x 10^{-8} Connector: BNC type External reference input Frequency: 10 or 13 MHz (±1 ppm) Level: ≥0 dBm Impedance: 50 Ω Connector: BNC type
RF signal generator	Frequency Frequency range: 30 to 2700 MHz (setting range: 0.4 to 2700 MHz) 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: ±1.0 dB (–120 to –10 dBm, Main, after calibration), ±1.0 dB (–110 to 0 dBm, AUX, after calibration) Signal purity Non-harmonic spurious: ≤–50 dBc Harmonics: ≤–25 dBc Uninterrupted level variation Variable range: 0 to –30 dB Setting resolution: 0.1 dB
Others	Display Color 8.4-inch TFT LCD, 640 x 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
Power supply	100 to 120/200 to 240 Vac (–15/+15%, 250 V max.), 47.5 to 63 Hz, ≤550 VA (with all Options)
Dimensions and mass	426 (W) x 221.5 (H) x 498 (D) mm (excluding projections), ≤26 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

• MT8820B-001 W-CDMA Measurement Hardware, MX882000C W-CDMA Measurement Software, MX88205xC W-CDMA Call Processing Software

Modulation analysis	Frequency: 300 to 2700 MHz Input level: –30 to +35 dBm (Main) Carrier Frequency accuracy: ± (Setting frequency x Reference oscillator accuracy + 10 Hz) Modulation accuracy (residual vector error): ≤2.5% (at input of single DPCCH and single DPDCH)
RF power	Frequency: 300 to 2700 MHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration Linearity: ±0.2 dB (0 to –40 dB, ≥–55 dBm), ±0.4 dB (0 to –40 dB, ≥–65 dBm) Measurement object: DPCH, PRACH
Occupied bandwidth	Frequency: 300 to 2700 MHz Input level: –10 to +35 dBm (Main)
Adjacent channel leakage power	Frequency: 300 to 2700 MHz Input level: –10 to +35 dBm (Main) Measurement range: ≥50 dB (at ±5 MHz), ≥55 dB (at ±10 MHz)
RF signal generator	Output frequency: 300 to 2700 MHz (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, Network disconnect, Terminal disconnect, Handover (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: 300 to 2700 MHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration Linearity: ±0.2 dB (0 to –40 dB, ≥–55 dBm), ±0.4 dB (0 to –40 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, 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, and 10 (executes each processing conforming to 3GPP standards and performs pass/fail evaluation)

• MX882000C-021 HSUPA Measurement Software

RF power	Frequency: 300 to 2700 MHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration Linearity: ±0.2 dB (0 to –40 dB, ≥–55 dBm), ±0.4 dB (0 to –40 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

RF power	Frequency: 300 to 2700 MHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration Linearity: ±0.2 dB (0 to –40 dB, ≥–55 dBm), ±0.4 dB (0 to –40 dB, ≥–65 dBm) Measurement object: DPCH, HS-DPCCH, E-DPCCH, E-DPDCH
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 14 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, Fixed Reference Channel, 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)

• MT8820B-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 x 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: ≤1 Ω 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

• MT8820B-002 TDMA Measurement Hardware, MX882001C GSM Measurement Software

Modulation analysis	Frequency: 300 to 2700 MHz Input level: –30 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst, 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: ≤0.5° rms, ≤2° peak
RF power	Frequency: 300 to 2700 MHz Input level: –30 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst, RACH Measurement accuracy: ±0.5 dB (–20 to +40 dBm), ±0.7 dB (–30 to –20 dBm) ∗After calibration Linearity: ±0.2 dB (0 to –40 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: 300 to 2700 MHz Input level: –30 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: 300 to 2700 MHz (1 Hz step) Phase error: ≤1° rms, ≤4° peak Output patterns: CCH, TCH, CCH+TCH Channel coding: FS, EFS, HS0, HS1, AFS, AHS0, AHS1 Coding scheme: CS-1, CS-2, CS-3, CS-4 TCH data: PN9, PN15, All 0, All 1, fixed pattern (PAT 0 - PAT 9) USF: 0 to 7 (GPRS)
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
Call processing	Call control GSM: Registration, Origination, Termination, Network disconnect, Terminal disconnect, Handover GPRS: Connection, Disconnection, Data transfer (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) 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: 300 to 2700 MHz 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: 300 to 2700 MHz Input level: –30 to +40 dBm (average power of burst signal, Main) Measurement object: Normal burst (GMSK, 8PSK), RACH Measurement accuracy: ±0.5 dB (–20 to +40 dBm), ±0.7 dB (–30 to –20 dBm) ∗After calibration Linearity: ±0.2 dB (0 to –40 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: 300 to 2700 MHz Input level: –30 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: 300 to 2700 MHz (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 GSM: Registration, Origination, Termination, Network disconnect, Terminal disconnect, Handover EGPRS: Connection, Disconnection, Data transfer Mobile terminal control GSM: Output level, Time slot, Timing advance, Loopback On/Off EGPRS: 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

• MT8820B-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, 1 Hz step Frequency accuracy: ± (Setting frequency x 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: ≤1 Ω 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

• MT8820B-003 CDMA2000 Measurement Hardware, MX882002C CDMA2000 Measurement Software

Modulation analysis	Frequency: 300 to 2700 MHz Input level: –30 to +35 dBm (Main) Carrier frequency accuracy: ± (Setting frequency x Reference oscillator accuracy + 10 Hz) Modulation accuracy Residual waveform quality: >0.999
RF power	Frequency: 300 to 2700 MHz Input level: –65 to +35 dBm (Main) Measurement accuracy: ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration Linearity: ±0.2 dB (0 to –40 dB, ≥–55 dBm), ±0.4 dB (0 to –40 dB, ≥–65 dBm)
Occupied bandwidth	Frequency: 300 to 2700 MHz Input level: –10 to +35 dBm (Main)
Code domain power measurement	At Reverse RC3, RC4 Input level: –10 to +35 dBm (Main) Measurement accuracy: ±0.2 dB (code power ≥–15 dBc), ±0.4 dB (code power ≥–23 dBc)

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RF signal generator	Output frequency: 300 to 2700 MHz (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 SYNC, PCH: Off, –30 to 0 dB, 0.25 dB step OCNS: Off, Auto-setting [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, –20 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 11, 14, 15 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, Analog Handoff (only when the MT8820B/15B-011 Audio Board is installed)

• MT8820B-004 1xEV-DO Measurement Hardware, MX882003C 1xEV-DO Measurement Software

Modulation analysis	Dependent on the performance of MX882002C
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: 300 to 2700 MHz (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, –20 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 11, 14, 15 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

• MT8820B-005 1xEV-DO Measurement Hardware, MX882006C 1xEV-DO Measurement Software

Modulation analysis	Dependent on the performance of MX882002C
RF power	Dependent on the performance of MX882002C
Occupied bandwidth	Dependent on the performance of MX882002C
Code domain power measurement	Same performance as MX882003C
RF signal generator	Same performance as MX882003C
Error rate measurement	Same performance as MX882003C
Call processing	Same performance as MX882003C

• 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	Dependent on the performance of MX882006C
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 11, 14, 15 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

• MT8820B-011 Audio Board, MX882002C-001 CDMA2000 Voice Codec

Frequency/RF power	Frequency: 800 to 960 MHz Level range: –65 to +35 dBm Level accuracy: After calibration, at Input level setting value ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) Linearity: ±0.2 dB (0 to –40 dB, ≥–55 dBm), ±0.4 dB (0 to –40 dB, ≥–65 dBm)
RF frequency measurement	Level range: –30 to +35 dBm Carrier Frequency accuracy: ± (Setting frequency x Reference oscillator accuracy + 10 Hz)
FM measurement	Level range: –30 to +35 dBm Deviation: 0 Hz to 20 kHz Demodulation frequency range: 30 Hz to 20 kHz
Deviation measurement	Accuracy: Indicated value ± (2% + residual FM) at 1 kHz demodulation frequency Frequency response: ±0.5 dB (demodulation frequency 30 Hz to 20 kHz, referenced to 1 kHz, 5 kHz deviation) Residual FM: <10 Hz rms (demodulation frequency 300 Hz to 3 kHz)
Demodulation distortion	<0.3% (demodulation frequency: 1 kHz, demodulation bandwidth: 0.3 to 3 kHz, 5 kHz deviation)
Analog RF signal generator (FM)	Frequency: 800 to 960 MHz, 1 Hz step Deviation: 0 Hz to 20 kHz, 5 Hz step Modulation signal: Internal modulation only, sine wave, setting frequency range 20 Hz to 10 kHz, 5 Hz step Deviation accuracy: ± (3.5% + 10 Hz) at 1 kHz modulation frequency, demodulation bandwidth 300 Hz to 3 kHz Frequency response: ±0.5 dB (modulation frequency 0.3 to 3 kHz), ±1.0 dB (Modulation frequency 20 Hz to 10 kHz) (4 kHz deviation, modulation frequency referenced to 1 kHz) Modulation deviation: ≤–50 dB (modulation frequency: 1 kHz, deviation: ≥4 kHz, demodulation bandwidth: 0.3 to 3 kHz)
Analog RF signal generator (SAT)	Modulation frequency: Off, 5970, 6000, 6030 Hz Deviation: 2 kHz fixed
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
AF output	Frequency range: 30 Hz to 10 kHz, 1 Hz step Frequency accuracy: ± (Setting frequency x 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: ≤1 Ω 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

• MT8820B-002 TDMA Measurement Hardware, MX882005C PHS Measurement Software

Modulation analysis	Frequency: 300 to 2700 MHz 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 x 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: 300 to 2700 MHz 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 Linearity: ±0.2 dB (0 to –40 dB, ≥–30 dBm) Carrier-off power measurement: ≥55 dB (≥–10 dBm) ≥ (RF power [dBm] + 70) dB (Wide dynamic range power measurement)

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Occupied bandwidth	Frequency: 300 to 2700 MHz 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: 300 to 2700 MHz 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
RF signal generator	Output frequency: 300 to 2700 MHz, 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**

Modulation analysis RF power Occupied bandwidth Adjacent channel leakage power RF signal generator Error rate measurement	Same performance as MX882005C PHS Measurement Software Measurement objects are as follows: Measurement object: PS-TCH ,L/4 DQPSK, L/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),

- **MT8820B-001 W-CDMA Measurement Hardware, MT8820B-007 TD-SCDMA Measurement Hardware, MX882007C TD-SCDMA Measurement Software**

Modulation analysis	Frequency: 300 to 2700 MHz Input level: –30 to +35 dBm (Main) Carrier frequency accuracy: ± (setting frequency x Reference oscillator accuracy + 10 Hz) Modulation accuracy (residual vector error): ≤2.5% (at single code input)
RF power	Frequency: 300 to 2700 MHz Input level: –70 to +35 dBm (Main) Measurement accuracy: ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–70 to –55 dBm) ∗After calibration Linearity: ±0.2 dB (0 to –40 dB, ≥–55 dBm), ±0.4 dB (0 to –40 dB, ≥–65 dBm) Measurement object: DPCH, UpPCH
Occupied bandwidth	Frequency: 300 to 2700 MHz Input level: –10 to +35 dBm (Main)
Adjacent channel leakage power	Frequency: 300 to 2700 MHz 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: 300 to 2700 MHz (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, Handover (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
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)

• MT8820B-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, 1 Hz step Frequency accuracy: ± (Setting Frequency x 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: ≤1 Ω 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

• MT8820B-031 W-CDMA Measurement Hardware Lite, MX882030C W-CDMA Measurement Software Lite

Modulation analysis	Same performance as MX882000C
RF power	Same performance as MX882000C
Occupied bandwidth	Same performance as MX882000C
Adjacent channel leakage power	Same performance as MX882000C
RF signal generator	Same performance as MX882000C
Error rate measurement	Same performance as MX882000C
Call processing (when MX882030C-050 installed)	Same performance as MX882000C

• MX882030C-011 HSDPA Measurement Software

RF power	Same performance as MX882000C-011
Throughput measurement	Functions: Transmit HS-SCCH, HS-PDSCH based on Fixed Reference Channel H-Set 1 Reference channel: RMC 12.2 kbps + FRC H-Set 1 Measurement items: BLER, Throughput Measurement object: ACK and NACK data imposed on HS-DPCCH
CQI measurement	Same performance as MX882000C-011
Call processing (when MX882030C-050 installed)	Same performance as MX882000C-011

• MX882030C-021 HSUPA Measurement Software

RF power	Same performance as MX882000C-021
Call processing (when MX882030C-050 installed)	Same performance as MX882000C-021

• MT8820B-011 Audio Board, MX882030C-001 W-CDMA Voice Codec

Voice codec	Same performance as MX882000C-001
Codec level adjustment	Same performance as MX882000C-001
AF output	Same performance as MX882000C-001
AF input	Same performance as MX882000C-001

• MT8820B-032 TDMA Measurement Hardware Lite, MX882031C GSM Measurement Software Lite

Modulation analysis	Same performance as MX882001C
RF power (Output RF spectrum)	Same performance as MX882001C
RF signal generator	Output frequency: 300 to 2700 MHz (1 Hz step) Phase error: ≤1° rms, ≤4° peak Output pattern: CCH, TCH, CCH+TCH Channel coding: FS, EFS Coding scheme: CS-1, CS-2, CS-3, CS-4 TCH data: PN9, PN15, All 0, All 1, Fixed pattern (PAT 0 - PAT 9) USF: 0 to 7 (GPRS)
Error rate measurement	Same performance as MX882001C
Call processing (when MX882031C-050 installed)	Call control GSM: Registration, Origination, Termination, Network disconnect, Terminal disconnect, Handover GPRS: Connection, Disconnection, Data transfer (executes each processing conforming to 3GPP standards and performs pass/fail evaluation) 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 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

• MX882031C-011 EGPRS Measurement Software

Modulation analysis	Same performance as MX882001C-011
RF power	Same performance as MX882001C-011
Output RF spectrum	Same performance as MX882001C-011
RF signal generator	Same performance as MX882001C-011
Error rate measurement	Same performance as MX882001C-011
Call processing (when MX882031C-050 installed)	Same performance as MX882001C-011

• MT8820B-011 Audio Board, MX882031C-001 GSM Voice Codec

Voice codec	GSM_EFR
Codec level adjustment	Same performance as MX882001C-001
AF output	Same performance as MX882001C-001
AF input	Same performance as MX882001C-001

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
MT8820B	Radio Communication Analyzer
	Standard accessories
	Power Cord, 2.6 m: 1 pc
Z0956A	ANR-CFX40T256 (CF card, 256 MB): 1 pc
CA68ADP	PC Card Adapter : 1 pc
W2778AE	MT8815B/MT8820B Operation Manual (CD-ROM): 1 pc
	Options
MT8820B-001	W-CDMA Measurement Hardware
MT8820B-002	TDMA Measurement Hardware
MT8820B-003	CDMA2000 Measurement Hardware
MT8820B-004	1xEV-DO Measurement Hardware*1
MT8820B-005	1xEV-DO Measurement Hardware*1
MT8820B-007	TD-SCDMA Measurement Hardware
MT8820B-011	Audio Board
MT8820B-012	Parallel Phone Measurement Hardware
MT8820B-031	W-CDMA Measurement Hardware Lite
MT8820B-032	TDMA Measurement Hardware Lite
MT8820B-043	CDMA2000 Time Offset CAL For GPS SG (requires MT8820B-003 and MX882002C)
MT8820B-101	W-CDMA Measurement Hardware Retrofit
MT8820B-102	TDMA Measurement Hardware Retrofit
MT8820B-103	CDMA2000 Measurement Hardware Retrofit
MT8820B-104	1xEV-DO Measurement Hardware Retrofit*1
MT8820B-105	1xEV-DO Measurement Hardware Retrofit*1
MT8820B-107	TD-SCDMA Measurement Hardware Retrofit
MT8820B-111	Audio Board Retrofit
MT8820B-112	Parallel Phone Measurement Hardware Retrofit
MT8820B-131	W-CDMA Measurement Hardware Lite Retrofit
MT8820B-132	TDMA Measurement Hardware Lite Retrofit
MT8820B-143	CDMA2000 Time Offset CAL For GPS SG Retrofit (requires MT8820B-003 and MX882002C)
	Softwares
MX882000C	W-CDMA Measurement Software (requires MT8820B-001 and MX88205xC)
MX882000C-001	W-CDMA Voice Codec (requires MT8820B-011 and MX882000C)
MX882000C-011	HSDPA Measurement Software (requires MT8820B-001, MX882000C, and MX882050C)
MX882000C-012	HSDPA H-Set 6 Throughput Test (requires MT8820B-001, MX882000C, MX882000C-011, and MX882050C)
MX882000C-013	HSDPA High Data Rate (requires MT8820B-001, MX882000C, MX882000C-011, and MX882050C)
MX882000C-021	HSUPA Measurement Software (requires MT8820B-001, MX882000C, MX882000C-011, and MX882050C)
MX882000C-031	HSPA Evolution Measurement Software*3 (requires MT8820B-001, MX882000C, MX882000C-011, MX882000C-021, and MX882050C)
MX882001C	GSM Measurement Software (requires MT8820B-002)
MX882001C-001	GSM Voice Codec (requires MT8820B-011 and MX882001C)
MX882001C-002	GSM External Packet Data (requires MX882001C)
MX882001C-011	EGPRS Measurement Software (requires MX882001C)
MX882002C	CDMA2000 Measurement Software (requires MT8820B-003)
MX882002C-001	CDMA2000 Voice Codec (requires MT8820B-011 and MX882002C)
MX882002C-002	CDMA2000 External Packet Data (requires MX882002C)

Model/Order No.	Name
MX882003C	1xEV-DO Measurement Software (requires MT8820B-003, MT8820B-004, and MX882002C)
MX882003C-002	1xEV-DO External Packet Data (requires MX882003C)
MX882005C	PHS Measurement Software (requires MT8820B-002)
MX882005C-011	Advanced PHS Measurement Software (requires MX882005C)
MX882006C	1xEV-DO Measurement Software (requires MT8820B-003, MT8820B-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 MT8820B-001 and MT8820B-007)
MX882007C-001	TD-SCDMA Voice Codec (requires MT8820B-011 and MX882007C)
MX882007C-003	TD-SCDMA Video Phone Test (requires MX882007C)
MX882007C-011	TD-SCDMA HSDPA Measurement Software*3 (requires MT8820B-001, MT8820B-007, and MX882007C)
MX882010C	Parallel Phone Measurement Software*2 [requires MT8820B-012, the two same measurement hardware (2 board/set) and one measurement software]
MX882030C	W-CDMA Measurement Software Lite (requires MT8820B-031)
MX882030C-001	W-CDMA Voice Codec (requires MT8820B-011 and MX882030C)
MX882030C-008	W-CDMA Band XI*3 (requires MX882030C-050)
MX882030C-009	W-CDMA Band IX*3 (requires MX882030C-050)
MX882030C-011	HSDPA Measurement Software (requires MX882030C)
MX882030C-021	HSUPA Measurement Software (requires MX882030C and MX882030C-011)
MX882030C-040	W-CDMA High-speed Adjustment (requires MX882030C)
MX882030C-050	W-CDMA Call Processing Software*3, *4 (requires MX882030C)
MX882031C	GSM Measurement Software Lite (requires MT8820B-032)
MX882031C-001	GSM Voice Codec (requires MT8820B-011 and MX882031C)
MX882031C-011	EGPRS Measurement Software (requires MX882031C)
MX882031C-040	EGPRS Predistortion Adjustment (requires MX882031C)
MX882031C-050	GSM Call Processing Software (requires MX882031C)
MX882050C	W-CDMA Call Processing Software*3 (requires MX882000C)
MX882050C-002	W-CDMA External Packet Data*3, *4 (requires MX882050C)
MX882050C-003	W-CDMA Video Phone Test*3 (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)
MX882070C	W-CDMA Ciphering Software*3 (requires MX882050C)
MX882051C	W-CDMA Call Processing Software*3 (requires MX882000C)
MX882051C-002	W-CDMA External Packet Data*3 (requires MX882051C)
MX882051C-003	W-CDMA Video Phone Test*3 (requires MX882051C)
MX882071C	W-CDMA Ciphering Software*3 (requires MX882051C)
	Warranty
MT8820B-ES210	Extended Two Year Warranty Service
MT8820B-ES310	Extended Three Year Warranty Service
MT8820B-ES510	Extended Five Year Warranty Service

Continued on next page

Model/Order No.	Name
	Application parts
P0019	TEST USIM001*5
P0035B	W-CDMA/GSM Test USIM
A0013	Handset
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 (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
J0127C	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 0.5 m
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
MN8110B	I/O Adapter (for call processing I/O)
B0332	Joint Plate (4 pcs/set)
B0333G	Rack Mount Kit
B0499	Carrying Case (hard type, with protective cover and casters)
B0499B	Carrying Case (hard type, with protective cover, without casters)
W2776AE	MT8815B/MT8820B Operation Manual (booklet)
W2765AE	MX882000C Operation Manual (booklet)
W2771AE	MX882001C Operation Manual (booklet)
W2790AE	MX882002C Operation Manual Panel Operation (booklet)
W2791AE	MX882002C Operation Manual Remote Control (booklet)
W2793AE	MX882003C Operation Manual Panel Operation (booklet)
W2794AE	MX882003C Operation Manual Remote Control (booklet)
W2769AE	MX882005C Operation Manual (booklet)
W2930AE	MX882006C Operation Manual (booklet)
W2931AE	MX882006C Operation Manual Remote Control (booklet)
W2940AE	MX882007C Operation Manual (booklet)
W2894AE	MX882030C Operation Manual (booklet)
W2895AE	MX882031C Operation Manual (booklet)
W2767AE	MX88205xC Operation Manual (booklet)
W2773AE	MX88207xC Operation Manual (booklet)

∗1: The MT8820B-004 hardware supports IS-856-0 (1xEV-DO Rev. 0) RF measurements but does not support IS-856-A (1xEV-DO Rev. A) measurements.
The MT8820B-005 hardware supports both IS-856-0 (1xEV-DO Rev. 0) and IS-856-a (1xEV-DO Rev. A) RF measurements.

∗2: The following measurement hardware supports the Parallelphone measurement option: MT8820B-001, MT8820B-002, MT8820B-003, MT8820B-004 (or MT8820B-005), MT8820B-007.
All the measurement hardware can be installed simultaneously. However, the MT8820B-004 and MT8820B-005 cannot be installed simultaneously.

∗3: For terminal connectivity, contact your Anritsu sales representative.

∗4: These options preinstall the integrity protection function.

∗5: 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.

RADIO COMMUNICATION ANALYZER

MT8815B

30 MHz to 2.7 GHz

CE GPIB

For Mobile Phone Service, Repair, RF Adjustments and RF Parametric Tests on Mobile Terminal Production Lines

Excellent Eco Product

Supports Multi-Communication Systems

The MT8815B platform covers a frequency range of 30 MHz to 2.7 GHz. When the dedicated optional measurement software and hardware is installed, the major Tx and Rx characteristics of W-CDMA/HSPA/HSPA Evolution, GSM/GPRS/EGPRS, CDMA2000 1X (IS-2000), CDMA2000 1xEV-DO, PHS/Advanced PHS, and TD-SCDMA/HSDPA terminals can be measured using a single MT8815B 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.

High-accuracy Tests at Repair and Maintenance

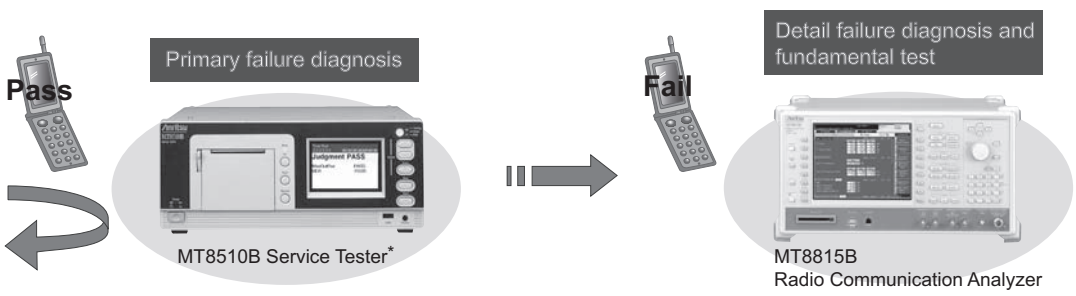
The MT8815B is a compact high-accuracy, high-speed tester for single RF measurements made at manufacturing, repair, and maintenance of mobile terminals.
It is the ideal solution for service points (sales offices) and repair centers when used in combination with the MT8510B Service Tester.

Manufacturer Test Suite

Manufacturer Test Suite is the ideal solution for making RF adjustments and RF parametric tests on mobile terminal production lines. The basic version consists of signal generator and signal analyzer functions without call processing, supporting RF adjustments and RF parametric tests in the test mode (mobile controlled by external PC). Installing the call processing software option supports RF parametric tests while controlling the mobile terminal at call processing. Adding the adjustment software option shortens the time required for RF adjustment by using the chipset adjustment function.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

Model for W-CDMA/GSM Mobile Phones



*: Read the MT8510B data sheet for details.

Specification

• MT8815B Radio Communication Analyzer

General	Frequency range: 30 to 2700 MHz Max. input level: +35 dBm (Main) Main I/O Impedance: 50 Ω VSWR: ≤1.2 (<1.6 GHz), ≤1.25 (1.6 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 x 10^{-8} (at 10 min after startup referenced to frequency 24 h after startup) Aging rate: ≤±2 x 10^{-8}/day, ≤±1 x 10^{-7}/year (referenced to frequency 24 h after startup) Temperature characteristics: ≤±5 x 10^{-8} Connector: BNC type External reference input Frequency: 10 or 13 MHz (±1 ppm) Level: ≥0 dBm Impedance: 50 Ω Connector: BNC type
RF signal generator	Frequency Frequency range: 30 to 2700 MHz (setting range: 0.4 to 2700 MHz) 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: ±1.0 dB (–120 to –10 dBm, Main, after calibration), ±1.0 dB (–110 to 0 dBm, AUX, after calibration) Signal purity Non-harmonic spurious: ≤–50 dBc Harmonics: ≤–25 dBc Uninterrupted level variation Variable range: 0 to –30 dB Setting resolution: 0.1 dB
Others	Display Color 8.4-inch TFT LCD, 640 x 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, RS-232C
Power supply	100 to 120/200 to 240 Vac (–15/+15%, 250 V max.), 47.5 to 63 Hz, ≤300 VA (with all Options)
Dimensions and mass	426 (W) x 221.5 (H) x 351 (D) mm (excluding projections), ≤17.8 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

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
MT8815B	Radio Communication Analyzer
	Standard accessories
	Power Cord, 2.6 m: 1 pc
Z0956A	ANR-CFX40T256 (CF card, 256 MB): 1 pc
CA68ADP	PC Card Adapter : 1 pc
W2778AE	MT8815B/MT8820B Operation Manual (CD-ROM): 1 pc
	Options
MT8815B-001	W-CDMA Measurement Hardware
MT8815B-002	TDMA Measurement Hardware
MT8815B-003	CDMA2000 Measurement Hardware
MT8815B-004	1xEV-DO Measurement Hardware*1
MT8815B-005	1xEV-DO Measurement Hardware*1
MT8815B-007	TD-SCDMA Measurement Hardware
MT8815B-011	Audio Board
MT8815B-031	W-CDMA Measurement Hardware Lite
MT8815B-032	TDMA Measurement Hardware Lite
MT8815B-043	CDMA2000 Time Offset CAL For GPS SG (requires MT8815B-003 and MX882002C)
MT8815B-101	W-CDMA Measurement Hardware Retrofit
MT8815B-102	TDMA Measurement Hardware Retrofit
MT8815B-103	CDMA2000 Measurement Hardware Retrofit
MT8815B-104	1xEV-DO Measurement Hardware Retrofit*1
MT8815B-105	1xEV-DO Measurement Hardware Retrofit*1
MT8815B-107	TD-SCDMA Measurement Hardware Retrofit
MT8815B-111	Audio Board Retrofit
MT8815B-131	W-CDMA Measurement Hardware Lite Retrofit
MT8815B-132	TDMA Measurement Hardware Lite Retrofit
MT8815B-143	CDMA2000 Time Offset CAL For GPS SG Retrofit (requires MT8815B-003 and MX882002C)
	Softwares
MX882000C	W-CDMA Measurement Software (requires MT8815B-001 and MX88205xC)
MX882000C-001	W-CDMA Voice Codec (requires MT8815B-011 and MX882000C)
MX882000C-011	HSDPA Measurement Software (requires MT8815B-001, MX882000C, and MX882050C)
MX882000C-012	HSDPA H-Set 6 Throughput Test (requires MT8815B-001, MX882000C, MX882000C-011, and MX882050C)
MX882000C-013	HSDPA High Data Rate (requires MT8815B-001, MX882000C, MX882000C-011, and MX882050C)
MX882000C-021	HSUPA Measurement Software (requires MT8815B-001, MX882000C, MX882000C-011, and MX882050C)
MX882000C-031	HSPA Evolution Measurement Software*2 (requires MT8815B-001, MX882000C, MX882000C-011, MX882000C-021, and MX882050C)
MX882001C	GSM Measurement Software (requires MT8815B-002)
MX882001C-001	GSM Voice Codec (requires MT8815B-011 and MX882001C)
MX882001C-002	GSM External Packet Data (requires MX882001C)
MX882001C-011	EGPRS Measurement Software (requires MX882001C)
MX882002C	CDMA2000 Measurement Software (requires MT8815B-003)
MX882002C-001	CDMA2000 Voice Codec (requires MT8815B-011 and MX882002C)
MX882002C-002	CDMA2000 External Packet Data (requires MX882002C)
MX882003C	1xEV-DO Measurement Software (requires MT8815B-003, MT8815B-004, and MX882002C)
MX882003C-002	1xEV-DO External Packet Data (requires MX882003C)
MX882005C	PHS Measurement Software (requires MT8815B-002)
MX882005C-011	Advanced PHS Measurement Software (requires MX882005C)
MX882006C	1xEV-DO Measurement Software (requires MT8815B-003, MT8815B-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 MT8815B-001 and MT8815B-007)
MX882007C-001	TD-SCDMA Voice Codec (requires MT8815B-011 and MX882007C)
MX882007C-003	TD-SCDMA Video Phone Test (requires MX882007C)
MX882007C-011	TD-SCDMA HSDPA Measurement Software*2 (requires MT8815B-001, MT8815B-007, and MX882007C)
MX882030C	W-CDMA Measurement Software Lite (requires MT8815B-031)
MX882030C-001	W-CDMA Voice Codec (requires MT8815B-011 and MX882030C)
MX882030C-008	W-CDMA Band XI*2 (requires MX882030C-050)
MX882030C-009	W-CDMA Band IX*2 (requires MX882030C-050)
MX882030C-011	HSDPA Measurement Software (requires MX882030C)

Model/Order No.	Name
MX882030C-021	HSUPA Measurement Software (requires MX882030C and MX882030C-011)
MX882030C-040	W-CDMA High-speed Adjustment (requires MX882030C)
MX882030C-050	W-CDMA Call Processing Software*2, *3 (requires MX882030C)
MX882031C	GSM Measurement Software Lite (requires MT8815B-032)
MX882031C-001	GSM Voice Codec (requires MT8815B-011 and MX882031C)
MX882031C-011	EGPRS Measurement Software (requires MX882031C)
MX882031C-040	EGPRS Predistortion Adjustment (requires MX882031C)
MX882031C-050	GSM Call Processing Software (requires MX882031C)
MX882050C	W-CDMA Call Processing Software*2 (requires MX882000C)
MX882050C-002	W-CDMA External Packet Data*2, *3 (requires MX882050C)
MX882050C-003	W-CDMA Video Phone Test*2 (requires MX882050C)
MX882050C-008	W-CDMA Band XI*2 (requires MX882050C)
MX882050C-009	W-CDMA Band IX*2 (requires MX882050C)
MX882050C-011	HSDPA External Packet Data*2 (requires MX882000C-011)
MX882070C	W-CDMA Ciphering Software*2 (requires MX882050C)
MX882051C	W-CDMA Call Processing Software*2 (requires MX882000C)
MX882051C-002	W-CDMA External Packet Data*2 (requires MX882051C)
MX882051C-003	W-CDMA Video Phone Test*2 (requires MX882051C)
MX882071C	W-CDMA Ciphering Software*2 (requires MX882051C)
	Warranty
MT8815B-ES210	Extended Two Year Warranty Service
MT8815B-ES310	Extended Three Year Warranty Service
MT8815B-ES510	Extended Five Year Warranty Service
	Application parts
P0019	TEST USIM001*4
P0035B	W-CDMA/GSM Test USIM
A0013	Handset
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 (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
J0127C	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 0.5 m
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
MN8110B	I/O Adapter (for call processing I/O)
B0332	Joint Plate (4 pcs/set)
B0333G	Rack Mount Kit
B0544	Carrying Case (hard type, with protective cover and casters)
B0545	Carrying Case (hard type, with protective cover, without casters)
W2776AE	MT8815B/MT8820B Operation Manual (booklet)
W2765AE	MX882000C Operation Manual (booklet)
W2771AE	MX882001C Operation Manual (booklet)
W2790AE	MX882002C Operation Manual Panel Operation (booklet)
W2791AE	MX882002C Operation Manual Remote Control (booklet)
W2793AE	MX882003C Operation Manual Panel Operation (booklet)
W2794AE	MX882003C Operation Manual Remote Control (booklet)
W2769AE	MX882005C Operation Manual (booklet)
W2930AE	MX882006C Operation Manual (booklet)
W2931AE	MX882006C Operation Manual Remote Control (booklet)
W2940AE	MX882007C Operation Manual (booklet)
W2894AE	MX882030C Operation Manual (booklet)
W2895AE	MX882031C Operation Manual (booklet)
W2767AE	MX88205xC Operation Manual (booklet)
W2773AE	MX88207xC Operation Manual (booklet)

∗1: The MT8815B-004 hardware supports IS-856-0 (1xEV-DO Rev. 0) RF measurements but does not support IS-856-A (1xEV-DO Rev. A) measurements.
The MT8815B-005 hardware supports both IS-856-0 (1xEV-DO Rev. 0) and IS-856-a (1xEV-DO Rev. A) RF measurements.
∗2: For terminal connectivity, contact your Anritsu sales representative.
∗3: These options preinstall the integrity protection function.
∗4: 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.

SERVICE TESTER
MT8510B

CE

All-in-one W-CDMA and GSM Go/No-Go Testing

Excellent Eco Product

- **Lightweight**
- **Test Results Output at Built-in Printer**
- **Remote Control Over LAN**
- **Easy-to-use**

The MT8510B Service Tester*1 is a Go/No-Go tester for 3G W-CDMA and 2G GSM mobile terminals.
Mobile terminals and cellular phones have become indispensable and popular with users. As a result, mobile terminal after-sales service is an important factor in assuring terminal reliability.
Three major benefits of the MT8510B are its simple operation, requiring no expert knowledge to measure mobile terminals; automatic test coverage of actual mobile terminal use; and remote management over LAN.
The MT8510B can be used almost anywhere related to after-sales service of mobile terminals, such as cell phone sales offices (service points), and repair/adjustment centers (service centers).

∗1: The MT8510B hardware has multi-band support. It supports the multiple frequency bands standardized for future W-CDMA systems just by installing software.

MA8120E Shield Box

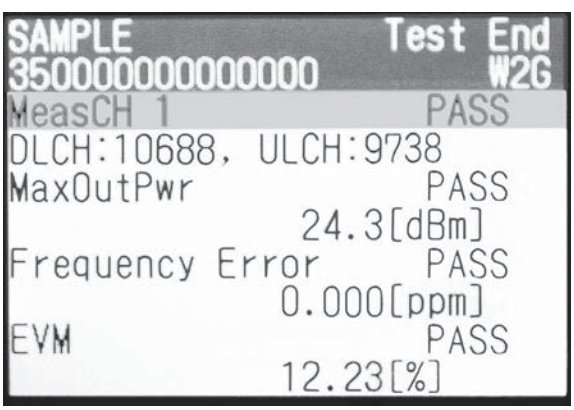
- **Simple Operation**

Tests are started by selecting the on-screen mobile model and pressing the Start button.
Test results are displayed on the LCD and using Pass and Fail LEDs on the front panel. They can also be printed at the built-in printer.

- **Close-to-actual Network Testing Environment**

In daily use, the mobile terminal and base stations are connected over an air interface via RF. Therefore, full performance tests must be executed in an equivalent environment.
The MA8120E Shield Box with internal wideband antenna (sold separately) is used to support testing including the mobile antenna.
Performance can also be tested by connecting the mobile terminal and MT8510B using a cable.
To assess the mobile Tx section, the MT8510B tests open loop power control, maximum output power, inner loop power control, error vector magnitude (EVM), and frequency error during W-CDMA measurement.
To assess the Rx section, it performs bit error rate (BER) tests in the loopback state.
Test items and evaluation thresholds for each performance test are created/saved as a test parameter*2 file using software bundled with the MT8510B.

∗2: Anritsu provides test parameters upon request. Contact our sales staff for more details.

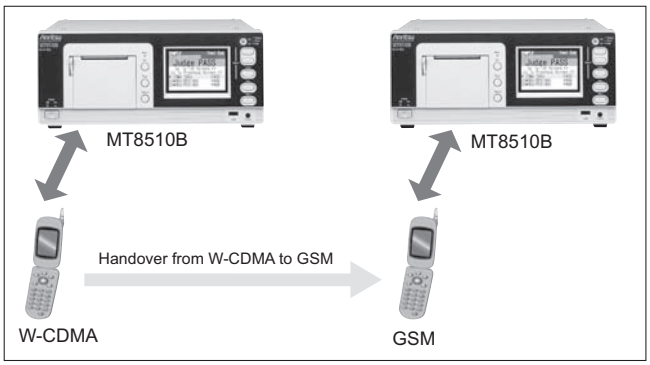


Example of Measured Results

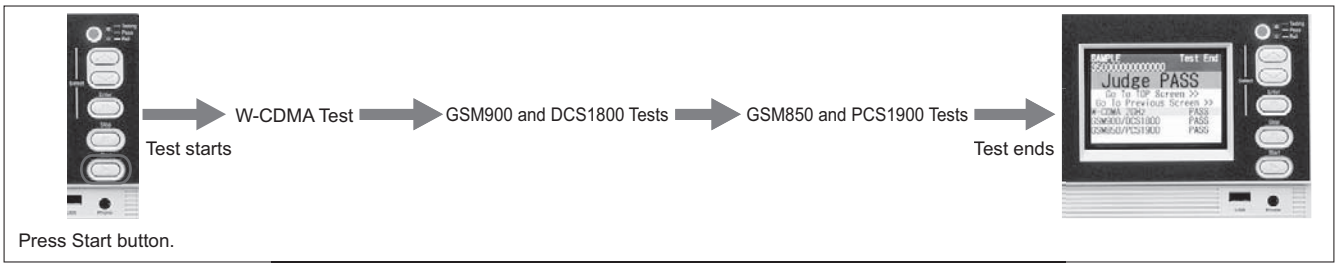
Supports Intersystem Handover Control

• W-CDMA and GSM Sequence Tests

The MT8510B Service Tester performs sequence tests easily by installing dedicated software for W-CDMA and GSM plus test parameters in test files for the appropriate sequence tests.
However, the mobile terminal must support the W-CDMA and GSM auto-switch function or Intersystem handover control. The test information files are created using the MX851010B or MX851060B Remote Control Software.



Intersystem Handover Control



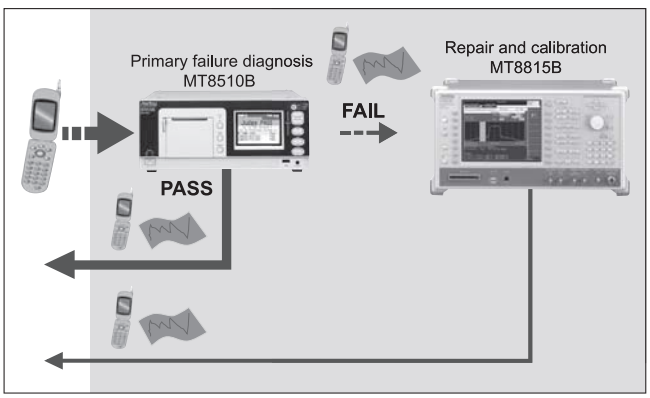
W-CDMA and GSM Sequence Test

• Multiband Support

The MT8510B meets the multiband specifications ensuring compliance with future designated W-CDMA frequency bands.

• Maintenance Solution

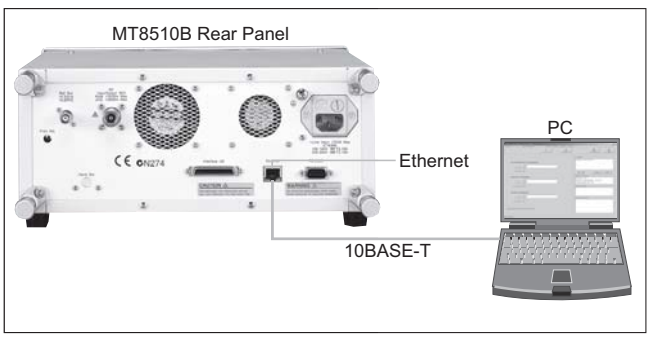
Anritsu's total maintenance solution offers customers the MT8510B for primary fault diagnosis and the MT8815B for repair and calibration.



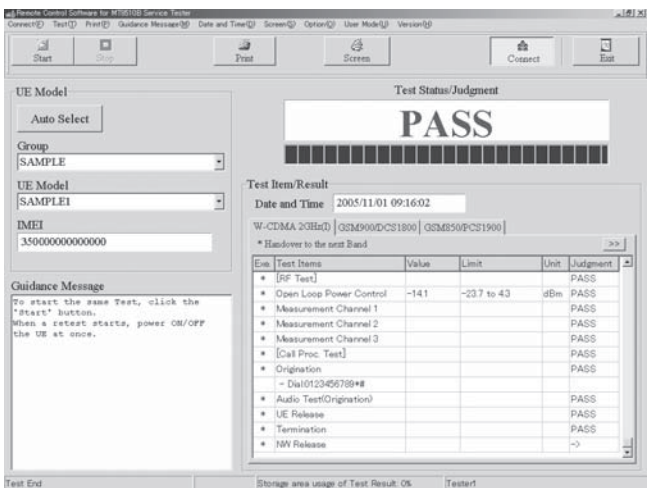
Service Center Testing

• Remote Control Over LAN

MT8510B units deployed at service points, service centers, and other service locations can be used more efficiently by remote control over LAN.
Tests can be started and stopped, settings changed, firmware downloaded, and test information controlled by installing the bundled remote control software in an external PC.



Setup Example



MX851060B Remote Control Software

Specifications

• MT8510B Service Tester

General	Frequency range	MX851000B W-CDMA Measurement Software Transmission frequency (Downlink) 2110.0 to 2170.0 MHz [W-CDMA (Ⅰ)] 1930.0 to 1990.0 MHz [W-CDMA (Ⅱ)] 1805.0 to 1880.0 MHz [W-CDMA (Ⅲ)] 869.0 to 894.0 MHz [W-CDMA (Ⅴ)] 875.0 to 885.0 MHz [W-CDMA (Ⅵ)] Reception frequency (Uplink) 1920.0 to 1980.0 MHz [W-CDMA (Ⅰ)] 1850.0 to 1910.0 MHz [W-CDMA (Ⅱ)] 1710.0 to 1785.0 MHz [W-CDMA (Ⅲ)] 824.0 to 849.0 MHz [W-CDMA (Ⅴ)] 830.0 to 840.0 MHz [W-CDMA (Ⅵ)] MX851001B GSM Measurement Software Transmission frequency (Downlink) 869.0 to 894.0 MHz (GSM850) 921.0 to 960.0 MHz (R-GSM900) 925.0 to 960.0 MHz (E-GSM900) 935.0 to 960.0 MHz (P-GSM900) 1805.0 to 1880.0 MHz (DCS1800) 1930.0 to 1990.0 MHz (PCS1900) Reception frequency (Uplink) 824.0 to 849.0 MHz (GSM850) 876.0 to 915.0 MHz (R-GSM900) 880.0 to 915.0 MHz (E-GSM900) 890.0 to 915.0 MHz (P-GSM900) 1710.0 to 1785.0 MHz (DCS1800) 1850.0 to 1910.0 MHz (PCS1900)
	Frequency resolution	100 kHz step
	Input impedance	Impedance: 50 Ω, VSWR: 1.5, Connector: N type
	Transmission output (downlink)*	Output level Level range: –110 to –45 dBm [When MX851030B is installed] –110 to –20 dBm Resolution: 0.1 dB RF Signal generator accuracy: ±1.5 dB [When MX851030B is installed] ±1.5 dB (output level ≤–45 dBm) ±2.0 dB (–45 dBm <output level ≤–20 dBm, W-CDMA Uplink input level ≤+25 dBm)
	Reception input (uplink)*	MX851000B: –30 to +28 dBm (W-CDMA uplink average power) (with MX851030B) –60 to +28 dBm (W-CDMA uplink average power) MX851001B: –30 to +35 dBm (GSM uplink in-burst average power) (with MX851030B) –60 to +35 dBm (GSM uplink in-burst average power) Level measurement accuracy: ±1.0 dB (0 dBm ≤input level) ±1.2 dB (–20 dBm ≤input level <0 dBm) ±1.5 dB (–30 dBm ≤input level <–20 dBm) (with MX851030B) ±1.0 dB (0 dBm ≤input level) ±1.2 dB (–20 dBm ≤input level <0 dBm) ±1.5 dB (–30 dBm ≤input level <–20 dBm) ±2.0 dB (–60 dBm ≤input level <–30 dBm, output level ≤–45 dBm)
	Modulation accuracy*	MX851000B: Residual vector error: ≤6.0% rms (0 dBm ≤input level) (with MX851030B) ≤6.0% rms (–20 dBm ≤input level) MX851001B: Residual phase error: ≤1.5˚ rms (GSM850, R-/E-/P-GSM900) ≤2.0˚ rms (DCS1800, PCS1900) (0 dBm ≤input level) (with MX851030B) ≤1.5˚ rms (GSM850, R-/E-/P-GSM900) ≤2.0˚ rms (DCS1800, PCS1900) (–20 dBm ≤input level)
Display		Color TFT LCD: 3.8-inch (320 x 240 dots) LED: Testing (lit), Pass (green), Fail (red)
Built-in printer		Measured date/time, model name, and serial number printed on test log
External interface		UE Control connector: DX50 type 100BASE-TX/10BASE-T: RJ-45 USB Connector: USB A type Voice input/output connector: Phone jack [when MT8510B-13 is installed] Reference signal output connector: BNC type
Power supply		100 to 120/200 to 250 Vac (±15%, 250 V max.), 47.5 to 63 Hz, ≤70 VA
Dimensions and mass		326 (W) x 138.5 (H) x 355 (D) mm (excluding projections), 5.5 kg max.

*: Temperature conditions 10˚ to 40˚C

Continued on next page

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
Others	Selftest function

• MX851000B W-CDMA Measurement Software, MX8510xxB W-CDMA Call Processing Software

Function test	Call processing	Location registration, Call origination, Call termination, Mobile disconnection, Network disconnection
	Audio test	Voice test by signal loopback at MT8510B
Performance test*	Maximum output Power	Pass/Fail judgement for mobile maximum output Tx power –30 to +28 dBm (W-CDMA uplink average power) (with MX851030B) –60 to +28 dBm (W-CDMA uplink average power) Measurement level accuracy: ±1.0 dB (0 dBm ≤input level) ±1.2 dB (–20 dBm ≤input level <0 dBm) ±1.5 dB (–30 dBm ≤input level <–20 dBm) (with MX851030B) ±1.0 dB (0 dBm ≤input level) ±1.2 dB (–20 dBm ≤input level <0 dBm) ±1.5 dB (–30 dBm ≤input level <–20 dBm) ±2.0 dB (–60 dBm ≤input level <–30 dBm, output level ≤–45 dBm)
	Open loop power control	Pass/Fail judgement for mobile open loop Tx power
	Inner loop power control	Pass/Fail judgement for mobile Tx power control
	Modulation accuracy	Pass/Fail judgement for mobile Tx modulation accuracy Residual vector error: ≤6.0% (rms) (0 dBm ≤input level) (–20 dBm ≤input level, with MX851030B)
	Frequency stability	Pass/Fail judgement for mobile Tx output frequency stability Measurement accuracy: ≤10 Hz (–10 dBm ≤input level) (–30 dBm ≤input level, with MX851030B)
	Reference sensitivity	Pass/Fail judgement by measuring bit error of mobile at low field strength reception
	CPICH RSCP	Pass/Fail judgement for measured CPICH RSCP
	Minimum output power (with MX851030B)	Pass/Fail judgement by measuring mobile bit error at low field strength reception Reception level range –60 to +28 dBm (W-CDMA uplink average power) Measurement level accuracy ±1.0 dB (0 dBm ≤input level) ±1.2 dB (–20 dBm ≤input level <0 dBm) ±1.5 dB (–30 dBm ≤input level <–20 dBm) ±2.0 dB (–60 dBm ≤input level <–30 dBm, output level ≤–45 dBm)

*: Temperature conditions 10˚ to 40˚C

• MX851001B GSM Measurement Software

Function test	Call processing	Location registration, Call origination, Call termination, Mobile disconnection, Network disconnection
	Audio test	Voice test by signal loopback at MT8510B
Performance test*	Tx Power	Pass/Fail judgement for mobile output Tx power –30 to +35 dBm (GSM uplink in-burst average power) (with MX851030B) –60 to +35 dBm (GSM uplink in-burst average power) Measurement Level accuracy: ±1.0 dB (0 dBm ≤input level) ±1.2 dB (–20 dBm ≤input level <0 dBm) ±1.5 dB (–30 dBm ≤input level <–20 dBm) [When MX851030B is installed] ±1.0 dB (0 dBm ≤input level) ±1.2 dB (–20 dBm ≤input level <0 dBm) ±1.5 dB (–30 dBm ≤input level <–20 dBm) ±2.0 dB (–60 dBm ≤input level <–30 dBm, output level ≤–45 dBm)
	Power vs time	Pass/Fail judgement for mobile burst waveform Dynamic range: ≥40 dB (0 dBm ≤input level) ≥40 dB (–20 dBm ≤input level, with MX851030B)
	Modulation accuracy	Pass/Fail judgement for mobile Tx modulation accuracy Residual phase error: ≤1.5˚ (rms) (GSM850, R-/E-/P-GSM900) ≤2.0˚ (rms) (DCS1800, PCS1900) (0 dBm ≤input level) (–20 dBm ≤input level, with MX851030B)
	Frequency stability	Pass/Fail judgement for mobile Tx output frequency stability ≤10 Hz (–10 dBm ≤input level) (–30 dBm ≤input level, with MX851030B)
	Reference sensitivity	Pass/Fail judgement by measuring mobile reception error at Ref. Sensitivity low field strength reception
	Mobile report	Display and Pass/Fail judgement for measured mobile Rx level and Rx QoS

*: Temperature conditions 10˚ to 40˚C

- **MT8510B-13 Voice Codec Board, MX851000B W-CDMA Measurement Software MX851050B W-CDMA Call Processing Software, MX851000B-01 W-CDMA Voice Codec**

Voice Codec	AMR 12.2 kbps
Handset level adjustment	Handset microphone volume levels: 6 steps Handset speaker volume levels: 6 steps
Input/output connector Input impedance Output impedance	Phone jack (rear panel) Converted to modular connector using RJ11 Adapter Cable (J1225) ≥10 kΩ ≤2 kΩ
Environmental conditions	Same as main frame (MT8510B)

- **MT8510B-13 Voice Codec Board, MX851001B GSM Measurement Software MX851001B-01 GSM Voice Codec**

Voice Codec	EFS

∗: Handset level adjustment, I/O connectors, Input impedance, Output impedance, and Environmental conditions same as W-CDMA Voice Codec

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	
MT8510B	Service Tester	
	Standard accessories	
	Power Cord, 2.6 m:	1 pc
F0012	Fuse, 3.15A:	1 pc
J1109B	LAN Cable (Cat-5, crossover):	1 pc
Z0618	Thermal Paper for Printer:	1 set (5 rolls)
P0029A	USB Flash Memory 256:	1 pc
W2499AE	MT8510B Operation Manual[*1] (CD-ROM):	1 pc
MX851010B	Remote Control Software[*1,*2] (Japanese, CD-ROM):	1 pc
MX851060B	Remote Control Software[*1,*2] (English, CD-ROM):	1 pc
MT8510B-14	Wide Dynamic Range Board[*3]	
	Options	
MT8510B-13	Voice Codec Board	
MT8510B-23	Voice Codec Board Retrofit	
MT8510B-24	Wide Dynamic Range Board Retrofit[*3]	

∗1: All-in-one CD-ROM
∗2: The MT8510B can be controlled remotely by a PC over LAN.
Controller PC:
OS: Windows (2000/XP), CPU: Intel Celeron 400 MHz min.,
Memory: 64 MB min., Hard disk: 25 MB min. (free space to install software), Display resolution: 800 x 600 dots min.
∗3: Standard option with MT8510B shipped before November 2005
∗4: For W-CDMA terminal connection, contact your Anritsu sales representative.

• Windows® is registered trademarks of Microsoft Corporation in the USA and other countries.
• Intel® Celeron® is registered trademarks of Intel Corporation or its subsidiaries in the USA and other countries

Model/Order No.	Name
	Maintenance service
MT8510B-ES210	Extended Warranty Service (2 years)
MT8510B-ES310	Extended Warranty Service (3 years)
MT8510B-ES510	Extended Warranty Service (5 years)
	Software
MX851000B	W-CDMA Measurement Software (requires MX851050B)
MX851000B-01	W-CDMA Voice Codec (requires MT8510B-13, MX851000B, and MX851050B)
MX851001B	GSM Measurement Software
MX851001B-01	GSM Voice Codec (requires MT8510B-13 and MX851001B)
MX851030B	Wide Dynamic Range (requires MT8510B-14; MX851000B and MX851050B for W-CDMA, MX851001B for GSM)
MX851050B	W-CDMA Call Processing Software[*4] (requires MX851000B, CD-ROM)
	Application parts
P0035B	W-CDMA/GSM Test USIM
J1110B	LAN Cable (Cat-5, straight)
J1158A	UE Interface Cable, 1.5 m
J1159A	Coaxial Cord, 1.5 m
BA-A858	Coaxial Adapter (N-P · SMA-J)
A0013	Handset
J1225	RJ11 Adapter Cable (for connecting MT8510B and A0013)
W2498AE	MT8510B Operation Manual (booklet)

SHIELD BOX
MA8120E
800 to 2500 MHz

CE

Shield Box Suitable for Testing Mobile Phones

Features

- The internal wide-band antenna (800 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.

Specifications

Frequency		800 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 or less
Environment conditions		Temperature: 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
MA8120E	**Main frame** Shield Box
B0560A W2651AE	**Standard accessories** UE Multi Holder: 1 pc MA8120E Operation Manual: 1 copy
J1150D J1150G J1151B J1153A J1155A J1157B	**Application parts** Coaxial Cord (N-P · N-P, 170 mm) Coaxial Cord (N-P · N-P, 3 m) Control Cable for PC USB cable externally connected to MA8120E, used in combination with J1215A (sold separately) UE I/F Cable (for W-CDMA mobile phone connection inside MA8120E, control signal)*1 UE I/F Cable with RF (for W-CDMA mobile phone connection inside MA8120E, control signal and RF)*1 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
J1312 Z0820A	**Optional parts** DX-50-CV1 Plug Cover Case*2 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

MG3700A

250 kHz to 3 GHz, 250 kHz to 6 GHz (Option)

CE 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)

- **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, LTE*2, XG-PHS*2

∗1: Read the MX3701xxA Series Software Catalog for details.
∗2: A license key must be installed in the main frame.

• High Level Accuracy

Absolute level accuracy:

±0.5 dB typ. (≥–120 dBm 25 MHz ≤fc ≤3 GHz, E-ATT*)
±0.8 dB typ. (≥–120 dBm 3 GHz <fc ≤6 GHz, E-ATT*)
±0.5 dB typ. (≥–120 dBm 25 MHz ≤fc ≤3 GHz, M-ATT*)
±0.8 dB typ. (≥–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

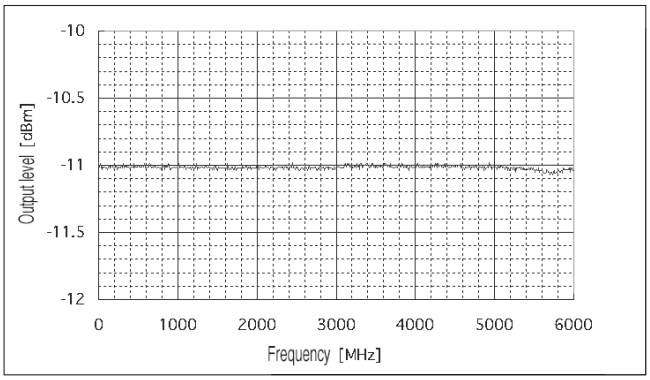
Wideband high-speed communication systems require transmission of long waveform patterns. To transfer long patterns at high speed, the MG3700A supports 100BASE-TX LAN connections. When the waveform patterns of two or more MG3700A systems must be updated, waveform data can be transferred simultaneously to all MG3700A units over the LAN, shortening update times.

• Built-in 40 GB Hard Disk

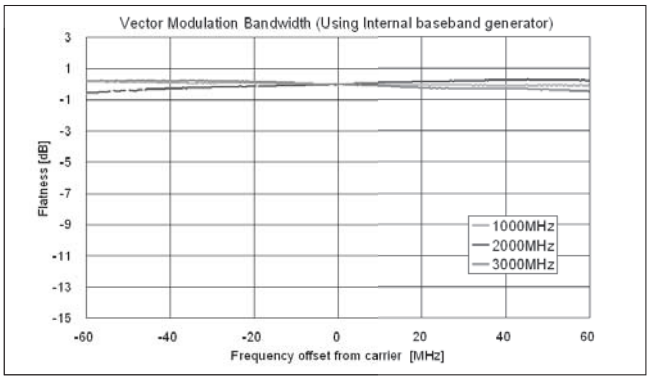
Various large-capacity waveform patterns and MG3700A parameters can be saved the built-in 40 GB hard disk. The transfer speed between the hard disk and waveform memory is fast (14 MB/s, typ.). If the hard disk fails, it can be changed using the optional HDD ASSY.

• Up to 2 GB Waveform Memory

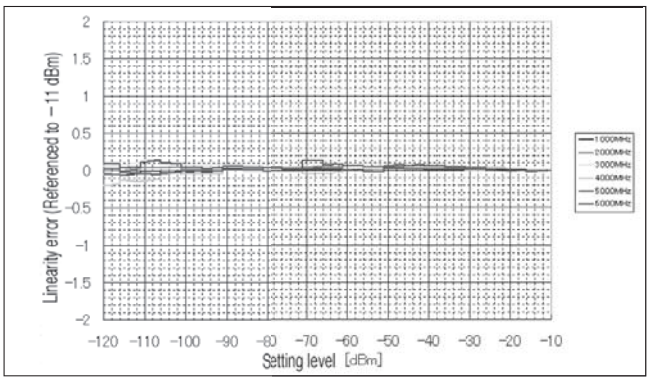
The large-capacity waveform memory can save many waveform patterns.
Waveform patterns are read from the hard disk and saved to memory for instant output without accessing the hard disk again.



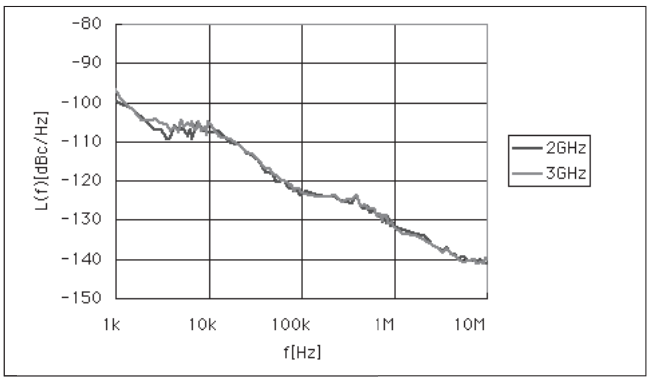
Frequency Characteristic



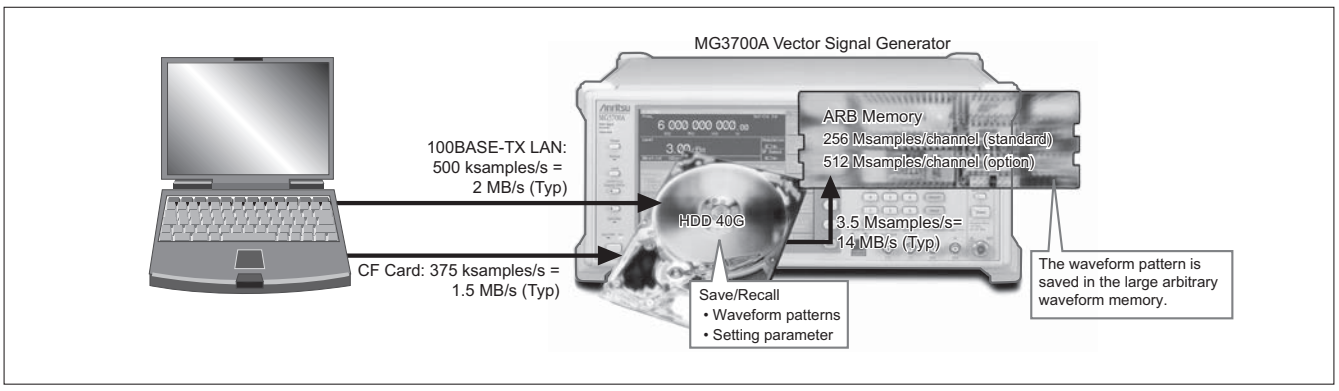
Vector Modulation Bandwidth (Using external IQ input)



Linearity

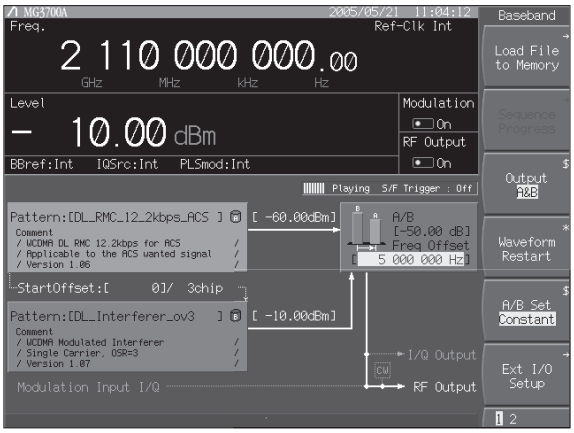


SSB Phase Noise (25 MHz ≤ f ≤3 GHz)
(CW, Continuous mode: OFF, Frequency changing speed: Normal)



• 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

• 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 1x1 SISO, 2x1 MISO, 1x2 SIMO, and 2x2 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 TS36.211, TS36.212, and TS25.814.

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).

*: 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	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)	Mobile WiMAX (IEEE802.16e)	*Bluetooth*	GPS	TD-SCDMA	RCR STD-39	ARIB STD-T61/T79/T86	Multi-carrier	Fading	3GPP LTE (FDD)
Waveform pattern	Preinstalled	√	√	√		√	√	√			√	√		√		√		√	√						
	MX370001A TD-SCDMA																			√					
	MX370002A Public Radio System																				√	√			
IQproducer	Standard accessories AWGN	√																							
	Standard accessories W-CDMA		√																						
	MX370101A HSDPA/HSUPA		√		√																				
	MX370102A TDMA									√	√	√	√								√	√			
	MX370103A CDMA2000 1xEV-DO					√																			
	MX370104A Multi-carrier	Multi-carrier IQproducer is software that generates the multi-carrier signal based on waveform pattern of various telecommunications systems.																							
	MX370105A Mobile WiMAX																√								
	MX370106A DVB-T/H														√										
	MX370107A Fading	Fading IQproducer is software that generates the Fading signal based on waveform pattern of various telecommunication systems.																							
	MX370108A LTE																								√
	MX370109A XG-PHS								√																

Read the MX3701xxA Software catalog for details.

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]

Frequency	Range	250 kHz to 3 GHz (Standard), 250 kHz to 6 GHz (Option)
	Resolution	0.01 Hz
	Internal reference oscillator	Frequency: 10 MHz, Aging rate: ±1 x 10^{-8}/day, ±1 x 10^{-7}/year, Temperature stability: ±2 x 10^{-8} (0˚ to 50˚C), Start-up characteristics (at 23˚C): ±5 x 10^{-8} (After 5 min, compared to frequency after 24 h warm-up) With Rubidium Reference Oscillator Option Frequency: 10 MHz, Aging rate: ±1 x 10^{-10}/Month, Temperature stability: ±1 x 10^{-9} (0˚ to 50˚C), Start-up characteristics (at 23˚C): ±1 x 10^{-9} (After 7 min, compared to frequency after 24 h warm-up)
	External reference input	Frequency: 5 MHz/10 MHz (auto-switching), Operating range: ±1 ppm, Input level: ≥0.7 Vp-p/50 Ω (AC coupled), Connector: BNC-J (rear panel, Ref Input)
	Buffer output (Reference output)	Frequency: 10 MHz, Output level: TTL (DC-coupled), Connector: BNC-J (rear panel, Buffered Output)
	Switching time	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)
	Frequency setup and Display	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.

Continued on next page

<table>
<tr><td rowspan="13">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. (at –120 to –11 dBm, 25 MHz ≤ f ≤3 GHz)
±0.3 dB typ. (at –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. (at –120 to –7 dBm, 25 MHz ≤ f ≤3 GHz)
±0.3 dB typ. (at –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>
<tr><td>Special setting mode</td><td>Continuous mode and EXT ALC mode are exclusive modes</td></tr>
<tr><td>Continuous mode</td><td>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.</td></tr>
<tr><td>EXT ALC mode</td><td>Output level is changed according to DC voltage input externally
Variable range: –8/+3 dB, Input impedance: 600 Ω (nominal),
Connector: BNC-J (rear panel, Ext. ALC)</td></tr>
<tr><td>Output connector</td><td>50 Ω, N-J (front panel, RF Output)</td></tr>
<tr><td>Maximum reverse input</td><td>Reverse input power: 1 W peak (≥300 MHz), 0.25 W peak (<300 MHz), DC: 0 V
With Mechanical Attenuator Option
Reverse input power: 1 W peak, DC: 0 V</td></tr>
<tr><td rowspan="4">Signal purity</td><td>Spurious</td><td>At CW, ≤–1 dBm (With Mechanical Attenuator Option: ≤+3 dBm)</td></tr>
<tr><td>Harmonics</td><td><–30 dBc (f ≥300 MHz @E-ATT, f ≥250 kHz @M-ATT)</td></tr>
<tr><td>Non harmonic</td><td><–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 to 6 GHz)
*Intersection spurious: 4.8 GHz – [output frequency] (at 25 MHz to 3 GHz),
8.8 GHz – [output frequency] (at 3 to 6 GHz)</td></tr>
<tr><td>Power supply relation</td><td><–50 dBc (250 kHz to 3 GHz), <–44 dBc (3 to 6 GHz)</td></tr>
</table>

Continued on next page

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 to 1000 MHz, 1800 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 to 2497 MHz, 4,900 to 5,925 MHz) ≤5% peak (at modulation equal to IEEE802.11b, Output frequency: 2,400 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 to 1000 MHz, 1800 to 2400 MHz) With Mechanical Attenuator Option –62 dBc/3.84 MHz, –64 dBc/3.84 MHz typ. (≤0 dBm, 800 to 1000 MHz, 1800 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 to 1000 MHz, 1800 to 2400 MHz) With Mechanical Attenuator Option –67 dBc/3.84 MHz typ. (≤+3 dBm, 800 to 1000 MHz, 1800 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: 50 Ω, 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: 50 Ω BNC-J (rear panel, Ext Pulse Mod Input)
IQ Output	Output voltage range	When output open. Output voltage amplitude + DC offset: –3.5 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 to +3 V, Resolution: 10 mV Differential DC offset: Variable range: –50 to +50 mV, Resolution: 50 µV
	Output connector	50 Ω, 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)
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)/50 Ω (AC coupled)
Waveform memory	Memory capacity	Waveform memories. A and B. 128 Msamples/channel x 2, 256 Msamples/channel Max. With ARB Memory Upgrade 512 Msample option 256 Msamples/channel x 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

Continued on next page

Waveform memory	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 x Sampling Clock x 2^n – Bandwidth)/2 (n: Maximum integer that satisfying Sampling Clock x 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 x Sampling Clock x 2^n – Bandwidth)/2 (n: Maximum integer that satisfying Sampling Clock x 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

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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	50 Ω, 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 Ether	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 x 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 to 120 V, 200 to 240 Vac (–15/+10%, 250 V Max.)
	Frequency	47.5 to 63 Hz
	Power consumption	≤200 VA
Temperature range		Operating: +5˚ to +45˚C, Storage: –20˚ to +60˚C
Dimensions and mass		426 (W) x 177 (H) x 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 x 10^{-8}/day, ±1 x 10^{-7}/year
	Rubidium Reference Oscillator		√	Rubidium Reference Oscillator Option Frequency: 10 MHz, Aging rate: ±1 x 10^{-10}/Month
Attenuator	Electron Attenuator	√		
	Mechanical Attenuator		√	Mechanical Attenuator Option Changes electronic attenuator to mechanical attenuator
Memory	1 GB = 256 Msamples/channel	√		128 Msamples/channel x 2 Maximum of 256 Msamples/channel
	2 GB = 512 Msamples/channel		√	ARB Memory Upgrade 512 Msample Option 256 Msamples/channel x 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)
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		√	License required (Model: MX370108A)
	XG-PHS		√	License required (Model: MX370109A)
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
J0017F	Power Cord, 2.6 m: 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-001	Rubidium Reference Oscillator (Aging rate: ±1 x 10^{-10}/Month)
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 x 2 to 256 Msample/channel x 2)
MG3700A-031	High Speed BER Test Function (Extends standard BER test function)
MG3700A-101	Rubidium Reference Oscillator Retrofit (Retrofitted to shipped MG3700A)
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
	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
MX370109A	XG-PHS IQproducer

Model/Order No.	Name
	Optional accessories
Z0777	Standard Waveform Pattern Upgrade Kit (DVD 4 piece sets)
W2495AE	MG3700A Operation Manual
W2496AE	MG3700A IQproducer Operation Manual
W2539AE	MG3700A Standard Waveform Pattern Operation Manual
W2533AE	MX370001A TD-SCDMA 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
G0141	HDD ASSY (hard disk)
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 (pass band: 1.92 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, cross, 3 m)
J0008	GPIB Cable, 2 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
B0334C	Hardtype Carrying Case (with front cover and a casters)
P0021	CompactFlash 128 MB
P0022	CompactFlash 256 MB
P0023	CompactFlash 512 MB

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.

Trademarks:
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DIGITAL MODULATION SIGNAL GENERATOR

MG3681A

250 kHz to 3 GHz

CE GPIB

For Evaluating Digital Mobile Communications Systems

Build-to order product

The MG3681A uses a wideband vector modulator to output the high-accuracy, high-speed vector modulation signals that are required for R&D and manufacturing of digital mobile communications equipment and related devices. It covers the frequency band of leading mobile communications systems for the frequency range of 250 kHz to 3 GHz.
It uses vector modulator to provide excellent frequency response, distortion and S/N ratio. It can perform accurate receiver sensitivity test and transmitter adjacent channel leakage power test for high-speed modulation communications systems. Expansion units such as MU368040A CDMA Modulation Unit for modulation signals generation of W-CDMA communication system can be installed on the expansion slots in the MG3681A. Various modulation signals can be generated with the expansion units and associated software.

The MG3681A also has analog modulation functions such as AM and FM for testing of analog communications systems. In addition, its excellent signal purity and various functions such as memory and frequency sweep are useful as a general-purpose signal generator.

Features

- High-resolution setting of frequency 0.01 Hz and output level 0.01 dB
- 30 MHz wideband and high-accuracy vector modulation
- Excellent adjacent channel leakage power ratio
- Various expansion units
- Excellent adjacent channel leakage power ratio
  The typical adjacent channel leakage power ratio for W-CDMA system is –68 dBc/3.84 MHz and the secondary adjacent channel leakage power ratio is –75 dBc/3.84 MHz.

Configuration of communication system software and expansion units

Communication system	Applicable software	Expansion units
W-CDMA/3GPP (FDD)	MX368041B W-CDMA Software	MU368040A CDMA Modulation Unit
cdmaOne	MX368042A IS-95 Device Test Software	
HSDPA	MX368041B-11 HSDPA Signal Pattern	
CDMA2000 1X*1 CDMA2000 1xEV-DO*2 GSM/EDGE*3 PDC*3, NADC*3, PHS*3	MX368031A Device Test Signal Generation Software	MU368030A Universal Modulation Unit
CDMA2000 1xEV-DO	MX368033A CDMA2000 1xEV-DO Signal Generation Software	
PDC packet	MX368034A PDC Packet Software	
PHS	MX368035A PHS Signal Generation Software	
W-CDMA/3GPP CDMA2000	–	MU368060A AWGN Unit

∗1: Since coding format of the Reverse is performed, it is utilizable for receiver sensitivity test (RC1 & 3) in base station production.
Since coding format of the Forward is not performed, it is not utilizable for receiver sensitivity test.
∗2: For the Forward, only 16QAM modulation is available, 8PSK and QPSK modulation is not available.
Since coding format of the Forward and the Reverse is not performed, it is not utilizable for receiver tests.
∗3: It is a continuous modulation signal based on the communication system.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA).

Specifications

• MG3681A Digital Modulation Signal Generator

<table>
<tr><td rowspan="6">Frequency</td><td>Range</td><td>250 kHz to 3000 MHz, Resolution: 0.01 Hz</td></tr>
<tr><td>Accuracy</td><td>Depends on installed reference oscillator, Reference frequency accuracy: ± (5% of FM setting deviation + 5 Hz) for frequency modulation</td></tr>
<tr><td>Internal reference oscillator</td><td>Aging rate: ±1 x 10^{-6}/year, Temperature stability: ±1 x 10^{-6} (0˚ to 50˚C)*
*: Aging rates down to 5 x 10^{-10}/day are available as reference crystal oscillator (MG3681A Option 01/02).</td></tr>
<tr><td>External reference input</td><td>10 MHz/13 MHz auto-switching, ±10 ppm, ≥0.7 V(p-p)/50 Ω (AC coupled), BNC connector (rear panel)</td></tr>
<tr><td>Buffer output</td><td>10 MHz, TTL level (DC coupled), BNC connector (rear panel)</td></tr>
<tr><td>Switching time</td><td>≤20 ms (response time from final command to ±500 Hz of set frequency on GPIB at CW, ALC on, except when setting frequency is crossing over 600 MHz and 1010 MHz)</td></tr>
<tr><td rowspan="6">Output level</td><td>Range</td><td>–143 to +13 dBm (settable range: –143 to +17 dBm)</td></tr>
<tr><td>Unit</td><td>dBm, W, dBμV, V (dBμV, V selected terminate/open voltage display)</td></tr>
<tr><td>Resolution</td><td>0.01 dB (dBm, dBμV units), 3 digit (W, V units)</td></tr>
<tr><td>Frequency response</td><td>±1 dB (CW, ALC on, 0 dBm)</td></tr>
<tr><td>Accuracy</td><td>CW, ALC on
<table><tr><th>Level \ Frequency</th><th>≤1 GHz</th><th>>1 GHz</th></tr><tr><td>≤+13 dBm, ≥–127 dBm</td><td>±1 dB</td><td>±2 dB</td></tr><tr><td><–127 dBm</td><td>±2 dB</td><td>±3 dB</td></tr></table></td></tr>
<tr><td>Output connector</td><td>50 Ω, N-type connector (front panel)</td></tr>
<tr><td>Switching time</td><td>≤50 ms (normal mode), ≤100 ms (safety mode), ≤10 ms (continuous mode)
*Response time from final command to ±0.5 dB of final level on GPIB at CW, ALC on</td></tr>
<tr><td>Special setting mode</td><td>Continuous mode:
Level continuously adjustable in set value range of ±10 dB (dBm, dBμV units only)
For vector modulation by optional digital modulation unit, continuous mode variance depends on modulation setting
Safety mode: Mechanical attenuator decreases level to prevent generation of high-level signal spikes</td></tr>
<tr><td>ALC mode</td><td>ALC on
Usage: Continuous wave or pulse modulation wave (burst wave) with RF On time of 10 μs or more
ALC time constant: Auto, 500 ns, 2.4 μs, 5 μs, 24 μs, 50 μs, 240 μs, 500 μs selectable
At Auto, automatically selected depending on frequency, AM and vector modulation [when digital modulation unit (option) is used]
The ALC time constant is automatically selected, depending on the set frequency, regardless of the time constant selected on the front panel
ALC off
Usage: Pulse modulation wave (burst wave) whose RF on time is less than 10 μs
Restrict item: Without AM
ALC calibration: Automatic during ALC Calibration operation and at frequency/level setting change</td></tr>
<tr><td rowspan="2">Signal purity</td><td>Spurious</td><td>Harmonics: <–30 dBc
Non harmonic:
<table><tr><th>Frequency</th><th>15 kHz to 300 MHz offset</th><th>>300 MHz offset</th><th>Fixed frequency spurious</th></tr><tr><td>≤2500 MHz</td><td><–60 dBc</td><td><–30 dBc</td><td>–50 dBc (660, 1320 MHz)</td></tr><tr><td>>2500 MHz</td><td colspan="2"><–30 dBc</td><td>–</td></tr></table>Those related power: <–40 dBc *CW, ≤0 dBm</td></tr>
<tr><td>SSB phase noise</td><td><–118 dBc/Hz (≥10 MHz, ≤1010 MHz), <–112 dBc/Hz (>1010 MHz) *At CW, 20 kHz offset</td></tr>
<tr><td rowspan="4">AM</td><td>Range</td><td>0 to 100% (cannot set internal/external modulation independently), Resolution: 0.1%</td></tr>
<tr><td>Modulation frequency response</td><td>≤0 dBm, ALC on, in band of ±1.5 dB based on modulation frequency of 1 kHz
<table><tr><th rowspan="3">Frequency</th><th rowspan="3">Lower limit frequency</th><th colspan="3">Upper limit frequency</th></tr><tr><th colspan="2">Vector modulation and wideband AM off</th><th>Vector modulation or wideband AM on</th></tr><tr><th>AM: 30%</th><th>AM: 80%</th><th>AM: 30%</th></tr><tr><td>≥0.4 MHz, <2 MHz</td><td rowspan="3">DC (Internal modulation, External modulation DC coupled), 20 Hz (External modulation AC coupled)</td><td>3 kHz</td><td>1 kHz</td><td rowspan="3">1 kHz</td></tr><tr><td>≥2 MHz, <10 MHz</td><td>10 kHz</td><td>10 kHz</td></tr><tr><td>≥10 MHz</td><td>10 kHz</td><td>10 kHz</td></tr></table></td></tr>
<tr><td>Internal modulation</td><td>Depends on AF synthesizer (Option 21)</td></tr>
<tr><td>External modulation</td><td>2 V(p-p) approx., 600 Ω, AC/DC coupled switchable, BNC connector (front panel)</td></tr>
<tr><td rowspan="5">FM</td><td>Modulation signal polarity</td><td>Positive/Negative switchable</td></tr>
<tr><td>Range</td><td>0 to 1000 kHz (≥10 MHz, ≤1010 MHz), 0 to 2000 kHz (>1010 MHz)
*Cannot set internal/external modulation independently.</td></tr>
<tr><td>Resolution</td><td>10 Hz (0 to 10 kHz deviation), 100 Hz (10.1 to 100 kHz deviation), 1 kHz (101 to 1000 kHz deviation), 10 kHz (1010 to 2000 kHz deviation)</td></tr>
<tr><td>Modulation frequency response</td><td>DC to 20 kHz (internal modulation, external modulation DC coupled), 20 Hz to 20 kHz (external modulation AC coupled)
*In band of ±1 dB based on modulation frequency of 1 kHz</td></tr>
<tr><td>Internal modulation</td><td>Depends on AF synthesizer (Option 21)</td></tr>
<tr><td>External modulation</td><td>2 V(p-p) approx., 600 Ω, AC/DC coupled switchable, BNC connector (front panel)</td></tr>
<tr><td>Modulation signal polarity</td><td>Positive/Negative switchable</td></tr>
</table>

Continued on next page

øM	Range	0 to 6.28 rad (≥10 MHz, ≤1010 MHz), 0 to 12.56 rad (>1010 MHz) *Cannot set internal/external modulation independently.
	Unit	rad, deg
	Resolution	rad unit: 0.01 rad, deg unit: 1 deg
	Modulation frequency response	DC to 20 kHz (internal modulation, external modulation DC coupled), 20 Hz to 20 kHz (external modulation AC coupled) *In band of ±1 dB based on modulation frequency of 1 kHz
	Internal modulation	Depends on AF synthesizer (Option 21)
	External modulation	2 V(p-p) approx., 600 Ω, AC/DC coupled switchable, BNC connector (front panel)
	Modulation signal polarity	Positive/Negative switchable
Wideband AM	Modulation frequency response	DC to 15 MHz (±2 dB bandwidth), DC to 30 MHz (±3 dB bandwidth) *External modulation, Input level: 0.9 V(p-p), ≥100 MHz, ≤0 dBm, Modulation frequency of 1 kHz
	Internal modulation	Depends on installed digital modulation unit (option)
	External modulation	≤1 V(p-p), 50 Ω, BNC connector (front panel), Sensitivity: 1 V(p-p) = 100%
Pulse modulation	On/off ratio	>60 dB
	Rise/fall time	<100 ns (external modulation)
	Minimum pulse width	<500 ns (external modulation)
	Pulse repetition frequency	DC to 1 MHz (external modulation, ALC off)
	Internal modulation	Depends on installed digital modulation unit (option)
	External modulation	TTL level, Positive logic, 50 Ω, BNC connector (front panel)
Vector modulation	Modulation frequency response	DC to 15 MHz (±2 dB bandwidth), DC to 30 MHz (±3 dB bandwidth) *External modulation, input level: 0.5 V(rms), ≥100 MHz, ≤0 dBm, Modulation frequency of 1 kHz
	Vector error	≤2.5%(rms) *External modulation, Input level: 0.5 V(rms), ≥100 MHz, ≤0 dBm, 3.84 Msps QPSK modulation
	Internal modulation	Depends on installed digital modulation unit (option)
	External modulation	$\sqrt{(I^2 + Q^2)}$ = 0.5 V(rms), I/Q = ±1.5 V(peak), 50 Ω, BNC connector (front panel)
	Quadrature degree adjustment function	Adjustment range: ≥±1 deg
	I/Q change	I, Q signal changeable (RF spectrum invert)
Simultaneous modulation		Modulation depth and deviation same for combinations below: AM (internal/external), FM (internal/external), øM (internal/external) Frequency and waveform of modulation signal source same for combinations below: AM (internal)/FM (internal), AM (internal)/øM (internal) Simultaneous modulation impossible as below: FM/øM, Wideband AM/Vector modulation, Vector (internal)/Vector (external) modulation
AF signal output		Depends on AF synthesizer (Option 21)
I/Q signal output*2	Output level	Depends on installed digital modulation unit (option)
	Signal source	Depends on installed digital modulation unit (option)
	Output connector	50 Ω, BNC connector (front panel)
Memory function	Basic parameter memory	512 sets of frequency and level
	All parameter memory	All parameters including 100 sets maximum of analog modulation and digital modulation units (option)
Sweep function	Sweep parameter	Basic parameter memory address
	Sweep pattern	Start address → stop address
	Sweep time	1 ms to 600 s (per memory; memory recall time restricts lower limit, resolution: 1 ms)
	Sweep mode	Auto (repetition sweep), Single (single sweep)
Special display	Relative display	Frequency, Output level (dBm, dBμV units only)
	Offset display	Frequency (offset range: –3 to +3 GHz), Output level (offset range: –55 to +55 dB, dBm, dBμV units only)
Display	Size	7.2 inch, 480 x 640 dots, color D-STN
	On/Off setting	Panel display on/off
Backup function		All items reset at power-on except following: Input data contents, Remote condition, Contents of GPIB data being transferred, RPP operation condition, Screen condition, Main function selections
Panel lock function	Panel lock	Disable operation of all keys except front panel power key, Panel lock key, Local key and Contrast key
	Knob hold	Disable rotary knob on front panel operation
External interface	GPIB	Remote control: All functions except power switch, Local key, and Contrast key Interfaces: SH1, AH1, T5, L4, TE0, SR1, RL1, DP0, PP0, DC1, DT1, C1, E2 Connector: Rear panel
	RS-232C	Remote control: All functions except power switch, Local key, and Contrast key Communications method: Async (start-stop), Half-duplex Communications control method: X on/off by command Baud rate: 1200, 2400, 4800, 9600, 19200, 38400 bps Data bits; 7 or 8 Parity: Odd, Even, None Start bit: 1 Stop bit: 1 or 2 Connector: D-Sub 9 pin, rear panel

Continued on next page

External interface	PC card	Memory card (memory backup, screen hard copy) Connector: JEIDA Ver 4/4.1 PCMCIA Rel 2.0, 1 slot (rear panel)
	Trigger	Executes item specified by command-input signals (3 bits) from following items: Frequency step-up/step-down, Output level step-up/step-down, Basic parameter recall address up/down, Output level on/off Interface: TTL level Connector: D-Sub 9 pin, Female (rear panel)
Reverse power protection		≤50 W (≤1 GHz), ≤25 W (>1 GHz), ±50 V (DC)
Power supply		AC 100 to 120/200 to 240 V (–15/+10%, 250 V max, Automatic selection), 47.5 to 63 Hz, ≤300 VA
Temperature		Operating: 0˚ to +50˚C, Storage: –20˚ to +60˚C
Dimensions and mass		426 (W) x 177 (H) x 451 (D) mm, ≤25 kg (excluding option)
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1

• Options

Option 01 Reference Oscillator	Frequency: 10 MHz Aging rate: ±5 x 10^{-9}/day Start-up characteristics: 1 x 10^{-7} (After 10 min, compared to frequency after 24 h warm-up) Temperature stability: ±3 x 10^{-8} (0˚ to 50˚C)
Option 02 Reference Oscillator	Frequency: 10 MHz Aging rate: ±5 x 10^{-10}/day Start-up characteristics: 1 x 10^{-7} (After 10 min, compared to frequency after 24 h warm-up) Temperature stability: ±5 x 10^{-9} (0˚ to 50˚C)
Option 11 Additional Function of I/Q Output	Functions: Adds level, offset setting, and differential output functions to I/Q output Level Range: 80 to 120% of nominal level, Resolution: 0.1% ∗2 sets of I/$\overline{\text{I}}$ and Q/$\overline{\text{Q}}$ set independently, 50 Ω termination Offset Range: –0.5 to +1.5 V, Resolution: 0.5 mV ∗4 sets of I, $\overline{\text{I}}$, Q, $\overline{\text{Q}}$ set independently, 50 Ω termination Quadrature degree variable function Range: ±5 deg, Resolution: 0.5 deg Differential output: $\overline{\text{I}}$, $\overline{\text{Q}}$ signals (Using front I/Q input connector) Signal source: Depends on installed digital modulation unit (option) Output connector: 50 Ω, BNC connector (front panel)
Option 21 AF Synthesizer	Frequency: 0.01 Hz to 400 kHz, Resolution: 0.01 Hz, Accuracy : same as reference oscillator Waveform: Sine, Triangular, Square, Sawtooth Frequency response: ±1 dB [sine wave, level: 2 V(p-p), offset: 0 V, 600 Ω termination, reference to 1 kHz, 10 Hz to 100 kHz] Harmonics: ≤–50 dB [sine wave, level: 2 V(p-p), offset: 0 V, 600 Ω termination, 1 kHz] Level Range: 0 to 4 V(p-p), Resolution: 1 mV(p-p), Accuracy: ± [8% of set level + 2 mV(p-p)] ∗600 Ω termination Offset Range: –2 to +2 V, Resolution: 1 mV, Accuracy: ± (8% of set level + 2 mV) ∗600 Ω termination Output connector: 600 Ω, BNC connector (front panel)
Option 42 RF High Level Output	Functions: 8 dB gain of maximum output level in W-CDMA band Frequency: 1900 to 2200 MHz Gain: 8 ±1 dB (from –3 dBm, RF high level output off, 2.1 GHz) Gain frequency response: ±1 dB (at +5 dBm, referenced to 2.1 GHz)

• Expansion Units and Software

Refer to the individual catalogs for the expansion units and software.

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	
MG3681A	Digital Modulation Signal Generator (Build-to order product)	
	Standard accessories	
B0325	Power Cord, 2.6 m:	1 pc
F0014	GPIB Connector Shield cap:	1 pc
W1708AE	Fuse, 6.3 A:	2 pcs
	MG3681A Operation Manual:	1 copy
	Options	
MG3681A-01	Reference Oscillator (aging rate: 5 x 10^{-9}/day)	
MG3681A-02	Reference Oscillator (aging rate: 5 x 10^{-10}/day)	
MG3681A-11	Additional Function of I/Q Output (level and offset setting, differential output)	
MG3681A-21	AF Synthesizer (0.01 Hz to 400 kHz, resolution: 0.01 Hz)	
MG3681A-42	RF High Level Output (for W-CDMA, 8 dB gain)	
	Maintenance service	
MG3681A-90	Extended Three Years Warranty Service	
MG3681A-91	Extended Five Years Warranty Service	
	Expansion units	
MU368030A	Universal Modulation Unit*1,*2	
MU368040A	CDMA Modulation Unit*1,*2	
MU368060A	AWGN Unit*1	
	Standard accessories	
W1973AE	MU368030A Operation Manual:	1 copy
W1758AE	MU368040A Operation Manual:	1 copy
W1955AE	MU368060A Operation Manual:	1 copy
	Maintenance service	
MU368030A-90	Extended Three Years Warranty Service	
MU368030A-91	Extended Five Years Warranty Service	
MU368040A-90	Extended Three Years Warranty Service	
MU368040A-91	Extended Five Years Warranty Service	
MU368060A-90	Extended Three Years Warranty Service	
MU368060A-91	Extended Five Years Warranty Service	
	Softwares*1	
MX368031A	Device Test Signal Generation Software (for MU368030A)	
MX368033A	CDMA2000 1xEV-DO Signal Generation Software (for MU368030A)	
MX368034A	PDC Packet Software (for MU368030A)	
MX368035A	PHS Signal Generation Software (for MU368030A)	
MX368041B	W-CDMA Software (for MU368040A)	
MX368041B-11	HSDPA Signal Pattern (for MX368041B)	
MX368042A	IS-95 Device Test Software (for MU368040A)	
	Standard accessories	
W1974AE	MX368031A Operation Manual:	1 copy
W2072AE	MX368033A Operation Manual:	1 copy
W2073AE	MX368034A Operation Manual:	1 copy
W2167AE	MX368035A Operation Manual:	1 copy
W2089AE	MX368041B Operation Manual:	1 copy
W1838AE	MX368042A Operation Manual:	1 copy
	Optional accessories	
J0576B	Coaxial Cord (N-P · 5D-2W · N-P), 1 m	
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	GPIB Cable, 1 m	
J0008	GPIB Cable, 2 m	
B0329C	Front Cover (1MW4U)	
B0331C	Front Handle (2 pcs/set)	
B0332	Joint Plate (4 pcs/set)	
B0333C	Rack Mount Kit	
B0334C	Carrying Case (Hard type, with front cover and casters)	
MA2512A	Band Pass Filter*1 (for W-CDMA, pass band: 1.92 to 2.17 GHz)	

*1: Refer to the individual catalogs for the expansion units, software and band pass filter.
*2: When using the MU368030A and MU368040A, dedicated software must be installed.

SIGNAL ANALYZER

MS2690A/MS2691A/MS2692A

50 Hz to 6.0 GHz 50 Hz to 13.5 GHz 50 Hz to 26.5 GHz

CE GPIB Ethernet

Signal Analyzer Solving Next-Generation Wireless Communications Issues

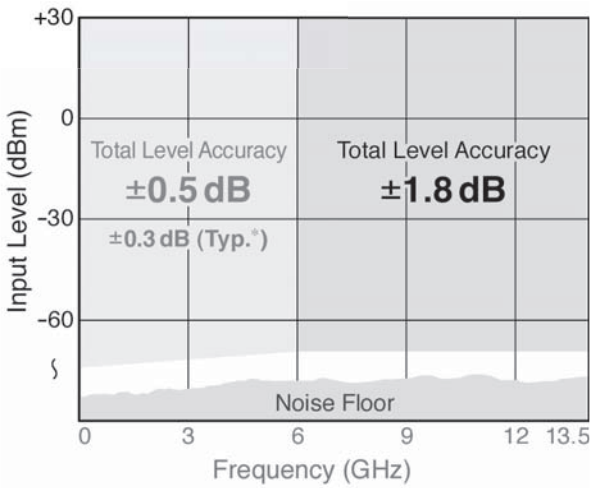
Excellent Eco Product

Next-generation wireless communications systems are becoming increasingly sophisticated with higher speeds, wider bandwidths, and multiple modulation methods in which the signal changes dynamically with time.
Frequency bands are shifting above 3 GHz to ensure sufficient bandwidth for new and emerging services and applications. As a result, to permit analysis without impact to transient changes, measuring instruments require excellent measurement accuracy and wideband analysis performance at frequency bands above 3 GHz.
Unlike other instruments with a basic band limited to 3 GHz, the MS2690A/MS2691A/MS2692A signal analyzer uses leading-edge architecture offering a basic band that goes to 6 GHz.
The MS2690A/MS2691A/MS2692A supports world-class absolute amplitude accuracy, modulation precision and wideband analysis across a frequency range from 50 Hz to 6 GHz.
The MS2690A/MS2691A/MS2692A has a built-in vector signal analysis function that performs FFT analysis over a 125 MHz bandwidth and a digitizing function that accurately captures signal waveforms with no signal dropout.
These advanced functions are ideal for the R&D arena where increasingly complex next-generation communication systems are being developed.
In addition, these analyzers are fast. Adding the optional vector signal generator (covering frequencies up to 6 GHz) creates a one-box tester that increases work efficiency in R&D applications, reduces tact times in manufacturing, and supports quick configuration of test systems.

Top Class RF Performance Based on Advanced Architecture

• Excellent Level Accuracy up to 6 GHz

The MS2690A/MS2691A/MS2692A integrates Anritsu's high-frequency technology and an advanced architecture that includes two built-in calibration oscillators. External power meters and single-frequency calibrations are obsolete, as the built-in calibration oscillators perform calibration across the entire band and enable the MS2690A/MS2691A/MS2692A to demonstrate a total level accuracy of ±0.5 dB from 50 Hz to 6 GHz.
The built-in phase calibration oscillator compensates for IF Filter frequencies and allows the analyzer to achieve the superior modulation accuracy required for WiMAX, 3G LTE, and other wideband technologies.
Coupling calibration across the entire frequency band with a low noise floor ensures that low level spurious signals can be seen and accurately measured.



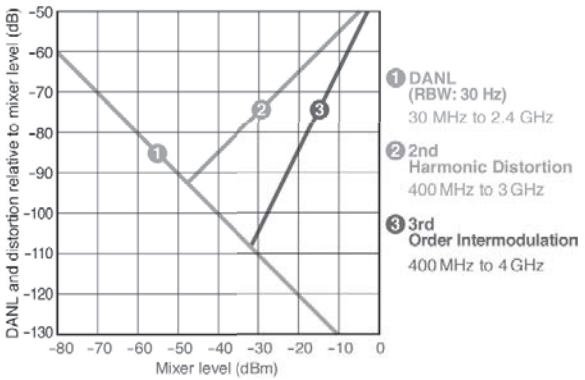
Note: Eliminates effect of noise floor
Used only when Uncal does not occur

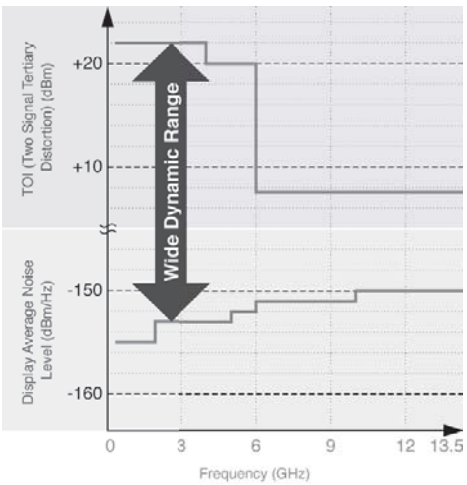
*: Excluding Guard Band

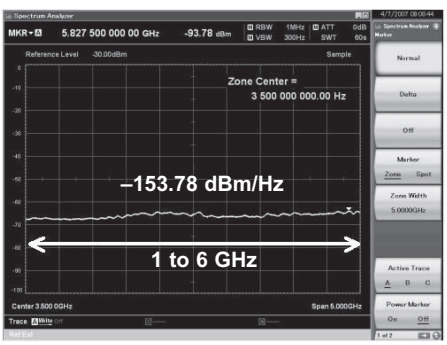
• Wide Dynamic Range for True Value Measurements

By using a front end that controls the noise figure and digital IF technology capable of advanced 16-bit ADC, this model achieves a superior display average noise level (DANL) of –155 dBm/Hz and a third-order intercept (TOI) ≥+22 dBm. Measurement performance does not degrade over this range, allowing measurement of true values across the entire dynamic range.

The Category B spurious test standard established by 3GPP, which requires a wide dynamic range in measuring instruments, can be measured without using correction devices, such as filters and amplifiers. The true values of devices and base stations are measured easily and spurious tests can be performed with less test equipment. This analyzer really shows its worth when configuring simple test systems by reducing the calibration burden and external equipment costs.







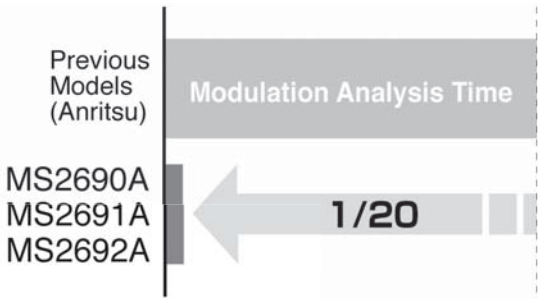
• World-class Measurement Speed

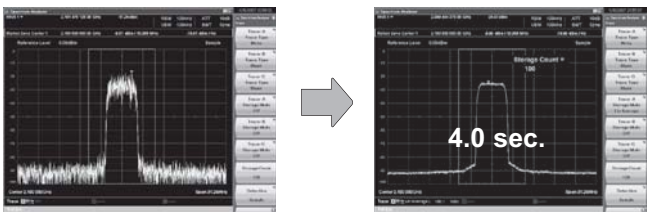
Taking full advantage of advanced software and high-speed CPUs, these analyzers use the full power of FFT (Fast Fourier Transform) technology to achieve world-class measurement speeds for modulation analysis measurements over span of 125 MHz.

The speed of the analysis software has been stepped up, supporting speeds 20 times faster than previous instruments.

A variety of interfaces, such as high-speed 1000BASE-T LAN and USB 2.0, are built-in as standard.

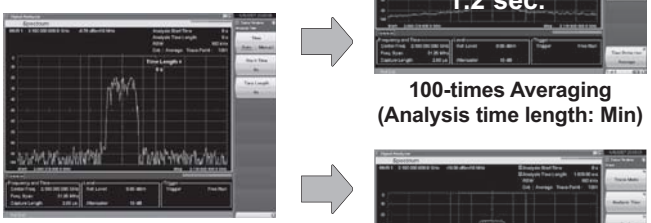
Overall, these analyzers raise efficiency for R&D development while cutting production-line tact times.





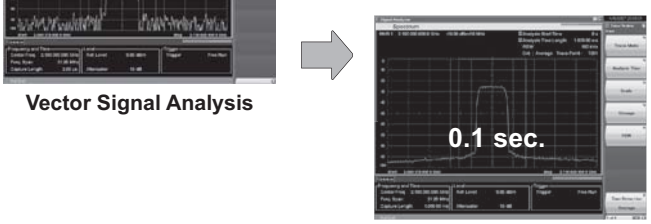
Spectrum Analyzer

100-times Averaging



Vector Signal Analysis

100-times Averaging
(Analysis time length: Min)

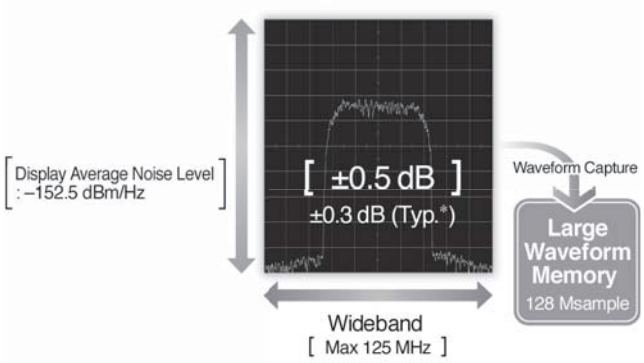


1-time Measurement
(Analysis time length: 1 ms)

Leading Vector Signal Analysis Function Combining Speed and Reliable RF Performance

• High-speed/High-performance FFT Analysis up to 125 MHz Bandwidth

The Vector Signal Analysis (VSA) functions support analysis for bandwidths up to 31.25 MHz as standard and up to 125 MHz as an option. Very fast measurement speed and reliable performance result from making the best use FFT technology with a high-performance RF front end, 16-bit ADC, and fast CPU.
Moreover, signals can be captured seamlessly using the digitize function for analysis from various views, such as frequency, power, and time, for easy and quick troubleshooting.



*: Excluding Guard Band

• Built-in Large-capacity 128 Msample Waveform Memory

A large-capacity 128 Msample waveform memory is built-in as standard, permitting waveform capture over long periods. The maximum capture time varies according to the frequency span as shown in Table 1.

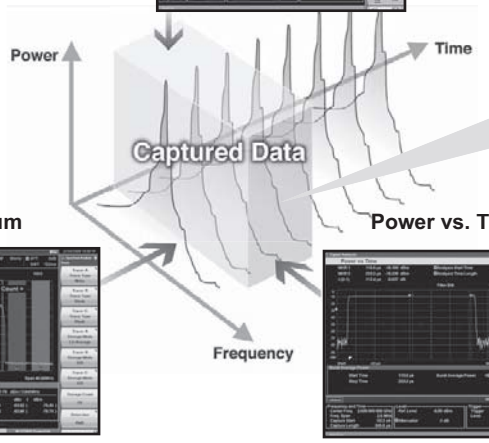
Frequency Span	Sampling Rate	Max. Capture Time
1 kHz	2 kHz	2000 s
2.5 kHz	5 kHz	2000 s
5 kHz	10 kHz	2000 s
10 kHz	20 kHz	2000 s
25 kHz	50 kHz	2000 s
50 kHz	100 kHz	1000 s
100 kHz	200 kHz	500 s
250 kHz	500 kHz	200 s
500 kHz	1 MHz	100 s
1 MHz	2 MHz	50 s
2.5 MHz	5 MHz	20 s
5 MHz	10 MHz	10 s
10 MHz	20 MHz	5 s
25 MHz	50 MHz	2 s
31.25 MHz	50 MHz	2 s
50 MHz	100 MHz	500 ms
100 MHz	200 MHz	500 ms
125 MHz	200 MHz	500 ms

Table 1

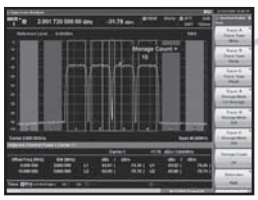
• Diverse Analysis of Captured Waveforms using VSA Function

Frequency vs. Time

Measures FSK and GMSK modulation wave frequency variation, and VCO frequency switching time.



Spectrum



Displays waveform of wideband SPAN up to 125 MHz without interruption.

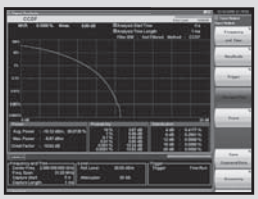
Power vs. Time

Monitors changes in power with time; useful for accurate and fast measurement of in-burst average power.

Spectrogram

Displays spectrum variations with time; useful for understanding waveform transients because supports visual monitoring of frequency and level time variations.

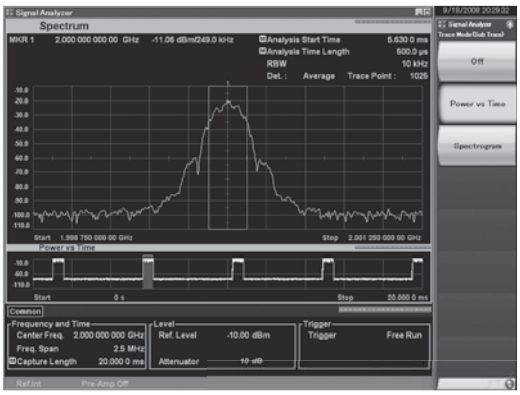
CCDF/APD



Supports wideband CCDF analysis up to 125 MHz; useful for evaluating power amplifiers in wideband communications systems.

• Sub-Trace (Split Screens) Display for Intuitive operation

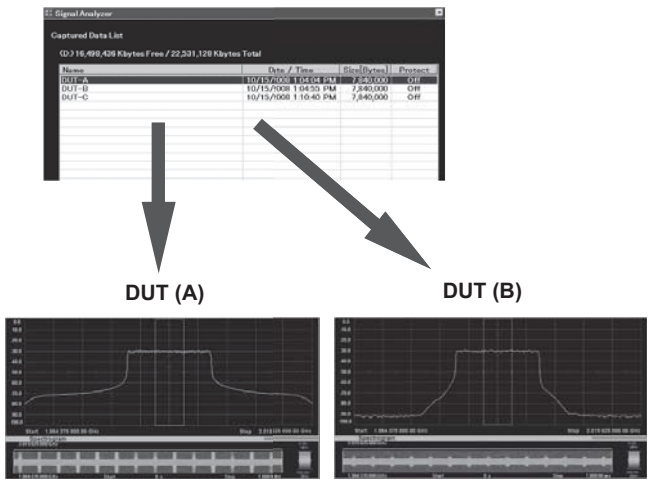
This function specifies the analysis range as a sub- trace (Power vs. Time, and spectrogram) and supports various VSA analyses at the main trace. Spectrum changes at signal-on segments, rising, falling, etc., are observed intuitively.



• Convenient Replay for Comparison

Saved waveform data can be read and analyzed by the VSA functions, allowing easy comparison and verification of data for multiple DUTs.

Captured Waveform Data: Selection Screen

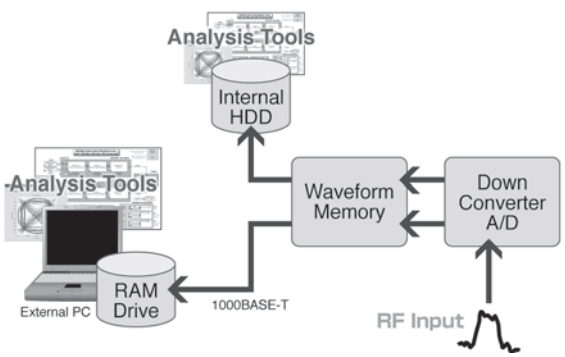


• Captured Waveforms Analysis using Commercial Analysis Tools

Other digitizers may exhibit severe degradation of the RF channel during capture, requiring troublesome calibration of the captured data when using analysis tools.

The MS2690A/MS2691A/MS2692A uses high-performance RF and two built-in calibration oscillators to minimize the degradation and eliminate the need for calibration before using analysis tools.

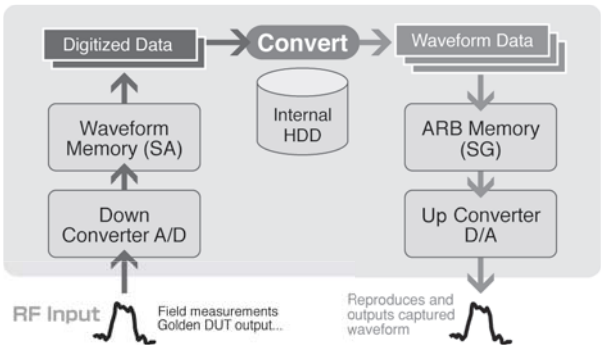
The waveform data are saved to the internal hard disk and can be output to an external PC via a high-speed interface, such as the 1000BASE-T LAN port.



• Captured Waveform Output from Vector Signal Generator Option

Waveforms captured using the digitizing function can be regenerated by using with the optional MS2690A/MS2691A/MS2692A-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

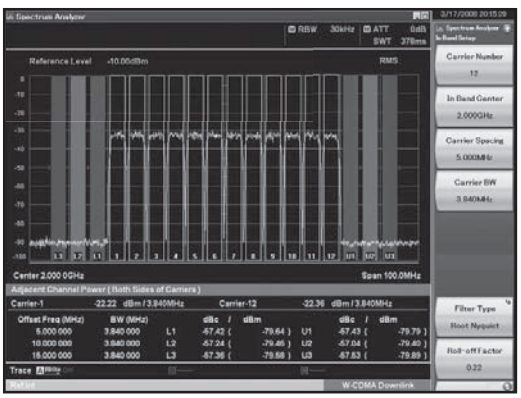
• Measure Function

The Measure function support the following measurements with one-touch operation.

Measure Function	SPA	VSA
Channel Power	√	√
Occupied Bandwidth	√	√
Adjacent Channel Leakage Power	√	√
Spectrum Emission Mask	√	
Spurious Emission	√	
Burst Average Power	√	√
AM Depth		√
FM Deviation		√

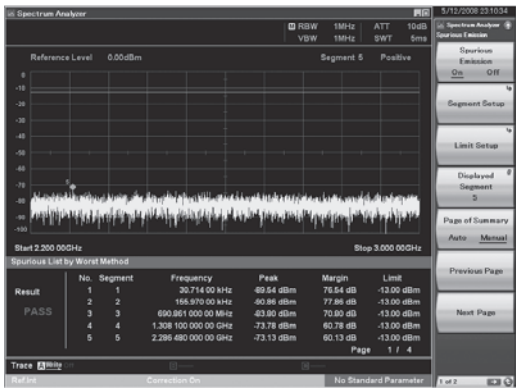
• Adjacent Channel Leakage Power

Measures adjacent channel leakage power for 12 carriers max.; supports instantaneous switching of set carrier number between 1 to 12.



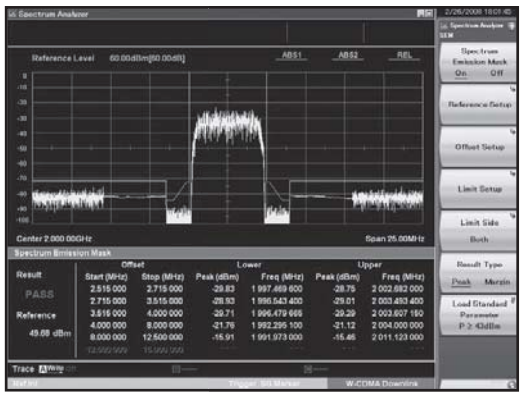
• Spurious Emission

Pass/Fail judgment can be performed for a set limit line at up to 20 segments.



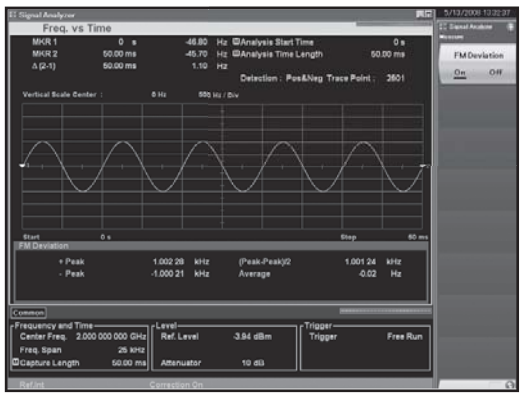
• Spectrum Emission Mask

Performs Pass/Fail evaluation for set limit line; supports any limit line setting for 6 segments max.



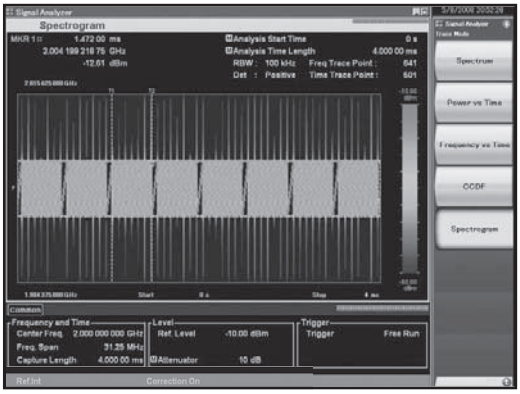
• FM Deviation

Measures FM deviation; displays measurement results as +Peak, –Peak, (Peak-Peak)/2, and Average.



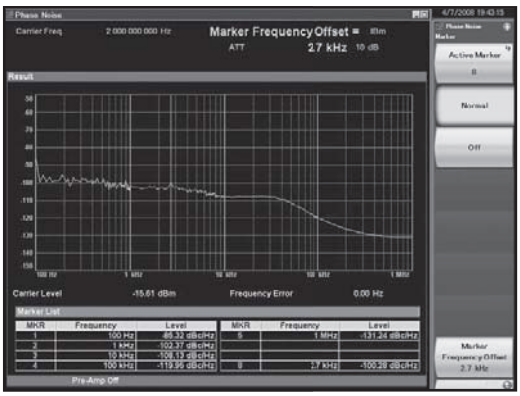
• Spectrogram Function

Monitors continuous time variations in spectrum span up to 125 MHz; convenient for confirming burst-signal time stability and rare interference signals because able to intuitively understand frequency and level time variations.



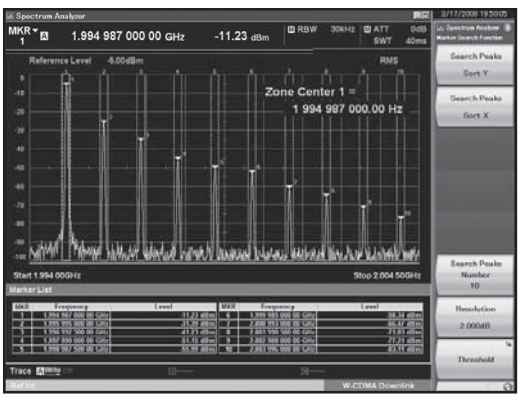
• Phase Noise Measurement

Supports phase noise measurements with frequency offset range from 100 Hz to 1 MHz; supports high-speed measurement at about 700 ms per one averaging, or about 3 s per 10 averagings.



• Marker Function

Sets threshold and searches for up to 10 peaks; supports accurate measurement of even unstable signals with frequency swing by automatically searching for peak values in set range and using zone marker to display results.



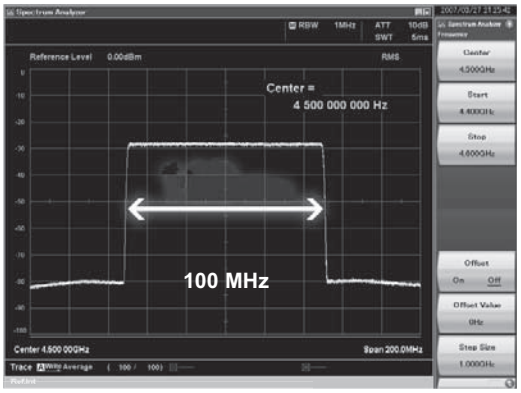
High-Performance Vector Signal Generator Option

- **Save Valuable Bench Space by Adding an Optional Signal Generator to the Analyzer**

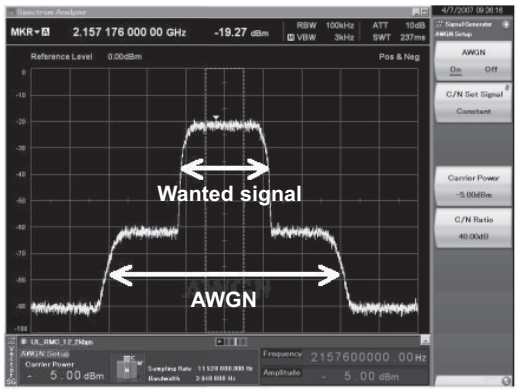
The MS2690A/MS2691A/MS2692A-020 Vector Signal Generator option covers a frequency range from 125 MHz to 6 GHz.
It is a high-performance waveform generator with a 120 MHz wide-band vector modulation band and built-in 256 Msample waveform memory.
Boasting superior ACLR functions and level accuracy that compares favorably with stand-alone signal generators, the addition of the signal generator option creates a versatile one-box tester capable of multiple applications including component and base station testing.

- Frequency: 125 MHz to 6 GHz
- 120 MHz wide vector modulation band
- 256 Msample large-capacity waveform memory
- Absolute level accuracy: ±0.5 dB, Linearity: ±0.2 dB (typ.)
- Excellent ACLR performance
  ≤–64 dBc (5 MHz offset)
  ≤–67 dBc (10 MHz offset)
- BER Measurement and AWGN addition functions*

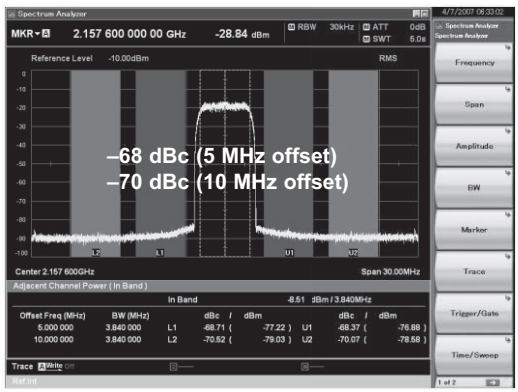
*: The AWGN bandwidth is the value of the sampling clock for the required waveform.



100 MHz Bandwidth Waveform Output Example (4.5 GHz)



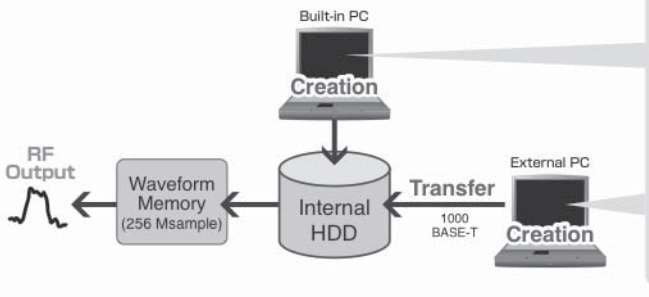
Wanted signal + AWGN signal output from one unit



ACLR (W-CDMA, Test Model 1, 64DPCH)

- **Versatile Multiple Waveform Generation**

Any type of waveform can be generated using the MS2690A/MS2691A/MS2692A-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 MS2690A/MS2691A/MS2692A main frame.

- HSDPA/HSUPA IQproducer
- TDMA IQproducer
- Multi-carrier IQproducer
- Mobile WiMAX IQproducer
- LTE IQproducer
- XG-PHS IQproducer

Creating Any Waveform

IQ Data created using the MS2690A/MS2691A/MS2692A 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 MS2690A/MS2691A/MS2692A arbitrary waveform generation option. It has the following three main functions.

Parameter Editing:

Function for easily editing parameters matching each communication method

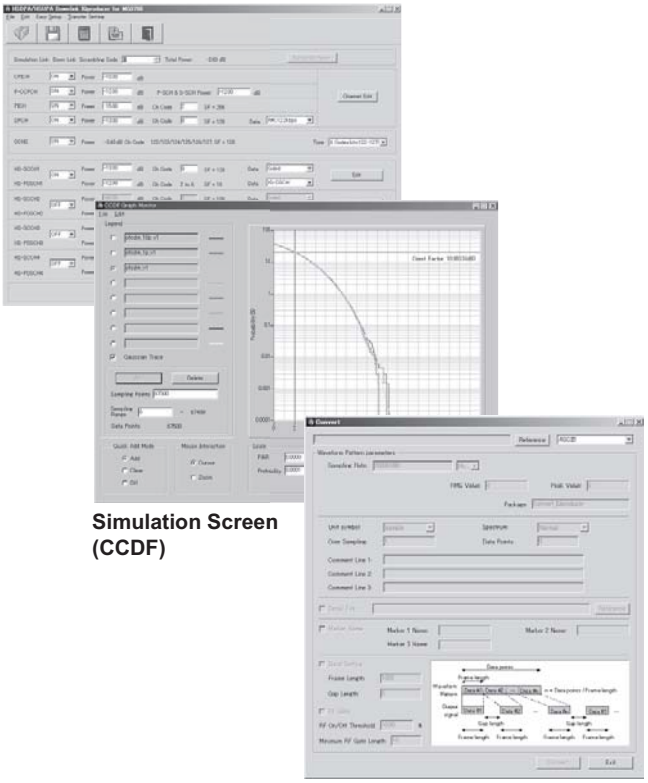
Simulation:

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 MS2690A/MS2691A/MS2692A-20

Parameter Setting Screen (HSDPA/HSUPA IQproducer)

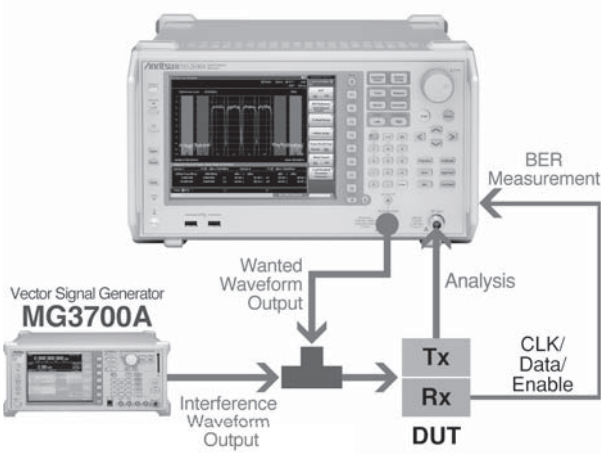


Simulation Screen (CCDF)

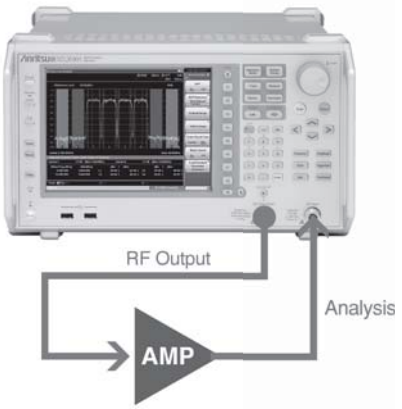
Convert Screen

• Application

Simplified Tx Test Setup

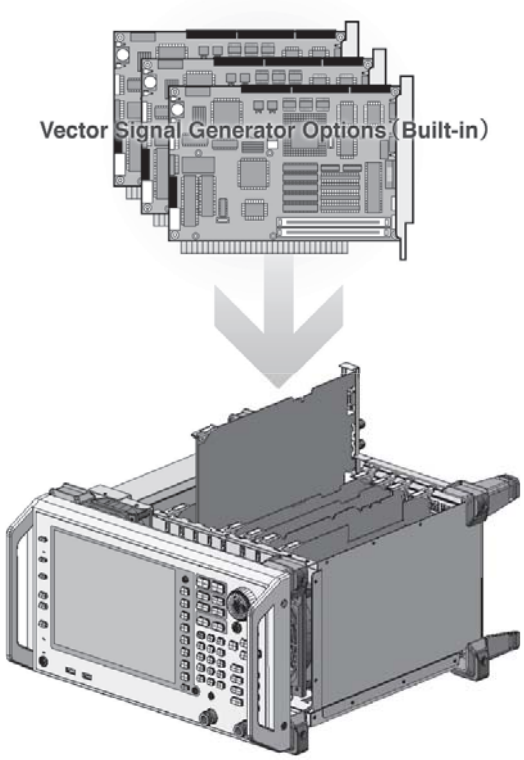


Easy AMP Test



Future-proof Platform

The MS2690A/MS2691A/MS2692A design adopts a modular multi-slot structure for excellent future-proof expandability. The analyzer is customized for its target measurements by installing options in these slots.



*Unique option lineup for sequential expansion

• Options

Hardware Options

MS2690A/MS2691A/MS2692A-001 Rubidium Reference Oscillator
This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 x 10^{-9} at 7 minutes after power-on.

MS2691A/MS2692A-003 Pre-selector Extended Lower Limit (3 GHz)
This option extends the lower limit of the pre-selector from 5.9 to 3 GHz. It can only be installed in the MS2691A/MS2692A.

MS2690A/MS2691A/MS2692A-004 Wideband Analysis Hardware
This option expands the maximum analysis bandwidth to 125 MHz.

MS2690A/MS2691A/MS2692A-008 6 GHz Preamplifier
This option increases the level sensitivity up to 6 GHz.

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-030
W-CDMA RNC Simulator (ATM 1.5M/2M)
This option simulates a Radio Network Controller (RNC) to control the W-CDMA base-station Tx/Rx conditions via the ATM EI/TI interface.
BER/BLER measurements are also supported.

*: Please consult us first about the connection between this option and the base station.

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 MS2690A/MS2691A/MS2692A-020 Vector Signal Generator, MX269040A RF UMTS Measurement Software, and MX269041A DigRF2.5G/3G Digital I/F Control Software.

*: See each catalog for details.

MS2690A/MS2691A/MS2692A-050 HDD Digitizing Interface
Installing the MS2690A/MS2691A/MS2692A-050 HDD Digitizing Interface option captures up to 4 hours of 20 MHz wideband RF signals. It is convenient for troubleshooting uncommon faults.

• IQproducer License for MS2690A/MS2691A/MS2692A-20 VSG
Waveforms generated by IQproducer can be downloaded to the MS2690A/MS2691A/MS2692A main frame in which the MS2690A/MS2691A/MS2692A-020 Vector Signal Generator is installed, but the following licenses (option) are required to output the signal.

*: No license is required to generate or edit the signal.

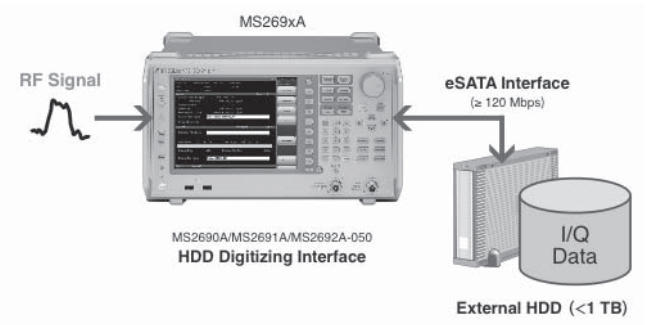
- MX269901A HSDPA IQproducer
- MX269902A TDMA IQproducer
- MX269904A Multi-Carrier IQproducer
- MX269905A Mobile WiMAX IQproducer
- MX269908A LTE IQproducer
- MX269909A XG-PHS IQproducer

• Measurement Software
Supports analysis of various systems by installing measurement software in MS2690A/MS2691A/MS2692A.

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
3GPP LTE (FDD)	LTE Downlink Measurement Software	MX269020A
	LTE Uplink Measurement Software	MX269021A

*: See each measurement software catalog for more details.

• Seamless Waveform Capture for 4 Hours Max.
Installing the MS2690A/MS2691A/MS2692A-050 HDD Digitizing Interface option captures up to 4 hours of 20 MHz wideband RF signals. It is convenient for troubleshooting uncommon faults.



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
J0017F	Power Cord (2.6 m long 100 Vac, 3 core, gray) :1 pc
J0266	Conversion Adapter (3 pin to 2 pin power adapter) :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 x 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-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2690A-030	W-CDMA RNC Simulator (ATM1.5M/2M) (Supports ATM 1.5M and 2M)
MS2690A-040	Baseband Interface Unit
MS2690A-050	HDD Digitizing Interface
MS2691A-001	Rubidium Reference Oscillator (Aging rate ±1 x 10^{-10}/month)
MS2691A-003	Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of pre-selector 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-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2691A-030	W-CDMA RNC Simulator (ATM1.5M/2M) (Supports ATM 1.5M and 2M)
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MS2692A-001	Rubidium Reference Oscillator (Aging rate ±1 x 10^{-10}/month)
MS2692A-003	Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of pre-selector 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-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2692A-030	W-CDMA RNC Simulator (ATM1.5M/2M) (Supports ATM 1.5M and 2M)
MS2692A-040	Baseband Interface Unit
MS2692A-050	HDD Digitizing Interface
	Retrofit options
MS2690A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 x 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-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2690A-130	W-CDMA RNC Simulator (ATM1.5M/2M) Retrofit (Supports ATM 1.5M and 2M)
MS2690A-140	Baseband Interface Unit Retrofit
MS2690A-150	HDD Digitizing Interface Retrofit
MS2691A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 x 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-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2691A-130	W-CDMA RNC Simulator (ATM1.5M/2M) Retrofit (Supports ATM 1.5M and 2M)
MS2691A-140	Baseband Interface Unit Retrofit
MS2691A-150	HDD Digitizing Interface Retrofit
MS2692A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 x 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-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2692A-130	W-CDMA RNC Simulator (ATM1.5M/2M) Retrofit (Supports ATM 1.5M and 2M)
MS2692A-140	Baseband Interface Unit Retrofit
MS2692A-150	HDD Digitizing Interface Retrofit

Model/Order No.	Name
	Software options
MX269010A	Mobile WiMAX Measurement Software (CD-ROM, license and instruction manual)
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software (CD-ROM, license and instruction manual)
MX269013A	GSM/EDGE Measurement Software (CD-ROM, license and instruction manual)
MX269013A-001	EDGE Evolution Measurement Software (CD-ROM, license and instruction manual)
MX269014A	ETC/DSRC Measurement Software (CD-ROM, license and instruction manual)
MX269015A	TD-SCDMA Measurement Software (CD-ROM, license and instruction manual)
MX269016A	XG-PHS Measurement Software (CD-ROM, license and instruction manual)
MX269020A	LTE Downlink Measurement Software (CD-ROM, license and instruction manual)
MX269021A	LTE Uplink Measurement Software (CD-ROM, license and instruction manual)
MX269030A	W-CDMA BS Measurement Software (CD-ROM, license and instruction manual)
MX269040A	UMTS Measurement Software for RF Device Test
MX269041A	Digital I/F Control Software for DigRF2.5G/3G
MX269901A	HSDPA/HSUPA IQproducer (CD-ROM, license and instruction manual)
MX269902A	TDMA IQproducer (CD-ROM, license and instruction manual)
MX269904A	Multi-Carrier IQproducer (CD-ROM, license and instruction manual)
MX269905A	Mobile WiMAX IQproducer (CD-ROM, license and instruction manual)
MX269908A	LTE IQproducer (CD-ROM, license and instruction manual)
MX269909A	XG-PHS IQproducer (CD-ROM, license and instruction manual)
	Warranty service
MS2690A-ES210	2-year Extended Warranty Service
MS2690A-ES310	3-year Extended Warranty Service
MS2690A-ES510	5-year Extended Warranty Service
MS2691A-ES210	2-year Extended Warranty Service
MS2691A-ES310	3-year Extended Warranty Service
MS2691A-ES510	5-year Extended Warranty Service
MS2692A-ES210	2-year Extended Warranty Service
MS2692A-ES310	3-year Extended Warranty Service
MS2692A-ES510	5-year Extended Warranty Service

Continued on next page

Model/Order No.	Name
	Application parts
W2850AE	MS2690A/MS2691A/MS2692A Operation Manual (Main frame Operation, Printed version)
W2851AE	MS2690A/MS2691A/MS2692A Operation Manual (Main frame Remote Control, Printed version)
W2852AE	MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Operation, Printed version)
W2853AE	MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Remote Control, Printed version)
W2854AE	MS2690A/MS2691A/MS2692A Operation Manual (Spectrum Analyzer Function Operation, Printed version)
W2855AE	MS2690A/MS2691A/MS2692A Operation Manual (Spectrum Analyzer Function Remote Control, Printed version)
W2856AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Operation, Printed version)
W2857AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Remote Control, Printed version)
W2914AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (IQproducer, Printed version)
W2929AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Standard Waveform Pattern, Printed version)
W2858AE	MS2690A/MS2691A/MS2692A-030 Operation Manual (Operation, Printed version)
W2859AE	MS2690A/MS2691A/MS2692A-030 Operation Manual (Remote Control, Printed version)
W3130AE	MS2690A/MS2691A/MS2692A-040 Operation Manual (Operation, Printed version)
W2919AE	MX269010A Operation Manual (Printed version)
W3098AE	MX269011A Operation Manual (Operation, Printed version)
W3099AE	MX269011A Operation Manual (Remote control, Printed version)
W3060AE	MX269012A Operation Manual (Operation, Printed version)
W3061AE	MX269012A Operation Manual (Remote control, Printed version)
W3100AE	MX269013A Operation Manual (Operation, Printed version)
W3101AE	MX269013A Operation Manual (Remote control, Printed version)
W3031AE	MX269014A Operation Manual (Operation, Printed version)
W3032AE	MX269014A Operation Manual (Remote control, Printed version)
W3044AE	MX269015A Operation Manual (Operation, Printed version)
W3045AE	MX269015A Operation Manual (Remote control, Printed version)
W3157AE	MX269016A Operation Manual (Remote control, Printed version)
W3158AE	MX269016A Operation Manual (Remote control, Printed version)
W3014AE	MX269020A Operation Manual (Operation, Printed version)
W3015AE	MX269021A Operation Manual (Operation, Printed version)
W2860AE	MX269030A Operation Manual (Operation, Printed version)
W2861AE	MX269030A Operation Manual (Remote control, Printed version)
W3003AE	MX269040A Operation Manual (W-CDMA Operation, Printed version)
W3004AE	MX269040A Operation Manual (GSM/EDGE Operation, Printed version)
W3005AE	MX269040A Operation Manual (Remote control, Printed version)

Model/Order No.	Name
W3006AE	MX269041A Operation Manual (BBIF Operation, Printed version)
W3007AE	MX269041A Operation Manual (BBIF Remote control, Printed version)
W3008AE	MX269041A Operation Manual (IQ Pattern/DUT Control Producer, Printed version)
W3016AE	MX269041A Operation Manual (RF device test integrated software, Printed version)
W3108AE	MX269050A Operation Manual (Operation, Printed version)
W3109AE	MX269050A Operation Manual (Remote control, Printed version)
W2915AE	MX269901A Operation Manual (Printed version)
W2916AE	MX269902A Operation Manual (Printed version)
W2917AE	MX269904A Operation Manual (Printed version)
W2918AE	MX269905A Operation Manual (Printed version)
W3023AE	MX269908A Operation Manual (Printed version)
W3153AE	MX269909A Operation Manual (Printed version)
K240B	Power Divider (K connector, DC to 26.5 GHz, 50 Ω, K-J, 1 W max)
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, 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 · 50 Ω SUCOFLEX104 · SMA-P), 0.5 m (DC to 18 GHz)
J0322B	Coaxial Cord (SMA-P · 50 Ω SUCOFLEX104 · SMA-P), 1 m (DC to 18 GHz)
J0322C	Coaxial Cord (SMA-P · 50 Ω SUCOFLEX104 · SMA-P), 1.5 m (DC to 18 GHz)
J0322D	Coaxial Cord (SMA-P · 50 Ω SUCOFLEX104 · SMA-P), 2 m (DC to 18 GHz)
J1264	SMA-N Conversion Adapter (DC to 18 GHz, 50 Ω, N-P · SMA-J)
J1398A	N-SMA Adapter (DC to 26.5 GHz, 50 Ω, 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
B0589A	Carrying Case (Hard type, with casters)
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

DIGITAL MOBILE RADIO TRANSMITTER TESTER

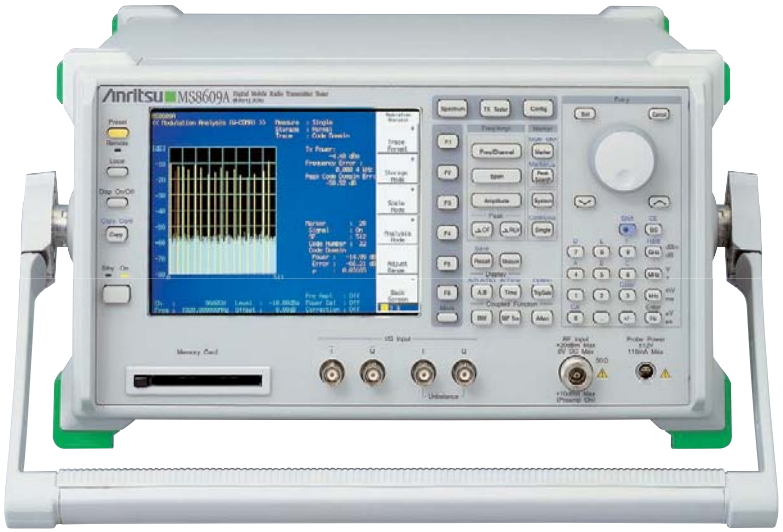
MS8609A

9 kHz to 13.2 GHz

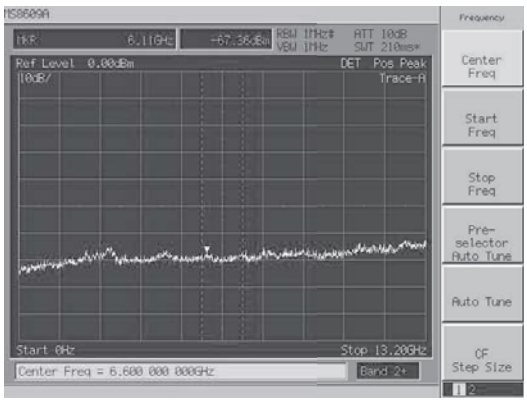
CE GPIB Ethernet OPTION

For Evaluation of 2G, 3G and 3.5G Communication Standards

Excellent Eco Product



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 (to 3 GHz)
Frequency span: Zero, 1 kHz to 13.2 GHz
Span accuracy: ±1%
Reference frequency accuracy:
±2 x 10^{-8}/day, ±5 x 10^{-10}/day (option), ±1 x 10^{-10}/year (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 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 Setup

Measurement parameters such as modulation accuracy and code domain power, etc., are set on the screen shown below.
Measurement is easy using a soft-key menu after setting measurement parameters.

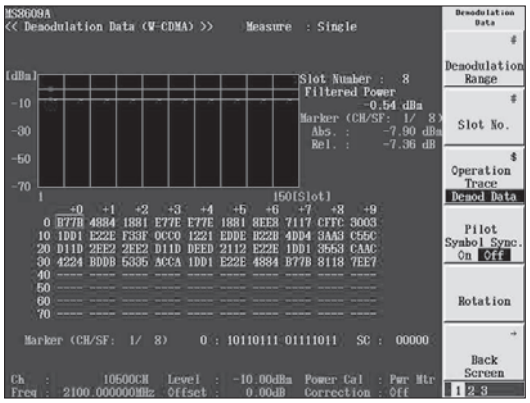
• Code Domain Power

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 Setup
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.

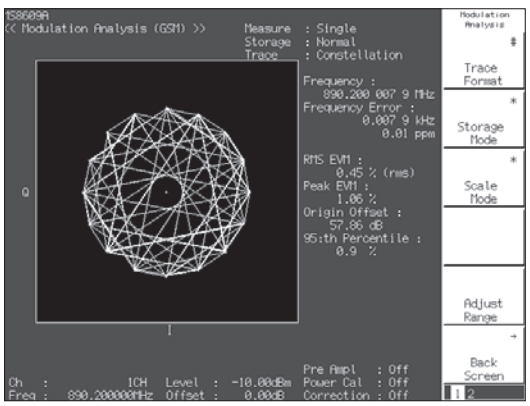
• Modulation Accuracy Measurement
The modulation accuracy is high. (The residual phase error of GMSK modulation is <0.5˚ rms and the residual EVM of 8PSK modulation is <1.0% rms.)

• 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 Setup
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).

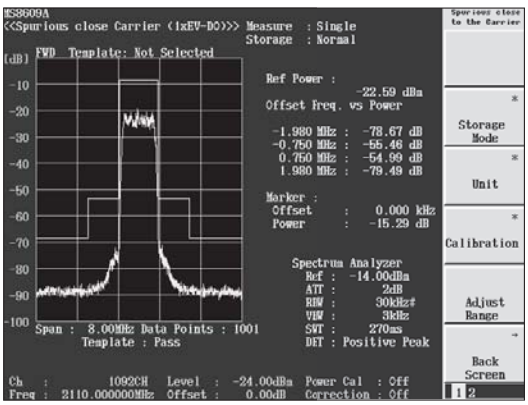
• BTS Code Domain Analysis
Only 2 seconds are required for code domain analysis of 1xRTT signals, and RC* 1 through RC5 can be measured.
The spreading factor of each code is detected automatically and displayed on-screen.

*: 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.

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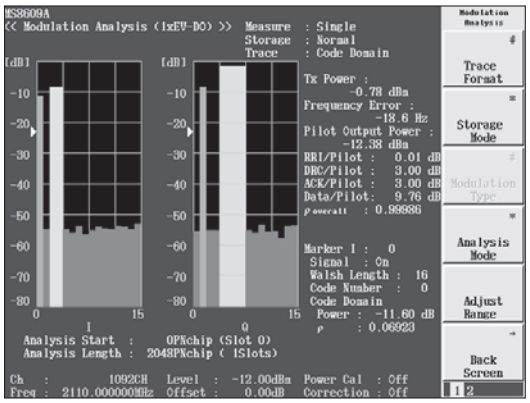
• MS Code Domain Analysis

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

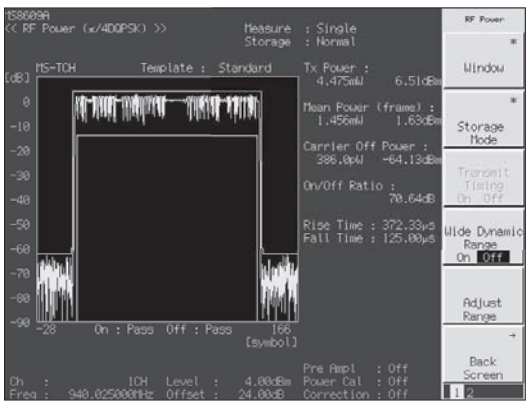
Analysis of PDC, PHS and NADC (IS-136) systems requires setting of parameters for important measurement such as modulation accuracy at this screen. Changing the symbol rate also permits analysis of systems other than PDC, PHS and NADC.

• 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

• Common Setup Parameters

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.

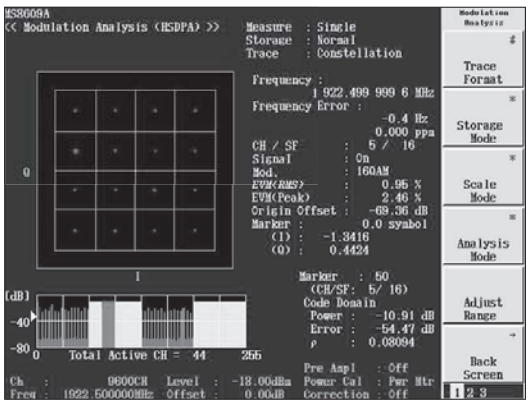
• Macro Function (Batch Processing)

Each item listed below 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 Setup

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 value, p-p value) 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.

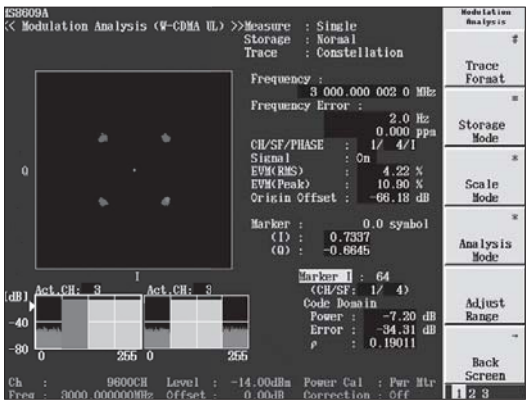
MX860951A
W-CDMA Release5 Uplink Measurement Software

• Parameter Settings

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.

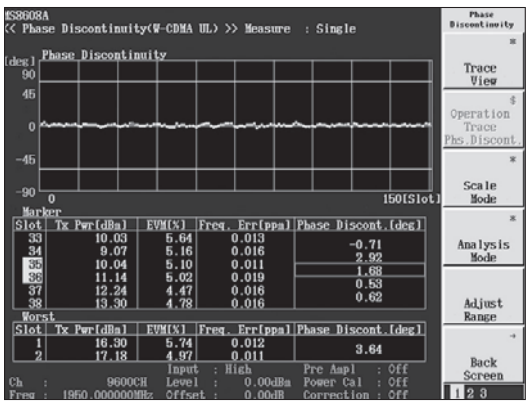


• Modulation Analysis Measurement [2]

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.

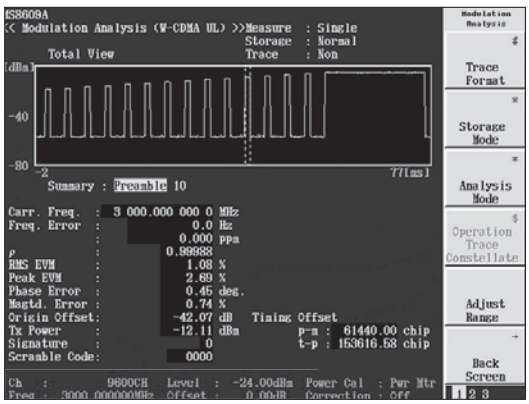
• Phase Discontinuity Measurement

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.



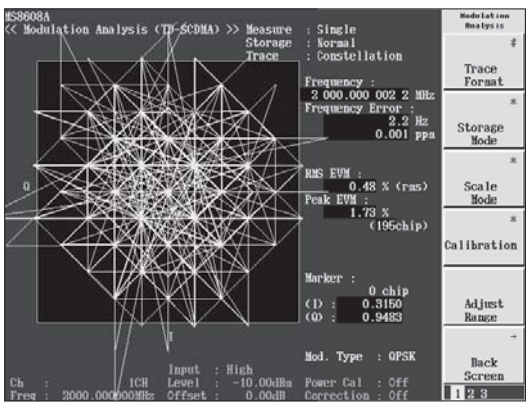
MX860960A TD-SCDMA Measurement Software

• Parameter Settings

This screen is used to set basic parameters, such as frequency and signal type. Measurement is simple after completing each setting.

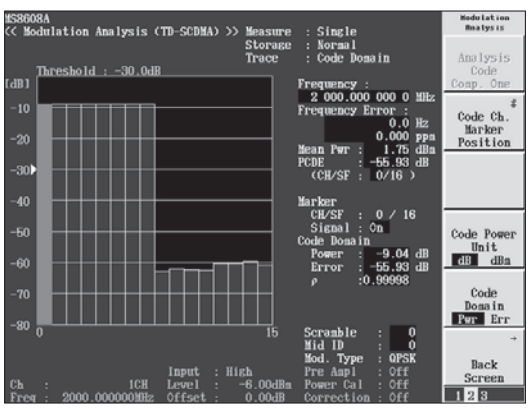
• Modulation Analysis Measurement [1]

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.).



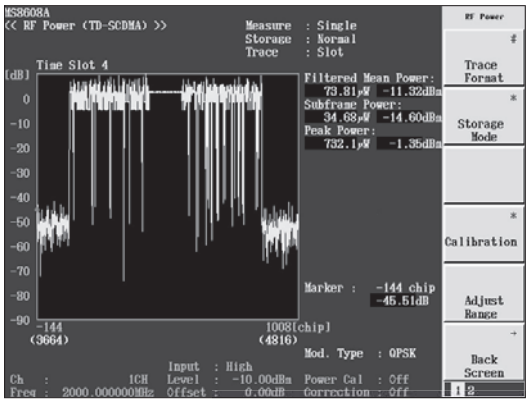
• Modulation Analysis Measurement [2]

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 50 Ω, VSWR: ≤1.3 (30 MHz to 3 GHz) Except power meter 50 Ω, VSWR: ≤1.5 (input attenuator: ≥4 dB, ≤3 GHz), ≤2.3 (input attenuator: ≥10 dB, >3 GHz)
Input connector		N-type
Reference oscillator		Frequency: 10 MHz Starting characteristics: ≤5 x 10^{-8}/day (after 10 minute warm-up, compared to frequency after 24 hour warm-up) Aging rate: ≤2 x 10^{-8}/day, ≤1 x 10^{-7}/year (compared to frequency after 24 hour warm-up) Temperature characteristics: ±5 x 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 to 13.2 GHz (Band 1 and 2) Frequency accuracy Accuracy: ± (display frequency x reference frequency accuracy + span x span accuracy + resolution bandwidth x 0.15 + 10 x 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): [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 to 3.2 GHz, Band 0) ≤–116 dBm (3.15 to 7.8 GHz, Band 1) ≤–107 dBm (7.7 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 to 3.2 GHz, Band 0) ≤–116 dBm (3.15 to 7.8 GHz, Band 1) ≤–107 dBm (7.7 to 13.2 GHz, Band 2) Residual response: ≤–100 dBm (1 MHz to 3.2 GHz, Band 0), ≤–90 dBm (3.15 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, 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 to 7.8 GHz, Band 1*), ±2.0 dB (7.7 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 to 200 MHz), ≤–75 dBc (200 to 850 MHz, Band 0), ≤–70 dBc (0.85 to 1.6 GHz, Band 0), ≤–90 dBc (1.6 to 6.6 GHz, Band 1 and 2) Two-tone 3rd order distortion: ≤–70 dBc (10 to 100 MHz), ≤–85 dBc (0.1 to 3.2 GHz), ≤–80 dBc (3.15 to 7.8 GHz), ≤–75 dBc (7.7 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 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$\sqrt{\text{Hz}}$ C/N: dBc/Hz, dBc/ch Frequency counter Resolution: 1, 10, 100 Hz, 1 kHz Measurement accuracy: ± (display frequency x reference frequency accuracy + 2 x 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 x 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 x 2, lower limit x 2 Mask measurement (frequency sweep): Upper limit x 2, lower limit x 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 (3.3/5 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) x 177 (H) x 411 (D) mm (except handle, feet, front cover and fan cover), ≤16 kg (nominal)
Power supply		100 to 120/200 to 240 Vac (–15/+10%, max. voltage: 250 V, voltage auto-switching), 47.5 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, preamplifier: off), –80 to +10 dBm (average power, preamplifier: on[*1]) Carrier frequency accuracy: ± (reference oscillator accuracy + 10 Hz) ∗Input level: ≥–30 dBm (preamplifier: off), ≥–40 dBm (preamplifier: on[*1]), 1 code channel Modulation accuracy (residual vector error): <2% (rms) ∗Input level: ≥–30 dBm (preamplifier: off), ≥–40 dBm (preamplifier: on[*1]), 1 code channel Origin offset accuracy: ±0.5 dB ∗Input level: ≥–30 dBm (preamplifier: off), ≥–40 dBm (preamplifier: 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, preamplifier: off), –80 to +10 dBm (average power, preamplifier: on[*1]) Code domain power accuracy: ±0.1 dB (code power: ≥–10 dBc), ±0.3 dB (code power: ≥–25 dBc) ∗Input level: ≥–10 dBm (preamplifier: off), ≥–20 dBm (preamplifier: 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 (preamplifier: off); ≥–20 dBm (preamplifier: 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, preamplifier: off), –80 to +10 dBm (average power, preamplifier: on[*1]) Transmitter power measurement Measurement range: –20 to +20 dBm (average power, preamplifier: off), –20 to +10 dBm (average power, preamplifier: 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 (preamplifier: off); ≥–20 dBm (preamplifier: 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, preamplifier: off), –80 to +10 dBm (average power, preamplifier: 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, preamplifier: 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, preamplifier: 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 to 150 kHz, Band 0) ≥79 dB (RBW: 10 kHz, 150 kHz to 30 MHz, Band 0) ≥79 dB (RBW: 100 kHz, 30 to 1000 MHz, Band 0) ≥76 – f [GHz] dB (RBW: 1 MHz, 1 to 3.15 GHz, Band 0) ≥76 dB (RBW: 1 MHz, 3.15 to 7.8 GHz, Band 1) ∗Carrier frequency: 1.8 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

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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, preamplifier: off), +30 dBm (peak power, preamplifier: off) –80 to +10 dBm (average power, preamplifier: on), +20 dBm (peak power, preamplifier: 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 capacity: <100 pF), 50 Ω 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 coupling 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 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, preamplifier: off), –60 to +10 dBm (burst average power, preamplifier: on[*1]) Carrier frequency accuracy: ± (reference oscillator accuracy + 10 Hz) ∗Input level (burst average power): ≥–30 dBm (preamplifier: off), ≥–40 dBm (preamplifier: on[*1]) Residual phase error (GMSK modulation): <0.5 deg (rms), <2.0 deg (peak) ∗Input level (burst average power): ≥–30 dBm (preamplifier: off), ≥–40 dBm (preamplifier: 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, preamplifier: off), –60 to +10 dBm (burst average power, preamplifier: 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, preamplifier: on[*1]) Accuracy: ±0.4 dB Power measurement linearity: ±0.2 dB (–30 to 0 dBm) ∗Input level (burst average power): ≥–10 dBm (preamplifier: off); ≥–20 dBm (preamplifier: on[*1]), without changing reference level setting after range optimization Carrier-off power measurement range Input level (burst average power): ≥–10 dBm (preamplifier: off), ≥–20 dBm (preamplifier: 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, preamplifier: off), –20 to +10 dBm (burst average power, preamplifier: 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, preamplifier: 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 do main 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 to 500 MHz, Band 0) ≥66 – f [GHz] dB (RBW: 3 MHz, 0.5 to 3.15 GHz, Band 0, except harmonic frequency) ≥66 dB (RBW: 3 MHz, 3.15 to 7.8 GHz, Band 1) ∗Carrier frequency: 0.8 to 1 GHz, 1.8 to 2 GHz

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I/Q Signal	Input: Balanced, unbalanced Input impedance: 1 MΩ (parallel capacity: <100 pF), 50 Ω 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, I/Q level Modulation accuracy Residual phase error: <0.5 deg (rms), DC coupling Residual EVM: <1.0% (rms), DC coupling *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 x 10^{-8}/7 min. (referenced to frequency at 24 hours after power-on)
Aging rate	≤±5 x 10^{-10}/day (referenced to frequency at 24 hours after power-on)
Temperature characteristics	≤±5 x 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 is 1 Hz, RF ATT is 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 to 3.2 GHz, band 0) ≤–138.5 dBm typ. (3.15 to 7.8 GHz, band 1) ≤–129.5 dBm typ. (7.7 to 13.2 GHz, band 2) With Option 08, pre-amp off, when RBW is 1 Hz, RF ATT is 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 to 3.2 GHz, band 0) ≤–138.5 dBm typ. (3.15 to 7.8 GHz, band 1) ≤–129.5 dBm typ. (7.7 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, when RBW is 10 Hz, RF ATT is 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 to 3.2 GHz, band 0) ≤–128.5 dBm typ. (3.15 to 7.8 GHz, band 1) ≤–119.5 dBm typ. (7.7 to 13.2 GHz, band 2) With Option 08, pre-amp off, when RBW is 10 Hz, RF ATT is 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 to 3.2 GHz, band 0) ≤–128.5 dBm typ. (3.15 to 7.8 GHz, band 1) ≤–119.5 dBm typ. (7.7 to 13.2 GHz, band 2)

• Option 05: Rubidium Reference Oscillator

Frequency	10 MHz
Start-up characteristics	±1 x 10^{-9}/7 min. (referenced to frequency 1 hour after power-on)
Aging rate	±1 x 10^{-10}/month (referenced to frequency 1 hour after power-on)
Temperature characteristics	±1 x 10^{-9} (0˚ to 45˚C, referenced to frequency at 25˚C)
Accessories	J1066 Coaxial Cord, 0.15 m (BNC211-LP4)

• Option 08: Preamplifier

Gain	20 dB typ.
Noise figure	6.5 dB typ. (input frequency: ≤2 GHz) ,12 dB (input frequency: >2 GHz)
Frequency	Frequency range: 100 kHz to 3 GHz Band 0: 100 kHz to 3 GHz, 1–: 3.15 to 6.3 GHz, 1+: 6.2 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) ∗At 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 when RF ATT = 10 to 50 dB, and 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, at preamplifier input level∗1 of –55 dBm 1 dB gain compression: ≥–35 dBm (input frequency ≥100 MHz) ∗At preamplifier input level∗1 Input impedance: VSWR ≤2.5 typ.

∗1: Preamplifier input level shown as: Preamplifier 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 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 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, when RF ATT = 10 dB, and 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 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, at frequency = 50 MHz when 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 to 2171 MHz (Except 1995 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 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, 2.6 m: 1 pc
J0996B	RS-232C Cable: 1 pc
Z0744	Memory Card (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 x 10^{-10}/day)
MS8609A-02	Narrow Resolution Bandwidth (FFT)
MS8609A-04	Digital Resolution Bandwidth
MS8609A-05	Rubidium Reference Oscillator
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 (JIS)
MS8609A-48	Rack Mount without Handle (IEC)
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	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	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
MA1612A	Four-point Junction Pad (5 to 3000 MHz)
J0395	High-power Fixed Attenuator (30 dB, 30 W, DC to 9 GHz)
B0472	High-power Fixed Attenuator (30 dB, 100 W, DC to 18 GHz)
B0452A	Hard Carrying Case (with casters)
B0452B	Hard Carrying Case (without casters)
B0329G	Front Cover (3/4 MW4U)
B0488	Rear Panel Protective Pad
B0480	Tilt Handle Soft Type
A3933	Circulator (1760 to 2115 MHz)
H3930	Isolator (1760 to 2115 MHz)
W1746AE	W-CDMA Operation Manual
W1795AE	MX860x02A Operation Manual
W1865AE	MX860x03A/MX268x03A Operation Manual
W1866AE	MX860x05A/MX268x05A Operation Manual
W2090AE	MX860x04A/MX268x04A Operation Manual
W2154AE	MX860820A/MX860920A Operation Manual
W2080AE	MX268x30A/MX860x30A Operation Manual
W2131AE	MX860x50A Operation Manual
W2617AE	W-CDMA Release 5 Uplink Measurement Software Operation Manual
W2593AE	TD-SCDMA Measurement Software 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

CE 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 50 Ω, VSWR: ≤1.2 (≤3 GHz), ≤1.3 (>3 GHz) Low-power input Power meter: 50 Ω, VSWR: ≤1.3 (≤3 GHz) Except power meter: 50 Ω, 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), 50 Ω 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 x 10^{-8} (after 10 minute warm-up, compared to frequency after 24 hour warm-up) Aging rate: ≤2 x 10^{-8}/day, ≤1 x 10^{-7}/year (compared to frequency after 24 hour warm-up) Temperature characteristics: ≤5 x 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 to 7.8 GHz (Band: 1) ∗Setting resolution: 1 Hz Pre-selector range: 3.15 to 7.8 GHz (Band: 1) Frequency accuracy Display accuracy: ± (display frequency x reference frequency accuracy + span x span accuracy + resolution bandwidth x 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% (at 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 to 3.2 GHz, Band 0, input attenuator: 20 dB) ≤–100 dBm + 0.8f [GHz] dB (high-power input, 3.15 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 to 3.2 GHz, Band 0, input attenuator: 20 dB) ≤–100 dBm + 0.8f [GHz] dB (high-power input, 3.15 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 to 3.2 GHz, Band 0, input attenuator: 0 dB) ≤–120 dBm + 0.8f [GHz] dB (low-power input, 3.15 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 to 3.2 GHz, Band 0, input attenuator: 0 dB) ≤–120 dBm + 0.8f [GHz] dB (low-power input, 3.15 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 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 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 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 to 200 MHz, Band 0, mixer input: –30 dBm) ≤–75 dBc (200 to 850 MHz, Band 0, mixer input: –30 dBm) ≤–70 dBc (0.85 to 1.6 GHz, Band 0, mixer input: –30 dBm) ≤–90 dBc (1.6 to 3.9 GHz, Band 1, mixer input: –10 dBm) Two tone 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–85 dBc (0.1 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 or 100 ns, whichever 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)

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/$\sqrt{\text{Hz}}$ 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 x 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 x 2, Lower limit x 2 Mask measurement (frequency sweep): Upper limit x 2, Lower limit x 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 (3.3/5 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) x 177 (H) x 411 (D) mm (except handle, feet, front cover and fan cover), ≤16 kg (nominal)
Power supply		100 to 120/200 to 240 Vac (–15%/+10%, max. voltage: 250 V, voltage auto-switching), 47.5 to 63 Hz, ≤400 VA
Operating temperature and humidity		0° to 50°C, ≤85% (no condensating)
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, 2.6 m: 1 pc
J0996B	RS-232C Cable: 1 pc
Z0744	Memory Card (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 x 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-05	Rubidium Reference Oscillator
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	RER/BLER Measurement Software
	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
W1746AE	W-CDMA 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	W-CDMA Release 5 Uplink Measurement Software Operation Manual
W2593AE	TD-SCDMA Measurement Software Operation Manual
	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-way Junction Pad (5 to 3000 MHz)
J0395	High-power Fixed Attenuator (30 dB, 30 W, DC to 9 GHz)
B0472	High-power Fixed Attenuator (30 dB, 100 W, DC to 18 GHz)
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
B0452A	Hard Carrying Case (with casters)
B0452B	Hard Carrying Case (without casters)
B0329G	Front Cover (3/4MW4U)
B0488	Rear Panel Protective Pad
B0480	Tilt Handle Soft Type
A3933	Circulator (1760 to 2115 MHz)
H3930	Isolator (1760 to 2115 MHz)
	Maintenance service
MS8608A-90	Extended Three Year Warranty Service
MS8608A-91	Extended Five Year Warranty Service

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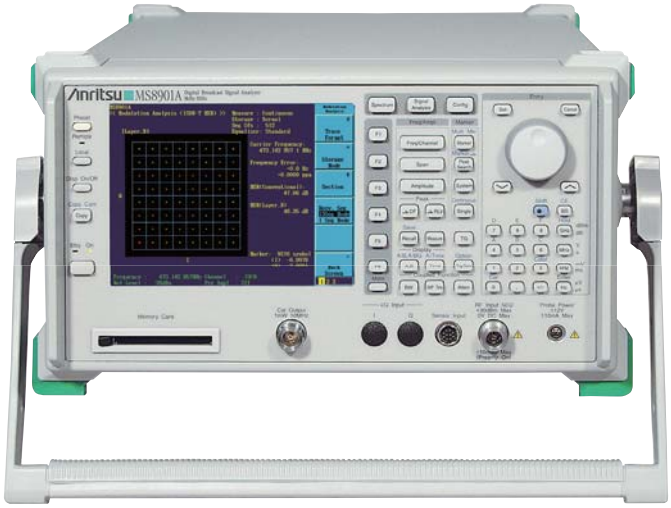
DIGITAL BROADCAST SIGNAL ANALYZER

MS8901A

9 kHz to 3 GHz

GPIB

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.

Features

- Fusion of RF microwave and DSP technologies
- All-in-one

Applications

• 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. The efficient system bus linking each module supports a system-independent platform.

• System Upgrade

The MS8901A is easily tailored to each broadcast system by installing measurement software with functions matching the system requirements.

• PCMCIA Card Slot

For the external memory interface, the ATA flash memory card is employed. This ATA flash memory card is better suited for notebook computer. The large quantity of measurement data or the parameter setting status in the field can be saved on a single 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.

• SSB Phase Noise Characteristics of High Purity

MS8901A uses the synthesizer, of which SSB phase noise characteristic is –95 dBc/Hz (1 kHz offset Note) 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.

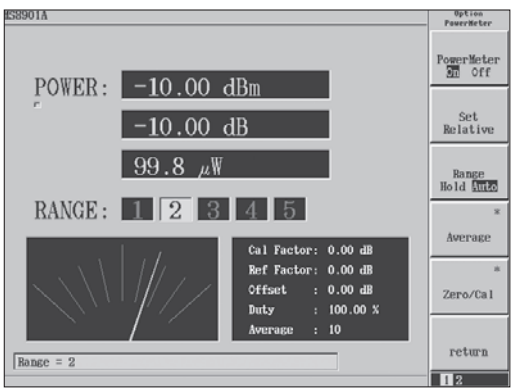
• High-performance Spectrum Analyzer

MS8901A includes the spectrum analyzer as standard equipment. In this spectrum analyzer, the high-performance frequency converter is installed. This analyzer features various display screens and major functions, which enables to measure frequency counter, occupied bandwidth, and channel power.

• Power Measurement of High Accuracy

Power Meter Function (Option)

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.
With this MS8901A, the user can remove the burden of bringing the power meter separately and the measurement is enabled with more efficiency in the field.



• 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.

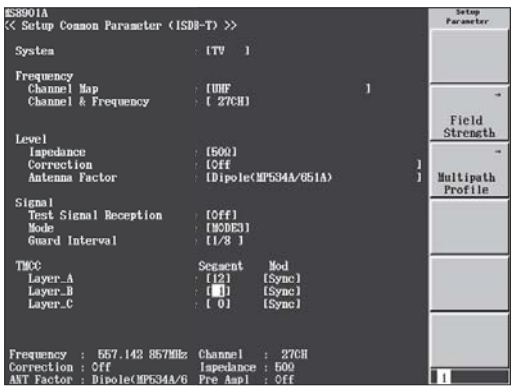
• Speeds-up System and Device Production Lines

The fast, 20-times-a-second refresh rate of the spectrum analyzer plus 120-bps GPIB interface supports faster measurement with higher production efficiency on system and device production lines.

MX890110A ISDB-T Field Test Software

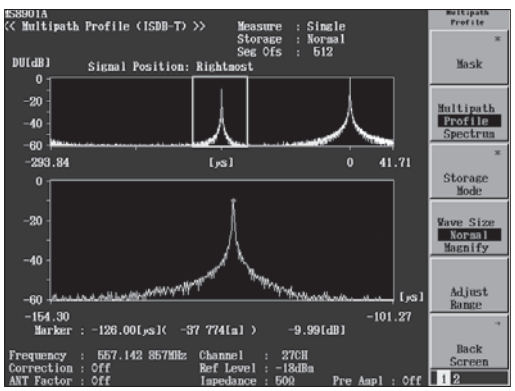
• For SFN Field Maintenance

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

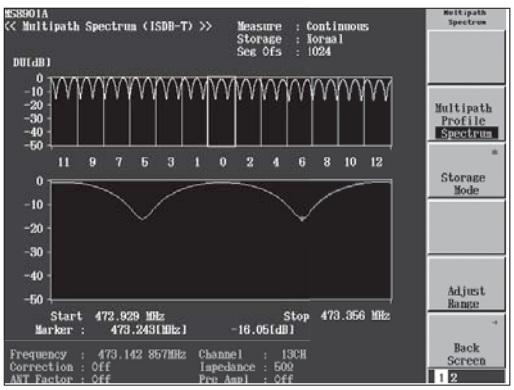
To assure that SFN network repeaters use the same frequency at the input and output sides, the repeater output is bypassed to the input side to generate echo. The echo can be analyzed using the delay profile measurement function because the same characteristics as the delay profile are displayed.

• 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.

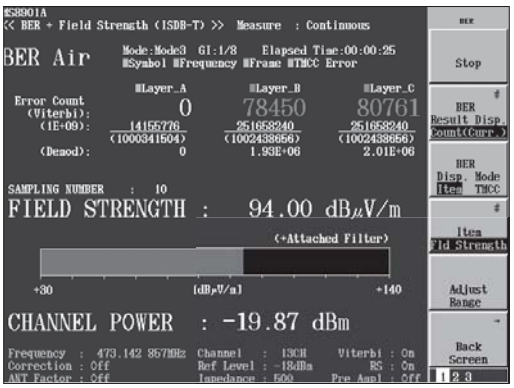


• For ISDB-T SFN Installation and Field Maintenance
Repeater Bypass Canceller Operation Test

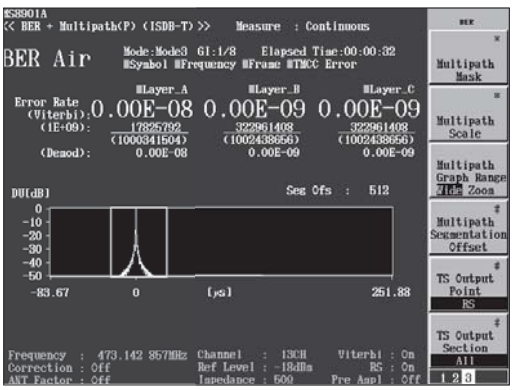
When a canceller is used to suppress repeater bypass, the frequency ripple generated by echo becomes flat. The multipath spectrum measurement function can be used to accurately measure how much the ripple is improved.

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.



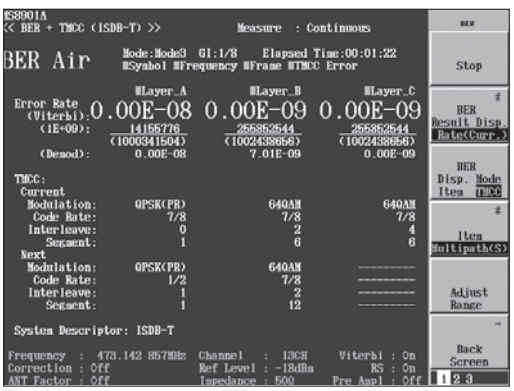
BER (Count) + Field Strength



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.



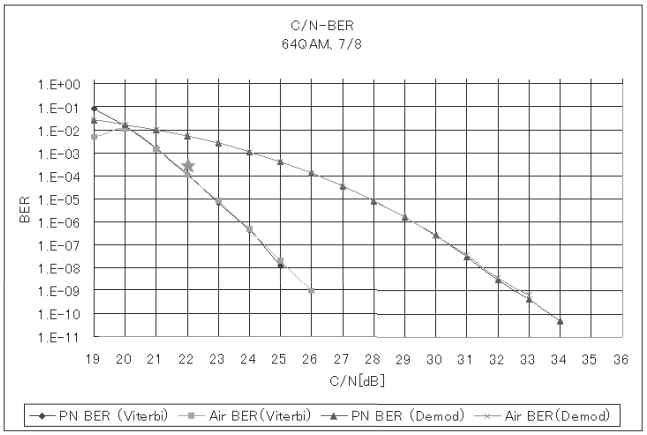
BER + TMCC Information

- **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**



MX890120B ISDB-T Signal Analysis Software For ISDB-T Broadcast Equipment Monitoring and Maintenance

- **All-in-one for Broadcast Equipment Measurements**

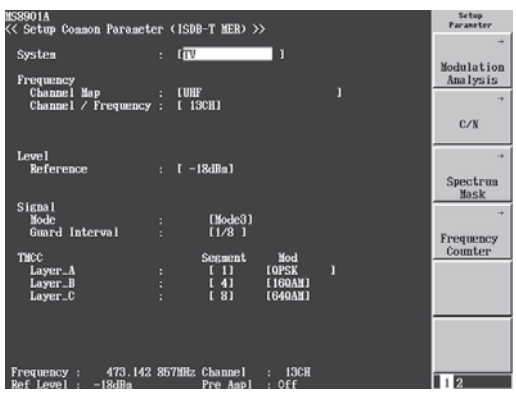
The MX890120B ISDB-T Signal Analysis Software is application software for the MS8901A. Installing it in the MS8901A supports the MER measurements needed for manufacturing and maintaining ISDB-T terrestrial digital transmitters and repeaters, as well as for signal analysis using constellation displays, 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.

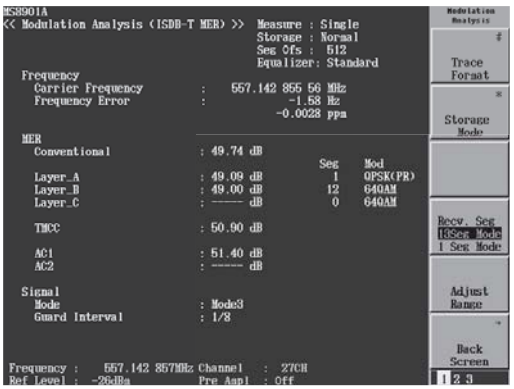


• Modulation Frequency Measurement

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 (MODE 3). 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.

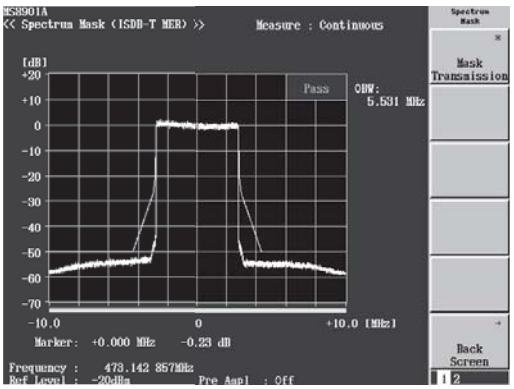
• MER (Modulation Error Ratio) Measurement Function

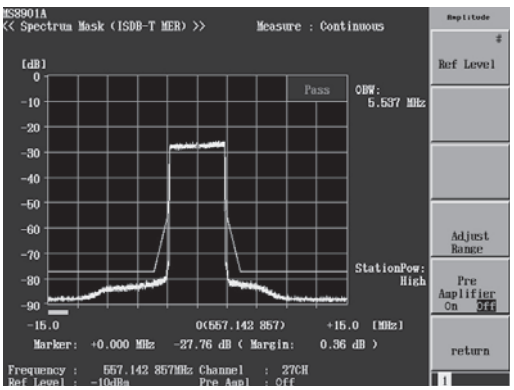
The Modulation Error Ratio (MER) is defined as the ratio of the vector error power converted from the ideal constellation point to the power of the ideal constellation point. MER is used by the European DVB standard as an index of the OFDM modulation signal quality. The MX890120B supports MER measurement 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 two 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.

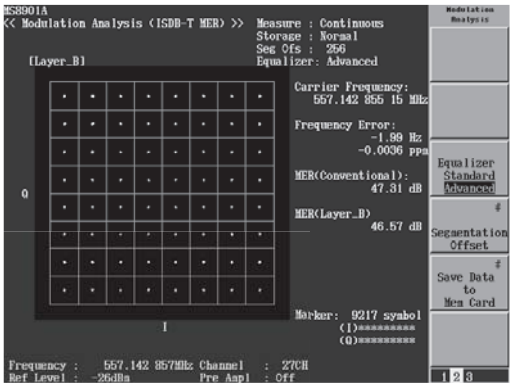


Figure 1 Advanced Mode: Constellation Monitor Screen

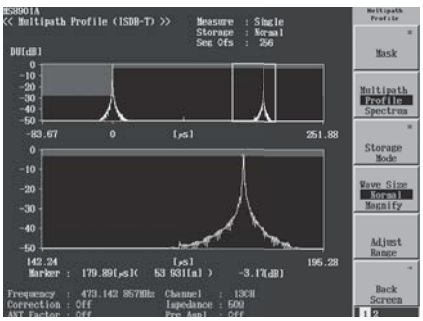
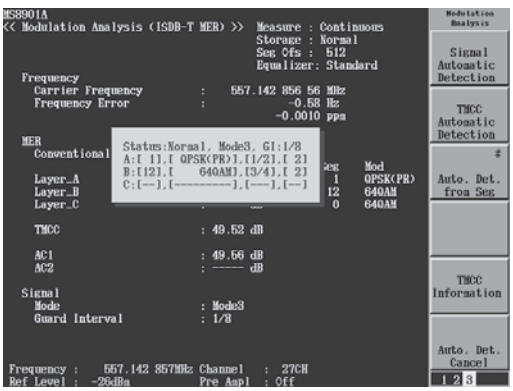


Figure 2 Delay profile measurement screen using MX890110A ISDB-T Field Test Software

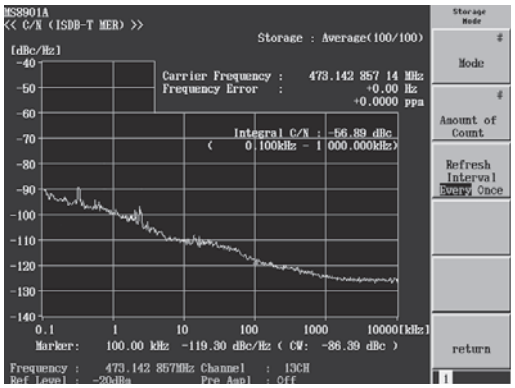
• Transmission Parameter Detection Function

Inputting the input signal frequency (channel) at ISDB-T signal analysis allows one-touch detection and setting of transmission parameters (MODE, GI, TMCC data).



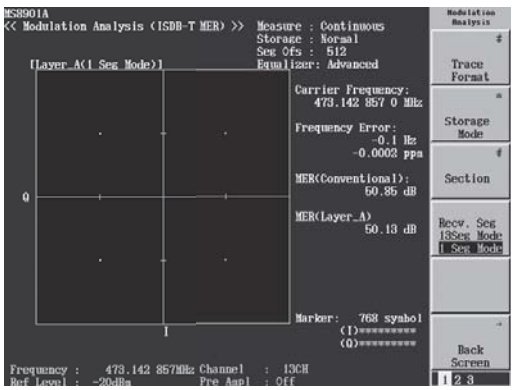
• C/N, C/N Integer Function

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.



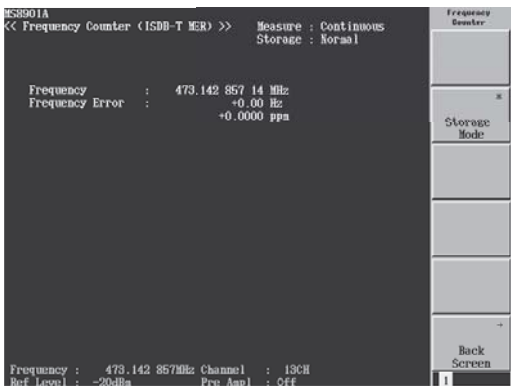
• One Segment Analysis Function

The only one segment of the ISDB-T signal can be measured to display the constellation and perform MER analysis.



• Frequency Counter Functions

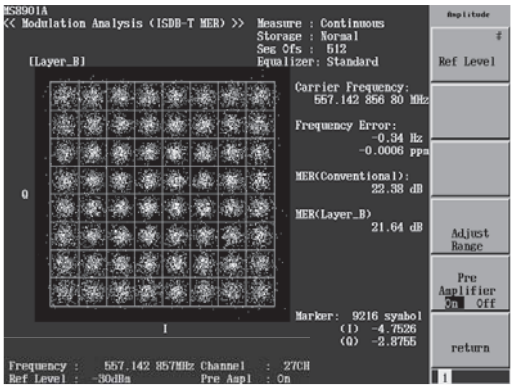
The frequency counter function can be used to measure the continuous waveform over a range of 3.9 to 1000 MHz at a display resolution of 0.01 Hz.

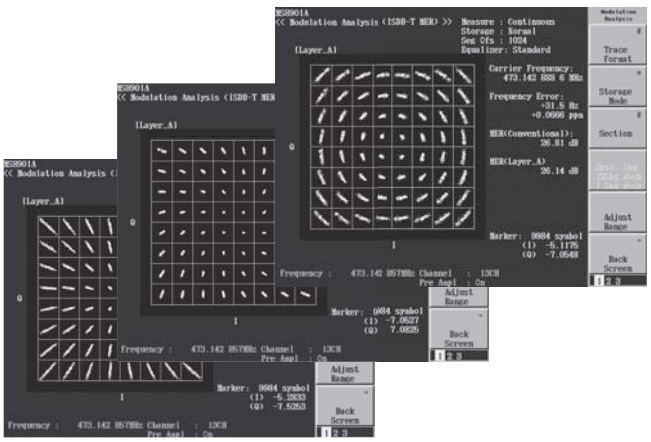


For R&D and Design Ranging from ISDB Devices to STB

• 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.

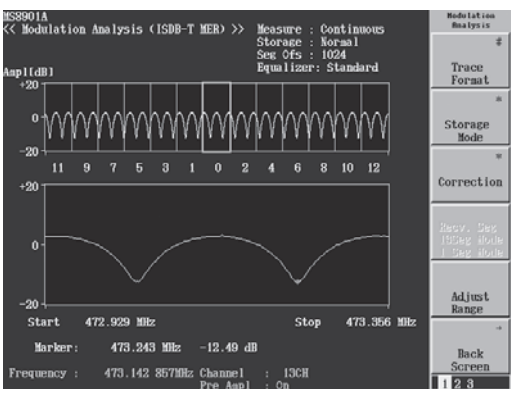




• Frequency Characteristics Measurement

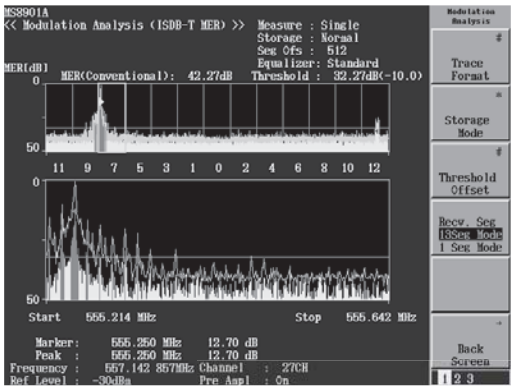
This function displays the 5.57-MHz in-band frequency characteristics using SP and CP in the OFDM modulation signal. The in-service frequency characteristics of transmitters and repeaters can be monitored using the modulation signal.

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.



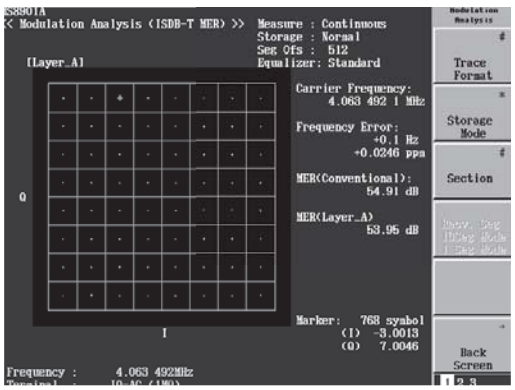
Option

• 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.

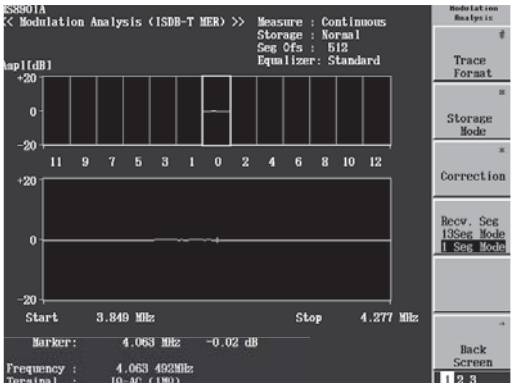
• MER (Modulation Error Ratio) Measurement

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

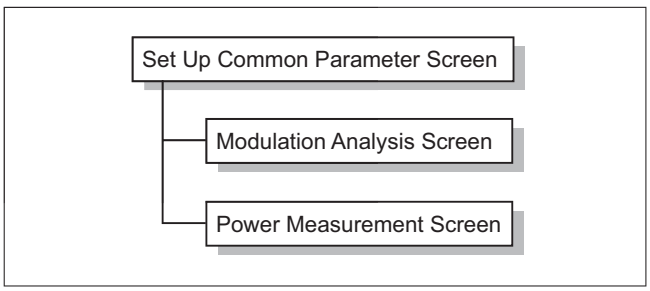
The MX890140A Digital CATV Analysis Software is installed in the MS8901A to support analysis of ITU-T J83 Annex B/C Digital CATV downlink signals for measuring MER and residual noise required to monitor and maintain digital CTAV networks.

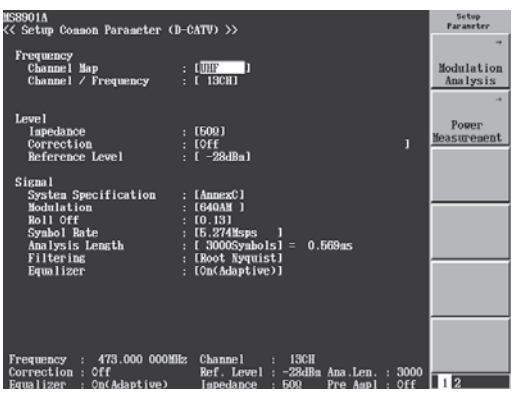
MX890140A Measurement Items

- 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.





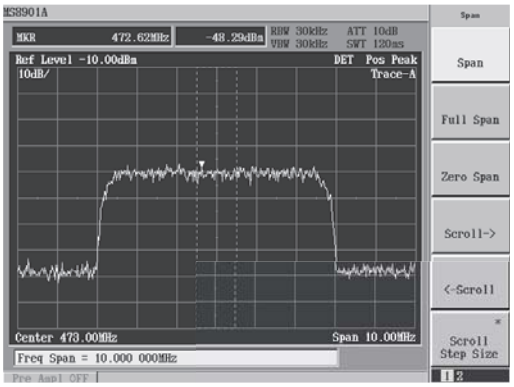
Setup Common Parameter Screen

Versatile Measurement Items

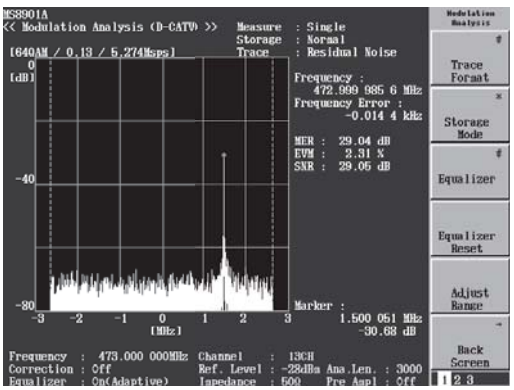
In addition to general modulation analysis items such as vector error, the MX890140A supports the important measurement items defined by ETSI TR 101 290, such as MER.

• 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.



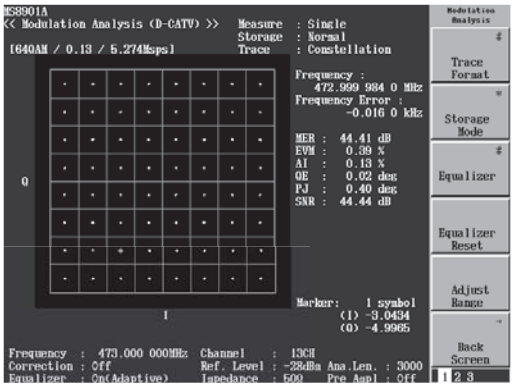
Spectrum Waveform



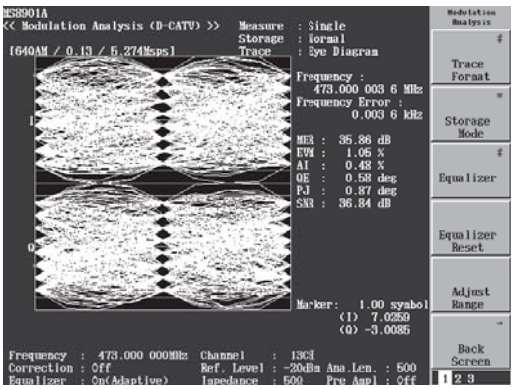
Residual Noise Display

• 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 readout accuracy	± (frequency readout x reference frequency accuracy + span x span accuracy + resolution bandwidth x 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 x 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 x 10^{-8}/day , ≤1 x 10^{-7}/year (referred to frequency after 24 hour warm-up) Temperature characteristics: ±5 x 10^{-8} (0 to 50˚C, referred to frequency at 25˚C)
Amplitude	Level measurement	Measuring range Average noise level to +30 dBm (pre-amplifier Off) Average noise level to +10 dBm (pre-amplifier On) Maximum input level +30 dBm (CW average power, input attenuator: 10 dB pre-amplifier Off), ±0 V (DC) +10 dBm (CW average power, pre-amplifier Off) Average noise level: Pre-amplifier On ≤–139 dBm + 2 x f [GHz] dB (1 MHz to 2.5 GHz) Pre-amplifier Off ≤–124 dBm + 2 x f [GHz] dB (1 MHz to 2.5 GHz) ≤–120 dBm + 2 x f [GHz] dB (2.5 to 3 GHz) (input attenuator: 0 dB, RBW: 300 Hz, VBW: 1 Hz, Detection mode: Sample) Residual response: ≤–100 dBm (1 MHz to 3.0 GHz) (input attenuator: 0 dB, input: 50 Ω termination)
	Reference level	Setting range Pre-amplifier Off Log scale: –100 to +40 dBm or equivalent level Linear scale: 2.24 µV to 22.4 V Pre-amplifier On Log scale: –120 to +10 dBm or equivalent level Linear scale: 0.224 µV to 707 mV Unit Log scale: dBm, dBV, dBmV, dBV (emf), W, dBV/m Linear scale: V Reference level accuracy: Pre-amplifier 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) Pre-amplifier 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 calibration, at 50 MHz frequency, span 1 MHz (when input attenuator, resolution bandwidth, video bandwidth, and sweep time set to AUTO) Resolution bandwidth switching uncertainly: ±0.3 dB (300 Hz to 5 MHz, pre-amplifier Off), ±0.5 dB (300 Hz to 5 MHz, pre-amplifier On) *After calibration, referenced to resolution bandwidth 3 kHz Input attenuator (input attenuator) Setting range: 0 to 62 dB, 2 dB step (manually or automatically settable according to reference level) Switching uncertainly: Pre-amplifier Off ±0.3 dB (10 to 50 dB), ±0.5 dB (52 to 62 dB) *After calibration, referenced to input attenuator 10 dB Input attenuator switching mode: 2, 10 dB step mode
Frequency	Frequency response	Referred to 50 MHz frequency, input attenuator 10 dB, temperature 18˚ to 28˚C ±0.6 dB (9 kHz to 3.0 GHz, pre-amplifier Off) Referred to 50 MHz frequency, input attenuator 10 to 62 dB ±1.0 dB (9 kHz to 3.0 GHz, pre-amplifier Off)

Continued on next page

Frequency	Scale fidelity	Scale: 10 div Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Pre-amplifier 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 Pre-amplifier 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
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, mixer input level –30 dBm) ≤–72 dBc (0.2 to 0.85 GHz, mixer input level –30 dBm) ≤–70 dBc (0.85 to 1.5 GHz, mixer input level –30 dBm) 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), –85 dBc (0.1 to 3.0 GHz) *Frequency reference of two signal: ≥50 kHz, mixer input level –30 dBm Image response: ≤–70 dBc
	1 dB gain compression	At mixer input level Pre-amplifier Off ≥0 dBm (≥100 MHz), ≥+3 dBm (≥500 MHz) Pre-amplifier On ≥–35 dBm (≥100 MHz)
	Maximum dynamic range	1 dB gain compression vs. Averaging noise level 124 dB – 2f [GHz] dB (≥100 MHz, nominal) *At RBW = 300 Hz
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 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 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 or 100 ns Post-trigger: Display waveform before triggering Setting range: 0 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, View, Max Hold, Min Hold, 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, ΔMarker → Span, Zone → Span
	Peak search	Peak, Next Peak, Min Dip, Next Dip
	Multi marker	Number of points: 10 max. (Highest 10, Harmonics, Manual Set)

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Function	Detection mode	Noise power: dBm/Hz, dBm/CH, dBV/$\sqrt{\text{Hz}}$ C/N: dBc/Hz, dBc/CH Occupied bandwidth: power N% method, X dB Down method Adjacent channel leakage power: 2 channels x 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 x each 2 (time domain) MASK: upper/lower limits x each 2 (time domain)
	Correction	The user can correct frequency response optionally, max 150 points Auto correction of MA1621A impedance transformer insertion loss correction accuracy (input attenuator 10 dB): ±2.5 dB (9 k to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 GHz to 3 GHz) Typical value
General specification	Display	Color TFT-LCD, Size: VGA 17 cm (6.5” Type), Number of colors: 4096 (RGB, 16-scale settable) Brightness: 5-scale settable (include Off)
	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 CompactFlash 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, jack
	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 50 Ω, VSWR 1.5 typ. (input attenuator 10 dB)
	IF output	BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Output level: –10 dBm typ. (frequency 50 MHz, at upper edge of display scale)
	Wideband IF output	BNC, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Gain: 0 dB typ. (frequency 50 MHz, input attenuator 0 dB)
	Video output (Y)	BNC, 75 Ω 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 50 MHz, at upper edge of display scales)
	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 (50 Ω termination)
	Buffered output	BNC connector Frequency: 10 MHz Output level: 2 to 5 Vp-p (200 Ω termination)
	Sweep output (X)	BNC connector Output level: 0 to 10 V ±1 V (100 k 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) x 177 (H) x 411 (D) mm (exclude handle, legs, front cover, fan cover)
	Mass	≤16 kg nominal value
	Power supply (operating range)	85 to 132 V, 170 to 250 V (automatic voltage change), 47.5 to 63 Hz, ≤400 VA
	Temperature range	Operating: 0˚ to +50˚C, ≤RH85% Storage: –20˚ to +60˚C

*: 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 x 10^{-10}/day (referred to frequency after 24 hour warm-up)
Temperature stability	≤5 x 10^{-10} (0 to 50˚C, referred to frequency at 25˚C)
Warm-up time within ≤5 x 10^{-8}	10 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, 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, Detection mode: Sample Pre-amplifier Off ≤–146.3 dBm + 1.5 x f [GHz] dB (typ.) (1 MHz to 2.5 GHz) ≤–144.3 dBm + 1.5 x f [GHz] dB (typ.) (2.5 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% nominal (RBW ≤30 Hz) Resolution Bandwidth Selectivity: ≤5:1 (RBW ≥100 Hz), ≤5:1 nominal (RBW ≤30 Hz) 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, Detection mode: Sample Pre-amplifier Off ≤–134.5 dBm + 1.5 x f [GHz] dB (typ.) (1 MHz to 2.5 GHz) ≤–130.5 dBm + 1.5 x f [GHz] dB (typ.) (2.5 to 3.0 GHz)

Option 05: Rubidium Reference Oscillator (Option 25 is an option retrofit)

Frequency	10 MHz
Start characteristic	±1 x 10^{-9} *Referred to frequency, temperature 25˚C after power on 7 min, 60 min
Aging rate	±1 x 10^{-10}/month *Referred to frequency, after power on 60 min
Temperature characteristic	±1 x 10^{-9} (0 to 45˚C, referred to Frequency, temperature 25˚C)
Appendant	J1066 coaxial code, 0.15 m (BNC211-LP4)

Option 09: Ethernet Interface

Function	Controlled by the external computer (Except power switch)
Connector	10BASE-T

Option 18: Low IF/IQ Unbalance Input

Outline	Low IF and IQ analysis is enabled by installing the optional measurement software MX890120B.
Connector	BNC x 2 (IQ connector added on the front panel)
Impedance	1 MΩ (Parallel capacitance: less than 100 pF), 50 Ω selectable
Input level range	0.1 to 1.0 Vp-p (at input connector) Unbalance DC coupling/AC coupling switchable

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 x 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 Measurement 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 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) x 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) x 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) x 6 + 0.142857 MHz 4 ≤ N ≤ 7: 173 + (N – 4) x 6 + 0.142857 MHz 8 ≤ N ≤ 12: 195 + (N – 8) x 6 + 0.142857 MHz • UHF: A frequency calculated from the following expression with N = 13 to 62 (channels) can be set. 473 + (N – 13) x 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) x 6 + 0.142857 MHz N = 22: 167.142857 MHz 23 ≤ N ≤ 63: 225 + (N – 23) x 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)	Pre-amplifier Off: –28 to +10 dBm (setting resolution: 2 dB) Pre-amplifier 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 pre-amplifier 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 distortion	Pre-amplifier Off, input attenuator 0 dB, CW signal, 93 dBμV(emf) input, 2-tone signal frequency difference 6 MHz: ≤ –56 dBc Pre-amplifier On, input attenuator 0 dB, CW signal, 73 dBμV(emf) input, 2-tone signal frequency difference 6 MHz: ≤ –53 dBc
	1 dB gain compression	Pre-amplifier Off, input attenuator 0 dB, OFDM signal conforming to ISDB-T: ≥107 dBμV(emf) Pre-amplifier 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) (pre-amplifier Off), 27 to 103 dBμV(emf) (pre-amplifier On) Accuracy: ±2 dB (average value from sampling count of 100) Resolution: 0.01 dB Noise floor: ≤35 dBμV(emf) (pre-amplifier Off), ≤19 dBμV(emf) (pre-amplifier 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

Continued on next page

<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 (Pre-amplifier Off) (typ.), –86 to –10 dBm (Pre-amplifier 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="11">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: 0 to –60 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 (Pre-amplifier Off), 43 dBµV(emf) or greater (Pre-amplifier 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 sec/0 dB, Path2: 0.95 GI/–3 dB
Path1: 0 sec/0 dB, Path2: 1.48 µs/–3 dB
Path1: 0 sec/0 dB, Path2: 0.95 GI/–20 dB
Path1: 0 sec/0 dB, Path2: 3.69 µs/–20 dB
Path1: 0 sec/0 dB, Path2: 0.95 GI/–30 dB
Path1: 0 sec/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: 0 to –60 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.
LIN: Converts the D/U value and relative level value once to a antilog value for averaging.</td></tr>
<tr><td rowspan="2">Level correction</td><td>Antenna factor</td><td>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</td></tr>
<tr><td>Impedance switch</td><td>50 Ω
75 Ω: The insertion loss of the MA1621A impedance converter is automatically corrected.</td></tr>
</table>

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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 sec. (= 99 h 59 m 59 s), in steps of 1 sec.) • 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: 75 Ω 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: 75 Ω Output level: 800 mVp-p (typ.)

• MX890120B ISDB-T Signal Analysis Software

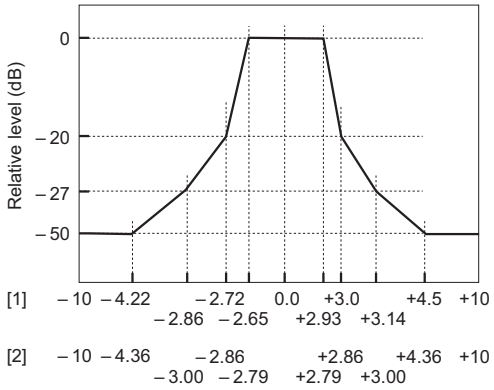
The specifications of the MX890120B are shown in the table below. These specifications are based on when the MX890120B is installed in the MS8901A. For performance specifications, each value is assumed to be obtained by implementing calibration after 30-minute preheating under constant ambient temperature conditions.

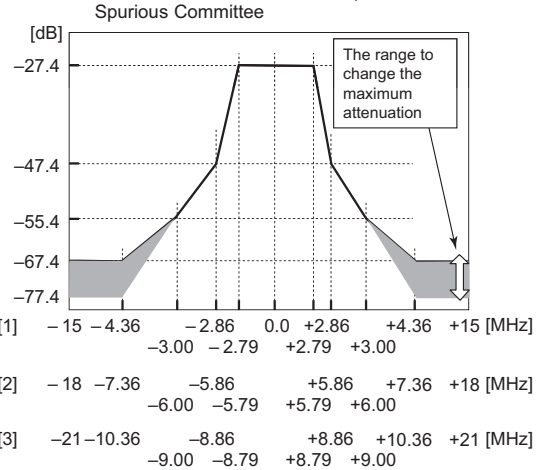
Frequency	Setting range	When Interim-1 or Interim-2 is selected for Channel Map: 13 to 32 channels When UHF is selected for Channel Map: 13 to 62 channels Center frequency of transmission bandwidth for N channels: 473 + (N-13) x 6 + 0.142857 MHz (Interim-1, UHF) 473 + (N-13) x 6 + 0.15 MHz (Interim-2) General is selected for Channel Map: 32 to 3000 MHz, 1 Hz steps IF Band is selected for Channel Map: 3.9 to 38 MHz, 1 Hz steps VHF is selected for Channel Map: 1 to 12 channel Nch center frequency of VHF 1 ≤N ≤3: 93 + (N-1) x 6 + 0.142857 MHz 4 ≤N ≤7: 173 + (N-4) x 6 + 0.142857 MHz 8 ≤N ≤12: 195 + (N-8) x 6 + 0.142857 MHz CATV is selected for Channel Map Channel: 13 to 63 Nch center frequency for CATV 13 ≤N ≤21: 111 + (N-13) x 6 + 0.142857 MHz N = 22: 167.142857 MHz 23 ≤N ≤63: 225 + (N-23) x 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 (Pre-amplifier Off) –46 to –10 dBm (Pre-amplifier 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 to 1000 MHz
	Frequency lock range	±99 kHz
	Level range	–26 to +10 dBm (Pre-amplifier Off), –46 to –10 dBm (Pre-amplifier 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 x 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 x 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: 64 QAM, average count: 5, ±0.15 Hz + (reference frequency accuracy x measurement frequency) When average count: 40 in the above condition ±0.1 Hz + (reference frequency accuracy x measurement frequency)
	MER measurement item	Conventional (overall) Layer_A Layer_B Layer_C TMCC AC1 AC2
	Residual MER	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, Pre-amplifier Off, average count: 10, 13 segments; ≥44 dB (37.15 MHz, typ.) ≥42 dB (500 MHz, typ.)

Continued on next page

<table>
<tr><td rowspan="5">Modulation analysis</td><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 when Advanced is selected for the Equalizer switch function, invalid values are included at the measurement point.</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 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>Mode \ Guard interval</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 Segment)
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 rowspan="8">C/N</td><td colspan="2">For CW (continuous wave)</td></tr>
<tr><td>Frequency range</td><td>32 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 (Pre-amplifier Off) or –40 to –10 dBm (Pre-amplifier On), for input signal of ±1 kHz from the set frequency, average count: 5; ±0.1 Hz + (reference frequency accuracy x 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 (Pre-amplifier Off), –40 to –10 dBm (Pre-amplifier 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="20">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 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 to 1000 MHz:
–22 to +10 dBm (Pre-amplifier Off)
–42 to –10 dBm (Pre-amplifier On)</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 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
• 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</td></tr>
<tr><td>Average power setting range (Average power)</td><td>0.25 to 2.5 W
Only when the station power is selected to Low</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>

Continued on next page

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].
	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 20 MHz span. Display: Only at 1 channel measurement
	Level range	–22 to +10 dBm (Pre-amplifier Off) (Frequency 32 to 1000 MHz) –42 to –10 dBm (Pre-amplifier On) (Frequency 32 to 1000 MHz)
	Mask line recall	Recalls the spectrum mask line by using a remote control command.
Frequency counter	For CW (continuous wave)	
	Frequency range	3.9 to 1000 MHz
	Frequency measurement accuracy	When input level: –20 to +10 dBm (Pre-amplifier Off) or –40 to –10 dBm (Pre-amplifier On), for input signal of ±1 kHz from the set frequency, average count: 5; ±0.1 Hz + (reference frequency accuracy x 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.
	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.
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 50 Ω selectable
Input level range		0.1 to 1.0 Vp-p (unbalanced input, via input pin) DC connection or AC connection selectable

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

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, 75 Ω/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 to 27 MHz (DVB-ASI)
LEDs	Counting, Syncloss, 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) x 88 (H) x 451 (D) mm, ≤15 kg
Power supply	85 to 250 Vac, 47.5 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

Model/Order No.	Name	
	Main frame	
MS8901A	Digital Broadcast Signal Analyzer	
	Standard accessories	
	Power Code, 2.6 m:	1 pc
	Adapter (tripolar/dipolar conversion):	1 pc
J0996B	RS-232C Cable:	1 pc
JT32MA3-NT1	PC-ATA Card (equivalent Card is OK):	1 pc
F0014	Fuse, 6.3 A:	1 pc
B0329G	Front Cover:	1 pc
MA1621A	50 Ω → 75 Ω Impedance Converter:	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
	Option	
MS8901A-01	Highly-stabilized Standard Crystal Controlled Oscillator (Aging Rate: 5 x 10^{-10}/day)	
MS8901A-02	Narrow-band Resolution Bandwidth (FFT) (1 Hz to 1 kHz)	
MS8901A-04	Digital Resolution Bandwidth (10 Hz to 1 MHz, RMS Detection Function)	
MS8901A-05	Rubidium Standard Oscillator	
MS8901A-09	Ethernet Interface (10BASE-T)	
MS8901A-21	Power Meter Function	
MS8901A-25	Rubidium Standard Oscillator (Retrofit)	
MS8901A-34	4 GHz LO output	
MS8901A-41	Power Meter Function (Retrofit)	
MS8901A-46	Power Return after Electricity Failure	
MS8901A-47	Rack-mount (IEC)	
MS8901A-48	Rack-mount (JIS)	
MU890100A	ISDB-T Demodulation Unit	
	Measurement Software	
MX890110A	ISDB-T Field Test Software (Attached to J1032 UHF Bandwidth Pass Filter)	
MX890120B	ISDB-T Signal Analysis Software	

Model/Order No.	Name
	Application parts
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	GRIB Connecting Cable, 1 m
J0008	GRIB Connecting Cable, 2 m
J1032	UHF Bandwidth Pass Filter (460 to 600 MHz)
MP59B	50 Ω Coaxial Switching Unit (DC to 3 GHz, Manual Switch)
MP640A	Turnouts and Crossing Units (DC to 1,700 MHz)
MP520C	CM Directional Integrating Unit (25 to 500 MHz, 50 Ω)
MP520D	CM Directional Integrating Unit (100 to 1,700 MHz, 50 Ω)
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 to 520 MHz)
MP651A	Dipole Antenna (470 to 1,700 MHz)
MP635A	Log Periodic Antenna (80 to 1,000 MHz)
MP666A	Log Periodic Antenna (200 to 2,000 MHz)
MB9A	Tripod Stand
MB19A	Tripod Stand
B0471A	Hard Carrying Case (Caster Attached)
MA4701A	Amorphous Power Sensor (10 MHz to 18 GHz, –30 to +20 dBm, N connector)
MA4703A	Amorphous Power Sensor (50 MHz to 26.5 GHz, –30 to +20 dBm, N connector)
MA4705A	Amorphous Power Sensor (50 MHz to 32 GHz, –30 to + 20 dBm, N connector)
J0370A	Sensor Code, 1.5 m

• MP8931A

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
	Optional 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	

SITE MASTER

S300D/S800D Series

2 MHz to 20 GHz

CE GPIB

For Analyzing Cable and Antenna Problems

S331D
2 MHz to 6 GHz Cable & Antenna Analyzer

S332D
2 MHz to 6 GHz Cable & Antenna Analyzer,
100 kHz to 3 GHz Spectrum Analyzer

S311D
2 to 1600 MHz cable & antenna analyzer

S312D
2 to 1600 MHz cable & antenna analyzer,
100 kHz to 1600 MHz Spectrum Analyzer

S810D/S820D
2 MHz to 10.5/20 GHz cable & antenna analyzer

Site Master is the instrument of choice for transmission line (coax and waveguide) and antenna installation and maintenance. It is the best way to reduce maintenance expenses and improve quality. It replaces stacks of heavy, expensive, and complex test equipment. Site Master's frequency domain reflectometry technique allows it to locate faults and degradations before they become catastrophic failures, thereby creating huge cost and time savings.
The Site Master is a precision hand-held return loss/SWR and fault location measurement instrument. OSL calibration can be applied to all 1-port measurements (RL/VSWR/Cable Loss/DTF) enabling accurate vector corrected measurements. The Site Master series offers wide frequency coverage, from 2 MHz to 20 GHz. In addition to the standard Return Loss, VSWR, Cable Loss, and DTF cable and antenna measurements, the Site Master series offers High Accuracy Power Meter, Spectrum Analysis, built-in variable bias tee, 2-port measurements, interference analysis, channel scanner, power monitor, and a GPS receiver. Site Masters' Spectrum Analyzer has dedicated routines for one-button measurements of field strength, channel power, occupied bandwidth, adjacent channel power ratio (ACPR), Carrier-to-Interference, and interference analysis. Light weight, rugged design, and wide temperature range make them ideal for field applications. Site Master's proprietary design provides superior immunity to on-channel RF interference, which is important for live site testing.
Handheld Software Tools is a Windows® compatible software program provided with every Site Master unit. This software program provides many useful features, including a database for Site Master measurements, Smith Chart display of S_{11}, zoom capability, a "drag-n-drop" overlay for measurement comparison, the capability to download data to a PC, and the capability to upload data such as custom cable list or traces to selected Site Master models. Advanced printing capabilities are provided by Handheld Software Tools including user definable plot scaling and a multiple plots per page option.
Site Master is the first test tool to provide the required accuracy, interference immunity, and repeatability for transmission line/antenna commissioning, and maintenance of today's wireless systems infrastructures.

Standard Features

- Accurate return loss/SWR and fault location measurements
- Accurately tests RF transmission lines and antennas
- Superior immunity to on-channel interference for testing at co-located antenna sites
- Multilingual user interface:
  English, German, Spanish, French, Chinese, Japanese
- TFT Color display
- Spectrum analysis (S312D, S332D)
- 130, 259, or 517 data points
- Synthesizer accurate to 50 ppm
- Internal memory saves up to 300 traces
- Instrument configuration up to 25 configurations
- Flex Calibration (S331D, S332D, S311D, S312D)
- InstaCal ICN50B (S331D, S332D, S311D, S312D)
- Alphanumeric trace naming
- Time, Date stamp
- Field replaceable battery
- Optical DTF measurements (requires ODTF-10)
- Segmented limit lines
- Six markers
- Graticule lines
- Trace overlay
- Direct printing via RS232 serial port
- Remote operation via RS232 serial port

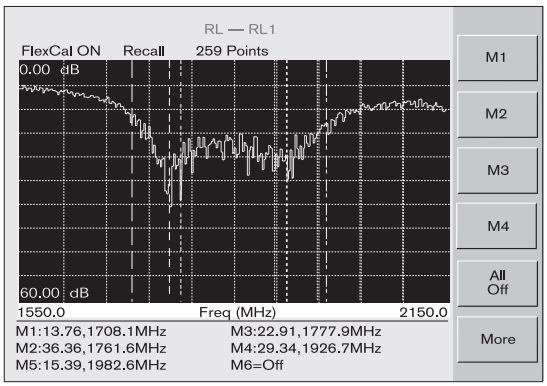
Optional Features

- Add Option 2: 2 MHz low frequency extension
- Option 5: Power Monitor to measure power – external detector needed
- Option 10A: Built-in 12 to 24 V variable bias tee (S312D, S332D)
- Option 16: 6 GHz frequency extension (S331D, S332D) cable & antenna analyzer
- Option 19: High Accuracy Power Meter, requires PSN50 sensor (S331D, S332D, S311D, S312D)
- Option 21: 2-port transmission measurements (S312D, S332D)
- Option 25: Interference Analyzer (S312D, S332D)
- Option 27: Channel Scanner (S312D, S332D)
- Option 28: CW Signal (S312D, S332D)
- Option 29: Internal Power Meter (S331D, S332D, S312D)
- Option 31: Built-in GPS receiver provides latitude, longitude, altitude information with trace data
- Option 50: T1/E1 Analyzer (S331D)

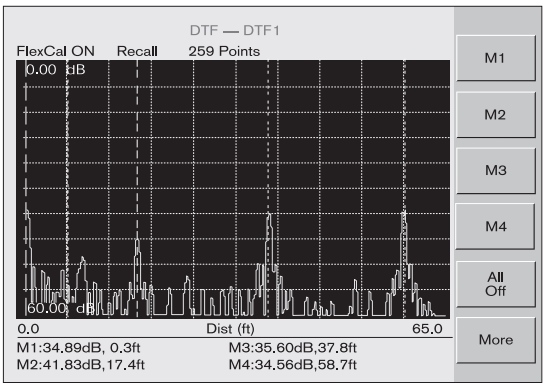
Applications

Cellular, ISM, PCS/PCN, paging service, safety service, avionics, two-way radio, military, and microwave point-to-point radio.
Site Master allows implementation of preventative maintenance procedures. Unlike TDRs and spectrum analyzers/tracking generators, Site Master can spot RF degradation before failures occur. Problems can be fixed before expensive cables or waveguides are ruined.
Site Master is designed for field requirements. Its rugged construction survives rough field treatment. Battery power, light weight, small size, wide temperature range, and simple user interface are exactly what

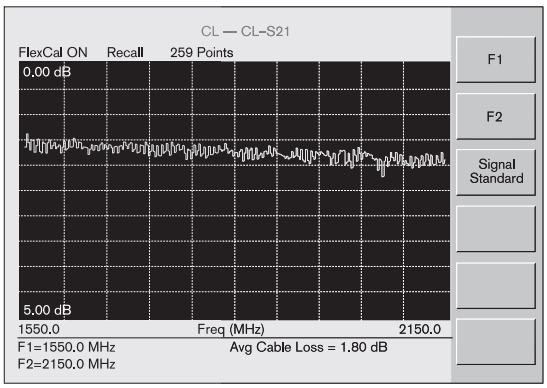
field technicians want today. Technicians can test antennas from ground level because Site Master's distance-to-fault measurement compensates for cable insertion loss. Furthermore, spectrum analysis, available in certain Site Master models, allows technicians and field engineers to quickly identify and solve common RF system problems, such as coverage, interference, and other path related signal problems. Site Master offers a new and better method to install and maintain transmission lines and antennas.



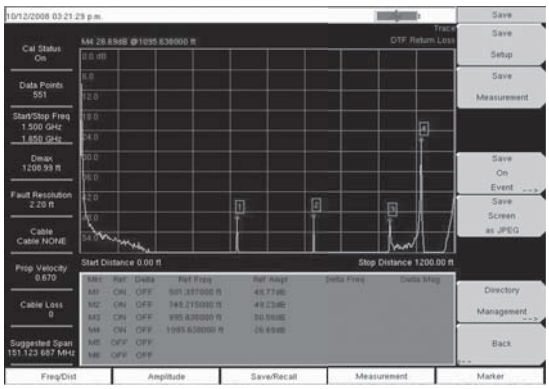
Return Loss



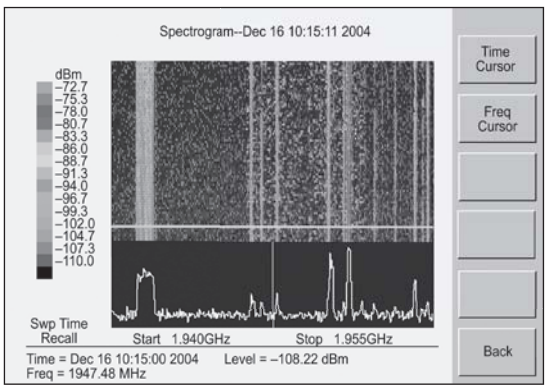
DTF



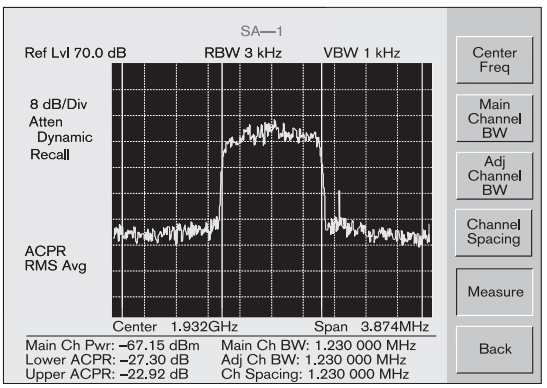
Cable Loss



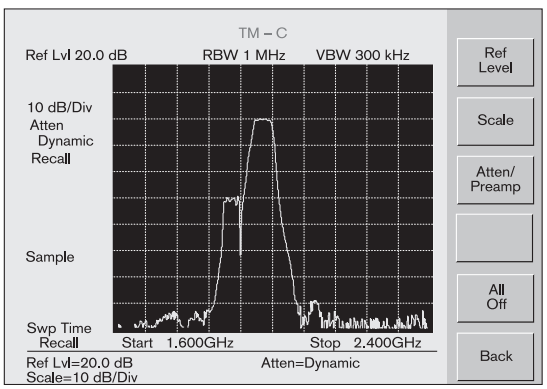
2-port TMA Gain using 251C and bias tee



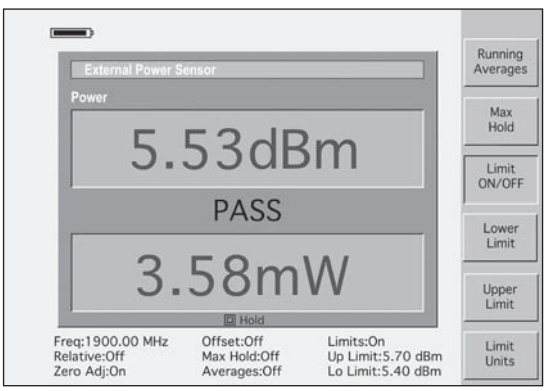
Spectrogram Display using S332D



ACPR using S332D



2-port gain of TMA using Option 21 and Option 10



High Accuracy Power Meter

Specifications*1

Model		S311D	S331D	S312D	S332D	S810D	S820D
Frequency range cable & antenna analyzer		25 to 1600 MHz	25 to 4000 MHz	25 to 1600 MHz	25 to 4000 MHz	25 MHz to 10.5 GHz	25 MHz to 20 GHz
Frequency range spectrum analyzer		N/A		100 kHz to 1600 MHz	100 kHz to 3000 MHz	N/A	
Frequency resolution		1 kHz (CW On) 100 kHz (CW Off)		1 kHz (CW On) 100 kHz (CW Off)		10 kHz	
Frequency accuracy (CW mode)		±75 ppm		±75 ppm		±3 ppm	
Display data points		Selectable: 130, 259, 517					
Immunity to interfering RF signals*2	On-frequency*3	–5 dBm		–5 dBm		–10 dBm	
	On-channel*4	+17 dBm		+17 dBm		+13 dBm	
Return loss		Range: 0 to 60 dB Resolution: 0.01 dB					
VSWR		Range: 1 to 65.53 Resolution: 0.01 dB					
Cable loss		Range: 0 to 30 dB Resolution: 0.01 dB					
Distance-to-fault		Vertical range Return loss: 0 to 60 dB SWR: 1 to 65.53 Horizontal range (meter): 0 to (# of data points – 1) x horizontal resolution, where data points = 130, 259 or 517 Horizontal resolution (Coax cable), using rectangular windowing (meter): (1.5×10^8) (Vp)/Δ frequency*5 Horizontal resolution (Waveguide): (1.5×10^8) x square root $(1 - (F_c/F_1)^2)$/Δ frequency*6					

Option	Description
2 MHz frequency extension, cable & antenna analyzer (Option 2)	2 to 1600 MHz (S810D, S311D, S312D) 2 MHz to 4 GHz (S820D, S331D, S332D)
RF power monitor (Option 5)	Display range: –80 to +80 dBm, 10 pW to 100 kW Measurement range: –50 to +16 dBm (10 nW to 100 mW) Offset range: 0 to +60 dB Resolution: 0.1 dB or 0.1 n/mW Accuracy: ±1 dB max for signals >–40 dBm and <18 GHz (using detector 560-7N50B)
Bias Tee (Option 10A) (S312D, S332D only)	Voltage: Switchable in 1 V steps between 12 and 24 V. Current (A): 6/Voltage (SS), 8/Voltage surge for 50 ms
6 GHz frequency extension, cable & antenna analyzer (Option 16)	Extends upper frequency range to 25 to 6000 MHz (S331D, S332D) Used in conjunction with Option 2, it is possible to get 2 MHz to 6 GHz coverage
High Accuracy Power Meter (Option 19)	Sensor: Measurement Range: –30 to +20 dBm Frequency Range: 50 MHz to 6 GHz Input Connector: Type N, male, 50 W Max Input without Damage: +33 dBm, ±25 VDC Input Return Loss: 50 MHz to 2 GHz: 26 dB, 2 to 6 GHz: 20 dB Accuracy: Total RSS Measurement Uncertainty (0˚ to 50˚C): ±0.16 dB* Noise: 20 nW max Zero Set: 20 nW Zero Drift: 10 nW max** Sensor Linearity: ±0.13 dB max Instrumentation Accuracy: 0.00 dB Sensor Cal Factor Uncertainty: ±0.06 dB Temperature Compression: ±0.06 dB max Continuous Digital Modulation Uncertainty: +0.06 dB (+17 to +20 dBm) *: Excludes mismatch errors. Excludes noise, zero set, zero drift for levels <–20 dBm. Excludes digital modulation uncertainty between +17 and +20 dBm. **: After 30 minute warm-up System: Measurement Resolution: 0.01 dB Offset Range: ±60 dB Power Requirements: Supply Voltage: 8 to 18 Vdc Supply Current: <100 mA
Transmission Measurement RF Source (Option 21) (S312D, S332D only)	Frequency Range: 25 MHz to 3 GHz (S332D), 25 to 1600 MHz (S312D) Frequency Resolution: 10 Hz Output Power Level: –10 dBm typical Dynamic Range: 80 dB, 25 MHz to 2 GHz 60 dB, 2 to 3 GHz

Continued on next page

2-Port Cable Loss (Option 22) (S810D, S820D only)	CW Source Module (CWM220xF) Frequency Range: 2 to 20000 MHz (with S820D), 2 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: CWM220NF: N (f), ±15 VDC, +20 dBm, maximum input, no damage CWM220SF: 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): ±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)
Interference Analyzer (Option 25) (S312D, S332D only)	Displays interference in four different ways: Spectrogram, RSSI, Signal Strength, Signal ID.
Channel Scanner (Option 27) (S312D, S332D only)	Frequency Range: 100 kHz to 3 GHz (S332D), 100 kHz to 1.6 GHz (S312D) Frequency Accuracy: ±10 Hz + Time base error, 99% confidence level Measurement Range: +20 to –100 dBm Channel Power: ±1 dB typical (±1.5 dB max) Adjacent Channel Power Accuracy: ±0.75 dBc
RF Power Meter (Option 29) (S331D, S332D, S312D only)	Frequency Range: 3 MHz to 3 GHz (S331D, S332D), 3 to 1600 MHz (S312D) Measurement Range: –80 to +20 dBm (+80 dBm with 60 dB external attenuator) Display Range: –80 to +80 dBm Offset Range: 0 to +60 dB Accuracy (Excludes Input VSWR): ±1 dB typical (±1.5 dBm max), >2 to 3 GHz, ±0.5 dB typical (±1 dB max.), 3 10 MHz to 2 GHz, ±2 dB typical, 3 to <10 MHz VSWR: 1.5:1 typical (Pin >–30 dBm, 10 MHz to 2.4 GHz) Maximum Power: +20 dBm (0.1 W) without external attenuator
GPS (Option 31)	GPS Location Indicator Latitude, Longitude, and Altitude on Display Latitude, Longitude, and Altitude with trace storage
T1/E1 Analyzer (Option 50) (S331D only)	Line Coding: AMI, HDB3 Framing Modes: PCM30, PCM30CRC, PCM31, PCM31CRC Connection Configurations: Terminate (75 W, 120 W), Bridge (31000 W), Monitor (Connect via 20 dB pad in DSX) Receiver Sensitivity: 0 to –43 dB Transmit Level: 0 dB, –7.5 dB, and –15 dB Clock Sources: External; Internal 2.048 MHz ±30 ppm Pulse Shapes: Conform to ITU G.703 Pattern Generation and Detection: PRBS: 2-9, 2-11, 2-15, 2-20, 2-23 Inverted and non-inverted, QRSS, 1-in-8 (1-in-7), 2-in-8, 3-in-24, All ones, All zeros, T1-Daly, User defined (232 bits) Circuit Status Reports: Carrier present, Frame ID and Sync, Pattern ID and Sync Alarm Detection: AIS, RAI, MMF Error Detection: Frame Bits, Bit, BER, BPV, CRC, E-Bits, Error Sec Error Insertion: Bit, BPV, Framing Bits, RAI, AIS Loopback Modes: Self loopback Level Measurements: Vp-p (±5%) Data Log: Continuous, up to 48 hrs
Spectrum analysis (S312D, S332D only)	
Frequency range	100 kHz to 1600 MHz (S312D) 100 kHz to 3000 MHz (S332D)
Accuracy	±2 ppm
Aging	±1 ppm/yr
Frequency span	10 Hz to 1.599 GHz in 1, 2, 5 step selections in auto mode, plus zero span (S312D) 10 Hz to 2.99 GHz in 1, 2, 5 step selections in auto mode, plus zero span (S332D)
Resolution bandwidth	100 Hz to 1 MHz in 1-3 sequence ±5% Accuracy (S312D, S332D)
Video Bandwidth	3 Hz to 1 MHz in 1-3 sequence ±5% Accuracy (S312D, S332D)
SSB Phase Noise @ (1 GHz) 30 kHz offset	≤ –75 dBc/Hz
Spurious responses (Input related)	≤ –45 dBc
Spurious responses (residual)	≤ –95 dBm
Dynamic range	≥65 dB (S312D, S332D, S332D)
Average noise level	≤–135 dBm typical, ≥10 MHz (preamp on) ≤–115 dBm typical, <10 MHz (preamp on) Input terminated, 0 dB attenuation, RMS detection, 100 Hz RBW
Measurement range	+20 to –135 dBm (S312D, S332D)
Display range	1 to 15 dB/div (S312D, S332D) in 1 dB steps – 10 divisions display
Total level accuracy	±1 dB ≥10 MHz to 3 GHz ±3 dB <10 MHz, (excludes input VSWR mismatch) (S312D, S332D)
RF input VSWR	RF Input VSWR: (20 dB atten) 1.5:1 typical (10 MHz to 1.6 GHz, S312D), (10 MHz to 2.4 GHz, S332D)
Trace memory	300 (S311D, S331D) 15 to 40 setups, 300 (S312D, S332D) 200 (S810D, S820D)

Continued on next page

Setup configuration*7	up to 25 (S311D, S331D) up to 20 (S312D, S332D) 25 (S810D, S820D)
Markers	6 for all models
Test port connector	Precision N female; K female for S810D, S820D (N 10 to 20 setups female connector is Option S8x0D/11NF)
Maximum input level without damage	
RF OUT test port	+23 dBm, 50 Ω, +50 Vdc
RF power detector (S810D, S820D)	+20 dBm, 50 Ω, +50 Vdc
RF power meter (S331D, S332D only)	+43 dBm , 50 Ω, +50 Vdc
RF IN Spectrum analyzer port (S114C only)???	+23 dBm, 50 Ω, ±50 Vdc
RF IN Spectrum analyzer port (S332D only)	+43 dBm, 50 Ω, +50 Vdc
Temperature	Operating: –10˚ to +55°C humidity 85% or less Non-operating: –51˚ to +71°C (recommend battery stored separately between 0°C and +40°C for any prolonged non-operating storage period)
Dimensions and mass	25.4 x 17.8 x 6.1 cm (10 x 7 x 2.4 in), <2.28 kg (<5 lbs.) including battery
General	Electromagnetic compatibility: Meets European community requirements for CE marking. RS232: 9 pin D-sub, three wire serial Safety: Conforms to EN 61010-1 for Class 1 portable equipment. Environmental: Meets MIL-PRF-28800F Class2

∗1: All specifications apply when calibrated at ambient temperature after a five minute warm up.
∗2: In most applications, immunity is typically better because interfering signals are modulated and varying in frequency rather than being CW. Measurements were made in CW mode by injecting a signal into the Site Master through a coupler.
∗3: On-Frequency interference immunity is specified to within +10 kHz of the carrier frequency.
∗4: On-Channel interference immunity is specified to within 1 MHz of the carrier frequency.
∗5: Where Vp is the cable's relative propagation velocity. Δ frequency is the stop frequency minus the start frequency (in Hz). Wide frequency sweeps improve resolution but reduce maximum display range.
∗6: Where Fc is waveguide cutoff frequency (in Hz). F1 is the start frequency (in Hz), Δ F is the stop frequency minus the start frequency (in Hz).
∗7: Calibration stored with instrument configuration.

InstaCal® Calibration Module*

The InstaCal calibration module is available for specified one-port Site Master models (S311D, S312D, S331D and S332D). With InstaCal, users can cut the time required to calibrate the Site Master by as much as 50%. Moreover, InstaCal reduces the potential for calibration error. With discrete calibration components users are required to connect, disconnect, and reconnect the various calibration components during the calibration process, which greatly increases the potential for calibration/measurement error. With InstaCal, users are only required to connect the InstaCal calibration module once – the calibration process sequences automatically, ensuring an accurate calibration of the Site Master. The benefit is calibrated measurements in much less time.

∗: The InstaCal® Calibration Module exhibits slightly degraded directivity performance compared to precision loads. Users having applications that require DTF-RL measurements
> | 38 dB | may want to consider using precision load calibration components in place of the InstaCal calibration module for greater measurement accuracy.

Universal Waveguide Component Accessories

	Part number*2	Freq. range	Waveguide type	Compatible flanges
Precision waveguide calibration components*1	XXUM40	3.30 to 4.90 GHz	WR229, WG11A	PDR40
	XXUM48	3.95 to 5.85 GHz	WR187, WG12	CAR48, PAR48, UAR48, PDR48
	XXUM70	5.85 to 8.20 GHz	WR137, WG14	CAR70, PAR70, UAR 70, PDR70
	XXUM84	7.05 to 10.00 GHz	WR112, WG15	CBR84, UBR84, PBR84, PDR84
	XXUM100	8.20 to 12.40 GHz	WR90, WG16	CBR100, UBR100, PBR100, PDR100
	XXUM120	10.00 to 15.00 GHz	WR75, WG17	CBR120, UBR120, PBR120, PDR120
	XXUM140	12.4 to 18.00 GHz	WR62,WG18	CBR140, UBR140, PBR140, PDR140
	XXUM220	17.00 to 26.5 GHz	WR42, WG20	CBR220, UBR220, PBR220, PDR220
	XXUA187	3.95 to 5.85 GHz	WR187, WG12	CPR187F, CPR187G, UG-1352/U, UG-1353/U, UG-1728/U, UG-1729/U, UG-148/U, UG-149A/U
	XXUA137	5.85 to 8.20 GHz	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
	XXUA112	7.05 to 10.00 GHz	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
	XXUA90	8.20 to 12.40 GHz	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
	XXUA62	12.40 to 18.00 GHz	WR62, WG18	UG-541A/U, UG-419/U, UG-1665/U, UG1666/U
	XXUA42	17.00 to 26.50 GHz	WR42, WG20	UG-596A/U, UG-595/U, UG-597/U, UG-598A/U
Precision waveguide-to-coaxial adapters*1	35UM40N	3.30 to 4.90 GHz	WR229, WG11A	PDR40
	35UM48N	3.95 to 5.85 GHz	WR187, WG12	CAR48, PAR48, UAR48, PDR48
	35UM70N	5.85 to 8.20 GHz	WR137, WG14	CAR70, PAR70, UAR 70, PDR70
	35UM84N	7.05 to 10.00 GHz	WR112, WG15	CBR84, UBR84, PBR84, PDR84
	35UM100N	8.20 to 12.40 GHz	WR90, WG16	CBR100, UBR100, PBR100, PDR100
	35UM120N	10.00 to 15.00 GHz	WR75, WG17	CBR120, UBR120, PBR120, PDR120
	35UM140N	12.40 to 18.00 GHz	WR62, WG18	CBR140, UBR140, PBR140, PDR140
	35UM220K	17.00 to 26.5 GHz	WR42, WG20	CBR220, UBR220, PBR220, PDR220
	35UA187N	3.95 to 5.85 GHz	WR187, WG12	CPR187F, CPR187G, UG-1352/U, UG-1353/U, UG-1728/U, UG-1729/U, UG-148/U, UG-149A/U
	35UA137N	5.85 to 8.20 GHz	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
	35UA112N	7.05 to 10.00 GHz	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
	35UA90N	8.20 to 12.40 GHz	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
	35UA62N	12.40 to 18.00 GHz	WR62, WG18	UG-541A/U, UG-419/U, UG-1665/U, UG1666/U
	35UA42K	17.00 to 26.50 GHz	WR42, WG20	UG-596A/U, UG-595/U, UG-597/U, UG-598A/U

*1: Call or contact Anritsu sales rep for other frequencies waveguide calibration components and waveguide-to-coaxial adapters.

*2: Part number Ordering information
Prefix (XX) 23 for 1/8 λ offset short
24 for 3/8 λ offset short
26 for Precision waveguide load
35 waveguide to coaxial adapter

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
S311D	Site Master (25 to 1600 MHz)
S312D	Site Master (25 to 1600 MHz), Spectrum Analysis (100 kHz to 1.6 GHz)
S331D	Site Master (25 to 4000 MHz),
S332D	Site Master (25 to 4000 MHz), Spectrum Analysis and Power Meter (100 kHz to 3.0 GHz)
S810D	Site Master (25 MHz to 10.5 GHz), Built in DTF
S820D	Site Master (25 MHz to 20 GHz), Built in DTF
	Standard accessories
	User's Guide
	Soft Carrying Case
	AC-DC Adapter
	Automotive Cigarette Lighter/12 Volt DC Adapter
	One Year Warranty
	CD-ROM containing Fault Location (DTF), Smith Chart, and Software Management Tools
	Serial Interface (Null Modem) Cable
	Rechargeable battery, NiMH
	Precision ruggedized K (m) to N (f) adapter (S810D and USB to RS232 Adapter Cable S820D; not included when Option 11F is ordered)
	Option
Option 2	2 MHz Frequency Extension
Option 5	RF Power Monitor (RF detector not included)
Option 6	Frequency Converter Control Module (S332D)
Option 10A	Built-in Bias Tee, 12 to 24 V (S332D, S312D)
Option 11NF	N (f) Test Port Connector (S810D, S820D)
Option 16	6 GHz Frequency Extension, Cable & Antenna Analyzer (S331D, S332D)
Option 19	High Accuracy Power Meter (S311D, S312D, S331D, S332D, Sensor PSN50 not included)
Option 21	Transmission Measurement (S332D, S312D)
Option 22XF	2-port Cable Loss (S810D, S820D)
Option 25	Interference Analyzer (S332D, S312D)
Option 27	Channel Scanner (S332D, S312D)
Option 28	CW Signal (S312D, S332D)
Option 29	RF Power Meter (requires no detector) (S331D, S332D, S312D)
Option 31	GPS Receiver (includes GPS antenna 2000-1410)
Option 50	T1/E1 Analyzer (S331D)
	Optional accessories
FCN 4760	Frequency Converter 4.7 to 6 GHz
42N50A-30	Attenuator, 30 dB, DC to 18 GHz, 50 W
42N50-20	Attenuator, 20 dB, DC to 18 GHz, 5 W
42N50A-30	Attenuator, 30 dB, 50 W, DC to 18 GHz, N (m) to N (f)
1010-121	Attenuator, 40 dB, 100 W, DC to 18 GHz, N (m) to N (f)
1010-127-R	Attenuator, 30 dB, 150 W, DC to 3 GHz, N (m)-N (f)
1010-128-R	Attenuator, 40 dB, 150 W, DC to 3 GHz, N (m)-N (f)
3-1010-122	Attenuator, 20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
3-1010-123	Attenuator, 30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
3-1010-124	Attenuator, 40 dB, 100 W, DC to 8.5 GHz, N (m) to N (f)
5400-71N50	RF Detector, N (m), 50 Ω, 1 to 3000 MHz
560-7N50B	RF Detector, N (m), 50 Ω, 10 MHz to 20 GHz
560-7K50	RF Detector, K (m), 50 Ω, 10 MHz to 40 GHz
560-7VA50	RF Detector, V (m), 50 Ω, 10 MHz to 50 GHz
65701	3 GHz Offset Cal Kit Consisting Of One Each: 3-1010-119, 10 dB Attenuator, DC to 6 GHz, 2 W 3-806-151, 4 GHz Cable, 18" (46 cm)
ODTF-1	Optical DTF Module
1N50C	5 W Limiter, N (m)-N (f), 18 GHz
22K50	Precision K (m) Short/Open, 40 GHz
22KF50	Precision K (f) Short/Open, 40 GHz
22N50	Precision N (m) Short/Open, 18 GHz
22NF50	Precision N (f) Short/Open, 18 GHz
SM/PL-1	Precision N (m) Load, 42 dB, 4.0 GHz
SM/PLNF-1	Precision N (f) Load, 42 dB, 4.0 GHz
OSLN50-1	Precision N (m) Open/short/Load, 42 dB, 4.0 GHz
OSLNF50-1	Precision N (f) Open/short/Load, 42 dB, 4.0 GHz
28K50	Precision N (m) Load, 40 GHz
28KF50	Precision N (f) Load, 40 GHz
28N50-2	Precision N (m) Load, 40 dB, 18 GHz
28NF50-2	Precision N (f) Load, 40 dB, 18 GHz
2000-767	Precision Open/Short/Load, 7-16 (m), 4 GHz
2000-768	Precision Open/Short/Load, 7-16 (f), 4 GHz
1015-54	TNC Termination (f), 18 GHz
1015-55	TNC Termination (m), 18 GHz
806-186-R	4 GHz Cable, N (m)-N (f), 0.91 m
806-187-R	4 GHz Cable, N (m)-N (m), 0.91 m
1091-55	TNC Open (f), 18 GHz

Model/Order No.	Name
1091-53	TNC Open (m), 18 GHz
1091-56	TNC Short (f), 18 GHz
1091-54	TNC Short (m), 18 GHz
15ND50-1.5C	Test Port Cable Armored, 1.5 m, N (m) to 7/16 DIN (m), 6 GHz
15NDF50-1.5C	Test Port Ext. Cable, 1.5 m, N (m) to 7/16 DIN (f), 6 GHz
15NN50-1.5C	Test Port Ext. Cable, 1.5 m, N (m) to N (m), 6.0 GHz
15NN50-3.0C	Test Port Ext. Cable, 3.0 m, N (m) to N (m), 6.0 GHz
15NN50-5.0C	Test Port Ext. Cable, 5.0 m, N (m) to N (m), 6.0 GHz
15NNF50-1.5B	Test Port Cable Armored, 1.5 m, N (m) to N (f), 18 GHz
15NNF50-1.5C	Test Port Cable Armored, 1.5 m, N (m) to N (f), 6.0 GHz
15NNF50-3.0C	Test Port Cable Armored, 3.0 m, N (m) to N (f), 6.0 GHz
15NNF50-5.0C	Test Port Cable Armored, 5.0 m, N (m) to N (f), 6.0 GHz
15KKF50-1.5A	Test Port Cable Armored, 1.5 m, K (m) to K (f), 20 GHz
15RDDF50-1.5A	Ruggedized Armored Test Port Cable, 1.5 m K (m) to K (f), 20 GHz
15RNFN50-1.5-R	Test Port Cable Armored w/Reinforced Grip, 1.5 m, N (m)-N (f), 6 GHz, 50 Ω
15NDF50-1.5C	Test Port Cable Armored, 1.5 m, N (m) to 7/16 DIN (f), 6 GHz
800-109	Detector Extender Cable, 7.6 m (25 ft.)
800-110	Detector Extender Cable, 15.2 m (50 ft.)
800-111	Detector Extender Cable, 30.5 m (100 ft.)
800-112	Detector Extender Cable, 61 m (200 ft.)
34NN50A	Precision N (m) to N (m) Adapter, 18 GHz
34NFNF50	Precision N (f) to N (f) Adapter, 18 GHz
34RKNF50	Precision Ruggedized K (m) to N (f) Adapter, 20 GHz
K220B	Precision K (m)-K (m) Adapter, 40 GHz
K222B	Precision K (f)-K (f) Adapter, 40 GHz
1091-26	Adapter N (m) to SMA (m), 18 GHz
1091-27	Adapter N (m) to SMA (f), 18 GHz
1091-80	Adapter, N (f) to SMA (m), 18 GHz
1091-81	Adapter, N (f) to SMA (f), 18 GHz
1091-172	Adapter, DC to 1.3 GHz, 50 Ω, N (m) to BNC (f)
513-62	Adapter, TNC (f) to N (f), 18 GHz, 50 Ω
1091-315	Adapter, TNC (m) to N (f), 18 GHz, 50 Ω
1091-324	Adapter, TNC (f) to N (m), 18 GHz, 50 Ω
1091-325	Adapter, TNC (m) to N (m), 18 GHz, 50 Ω
1091-317	Adapter, TNC (m) to SMA (f), 18 GHz, 50 Ω
1091-318	Adapter, TNC (m) to SMA (m), 18 GHz, 50 Ω
1091-323	Adapter, TNC (f) to TNC (f), 18 GHz, 50 Ω
1091-326	Adapter, TNC (m) to TNC (m), 18 GHz, 50 Ω
510-90	Adapter 7-16 (f) to N (m), 7.5 GHz
510-91	Adapter 7-16 (f) to N (f), 7.5 GHz
510-92	Adapter 7-16 (m) to N (m), 7.5 GHz
510-93	Adapter 7-16 (m) to N (f), 7.5 GHz
510-96	Adapter 7/16 (m) to 7/16 (m), 7.5 GHz
510-97	Adapter 7/16 (f) to 7/16 (f), 7.5 GHz
65717	Soft Carrying Case (S331D, S332D, S810D, S820D)
40-168	AC/DC Adapter
806-62	Automotive Cigarette Lighter/12 Volts DC adapter
800-441	Serial Interface Cable
806-16	Bantam Plug to Bantam Plug
806-116	Bantam Plug to BNC
806-117	Bantam "Y" Plug to RJ48
760-213	Transit Case for Site Master (S810D, S820D)
760-243-R	Transit Case for Site Master
633-27	Rechargeable Battery, NiMH for "C" series Site Master
2300-347	Handheld Software Tools
2000-1410	Magnet Mount GPS Antenna w/15 ft. Cable
2000-1029	External Battery Charger
1030-105-R	Band Pass Filter, 890 to 915 MHz, N (m) to N (f), 50 Ω
1030-106-R	Band Pass Filter, 1710 to 1790 MHz, N (m) to N (f), 50 Ω
1030-107-R	Band Pass Filter, 1910 to 1990 MHz, N (m) to N (f), 50 Ω
1030-109-R	Band Pass Filter, 824 to 849 MHz, N (m) to SMA (f), 50 Ω
1030-110-R	Band Pass Filter, 880 to 915 MHz, N (m) to SMA (f), 50 Ω
1030-111-R	Band Pass Filter, 1850 to 1910 MHz, N (m) to SMA (f), 50 Ω
1030-112-R	Band Pass Filter, 2400 to 2484 MHz, N (m) to SMA (f), 50 Ω
10580-00185	Site Master S311D, S312D User's Guide
10580-00079	Site Master S331D, S332D User's Guide
10680-00001	Site Master S810D, S820D User's Guide
10580-00186	Site Master S311D, S312D Programming Manual
10680-00002	Site Master S810D, S820D Programming Manual
10580-00100	Site Master S331D, S332D Programming Manual
10580-00077	Site Master S810D, S820D Programming Manual
10580-00101	Site Master S331D Maintenance Manual
10580-00102	Site Master S332D Maintenance Manual
10680-00003	Site Master S810D, S820D Maintenance Manual
2000-1030	Portable Antenna, SMA (m), 1.71 to 1.88 GHz
2000-1031	Portable Antenna, SMA (m), 1.85 to 1.99 GHz
2000-1032	Portable Antenna, SMA (m), 2.4 to 2.5 GHz
2000-1200	Portable Antenna, SMA (m), 806 to 869 MHz
2000-1035	Portable Antenna, SMA (m), 902 to 960 MHz
551-1691-R	Earthmate USB to Serial Adapter Cable

CABLE AND ANTENNA ANALYZER

S810D/S820D Broadband SiteMaster™

2 MHz to 20 GHz

CE

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, and defense programs responsible 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:

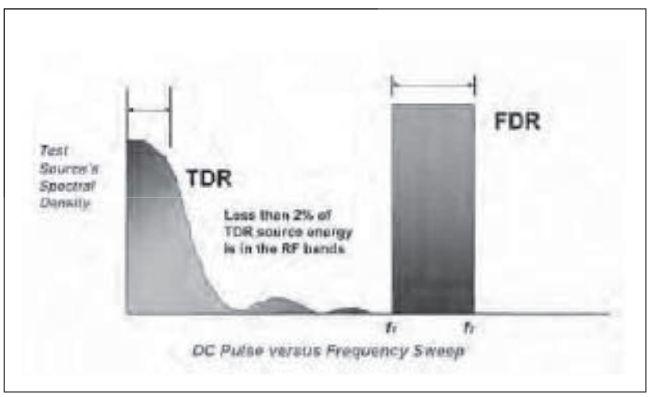
- Increased frequency range to cover 2 MHz to 20 GHz with a single connection
- New CW source module for true two-port cable loss measurements of long cables operating up to 20 GHz
- New smoothing feature improves accuracy of cable loss measurements
- Added capability to support user-defined calibration 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.



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)

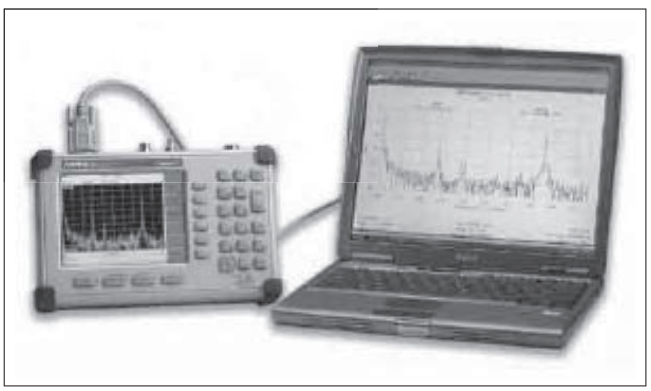
Using the standard 1-port approach, accurate cable loss measurements up to 10 dB are achievable, but the round trip loss of 20 dB is easy to exceed at higher frequencies. A CW source is needed when cable loss exceeds 10 dB. The Broadband Site Master offers an optional CW source with power monitor capability 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 pts – 1) x horizontal resolution, # of data pts = 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)

• RF Power Monitor (S8x0D/5) Requires External Detector

Detector range	–50 to +20 dBm, 10 nW to 100 mW
Offset range	0 to +60 dB
Display range	–80 to 80 dBm
Resolution	0.1 dB, 0.1 xW (x = n, μ, m based on detector power)
Measurement accuracy	±1 dB maximum for >–40 dBm and <18 GHz using 560-7N50B or 560-7S50B (see uncertainty curves)
Ports added to S8x0D	4-pin DIN connector for use with Anritsu 560-7N50B or 560-7S50B Detectors

• Detectors for RF Power Monitor

The 560 Series Detectors use zero-biased Schottky diodes. Measurements use a single cycle per sweep AC detection, and auto-zeroing with DC detection during the frequency sweep. Optional extender cables can be used with the S8x0D Series (see ordering information). Contact a local sales representative for special cables.

Maximum input power	+20 dBm
Standard cable length	122 cm (4 ft.)
Dimensions and mass	7.6 x 2.9 x 2.2 cm (3 x 1-1/8 x 7/8 in.), 170 g (6 oz.)

See www.anritsu.com for additional detectors

Model	Frequency range	Impedance	Return loss	Input connector	Frequency response
560-7N50B	0.01 to 20 GHz	50 Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	N (m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz
560-7S50B	0.01 to 20 GHz	50 Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	WSMA (m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz

• 2-Port Cable Loss (S8x0D/22xF)

CW source module (CWM220xF)	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 CWM220NF: N (f), ±15 VDC, +20 dBm, maximum input, no damage CWM220SF: 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

Language support		Chinese, English, French, German, Japanese, and Spanish	
Internal trace memory		Up to 200 traces	
Setup configurations		21	
Custom cable configuration memory		Up to 200 configurations	
Display		TFT color display with adjustable backlight	
Ports		RF Out Standard Type K (f) test port, 50 Ω: +23 dBm (Peak), ±50 VDC, Maximum input without damage Optional (S8x0D/11NF) Type N (f) test port, 50 Ω: +23 dBm (Peak), ±50 VDC, Maximum input without damage Serial Interface 9 pin D-sub: RS-232 three wire serial	
CE		Electromagnetic Compatibility: Meets European Community requirement EN61326-1: 1998 Safety: Meets European Community requirement EN61010-1: 2001	
Environment Condition and Status (MIL-PRF-28800F, Class 2)	Temperature/ Humidity	Temperature, operating (˚C)	3.8.2.1 & 4.5.5.14: Passed
		Temperature, not operating (˚C)	3.8.2.2 & 4.5.5.1: Passed
		Relative humidity	3.8.2.3 & 4.5.5.1: Passed
		Altitude, operating	3.8.3 & 4.5.5.2: Passed*1
		Altitude, not operating	3.8.3 & 4.5.5.2: Passed*1
	Mechanical	Vibration limits	3.8.4.1 & 4.5.5.3.1: Passed
		Bounce, loose cargo	3.8.4.3 & 4.5.5.3.3: 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
		Watertight 0.9 m	3.8.6.1 & 4.5.5.5.1: Passed
		Splash proof	3.8.6.2 & 4.5.5.5.2: Passed
		Drip proof	3.8.6.3 & 4.5.5.5.3: Passed
		Fungus resistance	3.8.7 & 4.5.6.1: Not Tested
		Salt exposure enclosure	3.8.8.1 & 4.5.6.2.1: Passed
		Salt exposure structural parts	3.8.8.2 & 4.5.6.2.2: Not Required*3
		Explosive atmosphere	3.8.9 & 4.5.6.3: Passed
		Dust resistance	3.8.10 & 4.5.6.4: Passed*1
		Solar radiation	3.8.10 & 4.5.6.8: Not Tested
Power Supply		External: DC input: 12 to 15 Volt DC, 5 A Internal: NiMH battery: 10.8 volts, 1800 mAh	
Dimensions and mass		254 (W) x 178 (H) x 61 (D) mm (10.0 x 7.0 x 2.4 in), <2.28 kg (<5 lbs) including battery	

∗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
65717	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: CWM220SF, 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: CWM220NF, 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)

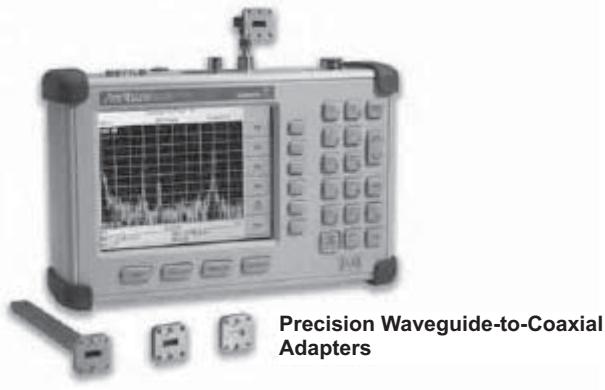
Model/Order No.	Name
	Coaxial Calibration Components
	K Connectors
22K50	Precision K (m) Short/Open, 40 GHz
22KF50	Precision K (f) Short/Open, 40 GHz
28K50	Precision Termination, DC to 40 GHz, 50 Ω, K (m)
28KF50	Precision Termination, DC to 40 GHz, 50 Ω, K (f)
15KKF50-1.5A	Armored Test Port Cable, 1.5 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
	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, 50 Ω, N (m)
28NF50-2	Precision Termination, DC to 18 GHz, 50 Ω, 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
	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, 50 Ω
1091-27	Adapter, N (m)-SMA (f), DC to 18 GHz, 50 Ω
1091-80-R	Adapter, N (f)-SMA (m), DC to 18 GHz, 50 Ω
1091-81-R	Adapter, N (f)-SMA (f), DC to 18 GHz, 50 Ω
513-62	Adapter, TNC (f) to N (f), 18 GHz, 50 Ω
1091-315	Adapter, TNC (m) to N (f), 18 GHz, 50 Ω
1091-324	Adapter, TNC (f) to N (m), 18 GHz, 50 Ω
1091-325	Adapter, TNC (m) to N (m), 18 GHz, 50 Ω
1091-317	Adapter, TNC (m) to SMA (f), 18 GHz, 50 Ω
1091-318	Adapter, TNC (m) to SMA (m), 18 GHz, 50 Ω
1091-323	Adapter, TNC (f) to TNC (f), 18 GHz, 50 Ω
1091-326	Adapter, TNC (m) to TNC (m), 18 GHz, 50 Ω
	Optional accessories
760-243-R	Transit Case with Wheels
760-213	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

• Waveguide Calibration Components

xx (in the following table) specifies Waveguide Calibration components:

- 23 = 1/8 Offset Short
- 24 = 3/8 Offset Short
- 26 = Precision Load
- 35 = W/C Adapters

Example: 23UA90, 24UA90, 26UA90, and 35UM90N



Precision Waveguide-to-Coaxial Adapters

• Precision Waveguide Calibration Components[*1]

Part No.	Frequency range	Waveguide type	Compatible flanges
xxUM40	3.30 to 4.90 GHz	WR229, WG11A	PDR40
xxUM48	3.95 to 5.85 GHz	WR187,WG12	CAR48, PAR48, UAR48, PDR48
xxUM70	5.85 to 8.20 GHz	WR137, WG14	CAR70, PAR70, UAR70, PDR70
xxUM84	7.05 to 10.00 GHz	WR112, WG15	CBR84, UBR84, PBR84, PDR84
xxUM100	8.20 to 12.40 GHz	WR90, WG16	CBR100, UBR100, PBR100, PDR100
xxUM120	10.00 to 15.00 GHz	WR75, WG17	CBR120, UBR120, PBR120, PDR120
xxUM140	12.40 to 18.00 GHz	WR62, WG18	CBR140, UBR140, PBR140, PDR140
xxUM220	17.00 to 26.50 GHz	WR42, WG20	CBR220, UBR220, PBR220, PDR220
xxUA187	3.95 to 5.85 GHz	WR187, WG12	CPR187F, CPR187G, UG-1352/U, UG-1353/U, UG-1728/U, UG-1729/U, UG-148/U, UG-149A/U
xxUA137	5.85 to 8.20 GHz	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
xxUA112	7.05 to 10.00 GHz	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
xxUA90	8.20 to 12.40 GHz	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
xxUA62	12.40 to 18.00 GHz	WR62, WG18	UG-541A/U, UG-419/U, UG-1665/U, UG1666/U
xxUA42	17.00 to 26.50 GHz	WR42, WG20	UG-596A/U, UG-595/U, UG-597/U, UG-598A/U

• Precision Waveguide-to-Coaxial Adapters[*1]

Part No.	Frequency range	Waveguide type	Compatible flanges
35UM40N	3.30 to 4.90 GHz	WR229, WG11A	PDR40
35UM48N	3.95 to 5.85 GHz	WR187, WG12	CAR48, PAR48, UAR48, PDR48
35UM70N	5.85 to 8.20 GHz	WR137, WG14	CAR70, PAR70, UAR 70, PDR70
35UM84N	7.05 to 10.00 GHz	WR112, WG15	CBR84, UBR84, PBR84, PDR84
35UM100N	8.20 to 12.40 GHz	WR90, WG16	CBR100, UBR100, PBR100, PDR100
35UM120N	10.00 to 15.00 GHz	WR75, WG17	CBR120, UBR120, PBR120, PDR120
35UM140N	12.40 to 18.00 GHz	WR62, WG18	CBR140, UBR140, PBR140, PDR140
35UM220K	17.00 to 26.50 GHz	WR42, WG20	CBR220, UBR220, PBR220, PDR220
35UA187N	3.95 to 5.85 GHz	WR187, WG12	CPR187F, CPR187G, UG-1352/U, UG-1353/U, UG-1728/U, UG-1729/U, UG-148/U, UG-149A/U
35UA137N	5.85 to 8.20 GHz	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
35UA112N	7.05 to 10.00 GHz	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
35UA90N	8.20 to 12.40 GHz	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
35UA62N	12.40 to 18.00 GHz	WR62, WG18	UG-541A/U, UG-419/U, UG-1665/U, UG1666/U
35UA42K	17.00 to 26.50 GHz	WR42, WG20	UG-596A/U, UG-595/U, UG-597/U, UG-598A/U

*1: Contact an Anritsu sales representative for availability of waveguide calibration components and waveguide-to-coaxial adapters not listed in the table.

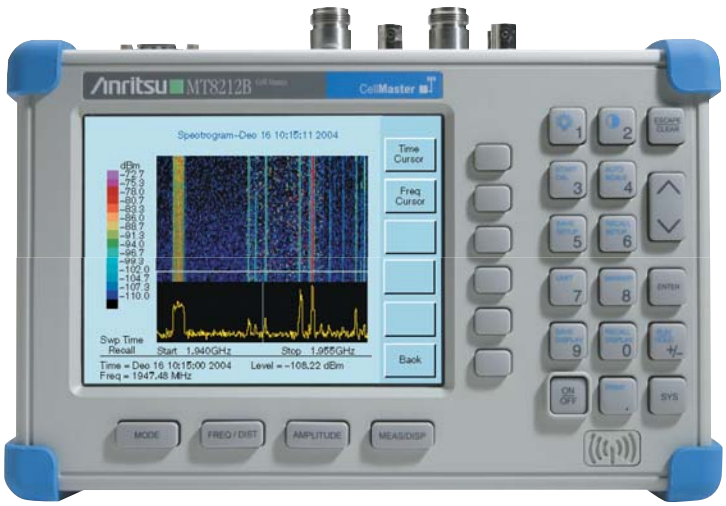
CELL MASTER

MT8212B

25 MHz to 4.0 GHz

CE

A Multi-Function Base Station Test Tool for Greater Flexibility and Technician Productivity



Cell Master MT8212B is a comprehensive, one-box base station test tool for deploying, maintaining and troubleshooting wireless base stations. Combining the functionality of a cable and antenna analyzer (25 MHz to 4.0 GHz), spectrum analyzer (100 kHz to 3.0 GHz), power meter (4.5 MHz to 3.0 GHz), interference analyzer, channel scanner, transmission analyzer for 2-port devices, transmitter analyzer (CDMA, EVDO and GSM, GSM and iDEN), GPS receiver, GPS Antenna Tester, high accuracy power meter, CW signal generator and T1/E1 analyzer into one lightweight, handheld test set - eliminates the need for field engineer and field technician to carry, manage and learn multiple test sets. MT8212B measurement capability includes precision return loss, VSWR, cable loss, distance-to-fault, signal identification, interference analysis, channel power, high accuracy power, adjacent channel power ratio, field strength, occupied bandwidth, burst power, code domain power, noise floor, voltage peak to peak, listen to DS0 or VF channel access. Patented RF interference rejection enables accurate, repeatable measurements in the presence of high RF activity. PC data analysis software enables assessment of system trends, problems, and performance in addition to professional report generation. Built-in GPS to store traces with location information (latitude, longitude and altitude).
The MT8212B includes PC data analysis software, soft carrying case, rechargeable battery, AC/DC power supply, 12 V automotive cigarette lighter adapter, RS232 null modem serial cable and user's guide.

Features

- Handheld, battery-operated, under 5 lbs (2.28 kg), including battery
- Rechargeable, snap-in field replaceable battery
- Withstands repeated drops and rough handling
- Built-in worldwide signal standards and frequency channels
- Multilingual user interface: English, French, Chinese, Japanese, Spanish, German
- Intuitive and easy to use with on-screen test set-ups and single key functions
- High accuracy power measurements for CW and modulated signals like CDMA/EVDO, GSM/EDGE, and W-CDMA/HSDPA
- Store/Recall 25 setup configurations and up to 300 traces
- Alphanumeric labeling and automatic time/date stamp of saved measurements
- Six markers, limit line, and segmented limit lines
- Trace overlay, trace math
- Superior immunity to RF interference
- 130, 259 and 517 data points for optimal resolution and long range fault locations
- Channel scanner measures the power of multiple transmitted signals, and is very useful for measuring channel power in AMPS, iDEN, GSM, and TDMA networks
- <500 msec per sweep to identify real time intermittent cable problems
- ±0.5 dB typical amplitude accuracy power measurements
- –135 dBm typical DANL
- Interference analysis
- T1 and E1 histograms
- Store traces with location information using the built-in GPS
- Demodulate CDMA/EVDO signals using Over-The-Air measurements while sitting in a vehicle

Handheld PC Software Analysis Tools Features

- Transfer traces with a single menu selection
- Stores an unlimited number of data traces for comparison to historical performances
- Cable editor supports downloading and uploading cable list and saving the list as a file
- Distance-to-fault and Smith Chart analysis

Specifications*1

• Cable and Antenna Analyzer

Frequency	Range	25 MHz to 4.0 GHz
	Accuracy	≤+75 ppm @ +25˚C
	Resolution	100 kHz
Output Power	<0 dBm (–10 dBm nominal)	
Immunity to Interfering Signals	on-channel*2	+17 dBm
	on-frequency*3	–5 dBm
Measurement speed	≤3.5 msec / data point (CW ON)	
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 65.00
	Resolution	0.01
Cable Loss	Range	0.00 to 30.00 dB
	Resolution	0.01 dB
Measurement Accuracy	>42 dB corrected directivity after calibration	
Distance-To-Fault	Vertical Range	Return Loss: 0.00 to 60.00 dB VSWR: 1.00 to 65.00
	Horizontal Range	Range: 0 to (# of data pts –1) x Resolution to a maximum of 1197 m (3929 ft), # of data pts = 130, 259, 517
	Horizontal Resolution (Rectangular windowing)	Resolution (meter) = (1.5 x 10^{-8}) x (Vp)/DF Where Vp is the cable's relative propagation velocity and where DF is the stop frequency minus the start frequency (in Hz)

• Spectrum Analyzer

Frequency	Range	100 kHz to 3.0 GHz
	Reference (Internal Timebase)	Aging: ±1 ppm/yr Accuracy: ±2 ppm
	Span	10 Hz to 2.99 GHz in 1, 2, 5 step selections in auto mode, plus zero span
	Sweep Time	≤1.1 sec full span; ≤50 µsec to 20 sec zero span
	Resolution Bandwidth (–3 dB)	100 Hz to 1 MHz in 1-3 sequence ±5% Accuracy
	Video Bandwidth (–3 dB)	3 Hz to 1 MHz in 1-3 sequence ±5% Accuracy
	SSB Phase Noise (1 GHz) @ 30 kHz Offset	≤–75 dBc/Hz
	Spurious Responses Input Related	≤–45 dBc
	Spurious Residual Responses	≤–90 dBm, ≥10 MHz, ≤–80 dBm, <10 MHz (10 kHz RBW, pre-amp on)
Amplitude	Total Level Accuracy	±1 dB typical (±1.5 dB Max.), >10 MHz to 3 GHz ±2 dB typical <10 MHz for input signal levels ≥–60 dBm, excluding input VSWR mismatch
	Measurement Range	+20 dBm to –135 dBm
	Input Attenuator Range	0 to 51 dB, selected manually or automatically coupled to the reference level. Resolution in 1 dB steps.
	Displayed Average Noise Level	≤–135 dBm, >10 MHz (preamp on) ≤–115 dBm (preamp off) for input terminated, 0 dB attenuation, RMS detection, 100 Hz RBW
	Dynamic Range	>65 dB typical
	Display Range	1 to 15 dB/division, in 1 dB steps, 10 divisions displayed
	Scale Units	dBm, dBV, dBmV, dBµV, V, W
	RF Input VSWR	(with 20 dB atten.) 1.5:1 typical, (10 MHz to 2.4 GHz)

• Power Meter

Frequency Range	4.5 MHz to 3.0 GHz
Display Range	–80 to +80 dBm
Measurement Range	–80 to +20 dBm (+80 dBm with external attenuator)
Offset Range	0 to +60 dB
Accuracy	±1 dB typical (±1.5 dB Max.), ≥10 MHz to 3 GHz (excludes input VSWR)
VSWR	1.5:1 typical (P_{in} >–30 dBm, >10 MHz to 2.4 GHz)
Maximum Power	20 dBm (0.1 W) without external attenuator

• High Accuracy Power Meter PSN50 (Option 19)

Sensor	Measurement Range	–30 to +20 dBm
	Frequency Range	50 MHz to 6 GHz
	Input Connector	Type N, male, 50 Ω
	Max. Input Without Damage	+33 dBm, ±25 VDC
	Input Return Loss	50 MHz to 2 GHz: ≥26 dB 2 to 6 GHz: ≥20 dB
Accuracy	Total RSS Measurement Uncertainty (0 to 50˚C)	±0.16 dB*1
	Noise	20 nW Max.
	Zero Set	20 nW
	Zero Drift	10 nW Max.*2
	Sensor Linearity	±0.13 dB Max.
	Instrumentation Accuracy	0.00 dB
	Sensor Cal Factor Uncertainty	±0.06 dB
	Temperature Compensation	±0.06 dB Max.
	Continuous digital modulation uncertainty	+0.06 dB (+17 to +20 dBm)
System	Measurement Resolution	0.01 dB
	Offset Range	±60 dB
	Power Requirements	Supply Voltage: 8 to 18 Vdc Supply Current: <100 mA

∗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

• Bias Tee (Option 10A)

Voltage	12 to 24 V
Max. Power	6 W (steady state)
Max. Current	6/Voltage (steady state)

• T1 Analyzer (Option 50)

Line Coding	AMI, B8ZS
Framing Modes	D4 (Superframe), ESF (Extended Superframe)
Connection Configurations	Terminate (100 Ω) Bridge (≥1000 Ω) Monitor (Connect via 20 dB pad in DSX)
Receiver Sensitivity	0 to –36 dBdsx
Transmit Level	0 dB, –7.5 dB, and –15 dB
Clock Sources	External Internal: 1.544 MHz ±30 ppm
Pulse Shapes	Conform to ANSI T1.403
Pattern Generation and Detection	PRBS: 2-9, 2-11, 2-15, 2-20, 2-23 Inverted and non-inverted, QRSS, 1-in-8 (1-in-7), 2-in-8, 3-in-24, All ones, All zeros, T1-Daly, User defined (≤32 bits)
Circuit Status Reports	Carrier present, Frame ID and Sync., Pattern ID and Sync.
Alarm Detection	AIS (Blue Alarm), RAI (Yellow Alarm)
Error Detection	Frame Bits, Bit, BER, BPV, CRC, Error Sec
Error Insertion	Bit, BPV, Framing Bits, RAI, AIS
Loopback Modes	Self loop, CSU, NIU, User defined, In-band or Data Link
Level Measurements	Vp-p (±5%)
T_1 Frequency Measurement	±10 ppm
Data Log	Continuous, up to 48 hrs
DS0 Channel Access	Tone Generator: Frequency: 100 Hz to 3000 Hz Level: –30 to 0 dBm, 1 dB steps Audio Monitor: Manually select channel 1-24
VF Measurement	Frequency: 100 Hz to 3000 Hz ±2 Hz Level: –40.0 to +3.0 dBm ±0.2 dBml

• E1 Analyzer (Option 50)

Line Coding	AMI, HDB3
Framing Modes	PCM30, PCM30CRC, PCM31, PCM31CRC
Connection Configurations	Terminate (75, 120 Ω) Bridge (≥1000 Ω) Monitor (Connect via 20 dB pad in DSX)
Receiver Sensitivity	0 to –43 dB
Clock Sources	External Internal 2.048 MHz ±30 ppm
Pulse Shapes	Conform to ITU G.703
Pattern Generation and Detection	PRBS: 2-9, 2-11, 2-15, 2-20, 2-23 Inverted and non-inverted, QRSS, 1-in-8 (1-in-7), 2-in-8, 3-in-24, All ones, All zeros, T1-Daly, User defined (≥32 bits)
Circuit Status Reports	Carrier present, Frame ID and Sync., Pattern ID and Sync.
Alarm Detection	AIS, RAI, MMF
Error Detection	Frame Bits, Bit, BER, BPV, CRC, E-Bits, Error Sec
Error Insertion	Bit, BPV, Framing Bits, RAI, AIS
Loopback Modes	Self loopback
Level Measurements	Vp-p (±5%), can also display in dBdsx
Data Log	Continuous, up to 48 hrs
E1 Frequency	±10 ppm
VF Channel Access	Tone Generator: Frequency: 100 Hz to 3000 Hz Level: –30 to 0 dBm Audio Monitor: Manually select channel 1-31
VF Measurement	Frequency: 100 Hz to 3000 Hz ±2 Hz Level: –40.0 to +3.0 dBm ±0.2 dBml

• Channel Scanner (Option 27)

Frequency Range	100 kHz to 3.0 GHz
Frequency Accuracy	±10 Hz + Time base error, 99% Confidence level
Measurement Range	+20 to –110 dBm
Channel Power	±1 dB typical (±1.5 dB Max.)
Adjacent Channel Power Accuracy	±0.75 dBc

• Transmission Measurement (Option 21)

RF Source	Frequency Range	25 MHz to 3 GHz
	Frequency Resolution	10 Hz
	Output Power Level	–10 dBm typical (up to –90 dBm with external attenuator)
	Dynamic Range	80 dB, 25 MHz to 2 GHz 60 dB, >2 to 3 GHz
	Output Impedance	50 Ω

• RF Measurements - GSM (Option 40)

Occupied Bandwidth	Bandwidth within which 0-99% of the power transmitted on a single channel.
Channel power	±1 dB typical (±1.5 dB Max.)
Burst power	±1 dB typical for –20 to +20 dBm (±1.5 dB Max.) ±1.75 dB typical for –80 to –20 dBm (±2 dB Max.)
Frequency error	±10 Hz + Time base error, 99% Confidence level

• RF Measurements - CDMA (Option 42)

Occupied Bandwidth	Bandwidth within which 0-99% of the power transmitted on a single channel lies
Channel power	±1 dB typical (±1.5 dB Max.)
Frequency error	±50 Hz + Time base error, 99% Confidence level

• Demodulator - cdmaOne and cdma2000 1xRTT (Option 43)

Residual rho	≥0.98 for RF input from +20 to –48 dBm
Rho accuracy	±0.01 for ρ ≥0.9
Code domain power (CDP)	Accurate to within ±1.5 dB above –20 dB for RF input from +20 to –48 dBm CDP can be displayed for RF input from +20 to –90 dBm
Carrier Frequency Error	±50 Hz 99% confidence level
Power accuracy	±1 dB typical (±1.5 dB absolute)
PN Offset	Within 1 x 64 chips
Pilot power	±1.5 dB typical

• OTA - cdmaone and cdma2000 1xRTT (Option 33)
Requires option 31 and 43

Six strongest pilots with Ec/Io
Two multipaths relative to strongest pilot
Tau: ±2 micro seconds

• GPS (Option 31)

GPS Location Indicator
Latitude, Longitude and Altitude on Display
Latitude, Longitude, Altitude with Trace Storage

• Interference Analyzer (Option 25)

Audible tone
Strength of the Interferer
RSSI
Spectrogram

• GPS Antenna Tester (Option 12A)

GPS Pass/Fail Indicator	Latitude, Longitude, Altitude, UTC Time
Tracked Satellites information	GPS Antenna Current draw (when MA82101A module powered by Cell Master)

• 1xEV-DO Over The Air (Option 34)

Over The Air Measurement	Six strongest pilots with power Two multipaths relative to strongest pilot
Tau	±2 µs

• 1xEV-DO RF Measurements (Option 62)

Occupied Bandwidth	Bandwidth within which 99% of the power transmitted on a single channel lies
Channel power	±1 dB typical (±1.5 dB Max.)
Frequency error	±50 Hz + Time base error, 99% confidence level
Graph	Idle and active power versus time graph

• 1xEV-DO Demodulator (Option 63)

Rho Accuracy	±0.02 for 0.9<r<1
Code Domain Power Display	Demodulation from –80 to +15 dBm
Code Domain Power (CDP)	±1 dB when >– 20 dB relative to Tx power
Mac Code Power	±1 dB CDP level >– 20 dB relative to total power in MAC interval
Data Code Power	±1 dB for non-idle slot data
Frequency Accuracy	±50 Hz + timebase error for 99% of measurements
Channel Power	±1 dB typical (±1.5 dB absolute)
Pilot Power	±1 dB typical (±1.5 dB absolute)

• iDEN Signal Analyzer (Option 68)

Channel Power	±1.5 dB
Modulation Type	16 QAM
Frequency Error	±0.05 ppm + Time base error, 99% confidence level

• General

Language Support	English, Spanish, French, German, Chinese, Japanese	
Internal Trace Memory	Up to 300 traces	
Setup Configuration*4	25	
Display	TFT Color display, viewable in sunlight	
Input and Output Ports	RF Out Maximum Input without Damage	Type N, female, 50 Ω +20 dBm, ±50 VDC
	RF In Maximum Input without Damage	Type N, female, 50 Ω +43 dBm (Peak), ±50 VDC
	Ext. Trig In	BNC, female (5 V TTL)
	Ext. Freq Ref In (2 to 20 MHz)	Shared BNC, female, 50 Ω, (–15 to +10 dBm)
	T1/E1 (Receive & Transmit)	Bantam Jacks
	Serial Interface	RS-232 9 pin D-sub, three wire serial
	GPS antenna connector	Reverse BNC female
	CDMA Timing Input	BNC female (5 V TTL)
Electromagnetic Compatibility	Meets European Community requirements for CE marking	
Safety	Conforms to EN 61010-1 for Class 1 portable equipment	
Temperature	Operating	–10˚ to 50˚C, humidity 85% or less
	Non-operating	–51˚ to +71˚C (recommend battery be stored separately between 0˚ to +40˚C for any prolonged non-operating storage period)
Power Supply	External DC Input	12 to 15 VDC, 1500 mA
	Internal	NiMH battery: 10.8 volts, 1800 mA maximum
Dimensions and mass	25.4 (W) x 17.8 (H) x 6.1 (D) cm (10.0 x 7.0 x 2.4 in), <2.28 kg (<5 lbs) includes battery	

∗1: All specifications apply when calibrated at ambient temperature after a five minute warm up.
∗2: On-Channel interference immunity is specified to within 1 MHz of the carrier frequency.
∗3: On-Frequency interference immunity is specified to within +10 kHz of the carrier frequency.
∗4: Calibration stored with instrument configuration.

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
MT8212B	**Main frame** Cable & Antenna Analyzer (25 MHz to 4.0 GHz), with Built-in DTF, Spectrum Analyzer (10 MHz to 3.0 GHz), Power Meter
	Standard accessories include User's Guide Soft Carrying Case AC-DC Adapter with Power Cord Automotive Cigarette Lighter/12 Volt DC Adapter One Year Warranty Handheld Software Tools Serial Interface Cable Rechargeable Battery, NiMH
	Options
Option 5	Power Monitor (requires external detector)*
Option 10A	Bias Tee
Option 12A	GPS Antenna Tester (MA82101A not included) (requires option 31)
Option 19A	High Accuracy Power Meter (PSN50 sensor not included)
Option 21	Transmission Measurement
Option 25	Interference Analyzer (requires directional antenna)
Option 27	Channel Scanner
Option 28	CW Signal Generator
Option 31	GPS
Option 33	cdmaOne and cdma2000 1xRTT Over The Air (OTA) (requires options 31 and 43)
Option 34	1xEV-DO Over The Air (OTA) (requires Options 31 and 43)
Option 40	RF Measurements-GSM
Option 42	RF Measurements-CDMA
Option 43	cdmaOne and cdma2000 1xRTT demodulator
Option 50	T1/E1 Analyzer*
Option 62	1xEV-DO RF Measurements
Option 63	1xEV-DO Demodulator
Option 68	iDEN Signal Analyzer
	Optional accessories
1N50C	Limiter, N (m) to N (f), 50 Ω, 10 MHz to 18 GHz
42N50-20	Attenuator, 20 dB, 5 W, DC to 18 GHz, N (m)-N (f)
42N50A-30	Attenuator, 30 dB, 50 W, DC to 18 GHz, N (m)-N (f)
SC7179	Variable Attenuator, DC to 2 GHz, 0~90 dB, N (m)-N (f)
ICN50	InstaCal™ Calibration Module, 2 MHz to 4.0 GHz, N (m), 50 Ω
3-1010-127	Attenuator, 40 dB, 150 W, DC tp 3 GHz, N (m)-N (f)
22N50	Open/Short, DC to 18 GHz, N (m), 50 Ω
22NF50	Open/Short, DC to 18 GHz, N (f), 50 Ω
SM/PL	Precision Load, DC to 4 GHz, 42 dB, N (m), 50 Ω
SM/PLNF	Precision Load, DC to 4 GHz, 42 dB, N (f), 50 Ω
OSLN50LF	Precision Open/Short/Load, DC to 4 GHz, 42 dB, 50 Ω, N (m)
OSLNF50LF	Precision Open/Short/Load, DC to 4 GHz, 42 dB, 50 Ω, N (f)
2000-767	Precision Open/Short/Load, DC to 4 GHz, 7/16 DIN (m), 50 Ω
2000-768	Precision Open/Short/Load, DC to 4 GHz, 7/16 DIN (f), 50 Ω
65701	Power Meter Offset Cal Kit consisting of one each: 3-1010-119, 10 dB Attenuator, DC to 6 GHz, 2 W 3-806-151, 4 GHz Cable, 18" (46 cm)
SC7371	CW Signal Generator Kit with Housing
15NN50-1.5C	Test Port Cable Armored, 1.5 meters, N (m)-N (m), 6 GHz, 50 Ω
3-806-187	Test Port Cable, 36" (91 cm) N (m)-N (m), 4 GHz, 50 Ω
3-806-186	Test Port Cable, 36" (91 cm) N (m)-N (f), 4 GHz, 50 Ω
15NN50-3.0C	Test Port Cable Armored, 3.0 m, N (m)-N (m), 6 GHz, 50 Ω
15NN50-5.0C	Test Port Cable Armored, 5.0 m, N (m)-N (m), 6 GHz, 50 Ω
15NNF50-1.5C	Test Port Cable Armored, 1.5 m, N (m)-N (f), 6 GHz, 50 Ω
15NNF50-3.0C	Test Port Cable Armored, 3.0 m, N (m)-N (f), 6 GHz, 50 Ω
15NNF50-5.0C	Test Port Cable Armored, 5.0 m, N (m)-N (f), 6 GHz, 50 Ω
15ND50-1.5C	Test Port Cable Armored, 1.5 m, N (m)-7/16 DIN (m), 6 GHz, 50 Ω
15NDF50-1.5C	Test Port Cable Armored, 1.5 m, N (m)-7/16 DIN (f), 6 GHz, 50 Ω
34NN50A	Precision Adapter, N (m)-N (m), DC to 18 GHz, 50 Ω
34NFNF50	Precision Adapter, N (f)-N (f), DC to 18 GHz, 50 Ω

*: Option 5 and option 50 are mutually exclusive

Model/Order No.	Name
1091-26	Adapter, N (m)-SMA (m), DC to 18 GHz, 50 Ω
1091-27	Adapter, N (m)-SMA (f), DC to 18 GHz, 50 Ω
1091-80	Adapter, N (f)-SMA (m), DC to 18 GHz, 50 Ω
1091-81	Adapter, N (f)-SMA (f), DC to 18 GHz, 50 Ω
1091-172	Adapter, N (m)-BNC (f), DC to 1.3 GHz, 50 Ω
510-90	Adapter, 7/16 DIN (f)-N (m), DC to 7.5 GHz, 50 Ω
510-91	Adapter, 7/16 DIN (f)-N (f), DC to 7.5 GHz, 50 Ω
510-92	Adapter, 7/16 DIN (m)-N (m), DC to 7.5 GHz, 50 Ω
510-93	Adapter, 7/16 DIN (m)-N (f), DC to 7.5 GHz, 50 Ω
510-96	Adapter, 7/16 DIN (m)-7/16 DIN (m), DC to 7.5 GHz, 50 Ω
510-97	Adapter, 7/16 DIN (f)-7/16 DIN (f), DC to 7.5 GHz, 50 Ω
510-102	Adapter, N (m)-N (m) 90° right angle, DC to 11 GHz, 50 Ω
2000-1030	Portable Antenna, SMA (m), 1.71 to 1.88 GHz, 50 Ω
2000-1031	Portable Antenna, SMA (m), 1.85 to 1.99 GHz, 50 Ω
2000-1032	Portable Antenna, SMA (m), 2.4 to 2.5 GHz, 50 Ω
2000-1200	Portable Antenna, SMA (m), 806 to 866 MHz, 50 Ω
2000-1035	Portable Antenna, SMA (m), 896 to 941 MHz, 50 Ω
2000-1410	Magnet Mount GPS Antenna with 15 ft. cable
2000-1411	Portable Yagi Antenna, N (f), 822 to 900 MHz, 10 dBd
2000-1412	Portable Yagi Antenna, N (f), 885 to 975 MHz, 10 dBd
2000-1413	Portable Yagi Antenna, N (f), 1.71 to 1.88 GHz, 10 dBd
2000-1414	Portable Yagi Antenna, N (f), 1.85 to 1.99 GHz, 9.3 dBd
2000-1415	Portable Yagi Antenna, N (f), 2.4 to 2.5 GHz, 12 dBd
2000-1416	Portable Yagi Antenna, N (f), 1.92 to 2.23 GHz, 12 dBd
806-16	Bantam Plug to Bantam Plug
806-116	Bantam Plug to BNC
806-117	Bantam "Y" Plug to RJ48
551-1691-R	USB to RS-232 adapter cable
65717	Soft Carrying Case
67135	Backpack
760-243-R	Transit Case
633-27	Rechargeable Battery, NiMH
2000-1029	Battery Charger, NiMH, w/ Universal Power Supply
40-115	AC/DC Adapter
806-62	Automotive Cigarette Lighter/12 Volts DC Adapter
800-441	Serial Interface Cable
2300-347	Software Tools
10580-00089	Cell Master User's Guide (for Model MT8212B)
10580-000106	Cell Master Programming Manual (for Model MT8212B)
10580-000107	Cell Master Maintenance Manual (for Model MT8212B)
MA82101A	GPS Antenna Driver
	High accuracy power meter accessories
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
40-168	AC-DC Adapter
800-441	Serial Interface Cable
3-1010-122	Attenuator (Bi-directional), 20 dB, 5 W, DC to 12.4 GHz, N (m)-N (f)
3-1010-123	Attenuator (Bi-directional), 30 dB, 50 W, DC to 8.5 GHz, N (m)-N (f)
3-1010-124	Attenuator (Uni-directional), 40 dB, 100 W, DC to 8.5 GHz, N (m)-N (f)
65701	3 GHz Offset Cal Kit consisting of one each: 3-1010-119, 10 dB Attenuator, DC to 6 GHz, 2 W 3-806-151, 4 GHz Cable, 18" (46 cm)

BTS MASTER

MT8222A Base Station Analyzer

100 kHz to 7.1 GHz

CE Ethernet

The new BTS Master is an integrated multi functional base station test tool eliminating the need to carry and learn multiple test sets. The MT8222A measurement capabilities include spectrum analysis including smart measurements, precision return loss, VSWR, cable loss, distance-to-fault, two port gain/loss, one port and two port magnitude and phase, interference analysis, spectrogram, RF and demodulation measurements for W-CDMA/HSDPA, GSM/GPRS/EDGE and Fixed WiMAX, demodulating W-CDMA/HSDPA over the air (OTA), location information, enhanced frequency reference oscillator accuracy, variable bias tee, and T1 measurements. The High Accuracy Power Meter (Option 19) provides true RMS measurements from 50 MHz to 6 GHz.
Master Software Tools (MTS), comprehensive data management and analysis software is user friendly and it is easy to manage, archive and analyze system performance, trends and the general health of monitored base stations.

Applications

- Spectrum analysis-anytime, anywhere (100 kHz to 7.1 GHz)
- Cable and antenna testing, one port and two port measurements (10 MHz to 4.0 GHz)
- W-CDMA/HSDPA node B analysis
- GSM/GPRS/EDGE base station analysis
- Fixed WiMAX base station analysis
- Interference detection and location
- T1 functional tests
- 2 Mb/s-E1 functional tests

Specifications

- **Cable and Antenna Analyzer**

Frequency Range	10 MHz to 4 GHz (6 GHz optional)
Frequency Accuracy	25 ppm
Frequency Resolution	10 kHz
Data Points	Low, Medium, High (137/275/551)
Interference Immunity	On-Channel: +17 dBm On-Frequency: 0 dBm (RF Out) +30 dBc RF in
1-Port Power	High: 0 dBm (typical)
2-Port Power	High: 0 dBm (typical) Low: –35 dBm (typical)
Corrected Directivity	42 dB (2 MHz to 6 GHz)
1-Port Accuracy	= <0.8 + I20 log (1 ±$10^{-E\Delta/20}$)I dB, typical EΔ = Directivity – Measured Return Loss
System Dynamic Range	80 dB, 2 MHz to 3 GHz 70 dB, >3 GHz to 5.5 GHz 65 dB, >5.5 GHz to 6 GHz
Return Loss	Range: 0 to 60 dB Resolution: 0.01 dB

Continued on next page

VSWR	Range: 1 to 65, Resolution 0.01
Cable Loss	Range: 0 to 30 dB, Resolution 0.01 dB
1-Port Phase	Range: –180˚ to +180˚, Resolution: 0.01˚
Smith Chart	Resolution: 0.01
2-Port Gain	Range: –120 to 100 dB, Resolution: 0.01 dB
2-Port Phase	Range: –180˚ to +180˚, Resolution: 0.01˚
Distance-to-Fault	Fault Resolution (meters): (1.5 x 10^8 x vp)/ΔF vp is the propagation constant and ΔF is F2-F1 in Hz Horizontal Range (meters): 0 to (data points-1) x Fault Resolution to a maximum of 1500 m (4921 ft.) where datapoints = 137/275/551 Vertical Range (Return Loss): 0 to 60 dB, Vertical Range (VSWR): 1 to 65

• Spectrum Analyzer

Frequency	Frequency	100 kHz to 7.1 GHz
	Maximum Continuous Input	+30 dBm
	Tuning Resolution	1 Hz
	Frequency Reference	Aging ±1 ppm/10 years
		Accuracy ±0.3 ppm (25˚C ±25˚C) + aging
	Frequency Span	10 Hz to 7.1 GHz plus 0 Hz (zero span)
	Sweep Time	Minimum 100 ms, 10 µs in zero span
	Sweep Trigger	Free run, Single, Video, External
	Resolution Bandwidth	(–3 dB width) ±10%, 10 Hz to 3 MHz in 1–3 sequence, 8 MHz demodulation bandwidth
	Video Bandwidth	(–3 dB) 1 Hz to 3 MHz in 1–3 sequence
	SSB Phase Noise	–100 dBc/Hz max at 10, 20 and 30 kHz offset from carrier –102 dBc/Hz max at 100 kHz offset from carrier
Amplitude	Measurement Range	DANL to +30 dBm
	Absolute amplitude accuracy Power Levels (≥ –50 dBm, ≤35 dB input attenuation, Preamplifier Off)	9 kHz to ≤10 MHz ±1.5 dB >10 MHz to 4 GHz ±1.25 dB >4 GHz to 7.1 GHz ±1.75 dB
	Displayed Average Noise Level (DANL in 10 Hz RBW, 0 dB attenuation, Reference level –50 dBm, preamp on)	Frequency — Typical — Max 10 MHz to 1 GHz — –153 dBm — –151 dBm >1 GHz to 2.2 GHz — –150 dBm — –149 dBm >2.2 GHz to 2.8 GHz — –146 dBm — –143 dBm >2.8 GHz to 4.0 GHz — –150 dBm — –149 dBm >4.0 GHz to 7.1 GHz — –148 dBm — –144 dBm
	Display Range	1 to 15 dB/div in 1 dB steps. Ten divisions displayed
	Amplitude Units Log Scale Moded	dBm, dBV, dBmV, dBµV
	Attenuator Range	0 to 65 dB
	Attenuator Resolution	5 dB steps

• Power Meter

Frequency Range	100 kHz to 7.1 GHz		
Display Range	–80 to +80 dBm		
Measurement Range	–60 to +30 dBm		
Offset Range	0 to +60 dB		
Accuracy	–40 dBm <Max ≤+15 dBm 10 MHz –4 GHz: ±1.25 dB 4 GHz –7.1 GHz: ±1.75 dB	Max> +15 dBm 10 MHz –6.5 GHz: ±1.75 dB 6.5 GHz –7 GHz: ±2 dB	Max ≤–40 dBm 10 MHz –4 GHz: ±1.5 dB 4 GHz –7.1 GHz: ±1.75 dB
VSWR	1.5:1 typical		
Maximum Power	+30 dBm (1 W) without external attenuator		

• W-CDMA/HSDPA RF Measurements (Option 44)

Frequency Ranges	Bands 1 - IX
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)[1] (824 to 894 MHz, 1710 to 2170): –54 dB typical at 5 MHz offset, –59 dB typical at 10 MHz offset
	Leakage Ratio (ACLR)[1] (2300 to 2700 MHz): –54 dB typical at 5 MHz offset, –57 dB typical at 10 MHz offset
	ACLR Accuracy (Single Channel Active) (824 to 894 MHz, 1710 to 2170): ±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 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[1] (824 to 894 MHz, 1710 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[1]	±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

• W-CDMA/HSDPA OTA (Option 35)

Resolution	0.1 dB

• Power Monitor (Option 5) requires external sensor

Display Range	–80 to +80 dBm (10 pW to 100 kW)
Measurement Range	–40 to +20 dBm (10 nW to 40 mW)
Offset Range	0 to +60 dB
Resolution	0.1 dB or 0.1W
Accuracy	±1 dB maximum for >–40 dBm using 560-7N50 detector

• Bias Tee (Option 10)

Voltage/Current	12 V, 250, or 500 mA steady state 15 V, 250, or 500 mA steady state 18 V, 350 mA steady state 21 V, 250 mA steady state 24 V, 250 mA steady state

• Interference Analyzer (Option 25)

Strength of the Interferer	Locate the Interferer
RSSI	Collect data up to 72 hours
Spectrogram	Collect data up to 72 hours

• Channel Scanner (Option 27)

Frequency Range	100 kHz to 7.1 GHz
Frequency Accuracy	±10 Hz + Time base error, 99% Confidence level
Measurement Range	+20 to –110 dBm
Channel Power	100 kHz to ≤10 MHz ±1.5 dB >10 MHz to 4 GHz ±1.25 dB >4 GHz to 7.1 GHz ±1.75 dB
Adjacent Channel Power Accuracy	±0.75 dBc

• GPS (Option 31)

GPS Location Indicator	Latitude, Longitude and Altitude on display 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
Internal High Accuracy, when GPS antenna is not connected	Better than ±50 ppb for 3 days from a High Accuracy GPS Lock and within 0 to 50 degree centigrade ambient temperature

• 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%

• Fixed WiMAX RF Measurements (Option 46)

Channel Power Accuracy[2]	±1 dB Typical for +20 to –50 dBm (±1.5 dB max)

• Fixed WiMAX Demodulator (Option 47)

Residual EVM (rms)	3% for +20 dBm to –50 dBm (3.5% max.)
Frequency Error	±10 Hz + time base error, 99% confidence level

• Mobile WiMAX Specifications

Bandwidths	5 MHz, 8.75 MHz, 10 MHz
Frame Length	5 ms, 10 ms
Zone Types	PUSC
DL-MAP Auto Decoding	Convolutional Coding (CC)

• Mobile WiMAX Over the Air (OTA) Measurements (Option 37)

Time Interval	1 sec - 60 sec
Measurement Duration	72 hours max
Auto Save	Yes
GPS Logging	Yes

• Mobile WiMAX RF Measurements (Option 66)

Channel Power Accuracy	±1 dB Typical (±1.5 dB max) for +20 to –50 dBm

• Mobile WiMAX Demodulator (Option 67)

Time Interval	1 sec - 60 sec
Measurement Duration	72 hours max

• T1 Bit-Error-Rate-Tester (BERT), (Option 50)

T1 Analyzer	
Line Coding	AMI, B8ZS
Framing Modes	D4 (Superframe) ESF (Extended Superframe)
Connection Configurations	Terminate (100 Ω) Bridge (≥1000 Ω) Monitor (Connect via 20 dB pad in DSX)
Receiver Sensitivity	0 to –36 dBdsx
Transmit Level	0 dB, –7.5 dB, and –15 dB
Clock Sources	External Internal: 1.544 MHz ±30 ppm
Pulse Shapes	Conform to ANSI T1.403
Pattern Generation and Detection	PRBS: 2-9, 2-11, 2-15, 2-20, 2-23 Inverted and non-inverted, QRSS, 1-in-8 (1-in-7), 2-in-8, 3-in-24, All ones, All zeros, T1-Daly, User defined (≤32 bits)
Circuit Status Reports	Carrier present, Frame ID and Sync., Pattern ID and Sync.
Alarm Detection	AIS (Blue Alarm) RAI (Yellow Alarm)
Error Detection	Frame Bits, Bit, BER, BPV, CRC, Error Sec
Error Insertion	Bit, BPV, Framing Bits, RAI, AIS
Loopback Modes	Self loop, CSU, NIU, User defined, In-band or Data Link
Level Measurements	Vp-p (±5%), can also display in dBdsx
Data Log	Continuous, up to 48 hrs
T1 Frequency Measurement	±10 ppm
DS0 Channel Access	Tone Generator: Frequency: 100 Hz to 3000 Hz, Level: –30 to 0 dBm, 1 dB steps
Audio Monitor	Manually select channel 1 to 24
VF Measurement	Frequency: 100 Hz to 3000 Hz, ±2 Hz Level: –40.0 to +3.0 dBm, ±0.2 dBm
ITU G-821 Analysis	Errored seconds, error free seconds, severely errored seconds, unavailable seconds, available seconds, degraded minutes

∗1: Depends on reference level, input signal level and single channel conditions
∗2: Will vary with amount of data burst traffic

• E1 Bit-Error-Rate-Tester (BERT), (Option 52)

Payloads	E1 Analyzer, Trau-channels
Line Coding	AMI, HDB3
Framing Modes	PCM30, PCM30CRC-4, PCM31, PCM31CRC-4
Connection Configurations	Terminate (75Ω) BNC unbalanced, (120Ω) RJ48C balanced, Bridge (>1000Ω) Monitor (Connect via 20 dB pad in DSX)
Receiver Sensitivity	Terminate +6 to –43 dB, Bridge +6 to –43 dB, Monitor 20 dB flat gain
Clock Sources	External Sets clock, Internal: 2.048 MHz ±5 ppm

Continued on next page

Pulse Shapes	Conform to ITU G.703
Pattern Generation and Detection	PRBS: 2-9, 2-11, 2-15, 2-20, 2-23 Inverted and non-inverted, QRSS, 1-in-8 (1-in-7), 2-in-8, 3-in-24, All ones, All zeros, User defined (32 bits)
Circuit Status Reports	Carrier present, Frame ID and Sync., Pattern ID and Sync.
Alarm Detection	AIS, RAI, MFAS RAI (PCM-30)
Error Detection	Frame Bits (FAS), Bit, CRC-4, E-Bits
Error Analysis	Error rates, Error Counts
ITU G-821 Analysis	Errored seconds, error free seconds, severely errored seconds, unavailable seconds, available seconds, degraded minutes
Error Insertion	E-bit, Framing Bits (FAS), RAI, AIS
Loopback Modes	Self loopback
Level Measurements	Vp-p (±5%)
Data Log	Continuous, up to 48 hrs
E1 Frequency Measurement	±5 ppm
Tone Generator	Frequency: 100 Hz to 3000 Hz Level: –30 to 0 dBm w/ 1 dB steps
Audio Monitor	manually select channel 1-31
VF Measurement	Frequency: 100 Hz to 3000 Hz ±3 Hz
Level	–40.0 to +3.0 dBm ±0.2 dBm

• High Accuracy Power Meter Specifications using PSN50 (Option 19)

Sensor	Measurement Range	–30 to +20 dBm
	Frequency Range	50 MHz to 6 GHz
	Input Connector	Type N, male, 50 Ω
	Max Input Without Damage	+33 dBm, ±25 VDC
	Input Return Loss	50 MHz to 2 GHz: 26 dB
	2 GHz to 6 GHz	20 dB
Accuracy	Total RSS Measurement Uncertainty (0 to 50˚C)	±0.16 dB*1
	Noise	20 nW max
	Zero Set	20 nW
	Zero Drift	10 nW max*2
	Sensor Linearity	±0.13 dB max
	Instrumentation Accuracy	0.00 dB
	Sensor Cal Factor Uncertainty	±0.06 dB
	Temperature Compensation	±0.06 dB max
	Continuous digital modulation uncertainty	+0.06 dB (+17 to +20 dBm)
System	Measurement Resolution	0.01 dB
	Offset Range	±60 dB
	Interfaces	USB A/mini-B 2.0

∗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

General Specifications	Maximum Continuous Input into Spectrum Analyzer	10 dB attenuation, +30 dBm, ±50 VDC
	RF Input VSWR	2.0:1 maximum, 1.5:1 typical (10 dB attenuation)
	Internal Time Base Accuracy	±0.3 ppm
	Interfaces	Type N female RF Connector Type N female RF Out Port and RF In Port (50 W) BNC female connectors for external reference and external trigger Reverse BNC connector for GPS antenna T1 (Receive and Transmit): Bantam Jack RF Detector: Type N (m) 50 W RJ45 connector for Ethernet 10/100BASE-T 2.5 mm 3-wire cellular headset connector 5-pin Mini-B USB 2.0 device connector USB 2.0 Host connector used with PSN50 and USB Flash Drives Maximum Input (Damage Level) into Cable and Antenna Analyzer Test Port, Type N: +23 dBm, ±50 VDC
	Environmental	MIL-PRF-28800F Class 2
		Operating: –10˚ to +55˚C, humidity 85%
		Storage: –51˚ to +71˚C
		Altitude: 4600 meters, operating and non-operating
	Safety	Conforms to EN 61010-1 for Class 1 portable equipment
	Electromagnetic Compatibility	Meets European Community requirements for CE marking
	Dimensions and mass	315 (W) x 211 (H) x 94 (D) mm (12.4 x 8.3 x 3.7 in.), 4 kg (9 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
MT8222A	**Main frame** BTS Master Cable and Antenna Analyzer Frequency Range: 10 MHz to 4 GHz Spectrum Analyzer Analyzer Frequency Range: 100 kHz to 7.1 GHz Interference Analyzer Frequency Range: 100 kHz to 7.1 GHz Channel Scanner Frequency Range: 100 kHz to 7.1 GHz Power Meter Frequency Range: 10 MHz to 7.1 GHz W-CDMA/HSDPA Analyzer Frequency Range: 824 to 894 MHz, 1710 to 2170 MHz, and 2300 to 2700 MHz GSM/GPRS/EDGE Analyzer Frequency Range: 380 to 400 MHz, 410 to 430 MHz, 450 to 468 MHz, 478 to 496 MHz, 698 to 746 MHz, 747 to 792 MHz, 806-866 MHz, 824 to 894 MHz, 890-960 MHz, 880 to 960 MHz, 876 to 960 MHz, 870 to 921 MHz, 1710 to 1990 MHz Fixed WiMAX Analyzer Frequency Range: 2.3 to 2.7 GHz, 3.3 to 3.8 GHz, 5.25 to 5.875 GHz
	Options*1
MT8222A-005	Power Monitor (requires external detector)*2
MT8222A-010	Built-in 12 to 24 V variable Bias Tee
MT8222A-019	High Accuracy Power Meter (PSN50 sensor not included)
MT8222A-025	Interference Analyzer
MT8222A-027	Channel Scanner
MT8222A-031	GPS (includes GPS antenna)
MT8222A-035	W-CDMA/HSDPA OTA
MT8222A-040	GSM/GPRS/EDGE RF Meas
MT8222A-041	GSM/GPRS/EDGE Demod
MT8222A-044	W-CDMA/HSDPA RF Meas
MT8222A-045	W-CDMA Demod
MT8222A-046	Fixed WiMAX RF Meas
MT8222A-047	Fixed WiMAX Demod
MT8222A-050	T1 Analyze*2
MT8222A-052	2 Mb/s-E1 Analyzer
MT8222A-065	W-CDMA/HSDPA Demod*3
	High accuracy power meter accessories
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
3-2000-1498	USB A/mini-B cable 10 ft
3-1010-122	Attenuator (Bi-directional), 20 dB, 5 W, DC to 12.4 GHz, N (m) to N (f)
3-1010-123	Attenuator (Bi-directional), 30 dB, 50 W, DC to 8.5 GHz, N (m) to N (f)
3-1010-124	Attenuator (Uni-directional), 40 dB, 100 W, DC to 8.5 GHz, N (m) to N (f)
	Accessories
65681	Soft Carrying Case
40-168	AC/DC Adapter
806-141	Automotive Cigarette Lighter/12 Volt DC Adapter
760-235	Transit Case for Anritsu MT8222A BTS Master
2300-498	Anritsu Master Software Tools
633-44	Rechargeable Battery, Li-Ion
2000-1374	Dual External, Li-Ion Charger with Universal Power Supply
2000-1358	64 MB Compact Flash Memory Module
2000-1410	Magnet Mount GPS Antenna with 3 m (15 ft) Cable
3-2000-1360	USB A/mini-B cable 6 ft.
1N50C	Limiter, N (m) to N (f), 50 Ω, 10 MHz to 18 GHz
790-641	Cable Lock
42N50-20	Attenuator, 20 dB, 5 W, DC to 18 GHz, N (m) to N (f)
42N50A-30	Attenuator, 30 dB, 50 W, DC to 18 GHz, N (m) to N (f)
22N50	Open/Short, DC to 18 GHz, N (m), 50 Ω
22NF50	Open/Short, DC to 18 GHz, N (f), 50 Ω
SM/PL	Precision Load, DC to 4 GHz, 42 dB, N (m), 50 Ω
SM/PLNF	Precision Load, DC to 4 GHz, 42 dB, N (f), 50 Ω
OSLN50LF	Precision Open/Short/Load, DC to 4 GHz, 42 dB, 50 Ω, N (m)
OSLNF50LF	Precision Open/Short/Load, DC to 4 GHz, 42 dB, 50 Ω, N (f)
2000-767	Precision Open/Short/Load, DC to 4 GHz, 7/16 DIN (m), 50 Ω
2000-768	Precision Open/Short/Load, DC to 4 GHz, 7/16 DIN (f), 50 Ω

∗1: All the options are upgradeable at Service Centers except T1 option.
∗2: Option 5 and Option 50 are mutually exclusive.
∗3: Option 65 includes Option 45.

Model/Order No.	Name
	Adapters
510–90	7/16 DIN (f) to N (m), DC to 7.5 GHz, 50 Ω
510–91	7/16 DIN (f) to N (f), DC to 7.5 GHz, 50 Ω
510–92	7/16 DIN (m) to N (m), DC to 7.5 GHz, 50 Ω
510–93	7/16 DIN (m) to N (f), DC to 7.5 GHz, 50 Ω
510–96	7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50 Ω
510–97	7/16 DIN (f) to 7/16 DIN (f), DC to 7.5 GHz, 50 Ω
510–102	N (m) to N (m) 90° right angle, DC to 11 GHz, 50 Ω
	Precision adapters
34NN50A	Precision Adapter, DC to 18 GHz, 50 W, N (m) to N (m)
34NFNF50	Precision Adapter, DC to 18 GHz, 50 W, N (f) to N (f)
	Directional antennas
2000-1411	Portable Yagi Antenna, 10 dBd, N (f), 822 to 900 MHz
2000-1412	Portable Yagi Antenna, 10 dBd, N (f), 885 to 975 MHz
2000-1413	Portable Yagi Antenna, 10 dBd, N (f), 1.71 to 1.88 GHz
2000-1414	Portable Yagi Antenna, 9.3 dBd, N (f), 1.85 to 1.99 GHz
2000-1415	Portable Yagi Antenna, 10 dBd, N (f), 2.4 to 2.5 GHz
2000-1416	Portable Yagi Antenna, 10 dBd, N (f), 1.92 to 2.23 GHz
	GPS antenna
2000-1410	Magnet Mount GPS Antenna with 15 ft. cable
	Portable antennas
2000-1030	SMA (m), 1.71 to 1.88 GHz, 50 Ω
2000-1031	SMA (m), 1.85 to 1.99 MHz, 50 Ω
2000-1032	SMA (m), 2.4 to 2.5 GHz, 50 Ω
2000-1035	SMA (m), 896 to 941 MHz, 50 Ω
2000-1200	SMA (m), 806 to 869 MHz, 50 Ω
2000-1361	SMA (m), 5725 to 5825 MHz, 50 Ω
2000-1473	SMA (m), 870 to 960 MHz, 50 Ω
2000-1474	SMA (m), 2.41 to 2.5 GHz, 50 Ω
2000-1475	SMA (m), 1920 to 1980, 2.11 to 2.17 GHz, 50 Ω
61532	Antenna Kit: 2000–1030, 2000–1031, 2000–1032, 2000-1035, 2000–1200, and 2000–1361
	Attenuator
42N50A-30	30 dB, 50 W, Bi-directional, DC to 18 GHz, N (m) to N (f)
	Cables
806-16R	Bantam Plug to Bantam Plug
3-806-116	Bantam Plug to BNC
3-807-1176	Bantam "Y" Plug to RJ48
3-806-169	72-inch (1.8 m), BNC to BNC, 75 ½ RG59 type coax cable
806-176R	Bantam Plug to Alligator Clips
806-177R	RJ48 to RJ48
	Band pass filters
1030-105	890 to 915 MHz Band, N (m) to N (f), 50 Ω
1030-106	1710 to 1790 MHz Band, N (m) to N (f), 50 Ω
1030-107	1910 to 1990 MHz Band, N (m) to N (f), 50 Ω
1030-109	824 to 849 MHz Band, N (m) to SMA (f), 50 Ω
1030-110	880 to 915 MHz Band, N (m) to SMA (f), 50 Ω
1030-111	1850 to 1910 MHz Band, N (m) to SMA (f), 50 Ω
1030-112	2400 to 2484 MHz Band, N (m) to SMA (f), 50 Ω
1030-114	806 to 869 MHz Band, N (m) to SMA (f), 50 Ω
	Test port cable armored
15NN50-1.5C	1.5 m, N (m) to N (m), 6 GHz, 50 Ω
15NNF50-1.5B	1.5 m, N (m) to N (f), 18 GHz, 50 Ω
15NN50-3.0C	3.0 m, N (m) to N (m), 6 GHz, 50 Ω
15NN50-5.0C	5.0 m, N (m) to N (m), 6 GHz, 50 Ω
15NNF50-1.5C	1.5 m, N (m) to N (f), 6 GHz, 50 Ω
15NNF50-3.0C	3.0 m, N (m) to N (f), 6 GHz, 50 Ω
15NN50-5.0C	5.0 m, N (m) to N (m), 6 GHz, 50 Ω
15ND50-1.5C	1.5 m, N (m) to 7/16 DIN (m), 6 GHz, 50 Ω
15NDF50-1.5C	1.5 m, N (m) to 7/16 DIN (f), 6 GHz, 50 Ω
	Power monitor detectors
560-7A50	0.01 to 18 GHz
560-7N50B	0.01 to 20 GHz
560-7S50B	0.01 to 20 GHz
560-7S50-2	0.01 to 26.5 GHz
560-7K50	0.01 to 40 GHz
560-7VA50	0.01 to 50 GHz

Bluetooth TEST SET

MT8852B

2.4 GHz Reference *Bluetooth* Transceiver

Bluetooth CE

Test Bluetooth Modules and Products with a Bluetooth Interface

MT8852B makes RF measurements on *Bluetooth* modules and products with *Bluetooth* interfaces including the latest Enhanced Data Rate (EDR) standard, quickly and at low cost. All measurements are made in accordance with the *Bluetooth* SIG RF Test Specifications versions 1.2, 2.0 and 2.1.

MT8852B establishes a *Bluetooth* link with the EUT (Equipment Under Test) using standard signaling. 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, whitening 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 Core Specification RF Test Suite**

MT8852B is fully compliant with the *Bluetooth* core specifications 1.2, 2.0 and 2.1 (EDR). 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 and 6 EDR 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. The audio quality of headsets and headset modules 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.

- **Adaptive Frequency Hopping (AFH) Measurements with Option 15**

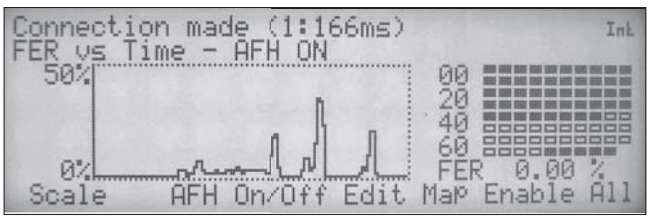
When two *Bluetooth* devices connect, they establish a basic frequency hopping scheme across 79 frequency channels in the 2.4 GHz ISM band, hopping at a rate of 1600 times per second. Interference may be encountered in environments where other wireless technologies, such as 802.11 WLAN or DECT are also active. Blocked channels, caused by interference, result in a deterioration in the performance of the connection, and this in turn results in poor voice quality or reduced data transfer rates. To limit the impact of this interference Adaptive Frequency Hopping (AFH) was introduced by the *Bluetooth* Special Interest Group in the 1.2 *Bluetooth* specification. AFH aims to restore the performance of a *Bluetooth* connection by identifying channels with high error rates and excluding the use of these channels thereafter.

When *Bluetooth* devices that implement the 1.2 specification are connected, each device can create its own Local Assessment Scheme. This is a channel map that defines which channels the device assesses to be clear and which are experiencing interference. The MT8852B is designed to respond to the EUT assessment of which channels are experiencing interference. The MT8852B, as the Master device, creates an Active Channel Map that is the combination of the EUT's local assessment scheme and any channels masked from the MT8852B user interface. This is shown in the figure below.

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.

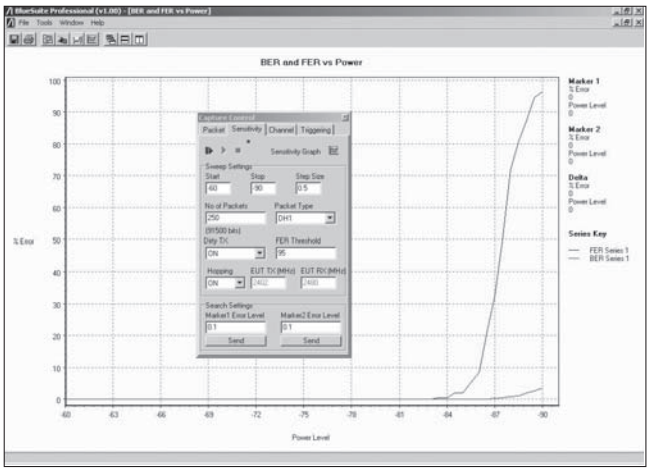


Frame Error Rate against time with AFH active

BlueSuite Pro software displays; modulation, power burst profile, IQ diagrams and sensitivity searches, graphically on PC monitor.

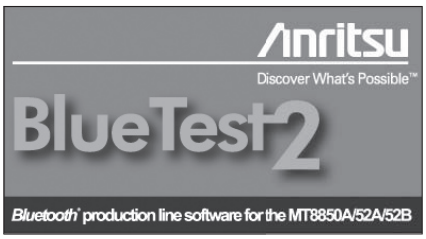
BlueSuite Pro is a comprehensive software tool that enables a greater understanding of all aspects of a devices RF characteristics. Running on a standard PC, BlueSuite Pro interfaces to the MT8852B through a GPIB interface. Use BlueSuite Pro to;

- 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.



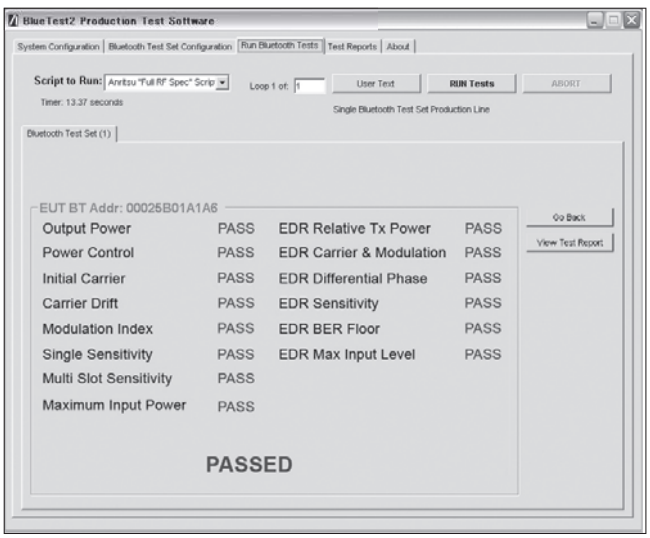
Automatic sensitivity search measurements display the FER/ BER performance of an EUT with decreasing power into the receiver. Tests can be performed on all supported standard rate and EDR packet types

BlueTest2 program automates production test software with test script generator and results data base

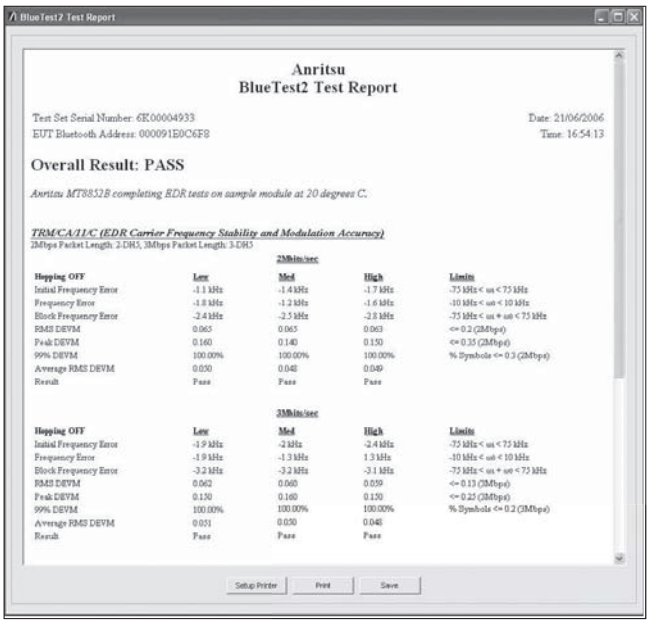


BlueTest2 software increases the efficiency of *Bluetooth* testing on the production line. The software provides a remote means to control and run *Bluetooth* tests on up to 16 MT8852B units simultaneously. Tests can be performed quickly and easily, plus script and configuration settings can be copied between multiple test sets in the line. BlueTest2 software is supplied as standard with MT8852B in both executable and source code formats (Visual Basic .NET).
Use BlueTest2 to;

- Run *Bluetooth* tests remotely using up to 16 MT8852B test sets.
- Copy settings from any of the test sets to BlueTest2.
- Apply settings from BlueTest2 to all of the test sets in the line.
- View and print detailed reports of the tests conducted.
- Write test results to a database on the local drive or to a separate server computer.



The results of the completed test are read back into the PC and the status of each test clearly displayed



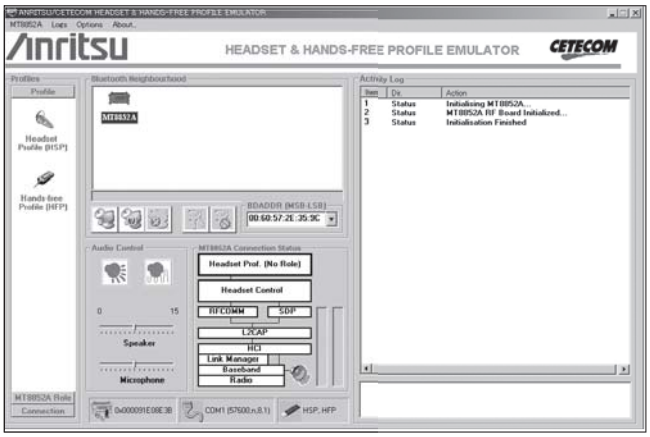
A detailed test report is automatically archived and can be printed in report format with user comments

Headset and Hands-free profile support for design verification of integrated *Bluetooth* headsets

The *Bluetooth* Headset and Hands-Free Profile Emulator is a software package developed in partnership with Centro De Tecnología de las Communications S.A. (CETECOM), and designed for use with the MT8852B *Bluetooth* Test Set. This PC software package runs the higher layers (above HCI) on the PC including the Headset and Hands-free profiles.

The emulator has been developed to facilitate the testing of integrated headsets in the integration and design proving stages as typically a fully integrated *Bluetooth* headset requires connections at the profile layer to maintain a connection to another *Bluetooth* device. Use of the emulator enables connection to a headset or audio gateway with the MT8852B and routing of audio signals directly to the microphone and speakers in the headset.
The Emulator allows the user to:

- Perform an EUT inquiry and name discovery.
- Manually enter an EUT address.
- Pair with the selected headset.
- Alert the headset.
- Initiate the MT8852B 1 kHz tone.
- Create and release an ACL or SCO connection between the MT8852B and the headset.
- Perform audio measurements on the headset by establishing an audio path to the headset microphone and speaker.
- View and save activity and host controller interface logs.
- Configure the MT8852B as the headset or audio gateway.



The main control window shows the profile selected for the MT8852B, the discovered devices and the connection status of the protocol stack. An activity log shows messaging, including AT commands, between the test set and the headset in real time. Detailed protocol logs including L2CAP, SDP and RFCOMM are also provided for protocol analysis and de-bugging.

Specifications

Bluetooth RF Measurements	As defined in *Bluetooth* specification Radio Frequency Test Suite Structure, revision 2.0.E.3 dated 21st March 2005		
	Output Power	TRM/CA/01/C	
		Measurement configuration	Hopping: OFF or ON – measure at Defined, All, or Any frequencies Test mode: ON Loopback or TX mode Payload: PRBS 9 Packet type: DH1, DH3, DH5
		Displayed results	Average power Peak power
		Number of measurement channels	User selectable, Defined (3), All, or Any
		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 Test mode: O NLoopback 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 qualification 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
	Initial Carrier Frequency Tolerance	TRM/CA/08/C	
		Measurement configuration	Hopping: OFF or ON – measure at Defined, All, or Any frequencies Test mode: ON Loopback or TX mode Payload: PRBS 9 Packet type: DH1
		Displayed results	Initial carrier frequency error
		Number of measurement channels	User selectable, Defined (3), All, or Any
		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 Test mode: ON Loopback or TX mode Payload: 10101010 Packet type: DH1, DH3, DH5
		Displayed results	Carrier frequency drift Drift rate
		Number of measurement channels	User selectable, Defined (3), All, or Any
		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

Continued on next page

Bluetooth RF Measurements	Sensitivity - Single Slot Packets	RCV/CA/01/C	
		Measurement configuration	Hopping: OFF or ON, user selectable Test mode: ON Loopback: ON Payload: PRBS9 Packet type: DH1 Dirty transmitter (as defined in the RF test spec): ON or OFF, user selectable
		Displayed results	BER (percentage) Total number of bit errors and FER
		Number of measurement frequencies	Three with hopping off, or hopping on
		Number of measured bits	1 to 10,000 packets (216 to 2,160,000 bits)
		MT8852B transmitter output range	0 to –80 dBm, resolution 0.1 dB
		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 Test mode: ON Loopback: ON Payload: PRBS 9 Packet type: DH3, DH5 Dirty transmitter (as defined in RF test spec): ON or OFF, user selectable
		Displayed results	BER (percentage) Total number of bit errors and FER
		Number of measurement frequencies	Three with hopping off, or hopping on
		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)
		MT8852B transmitter output range	0 to –80 dBm, 0.1 dB resolution
		BER/FER measurement range	0.000% to 100%
		BER/FER resolution	0.001%
	Modulation Index	TRM/CA/07/C	
		Measurement configuration	Hopping: OFF Test mode: ON Loopback or TX mode Payload: 11110000 and 10101010 Packet type: DH1, DH3, DH5
		Displayed results	Frequency deviation Δf1 Max. Δf2 Max. Δf1avg Δf2avg and Δf2avg/Δf1avg plus % of Δf2 Max. <115 kHz
		Number of measurement frequencies	Three, default to qualification 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 Power	RCV/CA/06/C	
		Measurement configuration	Hopping: OFF Test mode: ON Loopback: ON Payload: PRBS 9 Packet type: DH1
		Displayed results	BER and FER for –20 dBm at receiver input
		Number of measurement frequencies	Three, default to qualification specification or user defined
		Number of measured bits	1 to 10,000 packets (216 – 2,160,000 bits)
		Transmitter power settable range	0 to –80 dBm
		Resolution	0.1 dB

Continued on next page

EDR Specific Measurements	As defined in *Bluetooth* specification Radio Frequency Test Suite Structure, revision 2.0.E.3 dated 21st March 2005		
	EDR Relative Transmit Power	TRM/CA/10/C	
		Measurement configuration	Modulations: π/4DQPSK and 8DPSK Packets: 2-DH1,3,5 and 3-DH1,3,5 Number of test packets: default 10 Test control: Loopback or Tx mode EUT power level: Max. and Min Hopping mode: Off and On Test channels: Defined, All, Any (default defined, Low, Med High)
		Displayed results	Max. differential power (from all packets) Min differential power (from all packets) Average differential power (over all packets)
		Measurement range (nominal)	+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, (PGFSK–8 dB) <PDPSK < (PGFSK +4 dB)
	EDR Carrier Frequency Stability and Modulation Accuracy	TRM/CA/11/C	
		Measurement configuration	Modulations: π/4DQPSK and 8DPSK Packets: 2-DH1,3,5 and 3-DH1,3,5 Number of test blocks: default 200 Test control: Loopback or Tx mode EUT power level: Max. and Min Hopping mode: Off and On Test channels: Defined, All, Any (default defined, Low, Med High)
		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)
		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	Modulations: π4DQPSK and 8DPSK Packets: 2-DH1,3,5 and 3-DH1,3,5. Number of test packets: default 100 Test control: Tx mode Hopping mode: Off and On Test channels: Defined
		Displayed results	Number of packets received Number of packets with payload data errors Percentage of errored packets

Continued on next page

<table>
<tr><td rowspan="15">EDR Specific Measurements</td><td rowspan="8">EDR Sensitivity</td><td colspan="4">RCV/CA/07/C</td></tr>
<tr><td>Measurement configuration</td><td colspan="3">Modulations: π/4DQPSK and 8DPSK
Packets: 2-DH1,3,5 and 3-DH1,3,5.
Dirty transmitter control: On and Off
Payload bit count: transmitted or received
Bit threshold control: default threshold 1, 1.6 million, threshold 2, 16 million (user editable)
Test control: Loopback
Hopping mode: Off and On
Test channels: Defined</td></tr>
<tr><td>Displayed results</td><td colspan="3">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</td></tr>
<tr><td>Output power range</td><td colspan="3">0 to –90 dBm</td></tr>
<tr><td>Output power accuracy</td><td colspan="3">±1 dB, 0 to –80 dBm</td></tr>
<tr><td rowspan="4"></td><td colspan="3">Dirty transmitter specification
Frequency modulation error sine wave, ±10 kHz deviation and 100 µs period, plus table impairments below, cycled at a 20 packet rate</td></tr>
<tr><td>Measurement Conditions</td><td>Carrier Frequency Off</td><td>Symbol Timing Error</td></tr>
<tr><td>1</td><td>0 kHz</td><td>0 ppm</td></tr>
<tr><td>2</td><td>+65 kHz</td><td>+20 ppm</td></tr>
<tr><td>3</td><td>–65 kHz</td><td>–20 ppm</td></tr>
<tr><td rowspan="4">EDR BER Floor Performance</td><td colspan="4">RCV/CA/08/C</td></tr>
<tr><td>Measurement configuration</td><td colspan="3">Modulations: π/4DQPSK and 8DPSK
Packets: 2-DH1,3,5 and 3-DH1,3,5
Payload bit count: transmitted or received
Bit threshold control: default threshold 1, 8 million, threshold 2, 160 million (user editable)
Test control: Loopback
Hopping mode: Off and On
Test channels: Defined</td></tr>
<tr><td>Displayed results</td><td colspan="3">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</td></tr>
<tr><td>Output power range</td><td colspan="3">0 to –90 dBm</td></tr>
<tr><td rowspan="4">EDR maximum Input Level</td><td colspan="4">RCV/CA/10/C</td></tr>
<tr><td>Measurement configuration</td><td colspan="3">Modulations: π/4DQPSK and 8DPSK
Packets: 2-DH1,3,5 and 3-DH1,3,5
Payload bit count: transmitted or received
Number of bits: default 1.6 million (user editable)
Test control: Loopback
Hopping mode: Off and On
Test channels: Defined</td></tr>
<tr><td>Displayed results</td><td colspan="3">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</td></tr>
<tr><td>Output power range</td><td colspan="3">0 to –90 dBm</td></tr>
<tr><td></td><td>Output power accuracy</td><td colspan="3">±1 dB, 0 to –80 dBm</td></tr>
</table>

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MT8852B Signal Generator	Frequency	Frequency range	2.40 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
		Spurious	
	GFSK modulation	Modulation index	Variable, 0.25 to 0.38 (125 kHz to 190 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 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	RS232 HCI commands	The EUT control interface provides RS232 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 RS232 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.

Continued on next page

Audio Specifications	Number of SCO channels supported	3
	Codec air interfaces supported	CVSD, A-Law, Ì-Law
	Frequency response	(–3 dB) measured CODEC in to CODEC out: 160 Hz –3.5 kHz. Measured with 50Ω source impedance and 10 MW load impedance
	Maximum input / output signal level	3.4 Vpk-pk = 1.2 V 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	600 Ω
	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, 50 Ω 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
RS232	RS232	Offers full instrument control as standard
General	Power supply	85 to 264 Volts AC
	Frequency	47 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
Dimensions and mass		216.5 (W) x 88 (H) x 380 (D) mm, <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
	Included accessories
	MT8852B Operation Manual
	MT8852B Remote Programming Manual
	BlueSuite software (standard version)
	RS232 HCI control interface lead
	RS232 cable for firmware updates
	Power cord for destination country
	Certificate of calibration
	USB HCI control interface lead
	3.5 mm jack plugs (3)
	BlueTest2 software

Model/Order No.	Name
	Options
MT8850A/01	Rack Mount, single instrument
MT8850A/03	Rack Mount, side-by-side
MT8850A/10	*Bluetooth* antenna and adapter
MT8852A/14P/U	Headset and Handsfree profile emulator software
MT8852A/15	Adaptive Frequency Hopping (AFH)
MT8852A/16	Headset and Handsfree support
MT8850A/17	IQ data output
MT8850A/20	Spare EUT/RS232 cable
MT8850A/21	Spare EUT/USB cable
MT8850A/30	Extra Operation and Programming Manual
MT885xA/98	Z540, SO25 calibration certificate + test data
MT885xA/99	PREMIUM Z540, ISO25 calibration certificate + test data
MT8852B/319	Retrofit Audio to MT8852B
MT8852B/325	Retrofit EDR to MT8852B
D41310	Soft carry case with shoulder strap
MX885201B	BlueSuite Pro3 (standard rate and EDR)
MX885201B-301	Upgrade from BlueSuite Pro2 to BlueSuite Pro3

WLAN TEST SET

MT8860C

2.4 GHz 802.11b/g frequency bands

CE

One Test Set, Two Modes of Testing

NEW

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 through a GPIB interface.

Key Features

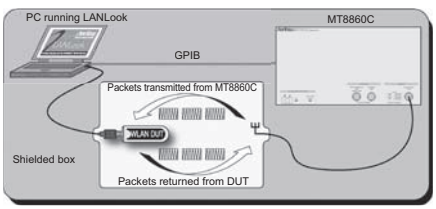
- Integrated test set for 802.11b/g/a Tx and Rx measurements
- “Network” mode allowing devices to be tested in a connection using standard WLAN protocols
- Automatic configuration of DUT IP settings using built-in DHCP server
- Packet loopback technique for simplified DUT Tx measurements
- Built-in reference radio for calibrated receiver Packet Error Ratio (PER) measurements
- “Direct” mode allowing WLAN devices to be tested with the support of control software from the chipset vendor
- Transmission of user defined WLAN packets
- Built-in Tx analyzer providing high-speed measurements including power, spectral mask, spectral flatness, Error Vector Magnitude (EVM), frequency and CCDF
- LANLook software for instrument configuration and results display
- LANTest software for automated production test requirements

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.

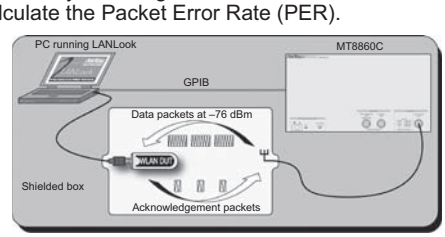
Network Mode Transmitter Testing

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 LANTest.
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 Basic® and full source code is provided allowing users to customize the software to exactly match their own unique requirements.
LANTest 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. LANTest 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 and 802.11a devices.
LANTest 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.
LANTest 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 LANTest.
LANTest provides a DUT control interface that allows Dynamic Link Library (DLL) files to be “registered” with LANTest. 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 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 LANTest 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

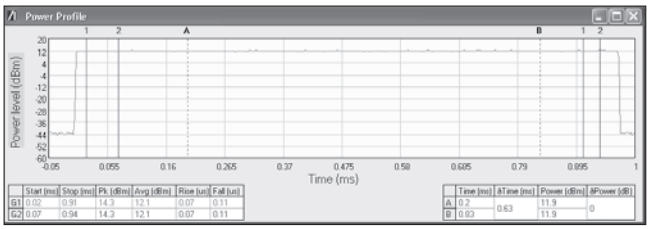
802.11g & 802.11a
(OFDM data rates – 6, 9, 12, 18, 24, 36, 48 and 54 Mbps)

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

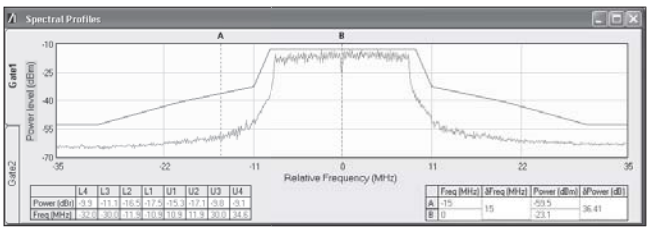
*: Additional signal source required

Example Measurements



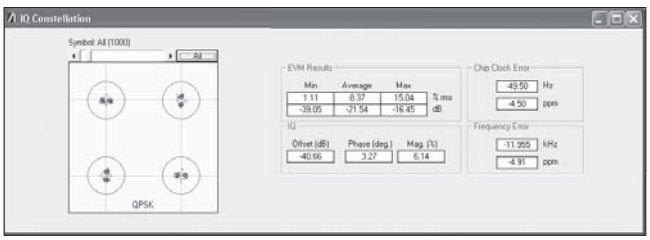
Power burst profile

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.



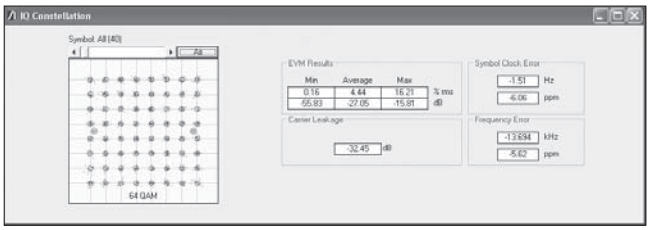
Spectral profiles

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.

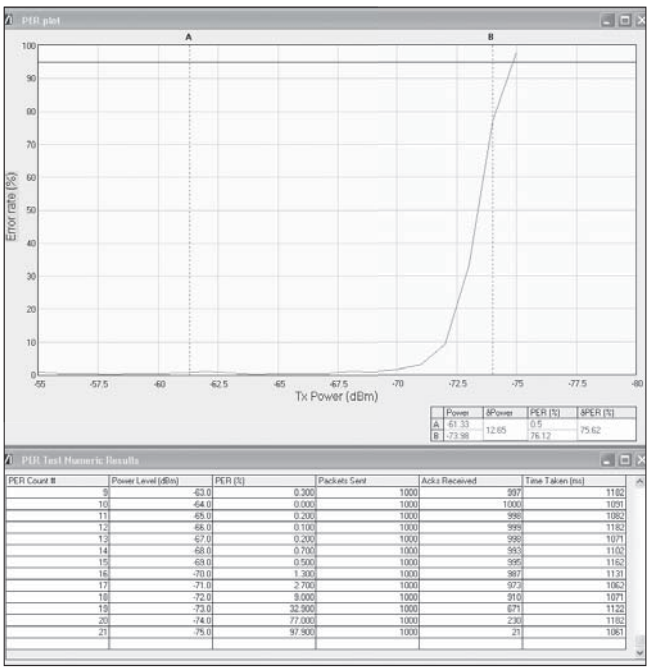


EVM (802.11g OFDM)

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 setup	Standards supported	IEEE 802.11b-1999 IEEE 802.11g-2003 IEEE 802.11a-1999 (Option 14) IEEE 802.11-2007
	Supported channels	802.11b/802.11g (DSSS): Channels 1 to 14 (2412 to 2484 MHz) 802.11g (OFDM): Channels 1 to 13 (2412 to 2472 MHz) 802.11a: Channels 36, 40, 44, 48 (5150 to 5250 MHz) Channels 52, 56, 60 ,64 (5250 to 5350 MHz) Channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140 (5470 to 5725 MHz) Channels 149, 153, 157, 161,165 (5725 to 5825 MHz)
	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)
Operating modes	Network mode	In this mode, testing of a DUT's Rx and Tx characteristics are possible after first establishing a network connection between the MT8860C and the DUT Receiver measurements Packet Error Rate (PER) at defined level Unicast packet type: The MT8860C calculates the PER based on the number of acknowledgement (ACK) packets transmitted by DUT in response to the data packets it receives from the MT8860C Broadcast packet type: MT8860C transmits data packets containing the broadcast address (FFFFFFFFFFFF). The measurement of PER is calculated externally and requires access to the DUT receive frame registers. These are normally available from the client software under "Advanced Information" Transmitter measurements Packet loopback mode: MT8860C forms a connection with DUT and transmits ICMP echo request packets and analyses the echo reply packets returned by the DUT in response
	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 DSSS preamble format: Long, Short Note: The Beacon Interval represents a number of time units (TU), with 1 TU being equal to 1024 µs IP properties: The IP settings of the DUT can be assigned manually or automatically via DHCP
	Direct mode	In this 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

• 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 802.11b-1999/IEEE 802.11-2007 (18.4.7.1) Definition: Average and peak power measurements derived from gate 1 or 2 Damage levels: >+27 dBm Dynamic range: +24 to –50 dBm average power (+27 dBm peak) Accuracy (CW): ±0.6 dB (+24 to –30 dBm), ±1.0 dB (–30 to –50 dBm) Resolution: 0.1 dB 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 802.11b-1999/IEEE 802.11-2007 (18.4.7.2) Definition: Peak and Average Power specification as for 18.4.7.1
Transmit spectrum mask	IEEE 802.11b-1999/IEEE 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 Dither mode OFF: Default mode ON: Additional Signal processing removes spurs from the spectral measurement Frequency span: 70 MHz (fc ±35 MHz) Flatness over frequency span: ±1 dB Linearity: ±0.8 dB (50 dB dynamic range CW measurements) Resolution: 0.1 dB Range: +20 to –40 dBm modulated carrier power 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)

Continued on next page

Transmit center frequency tolerance	IEEE 802.11b-1999/IEEE 802.11-2007 (18.4.7.4) Accuracy: ±1 kHz ± reference frequency oscillator error (ppm) for measurement gate >1 ms Resolution: 100 Hz
Chip clock frequency tolerance	IEEE 802.11b-1999/IEEE 802.11-2007 (18.4.7.5) Definition: Frequency error relative to 11 MHz chip clock. Measurement averaged over a fully coded DSSS packet with minimum payload length of 3,300 chips (300 µs) Display format: Hz and ppm Range: ±50 ppm Resolution: 0.1 Hz, 0.1 ppm Analysis length: 3,300 to 30,250 chips (default 5,500 chips)
Transmit power-on & power- down ramp	IEEE 802.11b-1999/IEEE 802.11-2007 (18.4.7.6) Definition: Time for burst to transit 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 802.11b-1999/IEEE 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 802.11b-1999/IEEE 802.11-2007 (18.4.7.8) Definition: Peak and Average Error Vector Magnitude measurement performed as defined in 18.4.7.8 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 Measurement configuration Rx filter selection (Selectable between): None Gaussian, BT 0.3 to 1.0 (default 0.5), resolution 0.1 Root Raised Cosine, a 0.30 to 1.00 (default 0.35), resolution 0.01 Averaging: Single measurements, or averaging applied to the EVM results Analysis length: 220 to 11,000 chips (default 1,000 chips)
Receiver minimum input sensitivity	IEEE 802.11b-1999/IEEE 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 1,000 (default 500) Payload length: 1 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 802.11b-1999/IEEE 802.11-2007 (18.4.8.2) Definition: Receiver PER specification as for 18.4.8.1
Receiver adjacent channel rejection	IEEE 802.11b-1999/IEEE 802.11-2007 (18.4.8.3) Definition: Adjacent Channel measurements made with external modulated signal source (e.g.MG3700A) using external interferer port
Additional Measurements	Occupied bandwidth: Measures the frequency range within which the specified percentage power is contained Occupied bandwidth percentage: 1 to 99% Frequency vs. time: Frequency drift measured over packet transmission

• 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 802.11g-2003/IEEE 802.11-2007 (19.4.7.1) IEEE 802.11a-1999/IEEE 802.11-2007 (17.3.9.1) Definition: Average, peak and crest factor power measurements on OFDM modulated signals on the supported channels Damage levels: >+27 dBm Dynamic range: 18 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: 0.1 dB Capture width: 10 µs to 5.95 ms Time resolution: 0.1 µs marker resolution with 10 µs time window
Transmit spectrum mask	IEEE 802.11g-2003/IEEE 802.11-2007 (19.5.4) IEEE 802.11a-1999/IEEE 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 Dither Mode OFF: Default mode ON: Additional Signal processing removes spurs from the spectral measurement Frequency span: 70 MHz (fc ±35 MHz) Flatness over frequency span: ±1 dB Linearity: ±0.8 dB (50 dB dynamic range CW measurements) Resolution: 0.1 dB Range: +18 to –40 dBm modulated carrier power 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, with Input Level Range 3L selected) 802.11g: –110 dBm 802.11a: –105 dBm Spurious Specification (for all supported channels, with Dither Mode ON) 802.11g: <–45 dBc 802.11a: <–43 dBc
Transmit center frequency tolerance	IEEE 802.11g-2003/IEEE 802.11-2007 (19.4.7.2) IEEE 802.11a-1999/IEEE 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: 100 Hz
Symbol clock frequency tolerance	IEEE 802.11g-2003/IEEE 802.11-2007 (19.4.7.3) IEEE 802.11a-1999/IEEE 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: 0.01 Hz, 0.1 ppm Analysis length: 16 to 500 symbols (default 55 symbols)
Transmitter center frequency leakage	IEEE 802.11g-2003/IEEE 802.11-2007 (19.4.7) IEEE 802.11a-1999/IEEE 802.11-2007 (17.3.9.6.1) Definition: Measurement of the leakage of the center carrier Data output format: dB Resolution: 0.1 dB
Transmitter spectral flatness	IEEE 802.11g-2003/IEEE 802.11-2007 (19.4.7) IEEE 802.11a-1999/IEEE 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 sub-carrier(s) is reported Unit of measurement: dBr
Transmitter modulation accuracy	IEEE 802.11g-2003/IEEE 802.11-2007 (19.7.2.7) IEEE 802.11a-1999/IEEE 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 (54 Mbps, +18 to –45 dBm) 802.11g: <2% residual RMS EVM 802.11a: <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 Analysis length: 16 to 500 symbols (default 40 symbols) OFDM pilot tracking: User selection of Phase tacking only or Phase and Amplitude tracking

Continued on next page

Receiver minimum input sensitivity	IEEE 802.11g-2003/IEEE 802.11-2007 (19.5.1) IEEE 802.11a-1999/IEEE 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 1,000 (default 500) Payload length: 1 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 802.11g-2003/IEEE 802.11-2007 (19.5.2) IEEE 802.11a-1999/IEEE 802.11-2007 (17.3.10.2) Definition: Adjacent Channel measurements made with external modulated signal source (e.g. MG3700A) using external interferer port
Receiver maximum input level	IEEE 802.11g-2003/IEEE 802.11-2007 (19.5.3) IEEE 802.11a-1999/IEEE 802.11-2007 (17.3.10.4) Definition: As per 19.5.1
Additional 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
Tx measurement controls	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 Video trigger dynamic range: +18 to –50 dBm average power with Input Level Range set to AUTO 802.11b/802.11g (DSSS): Triggers at –10 dB below average power level 802.11g (OFDM)/802.11a: Triggers at –20 dB below average power level External: TTL input, BNC on Rear Panel Measurement gates: Two gates for Power, Spectrum, Frequency and CCDF measurements. Gate positions set directly by GPIB 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	Network and Direct Modes Supported Channels 802.11b/802.11g (DSSS): Channels 1 to 14 (2412 to 2484 MHz) 802.11g (OFDM): Channels 1 to 13 (2412 to 2472 MHz) 802.11a: Channels 36, 40, 44, 48 (5150 to 5250 MHz) Channels 52, 56, 60 ,64 (5250 to 5350 MHz) Channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140 (5470 to 5725 MHz) Channels 149, 153, 157, 161, 165 (5725 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 Ω <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

Continued on next page

Reference radio receiver network mode	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: <1.5:1 802.11a: <1.6:1 (nominally <1.5:1) 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)

● **General**

Reference frequency oscillator		Frequency: 10 MHz Aging: <±1 ppm/year, <±2.5 ppm/10 years Drift: <±0.5 ppm, 0˚ to +45˚C
Inputs & Outputs	Front panel inputs & outputs	Test Port In/Out: Provides connection to DUT, N-type (f), 50 W nominal VSWR 802.11b/802.11g: <1.5:1 802.11a: <1.6:1 (nominally <1.5:1) Interferer input Provides input for external signal source (e.g. MG3700A), N-type (f), 1.5:1 VSWR Maximum Input Power: +27 dBm Loss to Test Port In/Out (for supported channels using supplied test data): Nominally 22 dB ±1 dB (802.11b/802.11g) Nominally 24 dB ±1 dB (802.11a) WLAN reference input: Allows an external reference radio to be used for DUT receiver measurements using only the leveling loop and attenuator of MT8860C Power output leveled to power specification for packets >110 µs Power input range >+12 to +18 dBm No measurements supported by MT8860C in this mode
	Rear panel inputs & outputs	GPIB: IEEE 488.2 compliant 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
General		Power Supply: 85 to 264 V AC Frequency: 47 to 63 Hz Power: 100 VA Operating temperature range: +5˚ to +40˚C Operating humidity: <75% non condensing
Dimensions and mass		180 (W) x 320 (H) x 350 (D) mm, <10 kg
EMC		EN61326-1, EN61000-4-3
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
MT8860C	**Main frame** WLAN Test Set with 802.11b/g Measurements
	Standard accessories Power Cable MT8860C WLAN Test Set Operation Manual (printed copy) MT8860C WLAN Test Set Remote Programming Manual (printed copy) CD Containing; • LANLook Software • Source Code for LANLook • LANTest WLAN Production Test software • Source Code for LANTest • LANTest Operation Manual (pdf) • LabView Plug and Play Instrument driver • LabWindows/CVI Plug and Play Instrument driver • MT8860C WLAN Test Set Operation Manual (pdf) • MT8860C WLAN Test Set Remote Programming Manual (pdf)
MT8860C-001 MT8860C-002 MT8860C-010 MT8860C-014 MT8860C-114 MT8860C-98 MT8860C-99	**Options** Rack Mount Kit Front Panel Handles Bluetooth/Dual Band WLAN Antenna and Adapter 802.11a Tx/Rx Measurements Retrofit 802.11a Tx/Rx Measurements Standard Calibration to ANSI/NCSL Z540 Premium Calibration to ANSI/NCSL Z540 (Test report and uncertainty data included)
2000-1548-R 2100-2 B0329G 13000-00258 13000-00259	**Accessories** N-type Termination Plug (6 GHz, 50 W) GPIB Cable, 2 m Protective Cover MT8860C WLAN Test Set Operation Manual MT8860C WLAN Test Set Remote Programming Manual

HIGH PERFORMANCE HANDHELD SPECTRUM ANALYZERS

MS2721B/MS2723B/MS2724B

9 kHz to 20 GHz

CE Ethernet

The Most Advanced Ultra-portable Spectrum Analyzer on the Market, Featuring Unparalleled Performance at a Modest Price

Continuous frequency coverage from 9 kHz to 20 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 20 GHz Input
- 1 Hz to 3 MHz RBW Range
- Very Low Phase Noise (–95 dBc/Hz Maximum at 10 kHz offset at 100 kHz to 20 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 (MS2721B only)
- 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

Model		MS2721B	MS2723B	MS2724B
Frequency	Frequency range	9 kHz to 7.1 GHz	9 kHz to 13 GHz	9 kHz to 20 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)	10 Hz to 13 GHz Plus 0 Hz (zero span)	10 Hz to 20 GHz Plus 0 Hz (zero span)
	Span accuracy	Same as frequency reference accuracy		
	Sweep time	Automatically sets fastest sweep time consistent with accuracy. 10 µs to 200 s range in zero span.		
	Sweep time accuracy	±2% in zero span		
	Sweep trigger	Free run, Single, Video, External		
	Resolution bandwidth	(–3 dB width) 1 Hz to 3 MHz in 1-3 sequence ±10%, 10 MHz demodulation bandwidth, 200 Hz, 9 kHz, and 120 kHz (–6 dB widths) when quasi-peak detector selected		
	Video bandwidth	(–3 dB) 1 Hz to 3 MHz in 1-3 sequence		
	SSB phase noise	9 kHz to 7.1 GHz: –100 dBc/Hz Max. at 10, 20 and 30 kHz offset –102 dBc/Hz Max. at 100 kHz	9 kHz to 13 GHz: 10, 20, 30 kHz offset –95 dBc/Hz 100 kHz offset –97 dBc/Hz 1 MHz offset –105 dBc/Hz 10 MHz offset –120 dBc/Hz	9 kHz to 13 GHz: 10, 20, 30 kHz offset –95 dBc/Hz 100 kHz offset –97 dBc/Hz 1 MHz offset –105 dBc/Hz 10 MHz offset –120 dBc/Hz 13 to 20 GHz: 10, 20, 30 kHz offset –91 dBc/Hz 100 kHz offset –93 dBc/Hz 1 MHz offset –102 dBc/Hz 10 MHz offset –116 dBc/Hz
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 9 kHz to 10 MHz ±1.5 dB >10 MHz to 4 GHz ±1.25 dB >4 to 7.1 GHz ±1.75 dB 40 to 55 dB input attenuation 9 kHz to 10 MHz ±1.5 dB >10 MHz to 4 GHz ±1.75 dB >4 to 6.5 GHz ±1.75 dB >6.5 to 7.1 GHz ±2 dB 60 to 65 dB input attenuation 9 kHz to 10 MHz ±1.5 dB >10 MHz to 6.5 GHz ±1.75 dB >6.5 to 7.1 GHz ±3 dB Preamplifier on, 0 or 10 dB input attenuation 9 kHz to 4 GHz ±1.5 dB >4 to 7.1 GHz ±1.75 dB	Overall Amplitude Accuracy: +20˚ to +30˚C, 30 minute warmup ±1.3 dB Full Temperature Range: –10˚ to +55˚C add ±1.2 dB Frequency Flatness: >4 GHz add ±1.4 dB	Overall Amplitude Accuracy: +20˚ to +30˚C, 30 minute warmup ±1.3 dB Full Temperature Range: –10˚ to +55˚C add ±1.2 dB Frequency Flatness: >4 GHz add ±1.5 dB
	Second harmonic distortion (0 dB input attenuation, –30 dBm input)	0.05 to 1.4 GHz, –50 dBc >1.4 to 2 GHz, –70 dBc >2 GHz, –80 dBc	–50 dBc, 50 to 500 MHz –45 dBc, 500 to 800 MHz –60 dBc, 800 to 3000 MHz –80 dBc, >3 GHz	–50 dBc, 50 to 500 MHz –45 dBc, 500 to 800 MHz –60 dBc, 800 to 3000 MHz –80 dBc, >3 GHz
	Third order intercept (TOI) (preamplifier off)	Frequency Min. 600 MHz +7 dBm 3.5 GHz +9 dBm Frequency Typical 50 to 300 MHz >8 dBm >300 MHz to 2.2 GHz >10 dBm >2.2 to 2.8 GHz >15 dBm >2.8 to 4.0 GHz >10 dBm >4.0 to 7.1 GHz >13 dBm 0 dB attenuation, –20 dBm reference level, –20 dBm tones, spaced 100 kHz	+6 dBm, 50 to 500 MHz +8 dBm, 500 to 2000 MHz +10 dBm, 2 to 6 GHz +12 dBm, 6 to 13 GHz	+6 dBm, 50 to 500 MHz +8 dBm, 500 to 2000 MHz +10 dBm, 2 to 6 GHz +12 dBm, 6 to 20 GHz

Continued on next page

	Model	MS2721B	MS2723B	MS2724B
Amplitude		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.		
	Displayed average noise level: DANL in 1 Hz RBW	Preamplifier On –163 dBm (Typical), –161 dBm (Max.), 10 MHz to 1 GHz –160 dBm (Typical), –159 dBm (Max.), >1 to 2.2 GHz –156 dBm (Typical), –153 dBm (Max.), >2.2 to 2.8 GHz –160 dBm (Typical), –159 dBm (Max.), >2.8 to 4.0 GHz –158 dBm (Typical), –154 dBm (Max.), >4.0 to 7.1 GHz Preamplifier Off –140 dBm (Typical), –137 dBm (Max.), 10 MHz to 1 GHz –136 dBm (Typical), –133 dBm (Max.), >1 to 2.2 GHz –130 dBm (Typical), –126 dBm (Max.), >2.2 to 2.8 GHz –139 dBm (Typical), –136 dBm (Max.), >2.8 to 4.0 GHz –131 dBm (Typical), –127 dBm (Max.), >4.0 to 7.1 GHz	Preamplifier On –149 dBm, 10 MHz to 1 GHz –146 dBm, 1 to 3 GHz –144 dBm, 3 to 4 GHz Preamplifier Off –139 dBm, 10 MHz to 4 GHz –136 dBm, 4 to 10 GHz –130 dBm, 10 to 13 GHz Preamplifier works to 4 GHz	Preamplifier On –149 dBm, 10 MHz to 1 GHz –146 dBm, 1 to 3 GHz –144 dBm, 3 to 4 GHz Preamplifier Off –139 dBm, 10 MHz to 4 GHz –136 dBm, 4 to 10 GHz –130 dBm, 10 to 13 GHz –136 dBm, 13 to 20 GHz Preamplifier works to 4 GHz
	Noise figure (derived from DANL measurement)	0 dB attenuation, 23°C: Preamplifier On Frequency / Typical 0 MHz to 1 GHz: 11 dB >1 to 2.2 GHz: 14 dB >2.2 to 2.8 GHz: 18 dB >2.8 to 4.0 GHz: 14 dB >4.0 to 7.1 GHz: 16 dB	Preamplifier on 10 MHz to 1 GHz: 15 dB 1 to 3 GHz: 18 dB 3 to 4 GHz: 20 dB Preamplifier off 10 MHz to 4 GHz: 35 dB 4 to 10 GHz: 38 dB 10 to 13 GHz: 44 dB	Preamplifier on 10 MHz to 1 GHz: 15 dB 1 to 3 GHz: 18 dB 3 to 4 GHz: 20 dB Preamplifier off 10 MHz to 4 GHz: 35 dB 4 to 10 GHz: 38 dB 10 to 13 GHz: 44 dB 13 to 20 GHz: 38 dB
	Input-related spurious –30 dBm input, 0 dB RF attenuation, span <1.7 GHz	–60 dBc Max., (<–70 dBc typical)	–60 dBc Max., (<–70 dBc typical) Except: Input Freq of 3275 MHz –50 dBc	–60 dBc Max., (<–70 dBc typical) Except: Input Freq of 3275 MHz –50 dBc
	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 to 7100 MHz Exceptions[*2]: Frequency / Spur Level 250, 300, and 350 MHz: –85 dBm Max. ~4010 MHz: –80 dBm Max. (–90 dBm typical) ~5084 MHz: –70 dBm Max. (–83 dBm typical) ~5894 MHz: –75 dBm Max. (–87 dBm typical) ~7028 MHz: –80 dBm Max. (–92 dBm typical)	–90 dBm Max.	–90 dBm Max. –85 dBm Max., >13 GHz
	Residual spurious, preamplifier on (RF input terminated, 0 dB RF attenuation)	–100 dBm Max.	100 kHz to 4 GHz, –100 dBm Max.	100 kHz to 4 GHz, –100 dBm Max.

Options Specifications

• RF and Demodulation Hardware (Option 9)

Hardware required to demodulate 3G and WiMax signals

• PSN50 High Accuracy Power Meter (Option 19)

PSN50 Sensor	Measurement Range: –30 to +20 dBm
	Frequency Range: 50 MHz to 6 GHz
	Input Connector: Type N, male, 50Ω
	Max Input Without Damage: +33 dBm, ±25 VDC
	Input Return Loss: 50 MHz to 2 GHz: ≥26 dB
	2 GHz to 6 GHz: ≥20 dB
PSN50 Accuracy	Total RSS Measurement Uncertainty (0˚ to 50˚C): ±0.16 dB*1
	Noise: 20 nW Max.
	Zero Set: 20 nW
	Zero Drift: 10 nW Max.*2
	Sensor Linearity: ±0.13 dB Max.
	Instrumentation Accuracy: 0.00 dB
	Sensor Cal Factor Uncertainty: ±0.06 dB
	Temperature Compensation: ±0.06 dB Max.
	Continuous digital modulation uncertainty: +0.06 dB (+17 to +20 dBm)
PSN50 System	Measurement Resolution: 0.01 dB
	Offset Range: ±60 dB
	Power Requirements:
	Supply Voltage: 8 to 18 Vdc
	Supply Current: <100 mA

• Tracking Generator (Option 20 for MS2721B only)

Frequency range	100 kHz to 7.1 GHz
Power output	0 to –40 dBm
Connector	Type N (f)
Step size	0.1 dB
Level accuracy (15˚ to 35˚C)	±1.5 dB Max., 450 kHz to 7.1 GHz Excluding SWR effects

• Interference Analyzer (Option 25)

Signal strength	Gives visual and aural indication of signal strength
RSSI	Collect data up to 72 hours
Spectrogram	Collect data up to 72 hours

• Channel Scanner (Option 27)

Measurement range	+20 dBm to –110 dBm
Number of channels	1 to 20

• GPS (Option 31)

GPS location indicator	Latitude, Longitude and Altitude on display 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
Internal high accuracy, when GPS antenna is not connected	Better than ±50 ppb for 3 days from a High Accuracy GPS Lock and within 0˚ to 50˚C ambient temperature
Connector	Reverse polarity BNC

• WCDMA/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%

• WCDMA/HSDPA RF Measurements (Option 44)

Frequency ranges	824 to 894 MHz, 1710 to 2170 MHz, 2300 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 to 894 MHz, 1710 to 2170)	–54 dB typical at 5 MHz offset –59 dB typical at 10 MHz offset
Leakage ratio (ACLR)*3 (2300 to 2700 MHz)	–54 dB typical at 5 MHz offset –57 dB typical at 10 MHz offset
ACLR accuracy (Single channel active) (824 to 894 MHz, 1710 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 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

• WCDMA Demodulation and WCDMA/HSDPA Demodulator (Options 45 and 65)

EVM accuracy*3 (824 to 894 MHz, 1710 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 PSN50 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) x 211 (H) x 77 (D) mm (12W x 8H x 3D in.) MS2721B: 3.1 kg (<6.9 lbs.) typical; MS2723B and MS2724B: 3.4 kg (7.5 lb) 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	RF & Demodulation Hardware
MS2721B-019	High Accuracy Power Meter (PSN50 sensor not included)
MS2721B-020	Tracking Generator
MS2721B-025	Interference Analysis
MS2721B-027	Channel Scanner
MS2721B-030	ISDB-T Digital Video Measurements (requires Opt. 009)
MS2721B-031	GPS (includes GPS antenna)
MS2721B-032	ISDB-T SFN (requires Opt. 009)
MS2721B-033	cdmaOne and CDMA2000 1xRTT Over the Air (OTA) (requires Opt. 009, 031)
MS2721B-034	EVDO Over The Air (OTA) Measurement (requires Opt. 009, 031)
MS2721B-035	W-CDMA/HSDPA OTA (requires Opt. 009 and 031)
MS2721B-037	Mobile WiMAX Over The Air (OTA) Measurement (requires Opt. 009)
MS2721B-040	GSM/GPRS/EDGE RF Measurement (requires Opt. 009)
MS2721B-041	GSM/GPRS/EDGE Demod (requires Opt. 009)
MS2721B-042	CDMA RF Measurement (requires Opt. 009)
MS2721B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Opt. 009)
MS2721B-044	W-CDMA/HSDPA RF Measurement (requires Opt. 009)
MS2721B-045	W-CDMA Demodulation (requires Opt. 009)
MS2721B-046	Fixed WiMAX RF Measurement (requires Opt. 009)
MS2721B-047	Fixed WiMAX Demodulation (requires Opt. 009)
MS2721B-057	DVB-T/H BER (requires Opt 009 & 064)
MS2721B-062	EVDO RF Measurement (requires Opt. 009)
MS2721B-063	EVDO Demodulator (requires Opt. 009)
MS2721B-064	DVB-T/H Digital Video Measurement (requires Opt 009)
MS2721B-065	W-CDMA/HSDPA Demod (requires Opt. 009)
MS2721B-066	Mobile WiMAX RF Measurement (requires Opt. 009)
MS2721B-067	Mobile WiMAX Demodulator (requires Opt. 009)
MS2721B-078	DVB-T/H SFN (requires Opt 009)
	Main frame
MS2723B	Handheld Spectrum Analyzer 9 kHz to 13 GHz
MS2724B	Handheld Spectrum Analyzer 9 kHz to 20 GHz
	Options
MS2723B-009	RF & Demodulation Hardware
MS2723B-019	High Accuracy Power Meter (PSN50 sensor not included)
MS2723B-025	Interference Analysis
MS2723B-027	Channel Scanner
MS2723B-031	GPS (includes GPS antenna)
MS2723B-033	cdmaOne and CDMA2000 1xRTT Over the Air (OTA) (requires Opt. 009, 031)
MS2723B-034	EVDO Over The Air (OTA) Measurement (requires Option 009, 031)
MS2723B-035	W-CDMA/HSDPA OTA (requires Opt. 009)
MS2723B-037	Mobile WiMAX Over The Air (OTA) Measurement (requires Opt. 009)
MS2723B-040	GSM/GPRS/EDGE RF Meas (requires Opt. 009)
MS2723B-041	GSM/GPRS/EDGE Demod (requires Opt. 009)
MS2723B-042	CDMA RF Measurement (requires Opt. 009)
MS2723B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Opt. 009)
MS2723B-044	WCDMA/HSDPA RF Measurement (requires Opt. 009)
MS2723B-045	W-CDMA Demodulation (requires Opt. 009)
MS2723B-046	Fixed WiMAX RF Measurement (requires Opt. 009)
MS2723B-047	Fixed WiMAX Demodulation (requires Opt. 009)
MS2723B-062	EVDO RF Measurement (requires Opt. 009)
MS2723B-063	EVDO Demodulator (requires Opt. 009)
MS2723B-065	W-CDMA/HSDPA Demodulation (requires Opt. 009)
MS2723B-066	Mobile WiMAX RF Measurement (requires Opt. 009)
MS2723B-067	Mobile WiMAX Demodulator (requires Opt. 009)

Model/Order No.	Name
	Standard accessories
10580-00175	User's Guide
61382	Soft Carrying Case
40-168	AC – DC Adapter
806-141	Automotive Cigarette Lighter/12 Volt DC Adapter
2300-498	CD-ROM Containing Master Software Tools
2000-1371	Ethernet Cable
2000-1209	Cross-over Ethernet Cable
633-44	Rechargeable battery, Li-Ion
1091-27	Type-N male to SMA female adapter
1091-172	Type-N male to BNC female adapter
64343	Tilt Bail Stand Accessory
2000-1520-R	2 GB USB Memory Device
3-2000-1360	USB Type A to Mini-B Cable
	One Year Warranty
	Optional accessories
15NNF50-1.5B	Test Port Cable, Armored, 1.5 m, N (m) to N (f), 18 GHz
15NN50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) to N (m), 6 GHz
15NN50-3.0C	Test Port Cable, Armored, 3.0 m, N (m) to N (m), 6 GHz
15NN50-5.0C	Test Port Cable, Armored, 5.0 m, N (m) to N (m), 6 GHz
15NNF50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) to N (f), 6 GHz
15NNF50-3.0C	Test Port Cable, Armored, 3.0 m, N (m) to N (f), 6 GHz
15NNF50-5.0C	Test Port Cable, Armored, 5.0 m, N (m) to N (f), 6 GHz
15ND50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) to 7/16 DIN (m), 6.0 GHz
15NDF50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) to 7/16 DIN (f), 6.0 GHz
510-90	Adapter, 7/16 DIN (f) to N (m), DC to 7.5 GHz, 50 Ω
510-91	Adapter, 7/16 DIN (f) to N (f), DC to 7.5 GHz, 50 Ω
510-92	Adapter, 7/16 DIN (m) to N (m), DC to 7.5 GHz, 50 Ω
510-93	Adapter, 7/16 DIN (m) to N (f), DC to 7.5 GHz, 50 Ω
510-96	Adapter, 7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50 Ω
1030-105	Band Pass Filters, 890 to 915 MHz, N (m) to N (f), 50 Ω
1030-106	Band Pass Filters, 1710 to 1790 MHz, N (m) to N (f), 50 Ω
1030-107	Band Pass Filters, 1910 to 1990 MHz, N (m) to N (f), 50 Ω
1030-109	Band Pass Filters, 824 to 849 MHz, N (m) to SMA (f), 50 Ω
1030-110	Band Pass Filters, 880 to 915 MHz, N (m) to SMA (f), 50 Ω
1030-111	Band Pass Filters, 1850 to 1910 MHz, N (m) to SMA (f), 50 Ω
1030-112	Band Pass Filters, 2400 to 2484 MHz, N (m) to SMA (f), 50 Ω
1030-114	Band Pass Filters, 806 to 869 MHz, N (m) to SMA (f), 50 Ω
510-97	Adapter, 7/16 DIN (f) to 7/16 DIN (f), 7.5 GHz
61382	Spare Soft Carrying Case
64343	Spare Tilt Bail Stand Accessory
40-168	Spare AC/DC adapter
806-141	Spare Automotive Cigarette Lighter/12 Volt DC Adapter
760-243-R	New Transit Case
2300-498	Anritsu Master Software Tools, models, MS2721B, MS2723B, MS2724B for all three manuals
10580-00175	Anritsu HHSA User's Guide, models, MS2721B, MS2723B, MS2724B for all three manuals (spare)
10580-00176	Anritsu HHSA Programming Manual, models, MS2721B, MS2723B, MS2724B for all three manuals
10580-00177	Anritsu HHSA Maintenance Manual, models, MS2721B, MS2723B, MS2724B for all three manuals
633-44	Rechargeable Battery, Li-Ion
3-2000-1500	256 MB Compact Flash Memory Module
2000-1374	Dual Battery Charger, Li-Ion with Universal Power Supply
2000-1411	Portable Yagi Antenna, 10 dBd, N (f) 822 to 900 MHz
2000-1412	Portable Yagi Antenna, 10 dBd, N (f) 885 to 975 MHz
2000-1413	Portable Yagi Antenna, 10 dBd, N (f) 1.71 to 1.88 GHz
2000-1414	Portable Yagi Antenna, 9.3 dBd, N (f) 1.85 to 1.99 GHz
2000-1415	Portable Yagi Antenna, 10 dBd, N (f) 2.4 to 2.5 GHz
2000-1416	Portable Yagi Antenna, 10 dBd, N (f) 1.92 to 2.23 GHz
2000-1030	Portable antenna, SMA (m) 1.71 to 1.88 GHz, 50 Ω
2000-1031	Portable antenna, SMA (m) 1.85 to 1.99 GHz, 50 Ω
2000-1032	Portable antenna, SMA (m) 2.4 to 2.5 GHz, 50 Ω
2000-1035	Portable antenna, SMA (m) 896 to 941 MHz, 50 Ω
2000-1200	Portable antenna, SMA (m) 806 to 869 MHz, 50 Ω
2000-1361	Portable Antenna, SMA (m) 5725 to 5825 MHz, 50 Ω
2000-1473	Portable Antenna, SMA (m) 870 to 960 MHz, 50 Ω
2000-1474	Portable Antenna, SMA (m) 2.4 to 2.5 GHz, 50 Ω
2000-1475	Portable Antenna, SMA (m) 2.11 to 2.17 GHz, 50 Ω
61532	Antenna Kit: 2000-1030, 2000-1031, 2000-1032, 2000-1035, 2000-1200, and 2000-1361

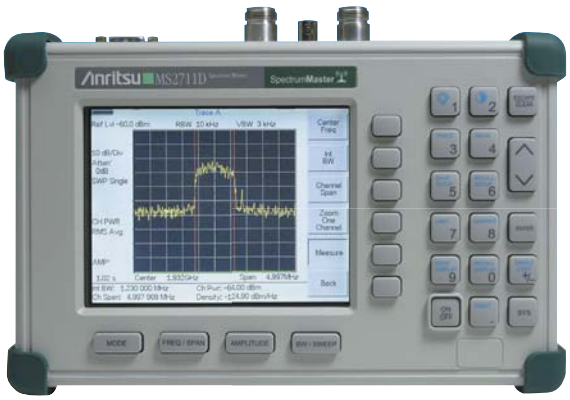
SPECTRUM MASTER

MS2711D Handheld Spectrum Analyzer

100 kHz to 3.0 GHz

CE

Fast, Accurate, Repeatable, Portable Spectrum Analysis



The MS2711D Handheld Spectrum Analyzer provides excellent measurement flexibility for field environments and applications requiring mobility. Unlike traditional spectrum analyzers, the MS2711D features a rugged, ultra-lightweight, battery-operated design that enables users to conduct spectrum analysis measurements anywhere, anytime.

Providing complete freedom from AC/DC power requirements, the MS2711D enables you to locate, identify, record and solve communication systems problems quickly and easily, without sacrificing measurement accuracy.

Whether you are installing, maintaining, or troubleshooting a modern wireless communication system, the MS2711D provides exceptional performance combined with ease-of-use and broad functionality – making them the ideal solution for engineers and technicians who conduct field measurements in the 100 kHz to 3.0 GHz frequency range. In fact, they are ideal for finding the source of interfering signals in modern wireless systems.

Rugged and Reliable

Because the MS2711D was designed specifically for field environments, they can easily withstand the day-to-day punishment of field use. Rugged packaging keeps the MS2711D performing in harsh environments.

Easy-to-Use

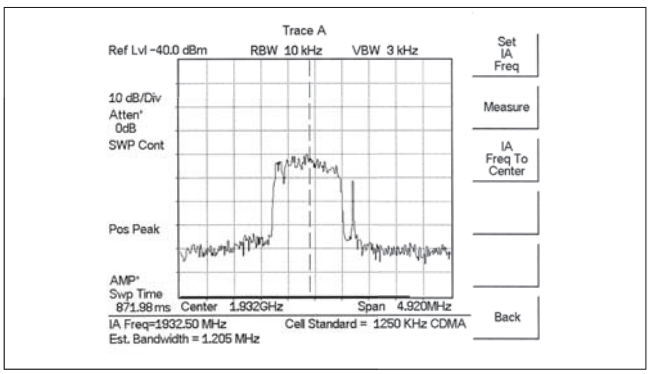
Not only is the MS2711D the lightest fully-functional spectrum analyzer available at 4.5 pounds (base model including battery), operation is straight-forward and driven by firmware that simplifies the process of making measurements and interpreting the results shown on the large, high-resolution LCD display. The menu-driven user interface is easy to use and requires little training.

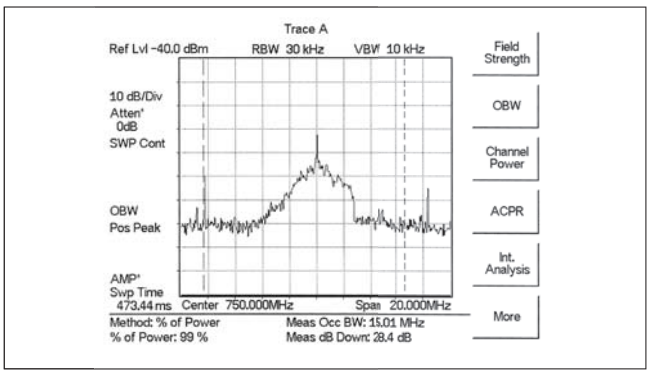
A full range of marker capabilities such as peak, center and delta functions are also provided, giving users a faster and more comprehensive measurement of displayed signals. Limit lines simplify amplitude measurements, giving users the capability to create quick, simple, pass/fail measurements. Frequency, span and amplitude functions are easily configured for optimum performance. Used together with the Save Setup feature, these functions can help to make testing easier and faster for less experienced users.

Powerful Trace Management

Users are able to store ten test setups along with 200 measurement traces internally in the unit's memory. The stored data can be easily downloaded to a personal computer (PC) or a printer via an RS232 or USB serial cable for further analysis. A computer can be used with the RS232 interface for automated control and data collection in the field.

A preamplifier plus a number of available options including transmission measurement (option 21, MS2711D) expand the MS2711D's capabilities.





To meet the challenges of today's wireless market, Anritsu Company has incorporated a pre-amp (standard) for its revolutionary MS2711D Handheld Spectrum Analyzer which increases the analyzer's sensitivity and dynamic range while improving measurement time. With the built-in pre-amp feature, the MS2711D is particularly effective in measuring low-level signals. The handheld spectrum analyzer's sensitivity is improved to –135 dBm (100 Hz RBW). With this option, the MS2711B/D can identify and make measurements on low-level signals much faster than previously possible.

The improved sensitivity, dynamic range, and measurement speed complement the existing benefits of the MS2711D. Weighing only 4.9 pounds (including a NiMH battery, fully loaded, base model only 4.5 pounds).

The MS2711D has been enhanced so that it can make highly accurate channel power measurements, occupied bandwidth and Adjacent Channel Power Ratio (ACPR) measurements. These are increasingly critical measurements, particularly for power amplifiers used in wireless communication systems. With the enhancements, the MS2711D has dedicated one button channel power, occupied bandwidth, and ACPR measurement capability to significantly reduce test time and expense. The MS2711D also features local language graphical user interface support (English, Chinese, Japanese, French, German, and Spanish).

Features

- Lightweight (4.5 lbs - base model, 4.9 lbs with transmission measurement, MS2711D option 21)
- Synthesizer-based performance
- Wide dynamic range
- One button, ACPR, OBW, channel power, C/I measurement
- Quick zoom-in, zoom-out display
- Five minute warm up
- Manual and automatic attenuator control
- Improved user interface, with local language support in five different languages
- Automatic overload and ESD protection
- Built-in AM/FM/SSB demodulation
- Built-in field strength measurement
- Ability to store and recall up to six sets of antenna factors
- Full range of marker capabilities including peak, center, and delta functions
- Limit lines for quick, simple pass/fail measurements
- Rugged, reliable packaging
- Battery operated design
  - 2.5 hours of continuous operation
  - Built-in energy conservation that extends battery life beyond an eight-hour workday
  - Operation using a 12.5 Vdc source AC-DC adapter or automotive cigarette lighter adapter, which simultaneously charges the battery
  - Field replaceable battery
- Built in clock and calendar
- Low cost ownership, global warranty
- Optional Interference Analysis including spectrogram, signal strength and RSSI
- Optional channel scanner for viewing the received power level of up to 20 channels
- Optional CW Signal Generator output . Power level is adjustable with this option using attenuator kit 61534
- Optional build-in GPS receiver with external antenna for location stamping measurements
- Data storage and memory
  - Store up to ten test setups and 200 measurement traces in non-volatile memory
  - Stored data is easily and quickly downloaded to a personal computer (PC) or printer
- Powerful trace management
  - Automatically date/time stamped
  - Alphanumeric labeling
- PC reporting software (Master Software Tools)
  - Windows® XP and Vista
  - Supports long file names for descriptive labeling
  - Can display an unlimited number of traces for comparison to historical performance
- Color LCD display with backlight capability
- Direct printer control via RS232 serial port

Applications

Convenient operating procedures, high sensitivity, and excellent repeatability enables the MS2711D to pinpoint the smallest system performance degradation and allow for easy verification of system compliance. Typical applications include:

- Transmitter Spectrum Analysis – occupied bandwidth, power, modulation measurements, location and identification of in-band, out-of-channel spurious and out-of-band spurious signals
- Receive Signal Analysis – locate and identify sources of interfering signals
- Modulation identification, modulation depth, deviation, and spectral mask
- Signal Strength Mapping – to determine the most suitable location for antennas, base stations, and repeaters; or pinpoint electromagnetic (EM) leakage in broadcast systems

Specifications

Frequency	Frequency range	100 kHz to 3.0 GHz
	Frequency reference	Aging: ±1 ppm/yr Accuracy: ±2 ppm
	Frequency span	10 Hz to 2.99 GHz in 1, 2, 5 step selections in auto mode, plus zero span
	Sweep time	≤1.1 second full span; ≤50 msec to 200 second zero span
	Resolution bandwidth (–3 dB width)	100 Hz to 1 MHz in 1-3 sequence, ±5%
	Video bandwidth (–3 dB)	100 Hz to 300 kHz in 1-3 sequence
	SSB Phase Noise (1 GHz) @30 kHz Offset	≤–75 dBc/Hz
	Spurious responses Input related	≤–45 dBc
	Spurious residual responses	≤–90 dBm (≥500 kHz)
Amplitude	Measurement range	+20 to –135 dBm (with preamp on)
	Displayed average noise level	≤–135 dBm typical, ≥1 MHz (preamp on) ≤–115 dBm typical, ≥500 kHz to <1 MHz ≤–110 dBm typical, <500 kHz for input terminated, 0 dB attenuation, RMS detection, 100 Hz RBW
	Dynamic range	>65 dB, typical
	Total level accuracy	±1 dB typical (±1.5 dB max) ≥10 MHz to 3 GHz ±2 dB typical <10 MHz for input signal level ≥–60 dBm, excludes input VSWR mismatch
	Display range	1 to 15 dB/div in 1 dB steps, Ten divisions displayed
	Max input level without damage	+43 dBm (Peak), ±50 Vdc
	Attenuator Range	0 to 51 dB, selected manually or automatically coupled to the reference level. Resolution in 1 dB steps.
	RF input	1.5:1 typical, (≥20 dB atten., 10 MHz to 2.4 GHz)

Continued on next page

General	Internal trace memory	200 maximum
	Setup storage	15 test setups
	Display	VGA Monochrome LCD
	Inputs and Outputs Ports RF In RF Out Ext trig In Ext Freq Ref In (2 MHz to 20 MHz) Serial Interface	 Type N, female, 50 Ω Type N, female, 50 Ω BNC, female (5 V TTL) Shared BNC, female, 50 Ω (–15 to +10 dBm) RS-232 9 pin D-sub, three wire serial
	Electromagnetic compatibility	Meets European community requirements for CE marking
	Safety	Conforms to EN 61010-1 for Class 1 portable equipment
	Temperature Operating Non-operating	 –10˚ to +55˚C, humidity 85% or less –51˚ to +71˚C (recommend battery stored separately between 0˚ to +40˚C for any prolonged storage period)
	Power supply External DC Input Internal	 12.5 to 15 volts dc, 1350 mA max NiMH battery: 10.8 volts, 1800 mA mAH
	Dimensions and mass	25.4 (W) x 17.8 (H) x 6.10 (D) cm (10.0 x 7.0 x 2.4 in) <2.14 kg (4.7 lbs) includes battery, <2.28 kg (5 lbs) includes transmission measurement

• MS2711D (Option 10A) Bias Tee

Bias Tee	Voltage	12 to 24 Vdc
	Power	8 Watts

• MS2711D (Option 21) Transmission Measurement

Frequency	Frequency range Frequency resolution	25 MHz to 3 GHz 10 Hz
Output	Output power level Output impedance	–10 dBm typical 50 Ω

• FCN4760 Frequency Converter

Frequency	Frequency range	4.7 GHz to 6 GHz
	Frequency resolution*	10 Hz
	Frequency reference	Aging: ±1 ppm/yr Accuracy: ±2 ppm
	SSB Phase Noise (6 GHz) @30 kHz Offset	≤–65 dBc/Hz
	Spurious responses Input related	≤–45 dBc
	Spurious residual responses*	≤–90 dBm
Amplitude	Measurement range	–40 to –100 dBm
	Sensitivity* (displayed avg. noise level)	–100 dBm
	Maximum input level without damage	–5 dBm
	RF input	VSWR 2.0:1 max
General	Inputs and Outputs Ports RF In RF Out Communication Interface	 Type N, female, 50 Ω Type N, male, 50 Ω 10 pin D-sub
	Electromagnetic compatibility	Meets European community requirements for CE marking
	Safety	Conforms to EN 61010-1 for Class 1 portable equipment
	Temperature Operating Non-operating	 –10˚ to +50˚C, humidity 85% or less –50˚ to +80˚C
	Power dissipation	850 mW max
	Dimensions and mass	6.6 (W) x 10.9 (H) x 3.3 (D) cm (2.6 x 4.3 x 1.3 in) <0.45 kg (< 1 lb.)

*: Specifications apply when connected to the MS2711D spectrum analyzer

- **MS2711D (Option 29) Power Meter**

Frequency Range	3 MHz to 3.0 GHz
Total Level Accuracy	±1 dB typical (±1.5 dB max) ≥10 MHz to 3 GHz ±2 dB typical <10 MHz for input signal level ≥–60 dBm, excludes input VSWR mismatch
Measurement Range	+20 to –80 dBm
Frequency Span	3 MHz to 2.99 GHz
Display Range	+80 to –80 dBm
Offset Range	0 to 60 dB
Maximum Input Power	+20 dBm without input attenuator

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
MS2711D	**Main frame** Handheld Spectrum Analyzer: 100 kHz to 3.0 GHz
	Standard accessories MS2711D User's Guide Soft Carrying Case AC – DC Adapter Automotive Cigarette Lighter/12 Volt DC Adapter One Year Warranty CD-ROM containing Software Tools Serial Interface Cable Rechargeable battery, NiMH Pre-amplifier (built-in)
Option 5 Option 6 Option 10 Option 19 Option 21 Option 25 Option 27 Option 28 Option 29 Option 31	**Options** Power Monitor (requires external detector, sold separately) Frequency Converter Controller Module for use with FCN4760 Bias Tee (built-in) Support for the PSN50 High Accuracy Sensor Transmission Measurement (built-in) Interference Analysis Channel Scanner CW Signal Generator (requires external attenuator kit, sold separately, Anritsu part number 61534) Power Meter GPS Receiver (includes GPS antenna, Anritsu part number 2000-1410)
FCN4760 PSN50 61534 5400-71N50 42N50A-30 34NN50A 34NFNF50C 15NN50-1.5C 15NN50-3.0C 15NN50-5.0C 15NNF50-1.5C 15NNF50-3.0C 15NNF50-5.0C 15ND50-1.5C 15NDF50-1.5C 510-90 510-91 510-92 510-96 510-97	**Optional accessories** 4.7 to 6.0 GHz Down Converter (requires MS2711D/6 or S332D/6) High Accuracy Power Sensor CW Signal Generator Kit RF Detector, N (m), 50 Ω, 1 to 3000 MHz (MS2711B only) 30 dB, 50 W, Bi-directional, DC to 18 GHz, N (m) to N (f) Attenuator Precision Adapter, DC to 18 GHz, 50 Ω, N (m) to N (m) Precision Adapter, DC to 18 GHz, 50 Ω, N (f) to N (f) Test Port Cable Armored, 1.5 m, N (m) to N (m), 6.0 GHz Test Port Cable Armored, 3.0 m, N (m) to N (m), 6.0 GHz Test Port Cable Armored, 5.0 m, N (m) to N (m), 6.0 GHz Test Port Cable Armored, 1.5 m, N(m) to N (f), 6.0 GHz Test Port Cable Armored, 3.0 m, N (m) to N (f), 6.0 GHz Test Port Cable Armored, 5.0 m, N (m) to N (f), 6.0 GHz Test Port Cable Armored, 1.5 m, N (m) to 7/16 DIN (m), 3.5 GHz Test port cable armored, 1.5 m, N (m) to 7/16 DIN (f), 3.5 GHz Adapter 7/16 (f) to N (m), 3.5 GHz Adapter, 7/16 DIN (f) to N (f), 7.5 GHz Adapter, 7/16 DIN (m) to N (m), 7.5 GHz Adapter 7/16 DIN (m) to 7/16 DIN (m), 7.5 GHz Adapter 7/16 DIN (f) to 7/16 DIN (f), 7.5 GHz

Model/Order No.	Name
560-7A50	Detector, 10 MHz to 18 GHz, GPC-7, 50 Ω
560-7N50B	Detector, 10 MHz to 20 GHz, N (m), 50 Ω
560-7S50B	Detector, 10 MHz to 20 GHz, WSMA (m), 50 Ω
560-7S50-2	Detector, 10 MHz to 26.5 GHz, WSMA (m), 50 Ω
560-7K50	Detector, 10 MHz to 40 GHz, K (m), 50 Ω
560-7VA50	Detector, 10 MHz to 50 GHz, V (m), 50 Ω
1030-109	Bandpass Filter, 824 to 849 MHz, N (m) - SMA (f), 50 Ω
1030-110	Bandpass Filter, 880 to 915 MHz, N (m) - SMA (f), 50 Ω
1030-111	Bandpass Filter, 1850 to 1910 MHz, N (m) - SMA (f), 50 Ω
1030-112	Bandpass Filter, 2400 to 2484 MHz, N (m) - SMA (f), 50 Ω
48258	Spare soft carrying case
40-168	Spare AC/DC adapter
806-62	Spare Automotive Cigarette Lighter/12 Volt DC Adapter
800-441	Spare Serial Interface Cable
760-243-R	New Transit Case
2300-347	Anritsu Handheld Software Tools
10580-00074	Anritsu HHSA User's Guide, Model MS2711B (spare)
10580-00071	Anritsu HHSA Programming Manual, Model MS2711B
10580-00072	Anritsu HHSA Maintenance Manual, Model MS2711B
10580-00097	Anritsu HHSA User's Guide, Model MS2711D
10580-00098	Anritsu HHSA Programming Manual, Model MS2711D
10580-00099	Anritsu HHSA Maintenance Manual, Model MS2711D
633-27	Rechargeable Battery, NiMH
551-1691	USB to Serial adapter
70-28	Headset
2000-1029	Battery Charger, NiMH with Universal Power Supply
2000-1030	Portable Antenna, 50 Ω, SMA (m) 1.71 to 1.88 GHz
2000-1031	Portable Antenna, 50 Ω, SMA (m) 1.85 to 1.99 GHz
2000-1032	Portable Antenna, 50 Ω, SMA (m) 12.4 to 2.5 GHz
2000-1035	Portable Antenna, 50 Ω, SMA (m) 896 to 941 MHz
2000-1200	Portable Antenna, 50 Ω, SMA (m) 806 to 869 MHz
2000-1411	Portable Yagi Antenna, 822 to 900 MHz, N (f), 10 dBd
2000-1412	Portable Yagi Antenna, 885 to 975 MHz, N (f), 10 dBd
2000-1413	Portable Yagi Antenna, 1710 to 1880 MHz, N (f), 10 dBd
2000-1414	Portable Yagi Antenna, 1850 to 1990 MHz, N (f), 9.3 dBd
2000-1415	Portable Yagi Antenna, 2400 to 2500 MHz, N (f), 10 dBd
2000-1416	Portable Yagi Antenna, 1920 to 2230 MHz, N (f), 10 dBd
2000-1214 2000-753 2000-663 2000-664 2000-666 2000-1218 2000-667 2000-1217 2000-1216	**Printers** HP DeskJet printer Includes: interface cable, black print cartridge, and US power cable Spare Serial-to-parallel Converter Cable Power Cable (Europe) for DeskJet printer Power Cable (Australia) for DeskJet printer Power Cable (Japan) for DeskJet printer Power Cable (UK) for DeskJet printer Power Cable (So. Africa) for DeskJet printer Rechargeable Battery for DeskJet printer Black Print Cartridge for DeskJet printer

VNA MASTER

MS2024A/MS2034A

VNA: 2 MHz to 4 GHz/Spectrum Analysis: 9 kHz to 4 GHz

MS2026A/MS2036A

VNA 2 MHz to 6 GHz/Spectrum Analysis: 9 kHz to 7.1 GHz

CE Ethernet

Handheld Vector Network and Spectrum Analysis for General Purpose Applications

RF engineers and technicians in the field provide a valuable service as they support defense and general purpose communication systems around the world. They ensure radars on Navy ships are operational. They test antennas on Army vehicles. They perform flight-line test on Air Force and commercial jets. They maintain communication systems on Marine expeditionary fighting vehicles. They support VHF Omni-directional Range (VOR) in radio navigational systems throughout the world. They ensure direction finding (DF) reconnaissance systems precisely pinpoint threats.

Equally valuable are the primary test instruments that serve these applications: vector network analyzer, spectrum analyzer, power meter, and vector voltmeter. In the factory, these handheld instruments are also especially attractive for lowering cost-of-test and minimizing capital equipment expenditures.

Anritsu introduces the MS202xA VNA Master and the MS203xA VNA Master plus Spectrum Analysis that offers these individual test capabilities in a handheld, battery-operated, rugged multi-function instrument. The VNA Master easily replaces bulky and obsolete bench-top instruments with a more efficient-to-use handheld instrument so technicians can freely roam the sites they service. This freedom increases their productivity as they phase match cables, identify sources of interference, and troubleshoot transmitters. The VNA Master is so ideally suited for cable and antenna measurements in the field that it can also double as a low-cost alternative in manufacturing and R&D.

Product Overview

- Two-port vector network analysis (2 MHz to 6 GHz)
- Broad spectrum analysis (9 kHz to 7.1 GHz) MS2034A/36A
- Broad power meter (10 MHz to 7.1 GHz) MS2034A/36A
- Optional power monitor measurements (1 MHz to 20 GHz)
- Optional high accuracy power meter, PSN50 (50 MHz to 6 GHz)
- Optional Vector Voltmeter (VVM) mode (2 MHz to 6 GHz)
- Ergonomically designed controls
- Handheld battery-operated RF test solution

VNA Features

- Two-port vector network analysis (2 MHz to 6 GHz)
- >42 dB directivity
- <±1 dB uncertainty for $|S_{11}|$ <20 dB
- <±0.5 dB uncertainty and <±4 degrees uncertainty for $|S_{21}|$ <30 dB
- >70 dB dynamic
- Smith Charts, Phase, and Group Delay measurements

Spectrum Analysis Features

- Broad spectrum analysis (9 kHz to 7.1 GHz)
- Wide dynamic range (100 dB typical)
- Excellent DANL (with preamp): –163 dBm in 1 Hz RBW
- Superior Single Side Band (SSB) Phase Noise of <–100 dBc/Hz at 1 kHz offsets
- Fast sweep speed of 200 ms in 10 MHz span
- Powerful markers: 6 markers, 7 marker modes, and marker table display
- New quasi-peak detector and CISPR bandwidths

General Features

- Light weight (less than 4 kg. including battery) and rugged design
- Large 8.4 in. full-color TFT display screen
- Type N female RF connectors
- Soft keys, directional buttons, and rotary knob
- LAN and USB 2.0 (full-speed) connections
- Rechargeable and field replaceable Li-Ion Battery
- 256 MB storage
- Remote programming via Ethernet

VNA Overview

Cables and antennas are a vital part of any communication system that unfortunately can degrade over time due to corrosion, water damage, or excessive deployment time. Phase matched cables are even more susceptible to these kinds of problems. Ideally, one can avoid the fix-after-failure scenario by routinely sweeping these critical components to detect earlier these potentially catastrophic problems. A field-friendly vector network analyzer can simplify this task.

The VNA Master is a 1-port and 2-port handheld vector network analyzer (VNA), which uses the superior Frequency Domain Reflectometry (FDR) approach instead of the DC pulse technique of older Time Domain Reflectometry (TDR) approaches. Using FDR, the VNA Master provides convenient 1-port measurements of return loss, VSWR, cable loss, Distance-To-Fault (DTF), and Smith Chart measurements in the field. Connect the VNA Master to a 2-port cable to measure cable loss, phase, and group delay. In other words, the VNA Master offers precise measurement capabilities for cables and antennas by simplifying S_{11} and S_{21} measurements in the field.

The VNA Master employs vector correction after an open-short-load calibration to ensure accuracy, repeatability, and overall quality of 1-port and 2-port measurements. As an improvement over traditional scalar measurement approaches, the VNA Master removes all the systematic errors associated with the 1-port reflection measurements, including directivity, source match, and reflection tracking. Additionally, the VNA Master removes transmission response errors and transmission source match errors (i.e., a 1-path, 2-port correction) when conducting 2-port transmission measurements. The vector correction of the VNA Master offers superior measurement accuracy for detecting problems or phase matching cables in a convenient handheld product so you can perform VNA measurements anywhere, anytime.

Spectrum Analysis Overview

In addition to cables and antennas, the typical communication system also contains more sophisticated transmitters, receivers, and signal separation components. These additional components increase the complexity of the overall system, which becomes especially difficult to maintain when there is an intermittent problem.

A field-friendly spectrum analyzer can simplify this task.

The VNA Master plus Spectrum Analysis (i.e., MS203xA) adds the capability to conduct spectrum analysis in the field to the already powerful MS202xA! Don't let the small footprint fool you, this instrument offers performance and features that rivals bench-top alternatives for simplifying spectrum monitoring, interference analysis, and other general purpose signal measurements in the field. The VNA Master offers broad spectrum analysis frequency coverage, impressive dynamic range, and excellent phase noise performance from 9 kHz to 7.1 GHz.

The VNA Master plus Spectrum Analysis includes many standard measurements. These measurements include field strength, occupied bandwidth, channel power, adjacent channel power ratio, and carrier to interference (C/I) ratio. In addition, the built-in AM/FM/SSB demodulator simplifies the task of identifying interfering signals. Overall, the VNA Master is a powerful handheld tool for general purpose spectrum analysis anywhere, anytime.

Optional VNA Features

• Power Monitor (Option 5)

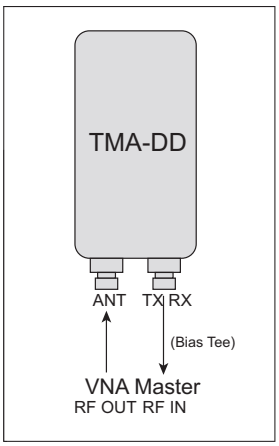
With the Anritsu 560 series detectors, technicians can accurately measure broadband power up to 50 GHz. These high precision detectors significantly help minimize mismatch uncertainty with detector flatness better than 0.5 dB up to 18 GHz.

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.

• Bias Tee (Option 10)

The integrated, variable Bias Tee is designed to supply bias to a tower mount amplifier (TMA) or other active device. This bias is supplied from the center conductor of the RF In port on the VNA Master, delivering a variable 12 to 24 V.

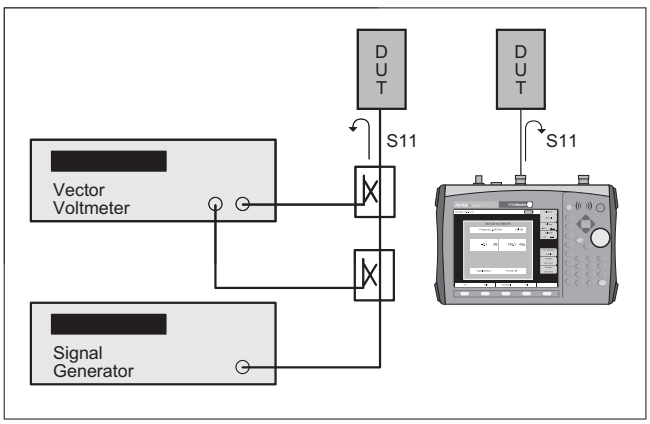


• Vector Voltmeter (Option 15)

The VNA Master offers a field-friendly version of the popular vector voltmeter for phase matching cables. In this approach, the VNA Master provides an optional user interface with display types of impedance, dB, and VSWR for 1- and 2-port measurements.

The VNA Master contains the signal generator, couplers, phase measurement receiver, and now the user interface of this popular approach. Field engineers can now upgrade their tools without impacting existing maintenance procedures by adding this popular user interface to the already easy-to-learn VNA Master.

As an additional capability, Option 15 also includes the valuable capability to compare up to five different cables to a reference cable. Using this capability, one can simplify the task of phase matching multiple cables in the field.



A side-by-side comparison shows how the VNA Master is a more convenient instrument for phase matching cables in the field.

• Power Meter (Option 019)

Anritsu's USB power sensors, either the PSN50 or MA24106A (50 MHz to 6 GHz), offer high accuracy power measurements remote from the VNA Master instrument. Purchase sensors separately. This means you can connect the PSN50 or MA24106A sensor units right at the transmitter output connector tap, for improved performance because the VSWR effects of the cables are minimized.

Optional Spectrum Analysis Features

• Interference Analyzer (Option 25)

With its built-in low-noise preamplifier, the MS203xA with interference analyzer option provides the ability to identify and locate interfering signals down to the noise floor, allowing technicians to better address the quality issues that affect user service.

Spectrogram

The Spectrogram display is a three dimensional display of frequency, power, and time of the spectrum. It is applicable for identifying intermittent interference and tracking signal levels over time.
The MS203xA can save data for up to 72 hours.

RSSI

The received signal strength indicator (RSSI) can be used to observe the signal strength of a single frequency over time. Data can be collected for up to 72 hours.

• Channel Scanner (Option 27)

The channel scanner option measures the power of multiple transmitted signals and is very useful for measuring channel power in up to 20 channels at the same time. Display data in graph or table format. In the custom setup menu each channel can be custom built with different frequency, bandwidth, or channels for convenient simultaneous analysis of a variety of different signal standards.

• GPS Receiver (Option 31)

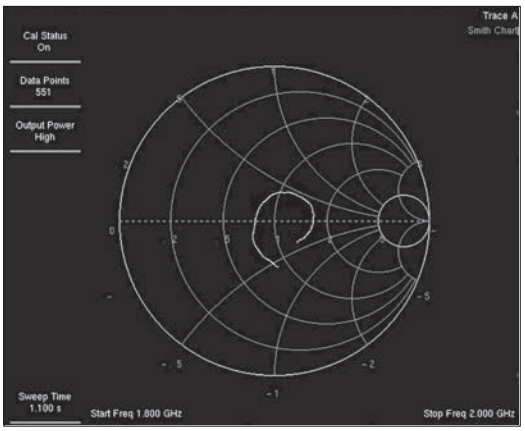
Built-in GPS provides precise location (latitude, longitude, and altitude) and Universal Time (UT) information to help the user verify that measurements are taken at the right location. The VNA Master then stamps each trace and stores the GPS location information. The GPS option also includes a convenient magnet-mount antenna with a 15-foot (5 m) cable for the car, truck or any other useful surface.

Master Software Tools

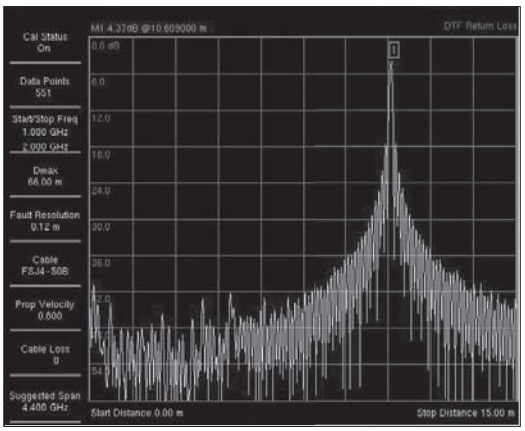
Each VNA Master ships with a test assistant: a copy of Anritsu's Master Software Tools for Windows® 2000/XP.
This allows an operator to add the processing capabilities of a PC and this software utility to the VNA Master to form a powerful and flexible measurement solution for both network and spectrum analysis. For automation, the VNA Master also supports remote programming via the Ethernet interface.

Connect VNA Master to a PC for archiving and additional analysis.

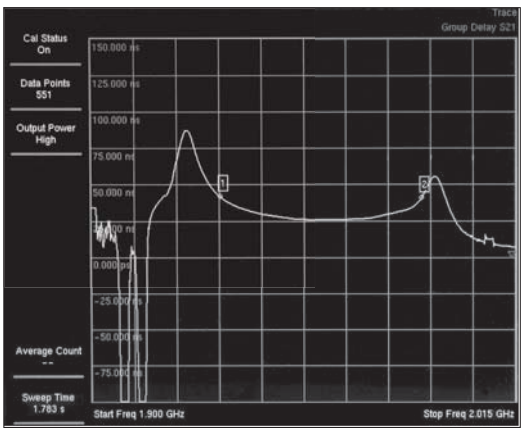
Typical Vector Network Analyzer Measurements



S_{11} Smith Chart

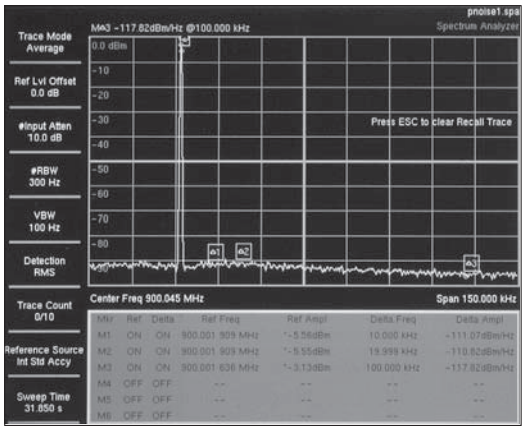


Distance-To-Fault

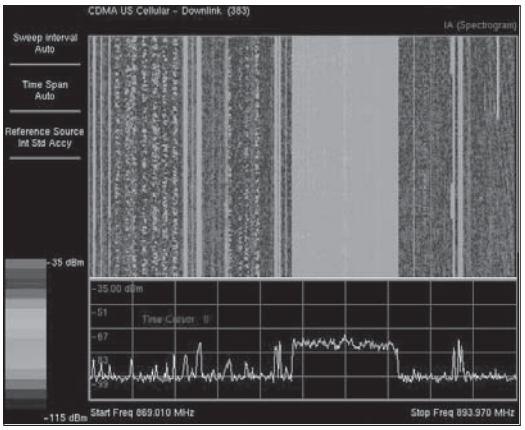


S_{21} Log Magnitude/Group Delay

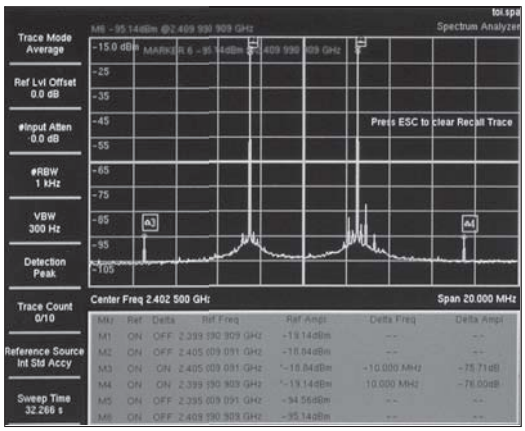
Typical Spectrum Analyzer Measurements



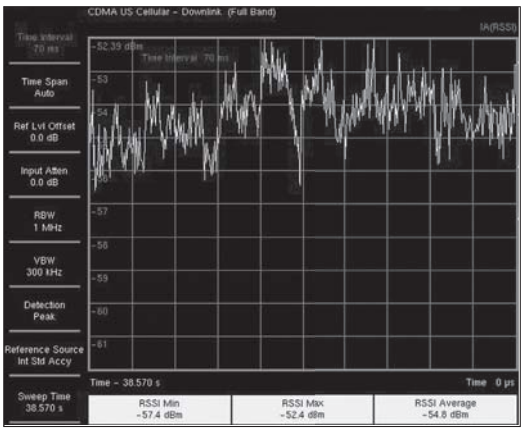
Phase Noise



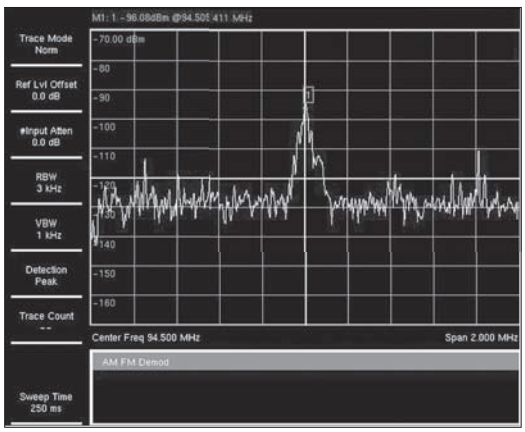
With Option 25, spectrogram measurements identifies intermittent interference.



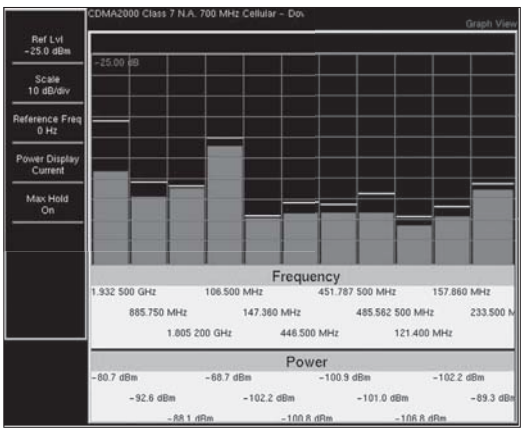
Signal Measurements



With Option 25, RSSI measurement analyzes signal strength of a signal over time.



AM, FM and SSB Demodulation



With Option 27, channel scanner measures power of multiple transmitters.

Specifications

• Vector Network Analyzer

Frequency range	610 kHz to 4 GHz (with MS2024A, MS2034A), operational down to 1 MHz 610 kHz to 6 GHz (with MS2026A, MS2036A), operational down to 1 MHz
Frequency accuracy	25 ppm
Frequency resolution	10 Hz
Data points	Low, Medium, High (137/275/551)
Interference immunity	On-Channel: +17 dBm On-Frequency: 0 dBm (RF Out), +30 dBc (RF In)
1-Port power	High: 0 dBm (typical)
2-Port power	High 0 dBm (typical) Low: –35 dBm (typical)
Corrected directivity	42 dB (2 MHz to 6 GHz)
1-Port accuracy	≤0.44 + |20 log (1 ±$10^{-E\Delta/20}$) | dB, typical; EΔ = Directivity – Measured Return Loss
Dynamic range	70 dB, 2 MHz to 10 MHz 80 dB, 10 MHz to 3 GHz 70 dB, >3 GHz to 5.5 GHz 65 dB, >5.5 GHz to 6 GHz
Return loss	Range: 0 to 60 dB Resolution: 0.01 dB
VSWR	Range: 1 to 65 Resolution: 0.01
Cable loss	Range: 0 to 30 dB Resolution: 0.01 dB
1-Port phase	Range: –180˚ to +180˚ Resolution: 0.01˚
Smith chart	Resolution: 0.01
2-Port gain	Range: –120 to 100 dB Resolution: 0.01 dB
2-Port phase	Range: –180˚ to +180˚ Resolution: 0.01˚
Distance-To-Fault	Fault Resolution (meters): (1.5 x 10^8 x vp)/ΔF; vp is the propagation constant and ΔF is F2–F1 in Hz Horizontal Range (meters): 0 to (data points–1) x Fault Resolution to a maximum of 1500 m (4921 ft.) where datapoints = 137/275/551 Vertical Range (Return Loss): 0 to 60 dB Vertical Range (VSWR): 1 to 65

• Spectrum Analyzer

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Maximum continuous input	+30 dBm
Tuning resolution	1 Hz
Frequency reference	Aging: ±1 ppm/10 years Accuracy: ±0.3 ppm (25˚C ±25˚C) + aging
Frequency span	10 Hz to 7.1 GHz plus 0 Hz (zero span)
Sweep time	Minimum 100 ms, 10 µs in zero span
Sweep trigger	Free run, Single, Video, External
Resolution bandwidth (–3 dB width)	1 Hz to 3 MHz in 1-3 sequence ±10%; 0-span, 1 Hz to 1 MHz 8 MHz demodulation bandwidth
Video bandwidth (–3 dB width)	1 Hz to 3 MHz in 1-3 sequence
SSB phase noise	–100 dBc/Hz max at 10, 20, and 30 kHz offset from carrier –102 dBc/Hz max at 100 kHz offset from carrier
Amplitude measurement range	DANL to +30 dBm
Absolute amplitude accuracy Power Levels ≥–50 dBm, ≤35 dB input attenuation, Preamplifier Off, –10˚ to +55˚C	9 kHz to 10 MHz, ±1.5 dB >10 MHz to 4 GHz, ±1.25 dB >4 GHz to 7.1 GHz, ±1.75 dB
Displayed average noise level (DANL in 1 Hz RBW, 0 dB attenuation, Reference level –50 dBm, preamp on)	Frequency / Max. (Preamp On) / Max. (Preamp Off) 10 MHz to 1 GHz / –161 dBm / –137 dBm >1 GHz to 2.2 GHz / –159 dBm / –133 dBm >2.2 GHz to 2.8 GHz / –143 dBm / –126 dBm >2.8 GHz to 4.0 GHz / –159 dBm / –136 dBm >4.0 GHz to 7.1 GHz / –154 dBm / –127 dBm
Display range	1 to 15 dB/div in 1 dB steps. Ten divisions displayed
Amplitude units log scale modes	dBm, dBV, dBmV, dBµV
Attenuator range	0 to 65 dB
Attenuator resolution	5 dB steps

• Power Meter

Frequency range	10 MHz to 4 GHz (with MS2034A) 10 MHz to 7.1 GHz (with MS2036A)
Display range	–80 to +80 dBm
Measurement range	–60 to +30 dBm
Offset range	0 to +60 dB
Accuracy	–40 dBm <Max ≤+15 dBm 10 MHz to 4 GHz: ±1.25 dB 4 to 7.1 GHz: ±1.75 dB Max. >+15 dBm 10 MHz to 6.5 GHz: ±1.75 dB 6.5 to 7 GHz: ±2 dB Max. <–40 dBm 10 MHz to 4 GHz: ±1.5 dB 4 to 7.1 GHz: ±1.75 dB
VSWR	1.5:1 typical
Maximum power	+30 dBm (1 W) without external attenuator

• Power Monitor (Option 5) requires external detector

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 (see www.anritsu.com for additional detectors)

Model	Frequency range	Impedance	Return loss	Input connector	Frequency response
560-7N50B	0.01 to 20 GHz	50 Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	N (m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz
560-7S50B	0.01 to 20 GHz	50 Ω	5 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	WSMA (m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz

• Bias Tee (Option 10)

Voltage/Current	12 V, 250, or 500 mA steady rate 15 V, 250, or 500 mA steady rate 18 V, 350 mA steady rate 21 V, 300 mA steady rate 24 V, 250 mA steady rate

• Vector Voltmeter (Option 15)

CW frequency range	2 MHz to 4 GHz (with MS2024A, MS2034A) 2 MHz to 6 GHz (with MS2026A, MS2036A)
Measurement display	CW, Table (Five Entries, Plus Reference)
Measurement types	Return Loss, Insertion
Measurement format	dB/VSWR/Impedance

• High Accuracy Power Meter (Option 19)*1

Option 19 supports both economy PSN50 and performance MA24106A USB Sensors. Refer to the following datasheets for more detailed performance specifications.
PSN50 datasheet is 11410-00414
MA24106A datasheet is 11410-00424

Frequency range	50 MHz to 6 GHz
Input connector	Type N, male, 50 Ω
Max input without damage	+33 dBm, ±25 VDC
Measurand	True-RMS/Average Power
Dynamic range	PSN50: –30 to +20 dBm MA24106A: –40 to +23 dBm
Measurement speed, typical	PSN50: 1 measurement per second MA24106A: 10 measurements per second*2
Input return loss	50 MHz to 2 GHz; ≥26 dB 2 to 6 GHz; ≥20 dB
System measurement resolution	0.01 dB
System offset range	±60 dB
Total rss measurement uncertainty (0˚ to 50˚C)	±0.16 dB*3
Continuous digital modulation uncertainty	PSN50: ±0.06 dB (+17 to +20 dBm)*4 MA24106A: ±0.02 dB, <+18 dBm*4 ±0.10 dB, ≥+18 dBm*4

∗1: Specifications apply after 30 minute warm-up
∗2: One measurement per second is typical in high aperture time mode
∗3: Excludes mismatch errors
Excludes noise, zero set, zero drift for levels <–20 dBm
Excludes digital modulation uncertainty between +17 and +20 dBm
∗4: Measurement error with reference to a CW signal of equal power and frequency at 25˚C

• Interference Analyzer (Option 25)

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Strength of the interferer	Gives visual and aural indication of signal strength
Rssi, spectrogram	Collect data up to 72 hours

• Channel Scanner (Option 27)

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Number of channels	1 to 20 Channels

• GPS (Option 31) includes GPS antenna

GPS Location Indicator	Latitude, Longitude, Altitude, and Universal Time on display Latitude, Longitude, Altitude, and Universal Time with trace storage
GPS High Frequency Accuracy when GPS antenna is connected	±25 ppb with GPS ON, three minutes after satellite lock
Internal High Accuracy when GPS antenna is not connected	Better than ±50 ppb for three days from a High Accuracy GPS Lock and within 0 to 50 degrees centigrade ambient temperature

• General

Maximum input (damage level) into vector network analyzer	Test Port, Type N: +23 dBm, ±50 VDC
Maximum continuous input into spectrum analyzer	10 dB attenuation, +30 dBm, ±50 VDC
RF input VSWR into spectrum analyzer	2.0:1 maximum, 1.5:1 typical (≥10 dB attenuation)
Interfaces	Type N female RF Connector Type N female RF Out Port and RF In Port (50 Ω) BNC female connectors for external references and external trigger Reverse BNC connector for GPS antenna RF Detector: Type N (m) 50 Ω RJ45 connector for Ethernet 10/100BASE-T 2.5 mm 3-wire cellular headset connector USB connectors Type A and mini-B
Environmental	MIL-PRF-28800F Class 2 Operating: –10˚ to +55˚C, humidity 85% Storaging: –51˚ to +71˚C Altitude: 4600 meters, operating and non-operating
Safety	Conforms to EN61010-1 for Class 1 portable equipment
Electromagnetic compatibility	Meets European Community requirements for CE marking
Dimension	315 x 211 x 78 mm (12.4 x 8.3 x 3.1 in.) for MS202xA 315 x 211 x 97 mm (12.4 x 8.3 x 3.8 in.) for MS203xA
Mass	<2.9 kg (6.4 lbs) for MS202xA; 4 kg (9 lbs) for MS203xA

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™ Models*1
MS2024A	2-port VNA Master, 2 MHz to 4 GHz
MS2026A	2-port VNA Master, 2 MHz to 6 GHz
MS2034A	2-port VNA Master, 2 MHz to 4 GHz Spectrum Analysis, 9 kHz to 4 GHz
MS2036A	2-port VNA Master, 2 MHz to 6 GHz Spectrum Analysis, 9 kHz to 7.1 GHz
	MS2024A VNA Master Options
MS2024A-005	Power Monitor (requires external detector)
MS2024A-010	Built-in Bias-Tee
MS2024A-015	Vector Voltmeter
MS2024A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2024A-031	GPS Receiver (includes GPS antenna)
	MS2026A VNA Master Options
MS2026A-005	Power Monitor (requires external detector)
MS2026A-010	Built-in Bias-Tee
MS2026A-015	Vector Voltmeter
MS2026A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2026A-031	GPS Receiver (includes GPS antenna)

*1: Each instrument includes standard one-year warranty and Certificate of Calibration and Conformance

Model/Order No.	Name
	MS2034A VNA Master + Spectrum Analysis Options
MS2034A-005	Power Monitor (requires external detector)
MS2034A-010	Built-in Bias-Tee
MS2034A-015	Vector Voltmeter
MS2034A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2034A-025	Interference Analysis, 9 kHz to 4 GHz (requires external antenna)
MS2034A-027	Channel Scanner, 9 kHz to 4 GHz (requires external antenna)
MS2034A-031	GPS Receiver (includes GPS antenna)
	MS2036A VNA Master + Spectrum Analysis Options
MS2036A-005	Power Monitor (requires external detector)
MS2036A-010	Built-in Bias-Tee
MS2036A-015	Vector Voltmeter
MS2036A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2036A-025	Interference Analysis, 9 kHz to 7.1 GHz (requires external antenna)
MS2036A-027	Channel Scanner, 9 kHz to 7.1 GHz (requires external antenna)
MS2036A-031	GPS Receiver (includes GPS antenna)

Continued on next page

Model/Order No.	Name
	MS2024A/MS2026A standard accessories
10580-00166	User's Guide
65729	Soft Carrying Case
3-2000-1500	Compact Flash Card (256 MB)
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Li-Ion
40-168	AC-DC Adapter
806-141	Automotive cigarette lighter 12 V DC adapter
3-2000-1498	USB A-to mini B cable, 3.05 m (10 ft.)
2000-1371	Ethernet cable, 2.13 m (7 ft.)
2000-1520-R	2 GB USB Flash Drive
3-806-152	Ethernet Crossover Cable, 2.13 m (7 ft.)
	MS2034A/MS2036A standard accessories
10580-00166	User's Guide
65681	Soft Carrying Case
3-2000-1500	Compact Flash Card (256 MB)
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Li-Ion
40-168	AC-DC Adapter
806-141	Automotive Cigarette Lighter 12 V DC adapter
3-2000-1498	USB A-to mini B cable, 1.83 m (3.05 m, 10 ft.)
2000-1371	Ethernet cable, 2.13 m (7 ft.)
3-806-152	Ethernet Crossover Cable, 2.13 m (7 ft.)
2000-1520-R	2 GB USB Flash Drive
	Manuals
10580-00166	VNA Master User's Guide
10580-00167	VNA Master Programming Manual
	Related Literature, Application Notes
10580-00400	VNA Master Brochure and Technical Data Sheet
11410-00214	Reflectometer Measurements - Revisited
11410-00206	Time Domain
11410-00270	What is Your Measurement Accuracy?
11410-00185	Distance-To-Fault
11410-00414	PSN50 USB Power Sensor
11410-00424	MA24106A USB Power Sensor
	Optional accessories
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24106A	USB Power Sensor, 50 MHz to 6 GHz
560-7N50B	Power Monitor Detectors, 0.01 to 20 GHz
560-7S50B	Power Monitor Detectors, 0.01 to 20 GHz
800-109	Detector Extender Cables, 7.6 m (25 ft)
800-110	Detector Extender Cables, 15.2 m (50 ft)
800-111	Detector Extender Cables, 30.5 m (100 ft)
800-112	Detector Extender Cables, 61.0 m (200 ft)
OSLN50-1	Coaxial Calibration Components, Precision N (m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50-1	Coaxial Calibration Components, Precision N (f) Open/Short/Load, 42 dB, 6 GHz
22N50	Coaxial Calibration Components, Precision N (m) Short/Open, 18 GHz
22NF50	Coaxial Calibration Components, Precision N (f) Short/Open, 18 GHz
SM/PL-1	Coaxial Calibration Components, Precision N (m) Load, 42 dB, 6.0 GHz
SM/PLNF-1	Coaxial Calibration Components, Precision N (f) Load, 42 dB, 6.0 GHz
1091-53	Coaxial Calibration Components, Precision TNC (m) Open, 18 GHz, 50 W
1091-54	Coaxial Calibration Components, Precision TNC (m) Short, 18 GHz, 50 W
1015-55	Coaxial Calibration Components, Precision TNC (m) Load, 18 GHz, 50 W
1091-55	Coaxial Calibration Components, Precision TNC (f) Open, 18 GHz, 50 W
1091-56	Coaxial Calibration Components, Precision TNC (f) Short, 18 GHz, 50 W

Model/Order No.	Name
1015-54	Coaxial Calibration Components, Precision TNC (f) Load, 18 GHz, 50 W
23L50	Coaxial Calibration Components, Precision 3.5 mm (m) Short, 9 GHz
23LF50	Coaxial Calibration Components, Precision 3.5 mm (f) Short, 9 GHz
24L50	Coaxial Calibration Components, Precision 3.5 mm (m) Open, 9 GHz
24LF50	Coaxial Calibration Components, Precision 3.5 mm (f) Open, 9 GHz
28L50R	Coaxial Calibration Components, Precision 3.5 mm (m) Load, 9 GHz
28LF50R	Coaxial Calibration Components, Precision 3.5 mm (f) Load, 9 GHz
2000-767	Coaxial Calibration Components, Precision Open/Short/ Load, 7/16 (m), 4.0 GHz
2000-768	Coaxial Calibration Components, Precision Open/Short/ Load, 7/16 (f), 4.0 GHz
34NN50A	Precision Adapters, N (m)-N (m), DC to 18 GHz, 50 W
34NFNF50	Precision Adapters, N (f)-N (f), DC to 18 GHz, 50 W
1091-26	Adapters, N (m)-SMA (m), DC to 18 GHz, 50 W
1091-27	Adapters, N (m)-SMA (f), DC to 18 GHz, 50 W
1091-80-R	Adapters, N (f)-SMA (m), DC to 18 GHz, 50 W
1091-81-R	Adapters, N (f)-SMA (f), DC to 18 GHz, 50 W
510-102	Adapters, N (m)-N (m), 90˚ right angle, DC to 11 GHz, 50 W
510-90	Adapters, 7/16 DIN (f)-N (m), DC to 7.5 GHz, 50 W
510-91	Adapters, 7/16 DIN (f)-N (f), DC to 7.5 GHz, 50 W
510-92	Adapters, 7/16 DIN (m)-N (m), DC to 7.5 GHz, 50 W
510-93	Adapters, 7/16 DIN (m)-N (f), DC to 7.5 GHz, 50 W
510-96	Adapters, 7/16 DIN (m)-7/16 DIN (m), DC to 7.5 GHz, 50 W
510-97	Adapters, 7/16 DIN (f)-7/16 DIN (f), DC to 7.5 GHz, 50 W
513-62	Adapter, TNC (f) to N (f), 18 GHz, 50 W
1091-315	Adapter, TNC (m) to N (f), 18 GHz, 50 W
1091-324	Adapter, TNC (f) to N (m), 18 GHz, 50 W
1091-325	Adapter, TNC (m) to N (m), 18 GHz, 50 W
1091-317	Adapter, TNC (m) to SMA (f), 18 GHz, 50 W
1091-318	Adapter, TNC (m) to SMA (m), 18 GHz, 50 W
1091-323	Adapter, TNC (f) to TNC (f), 18 GHz, 50 W
1091-326	Adapter, TNC (m) to TNC (m), 18 GHz, 50 W
15NN50-1.5C	Test Port Cables Armored, 1.5 m, N (m)-N (m), 6 GHz, 50 W
15NN50-3.0C	Test Port Cables Armored, 3.0 m, N (m)-N (m), 6 GHz, 50 W
15NN50-5.0C	Test Port Cables Armored, 5.0 m, N (m)-N (m), 6 GHz, 50 W
15NNF50-1.5C	Test Port Cables Armored, 1.5 m, N (m)-N (f), 6 GHz, 50 W
15NNF50-3.0C	Test Port Cables Armored, 3.0 m, N (m)-N (f), 6 GHz, 50 W
15NNF50-5.0C	Test Port Cables Armored, 5.0 m, N (m)-N (f), 6 GHz, 50 W
15ND50-1.5C	Test Port Cables Armored, 5.0 m, N (m)-7/16 DIN (m), 6 GHz, 50 W
15NDF50-1.5C	Test Port Cables Armored, 5.0 m, N (m)-7/16 DIN (f), 6 GHz, 50 W
2000-1030	Port Antennas, SMA (m), 1.71 to 1.88 GHz, 50 W
2000-1031	Port Antennas, SMA (m), 1.85 to 1.99 GHz, 50 W
2000-1032	Port Antennas, SMA (m), 2.4 to 2.5 GHz, 50 W
2000-1035	Port Antennas, SMA (m), 896 to 941 MHz, 50 W
2000-1200	Port Antennas, SMA (m), 806 to 869 MHz, 50 W
2000-1361	Port Antennas, SMA (m), 5725 to 5825 MHz, 50 W
2000-1473	Port Antennas, SMA (m), 870 to 960 MHz, 50 W
2000-1474	Port Antennas, SMA (m), 1.71 to 1.88 GHz, 50 W
2000-1475	Port Antennas, SMA (m), 1920 to 1980, 2.11 to 2.17 GHz, 50 W
61532	Port Antennas, Antenna Kit: 2000-1030, 2000-1031, 2000-1032, 2000-1035, 2000-1200, and 2000-1361
1N50C	Limiter, N (m) to N (f), 50 W, 0.01 to 50 GHz
42N50-20	Attenuator, 20 dB, 50 W, DC to 18 GHz, N (m)-N (f)
42N50A-30	Attenuator, 30 dB, 50 W, DC to 18 GHz, N (m)-N (f)
2000-1410	Magnet Mount GPS Antenna with 15 ft (4.6 m) cable
760-243-R	Hard Transit Case
66864	Rack Mount Kit, Master Platform (MS2024A, MS2026A only)

AREA TESTER

ML8720C

W-CDMA: 2110 to 2170 MHz, GSM: 925 to 960 MHz, 1805 to 1880 MHz

CE

For Performing Area Tests and Maintenance of W-CDMA and GSM Base Stations

The ML8720C Area Tester is a convenient battery powered measuring instrument with an 8.4-inch color display used for standalone measurements such as coverage area and other indoor measurements. Because of its excellent hardware performance, it can be used to for accurate area-coverage tests even in severe measurement environments with high interference because it can obtain radio wave carrier characteristics with high reliability.
When used in combination with the optional ML8720C-03 Two Carrier Measurement Function and MX872004C GSM Measurement Software, either two W-CDMA base stations on different frequencies or a W-CDMA plus a GSM base station can be measured simultaneously. The data collection efficiency for functions such as coverage testing is greatly improved compared to earlier products, and since the radio wave environment can be analyzed at the same time, the ML8720C is also very useful for fault analysis.
Furthermore, installing the MX872002B BCH Demodulation Software option permits confirmation of cell traffic data and base station settings, offering support for discovering base stations with insufficient traffic capacity, and preventing configuration errors.

- **Simultaneous W-CDMA and GSM Measurement**

Installing the optional ML8720C-03 Two Carrier Measurement Function and the MX872004C GSM Measurement software enables simultaneous W-CDMA and GSM measurement. The data collection efficiency for functions such as coverage testing is greatly improved compared to earlier products, and since the radio wave environment can be analyzed at the same time, the ML8720C is also very useful for fault analysis.

- **Simultaneous Measurement of Two Carrier Frequencies and Diversity Function**

By using the ML8720C-03 Dual Channel Measurement Function option, two carrier frequencies can be measured simultaneously.
The diversity function separates W-CDMA transmission diversity formatted signals for each transmission antenna so that the RSCP of the CPICH can be measured.

- **Checking Broadcast Information by BCH Demodulation**

For W-CDMA measurement, BCH data can be obtained via the MX872002B application software without using the UE.
Since the uplink interference power corresponding to the measured CPICH value is displayed in real time, cell traffic data can be checked. And since all SIBs (System Information Blocks) are supported, it is possible to check whether the base station parameters are set as designed.

- **Standalone Operation**

An external control PC is not required. Basic measurements and data collection can be performed by using only the ML8720C mainframe. Of course, the system can be extended in combination with area analysis software.

- **Handy Type**

At only 4 kg, the ML8720C is easily portable for both outside and inside work. An 8.4-inch transparent color TFT-LCD display has been incorporated.

- **Indoor Measurement Support**

Useful functions are provided for indoor measurement use: fixed-point measurements for saving the data of specific measured points, the addition of comments to measured data, and the automatic naming of data files before saving them.

- **3-hour Battery Operation**

In the standard configuration, the lithium-ion battery pack provides 3 hours of operation and a spare battery pack solves even long-term measurement problems.

- **High-speed and High-accuracy Area Analysis**

RSCP, Ec/No, and SIR can be measured at 30 cm intervals (using specified base station and single-channel measurements) while travelling at 100 km/h in a monitoring vehicle to provide fast and accurate area analysis.

- **High-speed Search with SCH**

When SCH search is selected in unspecified base station mode, CPICH can be searched at high speed using the same SCH search method as a UE. As one measurement example, 10 channels are searched for 4 sec on average and then the measurement is started.

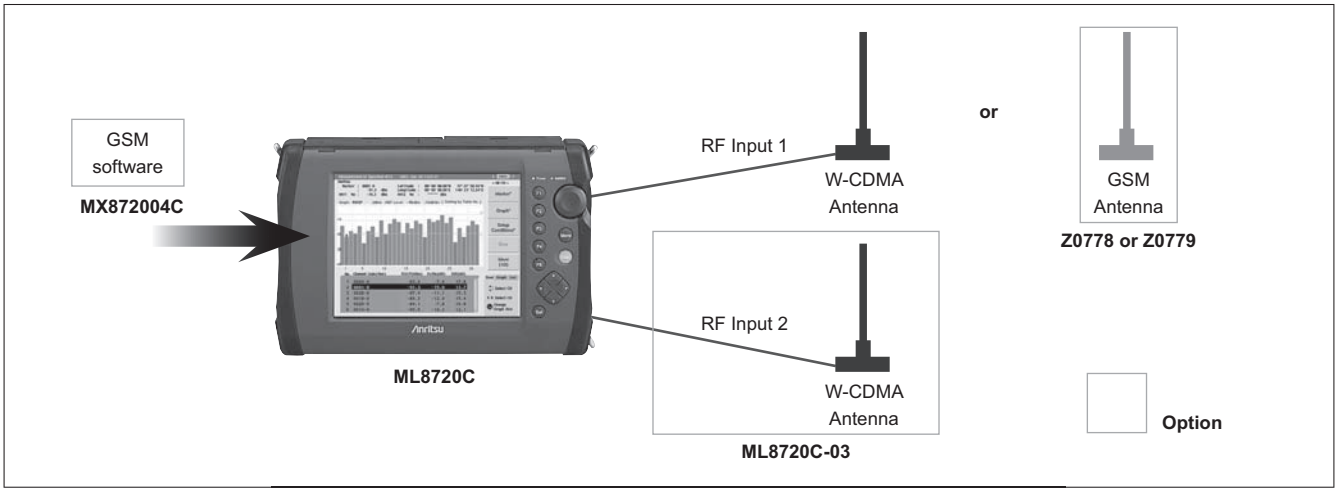
- **Correlation with GPS Positioning Data**

The measured data can be correlated with GPS positioning data (latitude and longitude) and saved to a memory card.
In addition, the measured data and positioning information can be downloaded in real time to an external PC via the RS-232C interface.

- **Specific Distance Measurement using Car Speed Pulses**

When a car speed pulse is used as an external trigger, measurements can be performed at specific distances.
The measurement period can be designated by the pulse count or distance when measuring using the external trigger.

Product Configuration



Required Option List

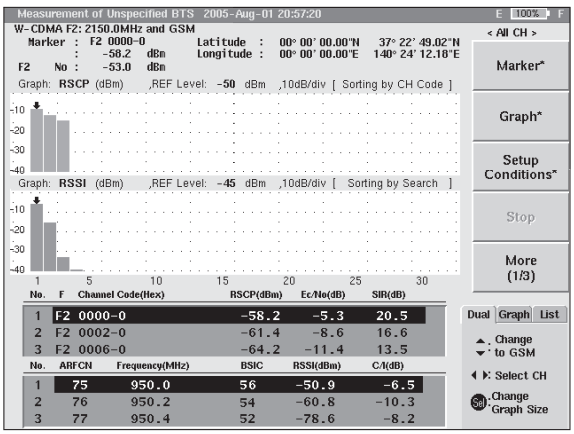
	ML8720C	ML8720C-03	MX872004C	Z0778 or Z0779
W-CDMA (1 carrier)	Required			
W-CDMA (2 carrier)	Required	Required		
W-CDMA or GSM selectable	Required		Required	Required
W-CDMA and GSM simultaneously	Required	Required	Required	Required

ML8720C Area Tester
ML8720C-03 Two Carrier Measurement
MX872004C GSM Measurement Software
Z0778 900 MHz/1800 MHz Whip Antenna
Z0779 900 MHz/1800 MHz Vehicle Antenna

W-CDMA + GSM Measurements

• Simultaneous W-CDMA and GSM Measurements

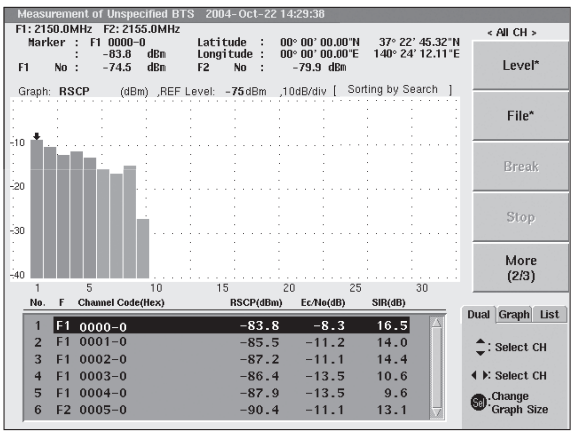
When the optional ML8720C-03 Two Carrier Measurement Function and the MX872004C GSM Measurement software are installed, W-CDMA and GSM measurements can be performed simultaneously with the measurement results displayed on a single screen.



W-CDMA x 2 Measurements

• Two Carrier Measurement Screen Display (All Channels)

When the optional ML8720C-03 Two Carrier Measurement Function is installed, up to 32 channels for two W-CDMA base stations using different frequencies can be measured separately.
Since multiple carriers of the same company can be measured simultaneously, the measurement efficiency is improved. Moreover, carriers of other companies can be measured simultaneously for benchmarking purposes.



Specifications

Frequency range	RF Input connector 1: 925 to 960 MHz (CW, spectrum monitor and at the time of measuring GSM*) 1805 to 1880 MHz (CW, spectrum monitor and at the time of measuring GSM*) 2110 to 2170 MHz (CW, spectrum monitor and at the time of measuring W-CDMA) RF Input connector 2: 2100 to 2200 MHz (at the time of measuring W-CDMA with ML8720C-03/23 attached.)
Input impedance	50 Ω (SMA type connector)
Frequency setting resolution	W-CDMA measurement mode: 200 kHz GSM measurement mode*: 200 kHz Spectrum monitor: 1 kHz CW measurement mode: 100 kHz
Reference oscillator	Aging rate: ±1 x 10^{-6}/year
Receive signals	W-CDMA measurement mode: P-CPICH, S-CPICH, P-SCH, S-SCH, P-CCPCH (At the time of BCH demodulation) GSM measurement mode*: BCH
Power measurement	Measurement range W-CDMA measurement mode: –117 to –33 dBm (RF input connector 1, the end of RF input connector 2) GSM measurement mode*: –110 to –40 dBm (the end of RF connector 1) Spectrum monitor: –123 to –33 dBm (the end of RF connector 1) CW measurement mode: –117 to –33 dBm (the end of RF connector 1) Note: When built-in divider of option ML8720C-03/23 is used, the level of minimum reception sensitivity is raised due to the divider's loss (Typ. 4.0 dB). Resolution: 0.1 dB Display units: dBm, dBμ, dBμV/m (CW measurement mode and spectrum monitor mode) W-CDMA measurement accuracy CPICH_RSCP: ±1 dB (Typ.) (23 ±5˚C) CPICH_SIR: ±2 dB (Typ.) (23 ±5˚C) SCH_RSCP: ±2 dB (Typ.) (23 ±5˚C) GSM measurement accuracy* RSSI: ±1 dB (Typ.) (23 ±5˚C) Spectrum monitor Accuracy: ±1 dB (Typ.) (23 ±5˚C) Noise level: –127 dBm (RBW 4 kHz) CW measurement accuracy: ±1 dB (Typ.) (room temperature) Dynamic characteristics: CPICH_RSCP, CPICH_SIR accuracy at 0 to 100 km/h (averaged distance: 50 m)
Measurement items	Specified base station, Unspecified base station, Spectrum monitor, CW measurement
Base station measurement	W-CDMA measurement items Received Signal Code Power (RSCP), Received energy per chip divided by the power density in the band (Ec/No), Signal to Interference Ratio (SIR) GSM measurement items* Receiving/Sending power in band with (RSSI, RBW 200 kHz), Carrier vs. interference power rate (C/I) Measurement modes: Time variation (internal trigger), Distance variation (external trigger) Sampling interval W-CDMA measurement: 10 ms/ch GSM measurement*: 20 ms/ch (specified channel measurement only, BSIC decode OFF) 50 ms/ch (unspecified channel included measurement, BSIC decode OFF) 100 ms/ch (BSIC decode ON) Measurement channels: 32 max. W-CDMA measurement sync acquisition time: 600 ms x the number of search channel (CPICH mode), 4 sec on average for TOP 10 display (SCH mode) Search method of BTS: CPICH mode, SCH mode GSM measurement search time*: 3.3 ms/ch (BSIC decode OFF), 20 ms/ch (BSIC decode ON) Data processing method: Average, Median, Max., Min., 10, 20, 30, 40, 60, 70, 80, 90% W-CDMA measurement display: All channel, Delay profile, Each finger, Fluctuation, SCH delay profile (unspecified base station measurement) GSM measurement display: All channel (GSM only or synchronous W-CDMA and GSM), Fluctuation
Spectrum monitor function	Frequency span: 4, 10, 30, 60 MHz Resolution bandwidth: 4 kHz
CW measurement	Frequency setting resolution: 100 kHz, Resolution bandwidth: 15 kHz
Demodulation function	Demodulation channel: BCH Demodulation information: MIB, SB1, SB2, SIB1, SIB2, SIB3, SIB4, SIB5, SIB6, SIB7, SIB8, SIB9, SIB10, SIB11, SIB12, SIB13, SIB13-1, SIB13-2, SIB13-3, SIB13-4, SIB14, SIB15, SIB15-1, SIB15-2, SIB15-3, SIB15-4, SIB15-5, SIB16, SIB17, SIB18 When the demodulation function is enabled, MIB, SB1, SB2, and SIB7 are always demodulated, and others can be selected for demodulation as desired. Although the uplink interference power (SIB7) is demodulated periodically, the demodulation period varies depending on the setting and environmental conditions. Demodulation processing time: 0.5 s (P-CCPCH 2 frame) Demodulation success rate: >50%, 70% (Typ.) (P-CCPCH 2 frame, Ec/No ≥–14 dB, Dynamic response 0 to 100 km/h)
Other functions	Master/slave function: Daisy chain connection of multiple ML8720C, parallel measurement GPS connection: Supports NMEA-0183 format Remote control: Via RS-232C File I/O: Read measurement conditions, Output measured results file Diversity function: Transmit diversity, Receive antenna diversity (Option 03/23) Two carrier measurement function: Two carrier frequencies can be measured simultaneously in the specified base station measurement and the unspecified base station measurement (Option 03/23) RAKE diversity: Six fingers External trigger calibration: Car speed pulse occurrence interval measurement and distance setting of measurement cycle are possible. Clock error detection: An alarm can be output when abnormal drifting of the base station clock is detected. Detection range: 4 to 8 ppm (typ.) for measurement of a specified base station

Continued on next page

Interface	IF output: ≥10 dBμV (190 MHz), SMB connector External reference input: 2 to 5 Vp-p (10 MHz), SMB connector External trigger input: 1.5 Vdc ± (2 to 13 Vp-p), BNC connector Sync output: TTL level, BNC connector RS-232C-1: For external computer (max. 115.2 kbps), D-Sub 9 pin connector RS-232C-2: For GPS (supports NMEA-0183 format), Mini-DIN 8 pin connector Printer: 8-bit parallel I/F (conform to Centronics), D-Sub 25 pin connector Keyboard: IBM US ENGLISH (101 keys) 106 supported, Mini-DIN 6 pin connector External monitor: VGA, mini-DIN 10 pin connector
Storage media	FDD (3.5-inch, 2HD), ATA flash card
Display	640 x 480 dots, 8.4-inch color LCD
Environment conditions	Temperature and humidity: 0˚ to +40˚C/≤85% (operating), –25˚ to +60˚C/≤85% (storage) Vibration: MIL-T-28800E (Class 3) Shock: MIL-T-28800E Drop test: MIL-T-28800E (Style C) EMC EN61326-1, EN61000-3-2 LVD EN61010-1
Power supply	DC: 10 to 24 V AC (rating): 100 to 240 V, 50/60 Hz (with AC adapter) Power Battery: Z0619 Li-ion Battery Pack Power consumption: 35 W max. (battery charge), Standard: 20 W, 30 W (with Option 03/23) Battery continuous operation time: 3 h (typical), 2 h (typical with Option 03/23)
Dimensions and mass	290 (W) x 194 (H) x 78 (D) mm, ≤4.5 kg (with battery pack) 290 (W) x 194 (H) x 124 (D) mm, ≤6.5 kg (with Option 03/23 and battery pack)

∗: Function to which only installing MX872004C is effective

Hardware Options

• ML8720C-03 Two Carrier Measurement Function

Two Carrier Measurement Function

Two carrier frequencies can be measured simultaneously for specified base station measurements and unspecified base station measurements.

When the MX872004C GSM Measurement software option is installed, it is possible to perform simultaneous measurement of both W-CDMA and GSM base stations.

Diversity Function

Signals from base stations supporting W-CDMA transmit diversity can be measured per transmit antenna for specified base station measurements. (The ML8720C-03 option and the ML8720C mainframe should be ordered together.)

• ML8720C-23 Two Carrier Measurement Retrofit

ML8720C-23 functionality is added to the ML8720C standard configuration (The mainframe is taken back for retrofitting ML8720C-23 to the ML8720C mainframe).

Applications Software

• MX872002B BCH Demodulation Software (sold separately)

This software adds a BCH demodulation function for W-CDMA base stations to the ML8720C.

The system information shown below can be displayed in text format conforming to the definition described in TS25.331 ASN.1.

Information that can be demodulated:

MIB, SB1, SB2, SIB1, SIB2, SIB3, SIB4, SIB5, SIB6, SIB7, SIB8, SIB9, SIB10, SIB11, SIB12, SIB13, SIB13-1, SIB13-2, SIB13-3, SIB13-4, SIB14, SIB15, SIB15-1, SIB15-2, SIB15-3, SIB15-4, SIB15-5, SIB16, SIB17, and SIB18.

During measurement, the above system information is saved to a memory card as a binary file.

When the accessory BCH Demodulation Tool is installed in a PC, saved binary-format files can be batch-converted to text files on the PC after measurement has been completed.

The BCH Demodulation Tool is supported by both Windows 2000 and Windows XP.

• MX872004C GSM Measurement Software (sold separately)

This option adds GSM measurement functions to the ML8720C. It provides RSSI and C/I measurements as well as BSIC decoding in the GSP900 (E-GSM) and DCS1800 bands.

• MX872022B Data Conversion Software (sold separately)

This software is used to convert an ML8720C measured W-CDMA data file (∗.DAT) to the data format required by MapInfo Professional. This software operates with Windows 98SE/2000/XP.

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	
ML8720C	Area Tester	
	Standard accessories	
W2544AE	ML8720C Operation Manual:	1 copy
Z0619	Li-ion Battery Pack:	1 pc
J1069	AC Adapter:	1 pc
J0979	A-2 (Japan) Power Cord:	1 pc
Z0402A	Protective Cover:	1 pc
Z0403A	Belt with Hook:	1 pc
Z0516	Antenna (2.1 GHz):	1 pc (2 pcs)*1
Z0703	Antenna Mount (with 5 m cable):	1 pc (2 pcs)*1
J0977	Serial Interface Cable (for connecting GPS, cross, 2 m):	1 pc
J1068	Serial Interface Cable (for connecting GPS, straight, 3 m):	1 pc
J1161	BL82-5133-02 (SMA plug-SMA jack):	1 pc (2 pcs)*1
J1248	SMA Connection Cable (Type L):	(2 pcs)*2
	Hardware options	
ML8720C-03	Two Carrier Measurement (selected when ordering a mainframe.)	
ML8720C-23	Two Carrier Measurement Retrofit [Retrofitted to the already-shipped main flame. (Main flame need to be taken back.)]	
	Applications software	
MX872002B	BCH Demodulation Software	
MX872004C	GSM Measurement Software (antenna for 900/1800 MHz is required separately.)	
MX872022B	Data Conversion Software (data conversion output for MapInfo)	
	Maintenance service	
ML8720C-ES210	Two Years Warranty Service	
ML8720C-90	Extended Three Years Warranty Service	
ML8720C-91	Extended Five Years Warranty Service	
	Application parts	
P0020	Compact Flash 64 MB (requires J1254)	
P0021	Compact Flash 128 MB (requires J1254)	
P0022	Compact Flash 256 MB (requires J1254)	
P0023	Compact Flash 512 MB (requires J1254)	
J1254	Compact Flash Adapter (conversion adapter)	
Z0436	Hand Carrying Case [560 (W) x 370 (H) x 220 (D) mm]	
Z0435	Soft Carrying Case [430 (W) x 300 (H) x 170 (D) mm, use with an option]	
B0442	Soft Carrying Case [440 (W) x 310 (H) x 110 (D) mm]	
Z0526	Case for Installation [365 (W) x 300 (H) x 185 (D) mm]	
J0127D	BNC Cable (for connecting external trigger)	
J0654A	Serial Interface Cable (for connecting IBM-PC/AT)	
J1296	Display Conversion Cable (for connecting external monitor)	
J1117	DC Power Cable (for cigarette lighter, minus ground vehicle, 3 m)	
J1118	DC Power Cable (with arrow shaped chip, 3 m)	
Z0697	Battery Charger (two Z0619 batteries can be charged simultaneously.)	
Z0812A	900 MHz/1800 MHz Antenna for Vehicle Installation (used in combination with Z0797)	
Z0797	Antenna Base (with 5 m cable)	
Z0865A	Antenna Base (with 3.5 m cable)	
Z0778	900 MHz/1800 MHz Whip Antenna (for direct connecting with main frame)	
Z0779	900 MHz/1800 MHz Antenna for Vehicle Installation (combination of Z0812A and Z0797)	
Z0705	Antenna Mount (with 3.5 m cable, for Z0516 exclusive use)	
Z0710	Exchange of Antenna Base (Z0703 → Z0705)	
Z0780A*3	ML8720B → ML8720C Modification	

*1: Antenna, Antenna mount and SMA Plug-SMA Jack are provided 2 packs when any of the Option 03/23 (ML8720C-03/ML8720C-23) is equipped.
*2: Attached only when any of the Option 03/23 (ML8720C-03/ML8720C-23) is equipped.
*3: When Option 01 (ML8720B-01) is equipped, required to detach.

Antenna (Z0516), Antenna mount (Z0703)

AREA SCANNER

ML8740B

W-CDMA: 2110 to 2170 MHz, GSM: 925 to 960 MHz, 1805 to 1880 MHz

CE

For Performing Area Tests and Maintenance of W-CDMA and GSM Base Stations

The ML8740B Area Scanner is for performing driving tests to optimize base station service areas.
Its excellent hardware performance makes it ideal for accurate area-coverage tests even in severe measurement environments with high interference because it captures carrier characteristics with high reliability.
When used with the ML8740B-001 Two Carrier Measurement Function and MX874002B GSM Measurement Software options, two W-CDMA base stations at different frequencies or a W-CDMA and GSM base stations can be measured simultaneously.
The drive testing data collection efficiency is greatly improved over earlier products. Furthermore, installing the MX874001B BCH Demodulation Software option permits confirmation of cell traffic data and base station settings to support discovery of base stations with insufficient traffic capacity and prevent configuration errors.

- **Simultaneous W-CDMA and GSM Measurement**

Installing the optional ML8740B-001 Two Carrier Measurement Function and the MX874002B GSM Measurement Software enables simultaneous W-CDMA and GSM measurement. The data collection efficiency for drive testing is greatly improved.

- **Simultaneous Measurement of Two Carrier Frequencies and Diversity Function**

By using the ML8740B-001 Two Carrier Measurement Function option, two carrier frequencies can be measured simultaneously.
In addition, the W-CDMA transmission diversity format RSCP of the CPICH can be measured by using the diversity function.

- **High-speed and High-accuracy Area Analysis**

Received Signal Code Power (RSCP), Received energy per chip divided by the power density in the band (Ec/No), and Signal to Interference Ratio (SIR) can be measured at 30 cm intervals (using specified base station and single-channel measurements) while traveling at 100 km/h in a monitoring vehicle to provide fast and accurate area analysis.

- **High-speed Search with SCH**

When SCH search is selected in unspecified base station mode, CPICH can be searched at high speed using the same SCH search method as a mobile terminal. As one measurement example, 10 channels are searched for 4 sec on average and then the measurement is started.

- **Correlation with GPS Positioning Data**

When the GPS receiver is connected, measurement data is recorded with GPS positioning data (latitude and longitude).

- **Checking Broadcast Information by BCH Demodulation**

For W-CDMA measurement, the W-CDMA base station BCH data can be obtained via the MX874001B BCH Demodulation Software without using the mobile terminal. Since the uplink interference power corresponding to the measured CPICH value is displayed in real time, cell traffic data can be checked. And since all SIBs (System Information Blocks) are supported, it is possible to check whether the base station parameters are set as designed.

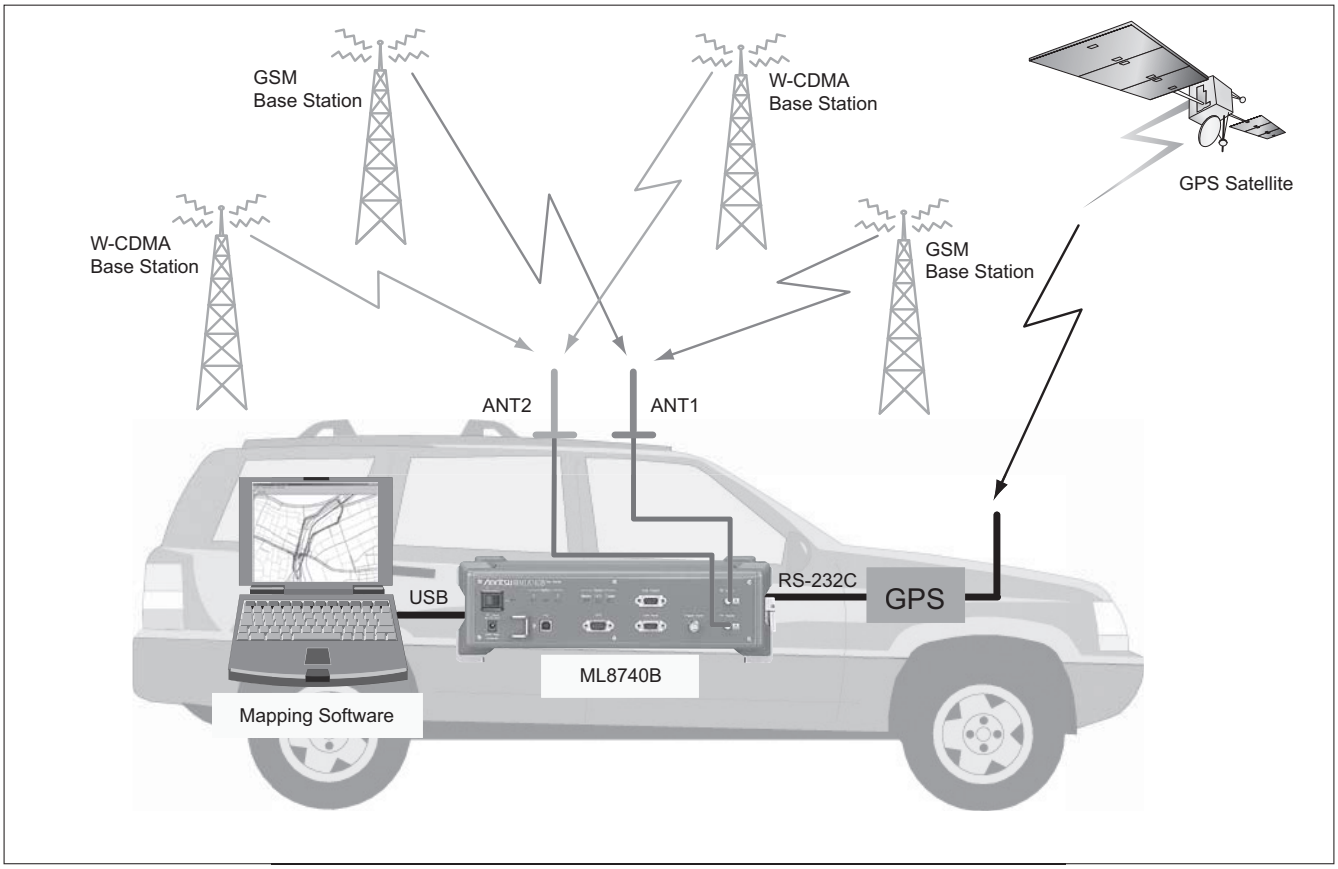
- **Specific Distance Measurement Using Car Speed Pulses**

When a car speed pulse is used as an external trigger, measurements can be performed at specific distances.
The measurement period can be designated by the pulse count or distance when measuring using the external trigger.

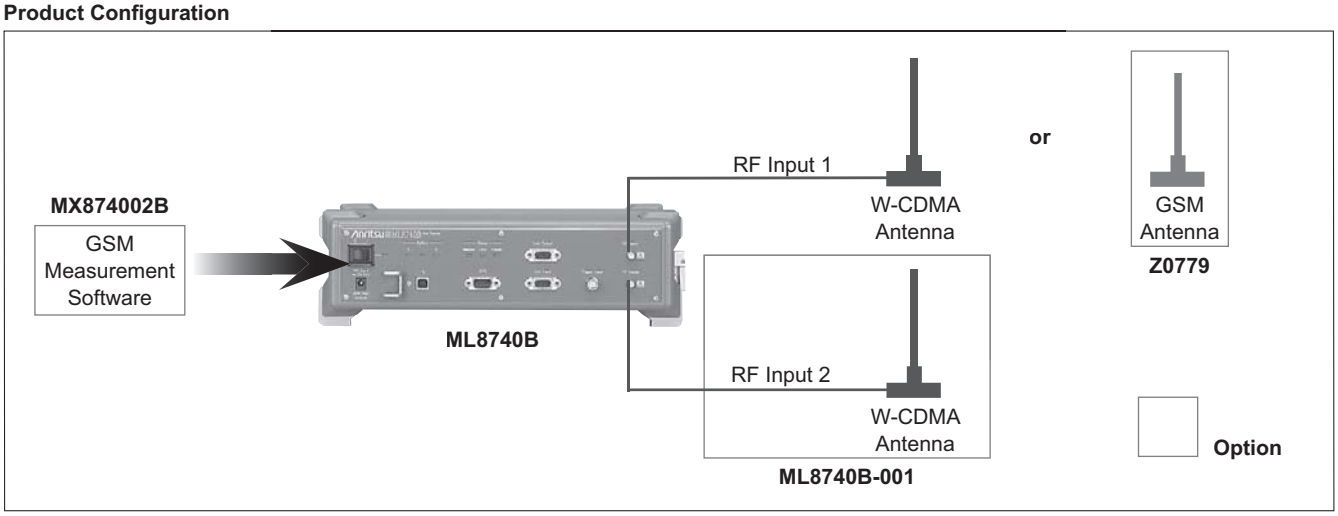
- **5-hour Battery Operation**

In the standard configuration, the lithium-ion battery pack provides 5 hours of operation and a spare battery pack solves even long-term measurement problems.

Example of Use



Product Configuration



Required Option List

	ML8740B	ML8740B-001	MX874002B	Z0779
W-CDMA (1 carrier)	Required			
W-CDMA (2 carrier)	Required	Required		
W-CDMA or GSM selectable	Required		Required	Required
W-CDMA and GSM simultaneously	Required	Required	Required	Required

ML8740B Area Scanner
ML8740B-001 Two Carrier Measurement
MX874002B GSM Measurement Software
Z0779 900 MHz/1800 MHz Vehicle Antenna

Specifications

Frequency range	RF Input connector 1: 925 to 960 MHz (CW, spectrum monitor and at the time of measuring GSM*) 1805 to 1880 MHz (CW, spectrum monitor and at the time of measuring GSM*) 2110 to 2170 MHz (CW, spectrum monitor and at the time of measuring W-CDMA) RF Input connector 2: 2110 to 2200 MHz (at the time of measuring W-CDMA with ML8740B-001 attached.)
Input impedance	50 Ω (SMA type connector)
Frequency setting resolution	W-CDMA measurement mode: 200 kHz GSM measurement mode*: 200 kHz Spectrum monitor: 1 kHz CW measurement mode: 100 kHz
Reference oscillator	Aging rate: ±1 x 10^{-6}/year
Receive signals	W-CDMA measurement mode: P-CPICH, S-CPICH, P-SCH, S-SCH, P-CCPCH (At the time of BCH demodulation) GSM measurement mode*: BCH
Power measurement	Measurement range W-CDMA measurement mode: –117 to –33 dBm (RF Input connector 1, the end of RF Input connector 2) GSM measurement mode*: –110 to –40 dBm (the end of RF connector 1) Spectrum monitor: –123 to –33 dBm (the end of RF connector 1) CW measurement mode: –117 to –33 dBm (the end of RF connector 1) Resolution: 0.1 dB Display units: dBm, dBμ, dBμV/m (CW measurement mode and spectrum monitor mode) W-CDMA measurement accuracy CPICH_RSCP: ±1 dB (Typ.) (23 ±5˚C) CPICH_SIR: ±2 dB (Typ.) (23 ±5˚C) SCH_RSCP: ±2 dB (Typ.) (23 ±5˚C) GSM measurement accuracy* RSSI: ±1 dB (Typ.) (23 ±5˚C) Spectrum monitor Accuracy: ±1 dB (Typ.) (23 ±5˚C) Noise level: –127 dBm (RBW 4 kHz) CW measurement accuracy: ±1 dB (Typ.) (23 ±5˚C) Dynamic characteristics: CPICH_RSCP, CPICH_SIR accuracy at 0 to 100 km/h (averaged distance: 50 m)
Measurement items	Specified base station, Unspecified base station, Spectrum monitor, CW measurement
Base station measurement	W-CDMA measurement items Received Signal Code Power (RSCP), Received energy per chip divided by the power density in the band (Ec/No), Signal to Interference Ratio (SIR) GSM measurement items* Receiving/sending power in band with (RSSI, RBW 200 kHz), Carrier versus interference power rate (C/I) Measurement modes: Time variation (internal trigger), distance variation (external trigger) Sampling interval W-CDMA measurement: 10 ms/ch GSM measurement*: 20 ms/ch (specified channel measurement only, BSIC decode OFF) 50 ms/ch (unspecified channel included measurement, BSIC decode OFF) 100 ms/ch (BSIC decode ON) Measurement channels: 32 max. W-CDMA measurement sync acquisition time: 600 ms x the number of search channel (CPICH mode), 4 sec on average for Top 10 display (SCH mode) Search method of BTS: CPICH mode, SCH mode GSM measurement search time*: 3.3 ms/ch (BSIC decode OFF), 20 ms/ch (BSIC decode ON) Data processing method: Average, median, max., min., 10, 20, 30, 40, 60, 70, 80, 90% Output data : All channels, delay profile, each finger, SCH delay profile (Delay profile and each finger are applied for W-CDMA measurement only. SCH delay profile is applied for W-CDMA and unspecified base station measurement only.)
Spectrum monitor	Frequency span: 4, 10, 30, 60 MHz
Function	Resolution bandwidth: 4 kHz
CW measurement	Frequency setting resolution: 100 kHz, Resolution bandwidth: 15 kHz
Demodulation function	Demodulation channel: BCH Demodulation information: MIB, SB1, SB2, SIB1, SIB2, SIB3, SIB4, SIB5, SIB6, SIB7, SIB8, SIB9, SIB10, SIB11, SIB12, SIB13, SIB13-1, SIB13-2, SIB13-3, SIB13-4, SIB14, SIB15, SIB15-1, SIB15-2, SIB15-3, SIB15-4, SIB15-5, SIB16, SIB17, SIB18 When the demodulation function is enabled, MIB, SB1, SB2, and SIB7 are always demodulated, and others can be selected for demodulation as desired. Although the uplink interference power (SIB7) is demodulated periodically, the demodulation period varies depending on the setting and environmental conditions. Demodulation processing time: 0.5 s (P-CCPCH 2 frame) Demodulation success rate: >50%, 70% (Typ.) (P-CCPCH 2 frame, Ec/No ≥–14 dB, Dynamic response 0 to 100 km/h)
Other functions	Master/slave function: Daisy chain connection of multiple ML8740B, parallel measurement GPS connection: Supports NMEA-0183 format Remote control: Via USB Diversity function: Transmit diversity, receive antenna diversity (with ML8740B-001) Two carrier measurement function: Two carrier frequencies can be measured simultaneously in the specified base station measurement and the unspecified base station measurement (with ML8740B-001) RAKE diversity: Six fingers External trigger calibration: Car speed pulse occurrence interval measurement and distance setting of measurement cycle are possible.

*: This function can work with MX874002B installed.

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Interface	External trigger input: 1.5 Vdc ± (2 to 13 Vp-p), BNC connector Sync output: TTL level, D-Sub 15 pin connector PC : USB (Full Speed : 12 Mbps), Type B connector GPS : RS-232C (38.4 kbps max.), D-Sub 9 pin connector
Environment conditions	Temperature and humidity: 0˚ to +40˚C/≤90% (operating), –40˚ to +80˚C/≤90% (storage) Vibration: MIL-T-28800E (Class 3) EMC EN61326-1, EN61000-3-2 LVD EN61010-1
Power supply	DC: (rating): 10 to 24 V (Power tolerance : 8 to 26.4 V) AC: (rating): 100 to 240 V, 50/60 Hz, 50 VA max (with AC adapter) Power Battery: Z0619 Li-ion Battery Pack (Sell separately) Power consumption: 35 W max. (battery charge), Standard: 15 W, 25 W (with ML8740B-001) Battery continuous operation time: 5 h (typical), 3 h (typical with ML8740B-001)
Dimensions and mass	320 (W) x 88 (H) x 231 (D) mm, ≤3.5 kg, ≤4 kg (with ML8740B-001)

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	
ML8740B	Area Scanner	
	Standard accessories	
J1069	AC Adapter:	1 pc
J1117	DC Power Cable (for cigarette lighter, minus ground vehicle, 3 m):	1 pc
J1316	USB Cable, 1 m:	1 pc
Z0516	Antenna (2.1 GHz):	1 pc (2 pcs)*
Z0797	Antenna Base (with 5 m cable):	1 pc (2 pcs)*
Z0793B	ML8740B CD-ROM (operation manual and attached software are installed.):	1 pc
	Options	
ML8740B-001	Two Carrier Measurement (selected when ordering a main frame.)	
ML8740B-101	Two Carrier Measurement Retrofit [Retrofitted to the already-shipped main frame. (Main frame need to be taken back.)]	
	Application software	
MX874001B	BCH Demodulation Software	
MX874002B	GSM Measurement Software (antenna for GSM measurement is required separately.)	
	Maintenance service	
ML8740B-ES310	Extended Three Years Warranty Service	
ML8740B-ES510	Extended Five Years Warranty Service	
	Application parts	
W2715AE	ML8740B Operation Manual	
J0127D	BNC Cable (for connecting external trigger)	
J1118	DC Power Cable (with arrow shaped chip, 3 m)	
J1317	Link Connection Cable, 0.7 m	
Z0619	Li-ion Battery Pack	
Z0697	Battery Charger (two Z0619 batteries can be charged simultaneously.)	
Z0812A	900 MHz/1800 MHz Antenna for Vehicle Installation (used in combination with Z0797)	
Z0797	Antenna Base (with 5 m cable)	
Z0865A	Antenna Base (with 3.5 m cable)	
Z0866A	Exchange Antenna Base (exchange Z0797 for Z0865A in shipping)	
Z0778	900 MHz/1800 MHz Whip Antenna (for direct connection to main frame)	
Z0779	900 MHz/1800 MHz Antenna for Vehicle Installation (combination of Z0812A and Z0797)	
Z0794	Hand Carrying Case [560 (W) x 370 (H) x 220 (D) mm]	
Z0910A	Hard Carrying Case (with antenna base and cable holder)	
Z0795	Power Divider (0.7 to 2.5 GHz)	
J0693D	SMA Cable (0.27 m, for power divider connection, 2 cables are required.)	
Z0869A	ML8740B Upgrade (for ML8740A)	

*: Antenna and Antenna mount are provided 2 packs when the option 001 (ML8740B-001) is equipped.

(a) (b) (c)

(a) Z0516 (For 2.1 GHz)
(b) Z0778 (900/1800 MHz, For direct connection to main frame)
(c) Z0812A (900/1800 MHz, Vehicle antenna)

Z0779

(Combination of Z0812A Antenna and Z0797 Antenna Base)

MEASURING RECEIVER

ML524B

25 to 1000 MHz

GPIB OPTION

For Measuring Service Area

Build-to order product

The ML524B has a full range of features and functions plus demodulation functions for various signals. The compact, lightweight construction makes it suitable for a variety of measurement applications. The GPIB interface option allows easy configuration of an automatic test system controlled by a personal computer.

Features

- Very compact and lightweight
- High frequency stability (A synthesizer local is used. Its reference oscillator has a high frequency stability of ±1 x 10^{-6}.)
- Wide dynamic range (80 dB without switching)
- Automatic gain calibration
- Direct readout of field strength
- High precision level display (indication in 0.1 dB steps)

Applications

For Field Strength Measurement

- Investigation to determine service areas
- Radio wave propagation test
- Measurement of spurious radiation from transmitter

For Other Than Field Strength Measurement

- Radio monitoring
- Measuring receiver
- High-sensitivity signal demodulation

Specifications

RF input		Nominal impedance 50 Ω, N-type connector
Frequency	Range	25.0000 to 999.9999 MHz
	Display	Liquid crystal display, 6 digits Minimum digit: 1 kHz (0.5 kHz is displayed using a symbol of ■.)
	Resolution	12.5 kHz (120 kHz bandwidth), 1 kHz (15 kHz bandwidth)
	Setting	Keyboard and FINE dial
	Memory	Up to 100 frequencies can be stored and recalled.
	Reference frequency stability	±1 x 10^{-6}
Voltage measurement (E.M.F.)	Minimum value	5 dBμV (25 to 300 MHz), 5 dBμV (300 to 999.999 MHz)
	Maximum value	100 dBμV (25 to 999.999 MHz)
	Setting	C/N: ≥6 dB (at minimum value), Bandwidth: 15 kHz
	Accuracy (digital display)	±2 dB (≥minimum value +6 dB)
	Comparison oscillator	Pulse generator
Field strength measurement	Minimum value	–5 to 19 dBμV/m (25 to 300 MHz), 19 to 32 dBμV/m (300 to 999.999 MHz)
	Maximum value	0 to 114 dBμV/m (25 to 300 MHz), 114 to 120 dBμV/m (300 to 999.999 MHz)
	Setting	C/N: ≥6 dB (at minimum value), Bandwidth: 15 kHz
	Type of antenna	Half-wave dipole
Selectivity	6 dB bandwidth	15 ±2 kHz (15 kHz bandwidth), 120 ±20 kHz (120 kHz bandwidth)
	Detuning characteristics	15 kHz bandwidth ≥50 dB (±20 kHz off center)
Image ratio		≥60 dB (at 25.000 to 299.999 MHz), ≥45 dB (at 300 to 999.999 MHz)
Residual spurious		≤10 dBμV (typical near 50, 130, 600, 1000 MHz)
Detection system		Average value

Continued on next page

Measured level indication	Display: Liquid crystal display, 4 digits, Minimum digit 0.1 dB (on digital display), Up to 80 dB (on analog display) Unit: dBµV, dBµV/m (on digital display)
Monitor output	AM and FM can be heard from a loudspeaker, and earphone output terminal is also provided.
IF output	Level: ≥85 dBµV at 80 dBµV input, Impedance: 50 Ω (nominal), Connector: BNC-type
Discriminator output	Level: 1 V ±20% (modulation frequency: 2 kHz, frequency deviation: 3.5 kHz, into 100 kHz load) Impedance: ≤150 Ω Connector: BNC-type
Output for recorder	Level: 1 V ±10% (at 80 dB on digital display, into 100 kΩ load), Impedance: ≤150 Ω, Connector: 3.5-mm mini-jack
Ambient temperature	0˚ to +50˚C (operate), –20˚ to +60˚C (storage)
Power supply	12 Vdc: <1 A 100 Vac, 50/60 Hz, ≤35 VA (using Z0898A AC Adapter supplied) Ni-Cd battery (optional MZ110B Battery Pack)
Dimensions and mass	210 (W) x 60 (H) x 175 (D) mm, ≤4 kg

Power Supply Selection Guide

Type of power supply	Model	When used with ML524B	Remarks
Dry cell	MZ137A Battery Pack 	• Operates continuously for about 2.5 to 5 hours* • Sold separately	• Twelve alkaline dry cells (LR20) • Does not permit GPIB operation
Ni-Cd battery	MZ110B Battery Pack 	• Operates continuously for about 30 to 60 minutes* • Sold separately	• Six Ni-Cd batteries with the same dimensions as R14 battery, chargeable 200 to 300 times • Fits inside the receiver • Does not permit GPIB operation
AC supply	Z0898A AC Adapter	• Permits operation at 100/220 Vac* • One of accessories supplied	• DC power is fed to the EXT 12 V terminal of the receiver. • Permits GPIB operation • EMC, safety
External DC supply	–	• The receiver can be operated directly from an external 12 Vdc supply.	• One DC power cord is supplied. • Permits GPIB operation
Battery charger	MZ115B Battery Charger	• Sold separately	• Two MZ110B can be charged simultaneously.

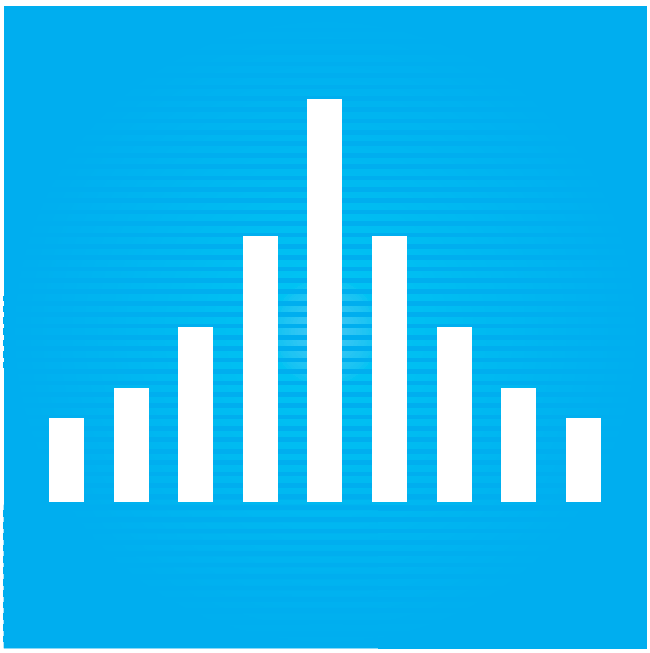
*: For continuous reception after power on, with calibration performed once only (more calibrations reduce the operating time).
Operating is also affected by how the battery has been stored, and operating temperature.

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	
ML524B	Measuring Receiver	
	Standard accessories	
J0231	Connecting Cord for Recorder (3.5ø plug · – · alligator clips), 1.5 m:	1 pc
J0144	DC Power Cord (RM12BPG-5S · 2CC7 · arrow tips), 1.5 m:	1 pc
A0002	Earphone:	1 pc
Z0898A	AC Adapter:	1 pc
B0259	Carrying Case:	1 pc
W0285AE	ML524A/B/C Operation Manual:	1 copy
	Options	
ML524B-01	GPIB	
ML524B-05	Terminated Voltage Indication	

Model/Order No.	Name
	Optional accessories
MP612A	RF Fuse Holder (without elements)
MP613A	RF Fuse Element (5 pcs/set)
MZ110B	Battery Pack (with six Ni-Cd batteries)
MZ115B	Battery Charger
Z0898A	AC Adapter
MP635A	Log-periodic Antenna
MZ137A	Battery Pack
MB19A	Tripod (for MP635A)
J0006	GPIB Cable, 0.5 m
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J0009	GPIB Cable, 4 m
MP663A	Dipole Antenna (with pole and tripod)
MP651B	Dipole Antenna
MP18A	Pole (for MP651B)
MB9A	Tripod (for MP651B)
MP520B	CM Directional Coupler (25 to 1000 MHz, 75 Ω, NC-type connector)
MP520D	CM Directional Coupler (100 to 1700 MHz, 50 Ω, N-type connector)



SIGNAL ANALYZERS/ SPECTRUM ANALYZERS

Selection Guide

Model	Measurement frequency range	Measurement level range (dBm)	Resolution bandwidth	C/N (dBc/Hz)	RF-band harmonic distortion (dBc)*7	Third order intercept point (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	–152.5 to +30	30 Hz to 3 MHz, 5, 10, 20 MHz (SPA mode) 1 Hz to 1 MHz (VSA mode)	–116*1	–75	+22	√*6	√	√	–	–	√	√	–	GPIB 10/100/ 1000 BASE-T USB	Windows XP	Portable
MS2691A	50 Hz to 13.5 GHz	–152.5 to +30	30 Hz to 3 MHz, 5, 10, 20 MHz (SPA mode) 1 Hz to 1 MHz (VSA mode)	–116*1	–75	+22	√*6	√	√	–	–	√	√	–		Windows XP	
MS2692A	50 Hz to 26.5 GHz	–152.5 to +30	30 Hz to 3 MHz, 5, 10, 20 MHz (SPA mode) 1 Hz to 1 MHz (VSA mode)	–116*1	–75	+22	√*6	√	√	–	–	√	√	–		Windows XP	
MS2687B	9 kHz to 30 GHz 18 to 110 GHz (with external mixer)	–124 to +30	300 Hz to 3 MHz, 5, 10, 20 MHz 1 Hz to 1 MHz (with Opt.)	–108*2	–70	+12.5	√	√	√	–	–	√	√	–	GPIB RS-232	–	
MS2683A	9 kHz to 7.8 GHz	–124 to +30	300 Hz to 3 MHz, 5, 10, 20 MHz, 1 Hz to 1 MHz (with Opt.)	–108*2	–70	+12.5	√	√	√	–	–	√	√	–	GPIB	–	
MS2681A	9 kHz to 3 GHz	–124 to +30	300 Hz to 3 MHz, 5, 10, 20 MHz, 1 Hz to 1 MHz (with Opt.)	–108*2	–70	+12.5	√	√	√	–	–	√	√	–	GPIB	–	
MS2668C	9 kHz to 40 GHz 18 to 110 GHz (with external mixer)	–115 to +30	1 kHz to 3 MHz 10 Hz to 3 MHz (with Opt.)	–90*3	–70	+7.5	√	√	√	√	–	Opt.	Opt.	–	GPIB	√	
MS2667C	9 kHz to 30 GHz 18 to 110 GHz (with external mixer)	–115 to +30	1 kHz to 3 MHz 10 Hz to 3 MHz (with Opt.)	–95*3	–70	+10	√	√	√	√	–	Opt.	Opt.	–	GPIB	√	
MS2665C	9 kHz to 21.2 GHz	–115 to +30	1 kHz to 3 MHz 30 Hz to 3 MHz (with Opt.)	–95*3	–70	+10	√	√	√	√	–	Opt.	Opt.	–	GPIB	√	
MS2663C	9 kHz to 8.1 GHz	–115 to +30	1 kHz to 3 MHz 30 Hz to 3 MHz (with Opt.)	–100*2	–79	+10	√	√	√	√	Opt.	Opt.	Opt.	Opt.	GPIB	√	
MS2661C	9 kHz to 3 GHz	–115 to +30 –130 to +30 (with Opt.)	1 kHz to 3 MHz 30 Hz to 3 MHz (with Opt.)	–100*2	–79	+10	√	√	√	√	Opt.	Opt.	Opt.	Opt.	GPIB	√	
MS2711D	100 kHz to 3 GHz	–135 to +20	100 Hz to 1 MHz	–75*4	–45	–7.5	–	√	–	√	–	–	–	Opt.	RS-232	–	Handheld (2.28 kg)
MS2721B	9 kHz to 7.1 GHz	–140 to +30	1 Hz to 3 MHz	–100*4	–80	+10	–	√	–	√	√	–	Opt.	–	LAN USB	–	Handheld (<3 kg)
MS2723B	9 kHz to 13 GHz	–	1 Hz to 3 MHz					√		√	√	–	Opt.	–	LAN USB	–	Handheld (<3 kg)
MS2724B	9 kHz to 20 GHz	–	1 Hz to 3 MHz					√		√	√	–	Opt.	–	LAN USB	–	Handheld (<3 kg)

∗1: 100 kHz offset
∗2: 10 kHz offset
∗3: –95 + 20 log n (n: local harmonic order)
∗4: 30 kHz offset
∗5: –15 dBm
∗6: Frequency vs. Time mode
∗7: –30 dBm, 1 GHz

SIGNAL ANALYZER

MS2690A/MS2691A/MS2692A

50 Hz to 6.0 GHz 50 Hz to 13.5 GHz 50 Hz to 26.5 GHz

CE GPIB Ethernet

Signal Analyzer Solving Next-Generation Wireless Communications Issues

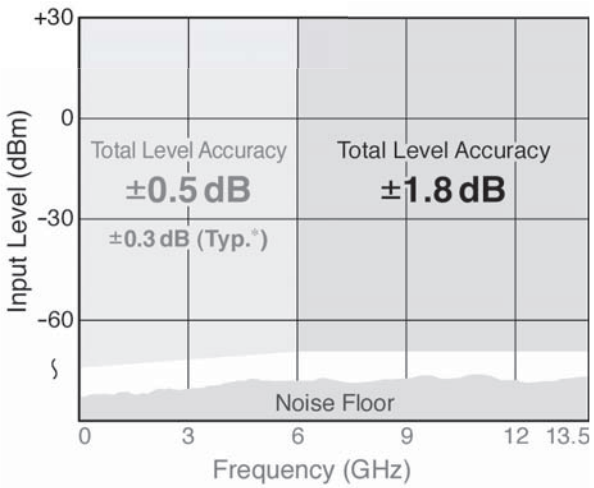
Excellent Eco Product

Next-generation wireless communications systems are becoming increasingly sophisticated with higher speeds, wider bandwidths, and multiple modulation methods in which the signal changes dynamically with time.
Frequency bands are shifting above 3 GHz to ensure sufficient bandwidth for new and emerging services and applications. As a result, to permit analysis without impact to transient changes, measuring instruments require excellent measurement accuracy and wideband analysis performance at frequency bands above 3 GHz.
Unlike other instruments with a basic band limited to 3 GHz, the MS2690A/MS2691A/MS2692A signal analyzer uses leading-edge architecture offering a basic band that goes to 6 GHz.
The MS2690A/MS2691A/MS2692A supports world-class absolute amplitude accuracy, modulation precision and wideband analysis across a frequency range from 50 Hz to 6 GHz.
The MS2690A/MS2691A/MS2692A has a built-in vector signal analysis function that performs FFT analysis over a 125 MHz bandwidth and a digitizing function that accurately captures signal waveforms with no signal dropout.
These advanced functions are ideal for the R&D arena where increasingly complex next-generation communication systems are being developed.
In addition, these analyzers are fast. Adding the optional vector signal generator (covering frequencies up to 6 GHz) creates a one-box tester that increases work efficiency in R&D applications, reduces tact times in manufacturing, and supports quick configuration of test systems.

Top Class RF Performance Based on Advanced Architecture

• Excellent Level Accuracy up to 6 GHz

The MS2690A/MS2691A/MS2692A integrates Anritsu's high-frequency technology and an advanced architecture that includes two built-in calibration oscillators. External power meters and single-frequency calibrations are obsolete, as the built-in calibration oscillators perform calibration across the entire band and enable the MS2690A/MS2691A/MS2692A to demonstrate a total level accuracy of ±0.5 dB from 50 Hz to 6 GHz.
The built-in phase calibration oscillator compensates for IF Filter frequencies and allows the analyzer to achieve the superior modulation accuracy required for WiMAX, 3G LTE, and other wideband technologies.
Coupling calibration across the entire frequency band with a low noise floor ensures that low level spurious signals can be seen and accurately measured.

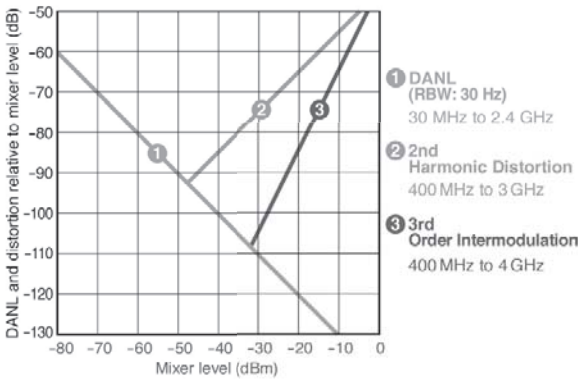


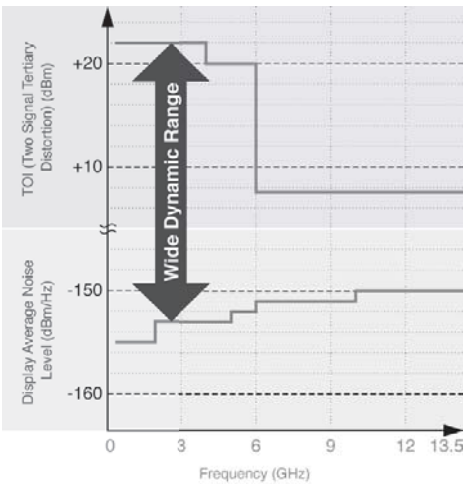
Note: Eliminates effect of noise floor
Used only when Uncal does not occur

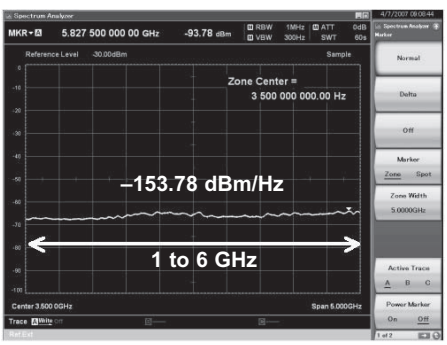
*: Excluding Guard Band

• Wide Dynamic Range for True Value Measurements

By using a front end that controls the noise figure and digital IF technology capable of advanced 16-bit ADC, this model achieves a superior display average noise level (DANL) of –155 dBm/Hz and a third-order intercept (TOI) ≥+22 dBm. Measurement performance does not degrade over this range, allowing measurement of true values across the entire dynamic range.
The Category B spurious test standard established by 3GPP, which requires a wide dynamic range in measuring instruments, can be measured without using correction devices, such as filters and amplifiers. The true values of devices and base stations are measured easily and spurious tests can be performed with less test equipment. This analyzer really shows its worth when configuring simple test systems by reducing the calibration burden and external equipment costs.

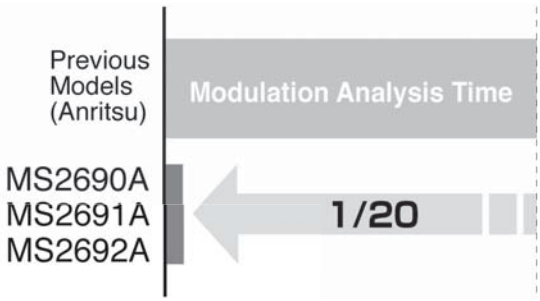




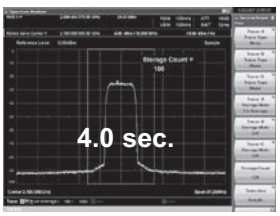


• World-class Measurement Speed

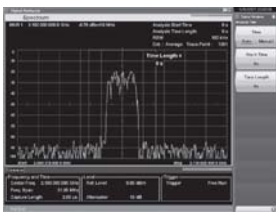
Taking full advantage of advanced software and high-speed CPUs, these analyzers use the full power of FFT (Fast Fourier Transform) technology to achieve world-class measurement speeds for modulation analysis measurements over span of 125 MHz.
The speed of the analysis software has been stepped up, supporting speeds 20 times faster than previous instruments.
A variety of interfaces, such as high-speed 1000BASE-T LAN and USB 2.0, are built-in as standard.
Overall, these analyzers raise efficiency for R&D development while cutting production-line tact times.



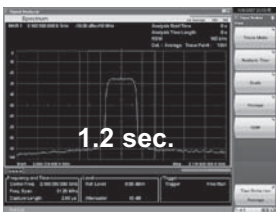
Spectrum Analyzer



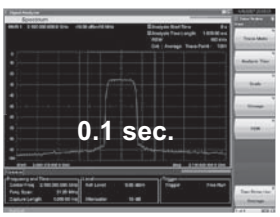
100-times Averaging



Vector Signal Analysis



100-times Averaging
(Analysis time length: Min)

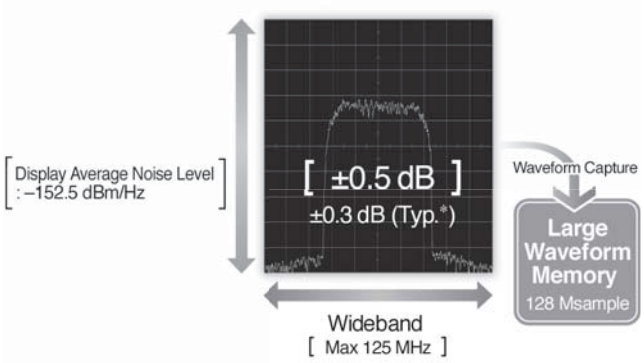


1-time Measurement
(Analysis time length: 1 ms)

Leading Vector Signal Analysis Function Combining Speed and Reliable RF Performance

• High-speed/High-performance FFT Analysis up to 125 MHz Bandwidth

The Vector Signal Analysis (VSA) functions support analysis for bandwidths up to 31.25 MHz as standard and up to 125 MHz as an option. Very fast measurement speed and reliable performance result from making the best use FFT technology with a high-performance RF front end, 16-bit ADC, and fast CPU.
Moreover, signals can be captured seamlessly using the digitize function for analysis from various views, such as frequency, power, and time, for easy and quick troubleshooting.



*: Excluding Guard Band

• Built-in Large-capacity 128 Msample Waveform Memory

A large-capacity 128 Msample waveform memory is built-in as standard, permitting waveform capture over long periods. The maximum capture time varies according to the frequency span as shown in Table 1.

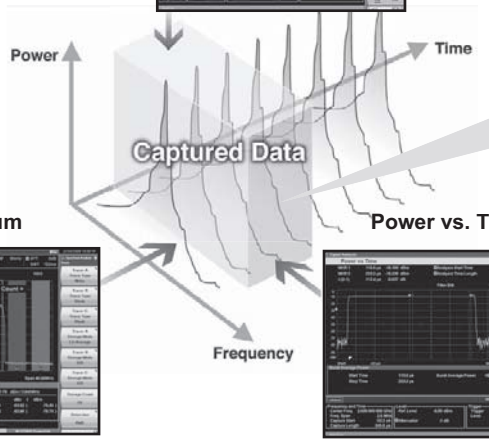
Frequency Span	Sampling Rate	Max. Capture Time
1 kHz	2 kHz	2000 s
2.5 kHz	5 kHz	2000 s
5 kHz	10 kHz	2000 s
10 kHz	20 kHz	2000 s
25 kHz	50 kHz	2000 s
50 kHz	100 kHz	1000 s
100 kHz	200 kHz	500 s
250 kHz	500 kHz	200 s
500 kHz	1 MHz	100 s
1 MHz	2 MHz	50 s
2.5 MHz	5 MHz	20 s
5 MHz	10 MHz	10 s
10 MHz	20 MHz	5 s
25 MHz	50 MHz	2 s
31.25 MHz	50 MHz	2 s
50 MHz	100 MHz	500 ms
100 MHz	200 MHz	500 ms
125 MHz	200 MHz	500 ms

Table 1

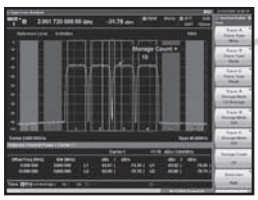
• Diverse Analysis of Captured Waveforms using VSA Function

Frequency vs. Time

Measures FSK and GMSK modulation wave frequency variation, and VCO frequency switching time.



Spectrum



Displays waveform of wideband SPAN up to 125 MHz without interruption.

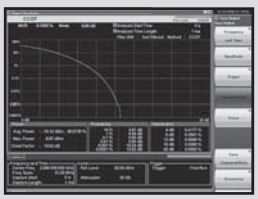
Power vs. Time

Monitors changes in power with time; useful for accurate and fast measurement of in-burst average power.

Spectrogram

Displays spectrum variations with time; useful for understanding waveform transients because supports visual monitoring of frequency and level time variations.

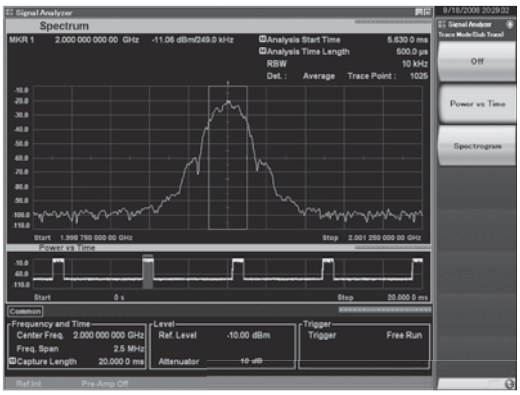
CCDF/APD



Supports wideband CCDF analysis up to 125 MHz; useful for evaluating power amplifiers in wideband communications systems.

• Sub-Trace (Split Screens) Display for Intuitive operation

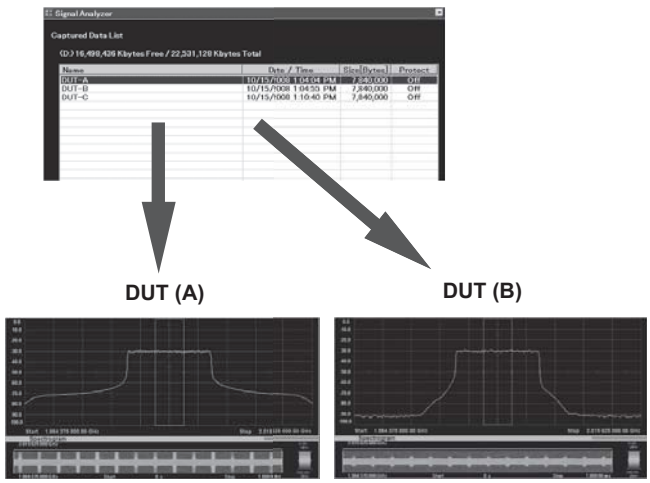
This function specifies the analysis range as a sub- trace (Power vs. Time, and spectrogram) and supports various VSA analyses at the main trace. Spectrum changes at signal-on segments, rising, falling, etc., are observed intuitively.



• Convenient Replay for Comparison

Saved waveform data can be read and analyzed by the VSA functions, allowing easy comparison and verification of data for multiple DUTs.

Captured Waveform Data: Selection Screen

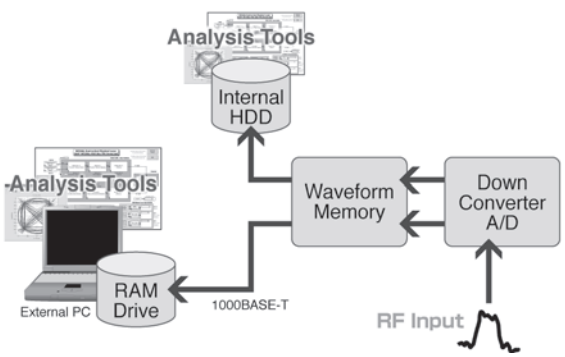


• Captured Waveforms Analysis using Commercial Analysis Tools

Other digitizers may exhibit severe degradation of the RF channel during capture, requiring troublesome calibration of the captured data when using analysis tools.

The MS2690A/MS2691A/MS2692A uses high-performance RF and two built-in calibration oscillators to minimize the degradation and eliminate the need for calibration before using analysis tools.

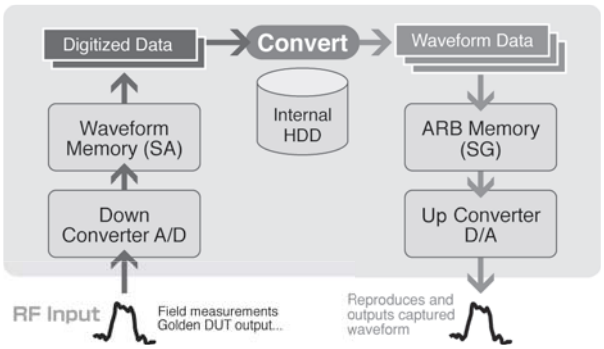
The waveform data are saved to the internal hard disk and can be output to an external PC via a high-speed interface, such as the 1000BASE-T LAN port.



• Captured Waveform Output from Vector Signal Generator Option

Waveforms captured using the digitizing function can be regenerated by using with the optional MS2690A/MS2691A/MS2692A-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

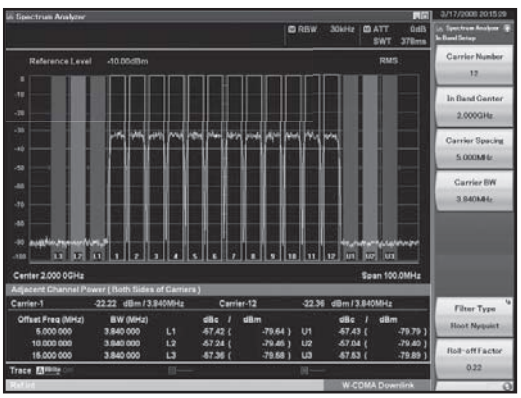
• Measure Function

The Measure function support the following measurements with one-touch operation.

Measure Function	SPA	VSA
Channel Power	√	√
Occupied Bandwidth	√	√
Adjacent Channel Leakage Power	√	√
Spectrum Emission Mask	√	
Spurious Emission	√	
Burst Average Power	√	√
AM Depth		√
FM Deviation		√

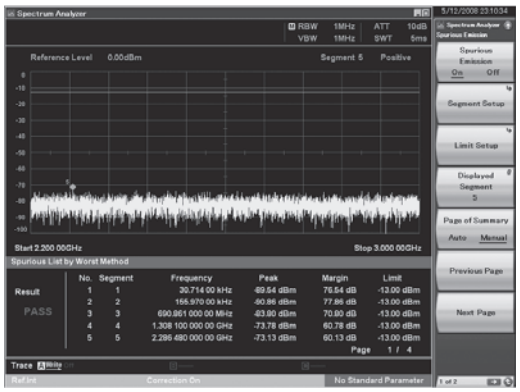
• Adjacent Channel Leakage Power

Measures adjacent channel leakage power for 12 carriers max.; supports instantaneous switching of set carrier number between 1 to 12.



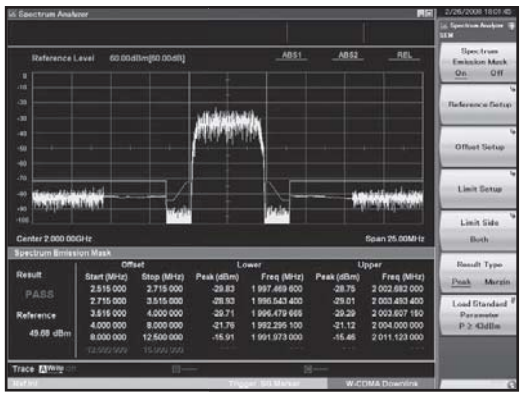
• Spurious Emission

Pass/Fail judgment can be performed for a set limit line at up to 20 segments.



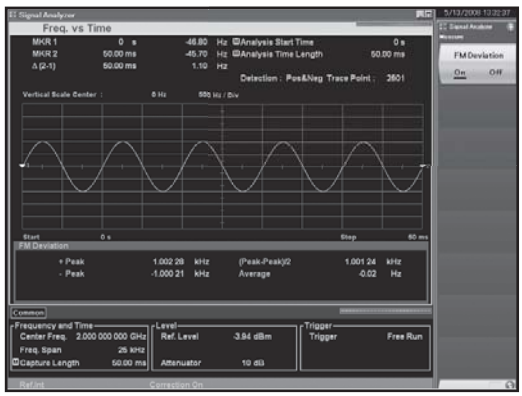
• Spectrum Emission Mask

Performs Pass/Fail evaluation for set limit line; supports any limit line setting for 6 segments max.



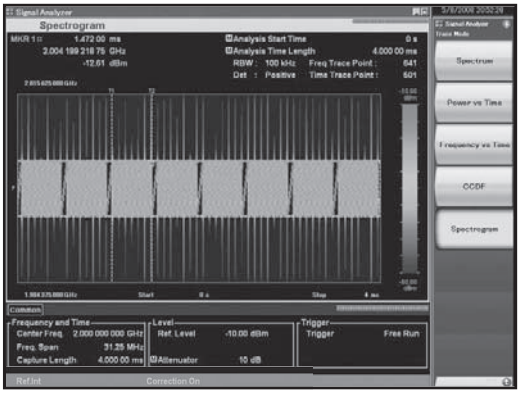
• FM Deviation

Measures FM deviation; displays measurement results as +Peak, –Peak, (Peak-Peak)/2, and Average.



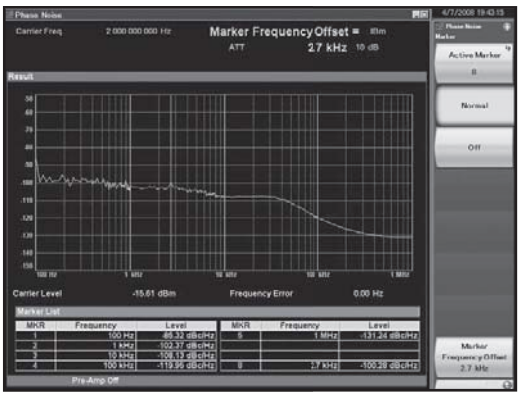
• Spectrogram Function

Monitors continuous time variations in spectrum span up to 125 MHz; convenient for confirming burst-signal time stability and rare interference signals because able to intuitively understand frequency and level time variations.



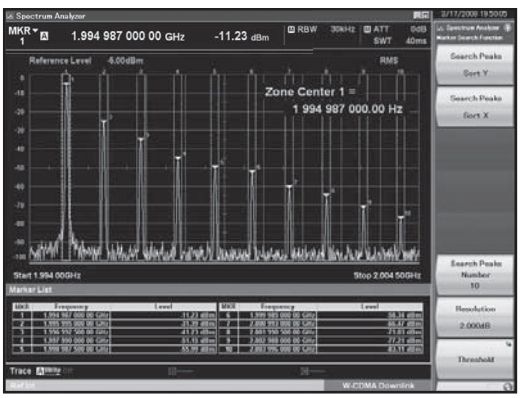
• Phase Noise Measurement

Supports phase noise measurements with frequency offset range from 100 Hz to 1 MHz; supports high-speed measurement at about 700 ms per one averaging, or about 3 s per 10 averagings.



• Marker Function

Sets threshold and searches for up to 10 peaks; supports accurate measurement of even unstable signals with frequency swing by automatically searching for peak values in set range and using zone marker to display results.



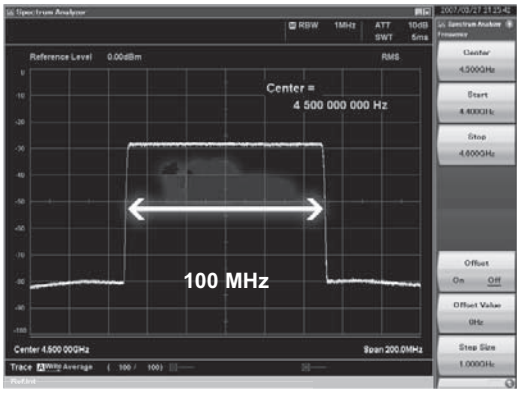
High-Performance Vector Signal Generator Option

• Save Valuable Bench Space by Adding an Optional Signal Generator to the Analyzer

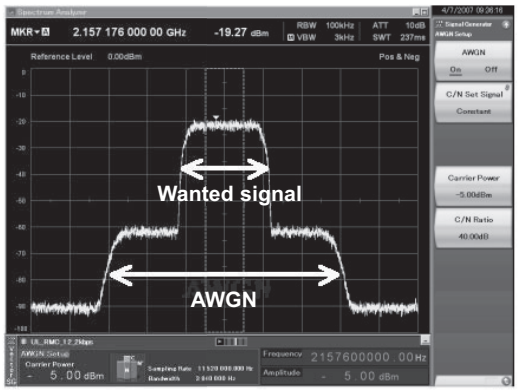
The MS2690A/MS2691A/MS2692A-020 Vector Signal Generator option covers a frequency range from 125 MHz to 6 GHz.
It is a high-performance waveform generator with a 120 MHz wide-band vector modulation band and built-in 256 Msample waveform memory.
Boasting superior ACLR functions and level accuracy that compares favorably with stand-alone signal generators, the addition of the signal generator option creates a versatile one-box tester capable of multiple applications including component and base station testing.

- Frequency: 125 MHz to 6 GHz
- 120 MHz wide vector modulation band
- 256 Msample large-capacity waveform memory
- Absolute level accuracy: ±0.5 dB, Linearity: ±0.2 dB (typ.)
- Excellent ACLR performance
  ≤–64 dBc (5 MHz offset)
  ≤–67 dBc (10 MHz offset)
- BER Measurement and AWGN addition functions*

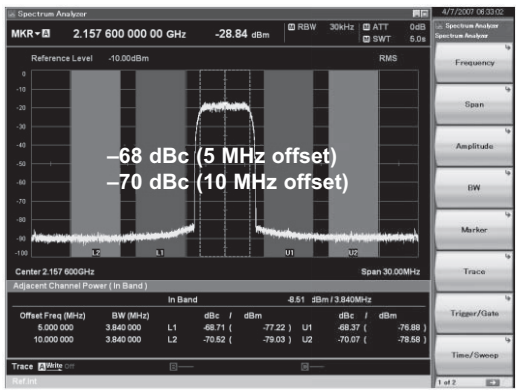
*: The AWGN bandwidth is the value of the sampling clock for the required waveform.



100 MHz Bandwidth Waveform Output Example (4.5 GHz)



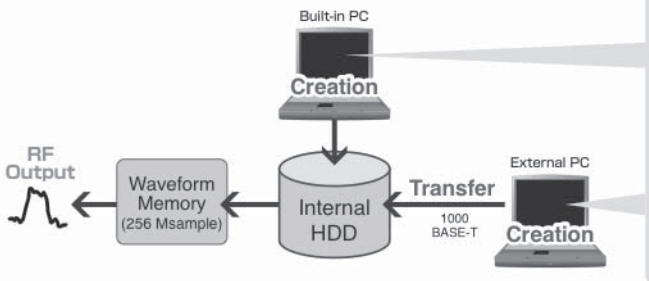
Wanted signal + AWGN signal output from one unit



ACLR (W-CDMA, Test Model 1, 64DPCH)

• Versatile Multiple Waveform Generation

Any type of waveform can be generated using the MS2690A/MS2691A/MS2692A-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 MS2690A/MS2691A/MS2692A main frame.

- HSDPA/HSUPA IQproducer
- TDMA IQproducer
- Multi-carrier IQproducer
- Mobile WiMAX IQproducer
- LTE IQproducer
- XG-PHS IQproducer

Creating Any Waveform

IQ Data created using the MS2690A/MS2691A/MS2692A 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 MS2690A/MS2691A/MS2692A arbitrary waveform generation option. It has the following three main functions.

Parameter Editing:

Function for easily editing parameters matching each communication method

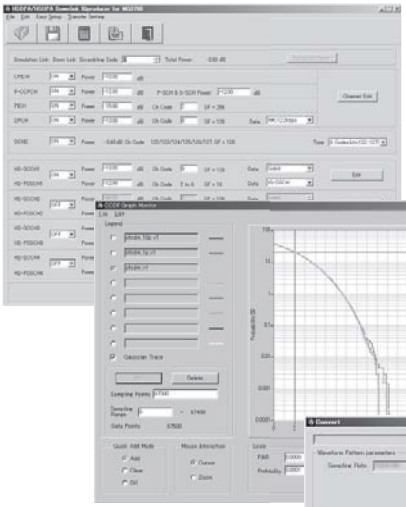
Simulation:

Function for checking generated waveform pattern before transfer to CCDF and FFT graphs

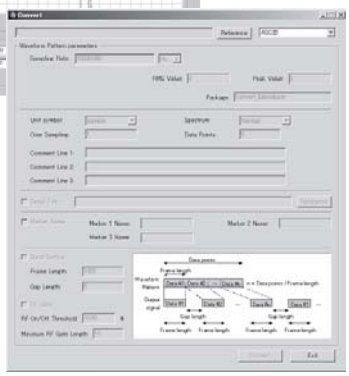
Conversion:

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 MS2690A/MS2691A/MS2692A-20

Parameter Setting Screen (HSDPA/HSUPA IQproducer)



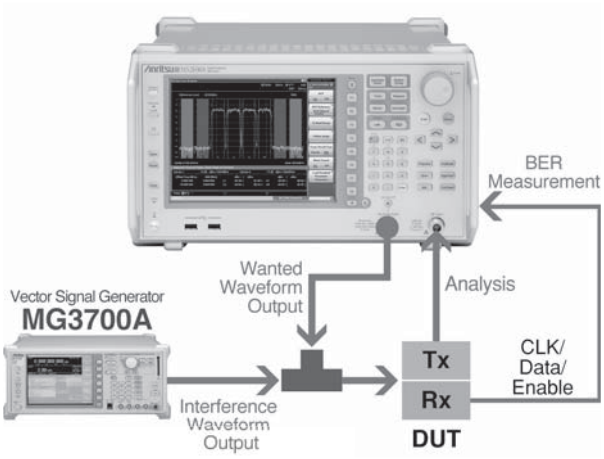
Simulation Screen (CCDF)



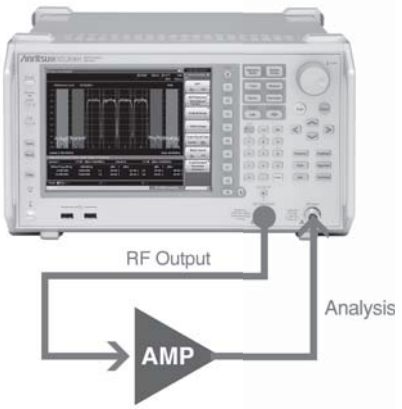
Convert Screen

• Application

Simplified Tx Test Setup

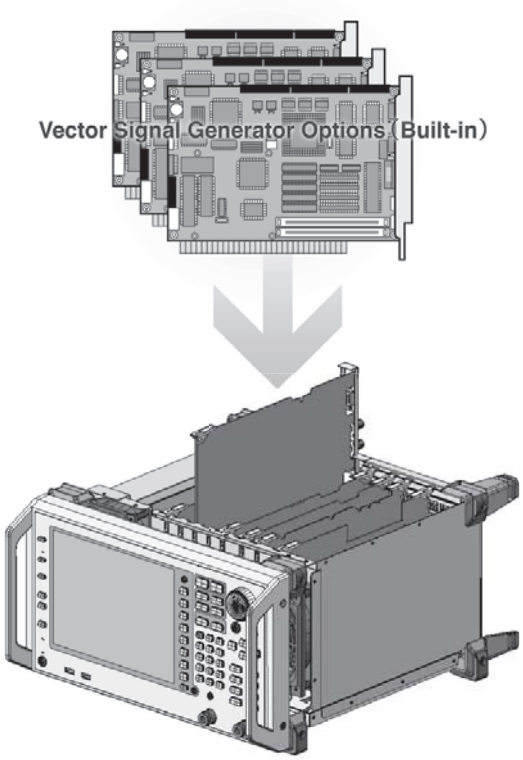


Easy AMP Test



Future-proof Platform

The MS2690A/MS2691A/MS2692A design adopts a modular multi-slot structure for excellent future-proof expandability. The analyzer is customized for its target measurements by installing options in these slots.



*Unique option lineup for sequential expansion

• Options

Hardware Options

MS2690A/MS2691A/MS2692A-001 Rubidium Reference Oscillator
This option is a 10 MHz reference crystal oscillator with excellent frequency stability startup characteristics of ±1 x 10^{-9} at 7 minutes after power-on.

MS2691A/MS2692A-003 Pre-selector Extended Lower Limit (3 GHz)
This option extends the lower limit of the pre-selector from 5.9 to 3 GHz. It can only be installed in the MS2691A/MS2692A.

MS2690A/MS2691A/MS2692A-004 Wideband Analysis Hardware
This option expands the maximum analysis bandwidth to 125 MHz.

MS2690A/MS2691A/MS2692A-008 6 GHz Preamplifier
This option increases the level sensitivity up to 6 GHz.

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-030
W-CDMA RNC Simulator (ATM 1.5M/2M)
This option simulates a Radio Network Controller (RNC) to control the W-CDMA base-station Tx/Rx conditions via the ATM EI/TI interface.
BER/BLER measurements are also supported.

*: Please consult us first about the connection between this option and the base station.

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 MS2690A/MS2691A/MS2692A-020 Vector Signal Generator, MX269040A RF UMTS Measurement Software, and MX269041A DigRF2.5G/3G Digital I/F Control Software.

*: See each catalog for details.

MS2690A/MS2691A/MS2692A-050 HDD Digitizing Interface
Installing the MS2690A/MS2691A/MS2692A-050 HDD Digitizing Interface option captures up to 4 hours of 20 MHz wideband RF signals. It is convenient for troubleshooting uncommon faults.

• IQproducer License for MS2690A/MS2691A/MS2692A-20 VSG

Waveforms generated by IQproducer can be downloaded to the MS2690A/MS2691A/MS2692A main frame in which the MS2690A/MS2691A/MS2692A-020 Vector Signal Generator is installed, but the following licenses (option) are required to output the signal.

*: No license is required to generate or edit the signal.

- MX269901A HSDPA IQproducer
- MX269902A TDMA IQproducer
- MX269904A Multi-Carrier IQproducer
- MX269905A Mobile WiMAX IQproducer
- MX269908A LTE IQproducer
- MX269909A XG-PHS IQproducer

• Measurement Software

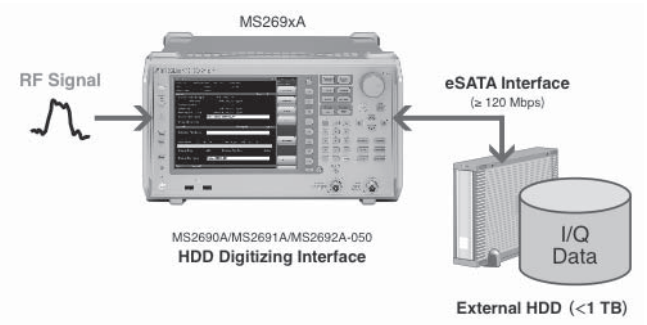
Supports analysis of various systems by installing measurement software in MS2690A/MS2691A/MS2692A.

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
3GPP LTE (FDD)	LTE Downlink Measurement Software	MX269020A
	LTE Uplink Measurement Software	MX269021A

*: See each measurement software catalog for more details.

• Seamless Waveform Capture for 4 Hours Max.

Installing the MS2690A/MS2691A/MS2692A-050 HDD Digitizing Interface option captures up to 4 hours of 20 MHz wideband RF signals. It is convenient for troubleshooting uncommon faults.



Specifications

The specification is the value after a 30-minute warmup at a constant ambient temperature.
Typical values are only for reference and are not guaranteed specifications.

- **MS2690A/MS2691A/MS2692A Signal Analyzer**

Vector Signal Analysis Function/Spectrum Analyzer Function Common

<table>
<tr><td rowspan="6">Frequency</td><td>Frequency range</td><td>50 Hz to 6.0 GHz (MS2690A), 50 Hz to 13.5 GHz (MS2691A), 50 Hz to 26.5 GHz (MS2692A)</td></tr>
<tr><td>Frequency bands</td><td>
<table>
<tr><th>Frequency</th><th>Band</th><th>Mixer harmonic order [N]</th><th></th></tr>
<tr><td>50 Hz≤Frequency≤6.0 GHz</td><td>0</td><td>1</td><td></td></tr>
<tr><td>3.0 GHz≤Frequency≤6.0 GHz</td><td>1 – L</td><td>1</td><td>(when MS2691A-003/MS2692A-003 installed, MS2691A/MS2692A)</td></tr>
<tr><td>5.9 GHz≤Frequency≤8.0 GHz</td><td>1–</td><td>1</td><td>(MS2691A/MS2692A)</td></tr>
<tr><td>7.9 GHz≤Frequency≤13.5 GHz</td><td>1+</td><td>1</td><td>(MS2691A/MS2692A)</td></tr>
<tr><td>13.4 GHz≤Frequency≤20.0 GHz</td><td>2–</td><td>2</td><td>(MS2692A)</td></tr>
<tr><td>19.9 GHz≤Frequency≤26.5 GHz</td><td>2+</td><td>2</td><td>(MS2692A)</td></tr>
</table>
</td></tr>
<tr><td>Pre-selector range</td><td>5.9 to 13.5 GHz (Frequency band mode: Normal) (MS2691A)
5.9 to 26.5 GHz (Frequency band mode: Normal) (MS2692A)
3.0 to 13.5 GHz (Frequency band mode: Spurious, Settable only when MS2691A-003 installed)
3.0 to 26.5 GHz (Frequency band mode: Spurious, Settable only when MS2692A-003 installed)</td></tr>
<tr><td>Frequency setting</td><td>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</td></tr>
<tr><td>Internal reference oscillator</td><td>Start-up characteristics (At 23˚C, referenced to frequency at 24 h after power-on):
±5 x 10^{-7} (2 minutes after power-on), ±5 x 10^{-8} (5 minutes after power-on)
Aging rate: ±1 x 10^{-7}/year
Temperature characteristics: ±2 x 10^{-8} (5˚ to 45˚C)
When Option 001 Rubidium Reference Oscillator installed
Start-up characteristics (At 23˚C, referenced to frequency at 24 h after power-on):
±1 x 10^{-9} (7 minutes after power-on)
Aging rate: ±1 x 10^{-10}/month
Temperature characteristics: ±1 x 10^{-9} (5˚ to 45˚C)</td></tr>
<tr><td>Single sideband noise</td><td>At 18˚ to 28˚C, 2 GHz
<table>
<tr><th>Frequency Offset</th><th>Max.</th></tr>
<tr><td>100 kHz</td><td>–116 dBc/Hz</td></tr>
<tr><td>1 MHz</td><td>–137 dBc/Hz</td></tr>
</table>
</td></tr>
<tr><td rowspan="3">Amplitude</td><td>Measurement range</td><td>Average noise level to +30 dBm</td></tr>
<tr><td>Max. input level</td><td>CW Average power: +30 dBm (Input attenuator ≥10 dB)
DC Voltage: 0 Vdc</td></tr>
<tr><td>Input Attenuator</td><td>0 to 60 dB, 2 dB steps</td></tr>
<tr><td rowspan="4">Reference level</td><td>Input attenuator switching error</td><td>Referenced to 10 dB input attenuator
Frequency band mode: Normal
Frequency≤6.0 GHz: ±0.2 dB (10 to 60 dB)
Frequency>6.0 GHz: ±0.75 dB (10 to 60 dB) (MS2691A/MS2692A)
Frequency band mode: Spurious
Frequency<3.0 GHz: ±0.2 dB (10 to 60 dB) (MS2691A/MS2692A)
Frequency≥3.0 GHz: ±0.75 dB (10 to 60 dB) (MS2691A/MS2692A)</td></tr>
<tr><td>Setting range</td><td>Log scale: –120 to +50 dBm or equivalent level
Linear scale: 22.4 μV to 70.7 V
Setting resolution: 0.01 dB or equivalent level</td></tr>
<tr><td>Units</td><td>Log scale: dBm, dBμV, dBmV, dBμV (emf), dBμV/m, V, W
Linear scale: V</td></tr>
<tr><td>Linearity error</td><td>Excluding the noise floor effect
±0.07 dB (Mixer input level≤–20 dBm)
±0.10 dB (Mixer input level≤–10 dBm)
Frequency band mode: Normal
±0.15 dB (Mixer input level≤0 dBm, Frequency≤6.0 GHz)
±0.50 dB (Mixer input level≤0 dBm, Frequency>6.0 GHz) (MS2691A)
±0.60 dB (Mixer input level≤0 dBm, Frequency>6.0 GHz) (MS2692A)
Frequency band mode: Spurious
±0.15 dB (Mixer input level≤0 dBm, Frequency<3.0 GHz) (MS2691A/MS2692A)
±0.50 dB (Mixer input level≤0 dBm, Frequency≥3.0 GHz) (MS2691A)
±0.60 dB (Mixer input level≤0 dBm, Frequency≥3.0 GHz) (MS2692A)</td></tr>
<tr><td>RF frequency characteristics</td><td>At 18˚ to 28˚C, after CAL, Input attenuator = 10 dB
±0.35 dB
(9 kHz≤Frequency≤6.0 GHz, Frequency band mode: Normal)
(9 kHz≤Frequency<3.0 GHz, Frequency band mode: Spurious) (MS2691A/MS2692A)
At 18˚ to 28˚C, after pre-selector tuning (MS2691A/MS2692A)
±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)
±2.5 dB
(13.5 GHz<Frequency≤26.5 GHz, Frequency band mode: Normal) (MS2692A)</td></tr>
</table>

Continued on next page

<table>
<tr><td rowspan="1">Reference level</td><td>1 dB gain compression</td><td>At 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) (MS2691A/MS2692A)
≥+3 dBm (MS2691A)
(3.0 GHz≤Frequency≤6.0 GHz, Frequency band mode: Spurious)
(6.0 GHz<Frequency≤13.5 GHz)
≥0 dBm (MS2692A)
(3.0 GHz≤Frequency≤6.0 GHz, Frequency band mode: Spurious)
(6.0 GHz<Frequency≤26.5 GHz)</td></tr>
<tr><td rowspan="2">Spurious response</td><td>2nd harmonic distortion</td><td>At mixer input level: –30 dBm
<table><tr><th>Harmonic [dBc]</th><th>SHI [dBm]</th></tr><tr><td>≤–60</td><td>≤+30 (10 MHz≤Frequency≤400 MHz)</td></tr><tr><td>≤–75</td><td>≤+45 (400 MHz<Frequency≤3.0 GHz)</td></tr></table>At mixer input level: –10 dBm (MS2691A/MS2692A)
<table><tr><th>Harmonic [dBc]</th><th>SHI [dBm]</th></tr><tr><td>≤–90</td><td>≤+80 (6 GHz<Frequency, Frequency band mode: Normal)</td></tr><tr><td>≤–90</td><td>≤+80 (3 GHz≤Frequency, Frequency band mode: Spurious)</td></tr></table></td></tr>
<tr><td>Residual response</td><td>Frequency≥1 MHz, Input attenuator = 0 dB
Signal Analyzer: Except bandwidth setting>31.25 MHz
≤–100 dBm</td></tr>
<tr><td rowspan="10">Connector</td><td>RF input</td><td>Front panel, N-J, 50 Ω
VSWR: At 18˚ to 28˚C, Input attenuator≥10 dB
≤1.2 (typ., 40 Hz≤Frequency≤3.0 GHz)
≤1.5 (typ., 3.0 GHz<Frequency≤6.0 GHz)
≤2.0 (typ., 6.0 GHz<Frequency≤13.5 GHz) (MS2691A)
≤2.0 (typ., 6.0 GHz<Frequency≤26.5 GHz) (MS2692A)</td></tr>
<tr><td>IF output</td><td>Back panel, BNC-J, 50 Ω (typ.)
Frequency: 875 MHz (Signal Analyzer, Bandwidth≤31.25 MHz)
900 MHz (Signal Analyzer, Bandwidth<31.25 MHz)
874.988 MHz (Spectrum Analyzer)
Gain: At RF input level reference, RF frequency 1 GHz, Input attenuator = 0 dB, 0 dB (typ.)
IF Bandwidth: 120 MHz (typ.)</td></tr>
<tr><td>External reference input</td><td>Back panel, BNC-J, 50 Ω (typ.)
Frequency: 10,13 MHz
Operation range: ±1 ppm
Input level: –15 dBm≤Level≤+20 dBm, 50 Ω (AC coupling)</td></tr>
<tr><td>Reference signal output</td><td>Back panel, BNC-J, 50 Ω (typ.)
Frequency: 10 MHz
Output level: ≥0 dBm (AC coupling)</td></tr>
<tr><td>Sweep status output</td><td>Back panel, BNC-J
Output level: TTL Level (High level at sweeping or waveform capture)</td></tr>
<tr><td>Trigger input</td><td>Back panel, BNC-J
Input level: TTL Level</td></tr>
<tr><td>External reference</td><td>Control from external controller (excluding power-on)
Ethernet 10/100/1000BASE-T, Back panel, RJ-45
GPIB: IEEE488.2, Back panel, IEEE488 bus connector
Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
USB (B): USB2.0, Back panel, USB-B connector</td></tr>
<tr><td>USB</td><td>USB2.0 Supporting waveform hard copy to external device, and saving main frame settings
USB-A Connector (2 ports on front panel and 2 ports on back panel)</td></tr>
<tr><td>Monitor output</td><td>Back panel, VGA compatible, mini D-Sub 15 pin</td></tr>
<tr><td>Aux</td><td>When using Option 020 trigger input/output
Back panel, 68 pins (DX10BM-68S equivalent)</td></tr>
<tr><td>Display</td><td>XGA Color LCD (1024 x 768 resolution), 8.4 inch (213 mm)</td></tr>
<tr><td rowspan="4">General specifications</td><td>Dimensions</td><td>340 (W) x 200 (H) x 350 (D) mm (excluding projections)</td></tr>
<tr><td>Mass</td><td>≤13.5 kg (excluding options)</td></tr>
<tr><td>Power supply</td><td>100 to 120 Vac, 200 to 240 Vac (–15/+10% but 250 V max.), 50 to 60 Hz (±5%)
≤260 VA (excluding options), ≤440 VA (including all options, max.)</td></tr>
<tr><td>Temperature</td><td>Operating range: +5˚ to +45˚C, Storage range: –20˚ to +60˚C</td></tr>
<tr><td colspan="2">EMC</td><td>EN61326-1, EN61000-3-2</td></tr>
<tr><td colspan="2">LVD</td><td>EN61010-1</td></tr>
</table>

● **Vector Signal Analysis Function**

Common	Trace mode	Spectrum, Power vs. Time, Frequency vs. Time, CCDF, Spectrogram
	Bandwidth	Specified analysis bandwidth from center frequency Range: 1 kHz to 25 MHz (1-2.5-5 sequence), 31.25 MHz
	Sampling rate	Auto-setting depending on RBW Range: 2 kHz to 50 MHz (1-2-5 sequence)
	Capture time	Capture time length: Set length of capture time 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
	Trigger	Trigger mode: Free Run (Trig Off), Video, Wide IF Video, External (TTL) SG Marker (when Option 020 installed)
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
	Resolution bandwidth (RBW)	Setting range: 1 Hz to 1 MHz (1-3 sequence) Selectivity: (–60 dB/–3 dB) 4.5:1 (typ.)
	Absolute amplitude accuracy	At 18˚ to 28˚C, after CAL, Input attenuator≥10 dB, Mixer input level≤0 dBm, RBW = Auto, Time Detection = Average, Marker Result = Integration or Peak (Accuracy), Center frequency, CW, Excluding the noise floor effect ±0.5 dB (50 Hz≤Frequency≤6.0 GHz, Frequency band mode: Normal) (50 Hz≤Frequency<3.0 GHz, Frequency band mode: Spurious) (MS2691A/MS2692A) After pre-selector tuning (MS2691A/MS2692A) ±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) After pre-selector tuning (MS2692A) ±3.0 dB (13.5 GHz≤Frequency≤26.5 GHz) The absolute amplitude accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.
	In-band frequency characteristics	With center frequency level as reference standard, SPAN≤31.25 MHz, center frequency ±10 MHz ±0.31 dB (30 MHz≤Frequency≤6 GHz)
	Display average noise level	At 18˚ to 28˚C, Input attenuator = 0 dB, Frequency band mode = Normal

Frequency	Max.	
100 kHz	–132.5 [dBm/Hz]	
1 MHz	–142.5 [dBm/Hz]	
30 MHz≤Frequency<2.4 GHz	–152.5 [dBm/Hz]	
2.4 GHz≤Frequency<4.0 GHz	–150.5 [dBm/Hz]	
4.0 GHz≤Frequency≤6.0 GHz	–149.5 [dBm/Hz]	(MS2690A)
4.0 GHz≤Frequency<6.0 GHz	–149.5 [dBm/Hz]	(MS2691A/MS2692A)
6.0 GHz≤Frequency<10.0 GHz	–148.5 [dBm/Hz]	(MS2691A/MS2692A)
10.0 GHz≤Frequency≤13.5 GHz	–147.5 [dBm/Hz]	(MS2691A/MS2692A)
13.5 GHz≤Frequency≤20.0 GHz	–144.5 [dBm/Hz]	(MS2692A)
20.0 GHz≤Frequency≤26.5 GHz	–140.5 [dBm/Hz]	(MS2692A)

Spectrum display function	Adjacent channel leakage power measurement (ACP)	Reference: Span Total, Carrier Total, Both Sides of Carriers, Carrier Select Adjacent channel specification: 3 channel x 2
	Channel power	Absolute value measurement: dBm, dBm/Hz
	Occupied bandwidth (OBW)	N% of Power, X dB Down
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)	AM Depth measurement +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 of RBW Input frequency range: 10 MHz to 6 GHz
	Display frequency accuracy	At input level –17 to +30 dBm, SPAN≤31.25 MHz, Scale = SPAN/25 At CW input: ± (Reference oscillator accuracy x Center frequency + Display frequency range x 0.01) Hz
	FM deviation (peak to peak measurement)	FM Deviation measurement +Peak, –Peak, (P-P)/2, Average

Continued on next page

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
	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 (typ.)
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 signal analyzer absolute amplitude accuracy
	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 and Minimum Capture Sample:

SPAN	Minimum capture sample
1 kHz	74000 (37 s)
2.5 kHz	160000 (32 s)
5 kHz	310000 (31 s)
10 kHz	610000 (30.5 s)
25 kHz	730000 (14.6 s)
50 kHz	730000 (7.3 s)
100 kHz	730000 (3.65 s)
250 kHz	730000 (1.46 s)
500 kHz	730000 (730 ms)
1 MHz	730000 (365 ms)
2.5 MHz	730000 (146 ms)
5 MHz	730000 (73 ms)
10 MHz	730000 (36.5 ms)
18.6 MHz	730000 (36.5 ms)
20 MHz	730000 (29.2 ms)
25 MHz	730000 (14.6 ms)
31.25 MHz	730000 (14.6 ms)
50 MHz	730000 (7.3 ms)
100 MHz	730000 (3.65 ms)
125 MHz	730000 (3.65 ms)

• 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, SPAN Accuracy: ±0.2%
	Display frequency accuracy	± [Display frequency x Reference oscillator accuracy + SPAN frequency x SPAN accuracy + RBW x 0.05 + 2 x N + SPAN frequency/(number of trace points – 1)] Hz N = Mixer harmonic order
	RBW	Setting range: 30 Hz to 3 MHz (1-3 sequence), 5, 10, 20 MHz Selectivity: (–60 dB/–3 dB) 4.5:1 (typ.)
	Video bandwidth (VBW)	Setting range: 1 Hz to 10 MHz (1-3 sequence), off VBW Mode: Video Average/Power Average

Continued on next page

<table>
<tr><td rowspan="2">Amplitude</td><td>Display average noise level</td><td>At 18˚ to 28˚C, Detector = Sample, VBW = 1 Hz (Video Average), Input attenuator = 0 dB,
Frequency band mode: Normal
<table><tr><th>Frequency</th><th>Max.</th><th></th></tr><tr><td>100 kHz</td><td>–135.0 [dBm/Hz]</td><td></td></tr><tr><td>1 MHz</td><td>–145.0 [dBm/Hz]</td><td></td></tr><tr><td>30 MHz≤Frequency<2.4 GHz</td><td>–155.0 [dBm/Hz]</td><td></td></tr><tr><td>2.4 GHz≤Frequency<4.0 GHz</td><td>–153.0 [dBm/Hz]</td><td></td></tr><tr><td>4.0 GHz≤Frequency≤6.0 GHz</td><td>–152.0 [dBm/Hz]</td><td>(MS2690A)</td></tr><tr><td>4.0 GHz≤Frequency<6.0 GHz</td><td>–152.0 [dBm/Hz]</td><td>(MS2691A/MS2692A)</td></tr><tr><td>6.0 GHz≤Frequency<10.0 GHz</td><td>–151.0 [dBm/Hz]</td><td>(MS2691A/MS2692A)</td></tr><tr><td>10.0 GHz≤Frequency≤13.5 GHz</td><td>–150.0 [dBm/Hz]</td><td>(MS2691A/MS2692A)</td></tr><tr><td>13.5 GHz≤Frequency≤20.0 GHz</td><td>–147.0 [dBm/Hz]</td><td>(MS2692A)</td></tr><tr><td>20.0 GHz≤Frequency≤26.5 GHz</td><td>–143.0 [dBm/Hz]</td><td>(MS2692A)</td></tr></table></td></tr>
<tr><td>Absolute amplitude accuracy</td><td>At 18˚ to 28˚C, after CAL, Input attenuator≥10 dB, Mixer input level≤0 dBm,
Auto Sweep Time Select = Normal, RBW: ≤1 MHz, Detection = Positive, CW,
excluding the noise floor effect
±0.5 dB (50 Hz≤Frequency≤6.0 GHz, Frequency band mode: Normal)
(50 Hz≤Frequency<3.0 GHz, Frequency band mode: Spurious) (MS2691A)
After pre-selector tuning (MS2691A/MS2692A)
±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)
After pre-selector tuning (MS2692A)
±3.0 dB (13.5 GHz≤Frequency≤26.5 GHz)
The absolute amplitude accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.</td></tr>
<tr><td rowspan="2">Spurious response</td><td>Two signal tertiary distortion</td><td>At 18˚ to 28˚C, Mixer input level = –15 dBm (per waveform), ≥300 kHz separation
≤–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) (MS2691A/MS2692A)
≤–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≤13.5 GHz, Frequency band mode: Normal) (MS2691A)
(3.0 GHz≤Frequency≤13.5 GHz, Frequency band mode: Spurious) (MS2691A)
(6.0 GHz<Frequency≤26.5 GHz, Frequency band mode: Normal) (MS2692A)
(3.0 GHz≤Frequency≤26.5 GHz, Frequency band mode: Spurious) (MS2692A)</td></tr>
<tr><td>Image response</td><td>≤–70 dBc (Frequency≤13.5 GHz)
≤–65 dBc (13.5 GHz<Frequency≤26.5 GHz) (MS2692A)</td></tr>
<tr><td rowspan="5">Sweep</td><td>Sweep mode</td><td>Single, Continuous</td></tr>
<tr><td>Sweep time</td><td>Setting range: 2 ms to 1000 s (SPAN≥300 Hz), 1 μs to 1000 s (SPAN = 0 Hz)</td></tr>
<tr><td>Detection mode</td><td>Pos&Neg, Positive Peak, Sample, Negative Peak, RMS</td></tr>
<tr><td>No. of trace points</td><td>SPAN>500 MHz: 1001, 2001, 5001, 10001
100 MHz<SPAN≤500 MHz: 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001
300 Hz≤SPAN≤100 MHz, Sweep Time>10 s: 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001
300 Hz≤SPAN≤100 MHz, Sweep Time≤10 s: 11, 21, 41, 51, 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001
SPAN = 0 Hz: 11, 21, 41, 51, 101, 201, 251, 401, 501, 1001, 2001, 5001, 10001</td></tr>
<tr><td>Scale</td><td>Log display (10 div): 20 to 0.1 dB/div, 1-2-5 sequence
Lin display (10 div): 1 to 10%/div, 1-2-5 sequence</td></tr>
<tr><td>Trigger function</td><td>Trigger mode: Free Run (Trig Off), Video, Wide IF, External (TTL), SG Marker (when Option 020 installed)</td></tr>
<tr><td>Gate function</td><td>Gate mode: Off, Wide IF, External, SG Marker (when Option 020 installed)</td></tr>
<tr><td rowspan="6">Measurement functions</td><td>Adjacent channel leakage power (ACP)</td><td>Adjacent channel leakage power (ACP)
Reference: SPAN Total, Carrier Total, Both side of Carrier, Carrier Select
Specified adjacent channels: 3 x 2</td></tr>
<tr><td>Burst average power</td><td>In time domain, displays average power in specified time</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, X dB Down</td></tr>
<tr><td>Spectrum emission mask</td><td>Pass/Fail evaluation at Peak/Margin measurement</td></tr>
<tr><td>Spurious emission</td><td>Pass/Fail evaluation at Worst/Peaks measurement</td></tr>
</table>

● **Hardware Options**

<table>
<tr><td colspan="2">MS2690A/MS2691A/MS2692A-001
Rubidium Reference Oscillator</td><td>Generates 10 MHz reference signal with higher frequency stability</td></tr>
<tr><td colspan="2">MS2691A/MS2692A-003
Pre-selector Extended Lower Limit (3 GHz)</td><td>Extends lower limit of pre-selector to 3 GHz</td></tr>
<tr><td rowspan="6">MS2690A/
MS2691A/
MS2692A-004
Wideband Analysis
Hardware</td><td>Bandwidth</td><td>This option adds the 50, 100, and 125 MHz bandwidths to the standard analysis bandwidths.</td></tr>
<tr><td>Sampling rate</td><td>Auto-setting depending on RBW
Range: 100, 200 MHz</td></tr>
<tr><td>Capture time</td><td>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</td></tr>
<tr><td>RBW</td><td>Setting range: 3 kHz to 10 MHz (1-3 sequence)
Selectivity: (–60 dB/–30 dB) 4.5:1 (typ.)</td></tr>
<tr><td>Frequency</td><td>100 MHz to 6.0 GHz</td></tr>
<tr><td>Amplitude</td><td>Display average noise level: At 18˚ to 28˚C, Input attenuator = 0 dB
When Option 008 is not installed, or preamplifier OFF
<table>
<tr><th>Frequency</th><th>Max.</th></tr>
<tr><td>100 MHz≤Frequency<2.4 GHz</td><td>–143.0 [dBm/Hz]</td></tr>
<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>
When preamplifier ON
<table>
<tr><th>Frequency</th><th>Max.</th></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>
Absolute amplitude accuracy:
At 18˚ to 28˚C, after CAL, Input attenuator≥10 dB, Mixer input level≤0 dBm, RBW = Auto,
Time Detection = Average, Marker Result = Integration or Peak (Accuracy), center frequency, CW,
when option 008 is not installed or preamplifier OFF, excluding the noise floor effect
±0.5 dB (100 MHz≤Frequency≤6.0 GHz, Frequency band mode: Normal)
The absolute amplitude accuracy is found from root sum of squares (RSS) of RF characteristics, linearity error, and input attenuator switching error.</td></tr>
<tr><td>Reference level</td><td>Linearity error: At frequency band mode: Normal, excluding the noise floor effect
When Option 008 is not installed, or preamplifier 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)
When preamplifier 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)
RF frequency characteristics: At 18˚ to 28˚C, after CAL, Input attenuator≥10 dB
When option 008 is not installed or preamplifier OFF
±0.35 dB (100 MHz≤Frequency≤6.0 GHz, Frequency band mode: Normal)
When preamplifier ON
±0.65 dB (100 MHz≤Frequency≤6.0 GHz, Frequency band mode: Normal)</td></tr>
</table>

Continued on next page

<table>
<tr><td rowspan="3">MS2690A/
MS2691A/
MS2692A-008
6 GHz Preamplifier</td><td>Frequency</td><td>Range: 100 kHz to 6 GHz</td></tr>
<tr><td>Amplitude</td><td>Measurement range: Display average noise level to +10 dBm
Max. input level: +10 dBm (Input attenuator = 0 dB)
Gain:
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)
Noise factor:
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)
Display average noise level:
Spectrum analyzer function: At 18˚ to 28˚C, Input attenuator = 0 dB,
Detector = sample, VBW = 1 Hz (Video average)
Vector signal analysis function: At 18˚ to 28˚C, Input attenuator = 0 dB
When Preamplifier = ON
<table><tr><th>Frequency</th><th>Max. (Spectrum analyzer function)</th><th>Max. (Vector signal analysis function)</th></tr><tr><td>100 kHz</td><td>–150.0 [dBm/Hz]</td><td>–147.5 [dBm/Hz]</td></tr><tr><td>1 MHz</td><td>–159.0 [dBm/Hz]</td><td>–156.5 [dBm/Hz]</td></tr><tr><td>30 MHz≤Frequency<2.4 GHz</td><td>–166.0 [dBm/Hz]</td><td>–163.5 [dBm/Hz]</td></tr><tr><td>2.4 GHz≤Frequency<3.0 GHz</td><td>–165.0 [dBm/Hz]</td><td>–162.5 [dBm/Hz]</td></tr><tr><td>3.0 GHz≤Frequency<4.0 GHz</td><td>–164.0 [dBm/Hz]</td><td>–161.5 [dBm/Hz]</td></tr><tr><td>4.0 GHz≤Frequency<5.0 GHz</td><td>–161.0 [dBm/Hz]</td><td>–158.5 [dBm/Hz]</td></tr><tr><td>5.0 GHz≤Frequency≤6.0 GHz</td><td>–159.0 [dBm/Hz]</td><td>–156.5 [dBm/Hz]</td></tr></table>
When Preamplifier = OFF
<table><tr><th>Frequency</th><th>Max. (Spectrum analyzer function)</th><th>Max. (Vector signal analysis function)</th></tr><tr><td>100 kHz</td><td>–135.0 [dBm/Hz]</td><td>–132.5 [dBm/Hz]</td></tr><tr><td>1 MHz</td><td>–145.0 [dBm/Hz]</td><td>–142.5 [dBm/Hz]</td></tr><tr><td>30 MHz≤Frequency<2.4 GHz</td><td>–153.0 [dBm/Hz]</td><td>–150.5 [dBm/Hz]</td></tr><tr><td>2.4 GHz≤Frequency<3.0 GHz</td><td>–152.0 [dBm/Hz]</td><td>–149.5 [dBm/Hz]</td></tr><tr><td>3.0 GHz≤Frequency<4.0 GHz</td><td>–151.0 [dBm/Hz]</td><td>–148.5 [dBm/Hz]</td></tr><tr><td>4.0 GHz≤Frequency<5.0 GHz</td><td>–150.0 [dBm/Hz]</td><td>–147.5 [dBm/Hz]</td></tr><tr><td>5.0 GHz≤Frequency<6.0 GHz</td><td>–149.0 [dBm/Hz]</td><td>–146.5 [dBm/Hz]</td></tr></table>
Input attenuator switching error
Frequency band mode: Normal
Frequency≤6.0 GHz: ±0.65 dB (10 to 60 dB)</td></tr>
<tr><td>Reference level</td><td>RF frequency characteristics: At 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)
Linearity error: Excluding the noise floor effect
±0.07 dB (Preamplifier input level*≤–40 dBm)
±0.10 dB (Preamplifier input level*≤–30 dBm)
Frequency band mode: Normal
±0.5 dB (Preamplifier input level*≤–20 dBm, frequency≤6.0 GHz)
1 dB gain compression: Preamplifier 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)
*: Preamplifier input level = RF input level – input attenuator setting value</td></tr>
<tr><td>Spurious response</td><td>2nd harmonic distortion: Preamplifier 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)
Two signal tertiary distortion:
At 18˚ to 28˚C, preamplifier 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)
*: Preamplifier input level = RF input level – input attenuator setting value</td></tr>
</table>

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MS2690A/ MS2691A/ MS2692A-020 Vector Signal Generator	Usage	Adds vector signal generation function
	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 Output level accuracy: At 18˚ to 28˚C, at 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) Output level linearity: At 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) Output connector: N-J Connector, 50 Ω [front panel, SG Output (Opt.)] VSWR Output level: At CW, –5 dBm max., –15 dBm max at modulation 1.3 (≤3.0 GHz) 1.9 (>3.0 GHz) Max. reverse input: Reverse input power: 1 W peak (≥300 MHz), 0.25 W peak (<300 MHz)
	Signal purity	Harmonic spurious: At Output level≤+5 dBm, CW, Output frequency 300 MHz max. ≤–30 dBc Non-harmonic spurious: At Output level≤+5 dBm, CW, min. 15 kHz offset 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	Vector accuracy: At 18˚ to 28˚C, W-CDMA (DL1code), SG Level Auto CAL = On, output level –5 dBm max., output frequency 800 to 2700 MHz ≤2% (rms) Carrier leak: At 18˚ to 28˚C, output frequency 300 MHz max., SG Level Auto CAL = On ≤–40 dBc Image rejection: At 18˚ to 28˚C, output frequency 300 MHz max., SG Level Auto CAL = On, using 10 MHz max. sine wave ≤–40 dBc ACLR: At 18˚ to 28˚C, SG Level Auto CAL = On, output level –5 dBm max. Using W-CDMA (Test Model 1 64DPCH) signal, 300 MHz≤Output frequency≤2.4 GHz 5 MHz offset: ≤–64 dBc/3.84 MHz, 10 MHz offset: ≤–67 dBc/3.84 MHz CW and level error at vector modulation: At 18˚ to 28˚C, AWGN signal with bandwidth of 5 MHz, SG Level Auto CAL = On, output frequency 300 MHz min., output level p p≤–15 dBm ±0.2 dB At output level –15 to –5 dBm –15<p≤–5 dBm ±0.4 dB (typ.) 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: Back-panel AUX connector, 600 Ω, 0 to 5 V, threshold value approx. 1 V
	Arbitrary waveform generator	Waveform resolution: 14 bits Marker output: Three signal (three signals in waveform pattern, or real-time three signal generation), TTL, polarity inversion function Internal baseband Reference clock Range: 20 kHz to 160 MHz Resolution: 0.001 Hz External baseband Reference clock input 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: Back-panel AUX connector, 0.7 Vp-p min. (AC/50 Ω), or TTL Waveform memory Memory: 256 Msamples AWGN Addition function CN Ratio absolute value: ≤40 dB

Continued on next page

<table>
<tr><td>MS2690A/
MS2691A/
MS2692A-020
Vector Signal
Generator</td><td>BER
measurement</td><td>Connector: Back-panel AUX connector
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
Sync establishment conditions
PN Signal: PN stage x 2 bit error free
At PNFix Signal: 0 PN stage x 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, 01Repeat: 10 bit error free
User Define: 8 to 1024 bits (variable) error free, Select header bit used at sync detection
Resync evaluation conditions: 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: ≤2^{32} – 1 bits
Measured error bit count: ≤2^{31} – 1 bits
Measurement end conditions: Measured bit count, measured error bit count
Auto-resync 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</td></tr>
<tr><td rowspan="3">MS2690A/
MS2691A/
MS2692A-030
W-CDMA RNC
Simulator
(ATM1.5M/2M)</td><td>Input/Output
connector</td><td>Terminal number: 1 port (1.5M/2M common)
Terminal shape: RJ-45, 100 Ω (1.5M), 120 Ω (2M)
Pin layout
1: Rx+, 2: Rx–, 3: N.C, 4: Tx+, 5: Tx–, 6: N.C., 7: N.C., 8: N.C.
1.5M
Output level: 2.4 to 3.6 V0-P (typ.)
Input level: 2.4 to 3.6 V0-P (typ.)
Bit rate: 1.544 Mbps
Code: B8ZS
2M
Output level: 3 ±0.3 V0-P (typ.)
Input level: 3 ±0.3 V0-P (typ.)
Bit rate: 2.048 Mbps
Code: HDB3</td></tr>
<tr><td>Transmit/Receive
control</td><td>Controls patterns below:
- Test Model 1 16/32/64 DPCH
- Test Model 2
- Test Model 3 16/32 DPCH
- Test Model 4 with/without P-CPICH
- Test Model 5 8/4/2 HS-PDSCH</td></tr>
<tr><td>Error rate
measurement</td><td>Measurement function: BER (Bit Error Rate), BLER (Block Error Rate)
Bit rate: 12.1, 64, 144, 384 kbps
Measured pattern: PN9, PN15
Resync evaluation conditions: (PN x 2) bit error free
Measured time: 10^4 to 10^9 bit (10^4 bit step), 10^2 to 10^4 block (10^2 block step)
Display: Error rate, Error bit count, Measured bit count</td></tr>
<tr><td rowspan="6">MS2690A/
MS2691A/
MS2692A-050
HDD Digitizing
Interface</td><td>Bandwidth,
sampling rate,
recorded data
format</td><td><table><tr><th>Bandwidth</th><th>Sampling rate</th><th>Recorded data format</th></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, 18.6 MHz</td><td>20 MHz</td><td rowspan="2">Fixed Decimal Format (16 bit)</td></tr><tr><td>20 MHz</td><td>25 MHz</td></tr></table></td></tr>
<tr><td>Recording time</td><td>5 seconds to 4 hours</td></tr>
<tr><td>Number of
Recorded File</td><td>1000 files max.</td></tr>
<tr><td>Resample function</td><td>Convert by resampling at data retrieval, Setting range: Sampling rate/2 to Sampling rate</td></tr>
<tr><td>Trigger function</td><td>Video, Wide IF Video, External, SG Marker</td></tr>
<tr><td>Count mode</td><td>Capturing times: 1 to 20 times</td></tr>
<tr><td>Interface</td><td>Connector: eSATA Connector
Hot Plug: Not supported*
*: The main frame and external HDD must be off when connecting/disconnecting connectors.</td></tr>
</table>

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
J0017F	Power Cord (2.6 m long 100 Vac, 3 core, gray) :1 pc
J0266	Conversion Adapter (3 pin to 2 pin power adapter) :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 x 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-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2690A-030	W-CDMA RNC Simulator (ATM1.5M/2M) (Supports ATM 1.5M and 2M)
MS2690A-040	Baseband Interface Unit
MS2690A-050	HDD Digitizing Interface
MS2691A-001	Rubidium Reference Oscillator (Aging rate ±1 x 10^{-10}/month)
MS2691A-003	Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of pre-selector 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-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2691A-030	W-CDMA RNC Simulator (ATM1.5M/2M) (Supports ATM 1.5M and 2M)
MS2691A-040	Baseband Interface Unit
MS2691A-050	HDD Digitizing Interface
MS2692A-001	Rubidium Reference Oscillator (Aging rate ±1 x 10^{-10}/month)
MS2692A-003	Extension of Preselector Lower Limit to 3 GHz (Extends lower limit of pre-selector 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-020	Vector Signal Generator (125 MHz to 6 GHz)
MS2692A-030	W-CDMA RNC Simulator (ATM1.5M/2M) (Supports ATM 1.5M and 2M)
MS2692A-040	Baseband Interface Unit
MS2692A-050	HDD Digitizing Interface
	Retrofit options
MS2690A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 x 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-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2690A-130	W-CDMA RNC Simulator (ATM1.5M/2M) Retrofit (Supports ATM 1.5M and 2M)
MS2690A-140	Baseband Interface Unit Retrofit
MS2690A-150	HDD Digitizing Interface Retrofit
MS2691A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 x 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-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2691A-130	W-CDMA RNC Simulator (ATM1.5M/2M) Retrofit (Supports ATM 1.5M and 2M)
MS2691A-140	Baseband Interface Unit Retrofit
MS2691A-150	HDD Digitizing Interface Retrofit
MS2692A-101	Rubidium Reference Oscillator Retrofit (Aging rate ±1 x 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-120	Vector Signal Generator Retrofit (125 MHz to 6 GHz)
MS2692A-130	W-CDMA RNC Simulator (ATM1.5M/2M) Retrofit (Supports ATM 1.5M and 2M)
MS2692A-140	Baseband Interface Unit Retrofit
MS2692A-150	HDD Digitizing Interface Retrofit

Model/Order No.	Name
	Software options
MX269010A	Mobile WiMAX Measurement Software (CD-ROM, license and instruction manual)
MX269011A	W-CDMA/HSPA Downlink Measurement Software
MX269012A	W-CDMA/HSPA Uplink Measurement Software (CD-ROM, license and instruction manual)
MX269013A	GSM/EDGE Measurement Software (CD-ROM, license and instruction manual)
MX269013A-001	EDGE Evolution Measurement Software (CD-ROM, license and instruction manual)
MX269014A	ETC/DSRC Measurement Software (CD-ROM, license and instruction manual)
MX269015A	TD-SCDMA Measurement Software (CD-ROM, license and instruction manual)
MX269016A	XG-PHS Measurement Software (CD-ROM, license and instruction manual)
MX269020A	LTE Downlink Measurement Software (CD-ROM, license and instruction manual)
MX269021A	LTE Uplink Measurement Software (CD-ROM, license and instruction manual)
MX269030A	W-CDMA BS Measurement Software (CD-ROM, license and instruction manual)
MX269040A	UMTS Measurement Software for RF Device Test
MX269041A	Digital I/F Control Software for DigRF2.5G/3G
MX269901A	HSDPA/HSUPA IQproducer (CD-ROM, license and instruction manual)
MX269902A	TDMA IQproducer (CD-ROM, license and instruction manual)
MX269904A	Multi-Carrier IQproducer (CD-ROM, license and instruction manual)
MX269905A	Mobile WiMAX IQproducer (CD-ROM, license and instruction manual)
MX269908A	LTE IQproducer (CD-ROM, license and instruction manual)
MX269909A	XG-PHS IQproducer (CD-ROM, license and instruction manual)
	Warranty service
MS2690A-ES210	2-year Extended Warranty Service
MS2690A-ES310	3-year Extended Warranty Service
MS2690A-ES510	5-year Extended Warranty Service
MS2691A-ES210	2-year Extended Warranty Service
MS2691A-ES310	3-year Extended Warranty Service
MS2691A-ES510	5-year Extended Warranty Service
MS2692A-ES210	2-year Extended Warranty Service
MS2692A-ES310	3-year Extended Warranty Service
MS2692A-ES510	5-year Extended Warranty Service

Continued on next page

Model/Order No.	Name
	Application parts
W2850AE	MS2690A/MS2691A/MS2692A Operation Manual (Main frame Operation, Printed version)
W2851AE	MS2690A/MS2691A/MS2692A Operation Manual (Main frame Remote Control, Printed version)
W2852AE	MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Operation, Printed version)
W2853AE	MS2690A/MS2691A/MS2692A Operation Manual (Signal Analyzer Function Remote Control, Printed version)
W2854AE	MS2690A/MS2691A/MS2692A Operation Manual (Spectrum Analyzer Function Operation, Printed version)
W2855AE	MS2690A/MS2691A/MS2692A Operation Manual (Spectrum Analyzer Function Remote Control, Printed version)
W2856AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Operation, Printed version)
W2857AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Remote Control, Printed version)
W2914AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (IQproducer, Printed version)
W2929AE	MS2690A/MS2691A/MS2692A-020 Operation Manual (Standard Waveform Pattern, Printed version)
W2858AE	MS2690A/MS2691A/MS2692A-030 Operation Manual (Operation, Printed version)
W2859AE	MS2690A/MS2691A/MS2692A-030 Operation Manual (Remote Control, Printed version)
W3130AE	MS2690A/MS2691A/MS2692A-040 Operation Manual (Operation, Printed version)
W2919AE	MX269010A Operation Manual (Printed version)
W3098AE	MX269011A Operation Manual (Operation, Printed version)
W3099AE	MX269011A Operation Manual (Remote control, Printed version)
W3060AE	MX269012A Operation Manual (Operation, Printed version)
W3061AE	MX269012A Operation Manual (Remote control, Printed version)
W3100AE	MX269013A Operation Manual (Operation, Printed version)
W3101AE	MX269013A Operation Manual (Remote control, Printed version)
W3031AE	MX269014A Operation Manual (Operation, Printed version)
W3032AE	MX269014A Operation Manual (Remote control, Printed version)
W3044AE	MX269015A Operation Manual (Operation, Printed version)
W3045AE	MX269015A Operation Manual (Remote control, Printed version)
W3157AE	MX269016A Operation Manual (Remote control, Printed version)
W3158AE	MX269016A Operation Manual (Remote control, Printed version)
W3014AE	MX269020A Operation Manual (Operation, Printed version)
W3015AE	MX269021A Operation Manual (Operation, Printed version)
W2860AE	MX269030A Operation Manual (Operation, Printed version)
W2861AE	MX269030A Operation Manual (Remote control, Printed version)
W3003AE	MX269040A Operation Manual (W-CDMA Operation, Printed version)
W3004AE	MX269040A Operation Manual (GSM/EDGE Operation, Printed version)
W3005AE	MX269040A Operation Manual (Remote control, Printed version)

Model/Order No.	Name
W3006AE	MX269041A Operation Manual (BBIF Operation, Printed version)
W3007AE	MX269041A Operation Manual (BBIF Remote control, Printed version)
W3008AE	MX269041A Operation Manual (IQ Pattern/DUT Control Producer, Printed version)
W3016AE	MX269041A Operation Manual (RF device test integrated software, Printed version)
W3108AE	MX269050A Operation Manual (Operation, Printed version)
W3109AE	MX269050A Operation Manual (Remote control, Printed version)
W2915AE	MX269901A Operation Manual (Printed version)
W2916AE	MX269902A Operation Manual (Printed version)
W2917AE	MX269904A Operation Manual (Printed version)
W2918AE	MX269905A Operation Manual (Printed version)
W3023AE	MX269908A Operation Manual (Printed version)
W3153AE	MX269909A Operation Manual (Printed version)
K240B	Power Divider (K connector, DC to 26.5 GHz, 50 Ω, K-J, 1 W max)
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, 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 · 50 Ω SUCOFLEX104 · SMA-P), 0.5 m (DC to 18 GHz)
J0322B	Coaxial Cord (SMA-P · 50 Ω SUCOFLEX104 · SMA-P), 1 m (DC to 18 GHz)
J0322C	Coaxial Cord (SMA-P · 50 Ω SUCOFLEX104 · SMA-P), 1.5 m (DC to 18 GHz)
J0322D	Coaxial Cord (SMA-P · 50 Ω SUCOFLEX104 · SMA-P), 2 m (DC to 18 GHz)
J1264	SMA-N Conversion Adapter (DC to 18 GHz, 50 Ω, N-P · SMA-J)
J1398A	N-SMA Adapter (DC to 26.5 GHz, 50 Ω, 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
B0589A	Carrying Case (Hard type, with casters)
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

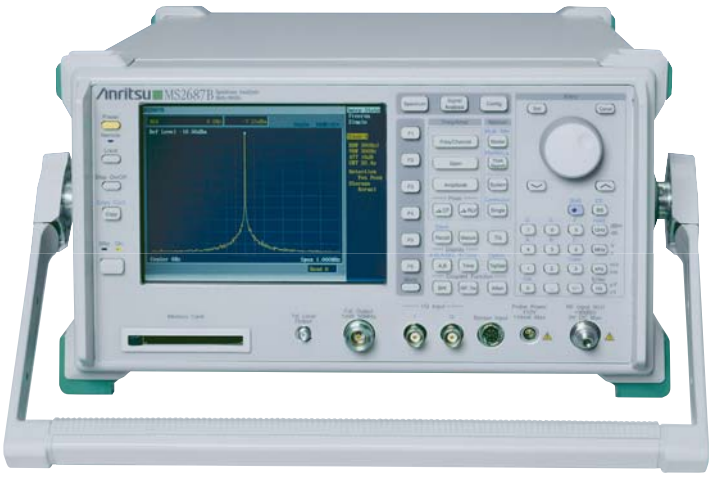
SPECTRUM ANALYZER

MS2681A/MS2683A/MS2687B

9 kHz to 3 GHz 9 kHz to 7.8 GHz 9 kHz to 30 GHz (18 to 110 GHz)

CE GPIB Ethernet OPTION

For Evaluation of IMT-2000, MMAC and Advanced Radio Communication Devices



The MS2681A/MS2683A/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.
- Data transmission speed approximately 10 times faster. (GPIB transmission speed: 120 kbps)
- Optional measurement software (sold separately) for high-speed modulation analysis (1.5 sec with W-CDMA, 0.5 sec with IEEE802.11a).
- Optional narrow resolution bandwidth from 1 Hz.
- Optional rubidium reference oscillator for warm-up time of just 7 minutes.
- Optional power meter that measures up to 32 GHz (MS2687B).

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.

Model		MS2681A	MS2683A	MS2687B
Frequency	Frequency range	9 kHz to 3 GHz	9 kHz to 7.8 GHz	9 kHz to 30 GHz, 18 to 110 GHz (with external mixer)
	Frequency band	—	Band 0: 9 kHz to 3.2 GHz, Band 1–L: 1.6 to 3.2 GHz (option 03), Band 1: 3.15 to 6.3 GHz, Band 1+: 6.2 to 7.8 GHz	Band 0: 9 kHz to 3.2 GHz Local harmonics order 1 Band 1–: 3.15 to 6.3 GHz Local harmonics order 1 Band 1+: 6.2 to 7.9 GHz Local harmonics order 1 Band 2+: 7.8 to 15.3 GHz Local harmonics order 2 Band 4+: 15.2 to 30 GHz Local harmonics order 4
	Pre-selector range	—	3.15 to 7.8 GHz, 1.6 to 7.8 GHz (option 03)	3.15 to 30 GHz (band 1–, 1+, 2+, 4+)

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	Model	MS2681A	MS2683A	MS2687B
Frequency	Display frequency accuracy	± (Display frequency x reference frequency accuracy + span x span accuracy + resolution bandwidth x 0.15 + 10 Hz)		± (Display frequency x reference frequency accuracy + span x span accuracy + resolution bandwidth x 0.15 + 10 Hz x 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 or less)		
	Frequency counter accuracy	± (Display frequency x reference frequency accuracy + 2 Hz + 1 LSD) (at S/N 20 dB or more and RBW 3 MHz or less)		± (Display frequency x reference frequency accuracy +2 x N Hz + 1 LSD) (at S/N 20 dB or more and RBW 3 MHz or less) *N: Local harmonics order
	Frequency span	Setting range: 0 Hz, and 5 kHz to 3.0 GHz Accuracy: ±1.0% (at data point of 1001)	Setting range: 0 Hz, and 5 kHz to 7.8 GHz Accuracy: ±1.0% (at data point of 1001)	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 (MS2683A/MS2687B: band 0) *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)		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: ≤5 x 10^{-8} (after 10 minutes warm-up, with frequency after 24 hours warm-up referenced) Aging rate: ≤2 x 10^{-8}/day, ≤1 x 10^{-7}/year (with frequency after 24 hours of warm-up referenced) Temperature characteristics: ±5 x 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 [Without option 08] ≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz) ≤–120 dBm + f [GHz] dB (2.5 to 3.0 GHz) [With option 08] ≤–122 dBm + 1.5f [GHz] dB (1 MHz to 2.5 GHz) ≤–120 dBm + 1.5f [GHz] dB (2.5 to 3.0 GHz) Residual response: ≤–100 dBm (1 MHz to 3.0 GHz)	Average noise level display RBW: 300 Hz, VBW: 1 Hz, RF ATT 0 dB, in SAMPLE detection mode [Without option 08] ≤–124 dBm + f [GHz] dB (1 MHz to 2.5 GHz, band 0) ≤–120 dBm + f [GHz] dB (2.5 to 3.2 GHz, band 0) ≤–122 dBm + 0.5f [GHz] dB (3.15 to 7.8 GHz, band 1) [With option 08] ≤–122 dBm + 1.5f [GHz] dB (1 MHz to 2.5 GHz, band 0) ≤–120 dBm + 1.5f [GHz] dB (2.5 to 3.2 GHz, band 0) ≤–122 dBm + 0.5f [GHz] dB (3.15 to 7.8 GHz, band 1) Residual response: ≤–100 dBm (1 MHz to 3.2 GHz, band 0) ≤–90 dBm (3.15 to 7.8 GHz, band 1)	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 to 3.2 GHz, band 0) ≤–115 dBm (3.15 to 7.9 GHz, band 1) ≤–113 dBm (7.8 to 15.3 GHz, band 2) ≤–103 dBm (15.2 to 30.0 GHz, band 4) Residual response: RF ATT 0 dB, input terminated at 50 Ω ≤–100 dBm (1 MHz to 3.2 GHz, band 0) ≤–90 dBm (3.15 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 calibration, at 50 MHz, span: 1 MHz (when RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10, 20 MHz) *After calibration, with RBW 3 kHz referenced		
		Input attenuator (RF ATT) Setting range: 0 to 62 dB (2 dB step), manually settable, or automatically settable according to reference level Switching uncertainty: ±0.3 dB (10 to 50 dB), ±0.5 dB (52 to 62 dB) *After calibration, with 50 MHz, RF ATT: 10 dB referenced Input attenuator switching mode: 2, 10 dB step mode		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

Continued on next page

	Model	MS2681A	MS2683A	MS2687B
Amplitude	Frequency response	±0.6 dB (9 kHz to 3.0 GHz) *With 50 MHz referenced (when RF ATT: 10 dB, 18˚ to 28˚C) ±1.0 dB (9 kHz to 3.0 GHz) *With 50 MHz referenced (when RF ATT: 10 to 62 dB)	±0.6 dB (9 kHz to 3.2 GHz, band 0) ±1.0 dB (3.15 to 7.8 GHz, band 1) ±1.0 dB (option 03, 1.6 to 7.8 GHz, band 1) *With 50 MHz referenced (when RF ATT: 10 dB, 18˚ to 28˚C) ±1.0 dB (9 kHz to 3.2 GHz, band 0) ±2.0 dB (3.15 to 7.8 GHz, band 1) ±2.0 dB (1.6 to 7.8 GHz, band 1) *With 50 MHz referenced (when RF ATT: 10 to 62 dB), after pre-selector tuning for band 1.	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 to 7.9 GHz, band 1) ±3.0 dB (7.8 to 15.3 GHz, band 2) ±4.0 dB (15.2 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 calibration) 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%		
	Spurious response	2nd harmonic distortion: ≤–60 dBc (input frequency 10 to 200 MHz) ≤–75 dBc (0.2 to 0.85 GHz) ≤–70 dBc (0.85 to 1.5 GHz) *Mixer input: –30 dBm Two-signal third-order intermodulation distortion (Frequency difference of two signals: ≥50 kHz, Mixer input: –30 dBm): ≤–70 dBc (10 to 100 MHz) ≤–85 dBc (0.1 to 3.0 GHz) Image response: ≤–70 dBc	2nd harmonic distortion: ≤–60 dBc (input frequency 10 to 200 MHz) ≤–75 dBc (0.2 to 0.85 GHz, band 0) ≤–70 dBc (0.85 to 1.6 GHz, band 0) *Mixer input: –30 dBm ≤–90 dBc (1.6 to 3.9 GHz, band 1) ≤–90 dBc (option 03, 0.8 to 3.9 GHz, band 1) *Mixer input: –10 dBm Two-signal third-order intermodulation distortion (Frequency difference of two signals: ≥50 kHz, Mixer input: –30 dBm): ≤–70 dBc (10 to 100 MHz) ≤–85 dBc (0.1 to 7.8 GHz) Image response: ≤–70 dBc	2nd harmonic distortion: ≤–60 dBc (input frequency 10 to 200 MHz) ≤–70 dBc (0.2 to 1.6 GHz, band 0) *Mixer input: –30 dBm ≤–90 dBc or lower than average noise level (1.6 to 15 GHz, band 1, 2, and 4) *Mixer input: –10 dBm Two-signal third-order intermodulation distortion (Frequency difference of two signals: ≥50 kHz, Mixer input: –30 dBm): ≤–70 dBc (10 to 100 MHz) ≤–85 dBc (0.1 to 3.2 GHz, band 0) ≤–80 dBc (3.15 to 7.9 GHz, band 1) ≤–75 dBc or lower than average noise level (7.8 to 22.5 GHz, band 2, 4) ≤–75 dBc or lower than average noise level (22.4 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)	≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz, band 1) ≥0 dBm (≥3.15 GHz, band 1) ≥0 dBm (option 03: ≥1.6 GHz, band 1)	≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz, band 0) ≥–5 dBm (≥3150 MHz, band 1, 2, and 4)
	Maximum dynamic range (Typical value)	1 dB gain compression to average noise level [Without Option 08] ≥124 dB – f [GHz] dB Reference value (0.1 to 3.0 GHz) [With Option 08] ≥122 dB – 1.5f [GHz] dB Reference value (0.1 to 3.0 GHz)	1 dB gain compression to average noise level [Without option 08] ≥124 dB – f [GHz] dB, Reference value (0.1 to 3.2 GHz, band 0) ≥122 dB – 0.5f [GHz] dB, Reference value (3.15 to 7.8 GHz, band 1) [With option 08] ≥122 dB – 1.5f [GHz] dB, Reference value (0.1 to 3.2 GHz, band 0) ≥122 dB – 0.5f [GHz] dB, Reference value (3.15 to 7.8 GHz, band 1)	—
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.	—	Sweeps the indicated range in the zone only.
	Tracking sweep	Sweeps following the peak point inside the zone marker (zone sweep also available)	—	Sweeps following the peak point inside the zone marker (zone sweep also available)

Continued on next page

Model		MS2681A	MS2683A	MS2687B
Time sweep	Sweep mode	Continuous, Single		
	Sweep time	Setting range/resolution: 1 to 50 µs (1-2-5 sequence), 100 µs to 4.9 ms (100 µs resolution), Sweep time: 5.0 ms to 1 s (5 ms resolution), 1 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 µs 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, ΔMARKER → 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/$\sqrt{\text{Hz}}$ 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 x 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 x 2, Lower limit x 2 MASK (at frequency sweep): Upper limit x 2, Lower limit x 2		
	Correction	Frequency response can be corrected arbitrarily up to 150 points		
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, $\overline{\text{DTSB}}$, $\overline{\text{ERROR}}$, 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: N-J, 50 Ω nominal value Impedance: VSWR ≤1.5 typ. (RF ATT ≥10 dB)		Input connector: K-J, 50 Ω nominal value Impedance: VSWR ≤2.3 typ. (RF ATT ≥10 dB)
		Video output: outputs analog RGB, D-Sub 15 pin connector (jack) IF output: BNC connector, 50 Ω nominal value, 66/10.69 MHz Level: –10 dBm typ. (frequency 50 MHz, display scale upper edge, 50 Ω terminated) Broadband IF output: BNC connector, 50 Ω nominal value, 60.69/66 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, 75 Ω terminated) Buffered Output: BNC connector, Level: 2 to 5 V (p-p) (200 Ω 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) x 177 (H) x 411 (D) mm (handle, leg, front cover, fan cover excluded), ≤16 kg (nominal value)		
Power supply		100 to 120/200 to 240 VAC (–15%/+10%, 250 V max., wide range input), 47.5 Hz to 63 Hz, ≤400 VA		
Ambient temperature and humidity		0˚ to +50˚C, RH ≤85% (no condensation allowed)		
Storage temperature range		–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	Frequency range: 18 to 110 GHz Frequency band: Band / Frequency range / Local harmonics order [N] K 18 to 26.5 GHz 4 Ka 26.5 to 40 GHz 6 Q 33 to 50 GHz 8 U 40 to 60 GHz 9 or 10 V 50 to 75 GHz 11 or 12 E 60 to 90 GHz 13 or 14 W 75 to 110 GHz 16
	Span setting range	0 Hz, (100 x 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 port mixer
	Local frequency	4 to 7 GHz
	IF frequency	460.69 or 466 MHz
	Display gain	0 ±2 dB (External mixer input level –10 dBm, Mixer transform loss 15 dB)

- **MS2681A Options**

Option 01: Precision Frequency Reference

Frequency	10 MHz
Start-up characteristics	≤±5 x 10^{-8} (≤7 minutes, 25˚C, Typical value)
Aging rate	≤±5 x 10^{-10}/day (With the frequency at 24 hours after the power is turned on referenced)
Temperature characteristics	≤±5 x 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	When RBW is 1 Hz and RF ATT is 0 dB [Without Option 08] ≤–148.3 dBm + f [GHz] dB (typ., 1 MHz to 2.5 GHz), ≤–146.3 dBm + f [GHz] dB (typ., 2.5 to 3.0 GHz) [With Option 08] ≤–146.3 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz), ≤–144.3 dBm + 1.5f [GHz] dB (typ., 2.5 to 3.0 GHz)

Option 04: Digital Resolution Bandwidth

Resolution bandwidth	Setting range: 10 Hz to 1 MHz (1-3 sequence) Bandwidth accuracy: ±10% (RBW: ≥100 Hz), ±10% NOMINAL (RBW: ≤30 Hz) Bandwidth selectivity (60 dB: 3 dB): ≤5:1 (RBW ≥100 Hz), ≤5:1 NOMINAL (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	When RBW is 10 Hz and RF ATT is 0 dB [Without Option 08]: ≤–136.5 dBm + 1.5f [GHz] dB (NOMINAL, 1 MHz to 2.5 GHz), ≤–132.5 dBm + 1.5f [GHz] dB (NOMINAL, 2.5 to 3.0 GHz) [With Option 08]: ≤–134.5 dBm + 1.5f [GHz] dB (typ., 1 MHz to 2.5 GHz), ≤–130.5 dBm + 1.5f [GHz] dB (typ., 2.5 to 3.0 GHz)

Option 08: Pre-amplifier*1

Frequency range	100 kHz to 3.0 GHz
Gain	20 dB typ.
Noise figure	6.5 dB typ. (input frequency ≤2.0 GHz), 12 dB typ. (input frequency >2.0 GHz)
Level measurement range	Average noise level display to +10 dBm
Max. input level	CW average power: +10 dBm
Reference level	Setting range Log scale: –120 to +10 dBm, or equivalent, Linear scale: 2.24 µV to 707 mV Reference level accuracy: ±0.9 dB (–69.9 to +10 dBm), ±1.5 dB (–90 to –70 dBm) *After calibration, with 50 MHz referenced, 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, 20 MHz) RF ATT switching uncertainty: ±0.5 dB (10 to 50 dB), ±0.75 dB (52 to 62 dB) *With 50 MHz and RF ATT 10 dB referenced
Average noise level display	–137 dBm + 2f [GHz] dB (1 MHz to 3.0 GHz) *When RBW is 300 Hz, VBW is 1 Hz, RF ATT is 0 dB, and detection mode is set to SAMPLE
Frequency response	±2.0 dB (100 kHz to 3.0 GHz) *With 50 MHz referenced, when RF ATT is 10 to 50 dB, and temperature is 18˚ to 28˚C
Linearity of waveform display	Log scale (after calibration): ±0.5 dB (–20 to 0 dB, RBW: ≤1 kHz), ±1.0 dB (–60 to 0 dB, RBW: ≤1 kHz), ±1.5 dB (–75 to 0 dB, RBW: ≤1 kHz) Linear scale (after calibration): ±5% (relative to reference level)
Spurious response	≤–70 dBc (10 MHz to 3.0 GHz) *Frequency difference of two signals ≥50 kHz, At pre-amplifier input level of –55 dBm*2
1 dB gain compression	≥–35 dBm (input frequency ≥100 MHz) *At pre-amplifier input level

*1: Overall specification with pre-amplifier ON (Noise figure and gain are single performance of pre-amplifier.)
*2: Pre-amplifier input level is shown by the Right equation: Pre-amplifier input level = RF input level – RF ATT setting level

Option 09: Ethernet Interface

Function	Control with external controller (except for power switch)
Connector	10BASE-T

Option 17: I/Q Balanced Input

Connector	BNC
Impedance	Selectable between 1 MΩ (parallel capacity <100 pF) and 50 Ω
Input level range	Differential voltage range: 0.1 to 1 Vp-p (at input terminal) In-phase voltage range: ±2.5 V (at input terminal)

Option 18: I/Q Unbalanced Input

Connector	BNC
Impedance	Selectable between 1 MΩ (parallel capacity <100 pF) and 50 Ω
Input level range	Differential voltage range: 0.1 to 1 Vp-p (at input terminal) Changeable between DC connection and AC connection

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.

• MS2683A Options

Option 01: Precision Frequency Reference

Frequency	10 MHz
Start-up characteristics	≤±5 x 10^{-8} (≤7 minutes, 25˚C, typ.)
Aging rate	≤±5 x 10^{-10}/day (With the frequency at 24 hours after the power is turned on referenced)
Temperature characteristics	≤±5 x 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	When RBW is 1 Hz and RF ATT is 0 dB [Without Option 08] ≤–146.5 dBm + f [GHz] dB typ. (1 MHz to 2.5 GHz, band 0) ≤–142.5 dBm + f [GHz] dB typ. (2.5 to 3.2 GHz, band 0) ≤–144.5 dBm + 0.5f [GHz] dB typ. (3.15 to 7.8 GHz, band 1) [With Option 08] ≤–144.5 dBm + 1.5f [GHz] dB typ. (1 MHz to 2.5 GHz, band 0) ≤–140.5 dBm + 1.5f [GHz] dB typ. (2.5 to 3.2 GHz, band 1) ≤–138.5 dBm + 0.5f [GHz] dB typ. (3.15 to 7.8 GHz, band 1)

Option 03: Extension of Pre-selector Lower Limit to 1.6 GHz

Function	Extends the lowest frequency of pre-selector from 3.15 to 1.6 GHz
Frequency band	0 band: 9 kHz to 3.2 GHz, 1–L band: 1.6 to 3.2 GHz, 1– band: 3.15 to 6.3 GHz, 1+ band: 6.2 to 7.8 GHz
Pre-selector range	1.6 to 7.8 GHz (band: 1–L, 1–, 1+)
Average noise level	≤–122 dBm + 0.5f [GHz] dB (1.6 to 7.8 GHz, band 1, RBW: 300 Hz, VBW: 1 Hz, RF ATT: 0 dB)
Residual response	≤–90 dBm (1.6 to 7.8 GHz, band 1, RF ATT: 0 dB, input terminated at 50 Ω)
Frequency response	±1.0 dB (with 1.6 to 7.8 GHz, band 1, and 50 MHz referenced, when RF ATT is 10 dB and temperature is 18˚ to 28˚C) ±2.0 dB (1.6 to 7.8 GHz, band 1, RF ATT: 10 to 62 dB) *After pre-selector tuning for band 1
2nd harmonic distortion	≤–90 dBc (0.8 to 3.9 GHz, band 1, mixer input: –10 dBm)
1 dB gain compression	≥0 dBm (1.6 to 7.8 GHz, band 1)
Maximum dynamic range	≥–122 dB + 0.5f [GHz] dB (1.6 to 7.8 GHz, band 1)

Option 04: Digital Resolution Bandwidth

Resolution bandwidth	Setting range: 10 Hz to 1 MHz (1-3 sequence) Bandwidth accuracy: ±10% (RBW: ≥100 Hz), ±10% NOMINAL (RBW: ≥30 Hz) Bandwidth selectivity (60 dB: 3 dB): ≤5:1 (RBW: ≥100 Hz), ≤5:1 NOMINAL (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	When RBW is 10 Hz and RF ATT is 0 dB [Without Option 08] ≤–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 to 3.2 GHz, band 0) ≤–134.5 dBm + 0.5f [GHz] dB typ. (3.15 to 7.8 GHz, band 1) [With Option 08] ≤–134.5 dBm + 1.5f [GHz] dB typ. (1 MHz to 2.5 GHz, band 0) ≤–130.5 dBm + 1.5f [GHz] dB typ. (2.5 to 3.2 GHz, band 0) ≤–134.5 dBm + 0.5f [GHz] dB typ. (3.15 to 7.8 GHz, band 1)

Option 08: Pre-amplifier*1

Frequency range	100 kHz to 3.0 GHz
Gain	20 dB typ.
Noise figure	6.5 dB typ. (input frequency ≤2.0 GHz), 12 dB typ. (input frequency >2.0 GHz)
Level measurement range	Average noise level display to +10 dBm
Max. input level	CW average power: +10 dBm
Reference level	Setting range Log scale: –120 to +10 dBm, or equivalent, Linear scale: 2.24 µV to 707 mV Reference level accuracy: ±0.9 dB (–69.9 to +10 dBm), ±1.5 dB (–90 to –70 dBm) *After calibration, with 50 MHz referenced, 1 MHz span (RF, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.5 dB (300 Hz to 5 MHz), ±0.75 dB (10, 20 MHz) RF ATT switching uncertainty: ±0.5 dB (10 to 50 dB), ±0.75 dB (52 to 62 dB) *With 50 MHz referenced, when RF ATT is 10 dB
Average noise level display	–137 dBm + 2f [GHz] dB (1 MHz to 2.5 GHz, band 0) *When RBW is 300 Hz, VBW is 1 Hz, RF ATT is 0 dB, and detection mode set to SAMPLE
Frequency response	±2.0 dB (100 kHz to 3.0 GHz) *With 50 MHz referenced, when RF ATT is 10 to 50 dB, and temperature is 18˚ to 28˚C
Linearity of waveform display	Log scale (after calibration): ±0.5 dB (–20 to 0 dB, RBW: ≤1 kHz), ±1.0 dB (–60 to 0 dB, RBW: ≤1 kHz), ±1.5 dB (–75 to 0 dB, RBW: ≤1 kHz) Linear scale (after calibration): ±5% (relative to reference level)
Spurious response	≤–70 dBc (10 MHz to 3.0 GHz) *Frequency difference of two signals ≥50 kHz, At pre-amplifier input level of –55 dBm*2
1 dB gain compression	≥–35 dBm (input frequency ≥100 MHz) *At pre-amplifier input level

*1: Overall specification with pre-amplifier ON (Noise figure and gain are single performance of pre-amplifier.)
*2: Pre-amplifier input level is shown by the Right equation: Pre-amplifier input level = RF input level – RF ATT setting level

Option 09: Ethernet Interface

Function	Exercises control with external controller (except for power switch)
Connector	10BASE-T

Option 17: I/Q Balanced Input

Connector	BNC
Impedance	Selectable between 1 MΩ (parallel capacity <100 pF) and 50 Ω
Input level range	Differential voltage range: 0.1 to 1 Vp-p (at input terminal) In-phase voltage range: ±2.5 V (at input terminal)

Option 18: I/Q Unbalanced Input

Connector	BNC
Impedance	Selectable between 1 MΩ (parallel capacity <100 pF) and 50 Ω
Input level range	Differential voltage range: 0.1 to 1 Vp-p (at input terminal) Changeable between DC connection and AC connection

Option 34: 4 GHz LO Output

Frequency	Frequency: 4 GHz Frequency accuracy: ± (4 GHz x 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.

• MS2687B Options

Option 01: Precision Frequency Reference

Frequency	10 MHz
Start-up characteristics	≤±5 x 10^{-8} (≤7 min. 25˚C, typ.)
Aging rate	≤±5 x 10^{-10}/day (With the frequency at 24 hours after the power is turned on referenced)
Temperature characteristics	≤±5 x 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	When RBW is 1 Hz, RF ATT is 0 dB ≤–146.5 dBm + 1.5f [GHz] dB typ. (1 MHz to 2.5 GHz, band 0) ≤–142.5 dBm + 1.5f [GHz] dB typ. (2.5 to 3.2 GHz, band 0) ≤–137.5 dBm typ. (3.15 to 7.9 GHz, band 1) ≤–129.5 dBm typ. (7.8 to 15.2 GHz, band 2) ≤–125.5 dBm typ. (15.1 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
Detection mode	NORMAL, POSITIVE PEAK, NEGATIVE PEAK, SAMPLE, RMS RMS: displays root-mean-square value of average power between sample points
Average noise level	When RBW is 10 Hz, RF ATT is 0 dB ≤–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 to 3.2 GHz, band 0) ≤–127.5 dBm typ. (3.15 to 7.9 GHz, band 1) ≤–119.5 dBm typ. (7.8 to 15.2 GHz, band 2) ≤–115.5 dBm typ. (15.1 to 30 GHz, band 4)

Option 05: Rubidium Reference Oscillator*

Frequency	10 MHz
Start-up characteristics	±1 x 10^{-9}/7 min. (with frequency one hour after the power is turned on referenced)
Aging rate	±1 x 10^{-10}/month (with frequency one hour after the power is turned on referenced)
Temperature characteristics	±1 x 10^{-9} (with frequency at 0˚ to 45˚C and 25˚C referenced)
Accessories	J1066 Coaxial Code 0.15 m (BNC211-LP4)

∗: Can not be installed with option 22

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) and 50 Ω
Input level range	Differential voltage range: 0.1 to 1 Vp-p (at 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 Typical value (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 Typical value (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 x 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	
MS2681A	Spectrum Analyzer	
MS2683A	Spectrum Analyzer	
MS2687B	Spectrum Analyzer	
	Standard accessories	
	Power Cord, 2.6 m:	1 pc
J0996B	RS-232C Cable:	1 pc
Z0808	Memory Card:	1 pc
F0014	Fuse, 6.3 A:	1 pc
MX268001A	File Transfer Utility:	1 pc
W1754AE	MS2681A/2683A/2687B Operation Manual:	1 copy
	Options	
MS2681A-01	Precision Frequency Reference (aging rate: ±5 x 10^{-10}/day)	
MS2681A-02	Narrow Resolution Bandwidths (FFT)	
MS2681A-04	Digital Resolution Bandwidth	
MS2681A-08	Pre-amplifier	
MS2681A-09	Ethernet Interface	
MS2681A-17	I/Q Balanced Input	
MS2681A-18	I/Q Unbalanced Input	
MS2681A-46	Auto Power Recovery	
MS2681A-47	Rack Mount (IEC) without Handles	
MS2681A-48	Rack Mount (JIS) without Handles	
MS2683A-01	Precision Frequency Reference (aging rate: ±5 x 10^{-10}/day)	
MS2683A-02	Narrow Resolution Bandwidths (FFT)	
MS2683A-03	Extension of Pre-selector Lower Limit to 1.6 GHz	
MS2683A-04	Digital Resolution Bandwidth	
MS2683A-08	Pre-amplifier	
MS2683A-09	Ethernet Interface	
MS2683A-17	I/Q Balanced Input	
MS2683A-18	I/Q Unbalanced Input	
MS2683A-34	4 GHz LO Output	
MS2683A-46	Auto Power Recovery	
MS2683A-47	Rack Mount (IEC) without Handles	
MS2683A-48	Rack Mount (JIS) without Handles	
MS2687B-01	Precision Frequency Reference (aging rate: ±5 x 10^{-10}/day)	
MS2687B-02	Narrow Resolution Bandwidths (FFT)	
MS2687B-04	Digital Resolution Bandwidth	
MS2687B-05	Rubidium Reference Oscillator	
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	
MX268101B	W-CDMA Measurement Software	
MX268102A	GSM Measurement Software	
MX268103A	cdma Measurement Software	
MX268104A	1xEV-DO Measurement Software	
MX268105A	π/4DQPSK Measurement Software	
MX268130A	WIRELESS LAN Measurement Software	
MX268151A	W-CDMA Release5 Uplink Measurement Software	
MX268160A	TD-SCDMA Measurement Software	
MX268301B	W-CDMA Measurement Software	
MX268302A	GSM Measurement Software	
MX268303A	cdma Measurement Software	
MX268304A	1xEV-DO Measurement Software	
MX268305A	π/4DQPSK Measurement Software	
MX268330A	WIRELESS LAN Measurement Software	
MX268351A	W-CDMA Release5 Uplink Measurement Software	
MX268360A	TD-SCDMA 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	W-CDMA Measurement Software Operation Manual (MS2681A/2683A/2687B Common)
W1854AE	GSM Measurement Software Operation Manual (MS2681A/2683A/2687B Common)
W1865AE	cdma Measurement Software Operation Manual (MS2681A/2683A/2687B Common)
W2090AE	1xEV-DO Measurement Software Operation Manual (MS2681A/2683A/2687B Common)
W1866AE	π/4DQPSK Measurement Software Operation Manual (MS2681A/2683A/2687B Common)
W2080AE	WIRELESS LAN Measurement Software Operation Manual (MS2681A/2683A/2687B Common)
W2617AE	W-CDMA Release5 Uplink Measurement Software Operation Manual (MS2681A/2683A/2687B Common)
W2593AE	TD-SCDMA Measurement Software Operation Manual (MS2681A/2683A/2687B Common)
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	50 Ω → 75 Ω Impedance Transformer (75 Ω, 9 kHz to 3 GHz, ±100 V, NC-type)
MP614B	50 → 70 Ω Impedance Converter (50 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)
34AKNF50	Ruggedized K-to-Type N Adapter
MA2507A	DC Block Adaptor (50 Ω, 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 to 26.5 GHz)
MA2741A	External Mixer (26.5 to 40 GHz)
MA2742A	External Mixer (33 to 50 GHz)
MA2743A	External Mixer (40 to 60 GHz)
MA2744A	External Mixer (50 to 75 GHz)
MA2745A	External Mixer (60 to 90 GHz)
MA2746A	External Mixer (75 to 110 GHz)
J0364	APC-3.5 to N Conversion Connector (for MA4703A and MA4605A)
	Warranty
MS2681A-90	Extended Three Year Warranty Service
MS2681A-91	Extended Five Year Warranty Service
MS2683A-90	Extended Three Year Warranty Service
MS2683A-91	Extended Five Year Warranty Service
MS2687B-90	Extended Three Year Warranty Service
MS2687B-91	Extended Five Year Warranty Service

SPECTRUM ANALYZER

MS2668C

9 kHz to 40 GHz (18 to 110 GHz)

CE PTA GPIB

For Measuring High-Speed Communications, such as MMAC and ITS

The MS2668C is a compact, lightweight and low-price spectrum analyzer covering the frequency range from 9 kHz to 40 GHz.
It has superior basic performance, such as high C/N ratio, low distortion, and high frequency/level accuracies, and is easy to operate.
The large selection of options means a wide range of applications can be handled at reasonable cost.

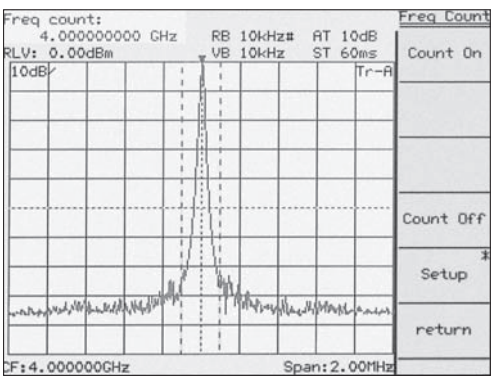
Features

- Millimeter-wave Applications
- Compact and Lightweight (15 kg in standard configuration)
- High C/N and Superior Distortion Characteristics
- Easy-to-use, Simple Operation
- Versatile Options Supporting Wide Range of Applications

Performance and Functions

- **Counter with 1 Hz Resolution**

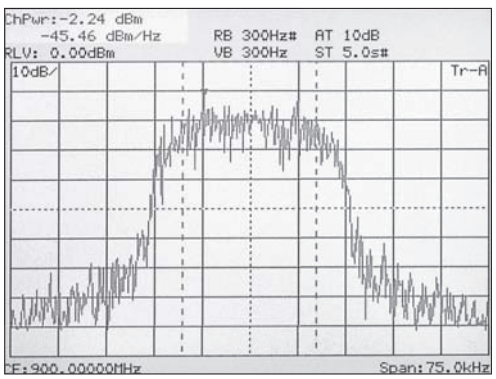
The MS2668C has a full complement of frequency counter function. The resolution is as high as ±1 Hz even at full span, and high-speed frequency measurements is easy. The high sensitivity compared to ordinary counters makes it easy to select and determine the frequency of one signal from many.



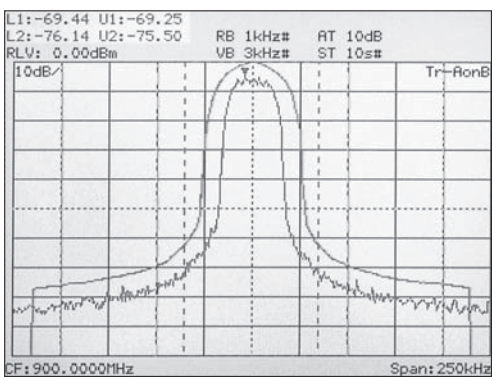
Frequency Measurement (1 Hz Resolution)

- **Radio Evaluation (Measure Functions)**

The full range of functions including measurement of power levels, frequencies, adjacent channel power, and mask and time template measurements support easy evaluation of radio performance. Key operation is simple and high-speed calculations make measurement fast and efficient.



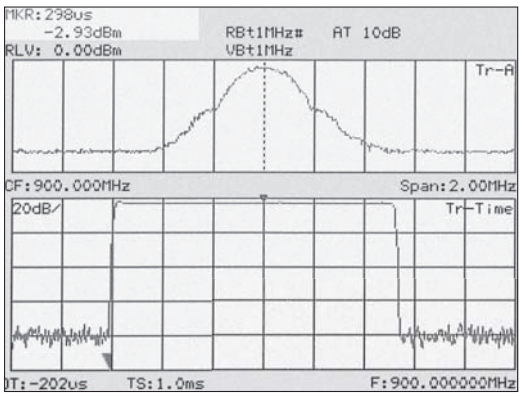
Channel Power Measurement



Adjacent Channel Power Measurement

• Split-screen Display

Two waveforms (Trace A and Trace B) with different frequencies can be displayed on a split screen simultaneously. Additionally, the same signal can be displayed in the frequency and time domains simultaneously. The split-screen display also permits efficient signal level adjustment and harmonic distortion measurement. In addition to displaying amplitude in the time domain, the FM-demodulation waveform can also be displayed.



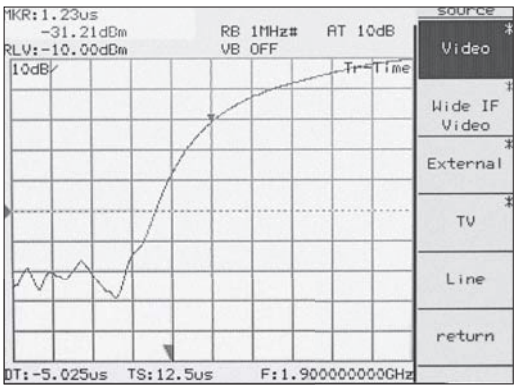
Spectrum and Time Domain Measurement

• For Testing Digital Mobile Communication Equipment

High-speed Time-domain Sweep (Option 04)

Testing of TDMA-type radio equipment requires measurements of antenna power, transient response characteristics of burst transmissions, transmission timing, and other characteristics in the time domain (zero span). Adding the High-speed time-domain sweep option boosts sweep time to 12.5 µs and resolution to 0.025 µs.

∗This option must be used with the Trigger/gate circuit (Option 06).



High-speed Time Domain Measurement (TS = 12.5 µs)

Specifications

Except where noted otherwise, specified values are obtained after warming-up 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 40 GHz
	Frequency band	Band 0: 0 kHz to 3.2 GHz (n = 1), Band 1–: 3.1 to 5.6 GHz (n = 1), Band 1+: 5.4 to 8.1 GHz (n = 1), Band 1+: 8.0 to 14.3 GHz (n = 2), Band 2–: 14.1 to 26.5 GHz (n = 4), Band 3–: 26.2 to 40 GHz (n = 6) ∗n: local harmonic order
	Pre-selector range	3.1 to 40 GHz
	Frequency setting resolution	(1 x n) Hz ∗n: local harmonic order
	Frequency display accuracy	± (display frequency x reference frequency accuracy + span x span accuracy) ∗Span: ≥ (10 x n) kHz, n: local harmonic order
	Marker frequency display accuracy	Normal marker: Same as display frequency accuracy Delta marker: Same as frequency span accuracy
	Frequency counter	Resolution: 1, 10, 100 Hz, 1 kHz Accuracy: Display frequency x reference frequency accuracy ±1 LSD (at S/N: ≥20 dB)
	Frequency span	Setting range: 0 Hz, (100 x n) Hz to 40.0 GHz ∗n: local harmonic order Accuracy: ±5%
	Resolution bandwidth (RBW) (3 dB bandwidth)	Setting range: 1, 3, 10, 30, 100, 300 kHz, 1, 3 MHz (manually settable, or automatically settable according to frequency span) ∗Option 02 (30, 100, 300 Hz), Option 03 (10, 30, 100, 300 Hz) added Measurements of noise, C/N, adjacent channel power and channel power using Measure function are executed with the calculated equivalent noise bandwidth of the RBW. Bandwidth accuracy: ±20% (1 kHz to 1 MHz), ±30% (3 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 and stability	Sideband noise: ≤–95 + 20 log n dBc/Hz (1 MHz to 40 GHz, 10 kHz offset) ∗n: local harmonic order Residual FM: ≤20 Hzp-p/0.1 s (1 GHz, span: 0 Hz) Frequency drift: ≤200 x n Hz/min (span: ≤10 kHz, sweep time: ≤100 s) ∗After 1 hour warm-up at constant ambient temperature; n: local harmonic order
	Reference oscillator	Frequency: 10 MHz Start-up characteristics: ≤5 x 10^{-8} /year (after 10 minutes warm-up, referenced to frequency after 24 hours warm-up) Aging rate: ≤1 x 10^{-7} /year, ≤2 x 10^{-8} /day Temperature characteristics: ±5 x 10^{-8} (0˚ to 50˚C, referenced to frequency at 25˚C)
Amplitude	Level measurement	Measurement range: Average noise level to +30 dBm Maximum input level: +30 dBm (CW average power, RF ATT: ≥10 dB), 0 V Average noise level: ≤–115 dBm (1 MHz to 1 GHz), ≤–115 dBm + 1.5f [GHz] dB (1 to 3.1 GHz), ≤–114 dBm (3.1 to 8.1 GHz), ≤–113 dBm (8.0 to 14.3 GHz), ≤–105 dBm (14.1 to 26.5 GHz), ≤–101 dBm (26.2 to 40 GHz) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB Residual response: ≤–90 dBm (RF ATT: 0 dB, input: 50 Ω terminated, 1 MHz to 8.1 GHz)

Continued on next page

Amplitude	Reference level	Setting range Log scale: –100 to +30 dBm, Linear scale: 224 µV to 7.07 V Unit Log scale: dBm, dBµV, dBmV, V, dBµVemf, W Linear scale: V Reference level accuracy: ±0.4 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) *After calibration, at 100 MHz, span: 1 MHz (when RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (1 kHz to 1 MHz), ±0.4 dB (3 MHz) *After calibration, referenced to RBW: 3 kHz Input attenuator (RF ATT) Setting range: 0 to 70 dB (10 dB steps) *Manual settable, or automatically settable according to reference level Switching uncertainty: ±0.3 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) *After calibration, frequency: 100 MHz, referenced to RF ATT: 10 dB
	Frequency response	Relative: ±1.5 dB (9.0 kHz to 3.2 GHz), ±1.0 dB (100 kHz to 3.2 GHz), ±1.5 dB (3.1 to 8.1 GHz), ±3.0 dB (8.0 to 14.3 GHz), ±4.0 dB (14.1 to 26.5 GHz), ±4.0 dB (26.2 to 40 GHz) *After pre-selector tuning at microwave band, referenced to midpoint between highest and lowest frequency deviation in each band. Absolute: ±5.0 dB (9 kHz to 40 GHz, RF ATT: 10 dB, referenced to 100 MHz) *After pre-selector tuning at microwave band
	Waveform display	Scale (10 div.) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (–20 to 0 dB, RBW: ≤1 MHz), ±1.0 dB (–70 to 0 dB, RBW: ≤100 kHz), ±1.5 dB (–85 to 0 dB, RBW: ≤3 kHz), ±2.5 dB (–90 to 0 dB, RBW: ≤3 kHz) Linear scale: ±4% (compared to reference level) Marker level resolution Log scale: 0.01 dB, Linear scale: 0.02% of reference level
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, mixer input: –30 dBm), ≤–70 dBc (0.2 to 1.55 GHz, mixer input: –30 dBm), ≤–90 dBc or noise level (1.55 to 20 GHz, mixer input: –10 dBm) Two signal 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–80 dBc (0.1 to 8.1 GHz), ≤–75 dBc or average noise level (8.1 to 26.5 GHz), ≤–75 dBc or average noise level (typ., 26.5 to 40 GHz) *Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm Image response: ≤–65 dBc (≤18 GHz), ≤–60 dBc (≤22 GHz), ≤–55 dBc (≤40 GHz) Multiple/out of band response: ≤–70 dBc (≤14 GHz), ≤–60 dBc (≤26 GHz), ≤–55 dBc (≤40 GHz)
	1 dB gain compression	≥–5 dBm (≥100 MHz, at mixer input)
Sweep	Sweep time	Setting range: 20 ms to 1000 s (manually settable, or automatically settable according to span, RBW, and VBW) Accuracy: ±15% (20 ms to 100 s), ±25% (110 to 1000 s), ±1% (time domain sweep: digital zero span mode)
	Sweep mode	Continuous, Single
	Time domain sweep mode	Analog zero span, Digital zero span
	Zero sweep	Sweeps only in frequency range indicated by zone marker.
	Tracking sweep	Sweeps while tracing peak points within zone marker (zone sweep also possible).
Functions	Number of data points	501
	Detection mode	NORMAL: Simultaneously displays max. and min. points between sample points. POS PEAK: Displays max. point between sample points. NEG PEAK: Displays min. point between sample points. SAMPLE: Displays momentary value at sample points. Detection mode switching uncertainty: ±0.5 dB (at reference level)
	Display	Color TFT-LCD, Size: 5.5-inch, Number of colors: 17 (RGB, each 64-scale settable), Intensity adjustment: 5 steps settable
	Display functions	Trace A: Displays frequency spectrum. Trace B: Displays frequency spectrum. Trace Time: Displays time domain waveform at center frequency. Trace A/B: Displays Trace A and Trace B simultaneously. Simultaneous sweep of same frequency, alternate sweep of independent frequencies. Trace A/BG: Displays frequency region to be observed (background) and object band (foreground) selected from background with zone marker simultaneously. Trace A/Time: Displays frequency spectrum, and time domain waveform at center frequency simultaneously. Trace move/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
	FM demodulation waveform display function	Demodulation range: 2, 5, 10, 20, 50, 100, 200 kHz/div Marker display Accuracy: ±5% of full scale (referenced to center frequency, DC-coupled, RBW: 3 MHz, VBW: 1 Hz, CW) Demodulation frequency response: DC (50 Hz at AC-coupled) to 100 kHz (range: ≤20 kHz/div, VBW: Off, at 3 dB bandwidth) DC (50 Hz at AC-coupled) to 500 kHz (range: ≤50 kHz/div, VBW: Off, at 3 dB bandwidth) *RBW: ≥1 kHz to 3 MHz usable
	Input connector	K-J, 50 Ω
	Auxiliary signal input and output	IF OUTPUT: –10 dBm (typ., 100 MHz, upper edge of scale, 50 Ω terminated), 10.69 MHz, BNC connector VIDEO OUTPUT (Y): 0 to 0.5 V ± 0.1 V (typ., from lower edge to upper edge at 10 dB/div) 0 to 0.4 V ± 0.1 V (typ., from lower edge to upper edge at 10%/div) BNC connector *75 Ω terminated at 100 MHz input COMPOSITE OUTPUT: For NTSC, 1 Vp-p (75 Ω terminated), BNC connector EXT REF INPUT: 10 MHz ± 10 Hz, –10 to +2 dBm (50 Ω terminated), BNC connector REF BUFFERED OUTPUT: ≥0 dBm (50 Ω terminated), BNC connector 1ST LOCAL OUTPUT: 4 to 7 GHz, ≥+8 dBm, 50 Ω, SMA-J connector

Continued on next page

Functions	Signal search	AUTO TUNE, PEAK → CF, PEAK → REF, SCROLL
	Zone marker	NORMAL, DELTA
	Marker →	MARKER → CF, MARKER → REF, MARKER → CF STEP SIZE, Δ MARKER → SPAN, ZONE → SPAN
	Peak search	PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK, MIN DIP, NEXT DIP
	Multi-marker	Number of markers: 10 max. (HIGHEST 10, HARMONICS, MANUAL SET)
	Measure	Noise power (dBm/Hz, dBm/ch), C/N (dBc/Hz, dBc/ch), Occupied bandwidth (power N% method, X-dB down method), Adjacent channel power (REF: total power/reference level/in-band level method, channel designate display: 2 channels x 2 graphic display), Average power of burst signal (average power in designated time range of time domain waveform), Channel power (dBm, dBm/Hz), Template comparison (upper/lower limits x each 2, time domain), MASK (upper/lower x each 2, frequency domain)
	Save/Recall	Saves setting conditions and waveform data to internal memory (max. 12) or memory card.
	Hard copy	Printer (HP dot matrix, EPSON dot matrix or compatible models): Display data hard-copied via RS-232C, GPIB and Centronics (Option 10) interfaces ∗HP dot image (control code: PCL3), EPSON dot image (control code: ESC/P-J84) There are restrictions on compatible types. Plotter (HP-GL, GP-GL compatible models): Screen output via RS-232C and GPIB interface
	PTA	Language: PTL (BASIC interpreter) Programming: Using external computer. Program memory: Memory card, upload/download to/from external computer Programming capacity: 192 KB Data processing: Directly accesses measurement data according to system variables, system subroutines, and system functions
	RS-232C	Outputs data to printer and plotter. Control from external computer (excluding power switch).
	GPIB	Meets IEEE488.2. Controlled by external computer (excluding power switch). Or controls external equipment with PTA. Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C28
	Correction	Automatic correction of insertion loss of MA1621A Impedance Transformer Correction accuracy (RF ATT: ≥10 dB): ±2.5 dB (9 to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 to 3 GHz) ∗Typical value
	Memory card interface	Functions: Saving/Recalling measurement parameters/Waveform data, Uploading/Downloading PTA programs; Supported cards: SRAM, EPROM, Flash EEROM Connector: PCMCIA Rel. 2.0, 2 slots ∗SRAM Memory cards: Read and write (Card size: 2 MB max.) EPROM and EEROM Memory cards: Read (Card size: 2 MB max.) The supported operating systems are Windows 95, 98, and XP.
External mixer	Frequency	Frequency range: 18 to 110 GHz Frequency band configuration Band K: 18 to 26.5 GHz (n = 4), Band A: 26.5 to 40 GHz (n = 6), Band Q: 33 to 50 GHz (n = 8), Band U: 40 to 60 GHz (n = 9), Band V: 50 to 75 GHz (n = 11), Band E: 50 to 90 GHz (n = 13), Band W: 75 to 110 GHz (n = 16) Span setting range: 0 Hz, (100 x n) Hz to each bandwidth ∗n: local harmonic order
	Amplitude	Level measurement Mixer conversion loss setting range: 15 to 85 dB Maximum input level: Depends on external mixer Average noise level: Depends on external mixer Reference level setting range: –100 dBm to (–25 to M) dBm ∗Log scale, M: Mixer conversion loss Frequency response: Depends on the external mixer used
	Input/output	Suitable mixer: 2-port mixer only (local frequency: 4 to 7 GHz, IF frequency: 689.31 MHz) Display gain: 0 ±2 dB (external mixer input: –10 dBm, at mixer conversion loss of 15 dB)
Others	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1
	Vibration	MIL-STD-810D
	Power supply (operating range)	85 to 132/170 to 250 Vac (automatic voltage switching), 47.5 to 63 Hz, ≤400 VA
	Dimensions and mass	320 (W) x 177 (H) x 381 (D) mm, ≤15 kg (without options)
	Ambient temperature	0˚ to +50˚C (operation), –40˚ to +75˚C (storage)

• Option 02: Narrow Resolution Bandwidth

Resolution bandwidth (3 dB)	30, 100, 300 Hz
Resolution bandwidth switching uncertainty	±0.4 dB (RBW: 3 kHz reference)
Resolution bandwidth accuracy	±20%
Selectivity (60 dB : 3 dB)	≤15:1

• Option 03: Narrow Resolution Bandwidth

Resolution bandwidth (3 dB)	10, 30, 100, 300 Hz
Resolution bandwidth switching uncertainty	±0.4 dB (RBW: 3 kHz reference)
Resolution bandwidth accuracy	±20%
Selectivity (60 dB : 3 dB)	≤15:1
Average noise level	≤–135 dBm (1 MHz to 1 GHz) ≤–135 dBm + 1.5f [GHz] dB (1 to 3.1 GHz) ≤–132 dBm (3.1 to 8.1 GHz) ≤–131 dBm (8.0 to 14.3 GHz) ≤–123 dBm (14.1 to 26.5 GHz) ≤–119 dBm (26.2 to 40 GHz) ∗RBW: 10 Hz, VBW: 1 Hz, RF ATT: 0 dB

• Option 04: High-speed Time Domain Sweep*

Sweep time	12.5, 25, 50, 100 to 900 µs (one most significant digit settable) 1.0 to 19 ms (two upper significant digits settable)
Accuracy	±1%
Marker level resolution	Log scale: 0.1 dB Linear scale: 0.2% (relative to reference level)

∗: This option is recommended to be mounted together with option 06.

• Option 06: Trigger/Gate Circuit

Trigger switch	FREERUN, TRIGGERED
Trigger source	EXT Trigger level: ±10 V (resolution: 0.1 V), TTL level Trigger slope: Rise/Fall Connector: BNC VIDEO Log scale: –100 to 0 dB (resolution: 1 dB) Trigger slope: Rise/Fall WIDE IF VIDEO Trigger level: High, middle, or low selectable Bandwidth: ≥20 MHz Trigger slope: Rise/Fall LINE Frequency: 47.5 to 63 Hz (line lock)
Trigger delay	Pre-trigger (displays waveform from previous max. 1 screen at trigger point) Range: –time span to 0 s, Resolution: time span/500 Post-trigger (displays waveform from after max. 65.5 ms at trigger point) Range: 0 to 65.5 ms, Resolution: 1 µs
Gate sweep	In frequency domain, displays spectrum of input signal in specified gate interval. Gate delay: 0 to 65.5 ms (from trigger point, resolution: 1 µs) Gate width: 2 µs to 65.5 ms (from gate delay, resolution: 1 µs)

• Option 07: AM/FM Demodulator

Voice output	With internal loudspeaker and earphone connector (ø3.5 jack), adjustable volume

• Option 10: Centronics Interface*

Function	Outputs data to printer (Centronics standard)
Connector	D-Sub 25 pin (jack)

*: GPIB interface can not be installed simultaneously.

• Option 15: Sweep Signal Output

Sweep output (X)	0 to 10 V ±1 V (≥100 kΩ termination, from left side to right side of display scale), BNC connector
Sweep status output (Z)	TTL level (low level with sweeping), BNC connector

• External Mixer

Models	Frequency range	Flange	Max. input power
MA2740A	18 to 26.5 GHz	MIL-F-3922/68-001KM	100 mW
MA2741A	26.5 to 40 GHz	MIL-F-3922/68-001AM	100 mW
MA2742A	33 to 50 GHz	MIL-F-3922/67B-006	100 mW
MA2743A	40 to 60 GHz	MIL-F-3922/67B-007	100 mW
MA2744A	50 to 75 GHz	MIL-F-3922/67B-008	100 mW
MA2745A	60 to 90 GHz	MIL-F-3922/68B-009	100 mW
MA2746A	75 to 110 GHz	MIL-F-3922/68B-010	100 mW

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
MS2668C	Spectrum Analyzer
	Standard accessories
	Power Cord, 2.6 m: 1 pc
F0013	Fuse, 5 A: 2 pcs
W1335AE	MS2668C Operation Manual: 1 copy
B0329G	Front Cover (3/4MW4U): 1 pc
	Options
MS2668C-02	Narrow Resolution Bandwidth
MS2668C-03	Narrow Resolution Bandwidth
MS2668C-04	High-speed Time Domain Sweep
MS2668C-06	Trigger/Gate Circuit
MS2668C-07	AM/FM Demodulator (outputs to loudspeaker or earphone connector)
MS2668C-10	Centronics Interface (GPIB interface can not be used simultaneously)
MS2668C-15	Sweep Signal Output
	Warranty
MS2668C-90	Extended Three Year Warranty Service
MS2668C-91	Extended Five Year Warranty Service
	Application parts
J0911	Coaxial Cord (K-P · K-P), 1 m (DC to 40 GHz, SUCOFLEX 102A)
J0912	Coaxial Cord (K-P · K-P), 0.5 m (DC to 40 GHz, SUCOFLEX 102A)
34AKNF50	Coaxial Adaptor (DC to 20 GHz, SWR: 1.5, ruggedized K-P · N-J)
J0322B	Coaxial Cord (SMA-P · SMA-P), 1 m (DC to 18 GHz, SUCOFLEX 104)
J0561	Coaxial Cord (N-P-5W · 5D-2W · N-P-5W), 1 m
J0104A	Coaxial Cord (BNC-P · RG-55/U · N-P), 1 m
CSCJ-256K-SM	256 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-512K-SM	512 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-001M-SM	1024 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-002M-SM	2048 KB Memory Card (meets PCMCIA Rel. 2.0)
B0395A	Rack Mount Kit (IEC)
B0395B	Rack Mount Kit (JIS)
MP612A	RF Fuse Holder (without elements)
MP613A	Fuse Element (5 pcs/set)

Model/Order No.	Name
J0805	DC Block (Model 7003, 10 kHz to 18 GHz, ±50 V, N-type, Weinschel product)
J0910	DC Block (Model 7006, 10 kHz to 18 GHz, ±50 V, SMA-type, Weinschel product)
MA2507A	DC Block Adaptor (50 Ω, 9 kHz to 3 GHz, ±50 V, N-type)
MA8601A	DC Block Adaptor (50 Ω, 30 kHz to 2 GHz, ±50 V, N-type)
MA8601J	DC Block Adaptor (75 Ω, 10 kHz to 2.2 GHz, ±50 V, N-type)
MA1621A	50 Ω → 75 Ω Impedance Transformer (9 kHz to 3 GHz, ±100 V, NC-type)
MP614B	50 Ω ↔ 75 Ω Impedance Transformer (50 to 1200 MHz, transformer type, N-P/NC-J, 1 W)
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J0742A	RS-232C Cable, 1 m (for PC-98 Personal Computer and VP-600, D-Sub 25 pin, straight)
J0743A	RS-232C Cable, 1 m (for PC/AT compatible, D-Sub 9 pin, cross)
J0064A	7 GHz Band Coaxial/waveguide Adaptor (5.8 to 8.6 GHz, N-J · BRJ-7)
J0064C	10 GHz Band Coaxial/waveguide Adaptor (8.2 to 12.4 GHz, N-J · BRJ-10)
J0004	Coaxial Adaptor (N-P · SMA-J)
DGM010-02000EE	Coaxial Cord, 2 m (N-type connector, general use)
DGM024-02000EE	Coaxial Cord, 2 m (N-type connector, low-loss type)
J0063	Fixed Attenuator for High Power (30 dB, 10 W, DC to 12.4 GHz, N-type)
J0395	Fixed Attenuator for High Power (30 dB, 30 W, DC to 9 GHz, N-type)
J0078	Fixed Attenuator for High Power (20 dB, 10 W, DC to 18 GHz, N-type)
MP526D	High Pass Filter (400 MHz band, N-type)
MA1601A	High Pass Filter (800/900 MHz band, N-type)
MA2740A	External Mixer (18 to 26.5 GHz)
MA2741A	External Mixer (26.5 to 40 GHz)
MA2742A	External Mixer (33 to 50 GHz)
MA2743A	External Mixer (40 to 60 GHz)
MA2744A	External Mixer (50 to 75 GHz)
MA2745A	External Mixer (60 to 90 GHz)
MA2746A	External Mixer (75 to 110 GHz)
B0421A	Carrying Case (hard type, with casters)
B0421B	Carrying Case (hard type, without casters)
B0435A	Carrying Case (soft type)

SPECTRUM ANALYZER

MS2667C

9 kHz to 30 GHz (18 to 110 GHz)

CE GPIB

For Evaluating LMDS Subscriber Radio Systems

The MS2667C is a compact, lightweight and low-price spectrum analyzer covering the frequency range from 9 kHz to 30 GHz. It has superior basic performance, such as high C/N ratio, low distortion, and high frequency/level accuracies, and is easy to operate.
The large selection of options means a wide range of applications can be handled at reasonable cost.

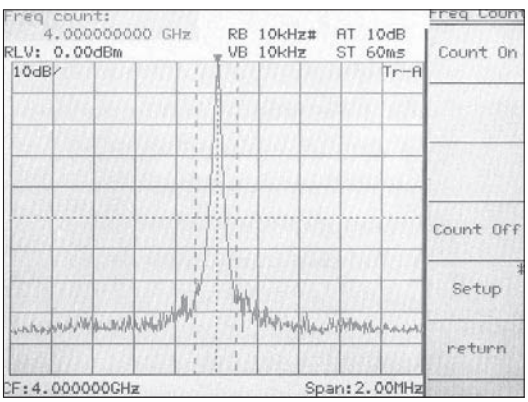
Features

- Compact and Lightweight (15 kg in standard configuration)
- High C/N and Superior Distortion Characteristics
- Easy-to-use, Simple Operation
- Millimeter-wave Applications
- Versatile Options Supporting Wide Range of Applications

Performance and Functions

- **Counter with 1 Hz Resolution**

The MS2667C has a full complement of frequency counter function. The resolution is as high as ±1 Hz even at full span, and high-speed frequency measurements is easy. The high sensitivity compared to ordinary counters makes it easy to select and determine the frequency of one signal from many.



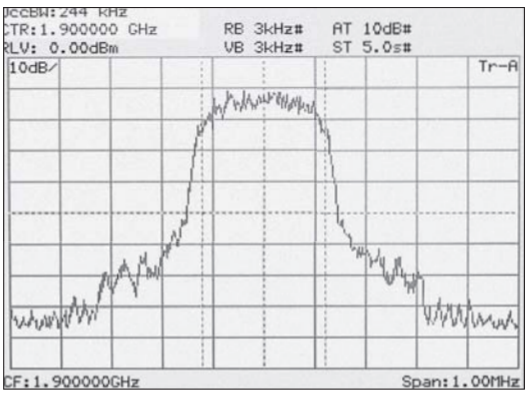
Frequency Measurement (1 Hz Resolution)

- **100 dB Display Dynamic Range**

The MS2667C can display nearly 90 dB on a single screen for measurements requiring a wide dynamic range, such as adjacent channel power.

- **High-accuracy Measurement**

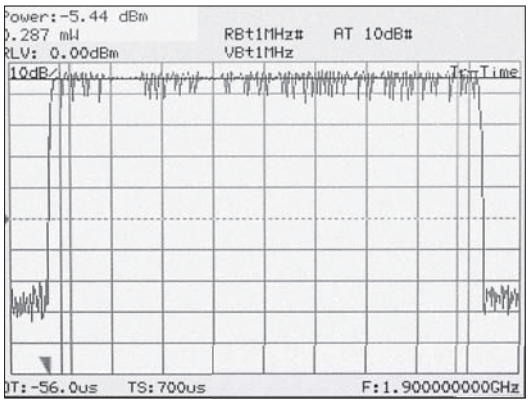
Auto-calibration ensures high-level accuracy.
A span accuracy of 2.5% and 501 sampling points offer accurate measurement of occupied frequency bandwidth and adjacent channel power.



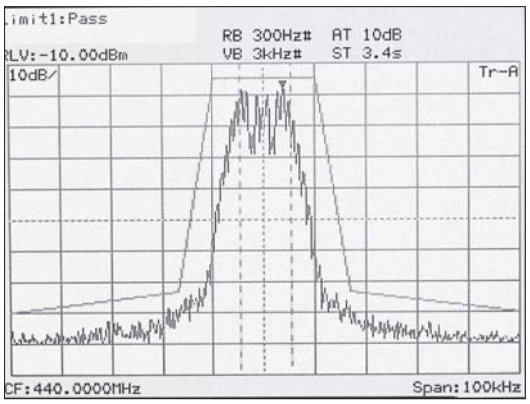
Occupied Bandwidth Measurement

• Radio Evaluation (Measure Functions)

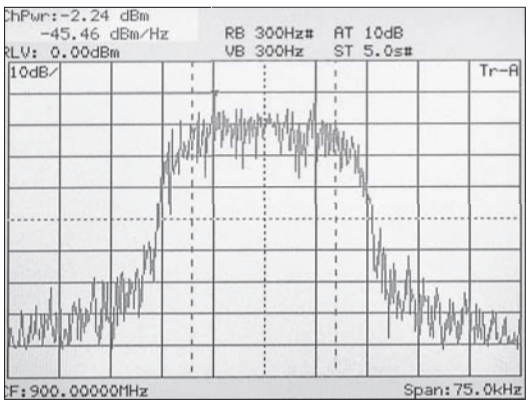
The full range of functions including measurement of power levels, frequencies, adjacent channel power, and mask and time template measurements support easy evaluation of radio performance.
Key operation is simple and high-speed calculations make measurement fast and efficient.



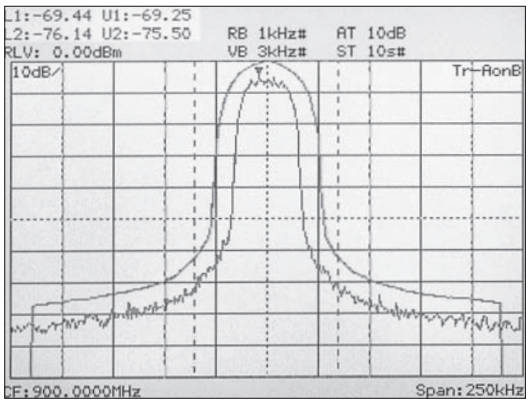
Burst Average Power Measurement



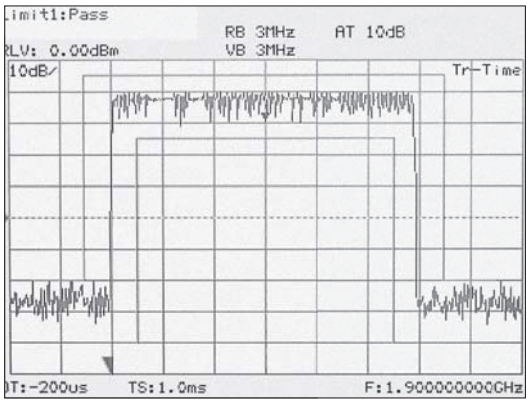
Mask Measurement



Channel Power Measurement



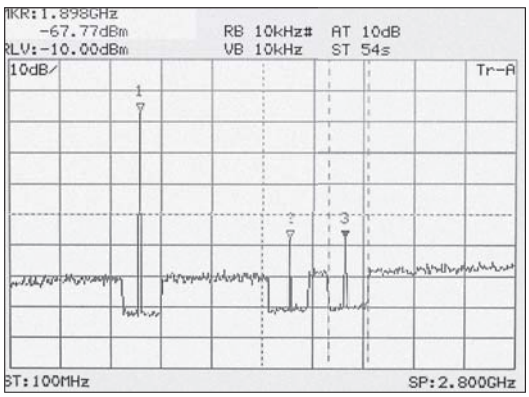
Adjacent Channel Power Measurement



Time Template Measurement

• Zone Sweep and Multi-zone Sweep Functions

Sweeps can be limited to zones defined by zone markers, resulting in shorter sweep times. This zone sweep function can be combined with Measure functions such as Noise Measure to directly read the total noise power in the zone, greatly reducing measurement times. The multi-zone sweep function can sweep a maximum of 10 zones.



Multi-zone Sweep

Specifications

Except where noted otherwise, specified values are obtained after warming-up 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
	Frequency band	Band 0: 0 to 3.2 GHz (n: 1), Band 1–: 3.1 to 6.5 GHz (n: 1), Band 1+: 6.4 to 8.1 GHz (n: 1), Band 2+: 8.0 to 15.3 GHz (n: 2), Band 3+: 15.2 to 22.4 GHz (n: 3), Band 4+: 22.3 to 30 GHz (n: 4) ∗n: local harmonic order
	Pre-selector range	3.1 to 30 GHz (band 1–, 1+, 2+, 3+, 4+)
	Frequency setting resolution	(1 x n) Hz ∗n: local harmonic order
	Frequency display accuracy	± (display frequency x reference frequency accuracy + span x span accuracy) ∗Span: ≥ (10 x n) kHz (n: local harmonic order, after calibration)
	Marker frequency display accuracy	Normal marker: Same as display frequency accuracy Delta marker: Same as frequency span accuracy
	Frequency counter	Resolution: 1, 10, 100 Hz, 1 kHz Accuracy: Display frequency x reference frequency accuracy ±1 LSD (at S/N: ≥20 dB)
	Frequency span	Setting range: 0 Hz, 100 Hz to 30 GHz Accuracy: ±5%
	Resolution bandwidth (RBW) (3 dB bandwidth)	Setting range: 1, 3, 10, 30, 100, 300 kHz, 1, 3 MHz (manually settable, or automatically settable according to frequency span) ∗Option 02 (30, 100, 300 Hz), Option 03 (10, 30, 100, 300 Hz) added Measurements of noise, C/N, adjacent channel power and channel power using Measure function are executed with the calculated equivalent noise bandwidth of the RBW. Bandwidth accuracy: ±20% (1 kHz to 1 MHz), ±30% (3 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 and stability	Sideband noise: ≤–95 + 20 log n dBc/Hz (1 MHz to 30 GHz, 10 kHz offset) ∗n: local harmonic order Residual FM: ≤20 Hzp-p/0.1 s (1 GHz, span: 0 Hz) Frequency drift: ≤200 x n Hz/min (span: ≤10 kHz x n, sweep time: ≤100 s) ∗After 1 hour warm-up at constant ambient temperature; n: local harmonic order
	Reference oscillator	Frequency: 10 MHz Aging rate: ≤1 x 10^{-7}/year, ≤2 x 10^{-8}/day Temperature characteristics: ±5 x 10^{-5} (0˚ to 50˚C, referenced to frequency at 25˚C)
Amplitude	Level measurement	Measurement range: Average noise level to +30 dBm Maximum input level: +30 dBm (CW average power, RF ATT: ≥10 dB), 0 Vdc Average noise level: ≤–115 dBm (1 MHz to 1 GHz, band 0), ≤–115 dBm + 1.5f [GHz] dB (1 to 3.1 GHz, band 0), ≤–110 dBm (3.1 to 8.1 GHz, band 1), ≤–102 dBm (8.0 to 15.3 GHz, band 2), ≤–98 dBm (15.2 to 22.4 GHz, band 3), ≤–91 dBm (22.3 to 30 GHz, band 4) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB Residual response: ≤–90 dBm (RF ATT: 0 dB, input: 50 Ω terminated, 1 MHz to 8.1 GHz)
	Reference level	Setting range Log scale: –100 to +30 dBm; Linear scale: 224 µV to 7.07 V Unit Log scale: dBm, dBµV, dBmV, V, dBµV(emf), W Linear scale: V Reference level accuracy: ±0.4 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) ∗After calibration, at 100 MHz, span: 1 MHz (when RF ATT, RBW, VBW and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (1 kHz to 1 MHz), ±0.4 dB (3 MHz) ∗After calibration, referenced to RBW: 3 kHz Input attenuator (RF ATT) Setting range: 0 to 70 dB (10 dB steps) ∗Manually settable, or automatically settable according to reference level Switching uncertainty: ±0.3 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) ∗After calibration, frequency: 100 MHz, referenced to RF ATT: 10 dB
	Frequency response	Relative: ±1.5 dB (9 to 100 kHz, band 0), ±1.0 dB (100 kHz to 3.2 GHz, band 0), ±1.5 dB (3.1 to 8.1 GHz, band 1), ±3.0 dB (8 to 15.3 GHz, band 2), ±4.0 dB (15.2 to 22.4 GHz, band 3), ±4.0 dB (22.3 to 30 GHz, band 4) ∗After pre-selector tuning at band 1, 2, 3 and 4, referenced to midpoint between highest and lowest frequency deviation in each band Absolute: ±5.0 dB (9 kHz to 30 GHz, RF ATT: 10 dB, referenced to 100 MHz) ∗After pre-selector tuning at band 1, 2, 3, and 4
	Waveform display	Scale (10 div) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (–20 to 0 dB, RBW: ≤1 MHz), ±1.0 dB (–70 to 0 dB, RBW: ≤100 kHz), ±1.5 dB (–85 to 0 dB, RBW: ≤3 kHz), ±2.5 dB (–90 to 0 dB, RBW: ≤3 kHz) Linear scale: ±4% (compared to reference level) Marker level resolution Log scale: 0.01 dB, Linear scale: 0.02% of reference level
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, band 0, mixer input: –30 dBm), ≤–70 dBc (0.2 to 1.55 GHz, band 0, mixer input: –30 dBm), ≤–90 dBc or noise level (1.55 to 15 GHz, band 1, 2, 3, and 4, mixer input: –10 dBm) Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–80 dBc (0.1 to 8.1 GHz), ≤–75 dBc or average noise level (8.1 to 26.5 GHz), ≤–75 dBc or average noise level (typ., 26.5 to 30 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm Image response: ≤–65 dBc (≤18 GHz), ≤–60 dBc (≤22 GHz), ≤–55 dBc (≤30 GHz) Multiple/out of band response: ≤–60 dBc (≤22 GHz), ≤–55 dBc (≤30 GHz)
	1 dB gain compression	≥–5 dBm (≥100 MHz, at mixer input)

Continued on next page

Sweep	Sweep time	Setting range: 20 ms to 1000 s (manually settable, or automatically settable according to span, RBW and VBW) Accuracy: ±15% (20 ms to 100 s), ±25% (110 to 1000 s), ±1% (time domain sweep: digital zero span mode)
	Sweep mode	Continuous, Single
	Time domain sweep mode	Analog zero span, Digital zero span
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracing peak points within zone marker (zone sweep also possible)
Functions	Number of data points	501
	Detection mode	NORMAL: Simultaneously displays max. and min. points between sample points POS PEAK: Displays max. point between sample points NEG PEAK: Displays min. point between sample points SAMPLE: Displays momentary value at sample points Detection mode switching uncertainty: ±0.5 dB (at reference level)
	Display	Color TFT-LCD, Size: 5.5-inch, Number of colors: 17 (RGB, each 64-scale settable), Intensity adjustment: 5 steps settable
	Display functions	Trace A: Displays frequency spectrum Trace B: Displays frequency spectrum Trace Time: Displays time domain waveform at center frequency Trace A/B: Displays Trace A and Trace B simultaneously. Simultaneous sweep of same frequency, alternate sweep of independent frequencies. Trace A/BG: Displays frequency region to be observed (background) and object band (foreground) selected from background with zone marker simultaneously Trace A/Time: Displays frequency spectrum and time domain waveforms at center frequency simultaneously Trace move/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
	FM demodulation waveform display function	Demodulation range: 2, 5, 10, 20, 50, 100, 200 kHz/div Marker display Accuracy: ±5% of full scale (referenced to center frequency, DC-coupled. RBW: 3 MHz, VBW: 1 Hz, CW) Demodulation frequency response: DC (50 Hz at AC-coupled) to 100 kHz (range: ≤20 kHz/div, VBW: Off, at 3 dB bandwidth) DC (50 Hz at AC-coupled) to 500 kHz (range: ≥50 kHz/div, VBW: Off, at 3 dB bandwidth) ∗RBW: ≥1 kHz to 3 MHz usable
	Input connector	K-J, 50 Ω
	Auxiliary signal input and output	IF OUTPUT: 10.69 MHz, BNC connector VIDEO OUTPUT (Y): 0 to 0.5 V ±0.1 V (typ., from lower edge to upper edge at 10 dB/div), 0 to 0.4 V ±0.1 V (typ., from lower edge to upper edge at 10%/div) ∗75 Ω terminated at 100 MHz input, BNC connector COMPOSITE OUTPUT: For NTSC, 1 Vp-p (75 Ω terminated), BNC connector EXT REF INPUT: 10 MHz ±10 Hz, –10 to +2 dBm (50 Ω terminated), BNC connector REF BUFFERED OUTPUT: ≥0 dBm (50 Ω terminated), BNC connector 1ST LOCAL OUTPUT: 4 to 7 GHz, ≥+8 dBm, 50 Ω, SMA-J connector
	Signal search	AUTO TUNE, PEAK → CF, PEAK → REF, SCROLL
	Zone marker	NORMAL, DELTA
	Marker →	MARKER → CF, MARKER → REF, MARKER → CF STEP SIZE, ΔMARKER → SPAN, ZONE → SPAN
	Peak search	PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK, MIN DIP, NEXT DIP
	Multi-marker	Number of markers: 10 max. (HIGHEST 10, HARMONICS, MANUAL SET)
	Measure	Noise power (dBm/Hz, dBm/ch), C/N (dBc/Hz, dBc/ch), Occupied bandwidth (power N% method, X-dB down method), Adjacent channel power (REF: total power/reference level/in-band level method, Channel designate display: 2 channels x 2 graphic display), Average power of burst signal (average power in designated time range of time domain waveform), Channel power (dBm, dBm/Hz), Template comparison (upper/lower limits x each 2, time domain), MASK (upper/lower x each 2, frequency domain)
	Save/Recall	Saves and recalls setting conditions and waveform data to internal memory (max. 12) or memory card
	Hard copy	Printer (HP dot matrix, EPSON dot matrix or compatible models): Display data hard-copied via RS-232C, GPIB and Centronics (Option 10) interfaces ∗HP dot image (control code: PCL3), EPSON dot image (control code: ESC/P-J84) There are restrictions on compatible types. Plotter (HP-GL, GP-GL compatible models): Screen output via RS-232C and GPIB interface
	PTA	Language: PTL (BASIC interpreter) Programming: Using external computer Program memory: Memory card, upload/download to/from external computer Programming capacity: 192 KB Data processing: Directly accesses measurement data according to system variables, system subroutines, and system function.
	RS-232C	Outputs data to printer and plotter. Control from external computer (excluding power switch)
	GPIB	Meets IEEE488.2. Controlled by external computer (excluding power switch). Or controls external equipment with PTA Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C28
	Correction	Automatic correction of insertion loss of MA1621A Impedance Transformer Correction accuracy (RF ATT: ≥10 dB): ±2.5 dB (9 to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 to 3 GHz) ∗Typical value
	Memory card interface	Functions: Saving/Recalling measurement parameters/Waveform data, Uploading/Downloading PTA programs, Supported cards: SRAM, EPROM, Flash EEROM Connector: PCMCIA Rel. 2.0, 2 slots ∗SRAM Memory cards: Read and write (Card size: 2 MB max.) EPROM and EEROM Memory cards: Read (Card size: 2 MB max.) The supported operating systems are Windows 95, 98, and XP.

Continued on next page

External mixer	Frequency	Frequency range: 18 to 110 GHz Frequency band configuration Band K: 18 to 26.5 GHz (n: 4), Band A: 26.5 to 40 GHz (n: 6), Band Q: 33 to 50 GHz (n: 8), Band U: 40 to 60 GHz (n: 9), Band V: 50 to 75 GHz (n: 11), Band E: 60 to 90 GHz (n: 13), Band W: 75 to 110 GHz (n: 16) Span setting range: 0 Hz, (100 x n) Hz to each bandwidth ∗n: local harmonic order
	Amplitude	Level measurement Mixer conversion loss setting range: 15 to 85 dB Maximum input level: Depends on external mixer Average noise level: Depends on external mixer Reference level setting range: –100 to (–25 to M) dBm ∗Log scale, M: Mixer conversion loss Frequency response: Depends on the external mixer used
	Input/Output	Suitable mixer: 2-port mixer only (local frequency: 4 to 7 GHz, IF frequency: 689.31 MHz) Display gain: 0 ±2 dB (external mixer input: –10 dBm, at mixer conversion loss of 15 dB)
Others	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1
	Vibration	MIL-STD-810D
	Power supply (operating range)	85 to 132/170 to 250 Vac (automatic voltage switching), 47.5 to 63 Hz, ≤400 VA
	Dimensions and mass	320 (W) x 177 (H) x 381 (D) mm, ≤15 kg (without options)
	Ambient temperature	0˚ to +50˚C (operation), –40˚ to +75˚C (storage)

• Option 02: Narrow Resolution Bandwidth

Resolution bandwidth (3 dB)	30, 100, 300 Hz
Resolution bandwidth switching uncertainty	±0.4 dB (RBW 3 kHz referenced)
Resolution bandwidth accuracy	±20%
Selectivity (60 dB:3 dB)	≤15:1

• Option 03: Narrow Resolution Bandwidth

Resolution bandwidth (3 dB)	10, 30, 100, 300 Hz
Resolution bandwidth switching uncertainty	±0.4 dB (RBW 3 kHz referenced)
Resolution bandwidth accuracy	±20%
Selectivity (60 dB:3 dB)	≤15:1
Average noise level	≤–135 dBm (1 MHz to 1 GHz, band 0) ≤–135 dBm + 1.5f [GHz] dB (1 to 3.1 GHz, band 0) ≤–130 dBm (3.1 to 8.1 GHz, band 1) ≤–122 dBm (8.0 to 15.3 GHz, band 2) ≤–118 dBm (15.2 to 22.4 GHz, band 3) ≤–111 dBm (22.3 to 30 GHz, band 4) ∗RBW: 10 Hz, VBW: 1 Hz, RF ATT: 0 dB

• Option 04: High-speed Time Domain Sweep

∗ This option is recommended to be mounted together with option 06

Sweep time	12.5, 25, 50, 100 to 900 µs (one most significant digit settable) 1.0 to 19 ms (two upper significant digits settable)
Accuracy	±1%
Marker level resolution	Log scale: 0.1 dB Linear scale: 0.2% (relative to reference level)

• Option 06: Trigger/Gate Circuit

Trigger switch	FREERUN, TRIGGERED
Trigger source	EXT Trigger level: ±10 V (resolution: 0.1 V), TTL level Trigger slope: Rise/Fall Connector: BNC VIDEO Log scale: –100 to 0 dB (resolution: 1 dB) Trigger slope: Rise/Fall WIDE IF VIDEO Trigger level: High, Middle, or Low selectable Bandwidth: ≥20 MHz Trigger slope: Rise/Fall LINE Frequency: 47.5 to 63 Hz (line lock)
Trigger delay	Pre-trigger (displays waveform from previous max. 1 screen at trigger point) Range: –time span to 0 s, Resolution: time span/500 Post-trigger (displays waveform from after max. 65.5 ms at trigger point) Range: 0 to 65.5 ms, Resolution: 1 µs
Gate sweep	In frequency domain, displays spectrum of input signal in specified gate interval Gate delay: 0 to 65.5 ms (from trigger point, resolution: 1 µs) Gate width: 2 µs to 65.5 ms (from gate delay, resolution: 1 µs)

• Option 07: AM/FM Demodulator

Voice output	With internal loudspeaker and earphone connector (ø3.5 jack), adjustable volume

• Option 10: Centronics Interface

∗ GPIB interface can not be installed simultaneously.

Function	Outputs data to printer (Centronics standard)
Connector	D-Sub 25 pin (jack)

• Option 15: Sweep Signal Output

Sweep output (X)	0 to 10 V ±1 V (≥100 k Ω termination, from left side to right side of display scale), BNC connector
Sweep status output (Z)	TTL level (low level with sweeping), BNC connector

External Mixer

Model	Frequency range	Flange	Max. input power
MA2740A	18 to 26.5 GHz	MIL-F-3922/68-001KM	100 mW
MA2741A	26.5 to 40 GHz	MIL-F-3922/68-001AM	100 mW
MA2742A	33 to 50 GHz	MIL-F-3922/67B-006	100 mW
MA2743A	40 to 60 GHz	MIL-F-3922/67B-007	100 mW
MA2744A	50 to 75 GHz	MIL-F-3922/67B-008	100 mW
MA2745A	60 to 90 GHz	MIL-F-3922/68B-009	100 mW
MA2746A	75 to 110 GHz	MIL-F-3922/68B-010	100 mW

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
MS2667C	Spectrum Analyzer
	Standard accessories
	Power Cord, 2.6 m: 1 pc
F0013	Fuse, 5 A: 2 pcs
W1335AE	MS2665C/MS2667C Operation Manual: 1 copy
B0329G	Front Cover (3/4MW4U): 1 pc
	Options
MS2667C-02	Narrow Resolution Bandwidth
MS2667C-03	Narrow Resolution Bandwidth
MS2667C-04	High-speed Time Domain Sweep
MS2667C-06	Trigger/Gate Circuit
MS2667C-07	AM/FM Demodulator (outputs to loudspeaker or earphone connector)
MS2667C-10	Centronics Interface (GPIB interface can't be installed simultaneously)
MS2667C-15	Sweep Signal Output
	Warranty
MS2667C-90	Extended Three Year Warranty Service
MS2667C-91	Extended Five Year Warranty Service
	Application parts
34AKNF50	Coaxial Adapter (DC to 20 GHz, SWR: 1.5, ruggedized K-P · N-J)
J0561	Coaxial Cord (N-P-5W · 5D-2W · N-P-5W), 1 m
J0104A	Coaxial Cord (BNC-P · RG-55/U · N-P), 1 m
J0322B	Coaxial Cord (SMA-P · SMA-P), 1 m (DC to 18 GHz, SUCOFLEX 104A)
J0911	Coaxial Cord (K-P · K-P), 1 m (DC to 40 GHz, SUCOFLEX 102A)
J0912	Coaxial Cord (K-P · K-P), 0.5 m (DC to 40 GHz, SUCOFLEX 102A)
CSCJ-256K-SM	256 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-512K-SM	512 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-001M-SM	1024 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-002M-SM	2048 KB Memory Card (meets PCMCIA Rel. 2.0)
B0395A	Rack Mount Kit (IEC)
B0395B	Rack Mount Kit (JIS)
MP612A	RF Fuse Holder (without elements)
MP613A	Fuse Element (5 pcs/set)

Model/order No.	Name
J0805	DC Block (Model 7003, 10 kHz to 18 GHz, ±50 V, N-type, Weinschel product)
MA2507A	DC Block Adapter (50 Ω, 9 kHz to 3 GHz, ±50 V, N-type)
MA8601A	DC Block Adapter (50 Ω, 30 kHz to 2 GHz, ±50 V, N-type)
MA8601J	DC Block Adapter (75 Ω, 10 kHz to 2.2 GHz, ±50 V, NC-type)
MA1621A	50 Ω → 75 Ω Impedance Transformer (9 kHz to 3 GHz, ±100 V, NC-type)
MP614B	50 Ω ↔ 75 Ω Impedance Transformer (50 to 1200 MHz, transformer type, NC-type)
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J0742A	RS-232C Cable, 1 m (for PC-98 Personal Computer and VP-600, D-Sub 25 pin, straight)
J0743A	RS-232C Cable, 1 m (for PC/AT compatible, D-Sub 9 pin, cross)
J0064A	7 GHz Band Coaxial/waveguide Adapter (5.8 to 8.6 GHz, N-J · BRJ-7)
J0064C	10 GHz Band Coaxial/waveguide Adapter (8.2 to 12.4 GHz, N-J · BRJ-10)
J0004	Coaxial Adapter (N-P · SMA-J)
DGM010-02000EE	Coaxial Cord, 2 m (N-type connector, general use)
DGM024-02000EE	Coaxial Cord, 2 m (N-type connector, low-loss type)
J0063	Fixed Attenuator for High Power (30 dB, 10 W, DC to 12.4 GHz, N-type)
J0395	Fixed Attenuator for High Power (30 dB, 30 W, DC to 9 GHz, N-type)
J0078	Fixed Attenuator for High Power (20 dB, 10 W, DC to 18 GHz, N-type)
MP526D	High Pass Filter
MA1601A	High Pass Filter (800/900 MHz band, N-type)
MA2740A	External Mixer (18 to 26.5 GHz)
MA2741A	External Mixer (26.5 to 40 GHz)
MA2742A	External Mixer (33 to 50 GHz)
MA2743A	External Mixer (40 to 60 GHz)
MA2744A	External Mixer (50 to 75 GHz)
MA2745A	External Mixer (60 to 90 GHz)
MA2746A	External Mixer (75 to 110 GHz)
B0421A	Carrying Case (hard type, with casters)
B0421B	Carrying Case (hard type, without casters)
B0435A	Carrying Case (soft type)

SPECTRUM ANALYZER

MS2665C

9 kHz to 21.2 GHz

CE GPIB

For Evaluating ETC Subscriber Radio Systems

The MS2665C is a compact, lightweight and low-price spectrum analyzer covering the frequency range from 9 kHz to 21.2 GHz. It has superior basic performance, such as high C/N ratio, low distortion, and high frequency/level accuracies, and is easy to operate.
The large selection of options means a wide range of applications can be handled at reasonable cost.

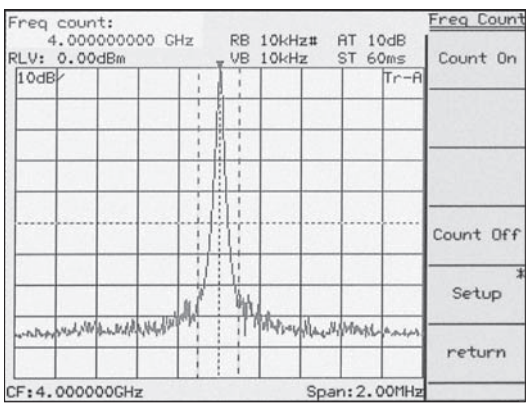
Features

- Compact and Lightweight (13 kg in standard configuration)
- High C/N and Superior Distortion Characteristics
- Easy-to-use, Simple Operation
- Versatile Options Supporting Wide Range of Applications
- Easy-to-set Automatic Measurements

Performance and Functions

• Counter with 1 Hz Resolution

The MS2665C has a full complement of frequency counter function. The resolution is as high as ±1 Hz even at full span, and high-speed frequency measurements is easy. The high sensitivity compared to ordinary counters makes it easy to select and determine the frequency of one signal from many.



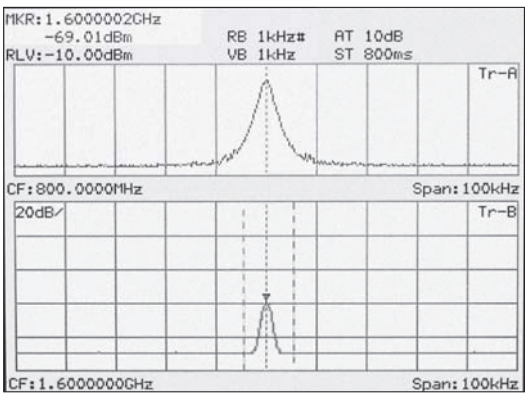
Frequency Measurement (1 Hz Resolution)

• 100 dB Display Dynamic Range

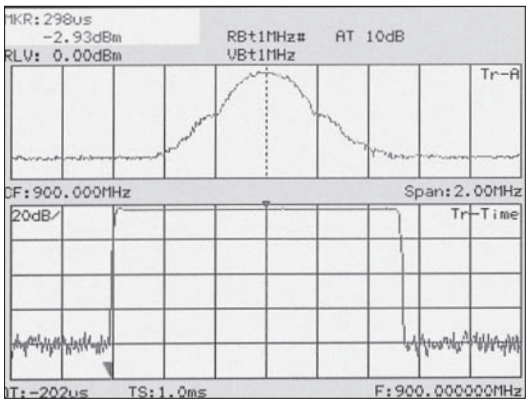
The MS2665C can display nearly 90 dB on a single screen for measurements requiring a wide dynamic range, such as adjacent channel power.

• Split-screen Display

Two waveforms (Trace A and Trace B) with different frequencies can be displayed on a split screen simultaneously. Additionally, the same signal can be displayed in the frequency and time domains simultaneously. The split-screen display also permits efficient signal level adjustment and harmonic distortion measurement. In addition to displaying amplitude in the time domain, the FM-demodulation waveform can also be displayed.



Two Traces with Different Frequencies



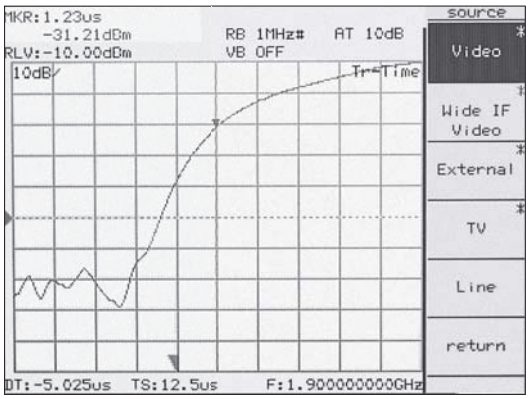
Spectrum and Time Domain Measurement

- **For Testing Digital Mobile Communication Equipment**

High-speed Time-domain Sweep (Option 04)

Testing of TDMA-type radio equipment requires measurements of antenna power, transient response characteristics of burst transmissions, transmission timing, and other characteristics in the time domain (zero span). Adding the High-speed time-domain sweep option boosts sweep time to 12.5 µs and resolution to 0.025 µs.

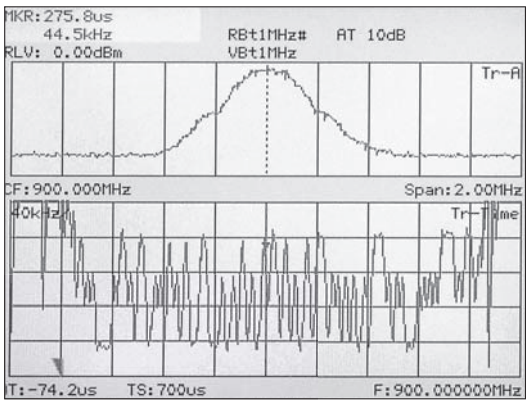
∗This option must be used with the Trigger/gate circuit (Option 06).



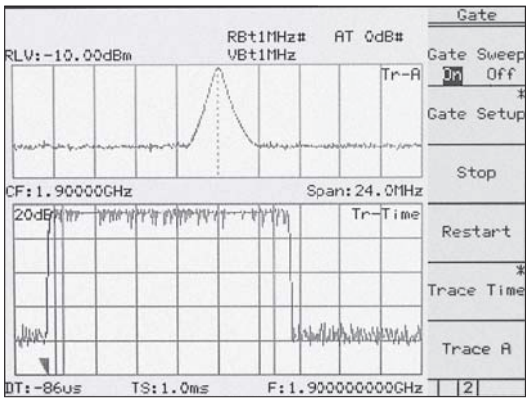
High-speed Time-domain Measurement (TS = 12.5 µs)

Trigger/Gate Circuit (Option 06)

The trigger function provides stable measurements of burst signals in the time domain. External, video, wide IF video, and line trigger can be selected. PASS/FAIL measurements are easily made on TDMA burst signals using limit lines created by the template function. Pre-trigger and post-trigger delays can be used. Burst signals can also be measured in the frequency domain using the gate sweep function. A wide IF video trigger function eliminates the need for an external trigger source that was previously required.



Wide IF Video Trigger Function



Wide IF Video Trigger and Gate Functions

Specifications

Except where noted otherwise, specified values are obtained after warming-up 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 21.2 GHz
	Frequency band	Band 0: 0 to 3.2 GHz (n: 1), Band 1–: 2.92 to 6.5 GHz (n: 1), Band 1+: 6.4 to 8.1 GHz (n: 1), Band 2+: 8.0 to 15.3 GHz (n: 2), Band 3+: 15.2 to 21.2 GHz (n: 3) ∗n: local harmonic order
	Pre-selector range	2.92 to 21.2 GHz (band 1–, 1+, 2+, 3+)
	Frequency setting resolution	Frequency domain: (1 x n) Hz, Zero span: (100 x n) Hz ∗n: local harmonic order
	Frequency display accuracy	± (display frequency x reference frequency accuracy + span x span accuracy + 100 Hz x n) ∗Span: ≥10 kHz x n (n: local harmonic order, after calibration)
	Marker frequency display accuracy	Normal marker: Same as display frequency accuracy; Delta marker: Same as frequency span accuracy
	Frequency counter	Resolution: 1, 10, 100 Hz, 1 kHz Accuracy: Display frequency x reference frequency accuracy ±1 LSD (at S/N: ≥20 dB)
	Frequency span	Setting range: 0 Hz, 1 kHz to 21.3 GHz Accuracy: ±2.5% (span: ≥10 kHz x n), ±5% (span: <10 kHz x n, Option 02 installed)
	Resolution bandwidth (RBW) (3 dB bandwidth)	Setting rage: 1, 3, 10, 30, 100, 300 kHz, 1, 3 MHz (manually settable, or automatically settable according to frequency span) ∗Option 02: 30, 100, and 300 Hz are added Measurements of noise, C/N, adjacent channel power, and channel power by measure function are executed with the calculated equivalent noise bandwidth of the RBW. Bandwidth accuracy: ±20% (1 kHz to 1 MHz), ±30% (3 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

Continued on next page

Frequency	Signal purity, stability	Sideband noise: ≤–95 + 20 log n dBc/Hz (1 MHz to 21.2 GHz, 10 kHz offset) ∗n: local harmonic order Residual FM: ≤20 Hzp-p/0.1 s (1 GHz, span: 0 Hz) Frequency drift: ≤200 x n Hz/min (span: ≤10 kHz x n, sweep time: ≤100 s) ∗After 1-hour warm-up at constant ambient temperature, n: local harmonic order
	Reference oscillator	Frequency: 10 MHz Aging rate: 2 x 10^{-6}/year (typ.), Option 01: ≤1 x 10^{-7}/year, ≤2 x 10^{-8}/day Temperature characteristics: 1 x 10^{-6} (typ., 0˚ to 50˚C); Option 01: ±5 x 10^{-8} (0˚ to 50˚C, referenced to frequency at 25˚C)
Amplitude	Level measurement	Measurement range: Average noise level to +30 dBm Maximum input level: +30 dBm (CW average power, RF ATT: ≥10 dB), 0 Vdc Average noise level: ≤–115 dBm (1 MHz to 1 GHz, band 0), ≤–115 dBm + 1.5f [GHz] dB (1 to 3.1 GHz, band 0), ≤–110 dBm (2.92 to 8.1 GHz, band 1), ≤–102 dBm (8.0 to 15.3 GHz, band 2), ≤–98 dBm (15.2 to 21.2 GHz, band 3) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB Residual response: ≤–90 dBm (RF ATT: 0 dB, input: 50 Ω terminated, 1 MHz to 8.1 GHz)
	Reference level	Setting range Log scale: –100 to +30 dBm; Linear scale: 224 µV to 7.07 V Unit Log scale: dBm, dBµV, dBmV, V, dBµV(emf), W Linear scale: V Reference level accuracy: ±0.4 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) ∗After calibration, at 100 MHz, span: 1 MHz (when RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (1 kHz to 1 MHz), ±0.4 dB (3 MHz) ∗After calibration, referenced to RBW: 3 kHz Input attenuator (RF ATT) Setting range: 0 to 70 dB (10 dB steps) ∗Manually settable, or automatically settable according to reference level Switching uncertainty: ±0.3 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) ∗After calibration, frequency: 100 MHz, referenced to RF ATT: 10 dB
	Frequency response	Relative: ±1.5 dB (9 to 100 kHz, band 0), ±1.0 dB (100 kHz to 3.2 GHz, band 0), ±1.5 dB (2.92 to 8.1 GHz, band 1), ±3.0 dB (8 to 15.3 GHz, band 2), ±4.0 dB (15.2 to 21.2 GHz, band 3) ∗After pre-selector tuning at band 1, 2 and 3, referenced to midpoint between highest and lowest frequency deviation in each band Absolute: ±5.0 dB (9 kHz to 21.2 GHz, RF ATT: 10 dB, referenced to 100 MHz) ∗After pre-selector tuning at band 1, 2 and 3, referenced to midpoint between highest and lowest frequency deviation in each band
	Waveform display	Scale (10 div) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (–20 to 0 dB, RBW: ≤1 MHz), ±1.0 dB (–70 to 0 dB, RBW: 100 MHz), ±1.5 dB (–85 to 0 dB, RBW: 3 kHz), ±2.5 dB (–90 to 0 dB, RBW: 3 kHz) Linear scale: ±4% (compared to reference level) Marker level resolution Log scale: 0.01 dB, Linear scale: 0.02% of reference level
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, band 0, mixer input: –30 dBm), ≤–70 dBc (0.2 to 1.55 GHz, band 0, mixer input: –30 dBm), ≤–100 dBc or noise level (1.46 to 10.6 GHz, band 1/2/3, mixer input: –10 dBm) Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–80 dBc (0.1 to 8.1 GHz), –75 dBc or noise level (8.1 to 21.2 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm Image response: ≤–65 dBc (≤18 GHz), ≤–60 dBc (>18 GHz) Multiple response: ≤–60 dBc
	1 dB gain compression	≥–5 dBm (≥100 MHz, at mixer input)
Sweep	Sweep time	Setting range : 20 ms to 1000 s (manually settable, or automatically settable according to span, RBW, and VBW) Accuracy: ±15% (20 ms to 100 s), ±25% (110 to 1000 s), ±1% (time domain sweep: digital zero span mode)
	Sweep mode	Continuous, Single
	Time domain sweep mode	Analog zero span, Digital zero span
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracing peak points within zone marker (zone sweep also possible)
Functions	Number of data points	501
	Detection mode	NORMAL: Simultaneously displays max. and min. points between sample points POS PEAK: Displays max. point between sample points NEG PEAK: Displays min. point between sample points SAMPLE: Displays momentary value at sample points Detection mode switching uncertainty: ±0.5 dB (at reference level)
	Display	Color TFT-LCD, Size: 5.5-inch, Number of colors: 17 (RGB, each 64-scale settable), Intensity adjustment: 5 steps settable
	Display functions	Trace A: Displays frequency spectrum Trace B: Displays frequency spectrum Trace Time: Displays time domain waveform at center frequency Trace A/B: Displays Trace A and Trace B simultaneously. Simultaneous sweep of same frequency, alternate sweep of independent frequencies. Trace A/BG: Displays frequency region to be observed (background) and object band (foreground) selected from background with zone marker simultaneously Trace A/Time: Displays frequency spectrum and time domain waveform at center frequency simultaneously Trace move/calculation: A → B, B → A, A ↔ B, A + B → A, A – B → A, A – B + DL → A

Continued on next page

Functions	Storage functions	NORMAL, VIEW, MAX HOLD, MIN HOLD, AVERAGE, CUMULATIVE, OVER WRITE
	FM demodulation waveform display function	Demodulation range: 2, 5, 10, 20, 50, 100, 200 kHz/div Marker display Accuracy: ±5% of full scale (referenced to center frequency, DC-coupled. RBW: 3 MHz, VBW: 1 Hz, CW) Demodulation frequency response: DC (50 Hz at AC-coupled) to 100 kHz (range: ≤20 kHz/div, VBW: Off, at 3 dB bandwidth) DC (50 Hz at AC-coupled) to 500 kHz (range: ≥50 kHz/div, VBW: Off, at 3 dB bandwidth) *RBW: ≥1 kHz to 3 MHz usable
	Input connector	N-J, 50 Ω
	Auxiliary signal input and output	IF OUTPUT: 10.69 MHz, BNC connector VIDEO OUTPUT (Y): 0 to 0.5 V ±0.1 V (typ., from lower edge to upper edge at 10 dB/div), 0 to 0.4 V ±0.1 V (typ., from lower edge to upper edge at 10%/div), BNC connector *75 Ω terminated at 100 MHz input COMPOSITE OUTPUT: For NTSC, 1 Vp-p (75 Ω terminated), BNC connector EXT REF INPUT: 10 MHz ±10 Hz, ≥0 dBm (50 Ω terminated), BNC connector
	Signal search	AUTO TUNE, PEAK → CF, PEAK → REF, SCROLL
	Zone marker	NORMAL, DELTA
	Marker →	MARKER → CF, MARKER → REF, MARKER → CF STEP SIZE, Δ MARKER → SPAN, ZONE → SPAN
	Peak search	PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK, MIN DIP, NEXT DIP
	Multi-marker	Number of markers: 10 max. (HIGHEST 10, HARMONICS, MANUAL SET)
	Measure	Noise power (dBm/Hz, dBm/ch), C/N (dBc/Hz, dBc/ch), Occupied bandwidth (power N% method, X-dB down method), Adjacent channel power (REF: total power/reference level/in-band level method, Channel designate display: 2 channels x 2 graphic display), Average power of burst signal (average power in designated time range of time domain waveform), Channel power (dBm, dBm/Hz), Template comparison (upper/lower limits x each 2, time domain), MASK (upper/lower x each 2, frequency domain)
	Save/Recall	Saves and recalls setting conditions and waveform data to internal memory (max. 12) or memory card
	Hard copy	Printer (HP dot matrix, EPSON dot matrix or compatible models): Display data hard-copied via RS-232C, GPIB and Centronics (Option 10) interfaces *HP dot image (control code: PCL3), EPSON dot image (control code: ESC/P-J84) There are restrictions on compatible types. Plotter (HP-GL, GP-GL compatible models): Screen output via RS-232C and GPIB interface
	PTA	Language: PTL (BASIC interpreter) Programming: Using external computer Program memory: Memory card, upload/download to/from external computer Programming capacity: 192 KB Data processing: Directly accesses measurement data according to system variables, system subroutines, and system function.
	RS-232C	Outputs data to printer and plotter. Control from external computer (excluding power switch)
	GPIB	Meets IEEE488.2. Controlled by external computer (excluding power switch). Or controls external equipment with PTA Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C28
	Correction	Automatic correction of insertion loss of MA1621A Impedance Transformer Correction accuracy (RF ATT: ≥10 dB): ±2.5 dB (9 to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 to 3 GHz) *Typical value
	Memory card interface	Functions: Saving/Recalling measurement parameters/Waveform data, Uploading/Downloading PTA programs; Supported cards: SRAM, EPROM, Flash EEROM Connector: PCMCIA Rel. 2.0, 2 slots *SRAM Memory cards: Read and write (Card size: 2 MB max.) EPROM and EEROM Memory cards: Read (Card size: 2 MB max.) The supported operating systems are Windows 95, 98, and XP.
Others	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1
	Vibration	MIL-STD-810D
	Power supply (operating range)	85 to 132/170 to 250 Vac (automatic voltage switching), 47.5 to 63 Hz, 380 to 420 Hz (85 to 132 V only), ≤330 VA
	Dimensions and mass	320 (W) x 177 (H) x 351 (D) mm, ≤13 kg (without options)
	Ambient temperature	0˚ to +50˚C (operation), –40˚ to +75˚C (storage)

• Option 01: Reference Crystal Oscillator

Frequency	10 MHz
Aging rate	≤1 x 10^{-7}/year, ≤2 x 10^{-8}/day (after power on, with reference to frequency after 24 h)
Temperature characteristics	±5 x 10^{-8} (0˚ to 50˚C, with reference to 25˚C)
Buffer output	10 MHz, >2 Vp-p (200 Ω termination), BNC connector

• Option 02: Narrow Resolution Bandwidth

Resolution bandwidth (3 dB)	30, 100, 300 Hz
Resolution bandwidth switching uncertainty	±0.4 dB (RBW 3 kHz referenced)
Resolution bandwidth accuracy	±20% (100, 300 Hz)
Selectivity (60 dB:3 dB)	≤15:1 (RBW: 100, 300 Hz), ≤20:1 (RBW: 30 Hz)

• Option 04: High-speed Time Domain Sweep

* This option is recommended to be mounted together with option 06

Sweep time	12.5, 25, 50, 100 to 900 µs (one most significant digit settable) 1.0 to 19 ms (two upper significant digits settable)
Accuracy	±1%
Marker level resolution	Log scale: 0.1 dB Linear scale: 0.2% (relative to reference level)

• Option 06: Trigger/Gate Circuit

Trigger switch	FREERUN, TRIGGERED
Trigger source	EXT Trigger level: ±10 V (resolution: 0.1 V), TTL level Trigger slope: Rise/Fall Connector: BNC VIDEO Log scale: –100 to 0 dB (resolution: 1 dB) Trigger slope: Rise/Fall WIDE IF VIDEO Trigger level: High, Middle, or Low selectable Bandwidth: ≥20 MHz Trigger slope: Rise/Fall LINE Frequency: 47.5 to 63 Hz (line lock)
Trigger delay	Pre-trigger (displays waveform from previous max. 1 screen at trigger point) Range: –time span to 0 s Resolution: time span/500 Post-trigger (displays waveform from after max. 65.5 ms at trigger point) Range: 0 to 65.5 ms Resolution: 1 µs
Gate sweep	In frequency domain, displays spectrum of input signal in specified gate interval Gate delay: 0 to 65.5 ms (from trigger point, resolution: 1 µs) Gate width: 2 µs to 65.5 ms (from gate delay, resolution: 1 µs)

• Option 07: AM/FM Demodulator

Voice output	With internal loudspeaker and earphone connector (ø3.5 jack), adjustable volume

• Option 10: Centronics Interface

* GPIB interface can not be installed simultaneously.

Function	Outputs data to printer (Centronics standard)
Connector	D-Sub 25 pin (jack)

• Option 15: Sweep Signal Output

Sweep output (X)	0 to 10 V ±1 V (≥100 kΩ termination, from left side to right side of display scale), BNC connector
Sweep status output (Z)	TTL level (low level with sweeping), BNC connector

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
MS2665C	Spectrum Analyzer
	Standard accessories
	Power Cord, 2.6f m: 1 pc
F0013	Fuse, 5 A: 2 pcs
W1335AE	MS2665C/MS2667C Operation Manual: 1 copy
B0329G	Front Cover (3/4MW4U): 1 pc
	Options
MS2665C-01	Reference Crystal Oscillator
MS2665C-02	Narrow Resolution Bandwidth
MS2665C-04	High-speed Time Domain Sweep
MS2665C-06	Trigger/Gate Circuit
MS2665C-07	AM/FM Demodulator (outputs to loudspeaker or earphone connector)
MS2665C-10	Centronics Interface (GPIB interface cannot be installed simultaneously)
MS2665C-15	Sweep Signal Output
	Warranty
MS2665C-90	Extended Three Year Warranty Service
MS2665C-91	Extended Five Year Warranty Service
	Application parts
J0561	Coaxial Cord (N-P-5W · 5D-2W · N-P-5W), 1 m
J0104A	Coaxial Cord (BNC-P · RG-55/U · N-P), 1 m
CSCJ-256K-SM	256 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-512K-SM	512 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-001M-SM	1024 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-002M-SM	2048 KB Memory Card (meets PCMCIA Rel. 2.0)
B0395A	Rack Mount Kit (IEC)
B0395B	Rack Mount Kit (JIS)
B0391A	Carrying Case (hard type, with casters)
B0391B	Carrying Case (hard type, without casters)
MP612A	RF Fuse Holder (without elements)
MP613A	Fuse Element (5 pcs/set)
J0805	DC Block (Model 7003, 10 kHz to 18 GHz, ±50 V, N-type Weinschel product)
MA2507A	DC Block Adapter (50 Ω, 9 kHz to 3 GHz, ±50 V, N-type)
MA8601A	DC Block Adapter (50 Ω, 30 kHz to 2 GHz, ±50 V, N-type)
MA8601J	DC Block Adapter (75 Ω, 10 kHz to 2.2 GHz, ±50 V, NC-type)
MA1621A	50 Ω → 75 Ω Impedance Transformer (9 kHz to 3 GHz, ±100 V, NC-type)
MP614B	50 Ω ↔ 75 Ω Impedance Transformer (50 to 1200 MHz, transformer type, NC-type)
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J0742A	RS-232C Cable, 1 m (for PC-98 Personal Computer and VP-600, D-Sub 25 pin, straight)
J0743A	RS-232C Cable, 1 m (for PC/AT compatible, D-Sub 9 pin, cross)
J0064A	7 GHz Band Coaxial/waveguide Adapter (5.8 to 8.6 GHz, N-J · BRJ-7)
J0064C	10 GHz Band Coaxial/waveguide Adapter (8.2 to 12.4 GHz, N-J · BRJ-10)
J0004	Coaxial Adapter (N-P · SMA-J)
DGM010-02000EE	Coaxial Cord, 2 m (N-type connector, general use)
DGM024-02000EE	Coaxial Cord, 2 m (N-type connector, low-loss type)

SPECTRUM ANALYZER

MS2663C

9 kHz to 8.1 GHz

CE GPIB

For Measuring up to 3rd Order Spurious Frequencies in the Mobile Communications Band

The MS2663C covers a frequency range of 9 kHz to 8.1 GHz, supporting measurement of spurious frequencies of up to three times greater than the frequency bands used worldwide for mobile communications. The MS2663C has superior basic performance such as high C/N ratio, low distortion, and high frequency/level accuracies, and is easy to operate. In addition, a Gaussian filter is used as the resolution bandwidth filter. The large selection of options means a wide range of applications can be handled at reasonable cost.

Features

- Compact and Lightweight (13.5 kg in standard configuration)
- High C/N and Superior Distortion Characteristics
- Easy-to-use, Simple Operation
- Versatile Options Supporting Wide Range of Applications
- Easy-to-set Automatic Measurements

Specifications

Except where noted otherwise, specified values are obtained after warming-up 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 8.1 GHz
	Frequency band	Band 0 (0 to 3.2 GHz), Band 1 – (2.92 to 6.5 GHz), Band 1 + (6.4 to 8.1 GHz)
	Pre-selector range	2.92 to 8.1 GHz (band 1–, 1+)
	Display frequency accuracy	± (display frequency x reference frequency accuracy + span x span accuracy + 100 Hz) *Span: ≥10 kHz, after calibration
	Marker frequency display accuracy	Normal: Same as display frequency accuracy, Delta: Same as frequency span accuracy
	Frequency counter	Resolution: 1, 10, 100 Hz, 1 kHz Accuracy: Display frequency x reference frequency accuracy ±1 LSD (at S/N: ≥20 dB)
	Frequency span	Setting range: 0 Hz, 1 kHz to 8.2 GHz Accuracy: ±2.5% (span: ≥10 kHz), ±5% (span: <10 kHz, Option 02 installed)
	Resolution bandwidth (RBW) (3 dB bandwidth)	Setting range: 1, 3, 10, 30, 100, 300 kHz, 1, 3 MHz (manually settable, or automatically settable according to frequency span) *Option 02: 30, 100, and 300 Hz are added. Measurements of noise, C/N, adjacent channel power, and channel power by measure function are executed with the calculated equivalent noise bandwidth of the RBW. Bandwidth accuracy: ±20% (1 kHz to 1 MHz), ±30% (3 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
	Noise sideband, stability	Sideband noise: ≤–100 dBc/Hz (1 GHz, 10 kHz offset) Residual FM: ≤20 Hzp-p/0.1 s (1 GHz, span: 0 Hz) Frequency drift: ≤200 Hz/min (span: ≤10 kHz, sweep time: ≤100 s) *After 1 hour warm-up at constant ambient temperature
	Reference oscillator	Frequency: 10 MHz Aging rate: 2 x 10^{-6}/year (typ.), Option 01: ≤1 x 10^{-7}/year, ≤2 x 10^{-8}/day Temperature characteristics: 1 x 10^{-5} (typ., 0˚ to 50˚C), Option 01: ±5 x 10^{-8} (0˚ to 50˚C) *Referenced to frequency at 25˚C

Continued on next page

Amplitude	Level measurement	Measurement range: Average noise level to +30 dBm Maximum input level: +30 dBm (CW average power, RF ATT: ≥10 dB), 0 Vdc Average noise level: [Without Option 08] ≤–115 dBm (1 MHz to 1 GHz, band 0), ≤–115 dBm + 1.5f [GHz] dB (1 to 3.1 GHz, band 0), ≤–115 dBm + 0.5f [GHz] dB (2.92 to 8.1 GHz, band 1) *RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB [With Option 08, pre-amplifier: off] ≤114 dBm (1 MHz to 1 GHz, Band 0), ≤–114 dBm + 1.5f [GHz] dB (1 to 3.1 GHz, Band 0), ≤–115 dBm + 0.5f [GHz] dB (2.92 to 8.1 GHz, Band 1) Residual response: ≤–100 dBm (RF ATT: 0 dB, input: 50 Ω termination, 1 MHz to 8.1 GHz)
	Total level accuracy	±1.3 dB (100 kHz to 3.1 GHz band 0), ±2.3 dB (2.92 to 8.1 GHz, band 1) *Level measurement accuracy after calibration using internal calibration signal Total level accuracy: Reference level accuracy (–49.9 to 0 dBm) + frequency response + log linearity (–20 to 0 dB) + calibrated signal source accuracy
	Reference level	Setting range Log scale: –100 to +30 dBm, Linear scale: 224 µV to 7.07 V Unit Log scale: dBm, dBµV, dBmV, V, dBµV(emf), W, dBµV/m Linear scale: V Reference level accuracy: ±0.4 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) *After calibration, at 100 MHz, span: 1 MHz (when RF ATT, RBW, VBW and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (1 kHz to 1 MHz), ±0.4 dB (3 MHz) *After calibration, referenced to RBW: 3 kHz Input attenuator (RF ATT) Setting range: 0 to 70 dB (10 dB steps) *Manually settable, or automatically settable according to reference level Accuracy: ±0.3 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) *After calibration, frequency: 100 MHz, referenced to RF ATT: 10 dB
	Frequency response	±0.5 dB (100 kHz to 3.2 GHz, band 0, referenced to 100 MHz, RF ATT: 10 dB, 18˚ to 28˚C) ±1.5 dB (9 to 100 kHz, band 0, referenced to 100 MHz, RF ATT: 10 dB, 18˚ to 28˚C) ±1.5 dB (2.92 to 8.1 GHz, band 1, referenced to 100 MHz, RF ATT: 10 dB, 18˚ to 28˚C) ±1.0 dB (100 kHz to 3.2 GHz, band 0, referenced to 100 MHz, RF ATT: 10 to 50 dB) ±3.0 dB (2.92 to 8.1 GHz, band 1, referenced to 100 MHz, RF ATT: 10 to 50 dB) *At band 1, after pre-selector tuning
	Waveform display	Scale (10 div) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (–20 to 0 dB, RBW: ≤1 MHz), ±1.0 dB (–70 to 0 dB, RBW: ≤100 kHz), ±1.5 dB (–85 to 0 dB, RBW: ≤3 kHz), ±2.5 dB (–90 to 0 dB, RBW: ≤3 kHz) Linear scale: ±4% (compared to reference level) Marker level resolution Log scale: 0.01 dB, Linear scale: 0.02% of reference level
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, band 0, mixer input: –30 dBm), ≤–75 dBc (0.2 to 1.3 GHz, band 0, mixer input: –30 dBm), ≤–70 dBc (1.3 to 1.55 GHz, band 0, mixer input: –30 dBm), ≤–80 dBc (0.8 to 1 GHz, band 0, mixer input: –30 dBm), ≤–100 dBc (1.46 to 4.05 GHz, band 1, mixer input: –20 dBm) Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–80 dBc (0.1 to 8.1 GHz) *Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm Image response: ≤–70 dBc, Multiple response: ≤–70 dBc (band 1)
	1 dB gain compression	≥–5 dBm (≥100 MHz, at mixer input level)
	Maximum dynamic range	1 dB gain compression level to average noise level: >110 dB (0.1 to 1 GHz, band 0), >110 dB – 1.5f [GHz] dB (1 to 3.1 GHz, band 0), >110 dB – 0.5f [GHz] dB (2.92 to 8.1 GHz, band 1) Distortion characteristics (RBW: 1 kHz) 2nd harmonic: >72.5 dB (10 to 200 MHz), >80 dB (200 to 500 MHz), >80 – 0.75f [GHz] dB (0.5 to 1.3 GHz), >82.5 – 0.75f [GHz] dB (0.8 to 1 GHz), >77.5 – 0.75f [GHz] dB (1.3 to 1.55 GHz, band 0), >97.5 – 0.25f [GHz] dB (1.46 to 4.05 GHz, band 1) 3rd order intermodulation: >80 dB (10 to 100 MHz), >83.3 dB (0.1 to 1 GHz), >83.3 – f [GHz] dB (1 to 3.1 GHz, band 0), >83.3 – (1/3)f [GHz] dB (2.92 to 8.1 GHz, band 1)
Sweep	Sweep time	Setting range : 20 ms to 1000 s (manually settable, or automatically settable according to span, RBW, and VBW) Accuracy: ±15% (20 ms to 100 s), ±45% (110 to 1000 s), ±1% (time domain sweep: digital zero span mode)
	Sweep mode	Continuous, Single
	Time domain sweep mode	Analog zero span, Digital zero span
	Zone sweep	Sweep only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracing peak points within zone marker (zone sweep also possible)
Functions	Number of data points	501
	Detection mode	NORMAL: Simultaneously displays max. and min. points between sample points POS PEAK: Displays max. point between sample points NEG PEAK: Displays min. point between sample points SAMPLE: Displays momentary value at sample points Detection mode switching uncertainty: ±0.5 dB (at reference level)
	Display	Color TFT-LCD, Size: 5.5-inch; Number of colors: 17 (RGB, each 64-scale settable); Intensity adjustment: 5 steps settable

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Functions	Display functions	Trace A: Displays frequency spectrum Trace B: Displays frequency spectrum Trace Time: Displays time domain waveform at center frequency Trace A/B: Displays Trace A and Trace B simultaneously. Simultaneous sweep of same frequency, alternate sweep of independent frequencies Trace A/BG: Displays frequency region to be observed (background) and object band (foreground) selected from background with zone marker simultaneously, alternate sweep Trace A/Time: Displays frequency spectrum, and time domain waveform at center frequency simultaneously, alternate sweep Trace move/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
	FM demodulation waveform display function	Demodulation range: 2, 5, 10, 20, 50, 100, 200 kHz/div Marker display Accuracy: ±5% of full scale (referenced to center frequency, DC-coupled. RBW: 3 MHz, VBW: 1 Hz, CW) Demodulation frequency range: DC (50 Hz at AC-coupled) to 100 kHz (range: ≤20 kHz/div, VBW: Off, at 3 dB bandwidth) DC (50 Hz at AC-coupled) to 500 kHz (range: ≥50 kHz/div, VBW: Off, at 3 dB bandwidth) *RBW: >1 kHz usable
	Input connector	N-J, 50 Ω
	Auxiliary signal input and output	IF OUTPUT: 10.69 MHz, BNC connector VIDEO OUTPUT (Y): 0 to 0.5 V ±0.1 V (100 MHz, from lower edge to upper edge at 10 dB/div or 10%/div, 75 Ω terminated), BNC connector COMPOSITE OUTPUT: For NTSC, 1 Vp-p (75 Ω terminated), BNC connector EXT REF INPUT: 10 MHz ±10 Hz, ≥0 dBm (50 Ω terminated), BNC connector
	Signal search	AUTO TUNE, PEAK → CF, PEAK → REF, SCROLL
	Zone marker	NORMAL, DELTA
	Marker →	MARKER → CF, MARKER → REF, MARKER → CF STEP SIZE, ΔMARKER → SPAN, ZONE → SPAN
	Peak search	PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK, MIN DIP, NEXT DIP
	Multi-marker	Number of markers: 10 max. (HIGHEST 10, HARMONICS, MANUAL SET)
	Measure	Noise power (dBm/Hz, dBm/ch), C/N (dBc/Hz, dBc/ch), Occupied bandwidth (power N% method, X-dB down method), Adjacent channel power (REF: total power/reference level/in-band level method, channel designate display: 2 channels x graphic display), Average power of burst signal (average power in designated time range of time domain waveform), Channel power (dBm, dBm/Hz), Template comparison (upper/lower limits x each 2, time domain), MASK (upper/lower x each 2, frequency domain)
	Save/Recall	Saves and recalls setting conditions and waveform data to internal memory (max. 12) or memory card
	Hard copy	Printer (HP dot matrix, EPSON dot matrix or compatible models): Display data hard-copied via RS-232C, GPIB and Centronics (Option 10) interfaces *HP dot image (control code: PCL3), EPSON dot image (control code: ESC/P-J84) There are restrictions on compatible types. Plotter (HP-GL, GP-GL compatible models): Screen output via RS-232C and GPIB interface
	PTA	Language: PTL (BASIC interpreter) Programming: Using external computer Program memory: Memory card, upload/download to/from external computer Programming capacity: 192 KB Data processing: Directly accesses measurement data according to system variables, system subroutines, and system functions
	RS-232C	Outputs data to printer and plotter. Control from external computer (excluding power switch)
	GPIB	Meets IEEE488.2. Controlled by external computer (excluding power switch). Or controls external equipment with PTA Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C28
	Correction	Automatic correction of insertion loss of MA1621A Impedance Transformer Correction accuracy (RF ATT: ≥10 dB): ±2.5 dB (9 to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 to 3 GHz, typ.) Antenna correction coefficients: Correct display and measurement of field strengths (dBμV/m) for specified antennas, Internal antenna correction coefficients (MP534A/MP651A Dipole Antenna, MP635A/MP666A Log-Periodic Antenna, MP414B Loop Antenna, and four antennas user-defined; writes via GPIB or RS-232C, saves/loads to/from memory card)
	Memory card interface	Functions: Saving/Recalling measurement parameters/Waveform data, Uploading/Downloading PTA programs; Supported cards: SRAM, EPROM, Flash EEROM Connector: PCMCIA Rel. 2.0, 2 slots *SRAM Memory cards: Read and write (Card size: 2 MB max.) EPROM and EEROM Memory cards: Read (Card size: 2 MB max.) The supported operating systems are Windows 95, 98, and XP.
Others	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1
	Vibration	MIL-STD-810D
	Power supply (operating range)	85 to 132/170 to 250 Vac (automatic voltage switching), 47.5 to 63 Hz, 380 to 420 Hz (85 to 132 V only), ≤330 VA
	Dimensions and mass	320 (W) x 177 (H) x 351 (D) mm, ≤13.5 kg (without options)
	Ambient temperature	0˚ to +50˚C (operation), –40˚ to +75˚C (storage)

• Option 01: Reference Crystal Oscillator

Frequency	10 MHz
Aging rate	≤1 x 10^{-7}/year, ≤2 x 10^{-8}/day (after power on, with reference to frequency after 24 h)
Temperature characteristics	±5 x 10^{-8} (0˚ to 50˚C, with reference to 25˚C)
Buffer output	10 MHz, >2 Vp-p (200 Ω termination), BNC connector

• Option 02: Narrow Resolution Bandwidth

Resolution bandwidth (3 dB)	30, 100, 300 Hz
Resolution bandwidth switching uncertainty	±0.4 dB (RBW 3 kHz referenced)
Resolution bandwidth accuracy	±20% (100, 300 Hz)
Selectivity (60 dB:3 dB)	≤15 : 1 (RBW: 100, 300 Hz), ≤20 : 1 (RBW: 30 Hz)

• Option 04: High-speed Time Domain Sweep

∗ This option is recommended to be mounted together with option 06.

Sweep time	12.5, 25, 50, 100 to 900 µs (one most significant digit settable) 1.0 to 19 ms (two upper significant digits settable)
Accuracy	±1%
Marker level resolution	0.1 dB (log scale) 0.2% (linear scale, relative to reference level)

• Option 06: Trigger/Gate Circuit

Trigger switch		FREERUN, TRIGGERED
Trigger source	EXT	Trigger level: ±10 V (resolution: 0.1 V), TTL level Trigger slope: Rise/Fall Connector: BNC
	VIDEO	Log scale: –100 to 0 dB (resolution: 1 dB) Trigger slope: Rise/Fall
	WIDE IF VIDEO	Trigger level: High, Middle, or Low selectable Bandwidth: ≥20 MHz Trigger slope: Rise/Fall
	LINE	Frequency: 47.5 to 63 Hz (line lock)
	TV	Method: M-NTSC, B/G/H PAL Sync: V-SYNC, H-SYNC Sync line (NTSC) H-SYNC (ODD): 7 to 262 line H-SYNC (EVEN): 1 to 263 line Sync line (PAL) H-SYNC (ODD): 1 to 312 line H-SYNC (EVEN): 317 to 625 line ∗Option 16 required
Trigger delay		Pre-trigger (displays waveform from previous max. 1 screen at trigger point) Range: –time span to 0 s Resolution: time span/500 Post-trigger (displays waveform from after max. 65.5 ms at trigger point) Range: 0 to 65.5 ms Resolution: 1 µs
Gate sweep		In frequency domain, displays spectrum of input signal in specified gate interval Gate delay: 0 to 65.5 ms (from trigger point, resolution: 1 µs) Gate width: 2 µs to 65.5 ms (from gate delay, resolution: 1 µs)

• Option 07: AM/FM Demodulator

Voice output	With internal loudspeaker and earphone connector (ø3.5 jack), adjustable volume

• Option 08: Pre-amplifier[*1]

∗ Option 20 can't be installed simultaneously

Frequency range		100 kHz to 3 GHz
Noise figure		≤8 dB (typ., <2 GHz), ≤13 dB (typ., ≥2 GHz)
Amplitude	Measurement range	Average noise level to +10 dBm
	Max. input level	CW average power: +10 dBm, 0 Vdc
	Average noise level	≤–132 dBm (1 MHz to 1 GHz) ≤–132 dBm + 2f [GHz] dB (>1 GHz) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB
	Reference level	Setting range Log scale: –120 to +10 dBm, or equivalent level Linear scale: 22.4 µV to 707 mV Reference level accuracy: ±0.5 dB (–69.9 to –20 dBm) ±0.75 dB (–89.9 to –70 dBm, –19.9 to +10 dBm) ∗After calibration, referenced to 100 MHz, 1 MHz span (RF ATT, RBW, VBW and sweep time set to AUTO) RBW switching uncertainty: ±0.5 dB ∗After calibration, referenced to 3 kHz RBW RF ATT switching uncertainty: ±0.5 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) ∗After calibration, referenced to 100 MHz, RF ATT: 10 dB
	Frequency response	±2.0 dB (100 kHz to 3 GHz, referenced to 100 MHz, RF ATT: 10 to 50 dB)
	Linearity of waveform display	Log scale (after calibration): ±0.5 dB (–20 to 0 dB), ±1.0 dB (–60 to 0 dB), ±1.5 dB (–75 to 0 dB) Linear scale (after calibration): ±5% (according to reference level)
	Spurious response	Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 MHz to 3 GHz) ∗Frequency difference of two signals: ≥50 kHz, Pre-amplifier input[*2]: –55 dBm
	1 dB gain compression	≥–35 dBm (≥100 MHz, at pre-amplifier input level[*2])

∗1: Overall specification with pre-amplifier on (Noise figure is the simple performance)

∗2: Pre-amplifier input level = RF input level – RF ATT setting level

• Option 10: Centronics Interface

∗ GPIB interface can't be installed simultaneously.

Function	Outputs data to printer (Centronics standard)
Connector	D-Sub 25 pin (jack)

• Option 15: Sweep Signal Output

Sweep output (X)	0 to 10 V ±1 V (≥100 kΩ termination, from left side to right side of display scale), BNC connector
Sweep status output (Z)	TTL level (low level with sweeping), BNC connector

● Option 12: QP Detector

* Requires Option 02

Functions	QP detection
6 dB bandwidth	200 Hz, 9, 120 kHz Accuracy: ±30% (18˚ to 28˚C)
Display	LOG scale, 5 dB/div (10 divisions) Linearity: ≤±2.0 dB (–40 to 0 dB, CW signal, reference level: 60 dBμV, RF ATT: 0 dB, 18˚ to 28˚C)
Pulse response characteristics	Response to CISPR pulse (DET mode: QP, 18˚ to 28˚C)

Repetition frequency	Bandwidth		
	120 kHz	9 kHz	200 Hz
1 kHz	≤–8.0 ±1.0 dB	≤–4.5 ±1.0 dB	–
100 Hz	Referenced	Referenced	≤–4.0 ±1.0 dB
60 Hz	–	–	≤–3.0 ±1.0 dB
25 Hz	–	–	Referenced
20 Hz	≤+9.0 ±1.0 dB	≤+6.5 ±1.0 dB	–
10 Hz	≤+14.0 ±1.5 dB	≤+10.0 ±1.5 dB	≤+4.0 ±1.0 dB
5 Hz	–	–	≤+7.5 ±1.5 dB
2 Hz	≤+26.0 ±2.0 dB	≤+20.5 ±2.0 dB	≤+13.0 ±2.0 dB
1 Hz	≤+28.5 ±2.0 dB	≤+22.5 ±2.0 dB	≤+17.0 ±2.0 dB

QP on/off switching uncertainty (PEAK, QP)	≤±1.0 dB (CW signal, reference level: – 40 dB, after auto-calibration, 18˚ to 28˚C)
Detection mode	QP, AVERAGE
Field strength measurement	Waveform data compensation data display for specified antenna factor, field strength (dBμV/m) Built-in antenna factors: MP534A/MP651A Dipole Antenna, MP635A/MP666A Log-Periodic Antenna, MP414B Loop Antenna, user-defined (four types writable via GPIB or RS-232C, can be saved/loaded to/from memory card)

● Option 14: PTA Parallel I/O

* Option 10 can't be installed simultaneously

Functions	Controls external devices from PTA
System variables	As follows using PTA system variables IOA: Controls 8 bit parallel output port A IOB: Controls 8 bit parallel output port B IOC: Controls 4 bit parallel input/output port C IOD: Controls 4 bit parallel input/output port D EIO: Controls I/O switching of ports C/D EXO: Controls I/O trigger
PTL statements	External interrupt control of input to I/O ports using PTA-PTL statements IOEN statement: Enables interrupt input IODI statement: Disables interrupt input IOMA statement: Masks interrupt input ON TO GOTO statement: Changes program flow at interrupt generation ON TO GOSUB statement: Changes program flow at interrupt generation
Write strobe signal	Write strobe signal (negative pulse) output externally at control of output ports C/D
Power supply	External 5 ±0.5 Vdc (max. 100 mA) supply
Signal logic levels	Negative logic, TTL level Specified current: Output ports A/B (max. output current Hi: 2.6 mA, Lo: 24 mA) Output ports C/D (max. output current Hi: 15 mA, Lo: 24 mA) Other control output lines (max. output current Hi: 0.4 mA, Lo: 8 mA)
Connection cable connectors	Amphenol 36 pins
Connector pin layout	

No.	Item	No.	Item	No.	Item
1	GND	13	Output port B (0) LSB	25	I/O port D (0) LSB
2	Trigger input	14	Output port B (1)	26	I/O port D (1)
3	Trigger output 1	15	Output port B (2)	27	I/O port D (2)
4	Trigger output 2	16	Output port B (3)	28	I/O port D (3) MSB
5	Output port A (0) LSB	17	Output port B (4)	29	Port C status 0/1: I/O
6	Output port A (1)	18	Output port B (5)	30	Port D status 0/1: I/O
7	Output port A (2)	19	Output port B (6)	31	Write strobe signal
8	Output port A (3)	20	Output port B (7) MSB	32	Interruption signal
9	Output port A (4)	21	I/O port C (0) LSB	33	Not used
10	Output port A (5)	22	I/O port C (1)	34	5 V power supply
11	Output port A (6)	23	I/O port C (2)	35	Not used
12	Output port A (7) MSB	24	I/O port C (3) MSB	36	Not used

• Option 20: Tracking Generator

* Option 08 can't be installed simultaneously

Frequency range	9 kHz to 3 GHz
Output level range	–60 to 0 dBm
Setting resolution	0.1 dB
Output level accuracy	≤±1.0 dB (at 100 MHz, 0 dBm)
Output level flatness	≤±1.5 dB (100 kHz to 3 GHz, output level: 0 dBm, referenced to 100 MHz frequency)
Output level linearity	≤±1.0 dB (–30 to 0 dBm), ≤±2.0 (–60 to –30 dBm) *100 kHz to 3 GHz, 0 dBm output level reference
Spurious	Harmonic: ≤–15 dBc (9 to 100 kHz), ≤–20 dBc (100 kHz to 3 GHz) Non-harmonic: ≤–15 dBc (9 to 100 kHz), ≤–35 dBc (100 kHz to 2 GHz), ≤–30 dBc (2 to 3 GHz)
Tracking generator feed through	≤–95 dBm (spectrum analyzer input and tracking generator output connectors terminated at 50 Ω)
Output connector	N-J, 50 Ω

• Option 21: Television Monitor (Multi)

* Requires Option 08

Video	M-NTSC, B/G/H/I/D PAL, Color
Audio	Simultaneous monitoring of video and audio *Needs Option 07
Functions	Channel: Automatic setting to broadcast wave of CCIR, Japan, USA, Italy, UK and China; automatic setting to CATV of CCIR, Japan and USA Trigger: Triggered sweep by V-SYNC, H-SYNC *Needs Trigger/Gate Circuit (Option 06) Aux. output: Composite video signal, Connector: BNC

• Option 24: Television Monitor (Brazil)

* Requires Option 08

Video	M-NTSC, M PAL, Color
Audio	Simultaneous monitoring of video and audio *Needs Option 07
Functions	Channel: Automatic setting to broadcast wave of CCIR, Japan and USA; automatic setting to CATV of CCIR, Japan and USA Trigger: Triggered sweep by V-SYNC, H-SYNC *Needs Trigger/Gate Circuit (Option 06) Aux. output: Composite video signal, Connector: BNC

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
MS2663C	Spectrum Analyzer
	Standard accessories
	Power Cord, 2.6 m: 1 pc
F0013	Fuse, 5 A: 2 pcs
W1251AE	MS2650B, MS2660B/C Series Operation Manual: 1 copy
B0329G	Front Cover (3/4MW4U): 1 pc
	Options
MS2663C-01	Reference Crystal Oscillator
MS2663C-02	Narrow Resolution Bandwidth
MS2663C-04	High-speed time Domain Sweep
MS2663C-06	Trigger/Gate Circuit
MS2663C-07	AM/FM Demodulator
MS2663C-08	Pre-amplifier (Option 20 can't be installed simultaneously)
MS2663C-10	Centronics Interface (GPIB can't be installed simultaneously)
MS2663C-12	QP Detector (requires Option 02, QP-BW: 0.2/9/120 kHz)
MS2663C-14	PTA Parallel I/O (Option 10 can't be installed simultaneously)
MS2663C-15	Sweep Signal Output
MS2663C-20	Tracking Generator (Option 08 can't be installed simultaneously)
MS2663C-21	Television Monitor (Multi)
MS2663C-24	Television Monitor (Brazil)
	Warranty
MS2663C-90	Extended Three Year Warranty Service
MS2663C-91	Extended Five Year Warranty Service
	Measurement software
MX260002A	CDMA Cellular System Measurement Software
MX260003A	PDC Measurement Software (for base station)
MX260004A	GSM Measurement Software
MX261001A	Low-power Data Communication System Measurement Software Conforming to Issue of Direct Spread Spectrum System
MX261002A	Low-power Data Communication System Measurement Software Conforming to Issue of Frequency Hopping System
MX262001A	CATV Measurement Software
MX264001A	EMI Measurement Software
	Application parts
J0561	Coaxial Cord (N-P-5W · 5D-2W · N-P-5W), 1 m
J0104A	Coaxial Cord (BNC-P · RG-55/U · N-P), 1 m
CSCJ-256K-SM	256 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-512K-SM	512 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-001M-SM	1024 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-002M-SM	2048 KB Memory Card (meets PCMCIA Rel. 2.0)
B0395A	Rack Mount Kit (IEC)
B0395B	Rack Mount Kit (JIS)
J0055	Coaxial Adapter (NC-P · BNC-J)
J0076	Coaxial Adapter (NC-P · F-J)

Model/order No.	Name
B0391A	Carrying Case (hard type, with casters)
B0391B	Carrying Case (hard type, without casters)
MP612A	RF Fuse Holder (without elements)
MP613A	Fuse Element (5 pcs/set)
J0805	DC Block (MODEL 7003, 10 kHz to 18 GHz, ±50 V, N connector, Weinschel product)
MA2507A	DC Block Adapter (50 Ω, 9 kHz to 3 GHz, ±50 V, N connector)
MA8601A	DC Block Adapter (50 Ω, 30 kHz to 2 GHz, ±50 V, N connector)
MA8601J	DC Block Adapter (75 Ω, 10 kHz to 2.2 GHz, ±50 V, NC connector)
MA1621A	50 Ω → 75 Ω Impedance Transformer (9 kHz to 3 GHz, ±100 V, NC connector)
MP614B	50 Ω ↔ 75 Ω Impedance Transformer
J0121	Coaxial Cord (NC-P-3W · 3C-2WS · NC-P-3W), 1 m
J0308	Coaxial Cord (BNC-P · 3C-2WS · NC-P-3W), 1 m
J0063	Fixed Attenuator for High Power (30 dB, 10 W, DC to 12.4 GHz)
J0395	Fixed Attenuator for High Power (30 dB, 30 W, DC to 9 GHz)
MP640A	Branch (DC to 1700 MHz, 40 dB, 50 Ω, N connector)
MP654A	Directional Coupler (0.8 to 3 GHz, 30 dB, 50 Ω, N connector)
MP520A	CM Directional Coupler (25 to 500 MHz, 75 Ω, NC connector)
MP520B	CM Directional Coupler (25 to 1000 MHz, 75 Ω, NC connector)
MP520C	CM Directional Coupler (25 to 500 MHz, 50 Ω, N connector)
MP520D	CM Directional Coupler (100 to 1700 MHz, 50 Ω, N connector)
MP526A	High Pass Filter (fc = 100 MHz, 50 Ω, N connector)
MP526B	High Pass Filter (fc = 240 MHz, 50 Ω, N connector)
MP526C	High Pass Filter (fc = 400 MHz, 50 Ω, N connector)
MP526D	High Pass Filter (fc = 670 MHz, 50 Ω, N connector)
MP526G	High Pass Filter (fc = 52 MHz, 50 Ω, N connector)
MA1601A	High Pass Filter (800/900 MHz band, N connector)
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J0742A	RS-232C Cable, 1 m [for PC-98 Personal Computer and VP-600, D-Sub 25 pin (straight)]
J0743A	RS-232C Cable, 1 m [for AT compatible, D-Sub 9 pin (cross)]
MH648A	Pre-amplifier (100 kHz to 1200 MHz)
MP534A	Dipole Antenna
MP651A	Dipole Antenna
BBA9106/VHA9103	Biconical Antenna
MP635A	Log-periodic Antenna
MP666A	Log-periodic Antenna
MB9A	Tripod
MB19A	Tripod
MA2601B	EMI Probe
MA2601C	EMI Probe

SPECTRUM ANALYZER

MS2661C

9 kHz to 3 GHz

CE GPIB

For Analyzing Digital Radio Equipment and CATV Signals

The MS2661C is a compact, lightweight and low-price spectrum analyzer covering the frequency range from 9 kHz to 3 GHz. It has superior basic performance, such as high C/N ratio, low distortion, and high frequency/level accuracies, and is easy to operate. In addition, a Gaussian filter is used as the resolution bandwidth filter. The large selection of options means a wide range of applications can be handled at reasonable cost.

Features

- Compact and Lightweight (10.8 kg in standard configuration)
- High C/N and Superior Distortion Characteristics
- Easy-to-use, Simple Operation
- Versatile Options Supporting Wide Range of Applications
- Easy-to-set Automatic Measurements

Specifications

Except where noted otherwise, specified values are obtained after warming-up 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 GHz
	Display frequency accuracy	± (display frequency x reference frequency accuracy + span x span accuracy + 100 Hz) ∗Span: ≥10 kHz, after calibration
	Marker frequency display accuracy	Normal: Same as display frequency accuracy, Delta: Same as frequency span accuracy
	Frequency counter	Resolution: 1, 10, 100 Hz, 1 kHz Accuracy: Display frequency x reference frequency accuracy ±1 LSD (at S/N: ≥20 dB)
	Frequency span	Setting range: 0 Hz, 1 kHz to 3.1 GHz Accuracy: ±2.5% (span: ≥10 kHz), ±5% (span: <10 kHz, with option 02)
	Resolution bandwidth (RBW) (3 dB bandwidth)	Setting range: 1, 3, 10, 30, 100, 300 kHz, 1, 3 MHz (manually settable, or automatically settable according to frequency span) ∗Option 02: 30, 100, and 300 Hz are added. Measurements of noise, C/N, adjacent channel power and channel power by measure function are executed with the calculated equivalent noise bandwidth of the RBW. Bandwidth accuracy: ±20% (1 kHz to 1 MHz), ±30% (3 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)
	Noise sideband, stability	Sideband noise: ≤–100 dBc/Hz (1 GHz, 10 kHz offset) Residual FM: ≤20 Hzp-p/0.1 s (1 GHz, span: 0 Hz) Frequency drift: ≤200 Hz/min (span: ≤10 kHz, sweep time: ≤100 s) ∗After 1 hour warm-up at constant ambient temperature
	Reference oscillator	Frequency: 10 MHz Aging rate: 2 x 10^{-6}/year (typ.), Option 01: ≤1 x 10^{-7}/year, ≤2 x 10^{-8}/day Temperature characteristics: 1 x 10^{-5} (typ., 0˚ to 50˚C), Option 01: ±5 x 10^{-8} (0˚ to 50˚C) ∗Referenced to frequency at 25˚C
Amplitude	Level measurement	Measurement range: Average noise level to +30 dBm Maximum input level: +30 dBm (CW average power, RF ATT: ≥10 dB), ±50 Vdc Average noise level: ≤–115 dBm (1 MHz to 1 GHz), ≤–115 dBm + f [GHz] dB (>1 GHz), ≤–114 dBm (1 MHz to 1 GHz, at Option 08 pre-amplifier installed), ≤–114 dBm + 1.5f [GHz] dB (>1 GHz, at Option 08 pre-amplifier installed) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB Residual response: ≤–100 dBm (RF ATT: 0 dB, input: 50 Ω termination, 1 MHz to 3 GHz)
	Total level accuracy	±1.3 dB (100 kHz to 3 GHz) ∗Level measurement accuracy after calibration using internal calibration signal Total level accuracy: Reference level accuracy (–49.9 to 0 dBm) + frequency response + log linearity (–20 to 0 dB) + calibration signal source accuracy

Continued on next page

Amplitude	Reference level	Setting range Log scale: –100 to +30 dBm, Linear scale: 224 µV to 7.07 V Unit Log scale: dBm, dBµV, dBmV, V, dBµV(emf), W, dBµV/m Linear scale: V Reference level accuracy: ±0.4 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm, +0.1 to +30 dBm), ±1.5 dB (–80 to –70 dBm) *After calibration, at 100 MHz, span: 1 MHz (when RF ATT, RBW, VBW, and sweep time set to AUTO) RBW switching uncertainty: ±0.3 dB (1 kHz to 1 MHz), ±0.4 dB (3 MHz) *After calibration, referenced to RBW: 3 kHz Input attenuator (RF ATT) Setting range: 0 to 70 dB (10 dB steps) *Manually settable, or automatically settable according to reference level Switching uncertainty: ±0.3 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) *After calibration, frequency: 100 MHz, referenced to RF ATT: 10 dB
	Frequency response	±0.5 dB (100 kHz to 3 GHz, referenced to 100 MHz, RF ATT: 10 dB, 18˚ to 28˚C) ±1.5 dB (9 to 100 kHz, referenced to 100 MHz, RF ATT: 10 dB, 18˚ to 28˚C) ±1.0 dB (100 kHz to 3 GHz, referenced to 100 MHz, RF ATT: 10 to 50 dB)
	Waveform display	Scale (10 div) Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (–20 to 0 dB, RBW: ≤1 MHz), ±1.0 dB (–70 to 0 dB, RBW: ≤100 MHz), ±1.5 dB (–85 to 0 dB, RBW: ≤3 kHz), ±2.5 dB (–90 to 0 dB, RBW: ≤3 kHz) Linear scale: ±4% (compared to reference level) Marker level resolution Log scale: 0.01 dB; Linear scale: 0.02% of reference level
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz), ≤–75 dBc (0.2 to 1.5 GHz), ≤–80 dBc (0.8 to 1 GHz) *Mixer input: –30 dBm Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–80 dBc (0.1 to 3 GHz) *Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm
	1 dB gain compression	≥–5 dBm (≥100 MHz, at mixer input level)
	Maximum dynamic range	1 dB gain compression level to average noise level: >110 dB (0.1 to 1 GHz), >110 dB – f [GHz] dB (>1 GHz), >109 dB (0.1 to 1 GHz, at Option 08 pre-amplifier installed), >109 dB – 1.5f [GHz] (>1 GHz, at Option 08 pre-amplifier installed) Distortion characteristics (RBW: 1 kHz) 2nd harmonic: >72.5 dB (10 to 200 MHz), >80 dB (200 to 500 MHz), >80 – f [GHz] dB (0.5 to 1.5 GHz), >82.5 – f [GHz] dB (0.8 to 1 GHz) 3rd order intermodulation: >80 dB (10 to 100 MHz), >83.3 dB (0.1 to 1 GHz), >83.3 – (2/3)f [GHz] dB (1 to 3 GHz)
Sweep	Sweep time	Setting range : 20 ms to 1000 s (Manually settable, or automatically settable according to span, RBW and VBW) Accuracy: ±15% (20 ms to 100 s), ±45% (110 to 1000 s), ±1% (time domain sweep: digital zero span mode)
	Sweep mode	Continuous, Single
	Time domain sweep mode	Analog zero span, Digital zero span
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracing peak points within zone marker (zone sweep also possible)
Functions	Number of data points	501
	Detection mode	NORMAL: Simultaneously displays max. and min. points between sample points POS PEAK: Displays max. point between sample points NEG PEAK: Displays min. point between sample points SAMPLE: Displays momentary value at sample points Detection mode switching uncertainty: ±0.5 dB (at reference level)
	Display	Color TFT-LCD, Size: 5.5-inch, Number of colors: 17 (RGB, each 64-scale settable); Intensity adjustment: 5 steps settable
	Display functions	Trace A: Displays frequency spectrum Trace B: Displays frequency spectrum Trace Time: Displays time domain waveform at center frequency Trace A/B: Displays Trace A and Trace B simultaneously. Simultaneous sweep of same frequency, alternate sweep of independent frequencies Trace A/BG: Displays frequency region to be observed (background) and object band (foreground) selected from background with zone marker simultaneously at alternate sweep Trace A/Time: Displays frequency spectrum, and time domain waveform at center frequency simultaneously at alternate sweep Trace move/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
	FM demodulation waveform display function	Demodulation range: 2, 5, 10, 20, 50, 100, 200 kHz/div Marker display accuracy: ±5% of full scale (referenced to center frequency, DC-coupled, RBW: 3 MHz, VBW: 1 Hz, CW) Demodulation frequency response: DC (50 Hz at AC-coupled) to 100 kHz *Range: ≤20 kHz/div, VBW: Off, at 3 dB bandwidth DC (50 Hz at AC-coupled) to 500 kHz *Range: ≥50 kHz/div, VBW: Off, at 3 dB bandwidth *RBW: ≥1 kHz usable
	Input connector	N-J, 50 Ω
	Auxiliary signal input and output	IF OUTPUT: 10.69 MHz, BNC connector VIDEO OUTPUT (Y): 0 to 0.5 V ±0.1 V (100 MHz, from lower edge to upper edge at 10 dB/div or 10%/div, 75 Ω terminated, BNC connector) COMPOSITE OUTPUT: For NTSC, 1 Vp-p (75 Ω terminated), BNC connector EXT REF INPUT: 10 MHz ±10 Hz, ≥0 dBm (50 Ω terminated), BNC connector
	Signal search	AUTO TUNE, PEAK → CF, PEAK → REF, SCROLL
	Zone marker	NORMAL, DELTA
	Marker →	MARKER → CF, MARKER → REF, MARKER → CF STEP SIZE, ΔMARKER → SPAN, ZONE → SPAN
	Peak search	PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK, MIN DIP, NEXT DIP

Continued on next page

Functions	Multi-marker	Number of markers: 10 max. (HIGHEST 10, HARMONICS, MANUAL SET)
	Measure	Noise power (dBm/Hz, dBm/ch), C/N (dBc/Hz, dBc/ch), Occupied bandwidth (power N% method, X-dB down method), Adjacent channel power (REF: total power/reference level/in-band level method, channel designate display: 2 channels x 2 graphic display), Average power of burst signal (average power in designated time range of time domain waveform), Channel power (dBm, dBm/Hz), Template comparison (upper/lower limits x each 2, time domain), MASK (upper/lower x each 2, frequency domain)
	Save/Recall	Saves and recalls setting conditions and waveform data to internal memory (max. 12) or memory card
	Hard copy	Printer (HP dot matrix, EPSON dot matrix or compatible models): Display data hard-copied via RS-232C, GPIB and Centronics (Option 10) interfaces ∗HP dot image (control code: PCL3), EPSON dot image (control code: ESC/P-J84) There are restrictions on compatible types. Plotter (HP-GL, GP-GL compatible models): Screen output via RS-232C and GPIB interface
	PTA	Language: PTL (BASIC interpreter) Programming: Using editor of external computer Program memory: Memory card, upload/download to/from external computer Programming capacity: 192 KB Data processing: Directly accesses measurement data according to system variables, system subroutines, and system functions
	RS-232C	Outputs data to printer and plotter. Control from external computer (excluding power switch)
	GPIB	Meets IEEE488.2. Controlled by external computer (excluding power switch). Or controls external equipment with PTA Interface function : SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C28
	Correction	Automatic correction of insertion loss of MA1621A Impedance Transformer Correction accuracy (RF ATT: ≥10 dB): ±2.5 dB (9 to 100 kHz), ±1.5 dB (100 kHz to 2 GHz), ±2.0 dB (2 to 3 GHz) ∗Typical value Antenna correction coefficients: Correct display and measurement of field strengths (dBμV/m) for specified antennas, Internal antenna correction coefficients (MP534A/MP651A Dipole Antenna, MP635A/MP666A Log-Periodic Antenna, MP414B Loop Antenna, and four antennas user-defined; writes via GPIB or RS-232C interface, saves/loads to/from memory card)
	Memory card interface	Functions: Saving/Recalling measurement parameters/Waveform data, Uploading/Downloading PTA programs; Supported cards: SRAM, EPROM, Flash EEROM Connector: PCMCIA Rel. 2.0, 2 slots ∗SRAM Memory cards: Read and write (Card size: 2 MB max.) EPROM and EEROM Memory cards: Read (Card size: 2 MB max.) The supported operating systems are Windows 95, 98, and XP.
Others	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1
	Vibration	MIL-STD-810D
	Power supply (operating range)	85 to 132/170 to 250 Vac (automatic voltage switching), 47.5 to 63 Hz, 380 to 420 Hz (85 to 132 V only), ≤330 VA
	Dimensions and mass	320 (W) x 177 (H) x 351 (D) mm, ≤10.8 kg (without options)
	Ambient temperature	0˚ to +50˚C (operation), –40˚ to +75˚C (storage)

• Option 01: Reference Crystal Oscillator

Frequency	10 MHz
Aging rate	≤1 x 10^{-7}/year, ≤2 x 10^{-8}/day (after power on, with reference to frequency after 24 h)
Temperature characteristics	±5 x 10^{-8} (0˚ to 50˚C, with reference to 25˚C)
Buffer output	BNC connector, 10 MHz, >2 Vp-p (200 Ω terminated)

• Option 02: Narrow Resolution Bandwidth

Resolution bandwidth (3 dB)	30, 100, 300 Hz
Resolution bandwidth switching uncertainty	±0.4 dB (RBW 3 kHz referenced)
Resolution bandwidth accuracy	±20% (100, 300 Hz)
Selectivity (60 dB:3 dB)	≤15:1 (RBW: 100, 300 Hz), ≤20:1 (RBW: 30 Hz)

• Option 04: High-speed Time Domain Sweep

∗ This option is recommended to be mounted together with option 06

Sweep time	12.5, 25, 50, 100 to 900 μs (one most significant digit settable) 1.0 to 19 ms (two upper significant digits settable)
Accuracy	±1%
Marker level resolution	0.1 dB (log scale) 0.2% (linear scale, relative to reference level)

• Option 06: Trigger/Gate Circuit

Trigger switch		FREERUN, TRIGGERED
Trigger source	EXT	Trigger level: ±10 V (resolution: 0.1 V), TTL level Trigger slope: Rise/Fall Connector: BNC
	VIDEO	Trigger level (at log scale): –100 to 0 dB (resolution: 1 dB) Trigger slope: Rise/Fall
	WIDE IF VIDEO	Trigger level: High, Middle, or Low selectable Bandwidth: ≥20 MHz Trigger slope: Rise/Fall
	LINE	Frequency: 47.5 to 63 Hz (line lock)
	TV	Method: M-NTSC, B/G/H PAL Sync: V-SYNC, H-SYNC Sync line (NTSC) H-SYNC (ODD): 7 to 262 line H-SYNC (EVEN): 1 to 263 line Sync line (PAL) H-SYNC (ODD): 1 to 312 line H-SYNC (EVEN): 317 to 625 line ∗Option 16 required
Trigger delay		Pre-trigger (displays waveform from previous max. 1 screen at trigger point) Range: –time span to 0 s Resolution: time span/500 Post-trigger (displays waveform from after max. 65.5 ms at trigger point) Range: 0 to 65.5 ms Resolution: 1 μs
Gate sweep		In frequency domain, displays spectrum of input signal in specified gate interval Gate delay: 0 to 65.5 ms (from trigger point, resolution: 1 μs) Gate width: 2 μs to 65.5 ms (from gate delay, resolution: 1 μs)

• Option 07: AM/FM Demodulator

Voice output	With internal loudspeaker and earphone connector (ø3.5 jack), adjustable volume

• Option 10: Centronics Interface

∗ GPIB interface can't be installed simultaneously.

Function	Outputs data to printer (Centronics standard).
Connector	D-Sub 25 pin (jack)

• Option 08: Pre-amplifier*1

Frequency range		100 kHz to 3 GHz, 100 kHz to 2.5 GHz (with Option 22)
Noise figure		≤7 dB (typ., <2 GHz), ≤12 dB (typ., ≥2 GHz), ≤9 dB (typ., <2 GHz, with Option 22), ≤14 dB (typ., ≥2 GHz, with Option 22)
Amplitude	Measurement range	Average noise level to +10 dBm
	Max. input level	CW average power: +10 dBm, 0 Vdc
	Average noise level	≤–134 dBm (1 MHz to 1 GHz), ≤–134 dBm + 2f [GHz] dB (>1 GHz), ≤–132 dBm (1 MHz to 1 GHz, with Option 22), ≤–132 dBm + 2f [GHz] dB (≥1 GHz, with Option 22) ∗RBW: 1 kHz, VBW: 1 Hz, RF ATT: 0 dB
	Reference level	Setting range Log scale: –120 to +10 dBm, or equivalent level Linear scale: 22.4 µV to 707 mV, 27.4 µV to 487 mV (with Option 22) Reference level accuracy: ±0.5 dB (–69.9 to –20 dBm), ±0.75 dB (–89.9 to –70 dBm, –19.9 to +10 dBm) ∗After calibration, referenced to 100 MHz, 1 MHz span (RF ATT, RBW, VBW and sweep time set to AUTO) RBW switching uncertainty: ±0.5 dB ∗After calibration, referenced to 3 kHz RBW RF ATT switching uncertainty: ±0.5 dB (0 to 50 dB), ±1.0 dB (0 to 70 dB) ∗After calibration, referenced to 100 MHz, RF ATT: 10 dB
	Frequency response	±2.0 dB (100 kHz to 3 GHz, referenced to 100 MHz, RF ATT: 10 to 50 dB) ±2.0 dB (with Option 22, 100 kHz to 2.5 GHz, referenced to 100 MHz, RF ATT: 10 dB, 18˚ to 28˚C)
	Linearity of waveform display	Log scale (after calibration): ±0.5 dB (–20 to 0 dB), ±1.0 dB (–60 to 0 dB), ±1.5 dB (–75 to 0 dB) Linear scale (after calibration): ±5% (according to reference level)
	Spurious response	Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 MHz to 3 GHz, 10 MHz to 2.5 GHz with Option 22) ∗Frequency difference of two signals: ≥50 kHz, Pre-amplifier input*2: –55 dBm
	1 dB gain compression	≥–35 dBm (≥100 MHz, at pre-amplifier input level*2)

∗1: Overall specification with pre-amplifier on (Noise figure is the simple performance)
∗2: Pre-amplifier input level = RF input level – RF ATT setting level

• Option 12: QP Detector

∗ Requires Option 02

Functions	QP detection
6 dB bandwidth	200 Hz, 9, 120 kHz Accuracy: ±30% (18˚ to 28˚C)
Display	LOG scale, 5 dB/div (10 divisions) Linearity: ≤±2.0 dB (–40 to 0 dB, CW signal, reference level: 60 dBµV, RF ATT: 0 dB, 18˚ to 28˚C)
Pulse response characteristics	Response to CISPR pulse (DET mode: QP, 18˚ to 28˚C)

Repetition frequency	Bandwidth		
	120 kHz	9 kHz	200 Hz
1 kHz	≤–8.0 ±1.0 dB	≤–4.5 ±1.0 dB	–
100 Hz	Referenced	Referenced	≤–4.0 ±1.0 dB
60 Hz	–	–	≤–3.0 ±1.0 dB
25 Hz	–	–	Referenced
20 Hz	≤+9.0 ±1.0 dB	≤+6.5 ±1.0 dB	–
10 Hz	≤+14.0 ±1.5 dB	≤+10.0 ±1.5 dB	≤+4.0 ±1.0 dB
5 Hz	–	–	≤+7.5 ±1.5 dB
2 Hz	≤+26.0 ±2.0 dB	≤+20.5 ±2.0 dB	≤+13.0 ±2.0 dB
1 Hz	≤+28.5 ±2.0 dB	≤+22.5 ±2.0 dB	≤+17.0 ±2.0 dB

QP on/off switching uncertainty (PEAK, QP)	≤±1.0 dB (CW signal, reference level – 40 dB, after auto-calibration, 18˚ to 28˚C)
Detection mode	QP, AVERAGE
Field strength measurement	Waveform data compensation data display for specified antenna factor, field strength (dBµV/m) Built-in antenna factors: MP534A/MP651A Dipole Antenna, MP635A/MP666A Log-Periodic Antenna, MP414B Loop Antenna, user-defined (four types writable via GPIB or RS-232C, can be saved/loaded to/from memory card)

• Option 14: PTA Parallel I/O

∗ Option 10 can't be installed simultaneously

Functions	Controls external devices from PTA
System variables	As follows using PTA system variables IOA: Controls 8 bit parallel output port A IOB: Controls 8 bit parallel output port B IOC: Controls 4 bit parallel input/output port C IOD: Controls 4 bit parallel input/output port D EIO: Controls I/O switching of ports C/D EXO: Controls I/O trigger
PTL statements	External interrupt control of input to I/O ports using PTA-PTL statements IOEN statement: Enables interrupt input IODI statement: Disables interrupt input IOMA statement: Masks interrupt input ON TO GOTO statement: Changes program flow at interrupt generation ON TO GOSUB statement: Changes program flow at interrupt generation
Write strobe signal	Write strobe signal (negative pulse) output externally at control of output ports C/D
Power supply	External 5 ±0.5 Vdc (max. 100 mA) supply
Signal logic levels	Negative logic, TTL level Specified current: Output ports A/B (max. output current Hi: 2.6 mA, Lo: 24 mA) Output ports C/D (max. output current Hi: 15 mA, Lo: 24 mA) Other control output lines (max. output current Hi: 0.4 mA, Lo: 8 mA)
Connection cable connectors	Amphenol 36 pins
Connector pin layout	

No.	Item	No.	Item	No.	Item
1	GND	13	Output port B (0) LSB	25	I/O port D (0) LSB
2	Trigger input	14	Output port B (1)	26	I/O port D (1)
3	Trigger output 1	15	Output port B (2)	27	I/O port D (2)
4	Trigger output 2	16	Output port B (3)	28	I/O port D (3) MSB
5	Output port A (0) LSB	17	Output port B (4)	29	Port C status 0/1: I/O
6	Output port A (1)	18	Output port B (5)	30	Port D status 0/1: I/O
7	Output port A (2)	19	Output port B (6)	31	Write strobe signal
8	Output port A (3)	20	Output port B (7) MSB	32	Interruption signal
9	Output port A (4)	21	I/O port C (0) LSB	33	Not used
10	Output port A (5)	22	I/O port C (1)	34	5 V power supply
11	Output port A (6)	23	I/O port C (2)	35	Not used
12	Output port A (7) MSB	24	I/O port C (3) MSB	36	Not used

• Option 15: Sweep Signal Output

Sweep output (X)	0 to 10 V ±1 V (≥100 kΩ termination, from left side to right side of display scale), BNC connector
Sweep status output (Z)	TTL level (low level with sweeping), BNC connector

• Option 19: DC Coupled Input

Functions	DC-couples input circuit of main unit and expands lower limit of receiver frequency range to 500 Hz ∗Can only be installed with narrow RBW (Option 02)
Electrical characteristics	The standard specifications of the main unit are supplemented and changed as follows: Frequency range: 500 Hz to 3.0 GHz Max. input level: +30 dBm (CW, RF ATT: ≥10 dB), 0 Vdc Average noise level: <–80 dBm (500 Hz to 10 kHz), ≤–90 dBm (10 to 200 kHz), ≤–110 dBm (200 kHz to 1 MHz) ∗RBW: 30 Hz, VBW: 1 Hz, RF ATT: 0 dB Frequency response: ±1.2 dB (500 Hz to 100 kHz), ±0.5 dB (100 kHz to 3 GHz) ∗Referenced to 100 MHz frequency, RF ATT: 10 dB, 18˚ to 28˚C

• Option 20: Tracking Generator

Frequency range	9 kHz to 3 GHz
Output level range	–60 to 0 dBm
Setting resolution	0.1 dB
Output level accuracy	≤±1.0 dB (at 100 MHz, 0 dBm)
Output level flatness	≤±1.5 dB (100 kHz to 3 GHz, output level: 0 dBm, referenced to 100 MHz frequency)
Output level linearity	≤±1.0 dB (–30 to 0 dBm), ≤±2.0 (–60 to –30 dBm) ∗100 kHz to 3 GHz, 0 dBm output level reference
Spurious	Harmonic: ≤–20 dBc (100 kHz to 3 GHz), Non-harmonic: ≤–35 dBc (100 kHz to 3 GHz)
Tracking generator feed through	≤–95 dBm (spectrum analyzer input and tracking generator output connectors terminated at 50 Ω)
Output connector	N-J, 50 Ω

• Option 21: Television Monitor (Multi)

Video	M-NTSC, B/G/H/I/D PAL, Color
Audio	Simultaneous monitoring of video and audio ∗Needs Option 07
Function	Channel: Automatic setting to broadcast wave of CCIR, Japan, USA, Italy, UK and China; automatic setting to CATV of CCIR, Japan and USA Trigger: Triggered sweep by V-SYNC, H-SYNC ∗Needs trigger/gate circuit (Option 06) Aux. output: Composite video signal; Connector: BNC

● Option 22: 75 Ω Input

∗ Option 12, 19, and 20 can't be installed simultaneously

Frequency range		100 kHz to 2.5 GHz
Amplitude	Level measurement	Measurement range: Average noise level to +25 dBm (133.8 dBμV) Max. input level: +25 dBm (133.8 dBμV, CW average power, RF ATT: ≥10 dB), ±100 Vdc Residual response: ≤–95 dBm (13.8 dBμV, RF ATT: 0 dB, input: 75 Ω terminated, 1 MHz to 2.5 GHz)
	Total level accuracy	±1.8 dB (100 kHz to 2.5 GHz, level measurement accuracy after calibration using internal calibration signal) Total level accuracy: Reference level accuracy (–49.9 to 0 dBm) + frequency response + log linearity (–20 to 0 dB) + calibration signal source accuracy
	Reference level	Setting range Log scale: 8.8 to 133.8 dBμV, Linear scale: 274 μV to 4.87 V
	Frequency response	±1.0 dB (100 kHz to 2.5 GHz, referenced to 100 MHz, RF ATT: 10 dB, 18˚ to 28˚C)
	Waveform display	Linearity (after calibration) Log scale: ±0.4 dB (–20 to 0 dB), ±1.0 dB (–70 to 0 dB), ±1.5 dB (–85 to 0 dB) Linear scale: ±4% (according to reference level) Marker level resolution Log scale: 0.01 dB Linear scale: 0.02% (according to reference level)
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, mixer input: –30 dBm), ≤–75 dBc (0.2 to 1.25 GHz, band 0, mixer input: –30 dBm), ≤–80 dBc (0.8 to 1 GHz, mixer input: –30 dBm) Two signals 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–80 dBc (0.1 to 2.5 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm
	Max. dynamic range	1 dB gain compression level to average noise level: >110 dB (0.1 to 1 GHz), >110 dB – f [GHz] dB (>1 GHz), >109 dB (0.1 to 1 GHz, with Option 08), >109 dB – 1.5f [GHz] dB (>1 GHz with Option 08) Distortion characteristics (RBW: 1 kHz) 2nd harmonic: >72.5 dB (10 to 200 MHz), >80 dB (200 to 500 MHz), >80 – f [GHz] dB (0.5 to 1.25 GHz), >82.5 – f [GHz] dB (0.8 to 1 GHz) 3rd order intermodulation: >80 dB (10 to 100 MHz), >83.3 dB (0.1 to 1 GHz), >83.3 dB – (2/3)f [GHz] dB (1 to 2.5 GHz)
Functions	Input connector	NC-J, 75 Ω
	Auxiliary I/O	VIDEO OUTPUT (Y): 0 to 0.5 V ±0.1 V (typ., from lower edge to upper edge at 10 dB/div, 100 MHz, 75 Ω terminated) 0 to 0.4 V ±0.1 V (typ., from lower edge to upper edge at 10%/div, 100 MHz, 75 Ω terminated), BNC connector

● Option 23: 75 Ω Tracking Generator

∗ Option 12, 19, and 20 can't be installed simultaneously

Frequency range	100 kHz to 2.5 GHz
Output level range	44 to 104 dBμV (setting resolution: 0.1 dB)
Output level accuracy	≤±1.5 dB (100 MHz, output level: 104 dBμV)
Output level flatness	≤±1.75 dB (100 kHz to 2.5 GHz, output level: 104 dBμV, referenced to 100 MHz)
Output level linearity	≤±1.0 dB (74 to 104 dBμV), ≤±2.0 dB (44 to 74 dBμV) ∗100 kHz to 2.5 GHz, referenced to 104 dBμV
Spurious	Harmonics: ≤–20 dBc (100 kHz to 2.5 GHz), Non-harmonics: ≤–30 dBc (100 kHz to 2.5 GHz)
Tracking generator feed through	≤13.8 dBμV (spectrum analyzer input and tracking generator output connectors terminated at 75 Ω)
Output connector	NC-J, 75 Ω

● Option 24: Television Monitor (Brazil)

Video	M-NTSC, M PAL, Color
Audio	Simultaneous monitoring of video and audio ∗Needs Option 07
Functions	Channel: Automatic setting to broadcast wave of CCIR, Japan and USA; automatic setting to CATV of CCIR, Japan and USA Trigger: Triggered sweep by V-SYNC, H-SYNC ∗Needs trigger/gate circuit (Option 06) Aux. output: Composite video signal, Connector: BNC

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	
MS2661C	Spectrum Analyzer	
	Standard accessories	
	Power Cord, 2.6 m:	1 pc
F0013	Fuse, 5 A:	2 pcs
W1251AE	MS2650B, MS2660B/C Series Operation Manual:	1 copy
B0329G	Front Cover (3/4MW4U):	1 pc
	Options	
MS2661C-01	Reference Crystal Oscillator	
MS2661C-02	Narrow Resolution Bandwidth	
MS2661C-04	High-speed Time Domain Sweep	
MS2661C-06	Trigger/Gate Circuit	
MS2661C-07	AM/FM Demodulator	
MS2661C-08	Pre-amplifier	
MS2661C-10	Centronics Interface (GPIB can't be installed simultaneously.)	
MS2661C-12	QP Detector (requires Option 02, QP-BW: 0.2/9/120 kHz)	
MS2661C-14	PTA Parallel I/O (Option 10 can't be installed simultaneously.)	
MS2661C-15	Sweep Signal Output	
MS2661C-19	DC Coupled Input (requires Option 02)	
MS2661C-20	Tracking Generator	
MS2661C-21	Television Monitor (Multi)	
MS2661C-22	75 Ω Input (Option 12, 19 and 20 can't be installed simultaneously.)	
MS2661C-23	75 Ω Tracking Generator (Option 12, 19 and 20 can't be installed simultaneously.)	
MS2661C-24	Television Monitor (Brazil)	
	Warranty	
MS2661C-90	Extended Three Year Warranty Service	
MS2661C-91	Extended Five Year Warranty Service	
	Measurement software	
MX260002A	CDMA Cellular System Measurement Software	
MX260003A	PDC Measurement Software (for base station)	
MX260004A	GSM Measurement Software	
MX261001A	Low-power Data Communication System Measurement Software Conforming to Issue of Direct Spread Spectrum System	
MX261002A	Low-power Data Communication System Measurement Software Conforming to Issue of Frequency Hopping System	
MX262001A	CATV Measurement Software	
MX264001A	EMI Measurement Software	

Model/order No.	Name
	Application parts
J0561	Coaxial Cord (N-P-5W · 5D-2W · N-P-5W), 1 m
J0104A	Coaxial Cord (BNC-P · RG-55/U · N-P), 1 m
CSCJ-256K-SM	256 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-512K-SM	512 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-001M-SM	1024 KB Memory Card (meets PCMCIA Rel. 2.0)
CSCJ-002M-SM	2048 KB Memory Card (meets PCMCIA Rel. 2.0)
B0395A	Rack Mount Kit (IEC)
B0395B	Rack Mount Kit (JIS)
J0055	Coaxial Adapter (NC-P · BNC-J)
J0076	Coaxial Adapter (NC-P · F-J)
B0391A	Carrying Case (hard type, with casters)
B0391B	Carrying Case (hard type, without casters)
MP612A	RF Fuse Holder (without elements)
MP613A	Fuse Element (5 pcs/set)
J0805	DC Block (MODEL 7003, 10 kHz to 18 GHz, ±50 V, N connector, Weinschel product)
MA2507A	DC Block Adapter (50 Ω, 9 kHz to 3 GHz, ±50 V, N connector)
MA8601A	DC Block Adapter (50 Ω, 30 kHz to 2 GHz, ±50 V, N connector)
MA8601J	DC Block Adapter (75 Ω, 10 kHz to 2.2 GHz, ±50 V, NC connector)
MA1621A	50 Ω → 75 Ω Impedance Transformer (9 kHz to 3 GHz, ±100 V, NC connector)
MP614B	50 Ω ↔ 75 Ω Impedance Transformer
J0121	Coaxial Cord (NC-P-3W · 3C-2WS · NC-P-3W), 1 m
J0308	Coaxial Cord (BNC-P · 3C-2WS · NC-P-3W), 1 m
J0063	Fixed Attenuator for High Power (30 dB, 10 W, DC to 12.4 GHz)
J0395	Fixed Attenuator for High Power (30 dB, 30 W, DC to 9 GHz)
MP640A	Branch (DC to 1700 MHz, 40 dB, 50 Ω, N connector)
MP654A	Directional Coupler (0.8 to 3 GHz, 30 dB, 50 Ω, N connector)
MP520A	CM Directional Coupler (25 to 500 MHz, 75 Ω, NC connector)
MP520B	CM Directional Coupler (25 to 1000 MHz, 75 Ω, NC connector)
MP520C	CM Directional Coupler (25 to 500 MHz, 50 Ω, NC connector)
MP520D	CM Directional Coupler (100 to 1700 MHz, 50 Ω, NC connector)
MP526A	High Pass Filter (fc = 100 MHz, 50 Ω, N connector)
MP526B	High Pass Filter (fc = 240 MHz, 50 Ω, N connector)
MP526C	High Pass Filter (fc = 400 MHz, 50 Ω, N connector)
MP526D	High Pass Filter (fc = 670 MHz, 50 Ω, N connector)
MP526G	High Pass Filter (fc = 52 MHz, 50 Ω, N connector)
MA1601A	High Pass Filter (800/900 MHz band, N connector)
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J0742A	RS-232C Cable, 1 m [for PC-98 Personal Computer and VP-600, D-Sub 25 pin (straight)]
J0743A	RS-232C Cable, 1 m [for AT compatible, D-Sub 9 pin (cross)]
87A50	Reflection Bridge
MH648A	Pre-amplifier (100 kHz to 1200 MHz)
MP534A	Dipole Antenna
MP651A	Dipole Antenna
BBA9106/VHA9103	Biconical Antenna
MP635A	Log-periodic Antenna
MP666A	Log-periodic Antenna
MB9A	Tripod
MB19A	Tripod
MA2601B	EMI Probe
MA2601C	EMI Probe

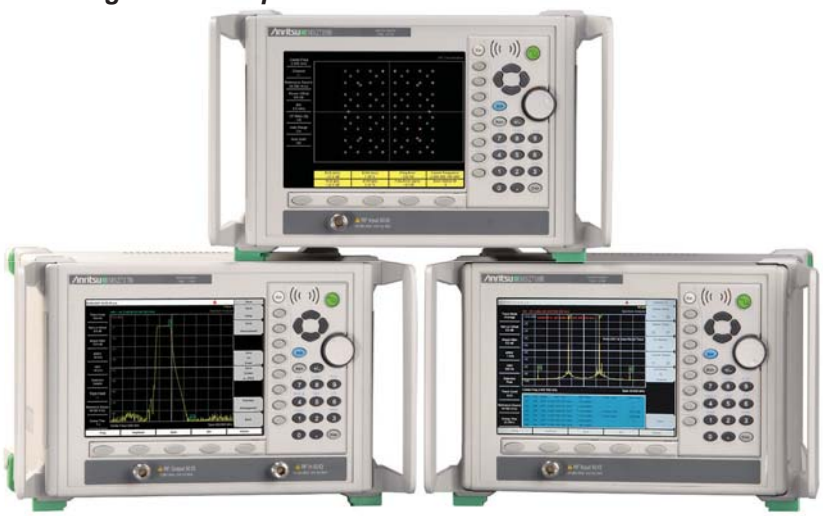
ECONOMY SPECTRUM ANALYZERS

MS2717B, MS2718B, MS2719B

9 kHz to 7.1, 13, and 20 GHz

CE Ethernet

Advanced Spectrum Analysis for Manufacturing, R&D and General Purpose Testing
Now with 13 wireless testing software options from WiMAX to GSM



Engineers in R&D and manufacturing need advanced tools for spectrum analysis of wireless components in the critical physical layer of modern communication systems. For best value and overall satisfaction, these general purpose tools must deliver performance, capabilities, and the ability to lower the cost of testing. Anritsu's new MS271xB Economy Microwave Spectrum Analyzers offer superior performance and advanced capabilities. Take a closer look and we think you will agree that the MS271xB family redefines the economy class by delivering superior spectrum analyzer performance at a surprisingly affordable price.
Covering the 9 kHz to 7.1, 13 and 20 GHz ranges, the MS271xB family easily handles most RF and microwave spectrum analyzer needs. The hallmark of the MS271xB family is the phase noise performance: typical –110 dBc/Hz SSB phase noise at 10 kHz offsets up to 7.1 GHz (MS2717B) which easily measures most wireless local oscillators and synthesizers. The superior dynamic range of 100 dB means fast and precise testing of wireless components that require exceptional linearity. The wide 10 MHz demodulation bandwidth supports 13 new software test routines, written to meet wireless industry specifications for system formats from the popular Mobile WiMAX to the classic GSM. Best of all, the MS271xB family is ergonomically designed so controls are easy-to-learn and easy-to-use for improving productivity in manufacturing, R&D, and general purpose testing.

Features

Typical Performance of the MS271xB

- 9 kHz to 7.1, 13 and 20 GHz
- Standard Built-in Preamplifier
- Dynamic Range of 100 dB
- Third Order Intercept of +12 dBm
- DANL (No Preamp) of –126 dBm (RBW = 10 Hz)
- DANL (With Preamp) of –150 dBm (RBW = 10 Hz)
- Phase Noise (800 MHz) of –114 dBc/Hz at 10 kHz Offset
- Amplitude Accuracy of ±1.0 dB to 20 GHz
- Sweep Speed of 279 ms in 10 MHz Span (RBW = 30 kHz, VBW = 10 kHz)
- Demodulation Bandwidth of 10 MHz
- Residual ACLR of –60 dB
- Residual EVM of 1.75%
- True RMS Detection
- 65 dB Attenuation Range, 5 dB Steps
- 20 Watt (+43 dBm) Input Protection

Optional Capabilities

- Tracking Generator option (MS2717B only)
- GPIB support
- High Accuracy Power Meter Option
- Rack Mount Chassis: Conveniently place MS271xB in 19 inch racks

LabVIEW® is a registered trademark of National Instruments Corporation

Master Software Tools

- Anritsu Master Software Tools: Powerful data management and pass/fail setup tool (Windows® 2000/XP compatible).

General

- Easy-to-Learn Operation
- 8.4 inch Color TFT Display (SVGA)
- Eight Built-in Languages (plus Two Custom)
- 256 MB Storage for 4,000 Traces and 4,000 Setups
- Six Markers, Nine Marker Modes
- Built-in AM/FM/SSB Demodulator
- Output Displays in JPEG Formats
- Connectivity: Ethernet, USB 2.0, Compact Flash
- USB 2.0 Host connector for PSN50 High Accuracy Power Meter and USB Flash Drives
- Remote Programming: Ethernet Only
- Compact Size and Weight: 5.6 kg (12 lbs)
- Operational –10˚ to +55˚C, Humidity <85%
- 1 Year Standard Warranty
- Improved Zero-Span Operation
- New Advanced Limit Line Capabilities - Pass/Fail Tests
- LabVIEW® Drivers Available

Optional Wireless Software Test Capabilities

Wireless Protocol	RF Measurements*1	Demodulator Measurements*1
GSM/GPRS/EDGE	Option 40	Option 41
CDMA	Option 42	Option 43
W-CDMA	Option 44	Option 45
W-CDMA/HSDPA	Option 44	Option 65*2
TD-SCDMA	Option 60	Option 61
EVDO	Option 62	Option 63
Fixed WiMAX	Option 46	Option 47
Mobile WiMAX	Option 66	Option 67

*1: RF and Demodulator options measure signal modulations and require Option 009
*2: Option 65 includes Option 45

Manufacturing Friendly

Manufacturing engineers in search of test solutions judge economy in terms of cost-of-test and cost-of-ownership. Other low-cost instruments sacrifice performance to slash cost-of-test of wireless RF components. No sacrifices are necessary with the MS271xB Economy Spectrum Analyzer. Its out-standing performance truly belies its "economy" label. Production lines everywhere can upgrade their capabilities and lower their costs.

Engineering Friendly

With all of its measurement performance and capability, the MS271xB-Family Economy Spectrum Analyzer is hardly limited to the production floor. General purpose test users throughout the world are facing increased bandwidths and data rates for systems with higher-order modulation formats using in-phase (I) and quadrature (Q) techniques. But even though competitive markets are demanding RF components for less, they must still provide high performance for these systems. And instrument makers are challenged to test and verify component performance faster and at lower costs.

Fortunately, with its superior performance, engineers can precisely characterize their designs in terms of both spectral responses and transmitter quality using a single instrument. The same instrument used to validate design performance can simply and easily verify manufacturing performance. The advanced capabilities and affordable performance of the MS271xB-Family Economy Spectrum Analyzer ensures smooth transition from design to production, improving not only time-to-market but time-to-volume profitability.

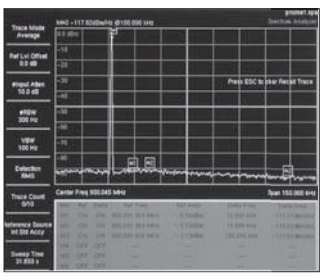
Master Software Tools

Each instrument ships with a test assistant: a copy of Anritsu's Master Software Tools™ for Windows® 2000/XP. This allows an operator to add the processing capabilities of a PC and this software to the MS271xB-Family Economy Spectrum Analyzers to form a powerful and flexible measurement solution.

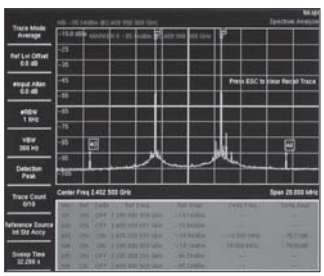
A new Limit-Line creation capability has been added to the Master Tools. For test applications with specification limits, the user can create and modify display limit lines, make changes or compare to actual signals. Limit lines plus the pass/fail functions of the wireless test options facilitate production testing times without human attention to detailed test routines. A Broadcast Spectrum limit version is available for transmitter testing to FCC standards.

Typical Spectrum Analysis Measurements

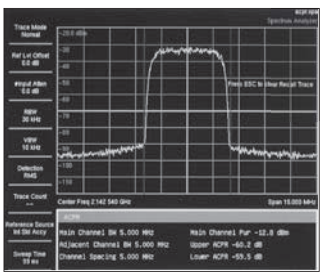
The following three examples highlight the most popular measurements using the MS271xB-Family Economy Spectrum Analyzer for RF & Microwave applications.



Phase noise measurements are the hallmark of the MS271xB-Family



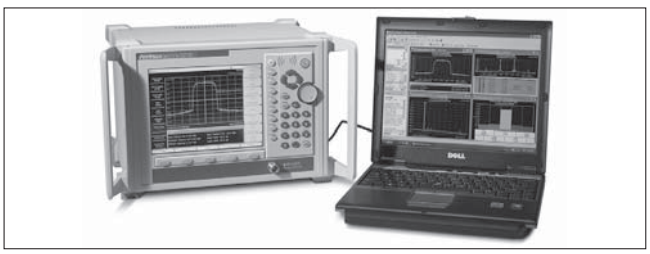
Intermodulation distortion measurements are faster and more precise with the MS271xB-Family



Automatic Adjacent Channel Power Ratio (ACPR) measurements are standard in the MS271xB-Family

Automatic Test Programming Tools Available

For production and other automatic test program creation, MS271xB-Family instrument drivers are available from the National Instrument Co. Known as LabVIEW®, the drivers make high-level language and programming tools available for the convenience and speed in generating automatic test capabilities for your production lines.



Multiply your Measurement Power with 13 Wireless Test Options

The MS271xB-Family of Economy Spectrum Analyzers is much more than just another spectrum analyzer series. In addition to making swept spectrum measurements, engineers and technicians can rely on this tool to accurately measure transmitter RF and modulation quality on critical wireless system components and sub-assemblies. These software test programs are pre-written test routines, intended to test signal performance against the wireless industry specifications. There are now 13 different functional test options available for specific performance testing of wireless systems, ranging from the hot new wireless technology of Mobile WiMAX to the venerable GSM, and four other system formats. For each wireless format, there are two options, one for characterizing the RF signal performance and the other for the demodulator functions. Within any given system format, a long list of test functions are performed, with displays showing both measured data as well as computed characterizations.

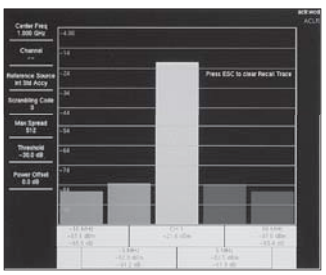
The following page shows two charts. The first contains the overview of all 13 options with their individual coverage of test routines. The second chart shows an example, based on the Mobile WiMAX technology, of the detailed characterizations and their associated display titles, and the value that they deliver to the test engineer. It should be noted that all the pre-written test routines include a pass/fail function which serves a valuable purpose in production applications since the on-screen display chart summarizes at once the overall test results for the test device or system.

With the companion MG3700A Vector Signal Generator (250 kHz – 3/6 GHz), you get precise test signals with complex modulation matching your wireless system configuration

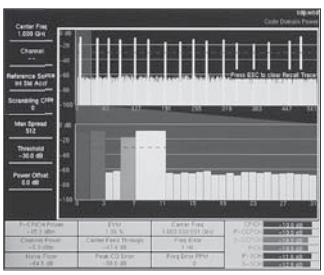
Typical Modulation Analysis Measurements

Some Typical Modulation Measurement Displays

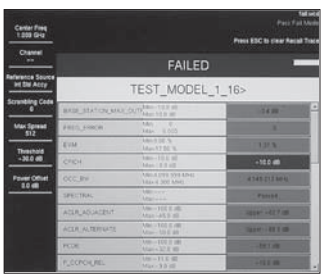
When upgraded with wireless software test options, such as Options 44 and 65, the following examples highlight some popular modulations measurements associated with high performance system operations.



Automated W-CDMA Adjacent Channel Leakage Ratio (ACLR) measurements are optional in the MS271xB-Family



Minimize keystrokes with a single MS271xB-Family display containing critical W-CDMA demodulated results



Quickly verify performance to 3GPP test models with the MS271xB-Family Economy Spectrum Analyzer

Overview of Optional Wireless Capabilities

MS271xB-Family available functional tests by option		Wireless signal analysis														
		GSM/GPRS/ EDGE		W-CDMA/HSDPA			CDMA		EVDO		Fixed WiMAX		Mobile WiMAX		TD-SCDMA	
Options		40	41	44	45	65	42	43	62	63	46	47	66	67	60	61
		RF	Demod	RF	Demod	Demod	RF	Demod	RF	Demod	RF	Demod	RF	Demod	RF	Demod
RF measurements	Spectrum	√		√			√		√		√		√		√	
	Power vs. time	√							√		√		√		√	
	ACLR/ACPR			√			√		√		√		√			
	Spectral emission mask			√												
	Spurious emission						√		√							
	RF summary	√		√			√		√		√		√		√	
Demodulation measurements	Code Domain Power (CDP), CDP Table				√	√		√		√						√
	Codogram				√	√										
	I/Q constellation		√			√						√		√		
	EVM vs. sub-carrier, EVM vs. symbol											√		√		√
	Spectral flatness											√		√		
	DL-MAP													√		
	Demodulation summary		√		√	√		√		√		√		√		√
Pass/Fail mode		√	√	√	√	√	√	√	√	√	√	√	√	√		

Examples of Measurement Results or Computed Parameters Displayed vs. Test Titles (Mobile WiMAX, Options 66 and 67)

RF measurements	Spectrum	Channel Power (RSSI), Occupied BW Select Span
	Power vs. time	Channel Power (RSSI), Preamble Power, Downlink Burst Power, Uplink Burst Power
	ACPR	Alternate Left, Adjacent Left, Channel Power, Adjacent Right, Alternate Right
	RF summary	Channel Power (RSSI), Downlink Burst Power, Preamble Power, Occupied BW, Uplink Burst Power
Demodulation measurements	I/Q constellation Select reference points Off/On EVM vs. sub-carrier, EVM vs. symbol	RCE (rms), RCE (pk), EVM (rms), EVM (pk), Frequency Error, Frequency Error (ppm), Carrier Frequency, Sector ID
	Spectral flatness	Adjacent Sub-carrier Flatness (Peak)
	DL-MAP	Auto Decode, Number of Zones, Selected Zone, Preamble Index, Segment, ID Cell, Subchannel Bitmaps
	Demodulation summary	RCE (rms), RCE (pk), EVM (rms), EVM (pk), Carrier Frequency, Frequency Error, Frequency Error (ppm), Sector ID

Pass/Fail Mode available for measurements in both options 66 and 67

MS271xB-Family Economy Spectrum Analyzer Specifications

Frequency	Frequency range, tuning resolution	9 kHz to 7.1, 13 and 20 GHz, 1 Hz
	Frequency reference	Aging ±1 ppm/10 years Every MS271xB now ships with the better-accuracy OCXO Accuracy ±0.3 ppm (+25˚C ±25˚C) + aging
	Frequency span	10 Hz to full frequency range plus 0 Hz (zero span)
	Sweep time	Zero span: 10 µs to 600 s Spans >0 Hz: Minimum 200 ms, automatically optimized. Can be manually increased
	Sweep trigger	Free run, Single, Video, External
	Resolution bandwidth (–3 dB width)	1 Hz to 3 MHz in 1–3 sequence ±10%, 200 Hz, 9 kHz, 120 kHz when quasi-peak detector selected
	Video bandwidth (–3 dB)	1 Hz to 3 MHz in 1–3 sequence
	SSB phase noise	–100 dBc/Hz max at 10, 20 & 30 kHz offset from carrier –102 dBc/Hz max at 100 kHz offset from carrier
	Capture bandwidth	10 MHz
Amplitude	Measurement range 2/3 (TOI—DANL), –20 dBm tones, 100 kHz spacing RBW = 1 Hz, 0 dB attn, Preamp = OFF	MS2717B: 600 MHz, 95 dB; 3.5 GHz, 96 dB MS2718B and MS2719B: 2.4 GHz, 101 dB
	Overall amplitude accuracy (95%) 20˚ to 30˚C, 10 dB input attenuation, preamplifier off, 0 to –50 dBm	±0.9 dB, 100 kHz to 3 GHz ±1.25 dB, >3 GHz to 7.1 GHz

Continued on next page

Amplitude	Displayed average noise level (DANL in 10 Hz RBW, 0 dB attenuation, –50 dBm reference level preamp off)	<table><tr><th>Frequency</th><th>MS2717B</th><th>MS2718B</th><th>MS2719B</th></tr><tr><td>10 MHz to 1.0 GHz</td><td>–137 dBm</td><td>–139 dBm</td><td>–139 dBm</td></tr><tr><td>>1 to 2.2 GHz</td><td>–133 dBm</td><td>–139 dBm</td><td>–139 dBm</td></tr><tr><td>>2.2 to 2.8 GHz</td><td>–126 dBm</td><td>–139 dBm</td><td>–139 dBm</td></tr><tr><td>>2.8 to 3.0 GHz</td><td>–136 dBm</td><td>–139 dBm</td><td>–139 dBm</td></tr><tr><td>>3.0 to 4.0 GHz</td><td>–136 dBm</td><td>–139 dBm</td><td>–139 dBm</td></tr><tr><td>>4.0 to 7.1 GHz</td><td>–127 dBm</td><td>–136 dBm</td><td>–136 dBm</td></tr><tr><td>>7.1 to 10 GHz</td><td>N/A</td><td>–136 dBm</td><td>–136 dBm</td></tr><tr><td>>10 to 13 GHz</td><td>N/A</td><td>–130 dBm</td><td>–130 dBm</td></tr><tr><td>>13 to 20 GHz</td><td>N/A</td><td>N/A</td><td>–130 dBm</td></tr></table>
	Display range	1 to 15 dB/div in 1 dB/steps, Ten divisions displayed
	Amplitude units log scales modes	dBm, dBV, dBmV, dBµV
	Attenuator range	0 to 65 dB

General Specifications

Maximum continuous input	10 dB attenuation, +30 dBm, ±50 VDC
RF input VSWR	2.0:1 maximum, 1.5:1 typical (≥10 dB attenuation)
Interfaces	Type N female RF Connector BNC female connectors for external reference and external trigger RJ45 connector for Ethernet 10/100BASE-T USB 2.0 (full-speed) Compact Flash 2.5 mm 3-wire cellular headset connector GPIB
Environmental	MIL-PRF-28800F Class 2 Operating: –10˚ to +55˚C, humidity 85% 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
Dimensions and mass	14.7 x 9.6 x 13.4 in. (372 x 242 x 339 mm), <12 lbs. (5.6 kg) typical
Power requirements	90 to 250 volts, 47 to 63 Hz, 35 VA maximum

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.

All models include standard 1 year warranty plus Certificate of Calibration and Conformance

Model/Order No.	Name
	Main frame
MS2717B	Economy Microwave Spectrum Analyzer 9 kHz to 7.1 GHz, including preamplifier
MS2718B	Economy Microwave Spectrum Analyzer 9 kHz to 13.0 GHz, including preamplifier
MS2719B	Economy Microwave Spectrum Analyzer 9 kHz to 20.0 GHz, including preamplifier
	Standard accessories
10580-00181	Anritsu User's Guide, Models MS271xB
2300-498	CD-ROM containing Master Software Tools
3-2000-1498	USB A-mini B Cable
2000-1371	RJ45 Ethernet Cable
3-2000-1567	512 MB Compact Flash
2000-1520-R	2 GB USB Flash Drive
1091-27	Type-N Male to SMA Female Adapter
1091-172	Type-N Male to BNC Female Adapter
	Options
MS271xB-001	Rack Mount (No Slides)
MS271xB-007	Secure Data Operation
MS271xB-009	RF and Demodulation Hardware
MS271xB-017	GPIB Interface
MS271xB-019	High Accuracy Power Meter Functionality (PSN50 Sensor not included)
MS2717B-020	Tracking Generator (MS2717B only)
MS2718B-089	IF Output
MS2719B-089	IF Output
	Calibration options
MS271xB/98	Z540/ISO Guide 25 Calibration
MS271xB/99	Premium Calibration
	Optional transit case
760-244-R	MS271xB Transit Case (includes wheels)
	Optional rack mount kit
MS271xB-001	Rack Mount (No Slides)

Model/Order No.	Name
	Optional accessories
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24106A	USB Power Sensor, 50 MHz to 6 GHz
3-2000-1567	512 MB Compact Flash
2000-1520-R	2 GB USB Flash Drive
2000-1209	Cross-over Ethernet Cable
42N50A-30	30 dB, 50 W, Bi-directional, DC to 18 GHz, N (m) – N (f) Attenuator
34NN50A	Precision Adapter, DC to 18 GHz, 50 Ω, N (m) – N (m)
34NFNF50C	Precision Adapter, DC to 18 GHz, 50 Ω, N (f) – N (f)
15NNF50-1.5B	Test Port Cable, Armored, 1.5 m, N (m) – N (f) 18 GHz
15NN50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) – N (m), 6 GHz
15NN50-3.0C	Test Port Cable, Armored, 3.0 m, N (m) – N (m), 6 GHz
15NN50-5.0C	Test Port Cable, Armored, 5.0 m, N (m) – N (m), 6 GHz
15NNF50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) – N (f), 6 GHz
15NNF50-3.5C	Test Port Cable, Armored, 3.0 m, N (m) – N (f), 6 GHz
15NNF50-5.0C	Test Port Cable, Armored, 5.0 m, N (m) – N (f), 6 GHz
15ND50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) – 7/16 DIN (m), 6.0 GHz
15NDF50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) – 7/16 DIN (f), 6.0 GHz
510-90	Adapter, 7/16 DIN (f) – N (m), DC to 7.5 GHz, 50 Ω
510-91	Adapter, 7/16 DIN (f) – N (f), DC to 7.5 GHz, 50 Ω
510-92	Adapter, 7/16 DIN (m) – N (m), DC to 7.5 GHz, 50 Ω
510-93	Adapter, 7/16 DIN (m) – N (f), DC to 7.5 GHz, 50 Ω
510-96	Adapter, 7/16 DIN (m) – 7/16 DIN (m), DC to 7.5 GHz, 50 Ω
510-97	Adapter, 7/16 DIN (f) – 7/16 DIN (f), 7.5 GHz
	Literature
10580-00181	Anritsu User Guide, Models MS271xB
10580-00182	Anritsu Programming Manual, Models MS271xB
11410-00418	MS271xB Family Brochure
	Software
2300-498	Master Software Tools CD-ROM
2300-517	Phase Noise Software CD-ROM and Key

Continued on next page

Model/Order No.	Name
	Wireless options (require option 009)
MS271xB-040	GSM/GPRS/EDGE RF Measurements
MS271xB-041	GSM/GPRS/EDGE Demodulator
MS271xB-042	CDMA RF Measurements
MS271xB-043	cdmaOne and CDMA2000 1xRTT Demodulator
MS271xB-044	W-CDMA/HSDPA RF Measurements
MS271xB-045	W-CDMA Demodulator
MS271xB-046	Fixed WiMAX RF Measurements
MS271xB-047	Fixed WiMAX Demodulator
MS271xB-060	TD-SCDMA Measurements
MS271xB-061	TD-SCDMA Demodulator
MS271xB-062	EVDO RF Measurements
MS271xB-063	EVDO Demodulator
MS271xB-065	W-CDMA/HSDPA Demodulator*1
MS271xB-066	Mobile WiMAX RF Measurements
MS271xB-067	Mobile WiMAX Demodulator

*1: Option 065 includes Option 045.

Wireless protocol	Frequency range (s)
GSM/GPRS/EDGE Mode	380 to 400 MHz 410 to 430 MHz 450 to 468 MHz 478 to 496 MHz 698 to 746 MHz 747 to 792 MHz 806 to 866 MHz 824 to 894 MHz 890 to 960 MHz 880 to 060 MHz 876 to 960 MHz 870 to 921 MHz 1710 to 1990 MHz
W-CDMA/HSDPA	824 to 894 MHz 1710 to 2170 MHz 2300 to 2700 MHz
CDMA Mode	1 MHz to 2.7 GHz
EVDO Mode	1 MHz to 2.7 GHz
Fixed WiMAX Mode	2.3 to 2.7 GHz 3.3 to 3.8 GHz 5.25 to 5.875 GHz
Mobile WiMAX Mode	2.3 to 2.7 GHz 3.3 to 3.8 GHz
TD-SCDMA Mode	1 MHz to 2.7 GHz

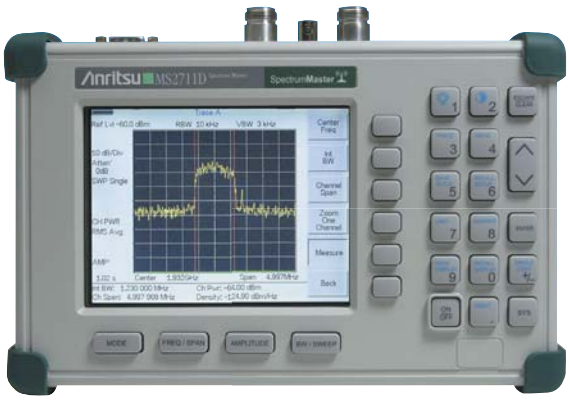
SPECTRUM MASTER

MS2711D Handheld Spectrum Analyzer

100 kHz to 3.0 GHz

CE

Fast, Accurate, Repeatable, Portable Spectrum Analysis



The MS2711D Handheld Spectrum Analyzer provides excellent measurement flexibility for field environments and applications requiring mobility. Unlike traditional spectrum analyzers, the MS2711D features a rugged, ultra-lightweight, battery-operated design that enables users to conduct spectrum analysis measurements anywhere, anytime.

Providing complete freedom from AC/DC power requirements, the MS2711D enables you to locate, identify, record and solve communication systems problems quickly and easily, without sacrificing measurement accuracy.

Whether you are installing, maintaining, or troubleshooting a modern wireless communication system, the MS2711D provides exceptional performance combined with ease-of-use and broad functionality – making them the ideal solution for engineers and technicians who conduct field measurements in the 100 kHz to 3.0 GHz frequency range. In fact, they are ideal for finding the source of interfering signals in modern wireless systems.

Rugged and Reliable

Because the MS2711D was designed specifically for field environments, they can easily withstand the day-to-day punishment of field use. Rugged packaging keeps the MS2711D performing in harsh environments.

Easy-to-Use

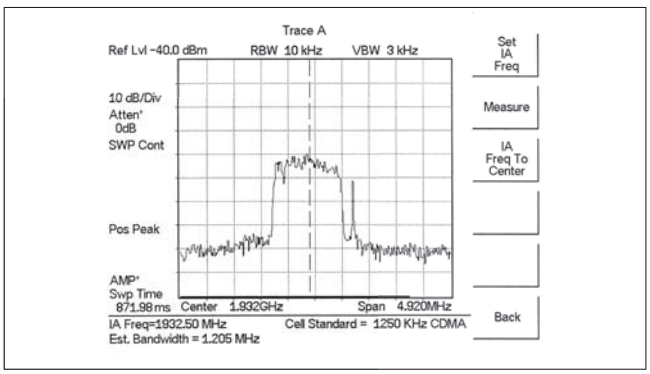
Not only is the MS2711D the lightest fully-functional spectrum analyzer available at 4.5 pounds (base model including battery), operation is straight-forward and driven by firmware that simplifies the process of making measurements and interpreting the results shown on the large, high-resolution LCD display. The menu-driven user interface is easy to use and requires little training.

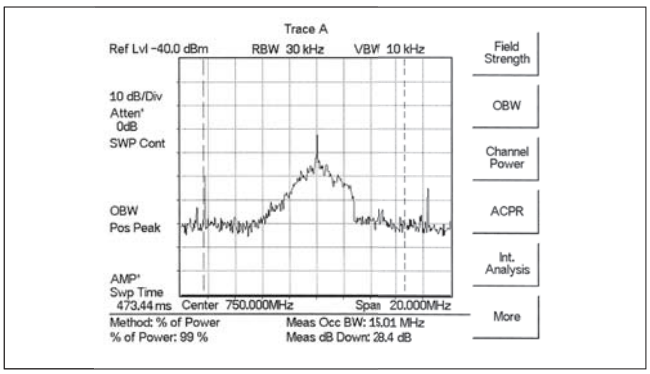
A full range of marker capabilities such as peak, center and delta functions are also provided, giving users a faster and more comprehensive measurement of displayed signals. Limit lines simplify amplitude measurements, giving users the capability to create quick, simple, pass/fail measurements. Frequency, span and amplitude functions are easily configured for optimum performance. Used together with the Save Setup feature, these functions can help to make testing easier and faster for less experienced users.

Powerful Trace Management

Users are able to store ten test setups along with 200 measurement traces internally in the unit's memory. The stored data can be easily downloaded to a personal computer (PC) or a printer via an RS232 or USB serial cable for further analysis. A computer can be used with the RS232 interface for automated control and data collection in the field.

A preamplifier plus a number of available options including transmission measurement (option 21, MS2711D) expand the MS2711D's capabilities.





To meet the challenges of today's wireless market, Anritsu Company has incorporated a pre-amp (standard) for its revolutionary MS2711D Handheld Spectrum Analyzer which increases the analyzer's sensitivity and dynamic range while improving measurement time. With the built-in pre-amp feature, the MS2711D is particularly effective in measuring low-level signals. The handheld spectrum analyzer's sensitivity is improved to –135 dBm (100 Hz RBW). With this option, the MS2711B/D can identify and make measurements on low-level signals much faster than previously possible.

The improved sensitivity, dynamic range, and measurement speed complement the existing benefits of the MS2711D. Weighing only 4.9 pounds (including a NiMH battery, fully loaded, base model only 4.5 pounds).

The MS2711D has been enhanced so that it can make highly accurate channel power measurements, occupied bandwidth and Adjacent Channel Power Ratio (ACPR) measurements. These are increasingly critical measurements, particularly for power amplifiers used in wireless communication systems. With the enhancements, the MS2711D has dedicated one button channel power, occupied bandwidth, and ACPR measurement capability to significantly reduce test time and expense. The MS2711D also features local language graphical user interface support (English, Chinese, Japanese, French, German, and Spanish).

Features

- Lightweight (4.5 lbs - base model, 4.9 lbs with transmission measurement, MS2711D option 21)
- Synthesizer-based performance
- Wide dynamic range
- One button, ACPR, OBW, channel power, C/I measurement
- Quick zoom-in, zoom-out display
- Five minute warm up
- Manual and automatic attenuator control
- Improved user interface, with local language support in five different languages
- Automatic overload and ESD protection
- Built-in AM/FM/SSB demodulation
- Built-in field strength measurement
- Ability to store and recall up to six sets of antenna factors
- Full range of marker capabilities including peak, center, and delta functions
- Limit lines for quick, simple pass/fail measurements
- Rugged, reliable packaging
- Battery operated design
  - 2.5 hours of continuous operation
  - Built-in energy conservation that extends battery life beyond an eight-hour workday
  - Operation using a 12.5 Vdc source AC-DC adapter or automotive cigarette lighter adapter, which simultaneously charges the battery
  - Field replaceable battery
- Built in clock and calendar
- Low cost ownership, global warranty
- Optional Interference Analysis including spectrogram, signal strength and RSSI
- Optional channel scanner for viewing the received power level of up to 20 channels
- Optional CW Signal Generator output . Power level is adjustable with this option using attenuator kit 61534
- Optional build-in GPS receiver with external antenna for location stamping measurements
- Data storage and memory
  - Store up to ten test setups and 200 measurement traces in non-volatile memory
  - Stored data is easily and quickly downloaded to a personal computer (PC) or printer
- Powerful trace management
  - Automatically date/time stamped
  - Alphanumeric labeling
- PC reporting software (Master Software Tools)
  - Windows® XP and Vista
  - Supports long file names for descriptive labeling
  - Can display an unlimited number of traces for comparison to historical performance
- Color LCD display with backlight capability
- Direct printer control via RS232 serial port

Applications

Convenient operating procedures, high sensitivity, and excellent repeatability enables the MS2711D to pinpoint the smallest system performance degradation and allow for easy verification of system compliance. Typical applications include:

- Transmitter Spectrum Analysis – occupied bandwidth, power, modulation measurements, location and identification of in-band, out-of-channel spurious and out-of-band spurious signals
- Receive Signal Analysis – locate and identify sources of interfering signals
- Modulation identification, modulation depth, deviation, and spectral mask
- Signal Strength Mapping – to determine the most suitable location for antennas, base stations, and repeaters; or pinpoint electromagnetic (EM) leakage in broadcast systems

Specifications

Frequency	Frequency range	100 kHz to 3.0 GHz
	Frequency reference	Aging: ±1 ppm/yr Accuracy: ±2 ppm
	Frequency span	10 Hz to 2.99 GHz in 1, 2, 5 step selections in auto mode, plus zero span
	Sweep time	≤1.1 second full span; ≤50 msec to 200 second zero span
	Resolution bandwidth (–3 dB width)	100 Hz to 1 MHz in 1-3 sequence, ±5%
	Video bandwidth (–3 dB)	100 Hz to 300 kHz in 1-3 sequence
	SSB Phase Noise (1 GHz) @30 kHz Offset	≤–75 dBc/Hz
	Spurious responses Input related	≤–45 dBc
	Spurious residual responses	≤–90 dBm (≥500 kHz)
Amplitude	Measurement range	+20 to –135 dBm (with preamp on)
	Displayed average noise level	≤–135 dBm typical, ≥1 MHz (preamp on) ≤–115 dBm typical, ≥500 kHz to <1 MHz ≤–110 dBm typical, <500 kHz for input terminated, 0 dB attenuation, RMS detection, 100 Hz RBW
	Dynamic range	>65 dB, typical
	Total level accuracy	±1 dB typical (±1.5 dB max) ≥10 MHz to 3 GHz ±2 dB typical <10 MHz for input signal level ≥–60 dBm, excludes input VSWR mismatch
	Display range	1 to 15 dB/div in 1 dB steps, Ten divisions displayed
	Max input level without damage	+43 dBm (Peak), ±50 Vdc
	Attenuator Range	0 to 51 dB, selected manually or automatically coupled to the reference level. Resolution in 1 dB steps.
	RF input	1.5:1 typical, (≥20 dB atten., 10 MHz to 2.4 GHz)

Continued on next page

General	Internal trace memory	200 maximum
	Setup storage	15 test setups
	Display	VGA Monochrome LCD
	Inputs and Outputs Ports RF In RF Out Ext trig In Ext Freq Ref In (2 MHz to 20 MHz) Serial Interface	 Type N, female, 50 Ω Type N, female, 50 Ω BNC, female (5 V TTL) Shared BNC, female, 50 Ω (–15 to +10 dBm) RS-232 9 pin D-sub, three wire serial
	Electromagnetic compatibility	Meets European community requirements for CE marking
	Safety	Conforms to EN 61010-1 for Class 1 portable equipment
	Temperature Operating Non-operating	 –10˚ to +55˚C, humidity 85% or less –51˚ to +71˚C (recommend battery stored separately between 0˚ to +40˚C for any prolonged storage period)
	Power supply External DC Input Internal	 12.5 to 15 volts dc, 1350 mA max NiMH battery: 10.8 volts, 1800 mA mAH
	Dimensions and mass	25.4 (W) x 17.8 (H) x 6.10 (D) cm (10.0 x 7.0 x 2.4 in) <2.14 kg (4.7 lbs) includes battery, <2.28 kg (5 lbs) includes transmission measurement

• MS2711D (Option 10A) Bias Tee

Bias Tee	Voltage	12 to 24 Vdc
	Power	8 Watts

• MS2711D (Option 21) Transmission Measurement

Frequency	Frequency range Frequency resolution	25 MHz to 3 GHz 10 Hz
Output	Output power level Output impedance	–10 dBm typical 50 Ω

• FCN4760 Frequency Converter

Frequency	Frequency range	4.7 GHz to 6 GHz
	Frequency resolution*	10 Hz
	Frequency reference	Aging: ±1 ppm/yr Accuracy: ±2 ppm
	SSB Phase Noise (6 GHz) @30 kHz Offset	≤–65 dBc/Hz
	Spurious responses Input related	≤–45 dBc
	Spurious residual responses*	≤–90 dBm
Amplitude	Measurement range	–40 to –100 dBm
	Sensitivity* (displayed avg. noise level)	–100 dBm
	Maximum input level without damage	–5 dBm
	RF input	VSWR 2.0:1 max
General	Inputs and Outputs Ports RF In RF Out Communication Interface	 Type N, female, 50 Ω Type N, male, 50 Ω 10 pin D-sub
	Electromagnetic compatibility	Meets European community requirements for CE marking
	Safety	Conforms to EN 61010-1 for Class 1 portable equipment
	Temperature Operating Non-operating	 –10˚ to +50˚C, humidity 85% or less –50˚ to +80˚C
	Power dissipation	850 mW max
	Dimensions and mass	6.6 (W) x 10.9 (H) x 3.3 (D) cm (2.6 x 4.3 x 1.3 in) <0.45 kg (< 1 lb.)

*: Specifications apply when connected to the MS2711D spectrum analyzer

- **MS2711D (Option 29) Power Meter**

Frequency Range	3 MHz to 3.0 GHz
Total Level Accuracy	±1 dB typical (±1.5 dB max) ≥10 MHz to 3 GHz ±2 dB typical <10 MHz for input signal level ≥–60 dBm, excludes input VSWR mismatch
Measurement Range	+20 to –80 dBm
Frequency Span	3 MHz to 2.99 GHz
Display Range	+80 to –80 dBm
Offset Range	0 to 60 dB
Maximum Input Power	+20 dBm without input attenuator

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
MS2711D	**Main frame** Handheld Spectrum Analyzer: 100 kHz to 3.0 GHz
	Standard accessories MS2711D User's Guide Soft Carrying Case AC – DC Adapter Automotive Cigarette Lighter/12 Volt DC Adapter One Year Warranty CD-ROM containing Software Tools Serial Interface Cable Rechargeable battery, NiMH Pre-amplifier (built-in)
Option 5 Option 6 Option 10 Option 19 Option 21 Option 25 Option 27 Option 28 Option 29 Option 31	**Options** Power Monitor (requires external detector, sold separately) Frequency Converter Controller Module for use with FCN4760 Bias Tee (built-in) Support for the PSN50 High Accuracy Sensor Transmission Measurement (built-in) Interference Analysis Channel Scanner CW Signal Generator (requires external attenuator kit, sold separately, Anritsu part number 61534) Power Meter GPS Receiver (includes GPS antenna, Anritsu part number 2000-1410)
FCN4760 PSN50 61534 5400-71N50 42N50A-30 34NN50A 34NFNF50C 15NN50-1.5C 15NN50-3.0C 15NN50-5.0C 15NNF50-1.5C 15NNF50-3.0C 15NNF50-5.0C 15ND50-1.5C 15NDF50-1.5C 510-90 510-91 510-92 510-96 510-97	**Optional accessories** 4.7 to 6.0 GHz Down Converter (requires MS2711D/6 or S332D/6) High Accuracy Power Sensor CW Signal Generator Kit RF Detector, N (m), 50 Ω, 1 to 3000 MHz (MS2711B only) 30 dB, 50 W, Bi-directional, DC to 18 GHz, N (m) to N (f) Attenuator Precision Adapter, DC to 18 GHz, 50 Ω, N (m) to N (m) Precision Adapter, DC to 18 GHz, 50 Ω, N (f) to N (f) Test Port Cable Armored, 1.5 m, N (m) to N (m), 6.0 GHz Test Port Cable Armored, 3.0 m, N (m) to N (m), 6.0 GHz Test Port Cable Armored, 5.0 m, N (m) to N (m), 6.0 GHz Test Port Cable Armored, 1.5 m, N(m) to N (f), 6.0 GHz Test Port Cable Armored, 3.0 m, N (m) to N (f), 6.0 GHz Test Port Cable Armored, 5.0 m, N (m) to N (f), 6.0 GHz Test Port Cable Armored, 1.5 m, N (m) to 7/16 DIN (m), 3.5 GHz Test port cable armored, 1.5 m, N (m) to 7/16 DIN (f), 3.5 GHz Adapter 7/16 (f) to N (m), 3.5 GHz Adapter, 7/16 DIN (f) to N (f), 7.5 GHz Adapter, 7/16 DIN (m) to N (m), 7.5 GHz Adapter 7/16 DIN (m) to 7/16 DIN (m), 7.5 GHz Adapter 7/16 DIN (f) to 7/16 DIN (f), 7.5 GHz

Model/Order No.	Name
560-7A50	Detector, 10 MHz to 18 GHz, GPC-7, 50 Ω
560-7N50B	Detector, 10 MHz to 20 GHz, N (m), 50 Ω
560-7S50B	Detector, 10 MHz to 20 GHz, WSMA (m), 50 Ω
560-7S50-2	Detector, 10 MHz to 26.5 GHz, WSMA (m), 50 Ω
560-7K50	Detector, 10 MHz to 40 GHz, K (m), 50 Ω
560-7VA50	Detector, 10 MHz to 50 GHz, V (m), 50 Ω
1030-109	Bandpass Filter, 824 to 849 MHz, N (m) - SMA (f), 50 Ω
1030-110	Bandpass Filter, 880 to 915 MHz, N (m) - SMA (f), 50 Ω
1030-111	Bandpass Filter, 1850 to 1910 MHz, N (m) - SMA (f), 50 Ω
1030-112	Bandpass Filter, 2400 to 2484 MHz, N (m) - SMA (f), 50 Ω
48258	Spare soft carrying case
40-168	Spare AC/DC adapter
806-62	Spare Automotive Cigarette Lighter/12 Volt DC Adapter
800-441	Spare Serial Interface Cable
760-243-R	New Transit Case
2300-347	Anritsu Handheld Software Tools
10580-00074	Anritsu HHSA User's Guide, Model MS2711B (spare)
10580-00071	Anritsu HHSA Programming Manual, Model MS2711B
10580-00072	Anritsu HHSA Maintenance Manual, Model MS2711B
10580-00097	Anritsu HHSA User's Guide, Model MS2711D
10580-00098	Anritsu HHSA Programming Manual, Model MS2711D
10580-00099	Anritsu HHSA Maintenance Manual, Model MS2711D
633-27	Rechargeable Battery, NiMH
551-1691	USB to Serial adapter
70-28	Headset
2000-1029	Battery Charger, NiMH with Universal Power Supply
2000-1030	Portable Antenna, 50 Ω, SMA (m) 1.71 to 1.88 GHz
2000-1031	Portable Antenna, 50 Ω, SMA (m) 1.85 to 1.99 GHz
2000-1032	Portable Antenna, 50 Ω, SMA (m) 12.4 to 2.5 GHz
2000-1035	Portable Antenna, 50 Ω, SMA (m) 896 to 941 MHz
2000-1200	Portable Antenna, 50 Ω, SMA (m) 806 to 869 MHz
2000-1411	Portable Yagi Antenna, 822 to 900 MHz, N (f), 10 dBd
2000-1412	Portable Yagi Antenna, 885 to 975 MHz, N (f), 10 dBd
2000-1413	Portable Yagi Antenna, 1710 to 1880 MHz, N (f), 10 dBd
2000-1414	Portable Yagi Antenna, 1850 to 1990 MHz, N (f), 9.3 dBd
2000-1415	Portable Yagi Antenna, 2400 to 2500 MHz, N (f), 10 dBd
2000-1416	Portable Yagi Antenna, 1920 to 2230 MHz, N (f), 10 dBd
2000-1214 2000-753 2000-663 2000-664 2000-666 2000-1218 2000-667 2000-1217 2000-1216	**Printers** HP DeskJet printer Includes: interface cable, black print cartridge, and US power cable Spare Serial-to-parallel Converter Cable Power Cable (Europe) for DeskJet printer Power Cable (Australia) for DeskJet printer Power Cable (Japan) for DeskJet printer Power Cable (UK) for DeskJet printer Power Cable (So. Africa) for DeskJet printer Rechargeable Battery for DeskJet printer Black Print Cartridge for DeskJet printer

HIGH PERFORMANCE HANDHELD SPECTRUM ANALYZERS

MS2721B/MS2723B/MS2724B

9 kHz to 20 GHz

CE Ethernet

The Most Advanced Ultra-portable Spectrum Analyzer on the Market, Featuring Unparalleled Performance at a Modest Price

Continuous frequency coverage from 9 kHz to 20 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 20 GHz Input
- 1 Hz to 3 MHz RBW Range
- Very Low Phase Noise (–95 dBc/Hz Maximum at 10 kHz offset at 100 kHz to 20 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 (MS2721B only)
- 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

	Model	MS2721B	MS2723B	MS2724B
Frequency	Frequency range	9 kHz to 7.1 GHz	9 kHz to 13 GHz	9 kHz to 20 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)	10 Hz to 13 GHz Plus 0 Hz (zero span)	10 Hz to 20 GHz Plus 0 Hz (zero span)
	Span accuracy	Same as frequency reference accuracy		
	Sweep time	Automatically sets fastest sweep time consistent with accuracy. 10 µs to 200 s range in zero span.		
	Sweep time accuracy	±2% in zero span		
	Sweep trigger	Free run, Single, Video, External		
	Resolution bandwidth	(–3 dB width) 1 Hz to 3 MHz in 1-3 sequence ±10%, 10 MHz demodulation bandwidth, 200 Hz, 9 kHz, and 120 kHz (–6 dB widths) when quasi-peak detector selected		
	Video bandwidth	(–3 dB) 1 Hz to 3 MHz in 1-3 sequence		
	SSB phase noise	9 kHz to 7.1 GHz: –100 dBc/Hz Max. at 10, 20 and 30 kHz offset –102 dBc/Hz Max. at 100 kHz	9 kHz to 13 GHz: 10, 20, 30 kHz offset –95 dBc/Hz 100 kHz offset –97 dBc/Hz 1 MHz offset –105 dBc/Hz 10 MHz offset –120 dBc/Hz	9 kHz to 13 GHz: 10, 20, 30 kHz offset –95 dBc/Hz 100 kHz offset –97 dBc/Hz 1 MHz offset –105 dBc/Hz 10 MHz offset –120 dBc/Hz 13 to 20 GHz: 10, 20, 30 kHz offset –91 dBc/Hz 100 kHz offset –93 dBc/Hz 1 MHz offset –102 dBc/Hz 10 MHz offset –116 dBc/Hz
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 9 kHz to 10 MHz ±1.5 dB >10 MHz to 4 GHz ±1.25 dB >4 to 7.1 GHz ±1.75 dB 40 to 55 dB input attenuation 9 kHz to 10 MHz ±1.5 dB >10 MHz to 4 GHz ±1.75 dB >4 to 6.5 GHz ±1.75 dB >6.5 to 7.1 GHz ±2 dB 60 to 65 dB input attenuation 9 kHz to 10 MHz ±1.5 dB >10 MHz to 6.5 GHz ±1.75 dB >6.5 to 7.1 GHz ±3 dB Preamplifier on, 0 or 10 dB input attenuation 9 kHz to 4 GHz ±1.5 dB >4 to 7.1 GHz ±1.75 dB	Overall Amplitude Accuracy: +20˚ to +30˚C, 30 minute warmup ±1.3 dB Full Temperature Range: –10˚ to +55˚C add ±1.2 dB Frequency Flatness: >4 GHz add ±1.4 dB	Overall Amplitude Accuracy: +20˚ to +30˚C, 30 minute warmup ±1.3 dB Full Temperature Range: –10˚ to +55˚C add ±1.2 dB Frequency Flatness: >4 GHz add ±1.5 dB
	Second harmonic distortion (0 dB input attenuation, –30 dBm input)	0.05 to 1.4 GHz, –50 dBc >1.4 to 2 GHz, –70 dBc >2 GHz, –80 dBc	–50 dBc, 50 to 500 MHz –45 dBc, 500 to 800 MHz –60 dBc, 800 to 3000 MHz –80 dBc, >3 GHz	–50 dBc, 50 to 500 MHz –45 dBc, 500 to 800 MHz –60 dBc, 800 to 3000 MHz –80 dBc, >3 GHz
	Third order intercept (TOI) (preamplifier off)	Frequency Min. 600 MHz +7 dBm 3.5 GHz +9 dBm Frequency Typical 50 to 300 MHz >8 dBm >300 MHz to 2.2 GHz >10 dBm >2.2 to 2.8 GHz >15 dBm >2.8 to 4.0 GHz >10 dBm >4.0 to 7.1 GHz >13 dBm 0 dB attenuation, –20 dBm reference level, –20 dBm tones, spaced 100 kHz	+6 dBm, 50 to 500 MHz +8 dBm, 500 to 2000 MHz +10 dBm, 2 to 6 GHz +12 dBm, 6 to 13 GHz	+6 dBm, 50 to 500 MHz +8 dBm, 500 to 2000 MHz +10 dBm, 2 to 6 GHz +12 dBm, 6 to 20 GHz

Continued on next page

	Model	MS2721B	MS2723B	MS2724B
Amplitude		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.		
	Displayed average noise level: DANL in 1 Hz RBW	Preamplifier On –163 dBm (Typical), –161 dBm (Max.), 10 MHz to 1 GHz –160 dBm (Typical), –159 dBm (Max.), >1 to 2.2 GHz –156 dBm (Typical), –153 dBm (Max.), >2.2 to 2.8 GHz –160 dBm (Typical), –159 dBm (Max.), >2.8 to 4.0 GHz –158 dBm (Typical), –154 dBm (Max.), >4.0 to 7.1 GHz Preamplifier Off –140 dBm (Typical), –137 dBm (Max.), 10 MHz to 1 GHz –136 dBm (Typical), –133 dBm (Max.), >1 to 2.2 GHz –130 dBm (Typical), –126 dBm (Max.), >2.2 to 2.8 GHz –139 dBm (Typical), –136 dBm (Max.), >2.8 to 4.0 GHz –131 dBm (Typical), –127 dBm (Max.), >4.0 to 7.1 GHz	Preamplifier On –149 dBm, 10 MHz to 1 GHz –146 dBm, 1 to 3 GHz –144 dBm, 3 to 4 GHz Preamplifier Off –139 dBm, 10 MHz to 4 GHz –136 dBm, 4 to 10 GHz –130 dBm, 10 to 13 GHz Preamplifier works to 4 GHz	Preamplifier On –149 dBm, 10 MHz to 1 GHz –146 dBm, 1 to 3 GHz –144 dBm, 3 to 4 GHz Preamplifier Off –139 dBm, 10 MHz to 4 GHz –136 dBm, 4 to 10 GHz –130 dBm, 10 to 13 GHz –136 dBm, 13 to 20 GHz Preamplifier works to 4 GHz
	Noise figure (derived from DANL measurement)	0 dB attenuation, 23°C: Preamplifier On Frequency / Typical 0 MHz to 1 GHz 11 dB >1 to 2.2 GHz 14 dB >2.2 to 2.8 GHz 18 dB >2.8 to 4.0 GHz 14 dB >4.0 to 7.1 GHz 16 dB	Preamplifier on 10 MHz to 1 GHz 15 dB 1 to 3 GHz 18 dB 3 to 4 GHz 20 dB Preamplifier off 10 MHz to 4 GHz 35 dB 4 to 10 GHz 38 dB 10 to 13 GHz 44 dB	Preamplifier on 10 MHz to 1 GHz 15 dB 1 to 3 GHz 18 dB 3 to 4 GHz 20 dB Preamplifier off 10 MHz to 4 GHz 35 dB 4 to 10 GHz 38 dB 10 to 13 GHz 44 dB 13 to 20 GHz 38 dB
	Input-related spurious –30 dBm input, 0 dB RF attenuation, span <1.7 GHz	–60 dBc Max., (<–70 dBc typical)	–60 dBc Max., (<–70 dBc typical) Except: Input Freq of 3275 MHz –50 dBc	–60 dBc Max., (<–70 dBc typical) Except: Input Freq of 3275 MHz –50 dBc
	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 to 7100 MHz Exceptions[*2]: Frequency / Spur Level 250, 300, and 350 MHz –85 dBm Max. ~4010 MHz –80 dBm Max. (–90 dBm typical) ~5084 MHz –70 dBm Max. (–83 dBm typical) ~5894 MHz –75 dBm Max. (–87 dBm typical) ~7028 MHz –80 dBm Max. (–92 dBm typical)	–90 dBm Max.	–90 dBm Max. –85 dBm Max., >13 GHz
	Residual spurious, preamplifier on (RF input terminated, 0 dB RF attenuation)	–100 dBm Max.	100 kHz to 4 GHz, –100 dBm Max.	100 kHz to 4 GHz, –100 dBm Max.

Options Specifications

• RF and Demodulation Hardware (Option 9)

Hardware required to demodulate 3G and WiMax signals

• PSN50 High Accuracy Power Meter (Option 19)

PSN50 Sensor	Measurement Range: –30 to +20 dBm
	Frequency Range: 50 MHz to 6 GHz
	Input Connector: Type N, male, 50Ω
	Max Input Without Damage: +33 dBm, ±25 VDC
	Input Return Loss: 50 MHz to 2 GHz: ≥26 dB
	2 GHz to 6 GHz: ≥20 dB
PSN50 Accuracy	Total RSS Measurement Uncertainty (0˚ to 50˚C): ±0.16 dB*1
	Noise: 20 nW Max.
	Zero Set: 20 nW
	Zero Drift: 10 nW Max.*2
	Sensor Linearity: ±0.13 dB Max.
	Instrumentation Accuracy: 0.00 dB
	Sensor Cal Factor Uncertainty: ±0.06 dB
	Temperature Compensation: ±0.06 dB Max.
	Continuous digital modulation uncertainty: +0.06 dB (+17 to +20 dBm)
PSN50 System	Measurement Resolution: 0.01 dB
	Offset Range: ±60 dB
	Power Requirements:
	Supply Voltage: 8 to 18 Vdc
	Supply Current: <100 mA

• Tracking Generator (Option 20 for MS2721B only)

Frequency range	100 kHz to 7.1 GHz
Power output	0 to –40 dBm
Connector	Type N (f)
Step size	0.1 dB
Level accuracy (15˚ to 35˚C)	±1.5 dB Max., 450 kHz to 7.1 GHz Excluding SWR effects

• Interference Analyzer (Option 25)

Signal strength	Gives visual and aural indication of signal strength
RSSI	Collect data up to 72 hours
Spectrogram	Collect data up to 72 hours

• Channel Scanner (Option 27)

Measurement range	+20 dBm to –110 dBm
Number of channels	1 to 20

• GPS (Option 31)

GPS location indicator	Latitude, Longitude and Altitude on display 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
Internal high accuracy, when GPS antenna is not connected	Better than ±50 ppb for 3 days from a High Accuracy GPS Lock and within 0˚ to 50˚C ambient temperature
Connector	Reverse polarity BNC

• WCDMA/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%

• WCDMA/HSDPA RF Measurements (Option 44)

Frequency ranges	824 to 894 MHz, 1710 to 2170 MHz, 2300 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 to 894 MHz, 1710 to 2170)	–54 dB typical at 5 MHz offset –59 dB typical at 10 MHz offset
Leakage ratio (ACLR)*3 (2300 to 2700 MHz)	–54 dB typical at 5 MHz offset –57 dB typical at 10 MHz offset
ACLR accuracy (Single channel active) (824 to 894 MHz, 1710 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 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

• WCDMA Demodulation and WCDMA/HSDPA Demodulator (Options 45 and 65)

EVM accuracy*3 (824 to 894 MHz, 1710 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 PSN50 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) x 211 (H) x 77 (D) mm (12W x 8H x 3D in.) MS2721B: 3.1 kg (<6.9 lbs.) typical; MS2723B and MS2724B: 3.4 kg (7.5 lb) 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	RF & Demodulation Hardware
MS2721B-019	High Accuracy Power Meter (PSN50 sensor not included)
MS2721B-020	Tracking Generator
MS2721B-025	Interference Analysis
MS2721B-027	Channel Scanner
MS2721B-030	ISDB-T Digital Video Measurements (requires Opt. 009)
MS2721B-031	GPS (includes GPS antenna)
MS2721B-032	ISDB-T SFN (requires Opt. 009)
MS2721B-033	cdmaOne and CDMA2000 1xRTT Over the Air (OTA) (requires Opt. 009, 031)
MS2721B-034	EVDO Over The Air (OTA) Measurement (requires Opt. 009, 031)
MS2721B-035	W-CDMA/HSDPA OTA (requires Opt. 009 and 031)
MS2721B-037	Mobile WiMAX Over The Air (OTA) Measurement (requires Opt. 009)
MS2721B-040	GSM/GPRS/EDGE RF Measurement (requires Opt. 009)
MS2721B-041	GSM/GPRS/EDGE Demod (requires Opt. 009)
MS2721B-042	CDMA RF Measurement (requires Opt. 009)
MS2721B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Opt. 009)
MS2721B-044	W-CDMA/HSDPA RF Measurement (requires Opt. 009)
MS2721B-045	W-CDMA Demodulation (requires Opt. 009)
MS2721B-046	Fixed WiMAX RF Measurement (requires Opt. 009)
MS2721B-047	Fixed WiMAX Demodulation (requires Opt. 009)
MS2721B-057	DVB-T/H BER (requires Opt 009 & 064)
MS2721B-062	EVDO RF Measurement (requires Opt. 009)
MS2721B-063	EVDO Demodulator (requires Opt. 009)
MS2721B-064	DVB-T/H Digital Video Measurement (requires Opt 009)
MS2721B-065	W-CDMA/HSDPA Demod (requires Opt. 009)
MS2721B-066	Mobile WiMAX RF Measurement (requires Opt. 009)
MS2721B-067	Mobile WiMAX Demodulator (requires Opt. 009)
MS2721B-078	DVB-T/H SFN (requires Opt 009)
	Main frame
MS2723B	Handheld Spectrum Analyzer 9 kHz to 13 GHz
MS2724B	Handheld Spectrum Analyzer 9 kHz to 20 GHz
	Options
MS2723B-009	RF & Demodulation Hardware
MS2723B-019	High Accuracy Power Meter (PSN50 sensor not included)
MS2723B-025	Interference Analysis
MS2723B-027	Channel Scanner
MS2723B-031	GPS (includes GPS antenna)
MS2723B-033	cdmaOne and CDMA2000 1xRTT Over the Air (OTA) (requires Opt. 009, 031)
MS2723B-034	EVDO Over The Air (OTA) Measurement (requires Option 009, 031)
MS2723B-035	W-CDMA/HSDPA OTA (requires Opt. 009)
MS2723B-037	Mobile WiMAX Over The Air (OTA) Measurement (requires Opt. 009)
MS2723B-040	GSM/GPRS/EDGE RF Meas (requires Opt. 009)
MS2723B-041	GSM/GPRS/EDGE Demod (requires Opt. 009)
MS2723B-042	CDMA RF Measurement (requires Opt. 009)
MS2723B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Opt. 009)
MS2723B-044	WCDMA/HSDPA RF Measurement (requires Opt. 009)
MS2723B-045	W-CDMA Demodulation (requires Opt. 009)
MS2723B-046	Fixed WiMAX RF Measurement (requires Opt. 009)
MS2723B-047	Fixed WiMAX Demodulation (requires Opt. 009)
MS2723B-062	EVDO RF Measurement (requires Opt. 009)
MS2723B-063	EVDO Demodulator (requires Opt. 009)
MS2723B-065	W-CDMA/HSDPA Demodulation (requires Opt. 009)
MS2723B-066	Mobile WiMAX RF Measurement (requires Opt. 009)
MS2723B-067	Mobile WiMAX Demodulator (requires Opt. 009)

Model/Order No.	Name
	Standard accessories
10580-00175	User's Guide
61382	Soft Carrying Case
40-168	AC – DC Adapter
806-141	Automotive Cigarette Lighter/12 Volt DC Adapter
2300-498	CD-ROM Containing Master Software Tools
2000-1371	Ethernet Cable
2000-1209	Cross-over Ethernet Cable
633-44	Rechargeable battery, Li-Ion
1091-27	Type-N male to SMA female adapter
1091-172	Type-N male to BNC female adapter
64343	Tilt Bail Stand Accessory
2000-1520-R	2 GB USB Memory Device
3-2000-1360	USB Type A to Mini-B Cable
	One Year Warranty
	Optional accessories
15NNF50-1.5B	Test Port Cable, Armored, 1.5 m, N (m) to N (f), 18 GHz
15NN50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) to N (m), 6 GHz
15NN50-3.0C	Test Port Cable, Armored, 3.0 m, N (m) to N (m), 6 GHz
15NN50-5.0C	Test Port Cable, Armored, 5.0 m, N (m) to N (m), 6 GHz
15NNF50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) to N (f), 6 GHz
15NNF50-3.0C	Test Port Cable, Armored, 3.0 m, N (m) to N (f), 6 GHz
15NNF50-5.0C	Test Port Cable, Armored, 5.0 m, N (m) to N (f), 6 GHz
15ND50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) to 7/16 DIN (m), 6.0 GHz
15NDF50-1.5C	Test Port Cable, Armored, 1.5 m, N (m) to 7/16 DIN (f), 6.0 GHz
510-90	Adapter, 7/16 DIN (f) to N (m), DC to 7.5 GHz, 50 Ω
510-91	Adapter, 7/16 DIN (f) to N (f), DC to 7.5 GHz, 50 Ω
510-92	Adapter, 7/16 DIN (m) to N (m), DC to 7.5 GHz, 50 Ω
510-93	Adapter, 7/16 DIN (m) to N (f), DC to 7.5 GHz, 50 Ω
510-96	Adapter, 7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50 Ω
1030-105	Band Pass Filters, 890 to 915 MHz, N (m) to N (f), 50 Ω
1030-106	Band Pass Filters, 1710 to 1790 MHz, N (m) to N (f), 50 Ω
1030-107	Band Pass Filters, 1910 to 1990 MHz, N (m) to N (f), 50 Ω
1030-109	Band Pass Filters, 824 to 849 MHz, N (m) to SMA (f), 50 Ω
1030-110	Band Pass Filters, 880 to 915 MHz, N (m) to SMA (f), 50 Ω
1030-111	Band Pass Filters, 1850 to 1910 MHz, N (m) to SMA (f), 50 Ω
1030-112	Band Pass Filters, 2400 to 2484 MHz, N (m) to SMA (f), 50 Ω
1030-114	Band Pass Filters, 806 to 869 MHz, N (m) to SMA (f), 50 Ω
510-97	Adapter, 7/16 DIN (f) to 7/16 DIN (f), 7.5 GHz
61382	Spare Soft Carrying Case
64343	Spare Tilt Bail Stand Accessory
40-168	Spare AC/DC adapter
806-141	Spare Automotive Cigarette Lighter/12 Volt DC Adapter
760-243-R	New Transit Case
2300-498	Anritsu Master Software Tools, models, MS2721B, MS2723B, MS2724B for all three manuals
10580-00175	Anritsu HHSA User's Guide, models, MS2721B, MS2723B, MS2724B for all three manuals (spare)
10580-00176	Anritsu HHSA Programming Manual, models, MS2721B, MS2723B, MS2724B for all three manuals
10580-00177	Anritsu HHSA Maintenance Manual, models, MS2721B, MS2723B, MS2724B for all three manuals
633-44	Rechargeable Battery, Li-Ion
3-2000-1500	256 MB Compact Flash Memory Module
2000-1374	Dual Battery Charger, Li-Ion with Universal Power Supply
2000-1411	Portable Yagi Antenna, 10 dBd, N (f) 822 to 900 MHz
2000-1412	Portable Yagi Antenna, 10 dBd, N (f) 885 to 975 MHz
2000-1413	Portable Yagi Antenna, 10 dBd, N (f) 1.71 to 1.88 GHz
2000-1414	Portable Yagi Antenna, 9.3 dBd, N (f) 1.85 to 1.99 GHz
2000-1415	Portable Yagi Antenna, 10 dBd, N (f) 2.4 to 2.5 GHz
2000-1416	Portable Yagi Antenna, 10 dBd, N (f) 1.92 to 2.23 GHz
2000-1030	Portable antenna, SMA (m) 1.71 to 1.88 GHz, 50 Ω
2000-1031	Portable antenna, SMA (m) 1.85 to 1.99 GHz, 50 Ω
2000-1032	Portable antenna, SMA (m) 2.4 to 2.5 GHz, 50 Ω
2000-1035	Portable antenna, SMA (m) 896 to 941 MHz, 50 Ω
2000-1200	Portable antenna, SMA (m) 806 to 869 MHz, 50 Ω
2000-1361	Portable Antenna, SMA (m) 5725 to 5825 MHz, 50 Ω
2000-1473	Portable Antenna, SMA (m) 870 to 960 MHz, 50 Ω
2000-1474	Portable Antenna, SMA (m) 2.4 to 2.5 GHz, 50 Ω
2000-1475	Portable Antenna, SMA (m) 2.11 to 2.17 GHz, 50 Ω
61532	Antenna Kit: 2000-1030, 2000-1031, 2000-1032, 2000-1035, 2000-1200, and 2000-1361

VNA MASTER

MS2024A/MS2034A

VNA: 2 MHz to 4 GHz/Spectrum Analysis: 9 kHz to 4 GHz

MS2026A/MS2036A

VNA 2 MHz to 6 GHz/Spectrum Analysis: 9 kHz to 7.1 GHz

CE Ethernet

Handheld Vector Network and Spectrum Analysis for General Purpose Applications

RF engineers and technicians in the field provide a valuable service as they support defense and general purpose communication systems around the world. They ensure radars on Navy ships are operational. They test antennas on Army vehicles. They perform flight-line test on Air Force and commercial jets. They maintain communication systems on Marine expeditionary fighting vehicles. They support VHF Omni-directional Range (VOR) in radio navigational systems throughout the world. They ensure direction finding (DF) reconnaissance systems precisely pinpoint threats.

Equally valuable are the primary test instruments that serve these applications: vector network analyzer, spectrum analyzer, power meter, and vector voltmeter. In the factory, these handheld instruments are also especially attractive for lowering cost-of-test and minimizing capital equipment expenditures.

Anritsu introduces the MS202xA VNA Master and the MS203xA VNA Master plus Spectrum Analysis that offers these individual test capabilities in a handheld, battery-operated, rugged multi-function instrument. The VNA Master easily replaces bulky and obsolete bench-top instruments with a more efficient-to-use handheld instrument so technicians can freely roam the sites they service. This freedom increases their productivity as they phase match cables, identify sources of interference, and troubleshoot transmitters. The VNA Master is so ideally suited for cable and antenna measurements in the field that it can also double as a low-cost alternative in manufacturing and R&D.

Product Overview

- Two-port vector network analysis (2 MHz to 6 GHz)
- Broad spectrum analysis (9 kHz to 7.1 GHz) MS2034A/36A
- Broad power meter (10 MHz to 7.1 GHz) MS2034A/36A
- Optional power monitor measurements (1 MHz to 20 GHz)
- Optional high accuracy power meter, PSN50 (50 MHz to 6 GHz)
- Optional Vector Voltmeter (VVM) mode (2 MHz to 6 GHz)
- Ergonomically designed controls
- Handheld battery-operated RF test solution

VNA Features

- Two-port vector network analysis (2 MHz to 6 GHz)
- >42 dB directivity
- <±1 dB uncertainty for $|S_{11}|$ <20 dB
- <±0.5 dB uncertainty and <±4 degrees uncertainty for $|S_{21}|$ <30 dB
- >70 dB dynamic
- Smith Charts, Phase, and Group Delay measurements

Spectrum Analysis Features

- Broad spectrum analysis (9 kHz to 7.1 GHz)
- Wide dynamic range (100 dB typical)
- Excellent DANL (with preamp): –163 dBm in 1 Hz RBW
- Superior Single Side Band (SSB) Phase Noise of <–100 dBc/Hz at 1 kHz offsets
- Fast sweep speed of 200 ms in 10 MHz span
- Powerful markers: 6 markers, 7 marker modes, and marker table display
- New quasi-peak detector and CISPR bandwidths

General Features

- Light weight (less than 4 kg. including battery) and rugged design
- Large 8.4 in. full-color TFT display screen
- Type N female RF connectors
- Soft keys, directional buttons, and rotary knob
- LAN and USB 2.0 (full-speed) connections
- Rechargeable and field replaceable Li-Ion Battery
- 256 MB storage
- Remote programming via Ethernet

VNA Overview

Cables and antennas are a vital part of any communication system that unfortunately can degrade over time due to corrosion, water damage, or excessive deployment time. Phase matched cables are even more susceptible to these kinds of problems. Ideally, one can avoid the fix-after-failure scenario by routinely sweeping these critical components to detect earlier these potentially catastrophic problems. A field-friendly vector network analyzer can simplify this task.

The VNA Master is a 1-port and 2-port handheld vector network analyzer (VNA), which uses the superior Frequency Domain Reflectometry (FDR) approach instead of the DC pulse technique of older Time Domain Reflectometry (TDR) approaches. Using FDR, the VNA Master provides convenient 1-port measurements of return loss, VSWR, cable loss, Distance-To-Fault (DTF), and Smith Chart measurements in the field. Connect the VNA Master to a 2-port cable to measure cable loss, phase, and group delay. In other words, the VNA Master offers precise measurement capabilities for cables and antennas by simplifying S_{11} and S_{21} measurements in the field.

The VNA Master employs vector correction after an open-short-load calibration to ensure accuracy, repeatability, and overall quality of 1-port and 2-port measurements. As an improvement over traditional scalar measurement approaches, the VNA Master removes all the systematic errors associated with the 1-port reflection measurements, including directivity, source match, and reflection tracking. Additionally, the VNA Master removes transmission response errors and transmission source match errors (i.e., a 1-path, 2-port correction) when conducting 2-port transmission measurements. The vector correction of the VNA Master offers superior measurement accuracy for detecting problems or phase matching cables in a convenient handheld product so you can perform VNA measurements anywhere, anytime.

Spectrum Analysis Overview

In addition to cables and antennas, the typical communication system also contains more sophisticated transmitters, receivers, and signal separation components. These additional components increase the complexity of the overall system, which becomes especially difficult to maintain when there is an intermittent problem.

A field-friendly spectrum analyzer can simplify this task.

The VNA Master plus Spectrum Analysis (i.e., MS203xA) adds the capability to conduct spectrum analysis in the field to the already powerful MS202xA! Don't let the small footprint fool you, this instrument offers performance and features that rivals bench-top alternatives for simplifying spectrum monitoring, interference analysis, and other general purpose signal measurements in the field. The VNA Master offers broad spectrum analysis frequency coverage, impressive dynamic range, and excellent phase noise performance from 9 kHz to 7.1 GHz.

The VNA Master plus Spectrum Analysis includes many standard measurements. These measurements include field strength, occupied bandwidth, channel power, adjacent channel power ratio, and carrier to interference (C/I) ratio. In addition, the built-in AM/FM/SSB demodulator simplifies the task of identifying interfering signals. Overall, the VNA Master is a powerful handheld tool for general purpose spectrum analysis anywhere, anytime.

Optional VNA Features

• Power Monitor (Option 5)

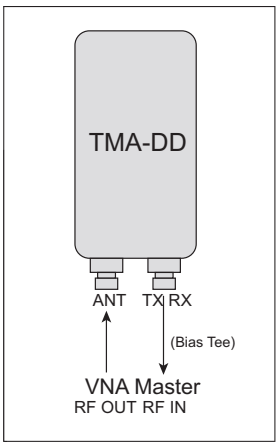
With the Anritsu 560 series detectors, technicians can accurately measure broadband power up to 50 GHz. These high precision detectors significantly help minimize mismatch uncertainty with detector flatness better than 0.5 dB up to 18 GHz.

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.

• Bias Tee (Option 10)

The integrated, variable Bias Tee is designed to supply bias to a tower mount amplifier (TMA) or other active device. This bias is supplied from the center conductor of the RF In port on the VNA Master, delivering a variable 12 to 24 V.

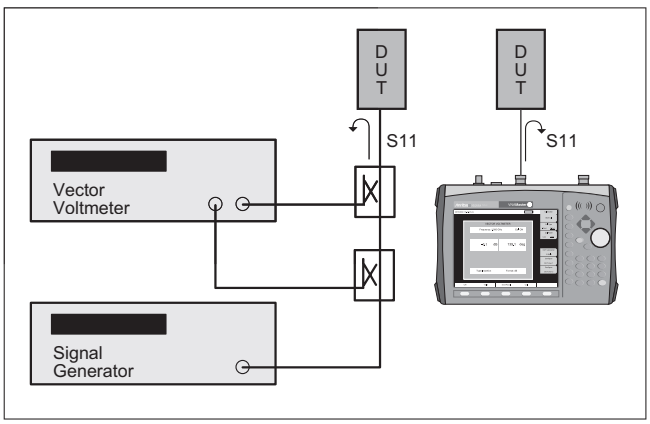


• Vector Voltmeter (Option 15)

The VNA Master offers a field-friendly version of the popular vector voltmeter for phase matching cables. In this approach, the VNA Master provides an optional user interface with display types of impedance, dB, and VSWR for 1- and 2-port measurements.

The VNA Master contains the signal generator, couplers, phase measurement receiver, and now the user interface of this popular approach. Field engineers can now upgrade their tools without impacting existing maintenance procedures by adding this popular user interface to the already easy-to-learn VNA Master.

As an additional capability, Option 15 also includes the valuable capability to compare up to five different cables to a reference cable. Using this capability, one can simplify the task of phase matching multiple cables in the field.



A side-by-side comparison shows how the VNA Master is a more convenient instrument for phase matching cables in the field.

• Power Meter (Option 019)

Anritsu's USB power sensors, either the PSN50 or MA24106A (50 MHz to 6 GHz), offer high accuracy power measurements remote from the VNA Master instrument. Purchase sensors separately. This means you can connect the PSN50 or MA24106A sensor units right at the transmitter output connector tap, for improved performance because the VSWR effects of the cables are minimized.

Optional Spectrum Analysis Features

• Interference Analyzer (Option 25)

With its built-in low-noise preamplifier, the MS203xA with interference analyzer option provides the ability to identify and locate interfering signals down to the noise floor, allowing technicians to better address the quality issues that affect user service.

Spectrogram

The Spectrogram display is a three dimensional display of frequency, power, and time of the spectrum. It is applicable for identifying intermittent interference and tracking signal levels over time.
The MS203xA can save data for up to 72 hours.

RSSI

The received signal strength indicator (RSSI) can be used to observe the signal strength of a single frequency over time. Data can be collected for up to 72 hours.

• Channel Scanner (Option 27)

The channel scanner option measures the power of multiple transmitted signals and is very useful for measuring channel power in up to 20 channels at the same time. Display data in graph or table format. In the custom setup menu each channel can be custom built with different frequency, bandwidth, or channels for convenient simultaneous analysis of a variety of different signal standards.

• GPS Receiver (Option 31)

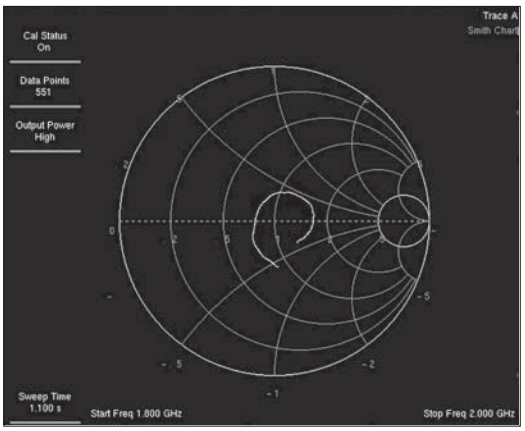
Built-in GPS provides precise location (latitude, longitude, and altitude) and Universal Time (UT) information to help the user verify that measurements are taken at the right location. The VNA Master then stamps each trace and stores the GPS location information. The GPS option also includes a convenient magnet-mount antenna with a 15-foot (5 m) cable for the car, truck or any other useful surface.

Master Software Tools

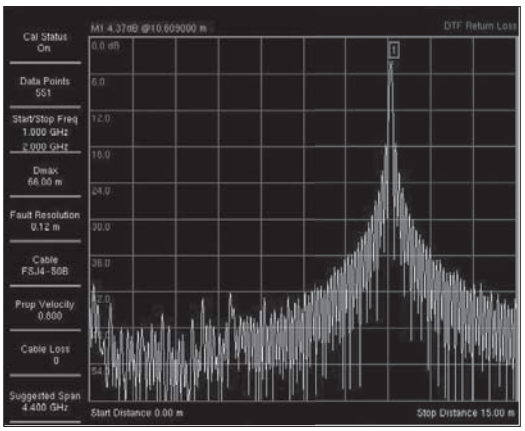
Each VNA Master ships with a test assistant: a copy of Anritsu's Master Software Tools for Windows® 2000/XP.
This allows an operator to add the processing capabilities of a PC and this software utility to the VNA Master to form a powerful and flexible measurement solution for both network and spectrum analysis. For automation, the VNA Master also supports remote programming via the Ethernet interface.

Connect VNA Master to a PC for archiving and additional analysis.

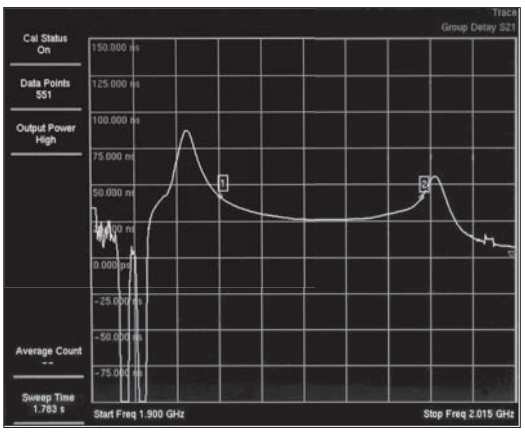
Typical Vector Network Analyzer Measurements



S_{11} Smith Chart

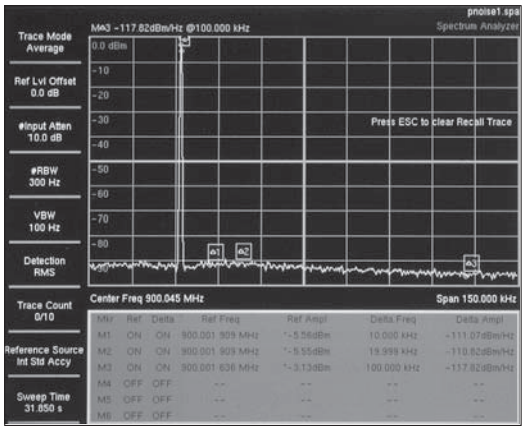


Distance-To-Fault

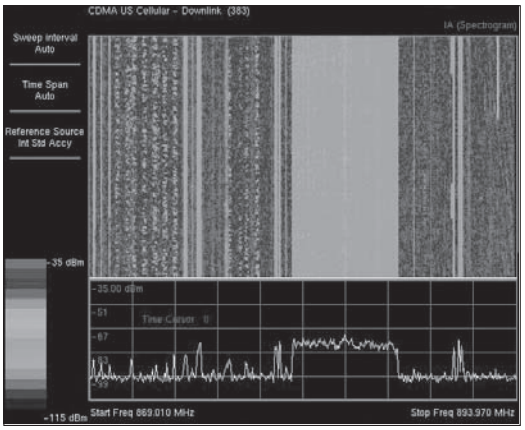


S_{21} Log Magnitude/Group Delay

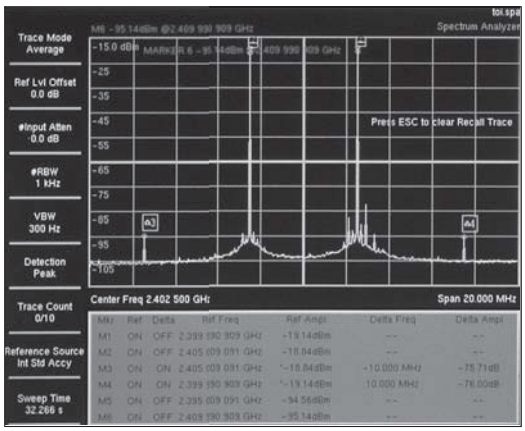
Typical Spectrum Analyzer Measurements



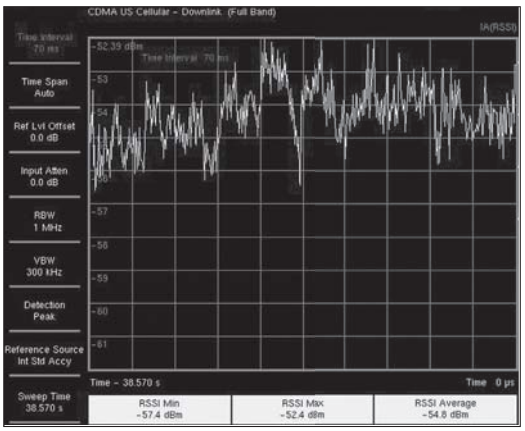
Phase Noise



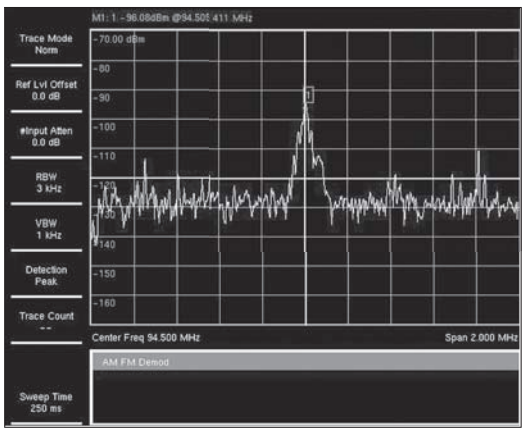
With Option 25, spectrogram measurements identifies intermittent interference.



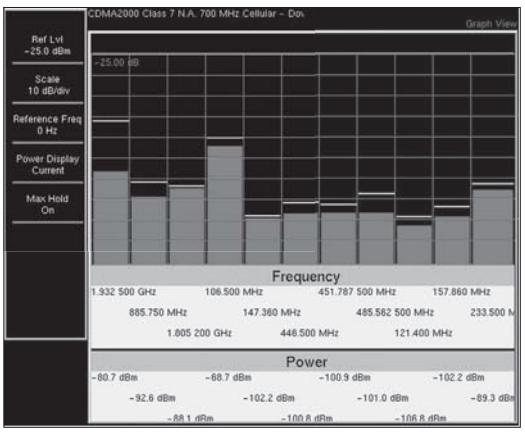
Signal Measurements



With Option 25, RSSI measurement analyzes signal strength of a signal over time.



AM, FM and SSB Demodulation



With Option 27, channel scanner measures power of multiple transmitters.

Specifications

• Vector Network Analyzer

Frequency range	610 kHz to 4 GHz (with MS2024A, MS2034A), operational down to 1 MHz 610 kHz to 6 GHz (with MS2026A, MS2036A), operational down to 1 MHz
Frequency accuracy	25 ppm
Frequency resolution	10 Hz
Data points	Low, Medium, High (137/275/551)
Interference immunity	On-Channel: +17 dBm On-Frequency: 0 dBm (RF Out), +30 dBc (RF In)
1-Port power	High: 0 dBm (typical)
2-Port power	High 0 dBm (typical) Low: –35 dBm (typical)
Corrected directivity	42 dB (2 MHz to 6 GHz)
1-Port accuracy	≤0.44 + |20 log (1 ±$10^{-E\Delta/20}$) | dB, typical; EΔ = Directivity – Measured Return Loss
Dynamic range	70 dB, 2 MHz to 10 MHz 80 dB, 10 MHz to 3 GHz 70 dB, >3 GHz to 5.5 GHz 65 dB, >5.5 GHz to 6 GHz
Return loss	Range: 0 to 60 dB Resolution: 0.01 dB
VSWR	Range: 1 to 65 Resolution: 0.01
Cable loss	Range: 0 to 30 dB Resolution: 0.01 dB
1-Port phase	Range: –180˚ to +180˚ Resolution: 0.01˚
Smith chart	Resolution: 0.01
2-Port gain	Range: –120 to 100 dB Resolution: 0.01 dB
2-Port phase	Range: –180˚ to +180˚ Resolution: 0.01˚
Distance-To-Fault	Fault Resolution (meters): (1.5 x 10^8 x vp)/ΔF; vp is the propagation constant and ΔF is F2–F1 in Hz Horizontal Range (meters): 0 to (data points–1) x Fault Resolution to a maximum of 1500 m (4921 ft.) where datapoints = 137/275/551 Vertical Range (Return Loss): 0 to 60 dB Vertical Range (VSWR): 1 to 65

• Spectrum Analyzer

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Maximum continuous input	+30 dBm
Tuning resolution	1 Hz
Frequency reference	Aging: ±1 ppm/10 years Accuracy: ±0.3 ppm (25˚C ±25˚C) + aging
Frequency span	10 Hz to 7.1 GHz plus 0 Hz (zero span)
Sweep time	Minimum 100 ms, 10 µs in zero span
Sweep trigger	Free run, Single, Video, External
Resolution bandwidth (–3 dB width)	1 Hz to 3 MHz in 1-3 sequence ±10%; 0-span, 1 Hz to 1 MHz 8 MHz demodulation bandwidth
Video bandwidth (–3 dB width)	1 Hz to 3 MHz in 1-3 sequence
SSB phase noise	–100 dBc/Hz max at 10, 20, and 30 kHz offset from carrier –102 dBc/Hz max at 100 kHz offset from carrier
Amplitude measurement range	DANL to +30 dBm
Absolute amplitude accuracy Power Levels ≥–50 dBm, ≤35 dB input attenuation, Preamplifier Off, –10˚ to +55˚C	9 kHz to 10 MHz, ±1.5 dB >10 MHz to 4 GHz, ±1.25 dB >4 GHz to 7.1 GHz, ±1.75 dB
Displayed average noise level (DANL in 1 Hz RBW, 0 dB attenuation, Reference level –50 dBm, preamp on)	Frequency / Max. (Preamp On) / Max. (Preamp Off) 10 MHz to 1 GHz / –161 dBm / –137 dBm >1 GHz to 2.2 GHz / –159 dBm / –133 dBm >2.2 GHz to 2.8 GHz / –143 dBm / –126 dBm >2.8 GHz to 4.0 GHz / –159 dBm / –136 dBm >4.0 GHz to 7.1 GHz / –154 dBm / –127 dBm
Display range	1 to 15 dB/div in 1 dB steps. Ten divisions displayed
Amplitude units log scale modes	dBm, dBV, dBmV, dBµV
Attenuator range	0 to 65 dB
Attenuator resolution	5 dB steps

• Power Meter

Frequency range	10 MHz to 4 GHz (with MS2034A) 10 MHz to 7.1 GHz (with MS2036A)
Display range	–80 to +80 dBm
Measurement range	–60 to +30 dBm
Offset range	0 to +60 dB
Accuracy	–40 dBm <Max ≤+15 dBm 10 MHz to 4 GHz: ±1.25 dB 4 to 7.1 GHz: ±1.75 dB Max. >+15 dBm 10 MHz to 6.5 GHz: ±1.75 dB 6.5 to 7 GHz: ±2 dB Max. <–40 dBm 10 MHz to 4 GHz: ±1.5 dB 4 to 7.1 GHz: ±1.75 dB
VSWR	1.5:1 typical
Maximum power	+30 dBm (1 W) without external attenuator

• Power Monitor (Option 5) requires external detector

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 (see www.anritsu.com for additional detectors)

Model	Frequency range	Impedance	Return loss	Input connector	Frequency response
560-7N50B	0.01 to 20 GHz	50 Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	N (m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz
560-7S50B	0.01 to 20 GHz	50 Ω	5 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	WSMA (m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz

• Bias Tee (Option 10)

Voltage/Current	12 V, 250, or 500 mA steady rate 15 V, 250, or 500 mA steady rate 18 V, 350 mA steady rate 21 V, 300 mA steady rate 24 V, 250 mA steady rate

• Vector Voltmeter (Option 15)

CW frequency range	2 MHz to 4 GHz (with MS2024A, MS2034A) 2 MHz to 6 GHz (with MS2026A, MS2036A)
Measurement display	CW, Table (Five Entries, Plus Reference)
Measurement types	Return Loss, Insertion
Measurement format	dB/VSWR/Impedance

• High Accuracy Power Meter (Option 19)*1

Option 19 supports both economy PSN50 and performance MA24106A USB Sensors. Refer to the following datasheets for more detailed performance specifications.
PSN50 datasheet is 11410-00414
MA24106A datasheet is 11410-00424

Frequency range	50 MHz to 6 GHz
Input connector	Type N, male, 50 Ω
Max input without damage	+33 dBm, ±25 VDC
Measurand	True-RMS/Average Power
Dynamic range	PSN50: –30 to +20 dBm MA24106A: –40 to +23 dBm
Measurement speed, typical	PSN50: 1 measurement per second MA24106A: 10 measurements per second*2
Input return loss	50 MHz to 2 GHz; ≥26 dB 2 to 6 GHz; ≥20 dB
System measurement resolution	0.01 dB
System offset range	±60 dB
Total rss measurement uncertainty (0˚ to 50˚C)	±0.16 dB*3
Continuous digital modulation uncertainty	PSN50: ±0.06 dB (+17 to +20 dBm)*4 MA24106A: ±0.02 dB, <+18 dBm*4 ±0.10 dB, ≥+18 dBm*4

*1: Specifications apply after 30 minute warm-up
*2: One measurement per second is typical in high aperture time mode
*3: Excludes mismatch errors
Excludes noise, zero set, zero drift for levels <–20 dBm
Excludes digital modulation uncertainty between +17 and +20 dBm
*4: Measurement error with reference to a CW signal of equal power and frequency at 25˚C

• Interference Analyzer (Option 25)

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Strength of the interferer	Gives visual and aural indication of signal strength
Rssi, spectrogram	Collect data up to 72 hours

• Channel Scanner (Option 27)

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Number of channels	1 to 20 Channels

• GPS (Option 31) includes GPS antenna

GPS Location Indicator	Latitude, Longitude, Altitude, and Universal Time on display Latitude, Longitude, Altitude, and Universal Time with trace storage
GPS High Frequency Accuracy when GPS antenna is connected	±25 ppb with GPS ON, three minutes after satellite lock
Internal High Accuracy when GPS antenna is not connected	Better than ±50 ppb for three days from a High Accuracy GPS Lock and within 0 to 50 degrees centigrade ambient temperature

• General

Maximum input (damage level) into vector network analyzer	Test Port, Type N: +23 dBm, ±50 VDC
Maximum continuous input into spectrum analyzer	10 dB attenuation, +30 dBm, ±50 VDC
RF input VSWR into spectrum analyzer	2.0:1 maximum, 1.5:1 typical (≥10 dB attenuation)
Interfaces	Type N female RF Connector Type N female RF Out Port and RF In Port (50 Ω) BNC female connectors for external references and external trigger Reverse BNC connector for GPS antenna RF Detector: Type N (m) 50 Ω RJ45 connector for Ethernet 10/100BASE-T 2.5 mm 3-wire cellular headset connector USB connectors Type A and mini-B
Environmental	MIL-PRF-28800F Class 2 Operating: –10˚ to +55˚C, humidity 85% Storaging: –51˚ to +71˚C Altitude: 4600 meters, operating and non-operating
Safety	Conforms to EN61010-1 for Class 1 portable equipment
Electromagnetic compatibility	Meets European Community requirements for CE marking
Dimension	315 x 211 x 78 mm (12.4 x 8.3 x 3.1 in.) for MS202xA 315 x 211 x 97 mm (12.4 x 8.3 x 3.8 in.) for MS203xA
Mass	<2.9 kg (6.4 lbs) for MS202xA; 4 kg (9 lbs) for MS203xA

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™ Models*1
MS2024A	2-port VNA Master, 2 MHz to 4 GHz
MS2026A	2-port VNA Master, 2 MHz to 6 GHz
MS2034A	2-port VNA Master, 2 MHz to 4 GHz Spectrum Analysis, 9 kHz to 4 GHz
MS2036A	2-port VNA Master, 2 MHz to 6 GHz Spectrum Analysis, 9 kHz to 7.1 GHz
	MS2024A VNA Master Options
MS2024A-005	Power Monitor (requires external detector)
MS2024A-010	Built-in Bias-Tee
MS2024A-015	Vector Voltmeter
MS2024A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2024A-031	GPS Receiver (includes GPS antenna)
	MS2026A VNA Master Options
MS2026A-005	Power Monitor (requires external detector)
MS2026A-010	Built-in Bias-Tee
MS2026A-015	Vector Voltmeter
MS2026A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2026A-031	GPS Receiver (includes GPS antenna)

*1: Each instrument includes standard one-year warranty and Certificate of Calibration and Conformance

Model/Order No.	Name
	MS2034A VNA Master + Spectrum Analysis Options
MS2034A-005	Power Monitor (requires external detector)
MS2034A-010	Built-in Bias-Tee
MS2034A-015	Vector Voltmeter
MS2034A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2034A-025	Interference Analysis, 9 kHz to 4 GHz (requires external antenna)
MS2034A-027	Channel Scanner, 9 kHz to 4 GHz (requires external antenna)
MS2034A-031	GPS Receiver (includes GPS antenna)
	MS2036A VNA Master + Spectrum Analysis Options
MS2036A-005	Power Monitor (requires external detector)
MS2036A-010	Built-in Bias-Tee
MS2036A-015	Vector Voltmeter
MS2036A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2036A-025	Interference Analysis, 9 kHz to 7.1 GHz (requires external antenna)
MS2036A-027	Channel Scanner, 9 kHz to 7.1 GHz (requires external antenna)
MS2036A-031	GPS Receiver (includes GPS antenna)

Continued on next page

Model/Order No.	Name
	MS2024A/MS2026A standard accessories
10580-00166	User's Guide
65729	Soft Carrying Case
3-2000-1500	Compact Flash Card (256 MB)
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Li-Ion
40-168	AC-DC Adapter
806-141	Automotive cigarette lighter 12 V DC adapter
3-2000-1498	USB A-to mini B cable, 3.05 m (10 ft.)
2000-1371	Ethernet cable, 2.13 m (7 ft.)
2000-1520-R	2 GB USB Flash Drive
3-806-152	Ethernet Crossover Cable, 2.13 m (7 ft.)
	MS2034A/MS2036A standard accessories
10580-00166	User's Guide
65681	Soft Carrying Case
3-2000-1500	Compact Flash Card (256 MB)
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Li-Ion
40-168	AC-DC Adapter
806-141	Automotive Cigarette Lighter 12 V DC adapter
3-2000-1498	USB A-to mini B cable, 1.83 m (3.05 m, 10 ft.)
2000-1371	Ethernet cable, 2.13 m (7 ft.)
3-806-152	Ethernet Crossover Cable, 2.13 m (7 ft.)
2000-1520-R	2 GB USB Flash Drive
	Manuals
10580-00166	VNA Master User's Guide
10580-00167	VNA Master Programming Manual
	Related Literature, Application Notes
10580-00400	VNA Master Brochure and Technical Data Sheet
11410-00214	Reflectometer Measurements - Revisited
11410-00206	Time Domain
11410-00270	What is Your Measurement Accuracy?
11410-00185	Distance-To-Fault
11410-00414	PSN50 USB Power Sensor
11410-00424	MA24106A USB Power Sensor
	Optional accessories
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24106A	USB Power Sensor, 50 MHz to 6 GHz
560-7N50B	Power Monitor Detectors, 0.01 to 20 GHz
560-7S50B	Power Monitor Detectors, 0.01 to 20 GHz
800-109	Detector Extender Cables, 7.6 m (25 ft)
800-110	Detector Extender Cables, 15.2 m (50 ft)
800-111	Detector Extender Cables, 30.5 m (100 ft)
800-112	Detector Extender Cables, 61.0 m (200 ft)
OSLN50-1	Coaxial Calibration Components, Precision N (m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50-1	Coaxial Calibration Components, Precision N (f) Open/Short/Load, 42 dB, 6 GHz
22N50	Coaxial Calibration Components, Precision N (m) Short/Open, 18 GHz
22NF50	Coaxial Calibration Components, Precision N (f) Short/Open, 18 GHz
SM/PL-1	Coaxial Calibration Components, Precision N (m) Load, 42 dB, 6.0 GHz
SM/PLNF-1	Coaxial Calibration Components, Precision N (f) Load, 42 dB, 6.0 GHz
1091-53	Coaxial Calibration Components, Precision TNC (m) Open, 18 GHz, 50 W
1091-54	Coaxial Calibration Components, Precision TNC (m) Short, 18 GHz, 50 W
1015-55	Coaxial Calibration Components, Precision TNC (m) Load, 18 GHz, 50 W
1091-55	Coaxial Calibration Components, Precision TNC (f) Open, 18 GHz, 50 W
1091-56	Coaxial Calibration Components, Precision TNC (f) Short, 18 GHz, 50 W

Model/Order No.	Name
1015-54	Coaxial Calibration Components, Precision TNC (f) Load, 18 GHz, 50 W
23L50	Coaxial Calibration Components, Precision 3.5 mm (m) Short, 9 GHz
23LF50	Coaxial Calibration Components, Precision 3.5 mm (f) Short, 9 GHz
24L50	Coaxial Calibration Components, Precision 3.5 mm (m) Open, 9 GHz
24LF50	Coaxial Calibration Components, Precision 3.5 mm (f) Open, 9 GHz
28L50R	Coaxial Calibration Components, Precision 3.5 mm (m) Load, 9 GHz
28LF50R	Coaxial Calibration Components, Precision 3.5 mm (f) Load, 9 GHz
2000-767	Coaxial Calibration Components, Precision Open/Short/ Load, 7/16 (m), 4.0 GHz
2000-768	Coaxial Calibration Components, Precision Open/Short/ Load, 7/16 (f), 4.0 GHz
34NN50A	Precision Adapters, N (m)-N (m), DC to 18 GHz, 50 W
34NFNF50	Precision Adapters, N (f)-N (f), DC to 18 GHz, 50 W
1091-26	Adapters, N (m)-SMA (m), DC to 18 GHz, 50 W
1091-27	Adapters, N (m)-SMA (f), DC to 18 GHz, 50 W
1091-80-R	Adapters, N (f)-SMA (m), DC to 18 GHz, 50 W
1091-81-R	Adapters, N (f)-SMA (f), DC to 18 GHz, 50 W
510-102	Adapters, N (m)-N (m), 90˚ right angle, DC to 11 GHz, 50 W
510-90	Adapters, 7/16 DIN (f)-N (m), DC to 7.5 GHz, 50 W
510-91	Adapters, 7/16 DIN (f)-N (f), DC to 7.5 GHz, 50 W
510-92	Adapters, 7/16 DIN (m)-N (m), DC to 7.5 GHz, 50 W
510-93	Adapters, 7/16 DIN (m)-N (f), DC to 7.5 GHz, 50 W
510-96	Adapters, 7/16 DIN (m)-7/16 DIN (m), DC to 7.5 GHz, 50 W
510-97	Adapters, 7/16 DIN (f)-7/16 DIN (f), DC to 7.5 GHz, 50 W
513-62	Adapter, TNC (f) to N (f), 18 GHz, 50 W
1091-315	Adapter, TNC (m) to N (f), 18 GHz, 50 W
1091-324	Adapter, TNC (f) to N (m), 18 GHz, 50 W
1091-325	Adapter, TNC (m) to N (m), 18 GHz, 50 W
1091-317	Adapter, TNC (m) to SMA (f), 18 GHz, 50 W
1091-318	Adapter, TNC (m) to SMA (m), 18 GHz, 50 W
1091-323	Adapter, TNC (f) to TNC (f), 18 GHz, 50 W
1091-326	Adapter, TNC (m) to TNC (m), 18 GHz, 50 W
15NN50-1.5C	Test Port Cables Armored, 1.5 m, N (m)-N (m), 6 GHz, 50 W
15NN50-3.0C	Test Port Cables Armored, 3.0 m, N (m)-N (m), 6 GHz, 50 W
15NN50-5.0C	Test Port Cables Armored, 5.0 m, N (m)-N (m), 6 GHz, 50 W
15NNF50-1.5C	Test Port Cables Armored, 1.5 m, N (m)-N (f), 6 GHz, 50 W
15NNF50-3.0C	Test Port Cables Armored, 3.0 m, N (m)-N (f), 6 GHz, 50 W
15NNF50-5.0C	Test Port Cables Armored, 5.0 m, N (m)-N (f), 6 GHz, 50 W
15ND50-1.5C	Test Port Cables Armored, 5.0 m, N (m)-7/16 DIN (m), 6 GHz, 50 W
15NDF50-1.5C	Test Port Cables Armored, 5.0 m, N (m)-7/16 DIN (f), 6 GHz, 50 W
2000-1030	Port Antennas, SMA (m), 1.71 to 1.88 GHz, 50 W
2000-1031	Port Antennas, SMA (m), 1.85 to 1.99 GHz, 50 W
2000-1032	Port Antennas, SMA (m), 2.4 to 2.5 GHz, 50 W
2000-1035	Port Antennas, SMA (m), 896 to 941 MHz, 50 W
2000-1200	Port Antennas, SMA (m), 806 to 869 MHz, 50 W
2000-1361	Port Antennas, SMA (m), 5725 to 5825 MHz, 50 W
2000-1473	Port Antennas, SMA (m), 870 to 960 MHz, 50 W
2000-1474	Port Antennas, SMA (m), 1.71 to 1.88 GHz, 50 W
2000-1475	Port Antennas, SMA (m), 1920 to 1980, 2.11 to 2.17 GHz, 50 W
61532	Port Antennas, Antenna Kit: 2000-1030, 2000-1031, 2000-1032, 2000-1035, 2000-1200, and 2000-1361
1N50C	Limiter, N (m) to N (f), 50 W, 0.01 to 50 GHz
42N50-20	Attenuator, 20 dB, 50 W, DC to 18 GHz, N (m)-N (f)
42N50A-30	Attenuator, 30 dB, 50 W, DC to 18 GHz, N (m)-N (f)
2000-1410	Magnet Mount GPS Antenna with 15 ft (4.6 m) cable
760-243-R	Hard Transit Case
66864	Rack Mount Kit, Master Platform (MS2024A, MS2026A only)

NETWORK ANALYZERS

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								√
	37247D	40 MHz to 20 GHz	√	√	√	√	√	√			
	37269D	40 MHz to 40 GHz	√	√	√	√	√	√			
	37297D	40 MHz to 65 GHz	√	√	√	√	√	√			
	37347D	40 MHz to 20 GHz	√	√	√	√	√	√			
	37369D	40 MHz to 40 GHz	√	√	√	√	√	√			
	37397D	40 MHz to 65 GHz	√	√	√	√	√	√			
	ME7808C	40 MHz to 110 GHz	√	√			√				
Site master	S311D	2 to 1600 MHz*3	√*2							√	
	S312D	2 to 1600 MHz*3	√*2						√	√	
	S331D	2 to 4000 MHz*3	√*2							√	
	S332D	2 to 4000 MHz*3	√*2						√	√	
	S810D	2 MHz to 10.5 GHz*3	√*2							√	
	S820D	2 MHz to 20 GHz*3	√*2							√	
VNA master	MS2024A	2 MHz to 4 GHz	√*1							√	
	MS2026A	2 MHz to 6 GHz	√*1							√	
	MS2034A	2 MHz to 4 GHz	√*1						√	√	
	MS2036A	2 MHz to 6 GHz	√*1						√	√	

*1: S_{11}/S_{21} measurement by 1 path 2 port calibration can be performed.
*2: S_{11} measurement by OSL calibration can be performed (Except Smith Chart).
*3: Requires Option 2 (2 MHz Frequency Extension)

Selection Guide (Frequency Range)

Group	Model	Frequency range																					Remarks
		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	
Vector	MS4630B	■	■	■	■	■	■	■	■	■	■	■	■	■										10 Hz to 300 MHz
	37247D										■	■	■	■	■	■	■	■	■					40 MHz to 20 GHz
	37269D										■	■	■	■	■	■	■	■	■	■	■			40 MHz to 40 GHz
	37297D										■	■	■	■	■	■	■	■	■	■	■	■	■	40 MHz to 65 GHz
	37347D										■	■	■	■	■	■	■	■	■					40 MHz to 20 GHz
	37369D										■	■	■	■	■	■	■	■	■	■	■			40 MHz to 40 GHz
	37397D										■	■	■	■	■	■	■	■	■	■	■	■	■	40 MHz to 65 GHz
	ME7808C										■	■	■	■	■	■	■	■	■	■	■	■	■	40 MHz to 110 GHz
Site master	S311D										■	■	■	■	■	■								25 to 1600 MHz*
	S312D										■	■	■	■	■	■								25 to 1600 MHz*
	S331D										■	■	■	■	■	■	■							25 to 4000 MHz*
	S332D										■	■	■	■	■	■	■							25 to 4000 MHz*
	S810D										■	■	■	■	■	■	■	■	■					25 MHz to 10.5 GHz*
	S820D										■	■	■	■	■	■	■	■	■	■				25 MHz to 20 GHz*
VNA master	MS2024A							■	■	■	■	■	■	■	■	■	■							2 MHz to 4 GHz
	MS2026A							■	■	■	■	■	■	■	■	■	■	■	■					2 MHz to 6 GHz
	MS2034A							■	■	■	■	■	■	■	■	■	■							2 MHz to 4 GHz
	MS2036A							■	■	■	■	■	■	■	■	■	■	■	■					2 MHz to 6 GHz

*: Requires Option 2 (2 MHz Frequency Extension)

MICROWAVE VECTOR NETWORK ANALYZERS

37000D Series

40 MHz to 65 GHz

CE GPIB Ethernet

For Fast and Accurate S-Parameter Measurements

The Lightning D-Series Vector Network Analyzers (VNAs) are high performance test tools designed to satisfy the growing needs of defense, satellite, radar, broadband communication, and high speed component markets. The new 37000D VNAs improve upon performance while providing a wider set of standard application features to better suit the needs of R&D engineers working on next generation designs. These new features, when combined with the ease of programming through helpful software utilities and faster data transfer over Ethernet, make it an equally valuable tool for manufacturing as well.

The Lightning D-Series consists of two primary configurations built for R&D and Production applications:

- **Premium Models (37300D)**

The Premium series are designed for active and passive device applications, where versatility is the main priority. These are high performance two-port VNAs that include step attenuators, internal bias tees, a gain compression application and wider power range as standard features.

They are available in three different frequency ranges; 20 (37347D), 40 (37369D) and 65 (37397D) GHz. Each one of them can be configured as an ME7808C millimeter wave VNA by simply adding a broadband test set, two synthesizers and the desired millimeter wave modules. The 37397D is also directly upgradeable to an ME7808C Broadband VNA with single sweep coverage from 40 MHz to 110 GHz.

- **Economy Models (37200D)**

The Economy series are basic two-port VNAs designed for passive applications. They are available in three different frequency ranges; 20 (37247D), 40 (37269D) and 65 (37297D) GHz. Each one of them can be configured as an Economy millimeter wave VNA by simply adding a broadband test set, two synthesizers and the desired mmW modules.

The 37300D Premium models include:

- Multiple Source Control and Frequency Offset
- E/O and O/E Application
- Gain Compression Application
- Internal Bias Tees
- Extended Power Range (Source Step Attenuator and Receiver Step Attenuator)
- Rear Panel IF Inputs (for upgrade to Millimeter Wave)
- NxN calibration Utility for Mixer Measurements
- Embed/De-Embed application
- High Stability Frequency Reference
- 1 Hz Frequency Resolution

The 37200D Economy models include:

- Multiple Source Control and Frequency Offset
- E/O and O/E Application
- Rear Panel IF Inputs (for upgrade to Millimeter Wave)
- NxN calibration Utility for Mixer Measurements
- Embed/De-Embed application
- High Stability Frequency Reference
- 1 Hz Frequency Resolution

Features

- **High speed data transfer and control**

For maximum efficiency, an Ethernet connection and dual GPIB ports are standard on every 37000D VNA. Ethernet connection provides high speed data transfers and remote data extraction from the VNA. The same can also be achieved via the standard GPIB interface. The second GPIB port is dedicated to control peripheral devices such as plotters, power meters, and frequency synthesizers. The 37000D series maximize throughput by combining fast, error-corrected sweeps with high-speed data transfers.

- **Time domain analysis (Option 2A)**

Analyze impedance discontinuities as a function of time or distance with the 37000D's high-speed time domain. Isolate individual reflections in time and evaluate their effects in the frequency domain. Remove the effects of device packages and fixturing with time domain gating to see the actual performance of your designs. Use the independent display channels to view the response of your designs before, during, and after time domain processing.

The software provides four different windowing functions to optimize dynamic range and resolution. The exclusive phasor impulse mode will show you the true impedance characteristics of mismatches in waveguide, microstrip, and other band-limited media.

- **Multiple source control and set-on receiver mode**

The frequency of two sources and a receiver can be controlled without the need for an external controller using this function. Independently specify the sweep ranges and output powers of the sources and the sweep range of the receiver to accommodate mixer, swept IMD, TOI, and harmonic measurements. The 37000D's set-on receiver mode allows it to operate as a tuned receiver by phase locking all of its local oscillators to its internal crystal reference oscillator.

• Software tools and compatibility

VNA Utilities, provided with every 37000D, is the ultimate solution for automated test software development. It includes fully functional application programs, re-usable calibration, set-up and data manipulation samples, and software development tools for creating custom applications.

VNA Utilities includes applications such as the Capture Utility, which allows the user to extract data from the VNA in any of the supported formats (bitmap, S2P, plotter graphics, etc.).

The Calkit File Maker helps create a custom calibration kit disk from the coefficients entered by the user. And the VNA File Utility manages system software downloads and data file uploads to/from the VNA's hard disk via a PC. VNA Utilities also includes drivers and help tools for various software environments such as Visual Basic®, Labview and others.

• NxN calibration utility

This application is used for making error-corrected measurements of frequency translating devices such as mixers. The calibration performed requires a three mixer combination to correct for the components in the measurement path. Any one of the mixers characterized can then be used for the measurement of the DUT mixer. The standard built-in application guides the user through the set up and the calibration.

• Embedding/De-embedding

The de-embedding function is used for removal of test fixture contributions and other networks from measurements. The embedding function can be used to simulate matching circuits for optimizing amplifier and other designs.

• Internally controlled AutoCal®

One source of potential errors and inaccuracies in any network analyzer system is the calibration of that system. The Anritsu AutoCal automatic calibrator is designed to speed and simplify the calibration of your 37000D VNA. Using the built-in software support and an AutoCal module connected to the serial port on the rear panel of the instrument, you are ready to make fast, accurate, and repeatable calibrations.

• Built-in mass storage

Testing devices with multiple setups is now easier. A built-in hard disk drive rapidly stores and recalls frequently used front panel setups and calibrations. Store your complete test setup including limit lines and frequency markers. Create descriptive file names to assist multiple users or device types. The high storage capability of the internal hard disk means there is space for literally hundreds of calibrations, front panel setups, and data traces. In secure environments, the internal hard disk can be removed (Option 4A) and either an external drive on the SCSI port or the internal 1.44 MB floppy drive can be used for uploading proprietary setups.

• Flexible test set (Option 15)

All 37000D VNAs can be configured with six front panel loops: four direct receiver access loops and two auxiliary source loops (one for each port). These are useful for measurements of mixers, antennas, as well as integration with external test sets (for example, multi-port).

• Upgradeability

The 37000D series analyzers are designed to accommodate higher frequency ranges and more powerful features as your requirements grow. Any 37000D series VNA can be upgraded to any other model in the instrument family to fit your changing requirements. In addition, any VNA can also be upgraded to the ME7808C Broadband and Millimeter Wave VNA. This provides a cost-effective approach to satisfying today's needs while providing the flexibility to meet tomorrow's demands. System software upgrades are easily performed by loading software through the floppy drive or GPIB.

• Three-year factory warranty

All 37000D series VNAs are backed with a no-questions-asked three-year warranty.

Applications

• Filters

The 37000D VNAs have built-in functions that automatically locate filter center frequency, 3 dB bandwidth, max/min insertion loss, Q, and shape factor. The analyzer's improved dynamic range can be used to measure filter rejection and input match on the same display. Sweep speed can be enhanced for tuning filters by using the instrument's tune mode. This unique feature helps users optimize sweep times in one direction for better hand-to-eye tuning while maintaining a 12-term corrected S-parameter display. The analyzer's tune mode maximizes sweep speed and accuracy, simultaneously, by allowing the user to choose when reverse parameters are updated.

Also, passband phase distortions can be measured with the automatic reference plane extension capability. A single key press can help quickly identify filter non-linear phase responses.

• Swept Power Gain Compression - Amplifiers (37300D models only)

The Swept Power Gain Compression application (standard on 37300D models) allows the user to easily measure amplifier gain compression vs. input power or frequency. Power meter assisted linearity and flat output power calibration, combined with a receiver port calibration, provides capability to measure output power in dBm. A 1 watt, 70 dB (60 dB on >40 GHz models) step attenuator in the port 1 path, and a 40 dB step attenuator in the port 2 path, coupled with 20 dB ALC range, give complete control to characterize virtually any amplifier. This range is reduced to 12 dB at frequencies >50 GHz. Internal bias tees simplify DC biasing of your active designs.

In addition, a front panel source loop on each port (option 15) allows external amplifier insertion, increasing port power up to 1 Watt maximum for high input power amplifiers.

• Mixers

Complex frequency translated device measurements such as error corrected conversion loss, group delay, and port match measurements of mixers and up/downconverters are simplified with the NxN mixer measurement application. The NxN application adjusts the VNA's 12-term calibration for the reference mixer, a Band Pass Filter, and attenuators used in the measurement setup, yielding accurate measurements of the frequency translated DUT.

• Multi-Port and Balanced/Differential

Single-ended and mixed-mode S-parameter measurements with the 37000D series VNA are accomplished using a multi-port test set and an external PC running the Navigator™ Multi-Port software. Multi-Port components (diplexers, couplers, power dividers, etc.) or balanced/differential components can be easily characterized to frequencies as high as 65 GHz.

• Microstrip devices

The 37000D series offers complete substrate measurement solutions for both microstrip and coplanar waveguide (CPW) designs. The 37000D series analyzers accommodate the model 3680 series Universal Test Fixtures (UTF), calibration kits, and verification kits. Guaranteed system specifications provide assurance that your test results are accurate and verifiable. Internal calibration routines such as the Line-Reflect-Line (LRL) and Line-Reflect-Match (LRM) calibration capability help completely characterize connectorless devices with the Lightning VNAs. The four channel design provides true LRL/LRM error-correction yielding the highest performance available for in-fixture measurements. Highly reflective devices, along with well matched ones can also be measured with the same degree of ease. Automatic dispersion compensation improves measurement accuracy to help determine phase distortions for all microstrip designs.

• E/O and O/E devices

The 37000D series incorporates an E/O and O/E measurement application that simplifies VNA calibration when measuring E/O and O/E devices. The transfer function, group delay, and return loss of optical modulators (E/O) and photoreceivers (O/E) can be easily characterized using this application. An O/E calibration module (MN4765A) and a laser source are required to complete the test set-up. The internal VNA application de-embeds the response of the O/E calibration module to allow direct measurement of the modulator. For O/E measurements, the O/E calibration module is used to characterize a modulator first, which is then used as the characterized reference to measure another photoreceiver.

• Antennas

All 37000D VNAs include rear panel IF inputs (<270 MHz) that can be used in remote mixing applications to make antenna measurements. For near field and far field measurements that require direct access to the VNA test and reference channels, Option 15 can be included on any 37000D VNA which adds the four test and reference loops on the front panel to simplify measurements.

In addition the VNAs Fast CW mode enhances data extraction over GPIB to rates of 0.8 ms/point using internal triggering, and 1.2 ms/point with external triggering or 1.5 ms/point with GPIB triggering, allowing for fast data extraction for accurate plotting of near and far field effects.

Specifications

Measurement capabilities	Number of channels	Four measurement channels
	Parameters	S_{11}, S_{21}, S_{12}, S_{22}, or user defined; analog voltage input; complex input and output impedance; complex input and output admittance; complex forward and reverse transmission
	Domains	Frequency domain, CW draw, and optional high speed time domain (Option 2A)
	Formats	Log magnitude, phase, log magnitude and phase, Smith chart (impedance), Smith chart (admittance), linear polar, log polar, group delay, linear magnitude, linear magnitude and phase, real, imaginary, real and imaginary, and SWR
	Data points	1601 maximum. System also accepts an arbitrary set of N discrete data points where 2≤N≤1601. CW mode permits selection of a single point.
	Reference delay	Can be entered in time or in distance. Automatic reference delay adds the correct electrical length compensation at the push of a button. Software compensation for the electrical length difference between the reference and test is accurate and stable since measurement frequencies are always synthesized.
	Reference offset	Magnitude and phase
	Markers	Six independent markers can be used to read out measurement data. In delta-reference mode, any one marker can be selected as the reference for the other five. Markers can automatically find critical filter parameters i.e. 3 dB bandwidth, loss, center frequency, shape factor and Q.
	Marker sweep	Sweeps upward in frequency between any two markers. Recalibration is not required during the marker sweep.
	Limits	Two limit lines per data trace to indicate test limits. Limits can be either single or segmented limits for testing devices pass-fail.
	Measurement dynamic range	Table 1 gives receiver dynamic range as the ratio of typical power at Port 1 and the noise floor.
	Data averaging	Averaging of 1 to 4096 averages per data point can be selected.
	IF bandwidth	Front panel switch selects four levels of IF bandwidth: 10 kHz, 1 kHz, 100 Hz and 10 Hz
Display capabilities	Display channels	1, 2, 3 or 4 channels can be displayed. Each channel can display any S-parameter or user defined parameter in any format with up to two traces per channel for a maximum of eight traces simultaneously.
	Display type	Color LCD, 8.5” diagonally, VGA display. Color of graticule, trace data and text are user definable.
	Trace overlay	Overlays two traces with the same graticule type on the same display
	Trace memory	A separate memory for each channel can be used to store measurement data for later display or subtraction, addition, multiplication or division.
	Scale resolution	Log mag: 0.001 dB, linear mag: 1 pU Phase: 0.01˚, group delay: 0.001 ps Time: 0.001 ms, distance: 0.1 mm SWR: 1 pU Power: 0.05 dB
	Autoscale	Automatically sets resolution and offset to display measurement data on the full display
	Reference position	Settable to any graticule line
	Annotation	Type of measurement, vertical and horizontal scale resolution, start and stop frequencies and reference position
Vector error correction	Error correction models	Full 12-term, one-path two-port, reflection only, transmission response
	LRL/LRM	Line-Reflect-Line and Line-Reflect-Match calibration models are available for coaxial, microstrip and waveguide transmission lines.
Signal source capabilities	Source power level	Source power may be set from the 37000D front panel menu.
	Flat power correction	The 37000D corrects for test port power variations using an external power meter. Once the port power has been flattened, the power meter is removed and the signal source power level may be changed within the remaining power adjustment range.
	Multiple source control	Allows a user to separately control the frequency of two sources and receiver without need for an external controller. Source #1: 37000D internal source, or any 68000C, 69000B, or MG3690B synthesizer Source #2: Any 68000C, 69000B, or MG3690B synthesizer Receiver: 37000D internal receiver
	Internal 10 MHz time base stability	Standard (1 Hz resolution) With aging: <1 x 10^{-9}/day With temperature: <5 x 10^{-9} over 0˚ to 55˚C
Hard copy	Printers	Select full screen, graphical, tabular data, and printer type. Compatible with most HP and Epson printers with a parallel port interface
	GPIB plotters	Compatible with most HP and Tektronix plotters
	Disk file	Bitmap, S2P, text, tabular data, and HPGL
Storage	Internal memory	Ten front panel states (setup) can be stored and recalled from non-volatile memory locations.
	Internal hard disk drive	Store and recall instrument setups, calibration files and trace data files. All files are MS-DOS compatible.
	Internal floppy disk drive	Store and recall instrument setups, calibration files and trace data files from 3.5 inch 1.44 MB floppy disks. All files are MS-DOS compatible.
Remote programming	Interface	GPIB (IEEE 488.2), Ethernet
	Addressing	GPIB address can be set from the front panel and can range from 1 to 30. Static IP address for Ethernet.
	Transfer formats	ASCII, 32-bit floating point and 64-bit floating point
	Speed	150 kB/sec over GPIB, up to 850 kB/sec over Ethernet
	Interface function codes	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DT1, DC0, C0
General	Test ports	GPC-7, 3.5 mm, N-type, K, and V connectors supported
	Power requirements	85 to 240 V, 48 to 63 Hz, 540 VA maximum
	Dimensions	432 (W) x 267 (H) x 585 (D) mm (10.5 x 17 x 23 in)
	Mass	27 kg (60 lbs)
	Temperature	0˚ to +50˚C (operate), –40˚ to +75˚C (storage)

Table 1: Dynamic Range

• 37347D and 37369D models

Frequency*1 (GHz)	Port 1 Power, Typical (dBm)	With Option 15	Noise Floor at Port 2 (dBm)*2	With Option 15	System Dynamic Range (dB)	With Option 15
0.04	10	10	–85	–85	95	95
2	8	8	–107	–107	115	115
20	3	2	–103	–102	106	104
40	2	1	–95	–94	97	95

• 37247D and 37269D models

Frequency*1 (GHz)	Port 1 Power, Typical (dBm)	With Option 15	Noise Floor at Port 2 (dBm)*2	With Option 15	System Dynamic Range (dB)	With Option 15
0.04	10	10	–85	–85	95	95
2	8	8	–107	–107	115	115
20	2	1	–104	–103	106	104
40	2	1	–97	–96	99	97

• 37397D models

Frequency*1 (GHz)	Port 1 Power, Typical (dBm)	With Option 15	Noise Floor at Port 2 (dBm)*2	With Option 15	System Dynamic Range (dB)	With Option 15
0.04	10	10	–88	–88	98	98
2	5	5	–110	–110	115	115
20	2	1	–106	–105	108	106
40	1	0	–98	–97	99	97
50	–1	–3	–94	–93	93	90
65	–2	–4	–82	–80	80	76

• 37297D models

Frequency*1 (GHz)	Port 1 Power, Typical (dBm)	With Option 15	Noise Floor at Port 2 (dBm)*2	With Option 15	System Dynamic Range (dB)	With Option 15
0.04	10	10	–88	–88	98	98
2	5	5	–110	–110	115	115
20	1	0	–107	–106	108	106
40	1	0	–100	–99	101	99
50	–1	–3	–96	–95	95	92
65	–1	–3	–84	–82	83	79

∗1: Specifications between the stated frequencies are to be linearly interpolated as typical values.
∗2: RMS values – compensated for loss in available source power from test port cable connected between Port 1 and Port 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
37247D	Vector Network Analyzer (40 MHz to 20 GHz)
37269D	Vector Network Analyzer (40 MHz to 40 GHz)
37297D	Vector Network Analyzer (40 MHz to 65 GHz)
37347D	Vector Network Analyzer (40 MHz to 20 GHz)
37369D	Vector Network Analyzer (40 MHz to 40 GHz)
37397D	Vector Network Analyzer (40 MHz to 65 GHz)
	Options
Option 1A	Rack mount kit with handles
Option 2A	High-speed time (distance) domain capability
Option 4A	External SCSI-2 hard disk drive compatibility (internal HDD removed)
Option 7A	Replaces universal K connector (standard) with universal GPC-7 (37200C/37300C only)
Option 7N	Replaces universal K connector (standard) with universal N-male (37200C/37300C only)
Option 7NF	Replaces universal K connector (standard) with universal N-female (37200C/37300C only)
Option 7S	Replaces universal K connector (standard) with universal 3.5 mm-male (37200C/37300C only)
Option 7K	Replaces universal V connector (standard) with universal K (m) (37277C/37297C/37377C/37397C models only)
Option 15	Flexible Test Set
	Calibration kits
3650	SMA/3.5 mm Calibration Kit
Option 1	Adds Sliding Terminations
3651	GPC-7 Calibration Kit
Option 1	Adds Sliding Terminations

Model/Order No.	Name
3652	K Connector Calibration Kit
Option 1	Adds Sliding Terminations
3653	Type N Calibration Kit
3654B	V Connector Calibration Kit with Sliding Terminations
36581NNF	AutoCal, N (m) to N (f), 40 MHz to 18 GHz
36581KKF	AutoCal, K (m) to K (f), 40 MHz to 20 GHz
36582KKF	AutoCal, K (m) to K (f), 40 MHz to 40 GHz
	Verification kits
3663	Type N Verification Kit
3666	SMA/3.5 mm Verification Kit
3667	GPC-7 Verification Kit
3668	K Connector Verification Kit
3669B	V Connector Verification Kit
3656	W1 Connector Calibration/Verification Kit
	Test port cables
3670A50-1	GPC-7 Semi-rigid Cable, 1 foot
3670A50-2	GPC-7 Semi-rigid Cable, 2 foot
3670K50-1	K Connector Semi-rigid Cable, 1 foot
3670K50-2	K Connector Semi-rigid Cable, 2 foot
3670V50-1	V Connector Semi-rigid Cable, 1 foot
3670V50-2	V Connector Semi-rigid Cable, 2 foot
3671A50-1	GPC-7 Flexible Cables, 25 in. (1 pair)
3671A50-2	GPC-7 Flexible Cables, 38 in.
3671S50-1	3.5 mm Flexible Cables, 25 in. (1 pair)
3671S50-2	3.5 mm Flexible Cables, 38 in.
3671K50-1	K Connector Flexible Cables, 25 in. (1 pair)
3671K50-2	K Connector Flexible Cables, 38 in.
3671V50B-1	V Connector Flexible Cables, 25 in. (1 pair)
3671V50B-2	V Connector Flexible Cables, 38 in.

MICROWAVE MULTI-PORT BALANCED VNA

37000D Series

40 MHz to 65 GHz

CE GPIB

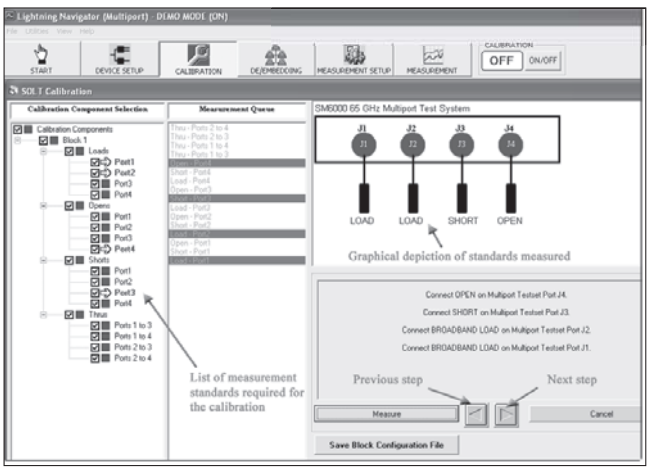
For Single-Ended, Balanced-Differential and Mixed-Mode S-Parameter Measurements

The Microwave Multi-Port Balanced VNAs are four port measurement solutions based on the Lightning VNAs. They consist of a 37000D Lightning VNA, a multi-port test set, and the Navigator™ Multi-Port software (external PC is required and is not included), and are available in three frequency ranges - 20, 40 and 65 GHz. The test sets have an option to add internal bias tees for active device measurements.
The easy-to-use Navigator™ Multi-Port software provides full step-by-step directions for measuring multiport, mixed-mode and balanced-differential devices, including full 4-port calibrations and embedding/de-embedding capabilities.
Existing Lightning VNAs can be readily upgraded to add the new multi-port test set and software. With the Lightning VNA's proven stability, the Multi-Port Balanced VNA provides excellent measurement repeatability and offers a cost-effective application solution for microwave multi-port and balanced-differential device characterization.

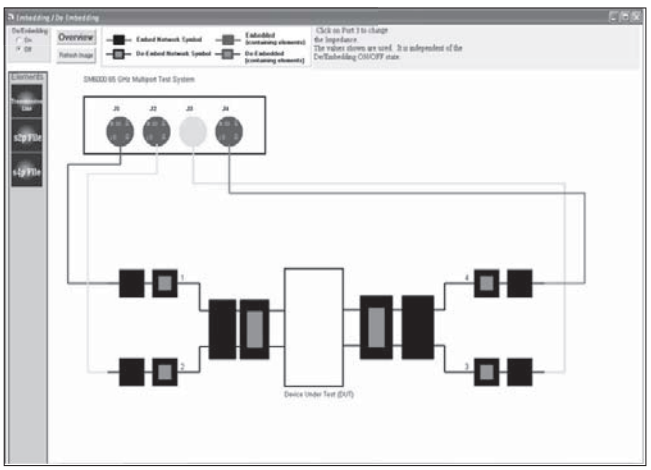
Features

- 2, 3, or 4-port single-ended and mixed-mode S-parameter measurements in coaxial or on-wafer
- Full 4-port calibrations (SOLT, LRM, LRL, SOLR) for superior accuracy
- Differential Time Domain analysis
- Advanced Embedding/de-embedding of S2P and S4P files and transmission line structures
- System Impedance transformation (real and complex) on each port for flexibility of different device impedances
- 16 channel display with unlimited traces on each channel
- Supports multiple graph types - Log magnitude, phase, Smith Chart, impedance
- SnP, MnP, TXT, JPG data output formats

Easy-to-Use Navigator™ Multi-Port Software

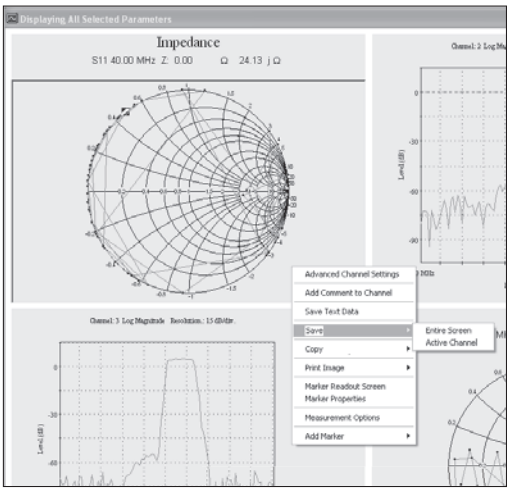


Four port Calibration menu

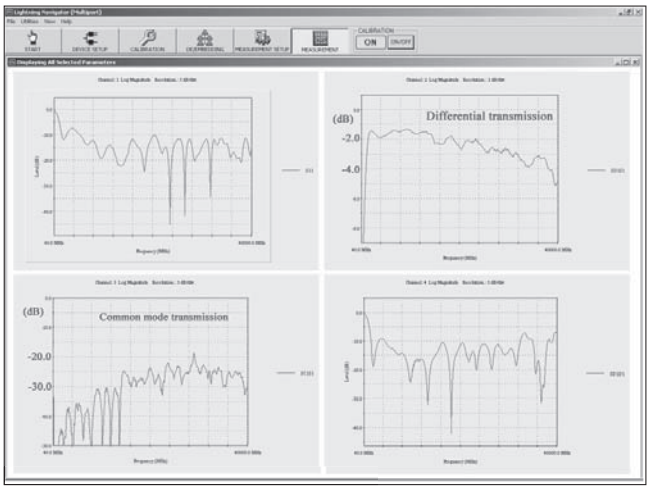


S2P and S4P embedding/De-embedding

Easy-to-Use Navigator™ Multi-Port Software



Data Output options



Measurement of a Balun

Specifications*

Frequency Range	20 GHz		40 and 65 GHz	
Test Port Connectors	K (2.92 mm) Male, 50 Ω		K (2.92 mm) male for 40 GHz V (1.85 mm) male, 50 Ω for 65 GHz	
Test Port Power	20 GHz	–5 dBm	40 GHz 50 GHz 60 GHz	–7 dBm –12 dBm –13.5 dBm
Directivity (corrected)	0.04 GHz 2 GHz 20 GHz	42 dB 42 dB 42 dB	2 GHz 20 GHz 40 GHz 65 GHz	40 dB 40 dB 36 dB 34 dB
Source Match (corrected)	0.04 GHz 2 GHz 20 GHz	40 dB 40 dB 38 dB	2 GHz 20 GHz 40 GHz 65 GHz	36 dB 36 dB 32 dB 28 dB
System Dynamic Range	0.04 GHz 2 GHz 20 GHz	70 dB 90 dB 80 dB	2 GHz 20 GHz 40 GHz 50 GHz 60 GHz 65 GHz	95 dB 90 dB 82 dB 70 dB 62 dB 56 dB
Test Set Isolation	90 dB between any ports			
Maximum Input Power	+20 dBm (25 VDC) all ports			
Bias Tees (optional)	30 VDC, 500 mA, all ports			
Control	Windows-based PC via GPIB [IEEE 488.2] interface			
Temperature Range (Storage)	–40˚ to +75˚C			
Temperature Range (Operating)	0˚ to 50˚C (specifications apply at 23 ±3˚C)			
AC Power (test set only)	100 VA Max., 47 to 63 Hz, 85 to 240 V			
Dimensions (test set only)	443 (W) x 153 (H) x 500 (D) mm (4.6 x 17.5 x 19.7 in)			
Mass (test set only)	Approximately 7 kg (15.4 lbs)			

*: Specifications are typical and subject to change without notice.

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
SM5962	Multiport Test Set, 20 GHz
SM5975	Multiport Test Set, 20 GHz, with bias tees
SM6070	Four port test set, 40 MHz to 40 GHz
SM6159	Four port test set w/bias tees, 40 MHz to 40 GHz
SM6000	Multiport Test Set, 65 GHz
SM6135	Multiport Test Set, 65 GHz, with bias tees

BROADBAND AND MILLIMETER WAVE VECTOR NETWORK ANALYZER

ME7808C

40 MHz to 110 GHz (expandable to 500 GHz)

CE GPIB Ethernet

Broadband S-Parameter Measurements to 110 GHz and Beyond

The ME7808C Broadband Vector Network Analyzer (VNA) is a high performance measurement solution that covers 40 MHz to 110 GHz in a single fast sweep. Built on the advanced technology of the Lightning 65 GHz VNA, the ME7808C is ideal for making accurate S-parameter measurements of components and devices to 110 GHz.
The flexible system architecture of the ME7808C makes it easy to adapt to multiple measurement applications.
An alternate configuration is the ME7808B Millimeter Wave VNA, a high performance measurement solution that covers specific millimeter wave bands from 50 GHz to 500 GHz. Any of the two-port Lightning 37000D VNA models can be used as the foundation for the Millimeter Wave VNA.

The ME7808C Broadband VNA consists of:

- Lightning 37397D 65 GHz VNA (with option 15 V, 1A and 2A)
- Two Millimeter Wave Modules (3742A Series)
  – Extended W Band (WR-10), 65 to 110 GHz
- Broadband Test Set
- Two 20 GHz Ultra-Low Phase Noise Frequency Sources
- Two Multiplexing Couplers
- Equipment Console with Table

The ME7808C Millimeter Wave VNA consists of:

- Any Lightning 37200D or 37300D series VNA (with option 1A and 1B)
- Two Millimeter Wave Modules (3740A or 3741A Series)
  – V Band (WR-15), 50 to 75 GHz
  – E Band (WR-12), 60 to 90 GHz
  – Extended E Band (WR-12), 56 to 94 GHz
  – W Band (WR-10), 75 to 110 GHz
  – Extended W Band (WR-10), 65 to 110 GHz
  – Higher frequency bands (up to 500 GHz)*
- Broadband Test Set
- Two 20 GHz Ultra-Low Phase Noise Frequency Sources
- Equipment Console with Table

*: With VNA2 Frequency Extension Modules from OML, Inc.

Features

• Ultra-Low Phase Noise Frequency Sources

The ME7808C Broadband and Millimeter Wave VNAs use two 20 GHz synthesized sources with ultra low phase noise (Option 3).
They provide the LO and RF drive to the mmW modules which translates to the lowest measurement trace noise available in a millimeter wave VNA.

• Single Pair of Coaxial Test Ports For Broadband Sweep

The ME7808C Broadband VNA combines the 40 MHz to 65 GHz output from the VNA and the 65 GHz to 110 GHz output from the mmW modules using a unique multiplexing coupler design. The effective system test ports for the broadband configuration are therefore two W1 coax connectors. The W1 Connector™ is compliant with the IEEE standard 1.0 mm connector. This design provides a DC path that permits bias injection from the VNA front panel bias inputs directly to the W1 coax test ports.

• Up to Three Systems in One

Using the approach of coupling the 65 GHz VNA output with that from the mmW modules, the ME7808C Broadband VNA can be operated in any of the following configurations:

1) as a broadband VNA (40 MHz to 110 GHz) with W1 Connector™ coaxial interface
2) as a stand-alone 65 GHz VNA with V Connector® coaxial interface
3) as a millimeter wave VNA (65 GHz to 110 GHz) with a WR-10 waveguide connector interface. Additional discrete mmW bands are easily supported by substituting other available mmW modules into the system.

The ME7808C Millimeter Wave VNA permits switching between the stand-alone coaxial and the millimeter wave modes, thus offering two systems in one.
Reconfiguration of the system is fast and simple using an internal software menu. When operating either the stand-alone VNA or mmW systems independently, higher output power and increased dynamic range are achievable. Wafer probe tips can be connected to any of the three interfaces to make on-wafer measurements.

• Complete Measurement Solutions

The ME7808C is compatible with leading probe stations and probe tips for making on-wafer measurements. On-wafer calibration software such as SussCal from Suss MicroTec and WinCal from Cascade Microtech have built in drivers for the Anritsu
Lightning VNAs. For parameter extraction and device modeling, an instrument driver for the ME7808C is integrated in Agilent EEsof's IC-CAP 2006B. In addition, a complete list of accessories is available including W1 coaxial calibration kits, waveguide calibration kits, W1 coaxial and waveguide to coaxial adapters.

4 PORT VECTOR NETWORK ANALYZER AUTOMATIC CALIBRATOR

36584 Series

10 MHz to 9 GHz

CE

Automatic, High-Reliability, and High-Quality Calibrators for Multi-port Coaxial Device Measurements

The 36584 series AutoCal® modules are automatic calibrators that provide fast, repeatable, and high-quality coaxial calibrations for 2, 3, and 4-Port S-parameter requirements up to 9 GHz. These modules contain precisely characterized calibration standards that aid in the removal of normal systematic errors when using the MS46XXA/B/C/D series Vector Network Measurement System (VNMS).
The 4-Port AutoCal is available in two models: 10 MHz to 9 GHz, with N (f) connectors and 10 MHz to 9 GHz, with K (f) connectors. 4-Port AutoCal modules come with a data file characterizing each standard in the calibrator module. Each module is guaranteed to perform to its specifications for six months without re-characterization. Following this period, re-characterization can be performed by the customer, or by sending the module to the nearest service center. The 4-Port AutoCal has a direct serial interface to the MS462x series of Anritsu Vector Network Measurement Systems. The control software is built-in to the VNMS.

Features

- **Calibration types**

1-port S11 and S22 calibration, and full 2-port, 12-term OSLT, 3-port, 24-term OSLT, and 4-port, 40-term OSLT calibrations can be performed with the 4-Port 36584 series AutoCal.

- **Fast**

Significantly reduces calibration time making it ideal for the manufacturing environment.

- **Reliable**

Eliminates unreliable measurements due to inaccurate manual calibrations.

- **Accurate**

Accuracy that exceeds OSLT calibration, with broadband loads. Characterized modules are traceable to NIST.

- **True thru**

Inherently, the internal calibrator thru is not as accurate as an external direct thru connection. The true thru mode offers the choice of manually removing the AutoCal module for a true thru calibration.

- **Isolation cal**

Isolation cal is offered as part of a full 2, 3, or 4-port calibration.
The user is given the option of skipping isolation, using the default averaging factor during isolation, or entering a custom averaging factor.

- **Thru update**

Due to cable movements and aging, periodically updating the thru portion of a calibration is recommended. Thru update mode offers the choice of simply performing a direct manual thru step to update a current calibration. This is easily performed without having to invoke the AutoCal module.

- **Manual control**

Manual control offers the ability to connect any of the internal standards to the test ports of the VNA. This feature could be used to manually verify a calibration.

- **Adapter removal**

VNA calibration for testing non-insertable devices requires phase equal insertables. If this is not possible, or is undesirable, adapter removal calibration is the solution. Adapter removal requires two full 12-term calibrations, moving an adapter from one test port cable to the other between calibrations (a job AutoCal makes quick and easy). Internal software mathematically subtracts the effect of the adapter, yielding the desired adapter-less measurement.

- **Test port converter sets**

The 36583S, 36583L, and 36583K test port converter sets allow change of the AutoCal connector type and sex.

Specifications

All specifications are guaranteed over the ambient temperature range of 23˚C ±3˚C.

• Directory

Frequency	AutoCal Module
0.01 to 1 GHz	42 dB
1 to 3 GHz	40 dB
3 to 6 GHz	36 dB
6 to 9 GHz	34 dB

• Source match

Frequency	AutoCal Module
0.01 to 1 GHz	42 dB
1 to 3 GHz	39 dB
3 to 6 GHz	35 dB
6 to 9 GHz	33 dB

General

• Serial input connector

9 pin D-sub allowing PC or direct VNA control (Serial cable supplied)

• Power supply input connector

5 V, ±15 V for the electronic modules, and 5 V, 24 V for the electromechanical module. The modules are keyed against plugging the wrong supply. The appropriate DC supply is supplied with each AutoCal module. These universal supplies will operate at either 110 V or 220 V input voltages.

• Power LED

On when the DC supply is plugged in.

• Operate LED

On when the module's internal temperature has stabilized at an optimum temperature for accurate calibrations.

• Dimensions

155 (W) x 65 (H) x 90 (D) mm (6W x 2.5H x 3.5D in.)

Environment

• 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
	AutoCal modules
366584KF	4-Port AutoCal, K (f) type, 10 MHz to 9 GHz
36584NF	4-Port AutoCal, N (f) type, 10 MHz to 9 GHz
	Test port converter sets
36583S	SMA type
36583L	3.5 mm type
36583K	K type

AutoCal may be sent to the nearest service center for re-characterization, or a service engineer may perform the task at the customer's site. To minimize down-time, the customer can re-characterize the AutoCal module with a Lightning or Scorpion family VNA and a traditional cal kit.

VECTOR NETWORK ANALYZER AUTOMATIC CALIBRATOR

3658 Series

10 MHz to 40 GHz

CE

Automatic, High-Reliability, and High-Quality Calibrators for Coaxial Device Measurements

The 3658 series AutoCal® modules are automatic calibrators that provide fast, repeatable, and high-quality coaxial calibrations up to 40 GHz. These modules contain precisely characterized calibration standards that aid in the removal of normal systematic errors when using vector network analyzers (VNAs). AutoCal is available in four models: 0.04 to 18 GHz, with N (m) to N (f) connectors, 0.01 to 9 GHz and 0.04 to 20 GHz, with K (m) to K (f) connectors, and 0.04 to 40 GHz, with K (m) to K (f) connectors.

AutoCal modules come with a data file characterizing each standard in the calibrator module. Each module is guaranteed to perform to its specifications for six months without re-characterization. Following this period, re-characterization can be performed by the customer, or by sending the module to the nearest service center.

Test port cable converter sets aid the user in calibrating a VNA for testing non-insertable devices and devices with SMA or 3.5 mm connectors. Test port converter sets are available for K Connector, SMA, and 3.5 mm connectors. Adapter removal calibration is required for N type non-insertable device testing.

AutoCal has a direct serial interface to the 37xxx and MS462x series of Anritsu vector network analyzers. The control software is built-in to the VNA. For operation with the 360B and/or older generation 37xxx models, an external PC running Microsoft Windows® with a National Instruments IEEE488.2 GPIB interface card is required.

Features

- **Calibration Types**

1-port S_{11} and S_{22} calibration, and full 2-port, 12-term OSLT calibrations can be performed with AutoCal.

- **True Thru**

Inherently, the internal calibrator thru is not as accurate as an external direct thru connection. The true thru mode offers the choice of manually removing the AutoCal module for a true thru calibration.

- **Isolation Cal**

Isolation cal is offered as part of a full 2-port calibration. The user is given the option of skipping isolation, using the default averaging factor during isolation, or entering a custom averaging factor.

- **Switch Averaging**

AutoCal modules use an electromechanical switch to select the calibration standards. Switch averaging is offered to reduce the effects of the electromechanical switch's non-repeatability. A 6 dB improvement in repeatability can be achieved by increasing switch averaging by a factor of four, at the expense of the overall calibration time.

- **Thru Update**

Due to cable movements and aging, periodically updating the thru portion of a full 12-term calibration is recommended. Thru update mode offers the choice of simply performing a direct manual thru step to update a current calibration. This is easily performed without having to invoke the AutoCal module.

- **Manual Control**

Manual control offers the ability to connect any of the internal standards to the test ports of the VNA. This feature could be used to manually verify a calibration.

- **Adapter Removal**

VNA calibration for testing non-insertable devices, requires phase equal insertables. If this is not possible or is undesirable, adapter removal calibration is the solution. Adapter removal requires two full 12-term calibrations, moving an adapter from one test port cable to the other between calibrations (a job AutoCal makes quick and easy). Internal software mathematically subtracts the effect of the adapter, yielding the desired adapter-less measurement.

- **Test Port Converter Sets**

The 36583S, 36583L, and 36583K test port converter sets allow change of the AutoCal connector type and sex.

Specifications

All specifications are guaranteed over the ambient temperature range of 23˚ ±3˚C.

• Directory

Frequency	AutoCal Module	AutoCal Module with 36583X
0.01 to 2 GHz	38 dB	36 dB
2 to 20 GHz	36 dB	34 dB
20 to 40 GHz	34 dB	32 dB

• Source match

Frequency	AutoCal Module	AutoCal Module with 36583X
0.01 to 2 GHz	34 dB	32 dB
2 to 18 GHz (N)	31 dB	29 dB
2 to 20 GHz (K)	34 dB	32 dB
20 to 40 GHz	26 dB	24 dB

• Reflection tracking

Frequency	AutoCal Module	AutoCal Module with 36583X
0.01 to 2 GHz	±0.15 dB	±0.20 dB
2 to 20 GHz	±0.20 dB	±0.25 dB
20 to 40 GHz	±0.25 dB	±0.30 dB

• Transmission tracking (Internal thru mode)

Frequency	AutoCal Module	AutoCal Module with 36583X
0.01 to 2 GHz	±0.15 dB	±0.20 dB
2 to 20 GHz	±0.20 dB	±0.25 dB
20 to 40 GHz	±0.25 dB	±0.30 dB

• Transmission tracking (True thru mode)

Frequency	AutoCal Module	AutoCal Module with 36583X
0.01 to 2 GHz	±0.15 dB	±0.20 dB
2 to 20 GHz	±0.20 dB	±0.25 dB
20 to 40 GHz	±0.25 dB	±0.30 dB

General

• Serial input connector

9 pin D-sub allowing PC or direct VNA control (Serial cable supplied)

• Power supply input connector

5 V, ±15 V for the electronic modules, and 5 V, 24 V for the electro-mechanical module. The modules are keyed against plugging the wrong supply. The appropriate DC supply is supplied with each AutoCal module. These universal supplies will operate at either 110 V or 220 V input voltages.

• Power LED

On when the DC supply is plugged in.

• Operate LED

On when the module's internal temperature has stabilized at an optimum temperature for accurate calibrations.

• Dimensions

155 (W) x 65 (H) x 90 (D) mm (6W x 2.5H x 3.5D in.)

Environment

• 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
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Immunity
EN61000-4-2-1995
EN61000-4-3-1995
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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
	AutoCal Modules
36581NNF	N Type, 40 MHz to 18 GHz
36581NNF/2	N Type, 10 MHz to 9 GHz
36581KKF	K Type, 40 MHz to 20 GHz
36581KKF/2	K Type, 10 MHz to 9 GHz
36582KKF	K Type, 40 MHz to 40 GHz
	Test port converter sets
36583S	SMA Type
36583L	3.5 mm Type
36583K	K Type
	Service
2300-228	Re-characterization Software (for 360B's and 37xxx prior to serial number 992001)

AutoCal may be sent to the nearest service center for re-characterization, or a service engineer may perform the task at the customer's site. To minimize down-time, the customer can re-characterize the AutoCal module with a Lightning or Scorpion family VNA and a traditional cal kit.

VNA MASTER

MS2024A/MS2034A

VNA: 2 MHz to 4 GHz/Spectrum Analysis: 9 kHz to 4 GHz

MS2026A/MS2036A

VNA 2 MHz to 6 GHz/Spectrum Analysis: 9 kHz to 7.1 GHz

CE Ethernet

Handheld Vector Network and Spectrum Analysis for General Purpose Applications

RF engineers and technicians in the field provide a valuable service as they support defense and general purpose communication systems around the world. They ensure radars on Navy ships are operational. They test antennas on Army vehicles. They perform flight-line test on Air Force and commercial jets. They maintain communication systems on Marine expeditionary fighting vehicles. They support VHF Omni-directional Range (VOR) in radio navigational systems throughout the world. They ensure direction finding (DF) reconnaissance systems precisely pinpoint threats.

Equally valuable are the primary test instruments that serve these applications: vector network analyzer, spectrum analyzer, power meter, and vector voltmeter. In the factory, these handheld instruments are also especially attractive for lowering cost-of-test and minimizing capital equipment expenditures.

Anritsu introduces the MS202xA VNA Master and the MS203xA VNA Master plus Spectrum Analysis that offers these individual test capabilities in a handheld, battery-operated, rugged multi-function instrument. The VNA Master easily replaces bulky and obsolete bench-top instruments with a more efficient-to-use handheld instrument so technicians can freely roam the sites they service. This freedom increases their productivity as they phase match cables, identify sources of interference, and troubleshoot transmitters. The VNA Master is so ideally suited for cable and antenna measurements in the field that it can also double as a low-cost alternative in manufacturing and R&D.

Product Overview

- Two-port vector network analysis (2 MHz to 6 GHz)
- Broad spectrum analysis (9 kHz to 7.1 GHz) MS2034A/36A
- Broad power meter (10 MHz to 7.1 GHz) MS2034A/36A
- Optional power monitor measurements (1 MHz to 20 GHz)
- Optional high accuracy power meter, PSN50 (50 MHz to 6 GHz)
- Optional Vector Voltmeter (VVM) mode (2 MHz to 6 GHz)
- Ergonomically designed controls
- Handheld battery-operated RF test solution

VNA Features

- Two-port vector network analysis (2 MHz to 6 GHz)
- >42 dB directivity
- <±1 dB uncertainty for $|S_{11}|$ <20 dB
- <±0.5 dB uncertainty and <±4 degrees uncertainty for $|S_{21}|$ <30 dB
- >70 dB dynamic
- Smith Charts, Phase, and Group Delay measurements

Spectrum Analysis Features

- Broad spectrum analysis (9 kHz to 7.1 GHz)
- Wide dynamic range (100 dB typical)
- Excellent DANL (with preamp): –163 dBm in 1 Hz RBW
- Superior Single Side Band (SSB) Phase Noise of <–100 dBc/Hz at 1 kHz offsets
- Fast sweep speed of 200 ms in 10 MHz span
- Powerful markers: 6 markers, 7 marker modes, and marker table display
- New quasi-peak detector and CISPR bandwidths

General Features

- Light weight (less than 4 kg. including battery) and rugged design
- Large 8.4 in. full-color TFT display screen
- Type N female RF connectors
- Soft keys, directional buttons, and rotary knob
- LAN and USB 2.0 (full-speed) connections
- Rechargeable and field replaceable Li-Ion Battery
- 256 MB storage
- Remote programming via Ethernet

VNA Overview

Cables and antennas are a vital part of any communication system that unfortunately can degrade over time due to corrosion, water damage, or excessive deployment time. Phase matched cables are even more susceptible to these kinds of problems. Ideally, one can avoid the fix-after-failure scenario by routinely sweeping these critical components to detect earlier these potentially catastrophic problems. A field-friendly vector network analyzer can simplify this task.

The VNA Master is a 1-port and 2-port handheld vector network analyzer (VNA), which uses the superior Frequency Domain Reflectometry (FDR) approach instead of the DC pulse technique of older Time Domain Reflectometry (TDR) approaches. Using FDR, the VNA Master provides convenient 1-port measurements of return loss, VSWR, cable loss, Distance-To-Fault (DTF), and Smith Chart measurements in the field. Connect the VNA Master to a 2-port cable to measure cable loss, phase, and group delay. In other words, the VNA Master offers precise measurement capabilities for cables and antennas by simplifying S_{11} and S_{21} measurements in the field.

The VNA Master employs vector correction after an open-short-load calibration to ensure accuracy, repeatability, and overall quality of 1-port and 2-port measurements. As an improvement over traditional scalar measurement approaches, the VNA Master removes all the systematic errors associated with the 1-port reflection measurements, including directivity, source match, and reflection tracking. Additionally, the VNA Master removes transmission response errors and transmission source match errors (i.e., a 1-path, 2-port correction) when conducting 2-port transmission measurements. The vector correction of the VNA Master offers superior measurement accuracy for detecting problems or phase matching cables in a convenient handheld product so you can perform VNA measurements anywhere, anytime.

Spectrum Analysis Overview

In addition to cables and antennas, the typical communication system also contains more sophisticated transmitters, receivers, and signal separation components. These additional components increase the complexity of the overall system, which becomes especially difficult to maintain when there is an intermittent problem.

A field-friendly spectrum analyzer can simplify this task.

The VNA Master plus Spectrum Analysis (i.e., MS203xA) adds the capability to conduct spectrum analysis in the field to the already powerful MS202xA! Don't let the small footprint fool you, this instrument offers performance and features that rivals bench-top alternatives for simplifying spectrum monitoring, interference analysis, and other general purpose signal measurements in the field. The VNA Master offers broad spectrum analysis frequency coverage, impressive dynamic range, and excellent phase noise performance from 9 kHz to 7.1 GHz.

The VNA Master plus Spectrum Analysis includes many standard measurements. These measurements include field strength, occupied bandwidth, channel power, adjacent channel power ratio, and carrier to interference (C/I) ratio. In addition, the built-in AM/FM/SSB demodulator simplifies the task of identifying interfering signals. Overall, the VNA Master is a powerful handheld tool for general purpose spectrum analysis anywhere, anytime.

Optional VNA Features

• Power Monitor (Option 5)

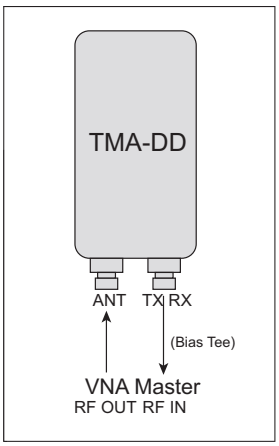
With the Anritsu 560 series detectors, technicians can accurately measure broadband power up to 50 GHz. These high precision detectors significantly help minimize mismatch uncertainty with detector flatness better than 0.5 dB up to 18 GHz.

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.

• Bias Tee (Option 10)

The integrated, variable Bias Tee is designed to supply bias to a tower mount amplifier (TMA) or other active device. This bias is supplied from the center conductor of the RF In port on the VNA Master, delivering a variable 12 to 24 V.

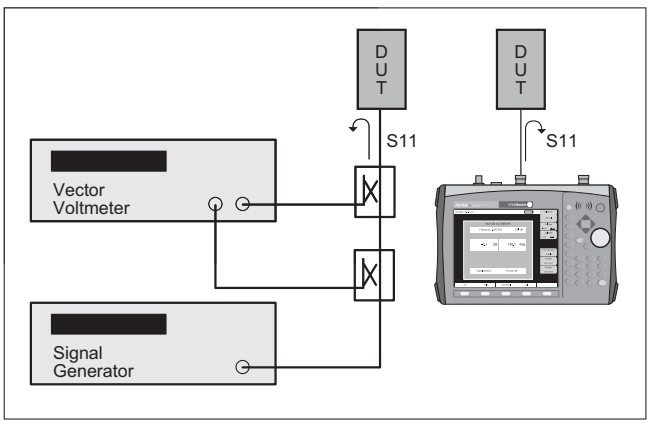


• Vector Voltmeter (Option 15)

The VNA Master offers a field-friendly version of the popular vector voltmeter for phase matching cables. In this approach, the VNA Master provides an optional user interface with display types of impedance, dB, and VSWR for 1- and 2-port measurements.

The VNA Master contains the signal generator, couplers, phase measurement receiver, and now the user interface of this popular approach. Field engineers can now upgrade their tools without impacting existing maintenance procedures by adding this popular user interface to the already easy-to-learn VNA Master.

As an additional capability, Option 15 also includes the valuable capability to compare up to five different cables to a reference cable. Using this capability, one can simplify the task of phase matching multiple cables in the field.



A side-by-side comparison shows how the VNA Master is a more convenient instrument for phase matching cables in the field.

• Power Meter (Option 019)

Anritsu's USB power sensors, either the PSN50 or MA24106A (50 MHz to 6 GHz), offer high accuracy power measurements remote from the VNA Master instrument. Purchase sensors separately. This means you can connect the PSN50 or MA24106A sensor units right at the transmitter output connector tap, for improved performance because the VSWR effects of the cables are minimized.

Optional Spectrum Analysis Features

• Interference Analyzer (Option 25)

With its built-in low-noise preamplifier, the MS203xA with interference analyzer option provides the ability to identify and locate interfering signals down to the noise floor, allowing technicians to better address the quality issues that affect user service.

Spectrogram

The Spectrogram display is a three dimensional display of frequency, power, and time of the spectrum. It is applicable for identifying intermittent interference and tracking signal levels over time.
The MS203xA can save data for up to 72 hours.

RSSI

The received signal strength indicator (RSSI) can be used to observe the signal strength of a single frequency over time. Data can be collected for up to 72 hours.

• Channel Scanner (Option 27)

The channel scanner option measures the power of multiple transmitted signals and is very useful for measuring channel power in up to 20 channels at the same time. Display data in graph or table format. In the custom setup menu each channel can be custom built with different frequency, bandwidth, or channels for convenient simultaneous analysis of a variety of different signal standards.

• GPS Receiver (Option 31)

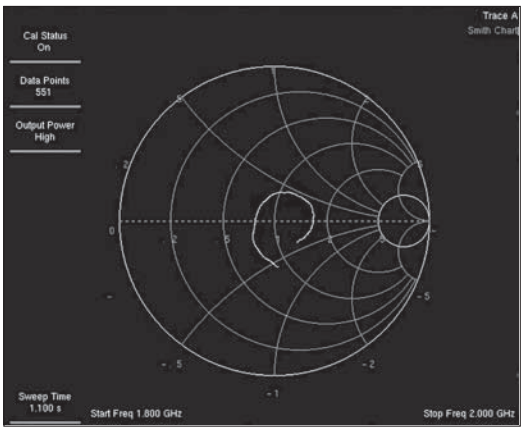
Built-in GPS provides precise location (latitude, longitude, and altitude) and Universal Time (UT) information to help the user verify that measurements are taken at the right location. The VNA Master then stamps each trace and stores the GPS location information. The GPS option also includes a convenient magnet-mount antenna with a 15-foot (5 m) cable for the car, truck or any other useful surface.

Master Software Tools

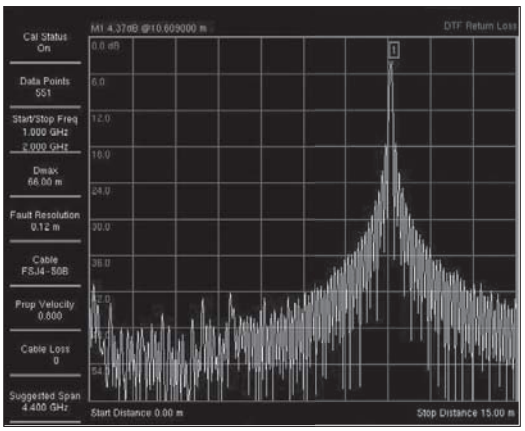
Each VNA Master ships with a test assistant: a copy of Anritsu's Master Software Tools for Windows® 2000/XP.
This allows an operator to add the processing capabilities of a PC and this software utility to the VNA Master to form a powerful and flexible measurement solution for both network and spectrum analysis. For automation, the VNA Master also supports remote programming via the Ethernet interface.

Connect VNA Master to a PC for archiving and additional analysis.

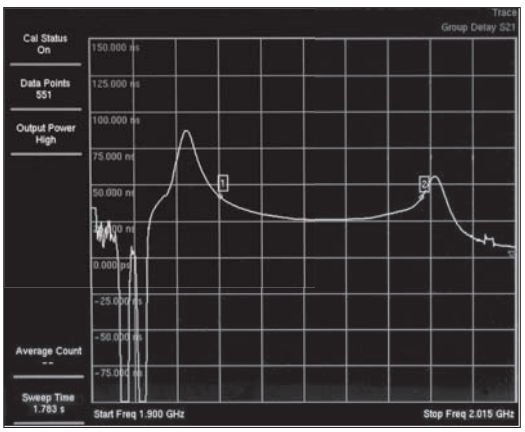
Typical Vector Network Analyzer Measurements



S_{11} Smith Chart

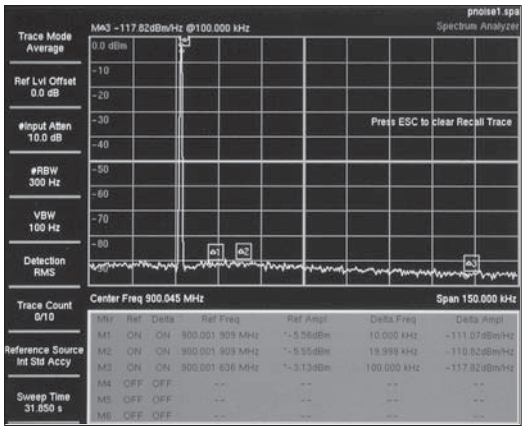


Distance-To-Fault

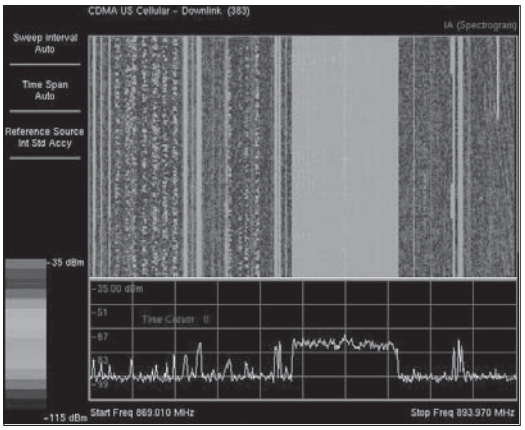


S_{21} Log Magnitude/Group Delay

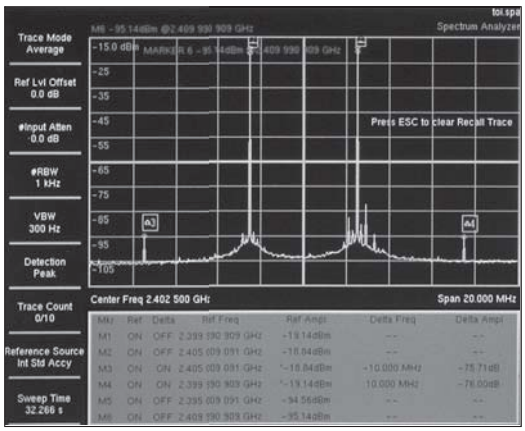
Typical Spectrum Analyzer Measurements



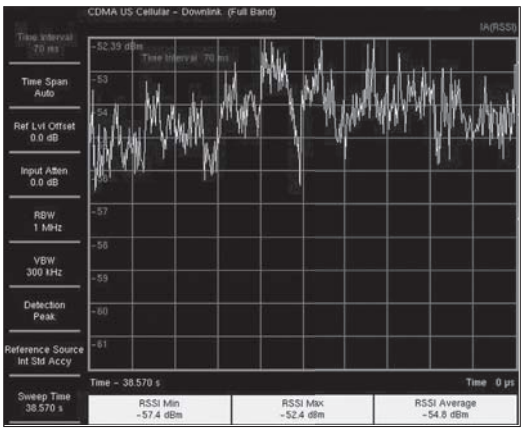
Phase Noise



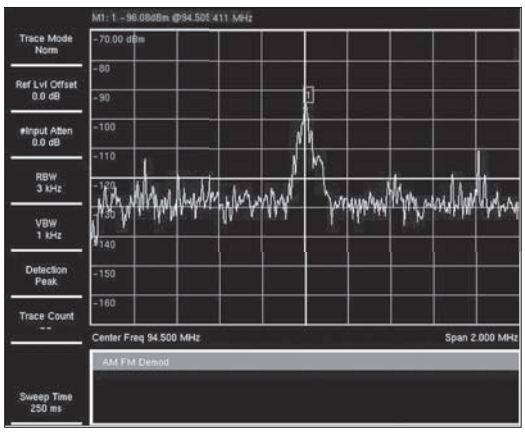
With Option 25, spectrogram measurements identifies intermittent interference.



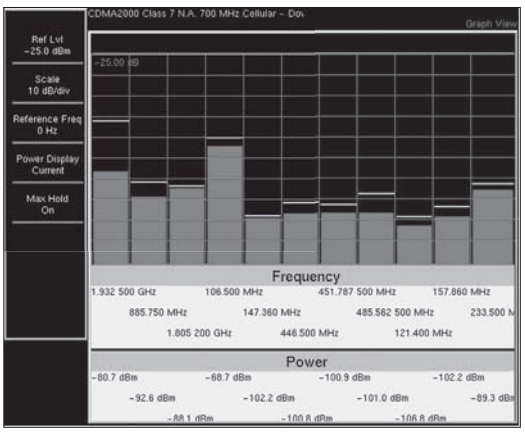
Signal Measurements



With Option 25, RSSI measurement analyzes signal strength of a signal over time.



AM, FM and SSB Demodulation



With Option 27, channel scanner measures power of multiple transmitters.

Specifications

• Vector Network Analyzer

Frequency range	610 kHz to 4 GHz (with MS2024A, MS2034A), operational down to 1 MHz 610 kHz to 6 GHz (with MS2026A, MS2036A), operational down to 1 MHz
Frequency accuracy	25 ppm
Frequency resolution	10 Hz
Data points	Low, Medium, High (137/275/551)
Interference immunity	On-Channel: +17 dBm On-Frequency: 0 dBm (RF Out), +30 dBc (RF In)
1-Port power	High: 0 dBm (typical)
2-Port power	High 0 dBm (typical) Low: –35 dBm (typical)
Corrected directivity	42 dB (2 MHz to 6 GHz)
1-Port accuracy	≤0.44 + |20 log (1 ±$10^{-E\Delta/20}$) | dB, typical; EΔ = Directivity – Measured Return Loss
Dynamic range	70 dB, 2 MHz to 10 MHz 80 dB, 10 MHz to 3 GHz 70 dB, >3 GHz to 5.5 GHz 65 dB, >5.5 GHz to 6 GHz
Return loss	Range: 0 to 60 dB Resolution: 0.01 dB
VSWR	Range: 1 to 65 Resolution: 0.01
Cable loss	Range: 0 to 30 dB Resolution: 0.01 dB
1-Port phase	Range: –180˚ to +180˚ Resolution: 0.01˚
Smith chart	Resolution: 0.01
2-Port gain	Range: –120 to 100 dB Resolution: 0.01 dB
2-Port phase	Range: –180˚ to +180˚ Resolution: 0.01˚
Distance-To-Fault	Fault Resolution (meters): (1.5 x 10^8 x vp)/ΔF; vp is the propagation constant and ΔF is F2–F1 in Hz Horizontal Range (meters): 0 to (data points–1) x Fault Resolution to a maximum of 1500 m (4921 ft.) where datapoints = 137/275/551 Vertical Range (Return Loss): 0 to 60 dB Vertical Range (VSWR): 1 to 65

• Spectrum Analyzer

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Maximum continuous input	+30 dBm
Tuning resolution	1 Hz
Frequency reference	Aging: ±1 ppm/10 years Accuracy: ±0.3 ppm (25˚C ±25˚C) + aging
Frequency span	10 Hz to 7.1 GHz plus 0 Hz (zero span)
Sweep time	Minimum 100 ms, 10 µs in zero span
Sweep trigger	Free run, Single, Video, External
Resolution bandwidth (–3 dB width)	1 Hz to 3 MHz in 1-3 sequence ±10%; 0-span, 1 Hz to 1 MHz 8 MHz demodulation bandwidth
Video bandwidth (–3 dB width)	1 Hz to 3 MHz in 1-3 sequence
SSB phase noise	–100 dBc/Hz max at 10, 20, and 30 kHz offset from carrier –102 dBc/Hz max at 100 kHz offset from carrier
Amplitude measurement range	DANL to +30 dBm
Absolute amplitude accuracy Power Levels ≥–50 dBm, ≤35 dB input attenuation, Preamplifier Off, –10˚ to +55˚C	9 kHz to 10 MHz, ±1.5 dB >10 MHz to 4 GHz, ±1.25 dB >4 GHz to 7.1 GHz, ±1.75 dB
Displayed average noise level (DANL in 1 Hz RBW, 0 dB attenuation, Reference level –50 dBm, preamp on)	Frequency / Max. (Preamp On) / Max. (Preamp Off) 10 MHz to 1 GHz / –161 dBm / –137 dBm >1 GHz to 2.2 GHz / –159 dBm / –133 dBm >2.2 GHz to 2.8 GHz / –143 dBm / –126 dBm >2.8 GHz to 4.0 GHz / –159 dBm / –136 dBm >4.0 GHz to 7.1 GHz / –154 dBm / –127 dBm
Display range	1 to 15 dB/div in 1 dB steps. Ten divisions displayed
Amplitude units log scale modes	dBm, dBV, dBmV, dBµV
Attenuator range	0 to 65 dB
Attenuator resolution	5 dB steps

• Power Meter

Frequency range	10 MHz to 4 GHz (with MS2034A) 10 MHz to 7.1 GHz (with MS2036A)
Display range	–80 to +80 dBm
Measurement range	–60 to +30 dBm
Offset range	0 to +60 dB
Accuracy	–40 dBm <Max ≤+15 dBm 10 MHz to 4 GHz: ±1.25 dB 4 to 7.1 GHz: ±1.75 dB Max. >+15 dBm 10 MHz to 6.5 GHz: ±1.75 dB 6.5 to 7 GHz: ±2 dB Max. <–40 dBm 10 MHz to 4 GHz: ±1.5 dB 4 to 7.1 GHz: ±1.75 dB
VSWR	1.5:1 typical
Maximum power	+30 dBm (1 W) without external attenuator

• Power Monitor (Option 5) requires external detector

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 (see www.anritsu.com for additional detectors)

Model	Frequency range	Impedance	Return loss	Input connector	Frequency response
560-7N50B	0.01 to 20 GHz	50 Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	N (m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz
560-7S50B	0.01 to 20 GHz	50 Ω	5 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	WSMA (m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz

• Bias Tee (Option 10)

Voltage/Current	12 V, 250, or 500 mA steady rate 15 V, 250, or 500 mA steady rate 18 V, 350 mA steady rate 21 V, 300 mA steady rate 24 V, 250 mA steady rate

• Vector Voltmeter (Option 15)

CW frequency range	2 MHz to 4 GHz (with MS2024A, MS2034A) 2 MHz to 6 GHz (with MS2026A, MS2036A)
Measurement display	CW, Table (Five Entries, Plus Reference)
Measurement types	Return Loss, Insertion
Measurement format	dB/VSWR/Impedance

• High Accuracy Power Meter (Option 19)*1

Option 19 supports both economy PSN50 and performance MA24106A USB Sensors. Refer to the following datasheets for more detailed performance specifications.
PSN50 datasheet is 11410-00414
MA24106A datasheet is 11410-00424

Frequency range	50 MHz to 6 GHz
Input connector	Type N, male, 50 Ω
Max input without damage	+33 dBm, ±25 VDC
Measurand	True-RMS/Average Power
Dynamic range	PSN50: –30 to +20 dBm MA24106A: –40 to +23 dBm
Measurement speed, typical	PSN50: 1 measurement per second MA24106A: 10 measurements per second*2
Input return loss	50 MHz to 2 GHz; ≥26 dB 2 to 6 GHz; ≥20 dB
System measurement resolution	0.01 dB
System offset range	±60 dB
Total rss measurement uncertainty (0˚ to 50˚C)	±0.16 dB*3
Continuous digital modulation uncertainty	PSN50: ±0.06 dB (+17 to +20 dBm)*4 MA24106A: ±0.02 dB, <+18 dBm*4 ±0.10 dB, ≥+18 dBm*4

*1: Specifications apply after 30 minute warm-up
*2: One measurement per second is typical in high aperture time mode
*3: Excludes mismatch errors
Excludes noise, zero set, zero drift for levels <–20 dBm
Excludes digital modulation uncertainty between +17 and +20 dBm
*4: Measurement error with reference to a CW signal of equal power and frequency at 25˚C

• Interference Analyzer (Option 25)

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Strength of the interferer	Gives visual and aural indication of signal strength
Rssi, spectrogram	Collect data up to 72 hours

• Channel Scanner (Option 27)

Frequency range	9 kHz to 4 GHz (with MS2034A) 9 kHz to 7.1 GHz (with MS2036A)
Number of channels	1 to 20 Channels

• GPS (Option 31) includes GPS antenna

GPS Location Indicator	Latitude, Longitude, Altitude, and Universal Time on display Latitude, Longitude, Altitude, and Universal Time with trace storage
GPS High Frequency Accuracy when GPS antenna is connected	±25 ppb with GPS ON, three minutes after satellite lock
Internal High Accuracy when GPS antenna is not connected	Better than ±50 ppb for three days from a High Accuracy GPS Lock and within 0 to 50 degrees centigrade ambient temperature

• General

Maximum input (damage level) into vector network analyzer	Test Port, Type N: +23 dBm, ±50 VDC
Maximum continuous input into spectrum analyzer	10 dB attenuation, +30 dBm, ±50 VDC
RF input VSWR into spectrum analyzer	2.0:1 maximum, 1.5:1 typical (≥10 dB attenuation)
Interfaces	Type N female RF Connector Type N female RF Out Port and RF In Port (50 Ω) BNC female connectors for external references and external trigger Reverse BNC connector for GPS antenna RF Detector: Type N (m) 50 Ω RJ45 connector for Ethernet 10/100BASE-T 2.5 mm 3-wire cellular headset connector USB connectors Type A and mini-B
Environmental	MIL-PRF-28800F Class 2 Operating: –10˚ to +55˚C, humidity 85% Storaging: –51˚ to +71˚C Altitude: 4600 meters, operating and non-operating
Safety	Conforms to EN61010-1 for Class 1 portable equipment
Electromagnetic compatibility	Meets European Community requirements for CE marking
Dimension	315 x 211 x 78 mm (12.4 x 8.3 x 3.1 in.) for MS202xA 315 x 211 x 97 mm (12.4 x 8.3 x 3.8 in.) for MS203xA
Mass	<2.9 kg (6.4 lbs) for MS202xA; 4 kg (9 lbs) for MS203xA

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™ Models*1
MS2024A	2-port VNA Master, 2 MHz to 4 GHz
MS2026A	2-port VNA Master, 2 MHz to 6 GHz
MS2034A	2-port VNA Master, 2 MHz to 4 GHz Spectrum Analysis, 9 kHz to 4 GHz
MS2036A	2-port VNA Master, 2 MHz to 6 GHz Spectrum Analysis, 9 kHz to 7.1 GHz
	MS2024A VNA Master Options
MS2024A-005	Power Monitor (requires external detector)
MS2024A-010	Built-in Bias-Tee
MS2024A-015	Vector Voltmeter
MS2024A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2024A-031	GPS Receiver (includes GPS antenna)
	MS2026A VNA Master Options
MS2026A-005	Power Monitor (requires external detector)
MS2026A-010	Built-in Bias-Tee
MS2026A-015	Vector Voltmeter
MS2026A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2026A-031	GPS Receiver (includes GPS antenna)

*1: Each instrument includes standard one-year warranty and Certificate of Calibration and Conformance

Model/Order No.	Name
	MS2034A VNA Master + Spectrum Analysis Options
MS2034A-005	Power Monitor (requires external detector)
MS2034A-010	Built-in Bias-Tee
MS2034A-015	Vector Voltmeter
MS2034A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2034A-025	Interference Analysis, 9 kHz to 4 GHz (requires external antenna)
MS2034A-027	Channel Scanner, 9 kHz to 4 GHz (requires external antenna)
MS2034A-031	GPS Receiver (includes GPS antenna)
	MS2036A VNA Master + Spectrum Analysis Options
MS2036A-005	Power Monitor (requires external detector)
MS2036A-010	Built-in Bias-Tee
MS2036A-015	Vector Voltmeter
MS2036A-019	High Accuracy Power Meter (requires PSN50 or MA24106A USB Sensor, sold separately)
MS2036A-025	Interference Analysis, 9 kHz to 7.1 GHz (requires external antenna)
MS2036A-027	Channel Scanner, 9 kHz to 7.1 GHz (requires external antenna)
MS2036A-031	GPS Receiver (includes GPS antenna)

Continued on next page

Model/Order No.	Name
	MS2024A/MS2026A standard accessories
10580-00166	User's Guide
65729	Soft Carrying Case
3-2000-1500	Compact Flash Card (256 MB)
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Li-Ion
40-168	AC-DC Adapter
806-141	Automotive cigarette lighter 12 V DC adapter
3-2000-1498	USB A-to mini B cable, 3.05 m (10 ft.)
2000-1371	Ethernet cable, 2.13 m (7 ft.)
2000-1520-R	2 GB USB Flash Drive
3-806-152	Ethernet Crossover Cable, 2.13 m (7 ft.)
	MS2034A/MS2036A standard accessories
10580-00166	User's Guide
65681	Soft Carrying Case
3-2000-1500	Compact Flash Card (256 MB)
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Li-Ion
40-168	AC-DC Adapter
806-141	Automotive Cigarette Lighter 12 V DC adapter
3-2000-1498	USB A-to mini B cable, 1.83 m (3.05 m, 10 ft.)
2000-1371	Ethernet cable, 2.13 m (7 ft.)
3-806-152	Ethernet Crossover Cable, 2.13 m (7 ft.)
2000-1520-R	2 GB USB Flash Drive
	Manuals
10580-00166	VNA Master User's Guide
10580-00167	VNA Master Programming Manual
	Related Literature, Application Notes
10580-00400	VNA Master Brochure and Technical Data Sheet
11410-00214	Reflectometer Measurements - Revisited
11410-00206	Time Domain
11410-00270	What is Your Measurement Accuracy?
11410-00185	Distance-To-Fault
11410-00414	PSN50 USB Power Sensor
11410-00424	MA24106A USB Power Sensor
	Optional accessories
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24106A	USB Power Sensor, 50 MHz to 6 GHz
560-7N50B	Power Monitor Detectors, 0.01 to 20 GHz
560-7S50B	Power Monitor Detectors, 0.01 to 20 GHz
800-109	Detector Extender Cables, 7.6 m (25 ft)
800-110	Detector Extender Cables, 15.2 m (50 ft)
800-111	Detector Extender Cables, 30.5 m (100 ft)
800-112	Detector Extender Cables, 61.0 m (200 ft)
OSLN50-1	Coaxial Calibration Components, Precision N (m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50-1	Coaxial Calibration Components, Precision N (f) Open/Short/Load, 42 dB, 6 GHz
22N50	Coaxial Calibration Components, Precision N (m) Short/Open, 18 GHz
22NF50	Coaxial Calibration Components, Precision N (f) Short/Open, 18 GHz
SM/PL-1	Coaxial Calibration Components, Precision N (m) Load, 42 dB, 6.0 GHz
SM/PLNF-1	Coaxial Calibration Components, Precision N (f) Load, 42 dB, 6.0 GHz
1091-53	Coaxial Calibration Components, Precision TNC (m) Open, 18 GHz, 50 W
1091-54	Coaxial Calibration Components, Precision TNC (m) Short, 18 GHz, 50 W
1015-55	Coaxial Calibration Components, Precision TNC (m) Load, 18 GHz, 50 W
1091-55	Coaxial Calibration Components, Precision TNC (f) Open, 18 GHz, 50 W
1091-56	Coaxial Calibration Components, Precision TNC (f) Short, 18 GHz, 50 W

Model/Order No.	Name
1015-54	Coaxial Calibration Components, Precision TNC (f) Load, 18 GHz, 50 W
23L50	Coaxial Calibration Components, Precision 3.5 mm (m) Short, 9 GHz
23LF50	Coaxial Calibration Components, Precision 3.5 mm (f) Short, 9 GHz
24L50	Coaxial Calibration Components, Precision 3.5 mm (m) Open, 9 GHz
24LF50	Coaxial Calibration Components, Precision 3.5 mm (f) Open, 9 GHz
28L50R	Coaxial Calibration Components, Precision 3.5 mm (m) Load, 9 GHz
28LF50R	Coaxial Calibration Components, Precision 3.5 mm (f) Load, 9 GHz
2000-767	Coaxial Calibration Components, Precision Open/Short/ Load, 7/16 (m), 4.0 GHz
2000-768	Coaxial Calibration Components, Precision Open/Short/ Load, 7/16 (f), 4.0 GHz
34NN50A	Precision Adapters, N (m)-N (m), DC to 18 GHz, 50 W
34NFNF50	Precision Adapters, N (f)-N (f), DC to 18 GHz, 50 W
1091-26	Adapters, N (m)-SMA (m), DC to 18 GHz, 50 W
1091-27	Adapters, N (m)-SMA (f), DC to 18 GHz, 50 W
1091-80-R	Adapters, N (f)-SMA (m), DC to 18 GHz, 50 W
1091-81-R	Adapters, N (f)-SMA (f), DC to 18 GHz, 50 W
510-102	Adapters, N (m)-N (m), 90˚ right angle, DC to 11 GHz, 50 W
510-90	Adapters, 7/16 DIN (f)-N (m), DC to 7.5 GHz, 50 W
510-91	Adapters, 7/16 DIN (f)-N (f), DC to 7.5 GHz, 50 W
510-92	Adapters, 7/16 DIN (m)-N (m), DC to 7.5 GHz, 50 W
510-93	Adapters, 7/16 DIN (m)-N (f), DC to 7.5 GHz, 50 W
510-96	Adapters, 7/16 DIN (m)-7/16 DIN (m), DC to 7.5 GHz, 50 W
510-97	Adapters, 7/16 DIN (f)-7/16 DIN (f), DC to 7.5 GHz, 50 W
513-62	Adapter, TNC (f) to N (f), 18 GHz, 50 W
1091-315	Adapter, TNC (m) to N (f), 18 GHz, 50 W
1091-324	Adapter, TNC (f) to N (m), 18 GHz, 50 W
1091-325	Adapter, TNC (m) to N (m), 18 GHz, 50 W
1091-317	Adapter, TNC (m) to SMA (f), 18 GHz, 50 W
1091-318	Adapter, TNC (m) to SMA (m), 18 GHz, 50 W
1091-323	Adapter, TNC (f) to TNC (f), 18 GHz, 50 W
1091-326	Adapter, TNC (m) to TNC (m), 18 GHz, 50 W
15NN50-1.5C	Test Port Cables Armored, 1.5 m, N (m)-N (m), 6 GHz, 50 W
15NN50-3.0C	Test Port Cables Armored, 3.0 m, N (m)-N (m), 6 GHz, 50 W
15NN50-5.0C	Test Port Cables Armored, 5.0 m, N (m)-N (m), 6 GHz, 50 W
15NNF50-1.5C	Test Port Cables Armored, 1.5 m, N (m)-N (f), 6 GHz, 50 W
15NNF50-3.0C	Test Port Cables Armored, 3.0 m, N (m)-N (f), 6 GHz, 50 W
15NNF50-5.0C	Test Port Cables Armored, 5.0 m, N (m)-N (f), 6 GHz, 50 W
15ND50-1.5C	Test Port Cables Armored, 5.0 m, N (m)-7/16 DIN (m), 6 GHz, 50 W
15NDF50-1.5C	Test Port Cables Armored, 5.0 m, N (m)-7/16 DIN (f), 6 GHz, 50 W
2000-1030	Port Antennas, SMA (m), 1.71 to 1.88 GHz, 50 W
2000-1031	Port Antennas, SMA (m), 1.85 to 1.99 GHz, 50 W
2000-1032	Port Antennas, SMA (m), 2.4 to 2.5 GHz, 50 W
2000-1035	Port Antennas, SMA (m), 896 to 941 MHz, 50 W
2000-1200	Port Antennas, SMA (m), 806 to 869 MHz, 50 W
2000-1361	Port Antennas, SMA (m), 5725 to 5825 MHz, 50 W
2000-1473	Port Antennas, SMA (m), 870 to 960 MHz, 50 W
2000-1474	Port Antennas, SMA (m), 1.71 to 1.88 GHz, 50 W
2000-1475	Port Antennas, SMA (m), 1920 to 1980, 2.11 to 2.17 GHz, 50 W
61532	Port Antennas, Antenna Kit: 2000-1030, 2000-1031, 2000-1032, 2000-1035, 2000-1200, and 2000-1361
1N50C	Limiter, N (m) to N (f), 50 W, 0.01 to 50 GHz
42N50-20	Attenuator, 20 dB, 50 W, DC to 18 GHz, N (m)-N (f)
42N50A-30	Attenuator, 30 dB, 50 W, DC to 18 GHz, N (m)-N (f)
2000-1410	Magnet Mount GPS Antenna with 15 ft (4.6 m) cable
760-243-R	Hard Transit Case
66864	Rack Mount Kit, Master Platform (MS2024A, MS2026A only)

VNA AND VNMS
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 or VNMS 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.

The following kits are for use with 37XXX Lightning VNAs.

3650 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 diskette

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

3652 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 diskette
- 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

3654B 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

3656 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 50 Ω 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 75 Ω 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

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
	Calibration Kits
3650	SMA/3.5 mm Calibration Kit
Option 1	Adds Sliding Terminations
3651	GPC-7 Calibration Kit
Option 1	Adds Sliding Terminations
3652	K Connector® Calibration Kit
Option 1	Adds Sliding Terminations
3654B	3653 Type N Calibration Kit
Option 1	Adds Sliding Terminations
3655E	V Connector® Calibration Kit with Sliding Terminations
	WR12 Waveguide Calibration Kit
Option 1	Adds Sliding Terminations
3655F	WR08 Waveguide Calibration Kit
Option 1	Adds Sliding Terminations
3655V	WR15 Waveguide Calibration Kit
Option 1	Adds Sliding Terminations
3655W	WR10 Waveguide Calibration Kit
Option 1	Adds Sliding Terminations
3656	W1 Calibration Kit
3750R	SMA/3.5 mm 9 GHz Calibration Kit
3751R	GPC-7 9 GHz Calibration Kit
3753R	Type N 9 GHz Calibration Kit
3753-75R	75 W Type N 3 GHz Calibration Kit

VNA AND VNMS

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.

The following kits are for use with 37XXX Lightning VNAs.

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

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
	Verification Kits
3663	Type N verification kit
3666	SMA/3.5 mm verification kit
3667	GPC-7 verification kit
3668	K Connector® verification kit
3669B	V Connector® verification kit
3663R	Type N 9 GHz verification kit
3666R	SMA/3.5 mm verification kit
3667R	GPC-7 9 GHz verification kit

NETWORK ANALYZER
MS4630B
10 Hz to 300 MHz

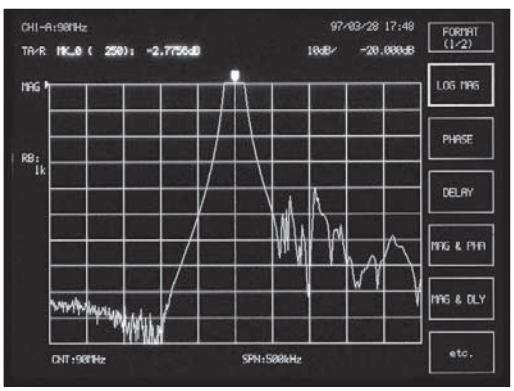
CE GPIB

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.

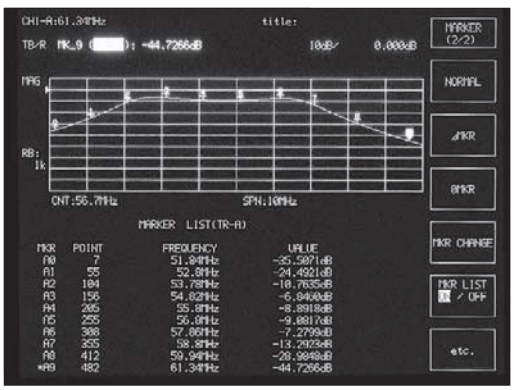
Features
- High-speed evaluation of IF filters, resonators, etc.
- Greatly increased production/inspection capacity

Performance and Functions
• High Dynamic Range
The high dynamic range of 120 dB (RBW: 1 kHz) supports fast and accurate out-of-band measurement of filters.



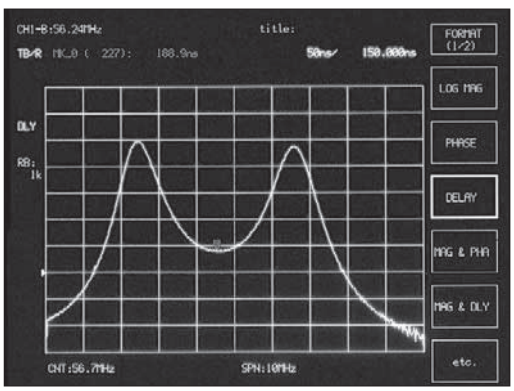
Filter Out-of-band Attenuation Measurement

• 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

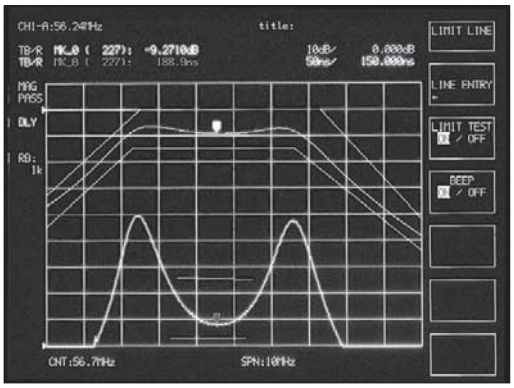
• High-accuracy Group Delay Measurement
Group delay characteristics can be measured with high accuracy at a resolution of 1/10,000 of the measurement range.



Group Delay Characteristics

• Limit Tests

Devices are pass/fail evaluated in real time using the single and segmented limit test functions.

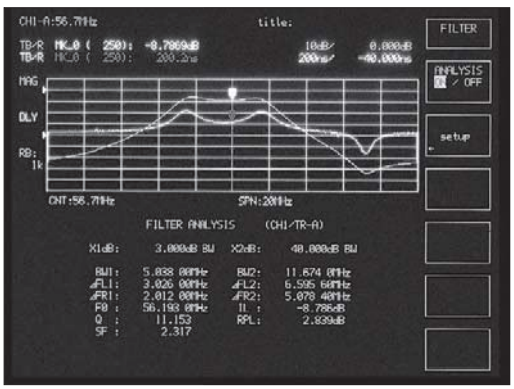


Filter Pass/Fail Evaluation using Limit Test

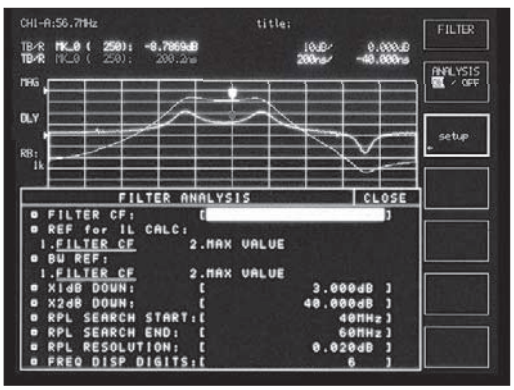
• Filters

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.



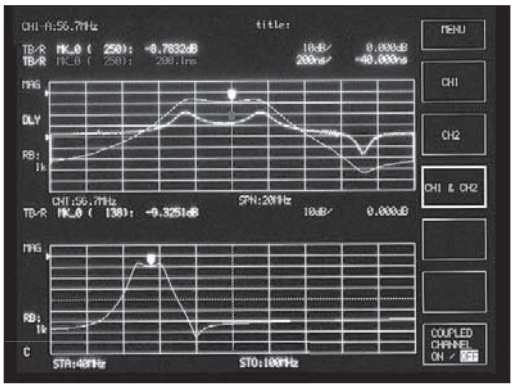
Filter Analysis Screen



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.

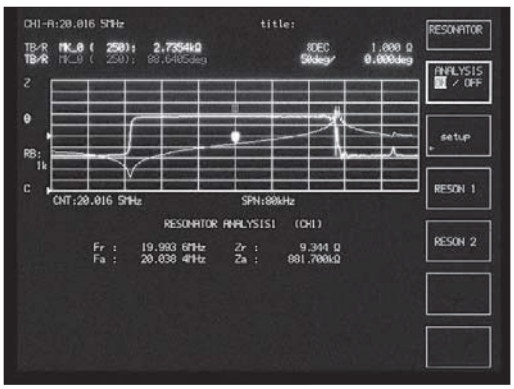


Spurious Measurement using Alternate Sweeping

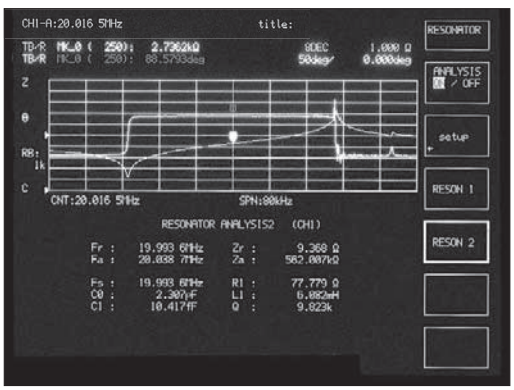
• Resonators

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

Measurement items	Transmission characteristics (ratio measurement): Amplitude, Phase, Group delay Reflection/Impedance characteristics: Amplitude, Phase (with external transducer) Level characteristics: Absolute amplitude
Frequency	Range: 10 Hz to 300 MHz Resolution: 0.01 Hz Accuracy (standard) Aging rate: ≤1 x 10^{-6}/day (15 minutes after power-on) Temperature characteristics: ≤±5 x 10^{-6} (0˚ to +50˚C) Accuracy (Option 13: High-stability reference oscillator) Aging rate: ≤±2 x 10^{-8}/day (24 h after power-on) Temperature characteristics: ≤±5 x 10^{-8} (0˚ to +50˚C)
Input	Channel No. Standard: 2 (R, TA); Option 12: 3 (R, TA, TB) Impedance: 50 Ω, 1 MΩ switchable Input range (IRG): 0/+20 dBm Max. input power AC: +20 dBm; DC ±2.2 V (50 Ω) AC: 0 dBm; DC: ±20 V (1 MΩ) Connector: BNC-J Probe source: 12 ±1 V, 100 mA (with protective circuit for shorts)
Average noise level	≤–120 dBm (RBW: 1 kHz, 1 to 300 MHz), ≤–110 dBm (RBW: 1 kHz, 80 kHz to 1 MHz)
Crosstalk	Between channels: ≥120 dB (80 kHz to 300 MHz), ≥110 dB (up to 80 kHz) Between transmitter and receiver: ≥125 dB
Resolution bandwidth	3, 10, 30, 100, 500 Hz, 1, 2, 3, 4, 5, 10, 20 kHz and automatic setting
Output	Output 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) Output resolution: 0.01 dB Output level accuracy: ≤±1.0 dB (frequency: 100 MHz, Output A: +10 dBm) Output level linearity: ≤±0.5 dB (0 dBm reference, frequency: 100 MHz, Output A: 0 to +21 dBm) Output level deviation: ≤±1.5 dB (output A: +10 dBm, 100 MHz reference) Step error: ±0.5 dB (Option 10) Output impedance: 50 Ω Connector: BNC-J
Amplitude measurement	Measurement range: ≥120 dB Measurement resolution: 0.001 dB Display scale: 0.01 to 50 dB/div (1-2-5 sequence) Dynamic accuracy

Level relative to IRG	80 kHz to 100 MHz	10 kHz to 300 MHz
0 to –10 dB	±0.20 dB	±0.20 dB
–10 to –60 dB	±0.05 dB	±0.05 dB
–60 to –70 dB	±0.10 dB	±0.30 dB
–70 to –80 dB	±0.30 dB	±1.00 dB
–80 to –90 dB	±1.20 dB	±4.00 dB
–90 to –100 dB	±4.00 dB	–

Phase measurement	Measurement range: ±180˚ Measurement resolution: 0.001˚ Display scale: 0.01˚ to 50˚ /div (1-2-5 sequence) Dynamic accuracy

Level relative to IRG	80 kHz to 100 MHz	10 kHz to 300 MHz
0 to –10 dB	±1.5˚	±1.5˚
–10 to –60 dB	±0.3˚	±0.3˚
–60 to –70 dB	±0.8˚	±2.0˚
–70 to –80 dB	±2.0˚	±6.0˚
–80 to –90 dB	±6.0˚	±20.0˚
–90 to –100 dB	±20.0˚	–

Group delay measurement	DRG: $\Delta\theta/(360 \times \Delta F)$ ∗$\Delta\theta$: phase measurement range; ΔF: frequency span x smoothing aperture (%); smoothing aperture: 20% to ($\frac{2}{\text{number measurement points}}$) x 100% Measurement resolution: 2.78 x $10^{-5}/\Delta F$ Display scale: 1 ps/div to 50 ms/div Dynamic accuracy: Phase measurement accuracy/(360 x aperture frequency)
Calibration, correction	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˚

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 x 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 to 512 KB)
Printing	Video plotter, Printer and FD (BMP format).
Rear-panel I/O	Frequency: 5/10 MHz ±10 ppm Level: ≥0.7 Vp-p (AC coupling) Input impedance: 50 Ω (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 to 120/200 to 240 Vac (–15%/+10%, 250 Vac max, 100/200 V system auto-switching), 47.5 to 63 Hz, ≤180 VA (max.)
Dimensions and mass	426 (W) x 177 (H) x 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, 2.6 m: 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: ≤±2 x 10^{-8}/day)
MS4630B-14	3-Branch Output (for 3-channel receiver)
	Optional accessories
MA2201A*	Reflection Bridge (10 Hz to 250 kHz, 600 Ω, unbalanced, MA214 terminal)
MA2203A*	Reflection Bridge (10 Hz to 250 kHz, 900 Ω, unbalanced, MA214 terminal)
MA2301A*	Reflection Bridge (2 kHz to 2 MHz, 75 Ω, unbalanced, MA214 terminal)
MA2302A*	Reflection Bridge (2 kHz to 2 MHz, 135 Ω, unbalanced, MA214 terminal)
MA2303A	Reflection Bridge (2 kHz to 2 MHz, 150 Ω, unbalanced, MA214 terminal)
MA2401A	Reflection Bridge (10 Hz to 70 kHz, 60 kHz to 30 MHz, 50 Ω, unbalanced, BNC-R)
MA2402A*	Reflection Bridge (10 Hz to 70 kHz, 60 kHz to 30 MHz, 75 Ω, unbalanced, BNC-R)
MA2204A	Impedance Probe (30 Hz to 300 kHz, 2 Ω to 1 MΩ)
MA2403A	Impedance Probe (30 kHz to 30 MHz, 2 Ω to 1 MΩ)
MA4605A	Impedance Converter (DC to 300 MHz, 50 Ω/75 Ω unbalanced)
MA414A	Impedance Measurement Kit (for MA2403A)
MA1506A	π-Network (1 to 125 MHz, for resonator measurement)
MA8603A	50 Ω Termination (BNC-P)
MA8603B	50 Ω Termination (BNC-J)
MA8604A	50 Ω Open/Short (BNC-P)
MA8604B	50 Ω Open/Short (BNC-J)
MP669A	75 Ω Termination (BNC-P)
MP669B	75 Ω Termination (BNC-J)
MP670A	75 Ω Open/Short (BNC-P)
MP670B	75 Ω 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)
MC3305A	PTA Keyboard (JIS type)
B0329C	Front Cover (1MW4U)
B0333C	Rack Mount Kit
B0334C	Carrying Case (hard type)

*: Requires Impedance Conversion Adapter when using MS4630B Network Analyzer.

REFLECTION BRIDGES

MA2401A

MA2201A

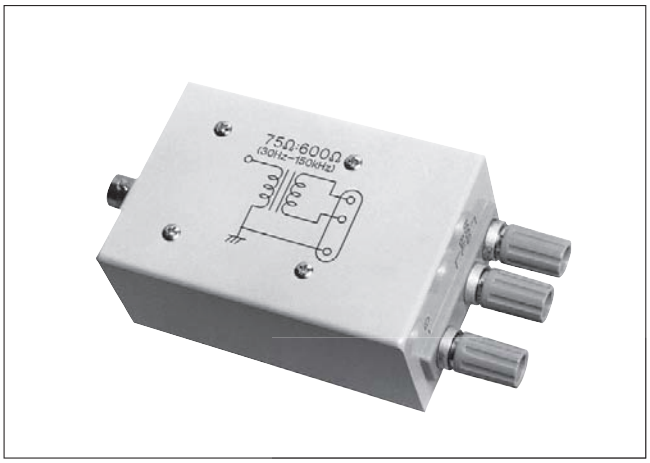
When connected to a reflection bridge, the network analyzers can measure reflection coefficient. This system is used to measure the input and output impedance of telecommunication, video, and audio equipment, and the S-parameter (S_{11} and S_{22}) of two-port networks.

Specifications

Model	MA2201A	MA2203A
Impedance	600 Ω balanced	900 Ω balanced
Connector	Terminal (compatible with M-214)	
Frequency range	10 Hz to 250 kHz	
Directivity	≥50 dB (50 Hz to 150 kHz), ≥40 dB (10 Hz to 250 kHz)	≥40 dB
Standard termination	600 Ω, 0 Ω	900 Ω, 0 Ω
Dimensions and mass	66 x 53 x 149 mm, ≤800 g	120 x 120 x 40 mm, ≤600 g
Input/Output impedance	75 Ω unbalanced	Standard impedance termination can be connected externally

Model	MA2301A	MA2302A	MA2303A	MA2401A	MA2402A
Impedance	75 Ω balanced	135 Ω balanced	150 Ω balanced	50 Ω unbalanced	75 Ω unbalanced
Connector	Terminal (compatible with M-214)			BNC-R	
Frequency range	2 kHz to 2 MHz			10 Hz to 70 kHz, 60 kHz to 30 MHz	
Directivity	≥40 dB			≥40 dB	
Standard termination	75 Ω, 0 Ω	135 Ω, 0 Ω	150 Ω, 0 Ω	50 Ω, 0 Ω	75 Ω, 0 Ω
Dimensions and mass	66 x 53 x 149 mm, ≤800 g			54 x 53 x 141 mm, ≤800 g	
Input/Output impedance	75 Ω unbalanced			50 Ω unbalanced	75 Ω unbalanced

TRANSFORMERS



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

Model	MA29A	MA29J	MA313A	MA313J	MA314A	MA314J	MA315A	MA315J	MA422A1
Input impedance	75 Ω	50 Ω	75 Ω	50 Ω	75 Ω	50 Ω	75 Ω	50 Ω	75 Ω
Output impedance	600 Ω	600 Ω	75 Ω	75 Ω	135 Ω	135 Ω	150 Ω	150 Ω	110 Ω
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	<0.3 dB								
Return loss	>25 dB								
Dimensions and mass	60 x 90 x 42 mm (without connector), ≤1 kg								

SIGNAL GENERATORS

Synthesizer Selection Guide (Measurement Function)

Group	Name	Functions: Frequency extensions: 10 MHz to 2 GHz	10 MHz to 2.2 GHz	0.1 Hz to 10 MHz	mm Wave (50 to 325 GHz) signal source	Level extensions: 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)	Modulation: AM modulation (Internal signal source is another)	FM/øM 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/øM modulation (Internal signal source)	For pulse modulation (Internal signal source)	Others: 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)	Remarks
Main frame	MG3691B	√	√	√		√			√	√	√			√	√	√		√	√	√	√	√	√	√	√		√	√	√	√	2 to 10 GHz
	MG3692B	√	√	√	√	√				√	√			√	√	√		√	√	√	√	√	√	√	√		√	√	√	√	2 to 20 GHz
	MG3693B	√	√	√	*1		√					√	√	√	√	√		√	√	√	√	√	√	√	√		√		√	√	2 to 30 GHz
	MG3694B	√	√	√	*1		√					√	√	√	√	√		√	√	√	√	√	√	√	√		√		√	√	2 to 40 GHz
	MG3695B	√	√	√	*1			√						√	√		√	√	√	√	√	√	√	√		√		√		√	√	2 to 50 GHz
	MG3696B	√	√	√	*1			√						√	√		√	√	√	√	√	√	√			√		√		√	√	2 to 67 GHz (setting range: 2 to 70 GHz)
	MG37022A	√				√										*2			√			√				√		√		√	√	2 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				√																											63850-15 to 03 Requires mm Wave module
	20																												√			
	22			√																												Modulation function is un-corresponding
	26A															√																Chooses with main frame frequency
	26B																√															
	27																	√	√													Three signal for AM, FM/øM, and Pulse
	28A													√	√	√		√	√													Chooses with main frame frequency
	28B													√	√		√	√	√													

*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	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	Dimensions and mass
MG3641A	125 kHz to 1040 MHz	–143 to 17 dBm	–30 dBc	–100 dBc	–130 dBc/Hz	√	√	Option	√	Option	Option	Option	20 kg
MG3642A	125 kHz to 2080 MHz	–143 to 17 dBm	–30 dBc	–100 dBc	–130 dBc/Hz	√	√	Option	√	Option	Option	Option	20 kg

Synthesizer Selection Guide (Frequency Range)

Group	Name	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	
Main frame	MG3691B																		■	■							2 to 10 GHz
	MG3692B																		■	■	■						2 to 20 GHz
	MG3693B																		■	■	■	■					2 to 30 GHz
	MG3694B																		■	■	■	■					2 to 40 GHz
	MG3695B																		■	■	■	■	■				2 to 50 GHz
	MG3696B																		■	■	■	■	■				2 to 67 GHz
	MG37022A																		■	■	■	■					2 to 20 GHz
Options	4											■	■	■	■	■	■	■									10 MHz to 2.2 GHz
	5											■	■	■	■	■	■	■									10 MHz to 2 GHz
	22	■	■	■	■	■	■	■	■	■	■																0.1 Hz to 10 MHz
	63850-15																						■				50 to 75 GHz
	63850-12																						■	■			60 to 90 GHz
	63850-10																							■			75 to 110 GHz
	63850-08																							■			90 to 140 GHz
	63850-06																								■		110 to 170 GHz
	63850-05																								■		140 to 220 GHz
	63850-03																									■	220 to 325 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	
MG3641A							■	■	■	■	■	■	■	■					125 kHz to 1040 MHz
MG3642A							■	■	■	■	■	■	■	■	■				125 kHz to 2080 MHz

RF/MICROWAVE SIGNAL GENERATOR

MG3690B

0.1 Hz to 70 GHz / 325 GHz

CE GPIB

The Ideal 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 MG3690B 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, 30, 40, 50, and 67 GHz (operational to 70 GHz)
  - 10 MHz Coverage Optional (Analog or Digital Down-Conversion)
  - 0.1 Hz Coverage Optional
- mmW Coverage up to 325 GHz, in Waveguide
- Ultra-Low SSB Phase Noise Option
- –110 dBc/Hz (typically) at 1 kHz Offset, 10 GHz Carrier
- Excellent Harmonics and Spurious Response
- High Output Power Option
  - +25 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
- Small and Light
- 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

A New Standard for a New Millennium

The MG3690B leverages the proven design of earlier Anritsu synthesizers, adding new features to meet the latest needs of the new millennium. The MG3690B builds on a proven reliability record of >49,000 hours MTBF. This allows the MG3690B to offer a standard 3-year warranty. From the sleek new lines of the front panel, the larger 1/4 VGA LCD, the reduced front panel buttons and menu depth, to the 10 kg lighter and 15 cm shallower depth, the MG3690B meets the new millennium value-based needs.

Automatic Test Equipment

The MG3690B 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 –120 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.

The flexible I/O model supports new communication technologies such as USB, Ethernet, and Firewire.
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 MG3690B 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 MG3690B data sheet, p/n 11410-00344. The latest version of this data sheet is available for down-loading in pdf format in the MG3690B section of the Anritsu website www.anritsu.com.

CW mode	Output		Twenty independent, presettable CW frequencies (F0 – F9 and M0 – M9)
	Accuracy		Same as internal or external 10 MHz time base
	Internal time base stability	With aging	<2 x 10^{-9}/day (<5 x 10^{-10}/day with Option 16)
		With temperature	<2 x 10^{-8}/°C over 0° to 55°C (<2 x 10^{-10}/°C with Option 16)
	Resolution		0.01 Hz
	External 10 MHz reference input		Accepts external 10 MHz ±100 Hz, 0 to +20 dBm time base signal. Automatically disconnects the internal high-stability time-base option, if installed. BNC, rear panel, 50 Ω impedance
	10 MHz reference output		0.5 Vp-p into 50 Ω, AC coupled. Rear panel BNC; 50 Ω impedance
	Switching time (typical maximum)		<40 ms to be within 1 kHz of final frequency
	Phase offset		Adjustable in 0.1° steps
	Electronic Frequency Control (EFC) input		–5 V to +5 V input range; Fout/(2 x 10^6) 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
	Switching time (typical maximum)		<5 ms + 1 ms/GHz step size or <40 ms, whichever is less, to be within 1 kHz of final frequency
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 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.		
	Switching time (typical maximum)		<25 ms to be within 1 kHz of final frequency
Programmable frequency agility	Under GPIB 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.		
	Switching time (typical maximum)		<25 ms to be within 1 kHz of final frequency
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
	Marker resolution		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		TTL low-level signal provides sequencing 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 "v" 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		Provides compensation for path loss due to external switching and cables. Compensation may come from a power table in a GPIB power meter, or it may be from 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, 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		90 to 264 Vac, 48 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) x 133 (H) x 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 the GPIB (IEEE-488 interface bus)		
	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 display	
		Remote	Under GPIB control (all instrument front panel keys except for the SYSTEM key and the RETURN TO LOCAL soft-key will be 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	Storage temperature range		–40˚ to +75˚C
	Operating temperature range		0˚ to +50˚C
	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 (MG3695B)	<–40 dBc*1
>40 GHz to ≤67 GHz (MG3696B)	<–25 dBc

*1: –30 dBc typical with high power Option 15
*2: 20 to 21 GHz and 39 to 40 GHz – 20 dBc typical

• 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 to ≤500 MHz (Option 4)	<–68	<–72	<–72
>500 to = 1050 MHz (Option 4)	<–62	<–72	<–72
>1050 to ≤2200 MHz (Option 4)	<–56	<–66	<–66
≥0.01 to ≤8.4 GHz	<–50	<–60	<–60
>8.4 to ≤20 GHz	<–46	<–56	<–60
>20 to ≤40 GHz	<–40	<–50	<–54
>20 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 3,4	Standard
≥0.01 to ≤8.4 GHz	<40	<120
>8.4 to ≤20 GHz	<40	<220
>20 to ≤40 GHz	<80	<440
>40 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 to <20 GHz	<5	<25
>20 GHz to <40 GHz	<10	<50
>40 GHz to <67 GHz	<20	<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			
	100 Hz	1 kHz	10 kHz	100 kHz
≥0.1 Hz to <10 MHz (Option 22)	–90 (–110)	–120 (–125)	–130 (–139)	–130 (–141)
≥10 to <500 MHz (Option 4)	–94 (–98)	–106 (–115)	–104 (–114)	–120 (–127)
≥500 MHz to <2.2 GHz (Option 4)	–82 (–90)	–94 (–102)	–92 (–100)	–108 (–117)
≥10 MHz to <2 GHz (Option 5)	–77 (–85)	–88 (–92)	–85 (–91)	–100 (–108)
≥2 to ≤6 GHz	–77 (–79)	–88 (–92)	–86 (–90)	–102 (–112)
>6 to ≤10 GHz	–73 (–78)	–86 (–91)	–83 (–90)	–102 (–107)
>10 to ≤20 GHz	–66 (–72)	–78 (–84)	–77 (–83)	–100 (–104)
>20 to ≤40 GHz	–60 (–66)	–75 (–78)	–72 (–77)	–94 (–98)
>40 to ≤67 GHz	–54 (–60)	–69 (–72)	–64 (–71)	–88 (–92)

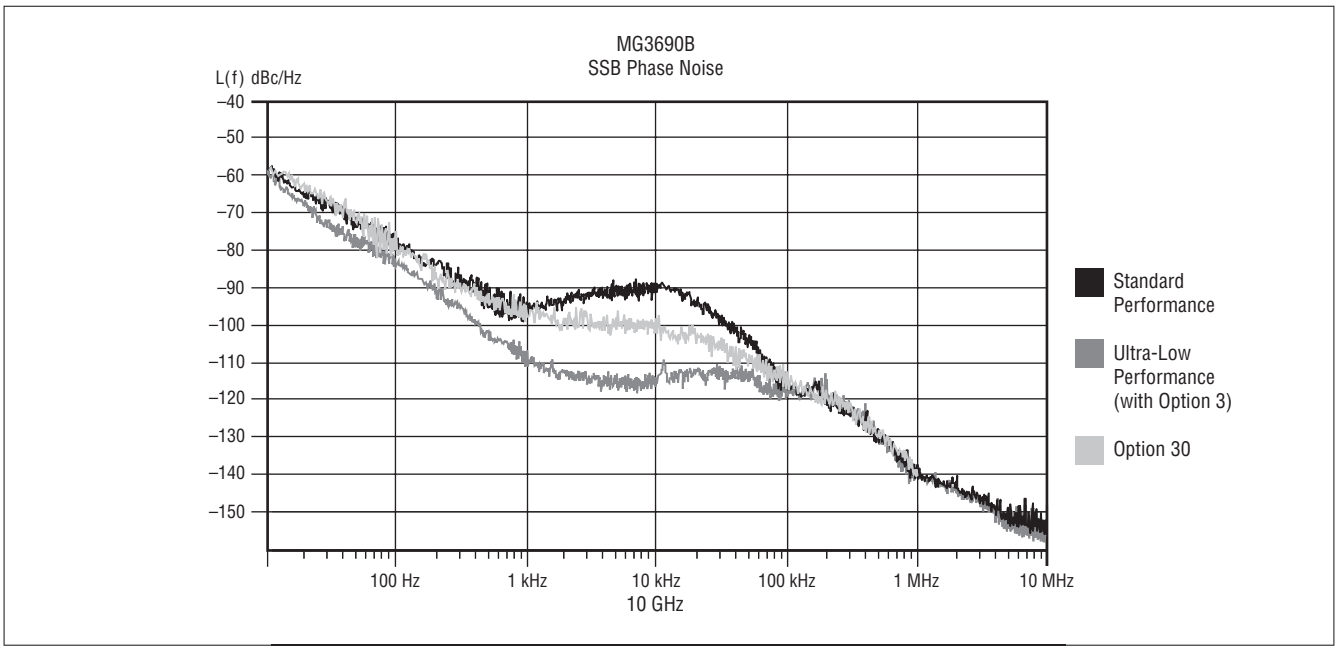
● Single-sideband phase noise (dBc/Hz) – Option 30: (Typical)

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)	–60 (–100)	–90 (–110)	–120 (–125)	–130 (–139)	–130 (–141)	–130 (–141)
≥10 to <500 MHz (Option 4)	–77 (–82)	–99 (–100)	–110 (–118)	–110 (–117)	–122 (–129)	–142 (–146)
≥500 MHz to <2.2 GHz (Option 4)	–64 (–70)	–86 (–92)	–98 (–106)	–98 (–107)	–110 (–119)	–135 (–143)
≥10 MHz to <2 GHz (Option 5)	–64 (–68)	–83 (–86)	–93 (–100)	–93 (–100)	–100 (–108)	–111 (–115)
≥2 to ≤6 GHz	–54 (–61)	–77 (–82)	–93 (–98)	–93 (–99)	–102 (–112)	–130 (–136)
>6 to ≤10 GHz	–52 (–60)	–73 (–78)	–93 (–96)	–93 (–99)	–105 (–112)	–128 (–136)
>10 to ≤20 GHz	–45 (–49)	–68 (–73)	–86 (–91)	–86 (–93)	–100 (–108)	–125 (–135)
>20 to ≤40 GHz	–45 (–49)	–63 (–67)	–80 (–85)	–80 (–87)	–94 (–102)	–119 (–129)
>40 to ≤67 GHz	–37 (–41)	–57 (–61)	–74 (–79)	–74 (–81)	–88 (–96)	–113 (–123)

● 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)	–60 (–100)	–90 (–110)	–120 (–125)	–130 (–139)	–130 (–141)	–130 (–141)
≥10 to ≤15.625 MHz (Option 4)	–105 (–118)	–126 (–133)	–139 (–145)	–142 (–148)	–141 (–148)	–145 (–149)
>15.625 to ≤31.25 MHz (Option 4)	–99 (–114)	–120 (–127)	–134 (–144)	–137 (–147)	–137 (–147)	–145 (–150)
>31.25 to ≤62.5 MHz (Option 4)	–90 (–111)	–114 (–121)	–129 (–143)	–136 (–146)	–136 (–146)	–144 (–152)
>62.5 to ≤125 MHz (Option 4)	–88 (–98)	–108 (–116)	–127 (–130)	–135 (–143)	–133 (–143)	–144 (–148)
>125 to ≤250 MHz (Option 4)	–84 (–90)	–102 (–110)	–125 (–129)	–132 (–137)	–130 (–135)	–143 (–147)
>250 to ≤500 MHz (Option 4)	–77 (–83)	–99 (–103)	–123 (–128)	–125 (–131)	–124 (–129)	–142 (–146)
>500 to ≤1050 MHz (Option 4)	–71 (–77)	–93 (–100)	–118 (–122)	–121 (–126)	–119 (–124)	–138 (–144)
>1050 to ≤2200 MHz (Option 4)	–66 (–71)	–86 (–96)	–112 (–116)	–115 (–121)	–113 (–119)	–135 (–143)
≥10 MHz to <2 GHz (Option 5)	–64 (–78)	–83 (–88)	–100 (–106)	–102 (–110)	–102 (–108)	–111 (–115)
≥2 to ≤6 GHz	–54 (–60)	–77 (–86)	–104 (–108)	–108 (–113)	–107 (–112)	–130 (–136)
>6 to ≤10 GHz	–52 (–57)	–73 (–81)	–100 (–105)	–107 (–114)	–107 (–113)	–128 (–136)
>10 to ≤20 GHz	–45 (–49)	–68 (–76)	–94 (–100)	–102 (–108)	–102 (–107)	–125 (–135)
>20 to ≤40 GHz	–45 (–49)	–63 (–70)	–92 (–94)	–98 (–102)	–98 (–101)	–119 (–129)
>40 to ≤67 GHz	–37 (–40)	–57 (–69)	–86 (–88)	–92 (–96)	–90 (–95)	–113 (–123)

*: 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 MG3690B single sideband phase noise at 10 GHz carrier.

RF output

Power level specifications apply at 25˚ ±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)
MG3691B	w/opt 4 or 5 STD	<2*1 GHz ≥2*2 to ≤10 GHz	+19.0 +19.0	+18.0 +18.0	+15.0 +13.0
MG3692B	w/opt 4 or 5 STD STD	<2*1 GHz ≥2*2 to ≤10 GHz >10 to ≤20 GHz	+19.0 +19.0 +17.0	+18.0 +18.0 +15.0	Not available
MG3693B	w/opt 4 or 5 STD STD STD	<2*1 GHz ≥2*2 to ≤10 GHz >10 to ≤20 GHz >20 to ≤30 GHz	+15.0 +15.0 +12.0 +6.0	+14.0 +14.0 +10.0 +3.0	Not available
MG3694B	w/opt 4 or 5 STD STD STD	<2*1 GHz ≥2*2 to ≤10 GHz >10 to ≤20 GHz >20 to ≤40 GHz	+15.0 +15.0 +12.0 +6.0	+14.0 +14.0 +10.0 +3.0	Not available
MG3695B	w/opt 4 or 5 STD STD	<2*1 GHz ≥2*2 to ≤20 GHz >20 to ≤50 GHz	+12.0 +10.0 +3.0	+10.0 +8.0 +0.0	Not available
MG3696B	w/opt 4 or 5 STD STD	<2*1 GHz ≥2*2 to ≤20 GHz >20 to ≤67 GHz	+12.0 +10.0 +3.0	+10.0 +8.0 +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)
MG3691B	w/opt 4 or 5 w/opt 4 or 5 w/o opt 4 or 5	2*1 GHz ≥2*2 to ≤10 GHz ≥2 to ≤10 GHz	+19.0 +23.0 +25.0	+18.0 +21.0 +23.0	+15.0 +16.0 +16.0
MG3692B	w/opt 4 or 5 w/opt 4 or 5 w/o opt 4 or 5	<2*1 GHz ≥2*2 to ≤20 GHz ≥2 to ≤20 GHz	+19.0 +21.0 +23.0	+18.0 +19.0 +21.0	Not available
MG3693B	w/opt 4 or 5 w/opt 4 or 5 w/opt 4 or 5 w/o opt 4 or 5 w/o opt 4 or 5	<2*1 GHz ≥2*2 to ≤20 GHz >20 to ≤30 GHz ≥2 to ≤20 GHz >20 to ≤30 GHz	+17.0 +21.0 +17.0 +23.0 +19.0	+16.0 +19.0 +15.0 +21.0 +17.0	Not available
MG3694B	w/opt 4 or 5 w/opt 4 or 5 w/opt 4 or 5 w/o opt 4 or 5 w/o opt 4 or 5	2*1 GHz ≥2*2 to ≤20 GHz >20 to ≤40 GHz ≥2 to ≤20 GHz >20 to ≤40 GHz	17.0 +21.0 +17.0 +23.0 +19.0	+16.0 +19.0 +15.0 +21.0 +17.0	Not available
MG3695B	w/opt 4 or 5 w/opt 4 or 5 w/opt 4 or 5 w/opt 4 or 5 w/o opt 4 or 5 w/o opt 4 or 5 w/o opt 4 or 5	<2*1 GHz ≥2*2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤50 GHz ≥2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤50 GHz	+16 +21 +17 +11 +23 +19 +13	+14 +19 +15 +8 +21 +17 +10	Not available
MG3696B	w/opt 4 or 5 w/opt 4 or 5 w/opt 4 or 5 w/opt 4 or 5 w/opt 4 or 5 w/o opt 4 or 5 w/o opt 4 or 5 w/o opt 4 or 5 w/o opt 4 or 5	<2*1 GHz ≥2*2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤67 GHz >67 to ≤70 GHz ≥2 to ≤20 GHz >20 to ≤40 GHz >40 to ≤67 GHz >67 to ≤70 GHz	+16 +19 +16 +9 +3*5 +21 +19 +9 +3*5	+15 +18 +14 +6*4 0*5 +19 +16 +6*4 0*5	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
*5: Typical

Minimum leveled output power range	Without an attenuator	Minimum leveled output power to –5 dBm (–10 dBm typical)
	With an attenuator (Option 2x)	Minimum leveled output power to –105 dBm (110 dB range) (MG3691B, MG3692B, MG3693B and MG3694B) Minimum leveled output power to –95 dBm (90 dB range) (MG3695B and MG3696B)
	With an electronic attenuator (Option 2x)	Maximum leveled output power to –115 dBm (120 dB range) (MG3691B)
Unleveled output power range (typical)	Without an attenuator	>40 dB below Max. power
	With an attenuator (Option 2x)	>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

<table>
<tr><td rowspan="8">Accuracy and flatness</td><td colspan="5">Accuracy specifies the total worst case accuracy. Flatness is included within the accuracy</td></tr>
<tr><td rowspan="3">Step sweep and CW modes</td><td colspan="2">Attenuation below Max. power</td><td>Frequency (GHz)</td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td>≤40*2</td><td>40 to 50</td><td>50 to 60</td><td>60 to 67</td></tr>
<tr><td>Accuracy</td><td>0 to 25 dB
25 to 60 dB
60 to 100 dB</td><td>±1.0 dB
±1.0 dB
±1.0 dB</td><td>±1.5 dB
±1.5 dB
±2.5 dB*1</td><td>±1.5 dB
±3.5 dB*1
±3.5 dB*1</td><td>±1.5 dB
N/A
N/A</td></tr>
<tr><td>Flatness</td><td>0 to 25 dB
25 to 60 dB
60 to 100 dB</td><td>±0.8 dB
±0.8 dB
±0.8 dB</td><td>±1.1 dB
±1.1 dB
±2.1 dB*1</td><td>±1.1 dB
±3.1 dB*1
±3.1 dB*1</td><td>±1.1 dB
N/A
N/A</td></tr>
<tr><td rowspan="3">Analog sweep mode (typical)</td><td colspan="2">Attenuation below Max. power</td><td>Frequency (GHz)</td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td>0.01 to 0.05</td><td>0.05 to 20</td><td>20 to 40</td><td>40 to 67</td></tr>
<tr><td>Accuracy</td><td>0 to 12 dB
12 to 30 dB
30 to 60 dB
60 to 122 dB</td><td>±2.0 dB
±3.5 dB
±4.0 dB
±5.0 dB</td><td>±2.0 dB
±3.5 dB
±4.0 dB
±5.0 dB</td><td>±2.0 dB
±4.6 dB
±5.2 dB
±6.2 dB</td><td>±3.0 dB
±5.6 dB
±6.2 dB
±7.2 dB</td></tr>
<tr><td>Flatness</td><td>0 to 12 dB
12 to 30 dB
30 to 60 dB
60 to 122 dB</td><td>±2.0 dB
±3.5 dB
±4.0 dB
±5.0 dB</td><td>±2.0 dB
±3.5 dB
±4.0 dB
±5.0 dB</td><td>±2.0 dB
±4.1 dB
±4.6 dB
±5.2 dB</td><td>±2.5 dB
±5.1 dB
±5.6 dB
±6.2 dB</td></tr>
<tr><td rowspan="12">Other output power specifications</td><td colspan="2">Output units</td><td colspan="4">Output units selectable as either dBm or mV. Selection of mV assumes 50 Ω load. All data entry and display are in the selected units</td></tr>
<tr><td colspan="2">Output power resolution</td><td colspan="4">0.01 dB or 0.001 mV</td></tr>
<tr><td colspan="2">Source impedance</td><td colspan="4">50 Ω nominal</td></tr>
<tr><td colspan="2">Source SWR (internal leveling)</td><td colspan="4"><2.0 typical</td></tr>
<tr><td colspan="2">Power level stability with temperature</td><td colspan="4">0.04 dB/˚C typical</td></tr>
<tr><td colspan="2">Level offset</td><td colspan="4">Offsets the displayed power level to establish a new reference level</td></tr>
<tr><td colspan="2">Output on/off</td><td colspan="4">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</td></tr>
<tr><td colspan="2">RF on/off between frequency steps</td><td colspan="4">System menu selection of RF on or RF off during frequency switching in CW, step sweep, and list sweep modes</td></tr>
<tr><td colspan="2">RF on/off during retrace</td><td colspan="4">System menu selection of RF on or RF off during retrace</td></tr>
<tr><td colspan="2">Internal leveling</td><td colspan="4">Power is leveled at the output connector in all modes</td></tr>
<tr><td rowspan="4">External leveling</td><td>External detector</td><td colspan="4">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</td></tr>
<tr><td>External power meter</td><td colspan="4">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</td></tr>
<tr><td>External leveling bandwidth</td><td colspan="4">30 kHz typical in detector mode. 0.7 Hz typical in power meter mode</td></tr>
<tr><td>User level flatness correction</td><td colspan="4">Number of points: 2 to 801 points per table
Number of tables: 5 available
Entry modes: GPIB power meter or computed data</td></tr>
<tr><td rowspan="6">CW power sweep</td><td colspan="2">Range</td><td colspan="4">Sweeps between any two power levels at a single CW frequency</td></tr>
<tr><td colspan="2">Resolution</td><td colspan="4">0.01 dB/step (Log) or 0.001 mV (Linear)</td></tr>
<tr><td colspan="2">Accuracy</td><td colspan="4">Same as CW power accuracy</td></tr>
<tr><td colspan="2">Log/linear sweep</td><td colspan="4">Power sweep selectable as either log or linear. Log sweep is in dB; linear sweep is in mV</td></tr>
<tr><td colspan="2">Step size</td><td colspan="4">User-controlled, 0.01 dB (Log) or 0.001 mV (Linear) to the full power range of the instrument</td></tr>
<tr><td colspan="2">Step dwell time</td><td colspan="4">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</td></tr>
<tr><td>Sweep frequency/ step power</td><td colspan="5">A power level step occurs after each frequency sweep. Power level remains constant for the length of time required to complete each sweep</td></tr>
</table>

*1: Typical
*2: Accuracy and Flatness with high power option 15, is ±1.5 dB.

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 to ≤15.625 MHz (Option 4)	256
>15.625 to ≤31.25 MHz (Option 4)	128
>31.25 to ≤62.5 MHz (Option 4)	64
>62.5 to ≤125 MHz (Option 4)	32
>125 to ≤250 MHz (Option 4)	16
>250 to ≤500 MHz (Option 4)	8
>500 to ≤1050 MHz (Option 4)	4
>1050 to ≤2200 MHz (Option 4)	2
>10 to ≤2000 MHz (Option 5)	1
>2 to ≤20 GHz	1
>20 to ≤40 GHz	1/2
>40 to ≤67 GHz	1/4

	Parameter	Modes	Conditions	Specifications
Frequency Modulation	Deviation	Locked Locked Low-noise Unlocked Narrow Unlocked Wide	Rate = 1 kHz to (Lesser of 8 MHz or 0.03 * Fcarrier) Rate = 50 kHz to Lesser of 8 MHz or 0.03 * Fcarrier) Rate = DC to (Lesser of 8 MHz or 0.03 * Fcarrier) Rate = DC to 100 Hz	± [Lesser of 10 MHz or 300 * (mod rate)]/n ± [Lesser of 10 MHz or 3 * (mod rate)]/n ± (10 MHz)/n ± (100 MHz)/n
	Bandwidth (3 dB)	Locked Locked Low-noise Unlocked Narrow Unlocked Wide	100 kHz rate 100 kHz rate 100 kHz rate DC rate	1 kHz to (Lesser of 10 MHz or 0.03 * Fcarrier) 30 kHz to (Lesser of 10 MHz or 0.03 * Fcarrier) DC to (Lesser of 10 MHz or 0.03 * Fcarrier) DC to 100 Hz
	Flatness	Locked	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)
	Incidental AM	Locked, Low-noise, Unlocked Narrow	Rate and Dev. = Lesser of 1 MHz or 0.01 * Fcarrier	<2% typical
	Harmonic Distortion	Locked	Rate= 10 kHz, Dev.= ± (1 MHz)/n	<1%
	External Sensitivity	Locked Locked Low-noise Unlocked Narrow Unlocked Wide		± (10 kHz/V to 20 MHz/V)/n ± (100 kHz/V to 100 MHz/V)/n
Phase Modulation	Deviation	Narrow Wide	Rate = DC to (Lesser of 8 MHz or 0.03 * Fcarrier) Rate = DC to (Lesser of 1 MHz or 0.03 * Fcarrier)	± [Lesser of 3 rad or (5 MHz)/(mod rate)]/n ± [Lesser of 400 rad or (10 MHz)/(mod rate)]/n
	Bandwidth (3 dB)	Narrow Wide	100 kHz rate 100 kHz rate	DC to (Lesser of 10 MHz or 0.03 * Fcarrier) DC to (Lesser of 1 MHz or 0.03 * Fcarrier)
	Flatness	Narrow Wide	Rate = DC to (Lesser of 1 MHz or 0.01 * Fcarrier) Rate = DC to (Lesser of 500 kHz or 0.01 * Fcarrier)	±1 dB relative to 100 kHz rate ±1 dB relative to 100 kHz rate
	Accuracy	Narrow and Wide	100 kHz, Int. or 1 Vpk Ext., sine	10%
	External Sensitivity	Narrow Wide		± (0.0025 rad/V to 5 rad/V)/m ± (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, 50 Ω 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 V

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*3	Video Feedthrough*3
≥10 to <31.25 MHz (Opt. 4)	400 ns*3	33%*3	40 ns	±70 mV
≥31.25 to <125 MHz (Opt. 4)	90 ns*3	22%*3	12 ns	±130 mV
≥125 to <500 MHz (Opt. 4)	33 ns*3	11%*3	12 ns	±70 mV
≥500 to <2200 MHz (Opt. 4	15 ns	10%*3	12 ns	±15 mV
≥10 to <1000 MHz (Opt. 5)	15 ns/10 ns*3	10%*3	8 ns	±30 mV
≥1 to <2 GHz (Opt. 5)	10 ns/5 ns*3	10%*3	8 ns	±30 mV
≥2 to ≤67 GHz	10 ns/5 ns*3	10%*1	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.		

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 Modes	Free-run, triggered, gated, delayed, 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*2	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	

∗1: For 50 and 67 GHz units, overshoot >40 GHz is 20% typical at rated power.
∗2: Period must be longer than the sum of delay and width by 5 clock cycles minimum.
∗3: Typical

Millimeter Wave Multipliers (63850 Series plus Option 18)

External multipliers can be added to the MG3690B to provide coverage as high as 325 GHz. Please call us for solutions beyond 325 GHz.
These external multipliers require at a minimum an MG3692B, with 20 GHz coverage. The output power required to drive the modules is +10 dBm. They can be powered up by an external power supply (12 Vdc, 1.5 A typ.) using the supplied double banana power cord. It is recommended to purchase an MG3690B with option 18, which adds the capability to bias these modules without the need of an additional power supply. It adds a rear panel Twinax connector that supplies the proper DC bias for these modules, and a cable to power them up. Option 18 is not available with options 7 and 15.

63850 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 mmW 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 MG3690B 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 mmW module, on the MG3690B's front panel display.

Multiplier p/n*1	63850-15	63850-12	63850-10	63850-08	63850-06	63850-05	63850-03
Frequency	50 to 75 GHz	60 to 90 GHz	75 to 110 GHz	90 to 140 GHz	110 to 170 GHz	140 to 220 GHz	220 to 325 GHz
Waveguide Output	WR-15	WR-12	WR-10	WR-08	WR-06	WR-05	WR-03
Flange*2	(008)	(009)	(010)	(M08)	(M06)	(M05)	(M03)
Output Power (typical)	+8 dBm	+6 dBm	+5 dBm	–5 dBm	–13 dBm	–15 dBm*3	–25 dBm*4
Output Flatness (typ.) (Unleveled)	±2 dB	±2 dB	±3 dB	—	—	—	—
Output Match	>12 dB	>12 dB	>12 dB	>12 dB	>12 dB	>12 dB	6 dB (typical)
Multiplication Factor (m)	x4	x6	x6	x8	x12	x12	x18
Input Frequency	12.5 to 18.75 GHz	10.0 to 15.0 GHz	12.5 to 18.4 GHz	11.2 to 17.5 GHz	9.1 to 14.2 GHz	11.6 to 18.4 GHz	12.2 to 18.1 GHz
Frequency Accuracy	(LO Synthesizer's Accuracy x m)						
Frequency Resolution	(LO Synthesizer's Resolution x m)						
Harmonics & Spurious	–15 dBc (typ.)						
Input Power Required	+10 dBm						
RF Input Connector	SMA (female)						
DC Power	12 Vdc, 1.5 A (double banana power cord included) Option 18 is recommended on the synthesizer, to supply the necessary bias.						
Dimensions	120 (W) x 110 (H) x 70 (D) mm (not including feet or interfaces)						
Mass	<1 kg						
Temperature	20˚ to 30˚C						

*1: These mmW modules are produced by OML Inc. (Oleson Microwave Labs), co-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 www.oml-mmw.com.
*2: Waveguide output flanges are per MIL.F-3922/67B-(xxx)
*3: Power rolls off from –15 dBm at 200 GHz, to –25 dBm typical at 220 GHz.
*4: Output power is estimated.

Inputs and Outputs

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	Provides for RF output from 50 Ω 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. 50 Ω impedance.
10 MHz REF OUT	Provides a 1 Vp-p, AC coupled, 10 MHz signal derived from the internal frequency standard. 50 Ω impedance.
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	Provides the bias for the external waveguide multipliers for coverage up to 325 GHz.
RF, LO, IF	Provides access to an internal IF up-conversion mixer, Option 7.
PULSE TRIG IN	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	Provides a TTL compatible signal, synchronized to the internal pulse modulation output, Option 27.
PULSE VIDEO OUT	Provides a video modulating signal from the internal pulse generator, Option 27.
AM IN	Accepts an external signal to amplitude modulate the RF output signal, Option 14. 50 Ω impedance
FM/ΦM IN	Accepts an external signal to frequency or phase modulate the RF output signal, Option 12. 50 Ω impedance
AM OUT	Provides the amplitude modulation waveform from the internal LF generator, Option 27.
FM/ΦM OUT	Provides the frequency or phase modulation waveform from the internal LF generator, Option 27.
SCAN MOD IN	Accepts an external signal to scan modulate the RF output signal, Option 20, High Impedance.
POWER MONITOR IN	Accepts an external detector for power monitoring, Option 8.

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
MG3691B	2 to 10 GHz CW Generator
MG3692B	2 to 20 GHz CW Generator
MG3693B	2 to 30 GHz CW Generator
MG3694B	2 to 40 GHz CW Generator
MG3695B	2 to 50 GHz CW Generator
MG3696B	2 to 67 GHz CW Generator (operational to 70 GHz)
	Options and accessories
MG3690B/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.
MG3690B/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.
MG3690B/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.)
MG3690B/2E	Electronic Step Attenuator – Adds a 10 dB/step electronic attenuator with a 120 dB range for the MG3691B. Rated RF output power is reduced.
MG3690B/3	Ultra Low Phase Noise, main band – Adds new modules to significantly reduce SSB phase noise.
MG3690B/4	10 MHz to 2.2 GHz RF coverage, Ultra-Low Phase Noise version – Uses a digital down converter to significantly reduce SSB phase noise.
MG3690B/5	10 MHz to 2 GHz RF coverage – Uses an analog down converter.
MG3690B/6	Analog Sweep Capability (limited to ≥500 MHz when used with Option 4)
MG3690B/7	IF Up-Conversion – Adds an internal 40 GHz mixer for up-converting an IF signal. (Not available with MG3695B, MG3696B, or with Option 18)
MG3690B/8	Power Monitor – Adds internal power measurement capability (not available with Option 9).
MG3690B/9X	Rear Panel Output – Moves the RF output connector to the rear panel. (This option comes in different versions, based on instrument configuration.)
MG3690B/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.
MG3690B/12	Frequency and Phase Modulation – External, via a rear panel BNC connector. For internal modulation capability, requires additionally LF Generator, Option 27.
MG3690B/14	Amplitude Modulation – External, via a rear panel BNC connector. For internal modulation capability, requires additionally LF Generator, Option 27.
MG3690B/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.)
MG3690B/16	High Stability Time Base – Adds an ovenized, 10 MHz crystal oscillator as a high-stability time base.
MG3690B/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.
MG3690B/18	mmW Bias Output – Adds a rear panel BNC Twinax connector required to bias the 63850 millimeter wave source modules, sold separately (Not available with Option 7 or Option 15x).
MG3690B/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).

Model/Order No.	Name
MG3690B/26X*	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.)
MG3690B/27	Internal LF and Pulse Generators – Provides modulation waveforms for internal AM, FM, FM, and Pulse. (Not available without Option 12, 14, or 26.)
MG3690B/28X*	Analog Modulation Suite – For ease of ordering and package pricing, this option bundles Options 12, 14, 26 and 27, offering internaland external AM, FM, FM, and Pulse
MG3690B/30	Modulation. (This option comes in different versions, based on instrument configuration.) Low phase noise
	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 (MG3690B/18 recommended)
63850-15	50 to 75 GHz V Band Multiplier Source Module, WR-15
63850-12	60 to 90 GHz E Band Multiplier Source Module, WR-12
63850-10	75 to 110 GHz W Band Multiplier Source Module, WR-10
63850-08	90 to 140 GHz F Band Multiplier Source Module, WR-08
63850-06	110 to 170 GHz D Band Multiplier Source Module, WR-06
63850-05	140 to 220 GHz G Band Multiplier Source Module, WR-05
63850-03	220 to 325 GHz H Band Multiplier Source Module, WR-03
806-121	SMA male-male flexible cable, 90 cm (3 ft) (could be used to connect the MG3690B output to the module's LO input)
	Upgrades Economical upgrades are available to upgrade any model to any higher performing model. Consult Anritsu for details.

*: 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.

RF/MICROWAVE SIGNAL GENERATORS

MG37020A

10 MHz to 20 GHz

CE

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 x 10^{-9}/day
With temperature: <2 x 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 50 Ω. AC coupled.
Rear panel BNC: 50 Ω impedance.
Electronic Frequency Control (EFC) Input:
–5 to +5 V input range. 2.5 x 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 to 15.625 MHz (Option 4)	–101 (–115)	–126 (–132)	–139 (–143)	–142 (–145)	–142 (–145)	–145 (–148)
>15.625 to 31.25 MHz (Option 4)	–95 (–106)	–121 (–127)	–134 (–142)	–139 (–145)	–139 (–145)	–145 (–148)
>31.25 to 62.5 MHz (Option 4)	–89 (–96)	–116 (–122)	–129 (–140)	–135 (–145)	–137 (–145)	–142 (–150)
>62.5 to 125 MHz (Option 4)	–83 (–92)	–110 (–116)	–127 (–139)	–129 (–140)	–134 (–139)	–138 (–146)
>125 to 250 MHz (Option 4)	–77 (–89)	–104 (–113)	–123 (–133)	–123 (–137)	–128 (–134)	–132 (–144)
>250 to 500 MHz (Option 4)	–71 (–85)	–98 (–105)	–117 (–126)	–117 (–130)	–122 (–128)	–126 (–140)
>500 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 to 10 GHz	–46 (–55)	–73 (–83)	–92 (–102)	–92 (–105)	–100 (–104)	–101 (–115)
>10 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: 50½ 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, ³1 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
MG37022A	**Main frame** 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-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 x 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.

SYNTHESIZED SIGNAL GENERATOR

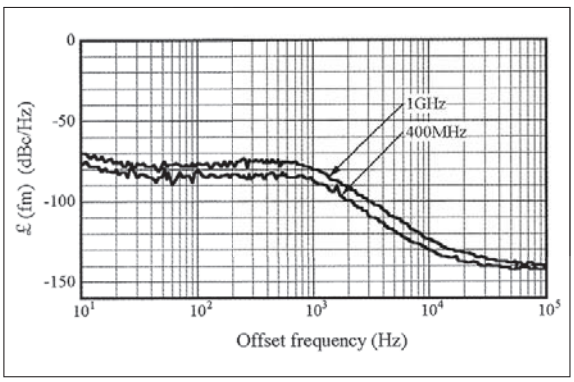
MG3641A/MG3642A

125 kHz to 1040/2080 MHz

CE GPIB

Economic High-Performance Signal Sources

Anritsu's synthesizer technology allows frequency to be set with a resolution of 0.01 Hz across the full frequency range. And the non-harmonic spurious is better than –100 dBc for reliable measurement at any frequency.
A unique low-noise YIG oscillator produces a high-purity signal with SSB phase noise of better then –130 dBc/Hz (1 GHz, 20 kHz offset), making these signal generators ideal for interference testing of radio receivers and as sources for various local and reference signals.



SSB Phase Noise Characteristic

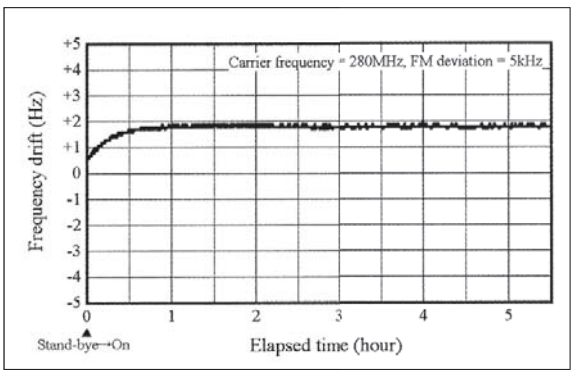
Features

- 0.01 Hz, 0.01 dB Setting Resolution
- High Signal Purity (–100 dBc Spurious)
- Versatile Modulation Functions

Performance

• High-stable Carrier Frequency

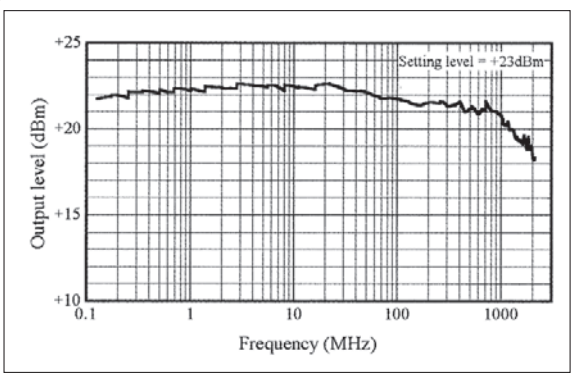
The carrier frequency is produced by a high-stability crystal oscillator and remains phase-locked even at frequency modulation.
Frequency calibration for testing FSK modulation receivers, such as paging systems, is unnecessary.



Frequency Stability of Carrier Wave at Frequency Modulation

• High Output

A stable signal with an output of 17 dBm can be output across the full frequency range to drive a variety of local signal sources and power amplifiers. In addition, an over-drive level up to 23 dBm can be set to make full use of the internal amplifier capability. If the amplifier output power reaches the limit and the output power is insufficient, a status message is displayed. This is useful for confirming output limits.

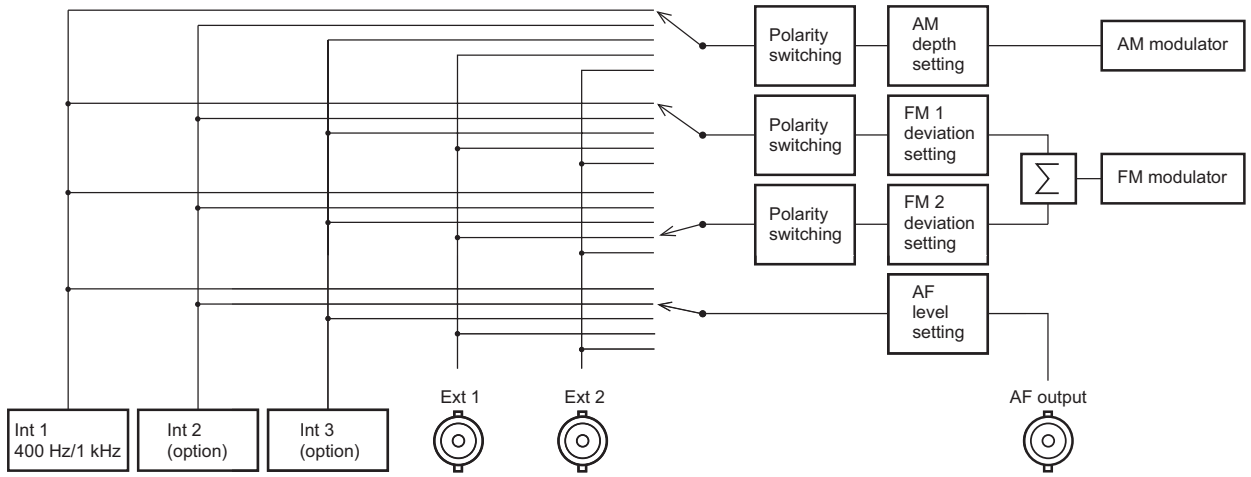


Maximum Output Level

• Various Modulation Types

Up to three internal AF signal sources are supported by adding options to the standard sine-wave oscillator (1 kHz, 400 Hz). The AF synthesizer (Option 21) is a digital synthesizer that generates sine-wave, triangular, square, and sawtooth waveforms; it can also be used as a function generator as well as a modulation signal source.
In addition to permitting simultaneous one-route AM and two-routes FM modulation, the modulation factor and polarity can be set independently.

High-speed pulse modulation is supported using an external modulation signal (TTL level). The output can be used for various burst signals with an ON/OFF ratio of more than 80 dB, as well as a pseudorandom signal for radar.
Installing the Pattern Generator (Option 23) in the MG3641A/MG3642A allows FSK modulation or pulse modulation in combination with the FSK Encoder (Option 22) or Pulse Modulator (Option 11) without an external instrument.

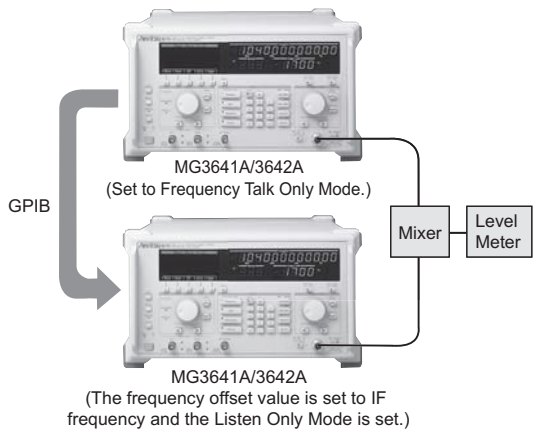


• GPIB Only-Mode Linked Operation

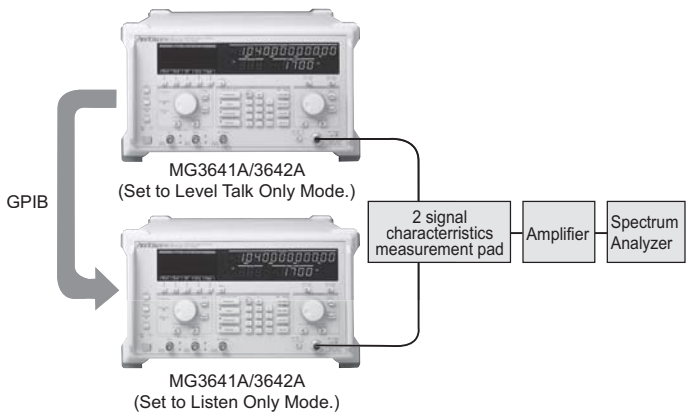
Two sets of the MG3641A/MG3642A can be linked and operated without an external controller by using the Frequency and Output Level Only modes.
The Frequency Only Mode is used for evaluating the characteristics of mixers.
The Level Only Mode is useful for evaluating the cross-modulation characteristics of non-linear devices, such as amplifiers.

• Pattern Generator (Option 23)

Installing the Pattern Generator (Option 23) in the MG3641A/MG3642A allows FSK modulation or pulse modulation in combination with the FSK Encoder (Option 22) or Pulse Modulator (Option 11) without an external instrument.



Measurement of mixer characteristics using Frequency Only Mode and frequency offset



Amplifier IM3 measurement using Level Only Mode

Specifications

• MG3641A/MG3642A Synthesized Signal Generator

Carrier frequency	Range: 125 kHz to 1040 MHz (MG3641A), 125 kHz to 2080 MHz (MG3642A) Resolution: 0.01 Hz Accuracy: Reference oscillator accuracy; reference oscillator accuracy ± (0.3% of FM setting deviation + 5 Hz) at frequency modulation Internal reference oscillator*1 Frequency: 10 MHz; Aging rate: ±5 x 10^{-9}/day; Start-up characteristics: 1 x 10^{-7}/10 min (for 24 h after power-on), Temperature stability: ±3 x 10^{-8} (0 to 50°C) External reference input: 5/10 MHz, ±10 ppm, ≥0.7 Vp-p/50 Ω (AC coupling), BNC connector (rear panel) Buffer output: 10 MHz, TTL level (DC coupling), BNC connector (rear panel) Switching time: <40 ms (external control, response time from last command until becomes within ±0.1 ppm of set frequency)

Continued on next page

<table>
<tr><td>Output</td><td>
Range: –143 to +17 dBm (settable range: –143 to +23 dBm)
Units: dBm, dBμ, V, mV, μV (dBμ, V, mV and μV switchable between termination voltage display and open voltage display)
Resolution: 0.01 dB
Frequency characteristics (at 0 dBm): ±0.5, ±1.0 dB (pulse modulation: on)*2
Accuracy: ±1 dB (–127 to +17 dBm, upper limit at pulse modulation*2: +12 dBm), ±3 dB (<–127 dBm)
Impedance: 50 Ω (N connector), VSWR: <1.5 (≤–3 dBm), <2.5 (>–3 dBm)
Switching time: <50 ms (normal mode), <100 ms (level safety mode), <10 ms (continuous mode)
∗Response time from last command until becomes within ±0.5 dB of final level
Special setting mode
Continuous mode: Variable within set value ±10 dB with no interruption of output
Safety mode: Prevent large spike signal generation when operating mechanical-type attenuator
Interference radiation: <0.1 μV (at output frequency), <1 μV (over entire frequency range, multi-menu display: OFF)
∗At 25 mm from cabinet measured with 25 mm diameter loop antenna (2 windings) terminated at 50 Ω
</td></tr>
<tr><td>Signal purity</td><td>
Spurious (CW mode, ≤+7 dBm)
Harmonics: <–30 dBc (2nd, 3rd)
Non-harmonic: <–100 dBc (≥15 kHz offset)
Those related power: <–40 dBc (<15 kHz offset)
SSB phase noise (CW Mode, 20 kHz offset):
<–140 dBc/Hz (10 to <256 MHz), <–136 dBc/Hz (256 to <512 MHz), <–130 dBc/Hz (512 to 1040 MHz),
<–124 dBc/Hz (>1040 MHz, MG3642A only)
Residual AM: <–80 dBc (≥500 kHz, CW mode, +7 dBm, 50 Hz to 15 kHz demodulation band)
Residual FM (CW mode)
300 Hz to 3 kHz demodulation band: <4 Hzrms (10 to <512 MHz), <8 Hzrms (512 to 1040 MHz), <16 Hzrms (>1040 MHz, MG3642A only)
50 Hz to 15 kHz demodulation band: <5 Hzrms (10 to <512 MHz), <10 Hzrms (512 to 1040 MHz), <20 Hzrms (>1040 MHz, MG3642A only)
</td></tr>
<tr><td>Amplitude modulation</td><td>
Range: 0 to 100%
Resolution: 0.1%
Accuracy: ± (5% offset value + 2%) ∗≥0.4 MHz, ≤+7 dBm, ≤90% AM, source: Int 1 (1 kHz), 300 Hz to 3 kHz demodulation band
Modulation frequency response (output: ≤+7 dBm)
<table>
<tr><th rowspan="2">Carrier frequency</th><th colspan="2">Upper limit frequency</th><th rowspan="2">Lower limit frequency</th></tr>
<tr><th>AM: 30%</th><th>AM: 90%</th></tr>
<tr><td>0.4 to <0.5 MHz</td><td>2 kHz (±1 dB bandwidth)</td><td>1 kHz (±1 dB bandwidth)</td><td rowspan="5">DC: External DC coupling (±1 dB bandwidth)
20 Hz: External AC coupling (±1 dB bandwidth)</td></tr>
<tr><td>0.5 to <2 MHz</td><td>10 kHz (±1 dB bandwidth)</td><td>5 kHz (±1 dB bandwidth)</td></tr>
<tr><td>2 to <32 MHz</td><td colspan="2">20 kHz (±1 dB bandwidth)</td></tr>
<tr><td>32 to <64 MHz</td><td colspan="2">50 kHz (±1 dB bandwidth)</td></tr>
<tr><td>≥64 MHz</td><td colspan="2">50 kHz (±1 dB bandwidth), 100 kHz (±3 dB bandwidth)</td></tr>
</table>
Distortion: <–40 dB (30% AM), <–30 dB (90% AM) ∗≥0.4 MHz, ≤+7 dBm, source: Int 1 (1 kHz)
Incidental FM: <200 Hz peak ∗≥0.4 MHz, ≤AM: 30%, ≤+7 dBm, source: Int 1 (1 kHz), 300 Hz to 3 kHz demodulation band
Modulation signal source: One of internal (Int 1, Int 2, Int 3) and external (Ext 1, Ext 2)
Modulation signal polarity: Positive/Negative switchable
</td></tr>
<tr><td>Frequency modulation</td><td>
Range:
0 to 125 Hz (125 to <250 kHz) 0 to 25.6 kHz (16 to <32 MHz)
0 to 250 Hz (250 to <500 kHz) 0 to 51.2 kHz (32 to <64 MHz)
0 to 500 Hz (0.5 to <1 MHz) 0 to 102 kHz (64 to <128 MHz)
0 to 1 kHz (1 to <2 MHz) 0 to 256 kHz (128 to <256 MHz)
0 to 2 kHz (2 to <4 MHz) 0 to 512 kHz (256 to <512 MHz)
0 to 4 kHz (4 to <8 MHz) 0 to 1024 kHz (512 to 1040 MHz)
0 to 10 kHz (8 to <16 MHz) 0 to 2048 kHz (>1040 MHz, MG3642A only)
Resolution:
1 Hz (0 to 4 kHz deviation) 250 Hz (102.25 to 256 kHz deviation)
10 Hz (4.01 to 10 kHz deviation) 500 Hz (256.5 to 512 kHz deviation)
25 Hz (10.025 to 25.6 kHz deviation) 1 kHz (513 to 1024 kHz deviation)
50 Hz (25.65 to 51.2 kHz deviation) 1 kHz (1025 to 2048 kHz deviation, MG3642A only)
100 Hz (51.3 to 102 kHz deviation)
Accuracy: ± (5% offset value + 10 Hz) (0.4 to <512 MHz), ± (5% offset value + 20 Hz) (512 to 1040 MHz)
± (5% offset value + 40 Hz) (>1040 MHz, MG3642A only)
∗Source: Int 1 (1 kHz), 300 Hz to 3 kHz demodulation band
Modulation frequency response: DC or 20 Hz*3 to 20 kHz (0.4 to <10 MHz), DC or 20 Hz*3 to 100 kHz (≥10 MHz) ∗±1 dB bandwidth
Distortion: <–40 dB ∗≥16 MHz, 3.5 kHz deviation, source: Int 1 (1 kHz)
<–45 dB ∗≥16 MHz, 22.5 kHz deviation, source: Int 1 (1 kHz)
Incidental FM: <1% peak ∗≥64 MHz, ≤+7 dBm, 100 kHz deviation, source: Int 1 (1 kHz), 300 Hz to 3 kHz demodulation band
External modulation group delay: <30 μs ∗≥10 MHz, source: external DC coupling mode, modulation rate: ≤100 kHz
Modulation signal source (FM1, FM2): One of internal (Int 1, Int 2, Int 3), and external (Ext 1, Ext 2)
Modulation signal polarity: FM1, FM2 Positive/Negative switchable
</td></tr>
<tr><td>Pulse modulation</td><td>According to option specifications</td></tr>
<tr><td>Modulation signal source</td><td>
Internal modulation (Int 1)
Frequency: 400 Hz, 1 kHz
Accuracy: Same as reference oscillator accuracy
Internal modulation (Int 2, Int 3): According to option specifications
External modulation (Ext 1, Ext 2)
Proper input level: 2 Vp-p approx.
Input impedance: 600 Ω, BNC connector
Coupling: DC/AC switchable
</td></tr>
<tr><td>AF Output</td><td>
Output signal source: One of internal (Int 1, Int 2, Int 3), and external (Ext 1, Ext 2)
Output level: 0 to 4 Vp-p
Output level resolution: 1 mVp-p
Output level accuracy: ± (5% of setting level + 2 mVp-p) ∗Source: Int 1 (1 kHz)
Impedance: 600 Ω, BNC connector
</td></tr>
</table>

Continued on next page

Simultaneous modulation	Excluding amplitude modulation and pulse modulation*2 combination, simultaneous modulation, modulation rate, deviation independently settable
Sweep function	Sweep parameters: Frequency, Output level, Memory Sweep patterns Frequency sweep (start/stop): Linear (specified step size and number of points), Log (multiplying factor: 1%) Frequency sweep (center/span): Linear (specified step size and number of points) Level sweep (start/stop, center/span): dB (specified step size and number of points) ∗Sweep: continuous mode (max. 20 dB width) Memory sweep: Start/stop Sweep mode: Auto, Single, Manual Sweep time Setting range: 1 ms to 600 s/point ∗Actual sweep time depends on switching time for each sweep parameter (frequency, output level) Resolution: 10 µs/point Auxiliary output X-Out: Ramp waveform (sweep start point: 0 V, sweep end point: 10 V), BNC connector (rear panel) Z-Out: TTL level (H-level at sweeping), BNC connector (rear panel) Blanking-Out: TTL level (L-level at switching), BNC connector (rear panel) Marker-Out: TTL level (H-level at marker match), BNC connector (rear panel)
Functions	Relative display: Carrier frequency, Output level Offset display: Carrier frequency, Output level Memory: Saves/Recalls 1000 panel settings; recall contents: panel, frequency, frequency/output level selection Trigger: An external trigger signal (rear panel BNC connector, TTL level) can be used to execute a previously programmed operation sequence on the panel (except power switch, [Preset] key, [Local] key and rotary knob). Max. number of sequence steps of trigger program: 20 steps Back-up: The panel settings before power-off are backed-up and displayed again at power-on, Except data-input contents, GPIB data contents, Remote settings, RPP operations GPIB Control: All functions, except programming operation for trigger program, Power switch, [Local] key, Rotary knobs, and Resolution keys (Interface: SH1, AH1, T5, L3, TE0, SR1, RL1, PP0, DC1, DT1, C0, E2)
Reverse power protection	Max. reverse input power: ≤50 W (≤1040 MHz), ≤25 W (>1040 MHz, MG3642A only), ±50 Vdc
Power supply	100 or 240 Vac*4 (+10/–15%), 47.5 to 63/380 to 420 Hz, ≤200 VA
Temperature	Operating: 0˚ to +50˚C, Storage: –30˚ to +71˚C
Dimensions and mass	320 (W) x 177 (H) x 451 (D) mm, ≤20 kg
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1

∗1: Can be changed to 5 x 10^{-10}/day using reference crystal oscillator (Option 01)
∗2: Only with pulse modulator (Option 11) installed
∗3: External DC coupling: DC, External AC coupling: 20 Hz
∗4: Specify a nominal voltage of either 100 V and 240 V when ordering; the maximum operating voltage is 250 V.

• Options

Option 01 Reference Oscillator	Frequency: 10 MHz Aging rate: 5 x 10^{-10}/day Temperature stability: ±5 x 10^{-9} (0˚ to 50˚C)
Option 11 Pulse Modulator	Frequency: 125 kHz to 2080 MHz On/off ratio: >80 dB Rise/fall time: <100 ns Min. pulse width: <500 ns Pulse repetition rate: DC to 1 MHz Max. delay time: <100 ns Overshoot, ringing: <20% Video feed-through: <20% Pulse modulation input: 50/600 Ω, TTL (positive logic), BNC connector (rear panel)
Option 21 AF Synthesizer	Frequency: 0.01 Hz to 400 kHz (sine-wave), 0.01 Hz to 50 kHz (triangular, square and sawtooth waveforms) Resolution: 0.01 Hz Waveform: Sine-wave, Triangular, Square and Sawtooth waveforms Frequency accuracy: Same as reference oscillator accuracy
Option 22 FSK Encoder	Frequency shift (Data 2^1, Data 2^0) = (0, 0): –frequency deviation setting, (Data 2^1, Data 2^0) = (0, 1): –frequency deviation setting/3, (Data 2^1, Data 2^0) = (1, 0): +frequency deviation setting, (Data 2^1, Data 2^0) = (1, 1): +frequency deviation setting/3 Frequency set Free: Frequency shift simultaneously with data input Rise trigger: Frequency shift at external clock rise time Fall trigger: Frequency shift at external clock fall time Baseband filter Filter type: 10-th order Bessel filter Cut-off frequency: 100 Hz to 30 kHz (–3 dB) Setting resolution: Upper 2 digits Frequency deviation accuracy: Depends on frequency modulation deviation accuracy of mainframe (at by-pass to baseband filter) External modulation input Data $2^0/2^1$: TTL level (pull-down), BNC connector (rear panel) External clock input: TTL level (pull-up), BNC connector (rear panel)

Continued on next page

Option 23 Pattern Generator	Data pattern	Free	Number of memories: 4 (defined: 1 to 4) Memory capacity: 524,288 bits/memory Pattern output Range: Top address and data bit length can be set for respective free-pattern memories. Top address setting range: 00000 to 65,535 Data bit length setting range: 2 to 524,288 bits (final address of output: 65,535 max.) Memory: Saves 1 byte units via GPIB interface Saves when pattern generator output off, or idle pattern being output
		Fixed	PN9 pseudorandom pattern (conforming to ITU-T V.52), PN15 pseudorandom pattern (conforming to ITU-T O.151), 01 fixed pattern
	Idle pattern		Number of memories: 1 (idle) Memory capacity: 524,288 bits Pattern output Range: The top address and data bit length can be set. Top address setting range: 00000 to 65,535 Data bit length setting range: 2 to 524,288 bits (Final address of output: 65,535 max.) Memory: Saves 1 byte units via GPIB interface Saves when pattern generator output off
	Output method		Single: Specified data pattern output once only (PN9 and PN15 output twice) Continuous: Specified data pattern output continuously When the data pattern is not output, the idle pattern is output continuously.
	Output rate		Range: 1 to 99,999 bps (resolution: 1 bps) Accuracy: Same as reference oscillator of MG3641A/MG3642A
	Output system		1 bit NRZ output (corresponding to binary data output): Data is output to the Data 2^1 Output sequentially, one bit after another starting from the top bit. The logic of Data 2^0 is fixed to 0. 2 bit NRZ output (corresponding to quadrature data output): Data is output to the Data 2^1 Output and Data 2^0 Output sequentially, two bits after another, starting from the top bit.
	Output level		Data 2^0 Output: TTL level, Data 2^1 Output: TTL level, Clock Output: TTL level, rising

• MX364001B Software for Pattern Generator Data Write

Read-out data	DOS text file
Write memory	Data pattern memory (defined: 1 to 4), idle pattern memory (idle)
Contents of write data	Pattern data: 2 to 524,288 bits/memory (text format file) Top address of output: 0 to 65,535 (any settable) Data bit length: 2 to 524,288 bits (bit length of pattern data automatically calculated and recorded) Data name: Max. 8 characters (idle pattern memory not named)
Personal Computer	IBM PC/AT compatible
OS	Microsoft Windows 95
Interface	GPIB (National Instruments PCI-GPIB or PCMCIA-GPIB)

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
MG3641A	Synthesized Signal Generator
MG3642A	Synthesized Signal Generator
	Standard accessories
	Power Cord, 2.5 m: 1 pc
B0325	GPIB Connector Shielded Cap: 1 pc
F0013	Fuse, 5 A (for 100 Vac): 2 pcs
F0012	Fuse, 3.15 A (for 200 Vac): 2 pcs
W1137AE	MG3641A/MG3642A Operation Manual: 1 copy
	Options
MG364[ ]A-01	Reference Oscillator (aging rate: 5 x 10^{-10}/day)
MG364[ ]A-11	Pulse Modulator (pulse repetition rate: DC to 1 MHz)
MG364[ ]A-21*1	AF Synthesizer (0.01 Hz to 400 kHz, resolution: 0.01 Hz)
MG364[ ]A-22*1	FSK Encoder (2 or 4 levels FSK)
MG364[ ]A-23*1	Pattern Generator
MX364001B*2	**Application software** Software for Pattern Generator Data Write (Microsoft Windows 95)
	Optional accessories
J0576B	Coaxial Cord (N-P · 5D-2W · N-P), 1 m
J0127A	Coaxial Cord (BNC-P · RG58A/U · BNC-P), 1 m
J0007	GPIB Cable, 1 m (408JE-101)
J0008	GPIB Cable, 2 m (408JE-102)
MP51A	Pad (DC to 200 MHz, 75 Ω → 50 Ω)
MP52A	Pad (DC to 200 MHz, 50 Ω → 75 Ω)
MA1612A	Four-point Junction Pad (5 to 3000 MHz)
MP721[ ]	Attenuator (DC to 12.4 GHz)
B0395C	Rack Mount Kit (EIA/IEC)
B0329G	Front Cover (3/4MW 4U)
B0412A	Carrying Case (with casters and B0329G front cover)
B0330B	Tilt Bail (3/4MW 450D)

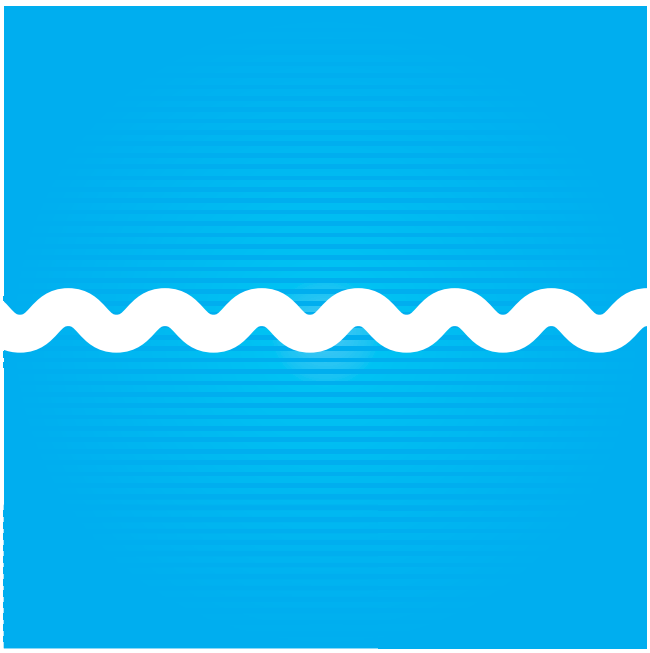
Combinations

∗1: Up to two units of Option 21, 22 or 23 can be installed.

Option 21	Option 21	Analog modulation of two tones, such as a tone squelch test
Option 21	Option 22	FSK modulation by external data input and analog modulation
Option 21	Option 23	
Option 22	Option 23	FSK modulation by internal data pattern

∗2: The following items must be provided by the user to use the MX364001B.

IBM PC/AT PC	486DX4 (75 MHz or faster) with 32 MB RAM min. (recommended) running Windows 95 OS
GPIB interface	PCMCIA-GPIB or PCI-GPIB or equivalent GPIB interface manufactured by National Instruments Inc., supporting NI-488.2



RF MICROWAVE MEASURING INSTRUMENTS

MICROWAVE FREQUENCY COUNTER

MF2400C Series

10 Hz to 20, 27, 40 GHz

CE GPIB

Newest Burst Wave Measurements

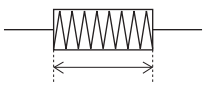
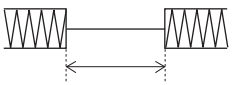
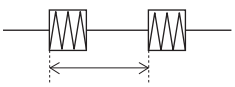
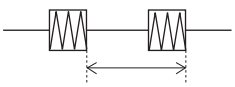
The MF2400C series Microwave Frequency Counter lineup is composed of three frequency counters:
the MF2412C (20 GHz), the MF2413C (27 GHz), and the MF2414C (40 GHz).
This series is ideal for evaluating mobile radio communications devices and circuits, and can also measure the carrier frequency and pulse 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.

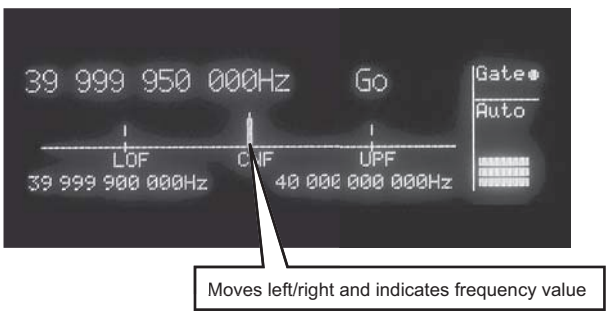
• High-Accuracy Burst Measurement

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.

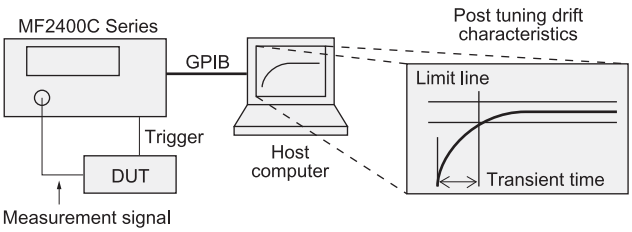


• Template Function

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 back panel as a TTL signal.
This is very useful for configuring an automatic Pass/Fail evaluation system (using analog display).

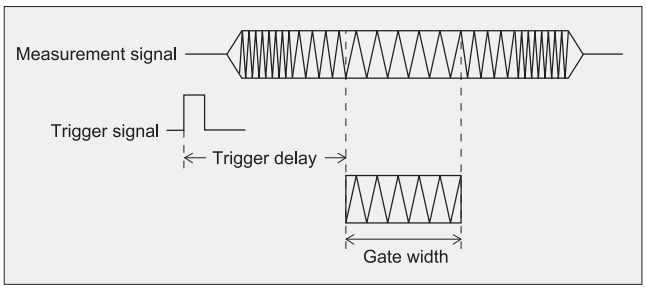
• High-Speed Transient Measurement

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.



• 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.



• 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.

• 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.

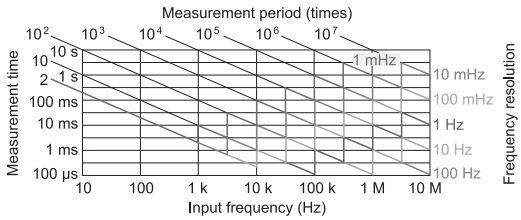
Specifications

• MF2400C Series Microwave Frequency Counter

Input	Frequency range	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 (50 Ω), 10 Hz to 10 MHz (1 MΩ)
	Input level range (sine wave input)	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 x frequency (GHz)] to +10 dBm (≤40 GHz) Input 2 25 mVrms to 2 Vrms (50 Ω), 25 mVrms to 10 Vrms (1 MΩ)
	Impedance, coupling	Input 1: 50 Ω, AC coupled Input 2: 50 Ω or ≥1 MΩ (≤35 pF), AC coupled
	Connector	Input 1 MF2412C: N-type, MF2413C: SMA-type, MF2414C: K-type Input 2: BNC-type
Gating function	Trigger mode	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: ≥100 Ω, Coupling: DC LINE: Triggered by AC line signal
	Trigger delay	20 ns to 0.1 s[*1], Off (≤320 ns in 20 ns steps, and <1 µs in 40 ns steps variable; ≥1 µs in continuously variable as effective two digits)
	Gate width	100 ns to 0.1 s (<1 µs in 20 ns steps variable; ≥1 µs in continuously variable as effective two digits)
Pulse modulation wave measurement	Frequency range	MF2412C: 600 MHz to 20 GHz, MF2413C: 600 MHz to 27 GHz, MF2414C: 600 MHz to 40 GHz
	Pulse width	340 ns to 0.1 s (NARROW), 1 µs to 0.1 s (WIDE)
	Pulse repetition cycle	340 ns to 0.1 s (pulse off time: ≥240 ns)
	Carrier frequency measurement[*2]	Max resolution: 1 kHz (pulse width: 100 ns to 1 µs), 100 Hz (pulse width: 1 to 10 µs), 10 Hz (pulse width: 10 to 100 µs), 1 Hz (pulse width: 100 µs to 1 ms), 0.1 Hz (pulse width: 1 to 100 ms) Measurement time: (T or T_S whichever is greater) x $\{1/(f_R \times T_{GW})\}^2$ [*3] ∗Example of measurement time when measurement carrier frequency = 1 GHz, T = $2/f_R$, and $T_{GW} = 0.1/f_R$ Accuracy: ±2 count ± time base accuracy x measurement frequency ± trigger accuracy ± residual error[*5]
	Pulse width measurement	Resolution: 1 ns Accuracy: ±20 ns ± time base accuracy x measurement pulse width ± trigger accuracy (time) Unit: µs (fixed)
	Pulse period measurement	Resolution: 1 ns Accuracy: ±20 ns ± time base accuracy x measurement period ± trigger accuracy (time) Unit: µs (fixed)

Resolution	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
Measurement time	200 s	20 s	2 s	200 ms	20 ms	5 ms	5 ms

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 (50 Ω): 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 
	Measurement accuracy	Input 1 NORMAL: ±1 count ± time base accuracy x measurement frequency ± residual error*4 FAST: ±1 count ± time base accuracy x measurement frequency ± trigger accuracy ± residual error*5 Input 2 10 MHz to 1 GHz: ±1 count ± time base accuracy x measurement frequency 10 Hz to 10 MHz: ±1 count ± time base accuracy x 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 x 64 dots
Reference crystal oscillator		Frequency: 10 MHz Warm-up: ±5 x 10^{-8}/10 minutes Aging rate: ±5 x 10^{-9}/day, ±8 x 10^{-8}/year (after 24 h warm-up) Temperature characteristics: ±5 x 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*6, Output voltage: ≥2 Vp-p (open end, AC coupled), Output impedance: ≤400 Ω
External control		GPIB (conforms to IEEE488.2 standards): SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
Power		100 to 120 V/200 to 240 V (auto-switching), 50 to 60 Hz, ≤90 VA, ≤80 VA
Operating temperature		0˚ to 50˚C
Dimensions and mass		213 (W) x 88 (H) x 350 (D) mm, ≤5 kg
EMC		EN61326-1, EN61000-3-2
LVD		EN61010-1

∗1: Delay time until counter started by trigger detection
∗2: MANUAL measurement mode
∗3: f_R: frequency resolution, T_{GW}: gate width, T_S: processing time (50 µs), T: Pulse repetition cycle
∗4: Measurement frequency (GHz)/10 count (rms), 5 GHz Measurement example: 5/10 = 0.5 count (rms)
∗5: Measurement frequency (GHz)/2 count (rms), 5 GHz Measurement example: 5/10 = 0.5 count (rms)
∗6: 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	±5 x 10^{-10}/day, ±2 x 10^{-8}/year ∗After power-on, with reference to frequency after 72 h		
Temperature characteristics	±5 x 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, 2.5 m: 1 pc
F0012	Fuse, 3.15 A: 2 pcs
W2897AE	MF2412C/2413C/2414C Operation Manual: 1 copy
	Options
MF2412C-003	Crystal Oscillator (5 x 10^{-10}/day)
MF2413C-003	Crystal Oscillator (5 x 10^{-10}/day)
MF2414C-003	Crystal Oscillator (5 x 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 (K-P · K-P), 2 ft
J0127A	Coaxial Cord (BNC-P · RG-58A/U · BNC-P), 1 m
J0853*3	Coaxial Cord (N-P · SF104P · N-P), 2 m
J0854*4	Coaxial Cord (APC3.5-P · SF104P · APC3.5-P), 2 m
MP612A*5	Fuse Holder (N-P · N-J, DC to 1 GHz)
MP613A*5	Fuse Element (DC to 1 GHz, Power rating: 17 dBm, Failsafe rating: ≥35 dBm)
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
B0409	Carrying Case (With B0329L Protection Cover)
B0598A	Carrying Bag (soft type, with B0329L Protection Cover)
B0390G	Rack Mount Kit (19" type, one unit)
B0411A	Rack Mount Kit (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

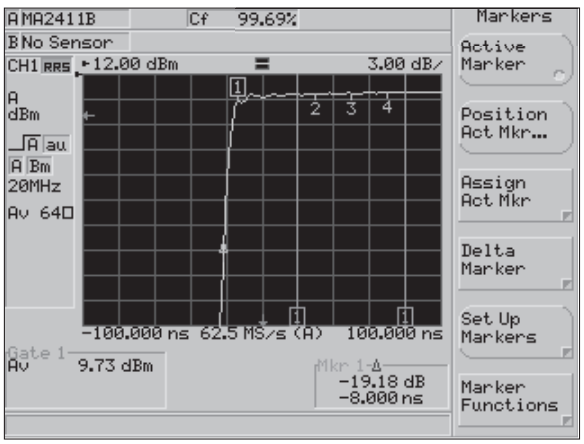
ML2490A Series

10 MHz to 50 GHz*

CE GPIB

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.



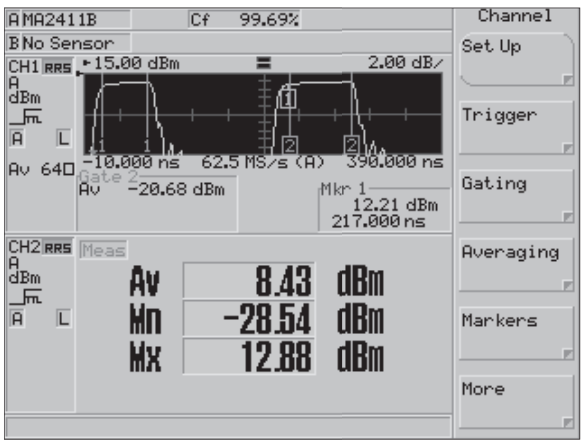
Fast Rise Time Measurements

*: 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 ns, 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>

Continued on next page

	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 x 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

Continued on next page

	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	90 to 250 VAC, 47 to 440 Hz, 40 VA Maximum		90 to 250 VAC, 47 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 x Height x Depth
Dimensions	213 (W) x 88 (H) x 390 (D) mm						
Mass	3 kg (excluding battery option)		3 kg				
Warranty	1 year Standard, 3 year Optional						

WIDEBAND PEAK POWER METERS

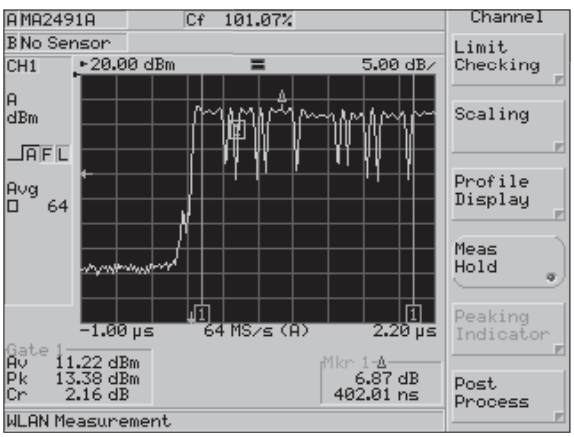
ML2480B Series

10 MHz to 50 GHz*

CE GPIB

For High Speed Modulated Power Measurements

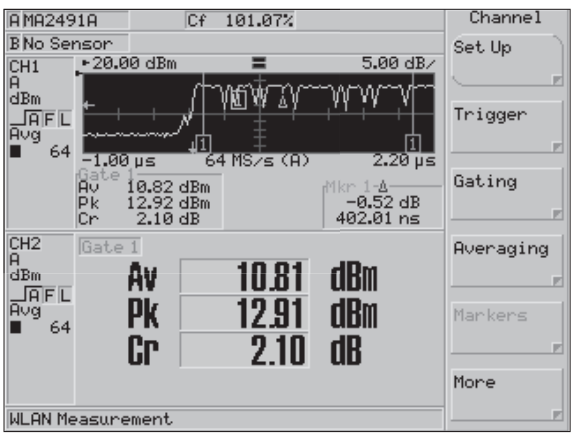
The ML2480B Series Power Meters are especially designed for accurate power measurements on high speed modulated measurements, as well as pulsed power measurements.
The power meter combines advances in diode sensor technology with DSP to produce a compact and economical high speed peak power meter. A 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 5/20 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

CE 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

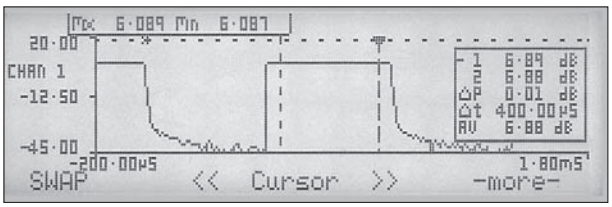
What use is high speed without triggering and sample controls? Data acquisition event arming and triggering functions traditionally found on expensive peak power meters are standard in the ML2430A series. Triggering delay and the sample integration time per reading can be directly controlled by the operator. 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 repeatably measured using between cursor averaging. Measure pulse-top power over >80 dB dynamic range in readout mode at GPIB speeds >200 readings per second.

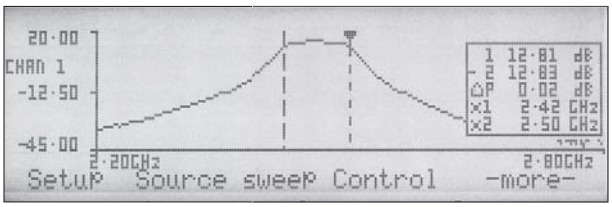
• Power vs. Time Graphics Display

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

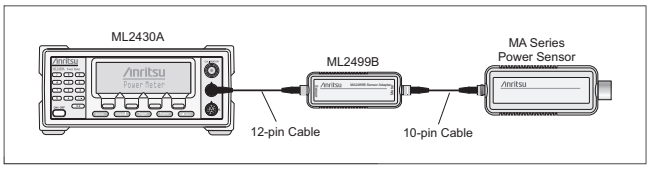
Softkey menus simplify instrument control by making the user interface easier to understand. The numerical keypad simplifies the operator interface.

• 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

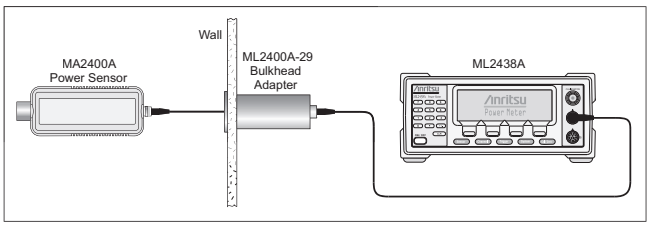
Traditional high power sensors are expensive and have degraded accuracy specifications. Further, their annual calibration requires more time and expense. Anritsu's new User Calibration Factor Tables avoid these problems. Any attenuator or coupler can be compensated by entering frequency and attenuation 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 standalone 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.

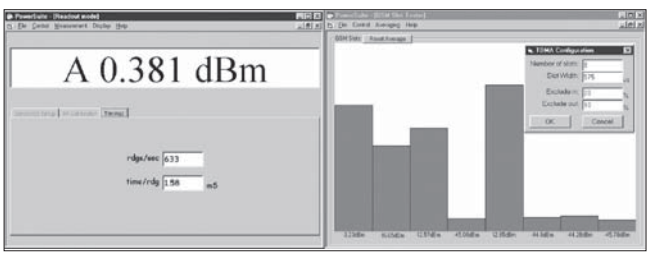
• Locate power sensors remotely

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
ML2400A-01	Rack Mount, single unit
ML2400A-03	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
ML2480B-001	Rack Mounted, right, (for ML248xB models)
ML2480B-003	Rack Mounted, right, dual (for ML248xB models)
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
	Options 1, 3, 5 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
ML2400A-01	Rack Mount, single unit
ML2400A-03	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
633-19	NiMH Battery
2000-996	NiMH Battery with Power Supply
2000-1534-R	NiMH Battery 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)
	Options 1 to 5 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.

CALIBRATION RECEIVER

ML2530A

100 kHz to 3 GHz

CE GPIB

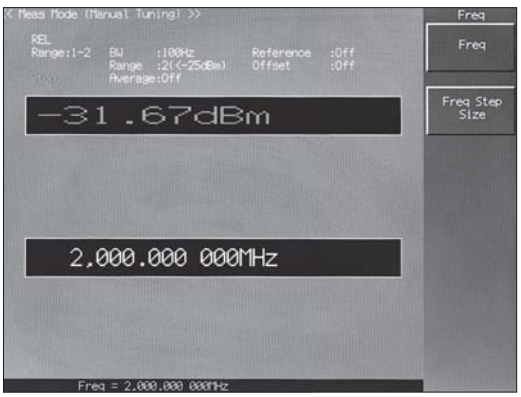
Measuring Level while Observing Signals under Test

Build-to order product

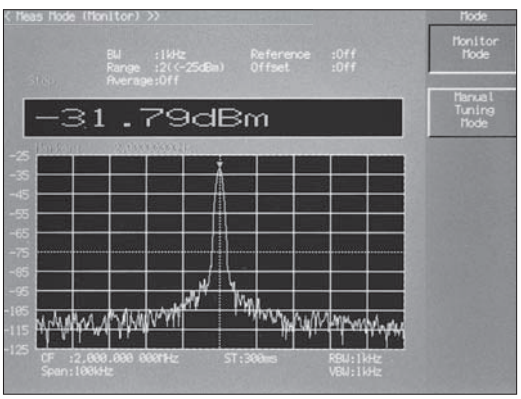
The ML2530A is a receiver for calibrating the output power level of such devices as signal generators and attenuators, covering the range of 100 kHz to 3 GHz. It is suitable for use as a reference level meter for the RF communications bands used by the world's mobile communications markets. High linearity is achieved by using a level detector that uses DSP technology. The level can be measured while observing the signal waveform to be measured by using the spectrum monitor function.

Features

- Wide dynamic range of –140 to +20 dBm and high linearity
- Provides measurement bandwidth of 1 Hz to 100 kHz, so that even signals with large residual FM can be measured using the 1 Hz bandwidth.
- Supports level units



Manual Tuning Mode



Monitor Mode

Specifications

• ML2530A Calibration Receiver

General	Frequency range	100 kHz to 3 GHz
	Level range	–140 to +20 dBm
	RF input connector	Connector: N-J Impedance: 50 Ω VSWR: ≤1.25 (Range 1), ≤1.40 (Range 2), ≤1.50 (Range 3) Max. Input level: +20 dBm, 0 Vdc
	CAL output*1	Connector: N-J Impedance: 50 Ω Frequency: 50 MHz ±500 kHz Level: 1.000 mW Level accuracy: ±1.2% (RSS: ±0.9%) Harmonic frequency: ≤–50 dBc
	Reference oscillator	Frequency: 10 MHz Start-up characteristics: ≤±5.1 x 10^{-8}/day (10 minutes after power on, with reference to frequency at 24 hours after power on) Aging rate: ≤±2.1 x 10^{-8}/day, ≤±10.1 x 10^{-8}/year (with reference to frequency at 24 hours after power on) Temperature characteristics: ≤±5.1 x 10^{-8} (with reference to frequency at 25˚C in 0˚ to 50˚C temperature range) Accuracy: ≤±15.1 x 10^{-8} (24 hours after power on, within 6 months of calibration)
	External reference input	Connector: BNC-J Impedance: 50 Ω Frequency: 10 MHz ±10 Hz Level: 0.5 to 5.0 Vp-p
	Internal reference output	Connector: BNC-J Impedance: 50 Ω Frequency: 10 MHz Frequency accuracy: Same as reference oscillator Level: 2.1 V ±0.6 Vp-p (when 2 m coaxial cable terminated with 50 Ω)
Level measurement	Measurement modes	Manual tuning: Measures level of frequency input directly by ten keys and encoder Monitor: Measures level of frequency specified by marker on spectrum monitor
	Measured frequencies	Range: 100 kHz to 3000 MHz, Resolution: 1 Hz
	Measurement bandwidth	Range: 1 Hz to 100 kHz (1-10 sequence) Filter: Gaussian type Accuracy (3 dB width): ±20% (BW: 1 Hz), ±5% (BW: 10 Hz to 100 kHz)
	Measured level	Range: –140 to +20 dBm Resolution: 0.1, 0.01, 0.001 dB
	Range	Range 1: –35 to +20 dBm, Range 2: –80 to –25 dBm, Range 3: –140 to –70 dBm
	Error*2	Total relative error: In-range linearity + range switching error + noise floor error +1 digit error Total absolute error: Total relative error + CAL output level accuracy + mismatch error at CAL + sensor module calibration factor uncertainty + calibration receiver linearity + sensor module insertion loss reproducibility + mismatch error In-range linearity: ±0.05 dB/55 dB (BW: 1/10/100 Hz, RSS: ±0.03 dB/55 dB) ±0.09 dB/55 dB (BW: 1/10 kHz, RSS: ±0.07 dB/55 dB) ±0.22 dB/55 dB (BW: 100 kHz, RSS: ±0.20 dB/55 dB) *In same range, BW: 100 kHz, frequency: ≥1 MHz Range switching error: ±0.01 dB (at range switch point: –30, –75 dBm) Noise floor (BW: at 100 Hz): ≤–70 dBm (Range 1, ≤11 MHz), ≤–80 dBm (Range 1, >11 MHz), ≤–115 dBm (Range 2, ≤11 MHz), ≤–120 dBm (Range 2, >11 MHz), ≤–125 dBm (Range 3, ≤11 MHz), ≤–135 dBm (Range 3, >11 MHz), Noise floor error: ±0.05 dB (S/N: ≤35 dB), ±0.4 dB (S/N: ≤25 dB), Not specified (S/N: ≤10 dB) Frequency drift error: ±0.007 dB (1% of BW frequency drift relative to set signal frequency) BW switching error: ±0.01 dB (BW: 1 Hz to 10 kHz), ±0.05 dB (BW: 1 Hz to 100 kHz, frequency: ≥1 MHz) *Excluding effect of measured signal residual FM
	Average	Measurement times: 1 to 256
	Display units	dBm, dB, dBμ, dBμ (emf) W, mW, μW, pW, fW, aW (automatically chosen best unit for measured value) V, mV, μV, nV, pV (automatically chosen best unit for measured value)
	Display digits	dB units: 0.1, 0.01, 0.001 dB W/V units: 3, 4, 5 digits
	Reference	Set any value: –180 to +60 dBm Meas → Ref: Obtain current measured value
	Offset	Setting range: –100 to +100 dB
	Calibration	Calibration frequency count: 300 Calibration level: 0 dBm +3/–4 dB (relative level calibration at Range 1, using MA2540A) –30 dBm +3/–4 dB (calibration between Range 1 and Range 2) –75 dBm +3/–4 dB (calibration between Range 2 and Range 3)
Spectrum monitor	Center frequency	100 kHz to 3 GHz, Min. setting resolution: 1 Hz
	Frequency span	10 kHz to 1 MHz, Setting resolution: 1 Hz
	Resolution bandwidth	300 Hz to 100 kHz (1-3 sequence)
	Video bandwidth	10 Hz to 100 kHz (1-3 sequence)
	Sweep time	100 ms to 1000 s
	Reference level	Range 1: +20 dBm, Range 2: –25 dBm, Range 3: –70 dBm

Continued on next page

Spectrum monitor	Markers	Functions MKR → PEAK: Moves marker to max. level in monitored range MKR → CNTR: Sets marker frequency to center frequency of monitored range PEAK → CNTR: Sets max. level frequency to center frequency of monitored range Frequency readout level Range 1: ≥–35 dBm, Range 2: ≥–80 dBm, Range 3: ≥–100 dBm Zone marker width: Spot, 1, 5, 10 div.
	Auto-tune	Signal detection frequency range: 30 to 3000 MHz Signal detection level: ≥–30 dBm
Other	Save/recall	Save count: 100
	Panel lock	Function: Disables all key and encoder functions except power switch and panel lock key
	GPIB	Function: Used to control ML2530A as device from controller Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
	Power supply	100 to 120 V/200 to 240 V (auto-switching), 47.5 to 63 Hz, ≤120 VA
	Dimensions and mass	426 (W) x 221.5 (H) x 451 (D) mm, ≤17.9 kg
	Environmental conditions	Operating temperature range: 0˚ to +50˚C Storage temperature range: –20˚ to +60˚C
	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1

∗1: At constant temperature in operating range of 15˚ to 35˚C
∗2: At fixed temperature in ambient temperature range of 15˚ to 35˚C, and level calibration after 1 hour warm-up

• MA2540A Sensor Module

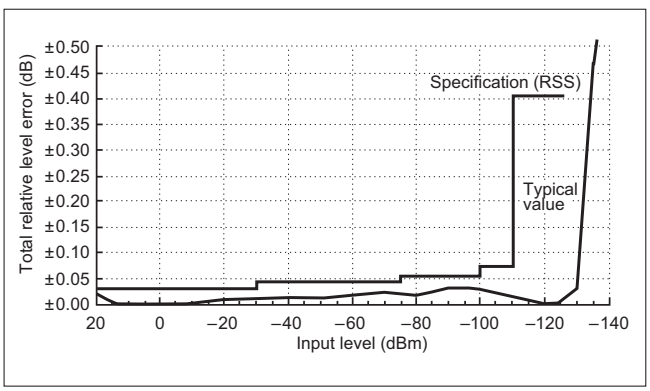
Frequency range	100 kHz to 3 GHz
Level	Level range: –140 to +20 dBm, Max. input level: +20 dBm
RF input connector	Type: N-J Nominal impedance: 50 Ω VSWR (power sensor side): ≤1.30 (100 to 300 kHz), ≤1.20 (0.3 to 1 MHz), ≤1.36 (1 to 3000 MHz) VSWR (through side): ≤1.12 (0.1 to 100 MHz), ≤1.35 (100 to 3000 MHz)
RF output connector	Type: N-J, Nominal impedance: 50 Ω
RF input/output characteristics	Through side insertion loss: ≤0.7 dB Through side insertion loss reproducibility: ±0.006 dB
Dimensions and mass	63 (W) x 54 (H) x 206 (D) mm, ≤1 kg
Environmental conditions	Same as the ML2530A

Sensor Module Calibration Factor Uncertainty

Frequency	Simple total	RSS total
0.1 MHz	±3.0%	±1.4%
10 MHz	±2.4%	±1.1%
100 MHz	±2.4%	±1.1%
1000 MHz	±3.0%	±1.4%
2000 MHz	±3.0%	±1.4%
3000 MHz	±3.2%	±1.5%

Total Level Error

The total level error is the total of each error source. For example, the total relative level error at a frequency of 1 GHz and a BW of 100 Hz is as shown below.



The absolute level error for a measured signal at a frequency of 1 GHz, measurement bandwidth of 100 Hz, device under test VSWR of 1.5, and signal level of –100 dBm is as follows.

Source of uncertainty	NIST traceable uncertainty
Relative level error at –100 dBm	1.6% (±0.07 dB)
CAL output level error	±0.93%
Mismatch error at calibration	±0.23%
Sensor module calibration factor error at measured frequency	±1.4%
Linearity error of the ML2530A power measurement section	±1.0%
Sensor module relay repeatability	±0.14% (±0.006 dB)
DUT mismatch error sensor module + calibration receiver	±3.7% VSWR: 1.2 (typ.)
Total (RSS)	±4.5 (±0.19 dB)

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
ML2530A	Calibration Receiver
	Standard accessories
	Power Cord, 2.6 m: 1 pc
F0012	Fuse, 3.15 A: 2 pcs
W1492AE	ML2530A Operation Manual: 1 copy
	Optional accessories
MP721A	Fixed Attenuator (DC to 12.4 GHz, 3 dB, 2 W)
MP721B	Fixed Attenuator (DC to 12.4 GHz, 6 dB, 2 W)
MP721C	Fixed Attenuator (DC to 12.4 GHz, 10 dB, 2 W)
MP721D	Fixed Attenuator (DC to 12.4 GHz, 20 dB, 2 W)
MP721E	Fixed Attenuator (DC to 12.4 GHz, 30 dB, 2 W)
MP721F	Fixed Attenuator (DC to 12.4 GHz, 40 dB, 2 W)
MP721G	Fixed Attenuator (DC to 12.4 GHz, 50 dB, 2 W)
MP721H	Fixed Attenuator (DC to 12.4 GHz, 60 dB, 2 W)
J0078	High Power Fixed Attenuator (20 dB, 10 W)
J0063	High Power Fixed Attenuator (30 dB, 10 W)
J0395	High Power Fixed Attenuator (30 dB, 30 W)
J0007	GPIB Cable, 1 m
J0008	GPIB Cable, 2 m
J0431F	Coaxial Cable (BNC-P · RG55A/U · BNC-P), 1 m
J0431G	Coaxial Cable (BNC-P · RG55A/U · BNC-P), 2 m
J0903A	Coaxial Cable (NP · RG-142B/U · N-P), 1.5 m
J0904A	Sensor Module Cable, 1.5 m (for MA2540A control)
B0333D	Rack Mount Kit
B0329D	Front Cover
B0331D	Front Handle (2 pcs/set)
B0332	Joint Plate (4 pcs/set)
B0334D	Carrying Case (hard type, with protective cover and casters)
	Sensor module
MA2540A	Sensor Module
	Standard accessories
J0903A	Coaxial Cable (N-P · RG-142B/U · N-P), 1.5 m: 1 pc
J0904A	Sensor Module Cable, 1.5 m (for MA2540A control): 1 pc
W1491AE	MA2540A Operation Manual: 1 copy

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
Impedance	50 Ω unbalanced Return loss: ≥30 dB (DC to 100 MHz) ≥25 dB (DC to 300 MHz) ≥20 dB (DC to 500 MHz)
Connector	N-type
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, DC to 500 MHz) Residual loss: ≤0.2 dB (DC to 100 MHz) ≤0.4 dB (DC to 300 MHz) ≤0.5 dB (DC 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
MN510C	**Main frame** Resistance Attenuator (build-to order product)
J0025A W0219CE	**Standard accessories** Coaxial Cord (S-5DWP · 5D-2W · S-5DWP), 1 m: 2 pcs MN510C Instruction Manual: 1 copy

PROGRAMMABLE ATTENUATOR

MN63A, MN65A, MN72A

DC to 2 GHz DC to 6 GHz DC to 18 GHz

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**

Model	MN63A	MN65A	MN72A
Frequency range	DC to 2 GHz	DC to 6 GHz	DC to 18 GHz
Impedance	50 Ω 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 to 1.5 GHz) ≤1.37 (≥16 dB, 1.5 to 2 GHz)	50 Ω unbalanced VSWR (return loss): ≤1.4 (≥15.6 dB, DC to 2 GHz) ≤2.0 (≥9.6 dB, 2 to 6 GHz)	50 Ω unbalanced VSWR (return loss): ≤1.2 (≥20.8 dB, DC to 2 GHz) ≤1.6 (≥12.8 dB, 2 to 12.4 GHz) ≤1.9 (≥10.2 dB, 12.4 to 18 GHz)
Input/Output connector	N-type		SMA-type
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 to 1.5 GHz, 1 to 10 dB) ±0.7 dB (1 to 1.5 GHz, 11 to 80 dB) ±1.0 dB (1 to 1.5 GHz, 81 to 100 dB) ±0.7 dB (1.5 to 2 GHz, 1 to 10 dB) ±1.0 dB (1.5 to 2 GHz, 11 to 80 dB) ±1.5 dB (1.5 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 to 4 GHz, 7 to 10 dB) ±0.7 dB (2 to 4 GHz, 11 to 30 dB) ±1.2 dB (2 to 4 GHz, 31 to 70 dB) ±1.5 dB (2 to 4 GHz, 71 to 85 dB) ±0.5 dB (4 to 6 GHz, 1 to 6 dB) ±0.7 dB (4 to 6 GHz, 7 to 10 dB) ±0.9 dB (4 to 6 GHz, 11 to 30 dB) ±1.6 dB (4 to 6 GHz, 31 to 70 dB) ±1.8 dB (4 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 to 12.4 GHz, 31 to 60 dB) ±2.0 dB (2 to 12.4 GHz, 61 to 70 dB) ±0.7 dB (12.4 to 18 GHz, 1 to 4 dB) ±0.9 dB (12.4 to 18 GHz, 5 to 10 dB) ±1.8 dB (12.4 to 18 GHz, 11 to 30 dB) ±3.2 dB (12.4 to 18 GHz, 31 to 60 dB) ±3.6 dB (12.4 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 to 1.5 GHz) 7.0 dB (1.5 to 2 GHz)	1.7 dB (DC to 2 GHz) 2.4 dB (2 to 4 GHz) 3.0 dB (4 to 6 GHz)	1.5 dB (DC to 2 GHz) 3.5 dB (2 to 12.4 GHz) 5.0 dB (12.4 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 $^{+10}_{-15}$ %, 50/60 Hz, ≤22 VA	AC 100 V $^{+10}_{-15}$ %, 50/60 Hz, ≤40 VA	AC 100 V $^{+10}_{-15}$ %, 50/60 Hz, ≤30 VA
Operating temperature range	0˚ to 50˚C		
Dimensions and mass	213 (W) x 88 (H) x 251 (D) mm, ≤4 kg	213 (W) x 88 (H) x 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	
	Standard accessories	
	Power Cord, 2.5 m:	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

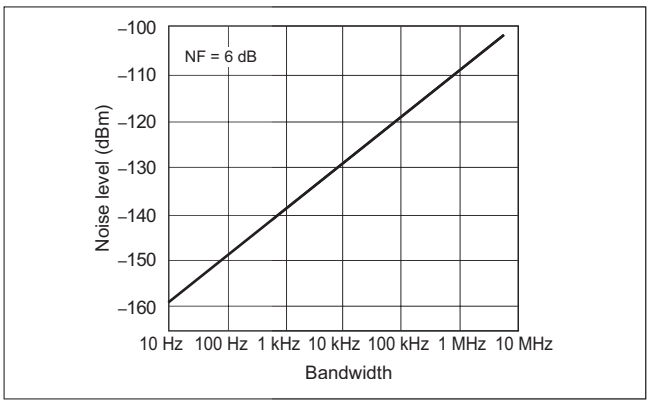
PRE-AMPLIFIER

MH648A

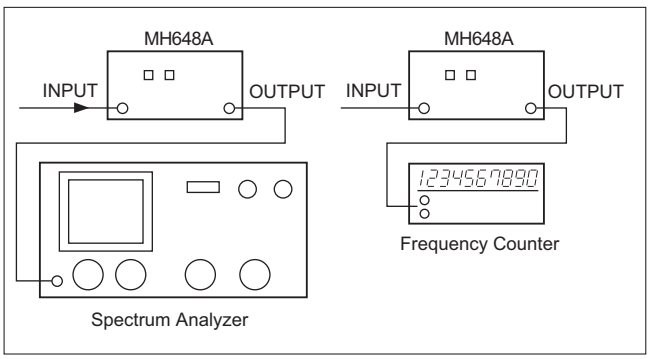
100 kHz to 1200 MHz

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	0.1 to 1200 MHz
Gain	30 dB ±1 dB (0.5 to 800 MHz), 30 dB +1.5/–6 dB (0.1 to 1200 MHz) ∗Input attenuator: 0 dB, 20˚ to 30˚C
Gain stability	±1.5 dB (0.1 to 800 MHz), ±3 dB (800 to 1200 MHz)
Noise figure	≤6 dB (0.5 to 800 MHz), ≤8 dB (0.1 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	50 Ω, VSWR: ≤2.5 (0.5 to 800 MHz), N (S)-type connector
Power supply	AC: 100 V, 50/60 Hz, ≤10 VA DC: 21 to 30 V, ≤120 mA
Operating temperature range	0˚ to 45˚C
Dimensions and mass	210 (W) x 95 (H) x 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
MH648A	**Main frame** Pre-amplifier
J0025A	**Standard accessories** Coaxial Cable (S-5DWP · 5D-2W · S-5DWP), 1 m: 1 pc
	Power Cord, 2.5 m: 1 pc
F0002	Fuse, 0.2 A: 3 pcs
W0261CE	MH648A Instruction Manual: 1 copy

EMI PROBE

MA2601B/MA2601C

5 to 1000 MHz 1 to 50 MHz

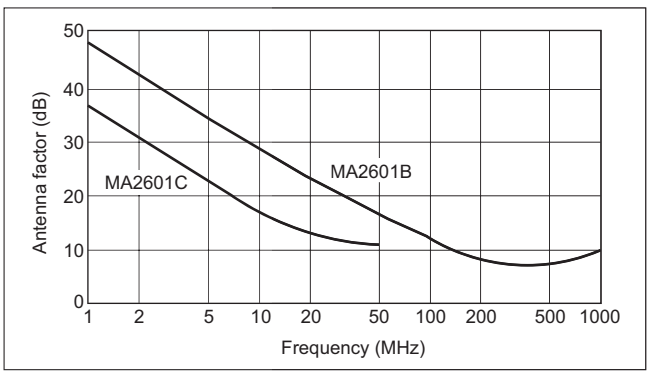


Fig. 1 Antenna Factor (for magnetic-field)

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 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

Specifications

Frequency range	5 to 1000 MHz (MA2601B), 1 to 50 MHz (MA2601C)
Antenna factor	Fig. 1
Connector	BNC-J
Dimensions	16 x 168 x 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
	MA2601B/C Operation Manual: 1 copy

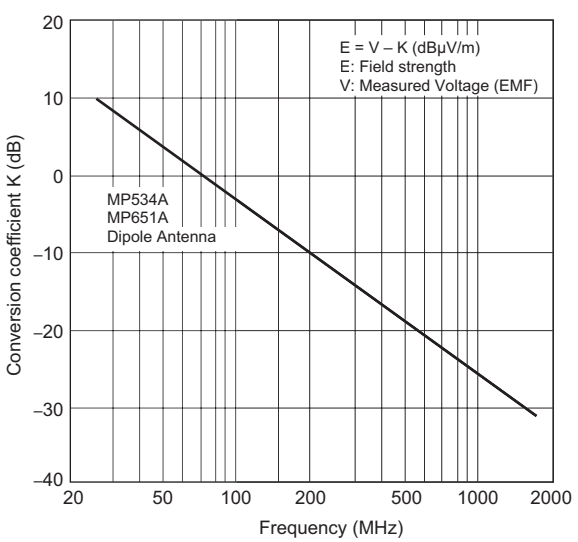
DIPOLE ANTENNA

MP534A/B, MP651A/B, MP663A

25 to 520 MHz 470 to 1700 MHz 300 to 1000 MHz

∗Tripod sold separately

MP534A MP663A



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 to 520 MHz	470 to 1700 MHz	300 to 1000 MHz
Input impedance	50 Ω (N-type connector)		
VSWR	≤2		
Average relative gain	0 dB		
Maximum input power	1 W (25 to 520 MHz) 10 W (250 to 500 MHz)	10 W	
Front-to-back ratio	0 dB		
Dimensions and mass	200 x 370 x 1300 mm, ≤11 kg	50 x 70 x 500 mm, ≤2.5 kg	80 x 120 x 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
0.8 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 0.8 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

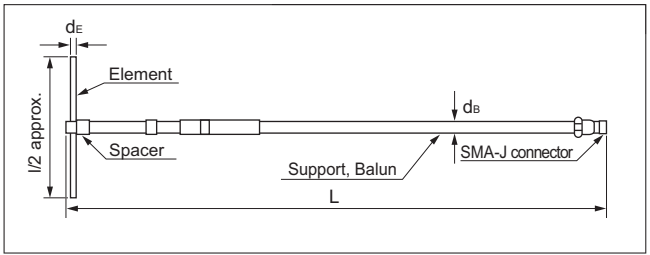
Specifications

Frequency range	0.8 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 to 880 MHz
MA5612A2	880 to 960 MHz
MA5612A3	1.4 to 1.55 GHz
MA5612B1	1.55 to 1.7 GHz
MA5612B2	1.7 to 1.95 GHz
MA5612B3	1.95 to 2.25 GHz
MA5612B4	2.25 to 2.6 GHz
MA5612B5	2.6 to 3 GHz
MA5612C1	3 to 3.5 GHz
MA5612C2	3.5 to 4 GHz
MA5612C3	4 to 4.6 GHz
MA5612C4	4.6 to 5.3 GHz
MA5612C5	5.3 to 6 GHz

Dimensions



Model	Element (d_E)	Support, Balun (d_B)	Support, Balun (L)
MA5612A series	ø2.5 mm	ø6 mm	300 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
MA5612 series	**Main frame** Dipole Antenna
J0698AE	**Standard accessories** 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)

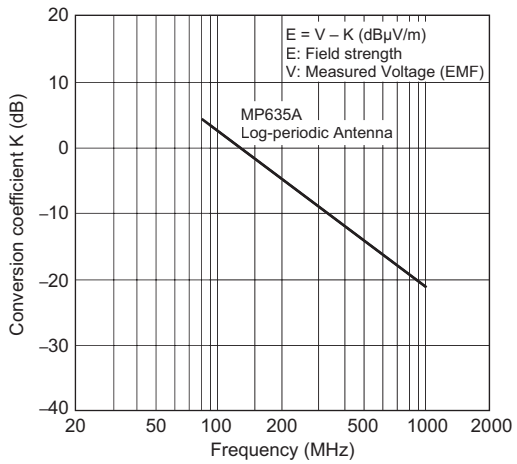
Note: When storing and transporting the antenna, use the dedicated antenna case and cable bag.

LOG-PERIODIC ANTENNA

MP635A, MP666A

80 to 1000 MHz 200 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 to 1000 MHz	200 to 2000 MHz
Input impedance	50 Ω (connector: N-type)	
VSWR	≤2.5	
Average relative again	5 dB	
Maximum input power	10 W	
Front-to-back ratio	≥15 dB	
Dimensions and mass	200 x 200 x 1750 mm, ≤7 kg	ø140 x 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

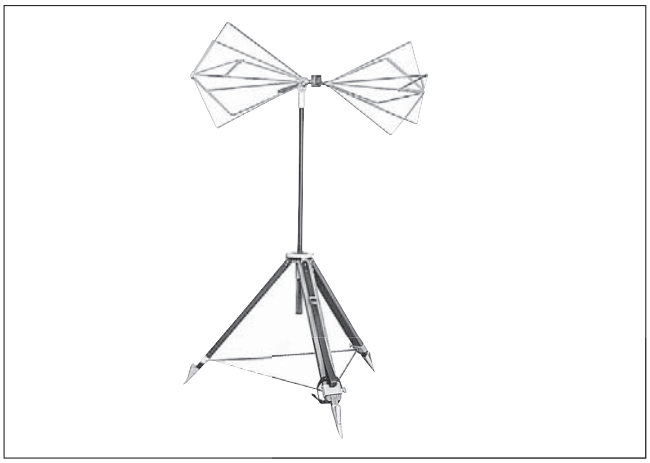
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

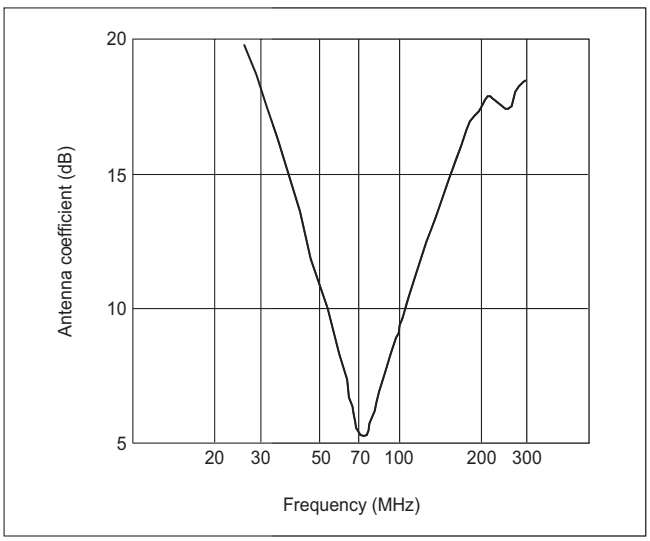
Model/Order No.	Name	
MP635A	**Main frame** Log-periodic Antenna	
J0025B	**Standard accessories** Coaxial Cable (S-5DWP · 5D-2W · S-5DWP), 10 m:	1 pc
B0104	Carrying Bag:	1 pc
W0286CE	MP635A Instruction Manual:	1 copy
MP666A	**Main frame** Log-periodic Antenna	
J0025B	**Standard accessories** Coaxial Cable (S-5DWP · 5D-2W · S-5DWP), 10 m:	1 pc
B0104	Carrying Bag:	1 pc
W0426CE	MP666A Instruction Manual:	1 copy
MB19A	**Optional accessories** Tripod (for MP635A/MP666A, with pole)	
MB9A	Tripod (for MP666A)	
MB18B	Pole (for MP666A)	

BICONICAL ANTENNA

BBA9106

30 to 300 MHz





The element length does not require adjustment. The BBA9106 and MP666A combination is convenient for EMI measurement.

Specifications

Frequency range	30 to 300 MHz
Input impedance	50 Ω, N-type connector
Dimensions and mass	520 x 700 x 1300 mm, <3 kg

Composition

Pole	MB18A, MB18B
Tripod	MB9A

Ordering Information

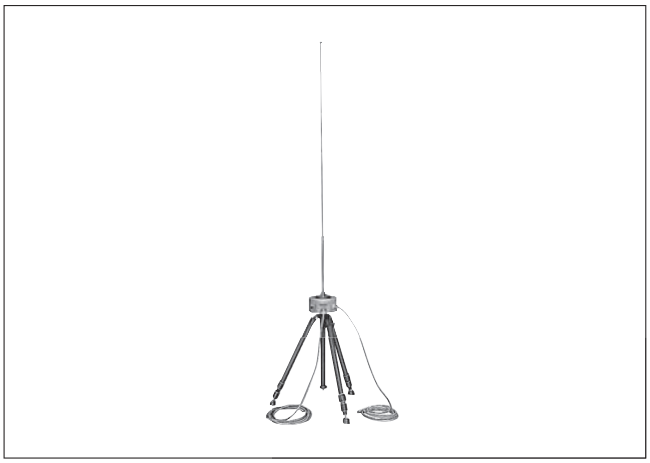
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
BBA9106/VHA9103	**Main frame** Biconical Antenna (with a balun)
	Standard accessories BBA9106 Operation Manual: 1 copy
J0025B	**Optional accessories** 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)

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	50 Ω
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
MP415B	**Main frame** Rod Antenna
J0133K J0397 W0493AE	**Standard accessories** Coaxial Cord (3CA-P2 · RG-55/U · 3CA-P2), 5 m: 1 pc Control Cable, 5 m: 1 pc MP415B Operation Manual (supplied with MP415B): 1 copy
MB27A J0040	**Optional accessories** Tripod Adaptor (N-P · BNC-J) 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	50 Ω
Connector	BNC
Power supply	Required Band Selector separately
Dimensions and mass	616 x 616 mm, ≤8 kg

Ordering Information

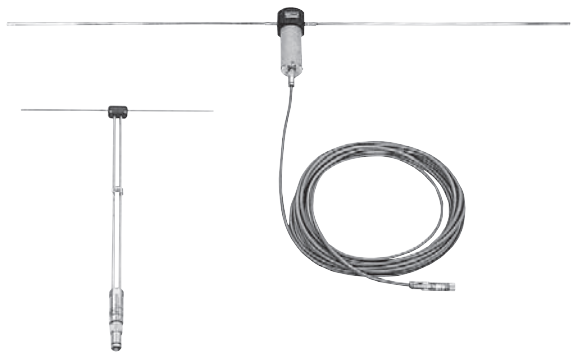
Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
MP414B	**Main frame** Loop Antenna
J0133K J0397 W0491AE	**Standard accessories** Coaxial Cord (3CA-P2 · RG-55/U · 3CA-P2), 5 m: 1 pc Control Cable, 5 m: 1 pc MP414B Operation Manual (supplied with MP414B): 1 copy
MB27A J0040	**Optional accessories** Tripod Adaptor (N-P · BNC-J) Band Selector

STANDARD DIPOLE ANTENNA SET

MP652B

30 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 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 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	50 Ω
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 Communications Research Laboratory of Japan's Ministry of Post and Telecommunications.

Composition

Baluns	30 to 85 MHz: 1 pc 100 to 250 MHz: 1 pc 300 to 400 MHz: 1 pc 500 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) x 260 (H) x 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	
MP652B	**Main frame** 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

MICROWAVE REPEATER CHECKER
MS75B

For Maintaining Microwave Repeaters

Build-to order product

The Microwave Repeater Checker (MRC) is an integrated microwave measuring instrument packed in a handy carrying case. It consists of three devices most frequently used for the maintenance of microwave communications systems: a power meter (10 MHz to 14 GHz) and frequency counter (10 Hz to 18 GHz) are standard accessories, and a signal generator is sold separately. The signal generator can be changed according to the frequency band to be measured. There are two difference generators available for the frequency range 6.3 to 7.8 GHz and 12 to 13 GHz.

Features

- Maintains and adjusts microwave line repeaters
- All parts and accessories are contained in the carrying case so the measurement procedure is less time-consuming.
- When removed from the carrying case, the power meter can be mounted independently in a specially designed case (optional accessory). It can run on either batteries or AC line power when used separately.

Specifications

• MS75B Microwave Repeater Checker

Power meter*1, *2	Indicator section Frequency range: Depends upon power sensor (10 MHz to 14 GHz) Measurement level: –20 to +10 dB Measurement range (full scale): –10 dBm (0.1 mW), –5 dBm (0.3 mW), 0 dBm (1 mW), +5 dBm (3 mW), +10 dBm (10 mW) Accuracy: ±3% in full scale Calibration oscillator: 50 MHz, Output level: 0 dBm, Connector: N-type Power sensor Frequency range: 10 MHz to 14 GHz Input impedance: 50 Ω VSWR: ≤1.4 Maximum power: +22 dBm (150 mW) Input connector: N-type
Frequency counter	Frequency range Input 1: 10 Hz to 200 MHz, Input 2: 200 MHz to 18 GHz Input level Input 1: 50 mVrms, Input 2: –22 dBm (200 MHz to 14 GHz), –15 dBm (14 to 18 GHz) Resolution: 0.1 Hz, 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 1 MHz (Display digit: 12) Measurement accuracy: ±1 count ± time base accuracy Input impedance Input 1: ≥1 MΩ/≤40 pF, 50 Ω, Input 2: 50 Ω Coupling/Input connector Input 1: AC (BNC), Input 2: DC (N) FM tolerance (Input 2): 25 MHzp-p (200 to 500 MHz), 50 MHzp-p (500 MHz to 18 GHz) Reference oscillator stability: 2 x 10^{-8}/day
Power supply	AC 100 V $^{+10}_{-15}$ %, 50/60 Hz, ≤100 VA
Dimensions and mass	460 (W) x 180 (H) x 370 (D) mm, ≤15 kg

∗1: The calibration factor accuracy of the power sensor is ±5% at 10 MHz to 10 GHz and ±7% at 10 to 14 GHz.
∗2: Power measurement error: During power measurement, impedance mismatch produces an error.
The error varies according to VSWR CTS value at the signal output connector.
The measurement error is as shown as below when the sensor VSWR is assumed to be 1.4.

• MG724E/G Signal Generator
(sold separately, build-to order product)

Model	MG724E	MG724G
Frequency range	6.3 to 7.8 GHz	12 to 13 GHz
Frequency dial accuracy	0.3%	
Output level*	–100 to –5 dBm (Max.: ≥0 dBm)	
Output level accuracy	±1.5 dB	
VSWR at output connector*	≤1.7	
FREQ CHECK output	≥–5 dBm	
Output connector	N-type	

∗: VSWR must be measured at the end of the 2 m cable.

Composition

- **MS75B Microwave Repeater Checker**

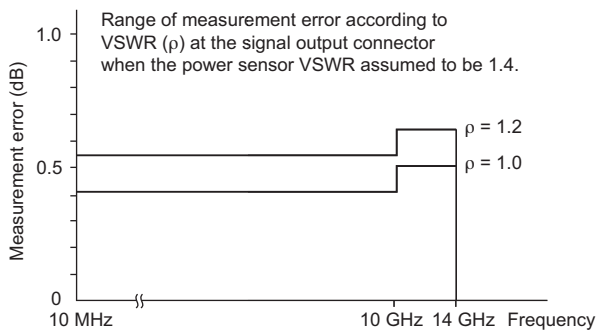
ML73B Power Meter, MA72A Power Sensor, Frequency counter

- **MG724E/G Signal Generator (sold separately)**

MG724E: 6.3 to 7.8 GHz, MG724G: 12 to 13 GHz

Optional Accessories

Item	Remarks
B0056 Case for ML73B	Power: AC 100 V, 50/60 Hz, rechargeable battery (rated operating hour: ≥5 hours) Dimensions and mass: 230 (W) x 50 (H) x 330 (D) mm, ≤4 kg (with power meter and power sensor) Recorder output: 1 V ±0.2 V at full scale
B0057 Case for MG724[ ]	240 (W) x 135 (H) x 120 (D) mm, ≤6 kg (with signal generator)
MP721D1 20 dB Coaxial Fixed Attenuator	20 dB, N-type, Max. input power: 2 W (+33 dBm), DC to 14 GHz
J0063 30 dB High-power Attenuator	30 dB, N-type, Max. input power: 10 W (+40 dBm), DC to 12.4 GHz
J0064A 5.8 to 8.6 GHz Band Coaxial-to-waveguide Adaptor	5.8 to 8.6 GHz, N-J · WRJ-7 (BRJ-7 flange)
J0064B 10 to 15 GHz Band Coaxial-to-waveguide Adaptor	10 to 15 GHz, N-J · WRJ-120 (BRJ-120 flange)



An Optional Carrying Case Allows for Independent Use of the Power Meter

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	
MS75B	Microwave Repeater Checker (build-to order product)	
	Composition (for MS75B)	
ML73B	Power Meter	
MA72A	Power Sensor	
	Frequency Counter	
	Standard accessories (for MS75B)	
J0161	Power Sensor Cable, 1.5 m (for MA72A):	1 pc
J0114B	Coaxial Cord (UG-21D/U · RG-9A/U · UG-21D/U), 2 m:	1 pc
	Power Cord, 2.5 m:	1 pc
MP540A	75 Ω/50 Ω Impedance Transformer:	1 pc
J0061	UG-29B/U Transformer Connector (N-type, J-J):	1 pc
J0246	MX-913/U Connector Cap (N-type):	1 pc
J0228	U Link:	1 pc
G0027	Screw Driver:	1 pc
F0022	Fuse, 2 A:	2 pcs
W0084AE	MS75B Operation Manual:	1 copy
	Signal Generator (sold separately)	
MG724E	Signal Generator (6.3 to 7.8 GHz, custom-made product)	
MG724G	Signal Generator (12 to 13 GHz, custom-made product)	
	Optional accessories	
B0056	Case for ML73B	
B0057	Case for MG724[ ]	
J0063	30 dB High-power Attenuator (30 dB, Max. input power: 10 W, DC to 12.4 GHz)	
J0064A	5.8 to 8.6 GHz Band Coaxial-to-waveguide Adaptor (5.8 to 8.6 GHz, coaxial N/flange BRJ-7)	
J0064B	10 to 15 GHz Band Coaxial-to-waveguide Adaptor (10 to 15 GHz, coaxial N/flange BRJ-120)	
MP721D1	20 dB Coaxial Fixed Attenuator (N-type, DC to 14 GHz)	

SIGNAL GENERATOR

MG724E1/G1

MG724E1: 6.3 to 7.8 GHz , MG724G1: 12 to 13 GHz

For Maintaining and Adjusting Microwave Links

Build-to order product

The MG724E1/G1 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		MG724E1	MG724G1
Frequency range		6.3 to 7.8 GHz	12 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, 50/60 Hz, ≤10 VA	AC 100 V, 50/60 Hz, ≤30 VA
Dimensions and mass		240 (W) x 135 (H) x 130 (D) mm, ≤4 kg	

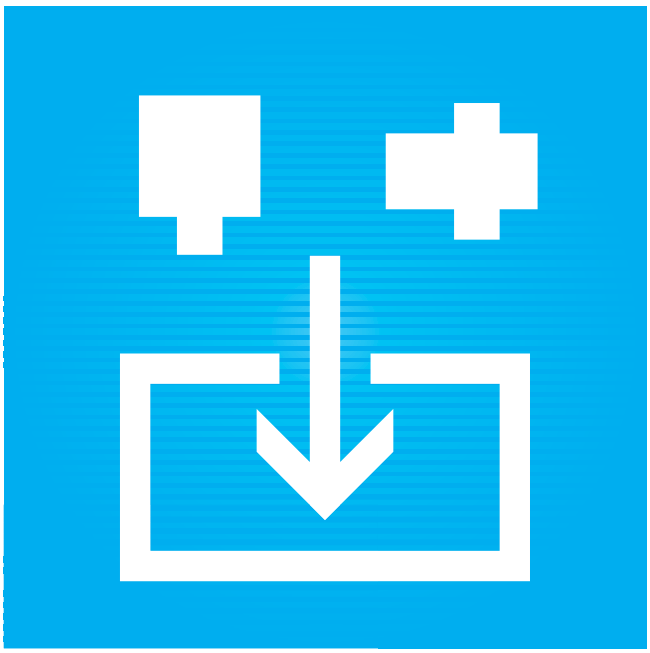
*: The value when measured at the end of the 2 m cable attached.

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	
MG724E1	Signal Generator (build-to order product)	
MG724G1	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, 2.5 m:	1 pc
F0016	Fuse, 0.2 A (for MG724E1):	2 pcs
F0017	Fuse, 0.5 A (for MG724G1):	2 pcs
F0039	Fuse, 0.2 A (for MG724E1):	1 pc
F0042	Fuse, 0.8 A (for MG724G1):	1 pc
W0082AE	MG724[ ]1 Operation Manual:	1 copy
	Application equipment	
B0051	Front Cover	

Model designation
MG724[ ] : Without power supply
MG724[ ]1 : With power supply

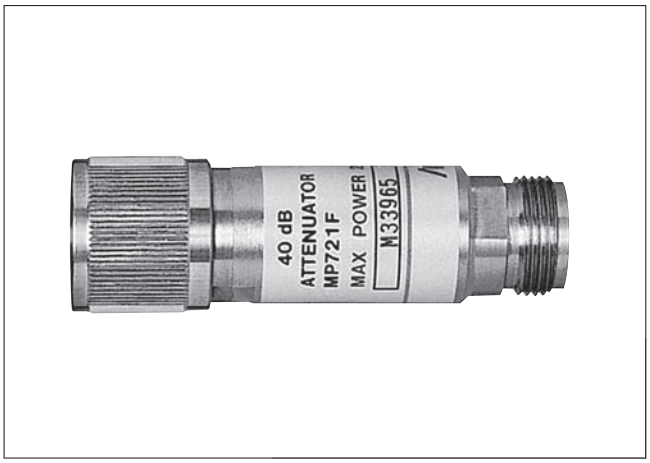


COMPONENTS

FIXED ATTENUATOR

MP721 Series

DC to 12.4 GHz



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	MP721A	MP721B	MP721C	MP721D	MP721E	MP721F	MP721G	MP721H
Attenuation	3 dB	6 dB	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB
Attenuation accuracy	0.3 dB			0.5 dB		1.0 dB (DC to 8 GHz), 1.5 dB (8 to 12.4 GHz)		
VSWR	1.25 (DC to 8 GHz) 1.35 (8 to 12.4 GHz)	1.2 (DC to 8 GHz) 1.3 (8 to 12.4 GHz)						
Maximum allowable power	2 W							
Impedance	50 Ω							
Connector	N-type							
Operating temperature range	0˚ to 50˚C							
Dimensions and mass	21ø x 63.5 mm, ≤100 g							

FIXED ATTENUATOR FOR HIGH POWER MEASUREMENT

Specifications

Model	J0063	J0078	J0395	B0472
Attenuation	30 dB	20 dB	30 dB	30 dB
Frequency range	DC to 12.4 GHz	DC to 18 GHz	DC to 9 GHz	DC to 18 GHz
Maximum allowable power	10 W (40 dBm)		30 W (44.7 dBm)	100 W (50 dBm)
Connector	N-type (50 Ω)			

TERMINATION
MP752A/B

DC to 12.4 GHz

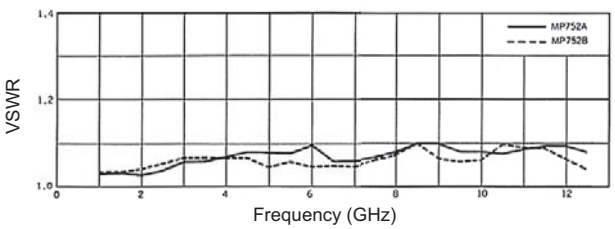
MP752A

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	50 Ω	
VSWR	1.15 (DC to 8 GHz), 1.20 (8 to 12 GHz)	
Maximum allowable power	2 W	
Connector	N-P	N-J
Operating temperature range	0˚ to 50˚C	
Dimensions and mass	20ø x 48 mm, ≤80 g	19ø x 50 mm, ≤80 g



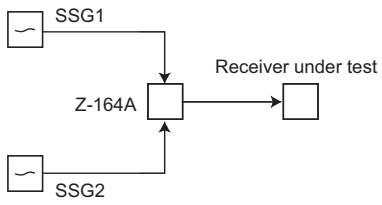
Characteristics

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.

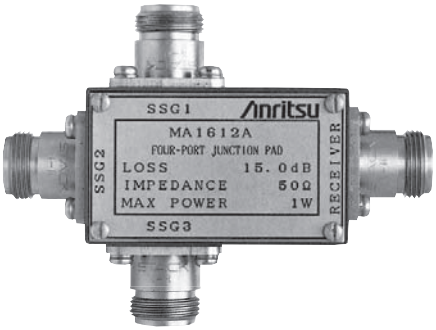
Specifications

Frequency range	DC to 1 GHz
Insertion loss	6 ±0.5 dB (voltage ratio)
Impedance characteristics	50 Ω VSWR: ≤1.3 (up to 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

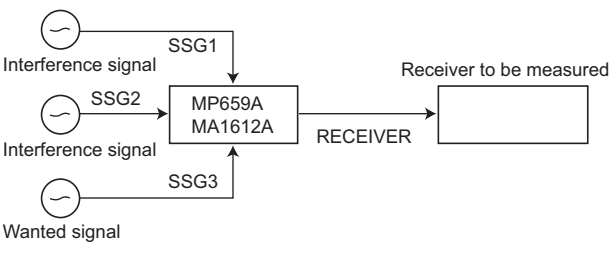


MA1612A

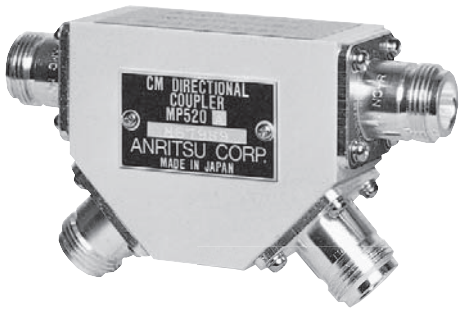
The MP659A and MA1612A are used as an impedance matching box applying the mixed output of three RF signal generators to a receiver input terminal for measurement of three-signal characteristics (such as receiver SINAD performance).

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	50 Ω VSWR: ≤1.3 (<500 MHz) ≤2.0 (≥1 GHz)	50 Ω VSWR: ≤1.4 (<1 GHz) ≤1.5 (≥500 MHz)
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 to 1700 MHz

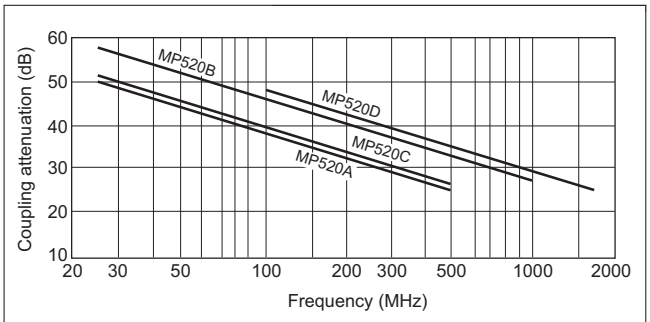


MP520A

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.

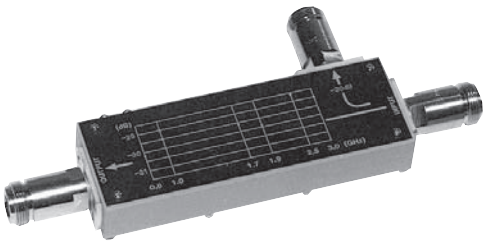
Specifications

Model	MP520A	MP520B	MP520C	MP520D
Frequency range	25 to 500 MHz	25 to 1000 MHz	25 to 500 MHz	100 to 1700 MHz
Impedance	75 Ω (NC-type connector)		50 Ω (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	50 Ω, VSWR: ≤1.07			
Operating temperature range	0˚ to 45˚C			
Dimensions and mass	98 (W) x 56 (H) x 26 (D) mm, ≤400 g			
Accessories supplied	Coaxial Cord (S-5DWP · 5D-2W · S-5DWP), 1 m: 1 pc Termination (50 Ω): 1 pc			



Coupling Attenuation Characteristics

DIRECTIONAL COUPLER
MP654A
0.8 to 3 GHz

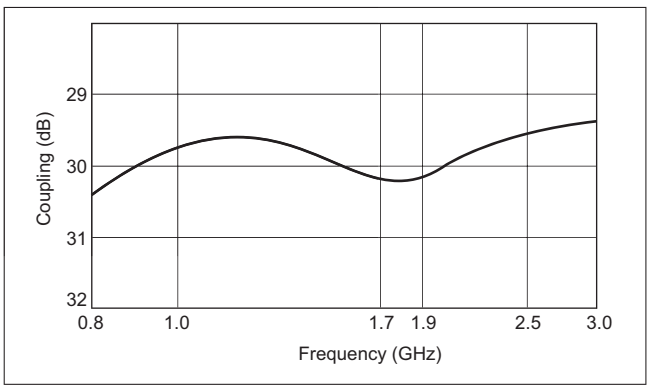


The MP654A is used to branch one part of the transmitted output for such measurements as those of fundamental wave and higher harmonic spurious characteristics using a spectrum analyzer. The MP654A is used for measuring personal radio transceivers and automobile telephones.

Specifications

Frequency range	0.8 to 3 GHz
Impedance	50 Ω (N-type connector)
Coupling	Approx. 30 dB*
Input power (max.)	50 W

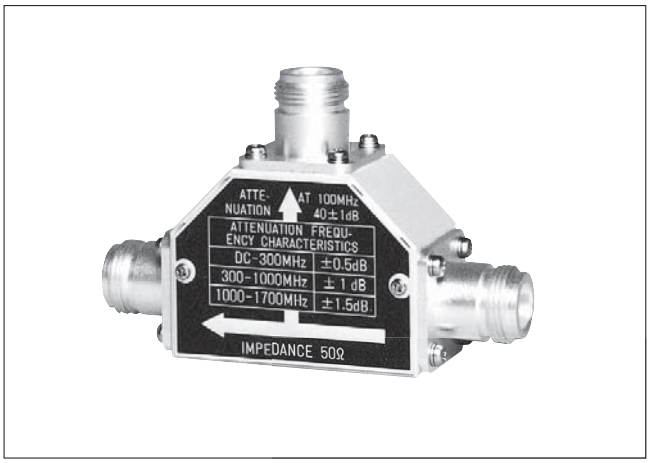
*: Calibration data reattached

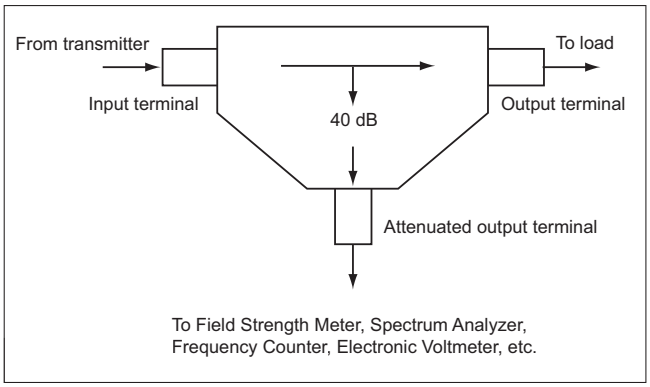


BRANCH

MP640A

DC to 1700 MHz

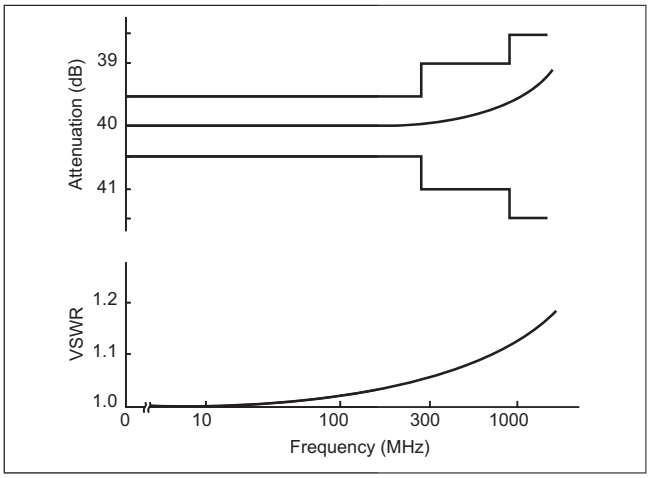




The MP640A is used for branching a part of the transmitted signal in measuring the spurious characteristics of a transmitter with a field strength meter or a spectrum analyzer. Its frequency characteristics of attenuation is flat over DC to 1700 MHz, so that it can be conveniently utilized for measurement without taking the frequency characteristic into consideration. The maximum allowable input power is 16 W.

Specifications

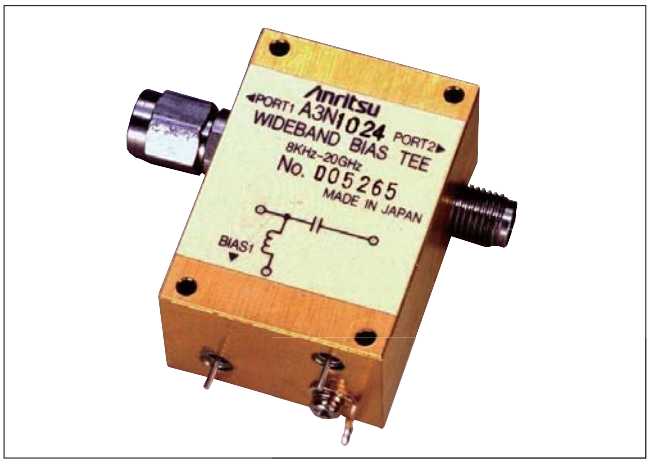
Frequency range	DC to 1700 MHz
Input/Output connector	N-type (50 Ω), VSWR: ≤1.2
Attenuation (input terminal to attenuated terminal)	40 dB ±1 dB at 100 MHz
Attenuation characteristics	±0.5 dB (DC to 300 MHz) ±1.0 dB (300 to 1000 MHz) ±1.5 dB (1000 to 1700 MHz)
Insertion loss	≤0.2 dB (DC to 300 MHz) ≤0.5 dB (300 to 1000 MHz) ≤1.0 dB (1000 to 1700 MHz)
Operating temperature range	0˚ to 45˚C
Dimensions and mass	91 (W) x 59 (H) x 31 (D) mm, ≤250 g



Typical Characteristics

BIAS TEE

A3N1000 Series



The A3N1000 Bias-T is for superimposing or extracting DC components without having any impact on high-frequency signals. Waveforms can be captured without degradation by connecting to the output of an open-drain amplifier.

Application

Semiconductor Input/Output Bias
LD Driver
Modulation Signal for Optical Modulator
Bias Supply to Measuring Instrument Input/Output

Absolute Maximum Rated Value

Maximum Bias Voltage: DC ±30 V
Maximum Bias Current: ±0.5 A
Operating Temperature Range: 0˚ to 60˚C

Connector

Standard Type Bias Terminal: Pin or K (F)
Thin Type (9.5 mm max.) Bias Terminal: Pin
Dual Type Bias Terminal: Pin
Wideband Type Bias Terminal: Pin

Specifications

Model		A3N1001 to A3N1008			A3N1013 to A3N1016			A3N1017 to A3N1020			A3N1024 to A3N1027		
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
Frequency		100 kHz	–	20 GHz	100 kHz	–	20 GHz	100 kHz	–	20 GHz	8 kHz	–	20 GHz
Insertion loss	100 kHz	–	2 dB	3 dB	–	2 dB	3 dB	–	2 dB	3 dB	–	2 dB (8 kHz)	3 dB (8 kHz)
	200 kHz	–	0.5 dB	–	–	0.5 dB	–	–	0.5 dB	–	–	0.5 dB (20 kHz)	–
	1 GHz	–	0.2 dB	–	–	0.2 dB	–	–	0.5 dB	–	–	0.5 dB	–
	10 GHz	–	1 dB	–	–	1 dB	–	–	1 dB	–	–	1 dB	–
	20 GHz	–	2 dB	3 dB	–	2 dB	3 dB	–	2 dB	3 dB	–	2 dB	3 dB
Return loss		12 dB	20 dB	–	12 dB	20 dB	–	11 dB	20 dB	–	10 dB	20 dB	–
Tr/Tf*1		–	18 ps	20 ps	–	18 ps	–	–	18 ps	–	–	18 ps	–
Connector*2		K connector			K connector			K connector			K connector		
		Standard type/ Bias terminal: pin or SMA (F)			Thin type (max. 9.5 mm)/ Bias terminal: pin			Dual type/Bias terminal: pin			Wide band type/ Bias terminal: pin		

∗1 Tr, Tf = $(Tm^2 - Ts^2 - Ti^2)^{1/2}$
Tm: Measurement value by Oscilloscope
Ts: Tr, Tf of Oscilloscope
Ti: Tr, Tf of Signal Generator

∗2 Specify male or female K connector for high-frequency signal input/output.

50 Ω ↔ 75 Ω IMPEDANCE TRANSFORMER

MP614B, MB-009

50 to 1200 MHz DC to 2 GHz

MP614B

The MP614B is used over the range from 50 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 50 Ω N-type plug is connected by mistake to the 75 Ω side.

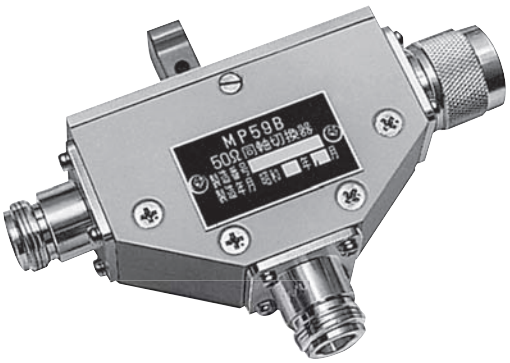
Specifications

Model	MP614B	MB-009
Frequency range	50 to 1200 MHz	DC to 2 GHz
Impedance characteristics	VSWR: ≤1.2 (50 to 600 MHz) ≤1.3 (≥600 MHz) *On the 75 Ω side by terminating the 50 Ω side	VSWR: ≤1.2 *On both sides of 50 and 75 Ω
Connector	N-P (50 Ω), NC-J (75 Ω)	
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 x 70 mm, ≤100 g	21ø x 65 mm

50 Ω COAXIAL SWITCHING UNIT

MP59B

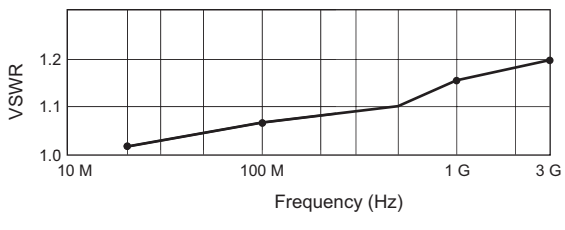
DC to 3 GHz



The MP59B 50 Ω Coaxial Switching Unit is used to switch signals in high-frequency measurement circuits.
Its low insertion loss and high isolation performance support all types of measurement.

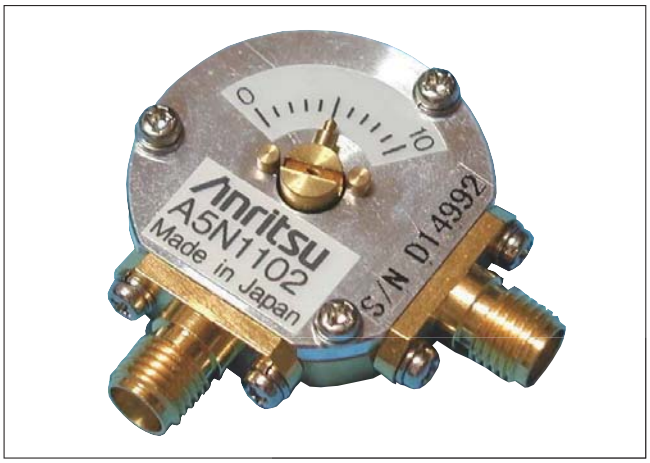
Specifications

Frequency range	DC to 3 GHz
Impedance	50 Ω
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

PHASE SHIFTER
A5N1102



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.

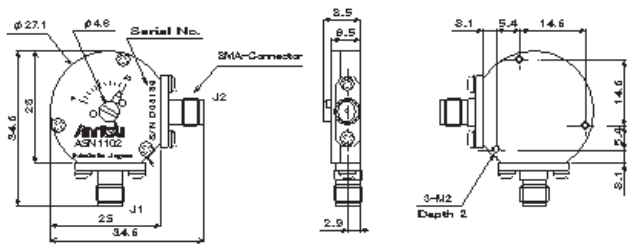
Features
Bandwidth: DC to 11 GHz
Low Insertion Loss: 1.2 dB max. (11 GHz)
Size: 35 × 35 × 8.5 mm
Weight: About 25 g

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 to 55 Hz, total amplitude 1.5 mm
Shockproofing: 490 m/s^2

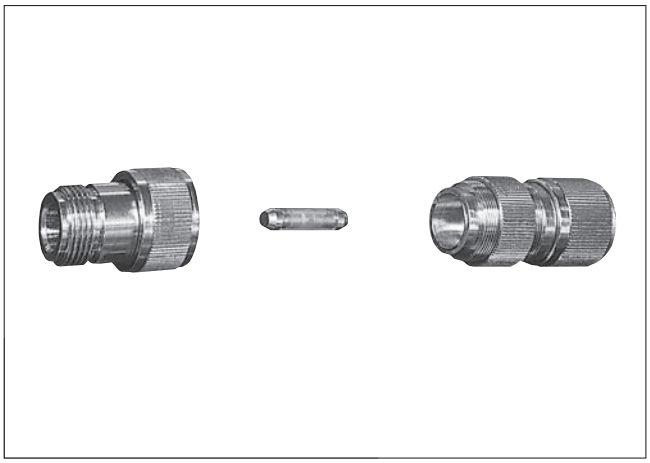
External Dimensions Diagram



Mass: Approx. 25 g

RF FUSE HOLDER
MP612A
DC to 1000 MHz

FUSE ELEMENT
MP613A

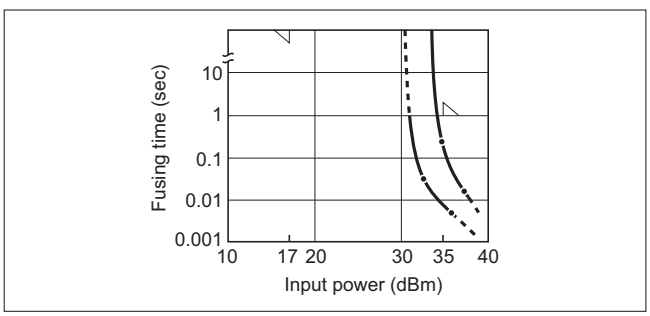


The MP612A RF Fuse Holder protects measuring instruments by preventing internal damage (parts burnout, etc.). The MP613A Fuse Element uses a vacuum-deposited metal resin film for low melting point and excellent high-frequency characteristics. The high fuse performance is designed to prevent damage even 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 1000 MHz
Impedance	50 Ω unbalanced, VSWR: ≤1.2 (50 Ω termination)
Connector	N-P, N-J
Insertion loss	≤0.5 dB
Rated power	17 dBm (50 Ω load)
Max. fuse rated power	≤35 dBm (50 Ω load)
Operating temperature range	0˚ to 45˚C
Dimensions and mass	20ø x 65 mm, ≤110 g

MP613A Fuse Element (5 pcs/set)

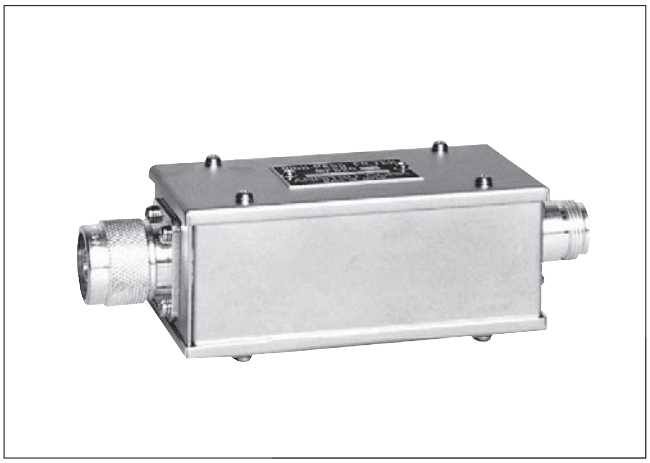


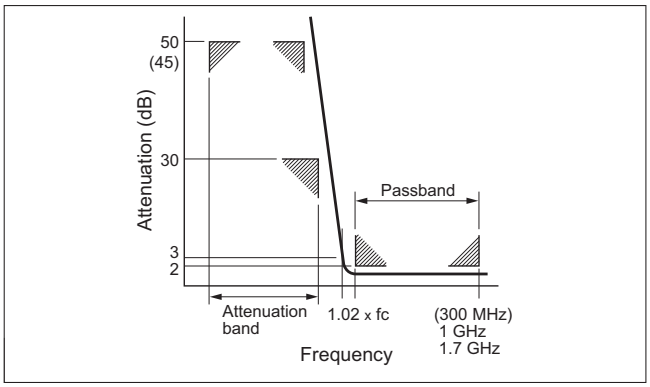
Fusing time (sec) and Input power (dBm) characteristics

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.

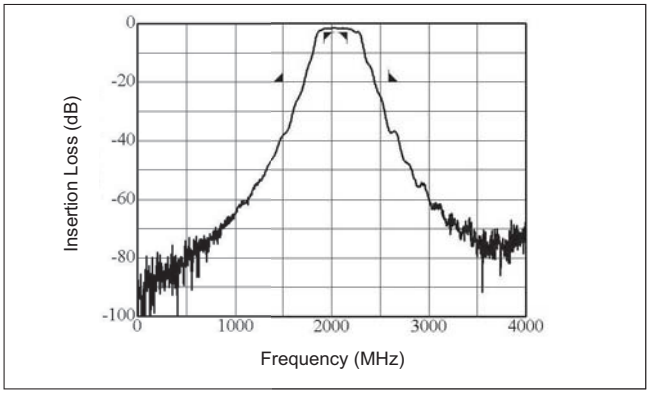
Specifications

Model	MP526A	MP526B	MP526C	MP526D	MP526G
Frequency band	60 MHz	150 MHz	250 MHz	400 MHz	27 MHz
Attenuation band	50 to 80 MHz	120 to 190 MHz	200 to 300 MHz	335 to 520 MHz	26 to 30 MHz
Cut-off frequency (fc)	100 MHz	240 MHz	400 MHz	670 MHz	52 MHz
Attenuation characteristics	≥50 dB (70 MHz) ≥30 dB (80 MHz)	≥50 dB (170 MHz) ≥30 dB (190 MHz)	≥50 dB (280 MHz) ≥30 dB (300 MHz)	≥50 dB (470 MHz) ≥30 dB (300 MHz)	≥45 dB (28 MHz) ≥30 dB (30 MHz)
Passband	≥ (1.02 x 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	50 Ω nominal, connector: N-type				
Operating temperature range	0˚ to 45˚C				
Dimensions and mass	51 (W) x 48 (H) x 138 (D) mm, ≤400 g				

BAND PASS FILTER
MA2512A
1.92 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.



Frequency Characteristics

Specifications

Pass band	Frequency range: 1.92 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: 50 Ω Return loss: ≥15 dB
Filter band	Frequency range: DC to 1.5 GHz, 2.58 to 7 GHz Attenuation: ≥20 dB (<5 GHz), ≥10 dB (≥5 GHz)
I/O connector	N-J
Max. input power	1 W
Dimensions and mass	148 (W) x 35 (H) x 31 (D) mm, ≤500 g

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
W1876AE	**Standard accessory** MA2512A Operation Manual: 1 copy

PERIPHERAL EQUIPMENT

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) x 350 (H) x 451 (D) mm, 40 kg	426 (W) x 550 (H) x 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

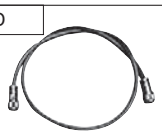
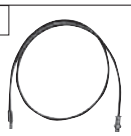
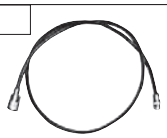
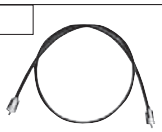
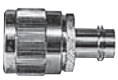
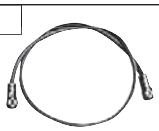
Ordering Information

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 A125 V Type A Cable Tap
J1340A	20 A125 V Type A Cable Tap
B0585A	Portable Test Rack Angle
B0343	Safety Belt (1.5 m)

COAXIAL CORDS, ADAPTERS

	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
		30	Coaxial cord	S-5DWP · 5D-2W · S-5DWP	1 m 2 m	J0025A J0025C
		2	Coaxial cord	3CA-P2 · TG-58A/U · 3CA-P2	1 m 2 m	J0133A J0133C
		3	Clip conversion pad	N-J · Clip		J0047
		4	Coaxial cord	3CA-P2 · TG-58A/U · Alligator clip	1 m	J0054A
	75 Ω	5	Coaxial cord	3CV-P2 · 3C-2V · 3CV-P2	1 m 2 m	J0026A J0081
		6	Coaxial cord	SP-3CP · 3C-2WS · SP-3CP	1 m 2 m	J0028A J0028B
		7	Coaxial cord	SP-3CP · 3C-2WS · 3CW-P	1 m 2 m	J0029A J0029B
		8	Coaxial cord	P-5CP · 5C-2W · P-5CP	1 m 2 m	J0030A J0030B
		9	Coaxial cord	M-P-3 · 3C-2V · 3CV-P2	1 m 2 m	J0027A J0027B
		10	Coaxial cord	M-P-5 · 5C-2V · M-P-5	1 m 2 m	J0031A J0031B
	(balanced)	11	Balanced cord	I-214APS · C1UUS shielded connecting cord · I-214APS	1 m 2 m	J0032 J0033
		12	Balanced cord	M-214S · Shielded connecting cord · M-214S	1 m	J0050A
		13	CS1-MM2 shielded connecting cord		2 m	J0034
Conversion connectors	50 Ω	14	Coaxial adapter	N-P · N-P	–	J0038
		15	Coaxial adapter	N-J · N-J	–	J0039
		16	Coaxial adapter	N-P · BNC-J	–	J0040
		17	Coaxial adapter	N-J · BNC-J	–	J0044
		18	Coaxial adapter	N-J · BNC-P	–	J0043
	–	19	Coaxial adapter	N-P · M-J		J0041
		20	Coaxial adapter	N-J · M-P	–	J0042
	75 Ω	21	Coaxial adapter	NC-P · SP-3CJ	–	J0046
		22	Coaxial adapter	NC-P · BNC-J	–	J0055
		23	Coaxial adapter	BNC-P · M-J	–	J0045
		24	Coaxial adapter	SP-3CJ · 3C-P (BNC-P)	–	J0053
		25	Coaxial adapter	SP-3CP · 3C-J (BNC-J)	–	J0052
U-link	75 Ω	26	MP529A U-Link		–	–
Coaxial T-connectors	50 Ω	27	Coaxial T-connector	S (N)-type	–	J0048
	70 Ω	28	Coaxial T-connector	M-type	–	J0049

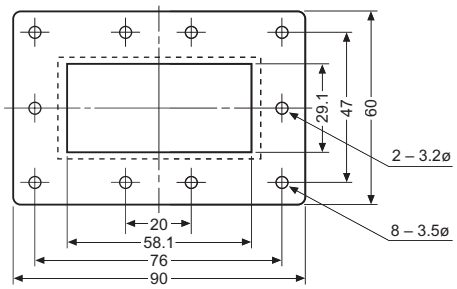
Order Number / Item/Composition			
J0576B/D 1  Coaxial cord 1 m/2 m N-P · 5D-2W · N-P	J0133A/C 2  Coaxial cord 1 m/2 m 3CA-P2 · RG-58A/U · 3CA-P2	J0047 3  Clip conversion pad, N-J · clip	J0054A 4  Coaxial cord 1 m 3CA-P2 · RG-58A/U · Alligator clip
J0026A J0081 5  Coaxial cord 1 m/2 m 3CV-P2 · 3C-2V · 3CV-P2	J0028A/B 6  Coaxial cord 1 m/2 m SP-3CP · 3C-2WS · SP-3CP	J0029A/B 7  Coaxial cord 1 m/2 m SP-3CP · 3C-2WS · 3CW-P	J0030A/B 8  Coaxial cord 1 m/2 m P-5CP · 5C-2W · P-5CP
J0027A/B 9  Coaxial cord 1 m/2 m M-P-3 · 3C-2V · 3CV-P2	J0031A/B 10  Coaxial cord 1 m/2 m M-P-5 · 5C-2V · M-P-5	J0032 J0033 11  Balanced cord 1 m/2 m I-214APS · C1UUS shielded connecting cord · I-214APS	J0050A 12  Balanced cord 1 m, M-214S · shielded connecting cord · M-214S (compatible with I-214APS)
J0034 13  CS1-MM2 shielded connecting cord, 2 m	J0038 14  Coaxial adapter N-P · N-P	J0039 15  Coaxial adapter N-J · N-J	J0040 16  Coaxial adapter N-P · BNC-P
J0044 17  Coaxial adapter N-J · BNC-J	J0043 18  Coaxial adapter N-J · BNC-P	J0041 19  Coaxial adapter N-P · M-J	J0042 20  Coaxial adapter N-J · M-P
J0046 21  Coaxial adapter NC-P · SP-3CJ	J0055 22  Coaxial adapter NC-P · BNC-J	J0045 23  Coaxial adapter BNC-P · M-J	J0053 24  Coaxial adapter SP-3CJ · 3C-P (BNC-P)
J0052 25  Coaxial adapter SP-3CP · 3C-J (BNC-J)	MP529A 26  U-Link	J0048 27  Coaxial T-connector, 50 Ω, S (N) type	J0049 28  Coaxial T-connector, 75 Ω, M type
J0025A/C 29  Coaxial cord 1 m/2 m S-5DWP · 5D-2W · S-5DWP			

List of Principal Coaxial Cables

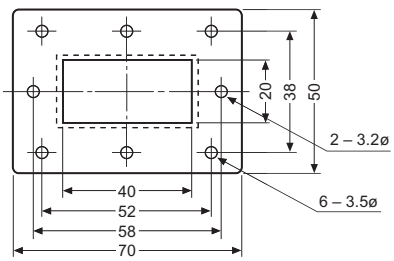
Coaxial cable	Characteristic impedance	Nominal attenuation (10 MHz)	Nominal capacitance	Finished diameter	Mass (g/m)	Suitable connector	Remarks
3C-2V	75 ±3 Ω (10 MHz)	0.042 dB/m	67 pF/m	5.8 mm	48	3C connector	Single outer conductor, PVC covered
3C-2W				6.5 mm	75		Double outer conductor, PVC covered
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					

Dimensions of Waveguide Flanges

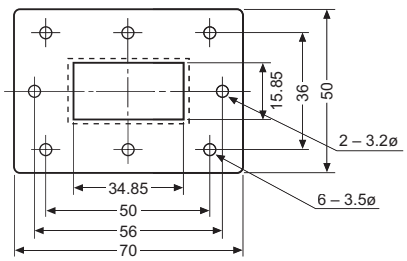
BRJ-4 (3.30 to 4.90 GHz)



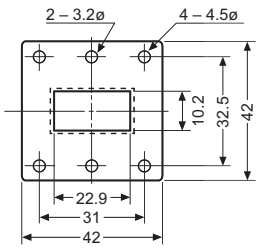
BRJ-6 (4.90 to 7.05 GHz)



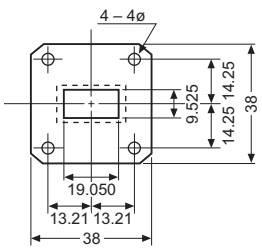
BRJ-7 (5.85 to 8.20 GHz)



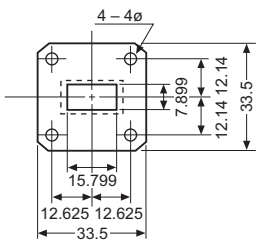
BRJ-10 (8.20 to 12.40 GHz)



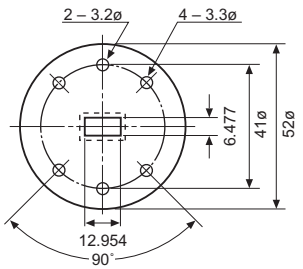
BRJ-120 (9.84 to 15.0 GHz)



BRJ-140 (11.9 to 18.0 GHz)



BRJ-18 (14.5 to 22.0 GHz)

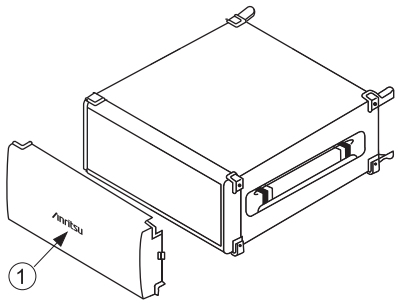


(Unit: mm)

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.

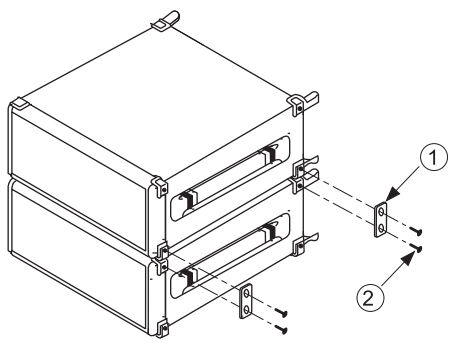
• Protective Cover
Protects front of cabinet



No.	Description	Quantity
①	Protective cover	1

Item	Order No.
Protective cover 1MW2U	B0329A
Protective cover 1MW3U	B0329B
Protective cover 1MW4U	B0329C
Protective cover 1MW5U	B0329D
Protective cover 3/4MW3U	B0329F
Protective cover 3/4MW4U	B0329G
Protective cover 2/3MW4U	B0329K
Protective cover 1/2MW2U	B0329L

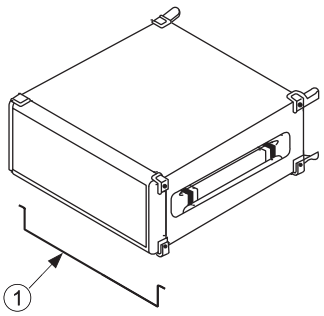
• Coupler
To mount two or more F-series cabinets in a stack



No.	Description	Quantity
①	Coupler	4
②	Screw	8

Item	Order No.
Coupler	B0332

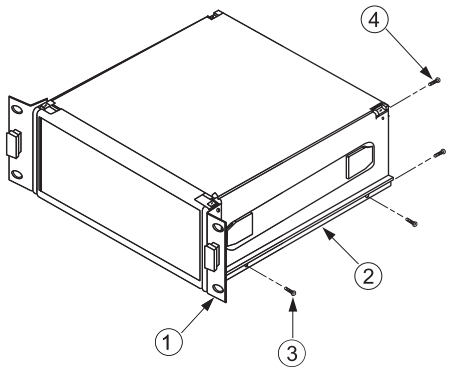
• Tilt Stand
Allows cabinet to be used at an angle



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

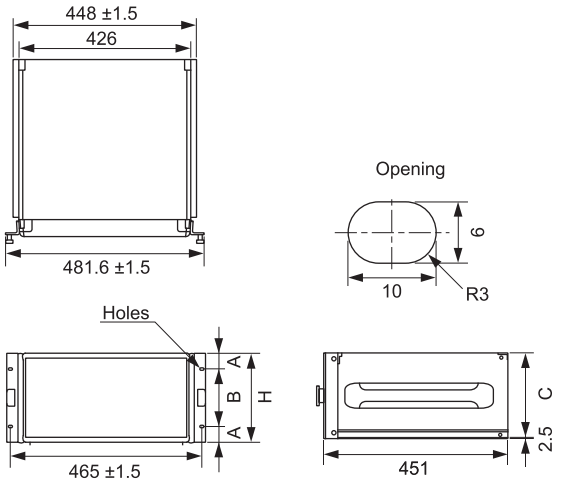
• Rack Mount Kit
The rack mount accessory is for use with 1MW450D cabinet.
For EIA/IEC standard rack



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

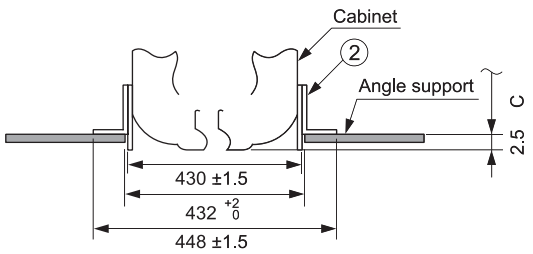
• F-series Cabinet Rack Mount Dimensions



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

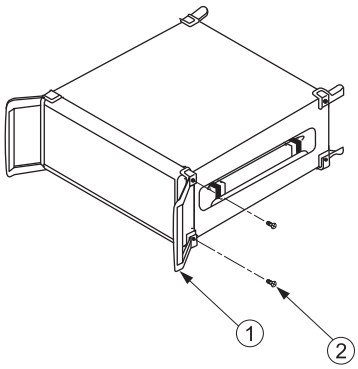
• Cabinet Angle Support Dimensions



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

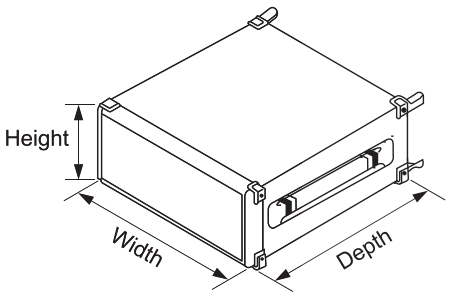
Protects the front section



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



Height

Symbol	Dimension (mm)
2U	88
3U	132.5
4U	177
5U	221.5
6U	266

Width

Symbol	Dimension (mm)
1MW	426
3/4MW	320
2/3MW	284
1/2MW	213

Depth

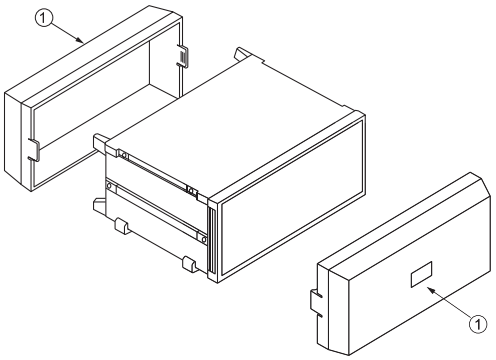
Symbol	Dimension (mm)
250D	251
350D	351
450D	451

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

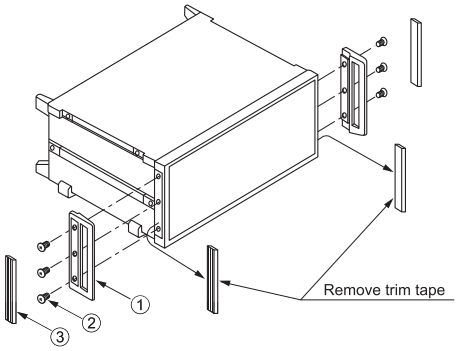


Protects front and back of cabinet.
Due to projections, the rear cover may not be usable with some equipment. Front handles and front cover cannot be used simultaneously.

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



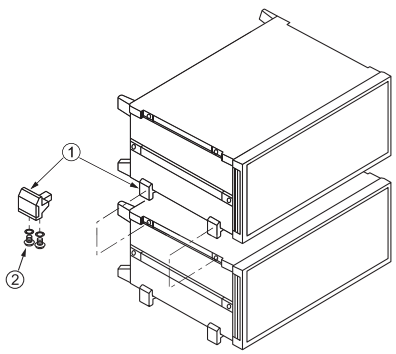
Front cover cannot be used.

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



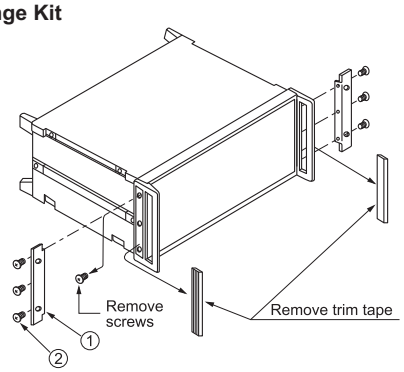
These one-touch lock feet replace the standard molded feet for use when stacking equipment of the same width and depth, and when mounting the equipment on a portable test rack.

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



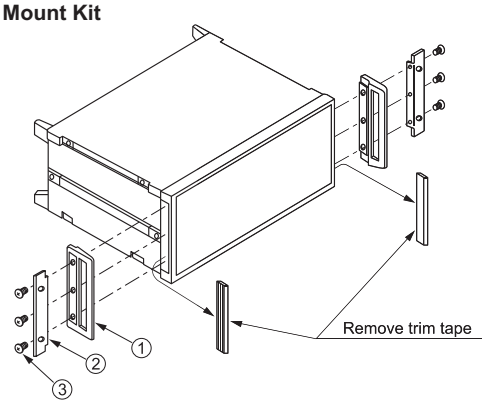
The rack mount accessory is for use with equipment having 1MW cabinet width providing front handles.

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.

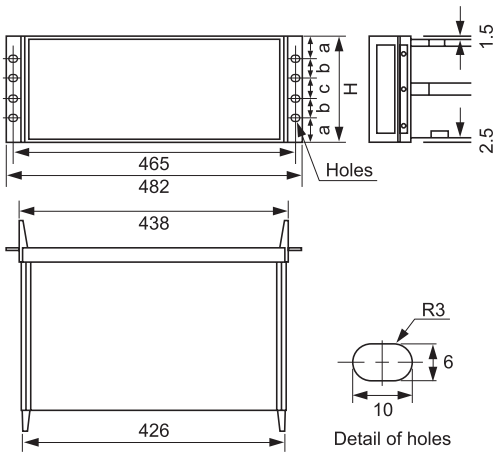
Note: Merely attaching the equipment to the rack with rack mount kit does not provide enough support. Use either angle supports or shelves to provide the necessary support.

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

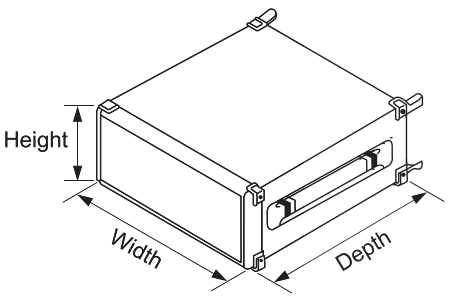
• E-series Cabinet Rack Mount Dimensions



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



Height

Symbol	Dimension (mm)
2U	88
3U	132.5
4U	177
5U	221.5
6U	266

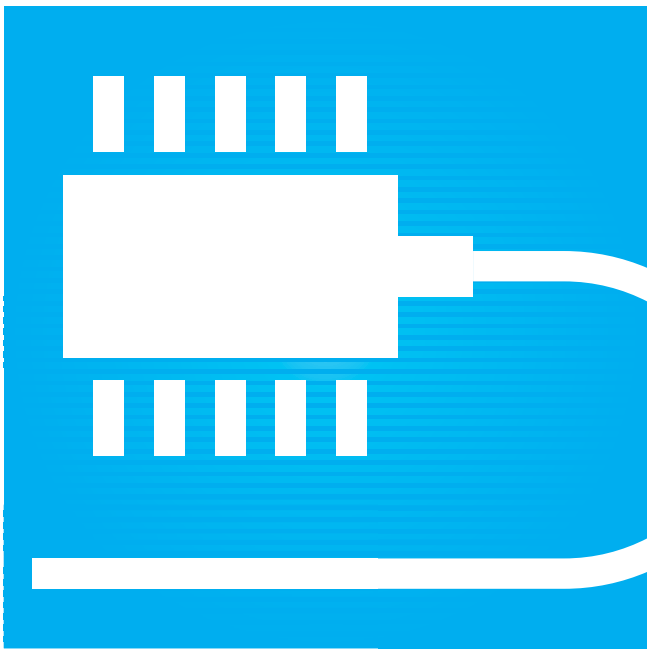
Width

Symbol	Dimension (mm)
1MW	426
3/4MW	320
2/3MW	284
1/2MW	213

Depth

Symbol	Dimension (mm)
250D	251
350D	351
450D	451

Note: Knobs, handles, and feet are not included in cabinet external dimensions.



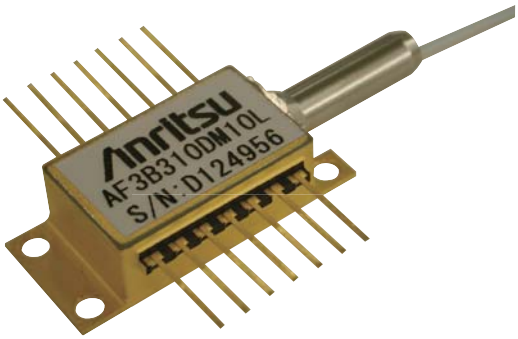
OPTICAL DEVICES

1.31/1.55 µm LD MODULE

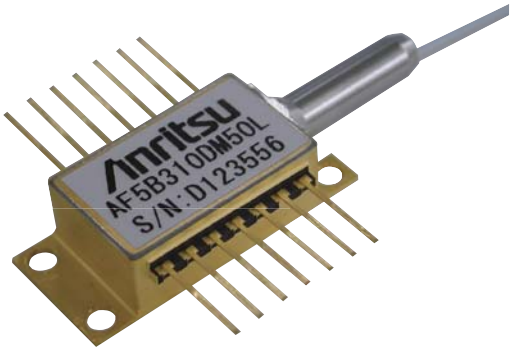
AF3B310DM10L/AF5B310DM50L

RoHS Compliant

NEW



AF3B310DM10L



AF5B310DM50L

1.31/1.55 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).

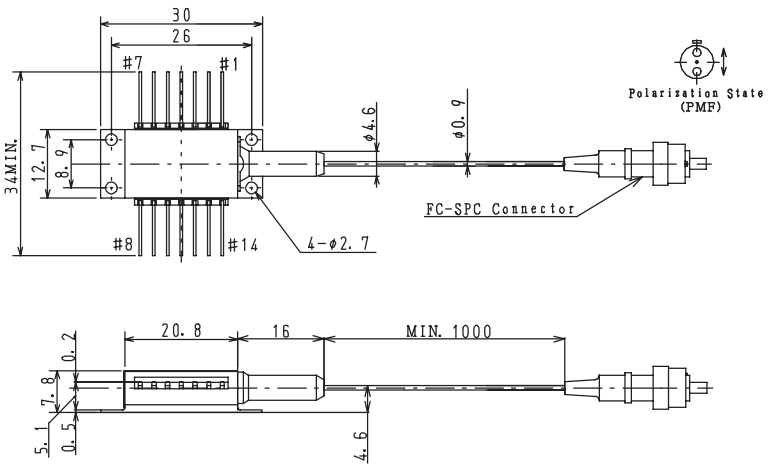
Features

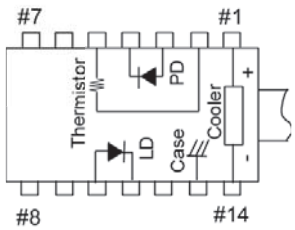
- High optical output : 100 mW/≤500 mA
- PMF output (fiber: ø0.9 mm)
- Built-in optical isolator
- Internal monitor PD and TEC

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

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

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.

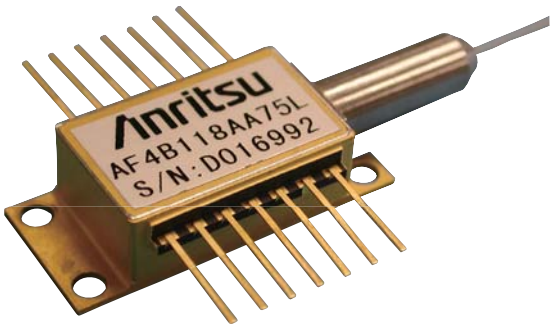
1.48 µm LD MODULE

AF4B Series

Type A: 120 to 180 mW, Type B: 200 to 250 mW, Type C: 300 to 400 mW, Type D: 420 to 500 mW

RoHS Compliant

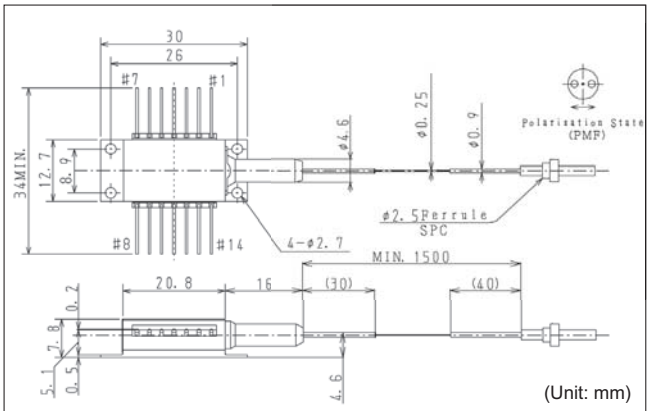
NEW



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).

Dimensions



(Unit: mm)

Polarization state of LD is aligned parallel to the slow axis.

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

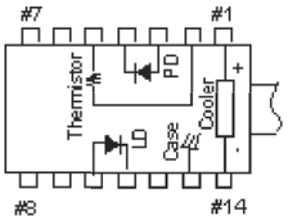
Type D:
420 mW (I_F ≤1600 mA) AF4B142FA75L/AF4B142FD75L
460 mW (I_F ≤1700 mA) AF4B146FA75L/AF4B146FD75L
500 mW (I_F ≤1800 mA) AF4B150FA75L/AF4B150FD75L

- **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			

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

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	ΔP_f	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	ΔP_f	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					

*: EOL = BOL×1.2
**: Only PMF

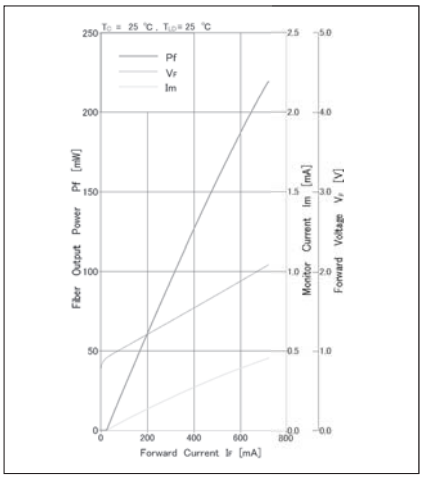
Item	Symbol	Test condition	Type D		
			AF4B142FA75L AF4B142FD75L	AF4B146FA75L AF4B146FD75L	AF4B150FA75L AF4B150FD75L
Output power	P_f		420 mW	460 mW	500 mW
Forward Voltage	V_F	At Output Power	Max. 2.2 V		
Threshold Current	I_{th}		Typ. 70 mA, Max. 150 mA		
Forward Current (BOL)	I_F	At Output Power	Max. 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	ΔP_f	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

AF4B Series Typical Characteristics

• Fiber Output Power/Monitor Current/Voltage-Forward Current Characteristics

[AF4B118AA75L]



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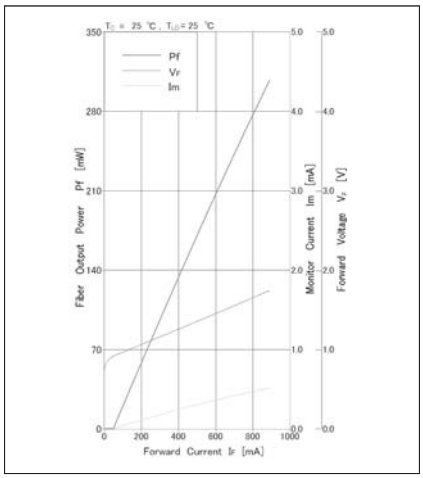

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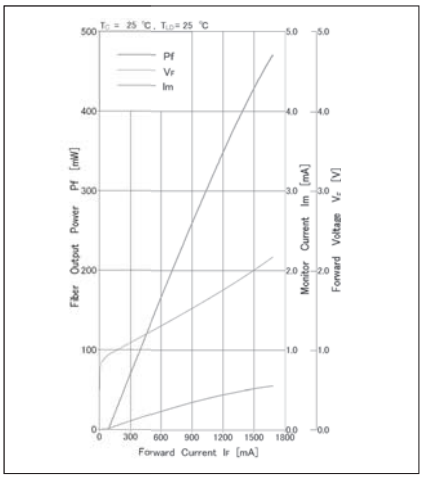

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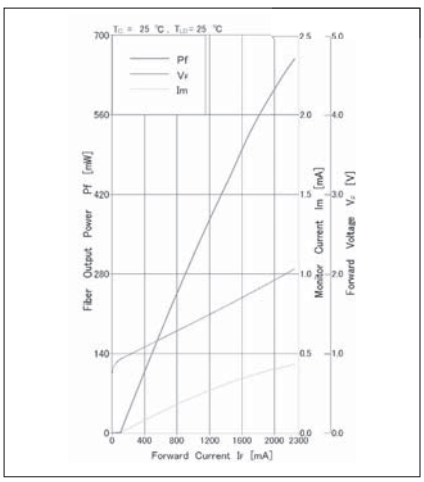
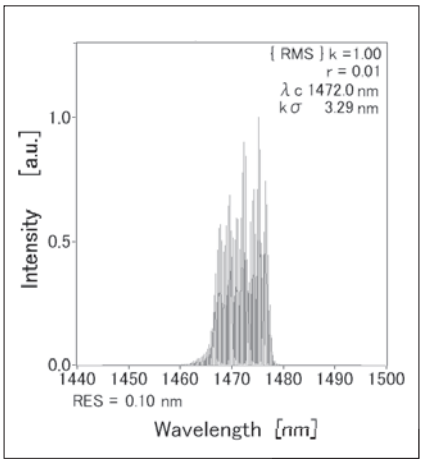


● **Emission Spectrum**

[AF4B118AA75L]



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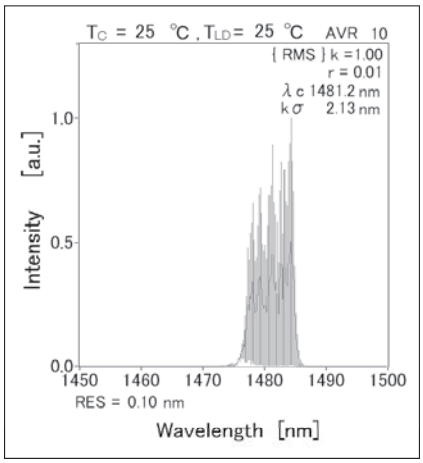

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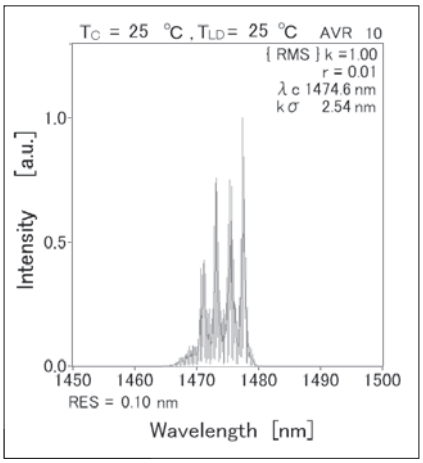

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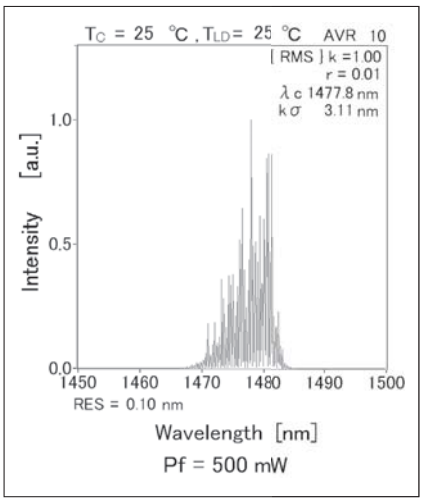


Ordering Information

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

NEW

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

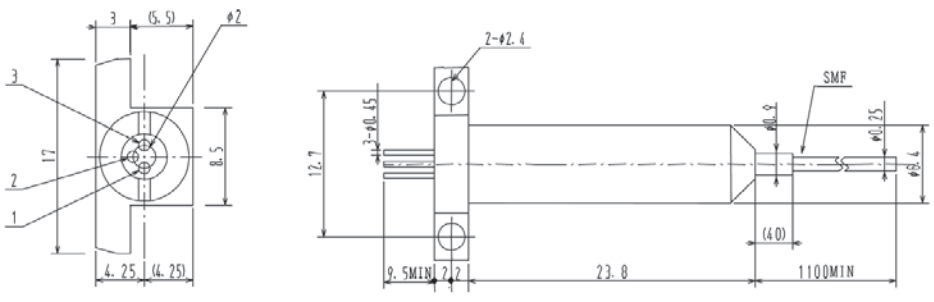
*: Wavelength begins to be distributed under the cut-off (1450 nm) when operated below 30 deg.C

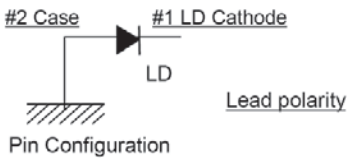
Optical and Electrical Characteristics (T_C = 70 deg.C)

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



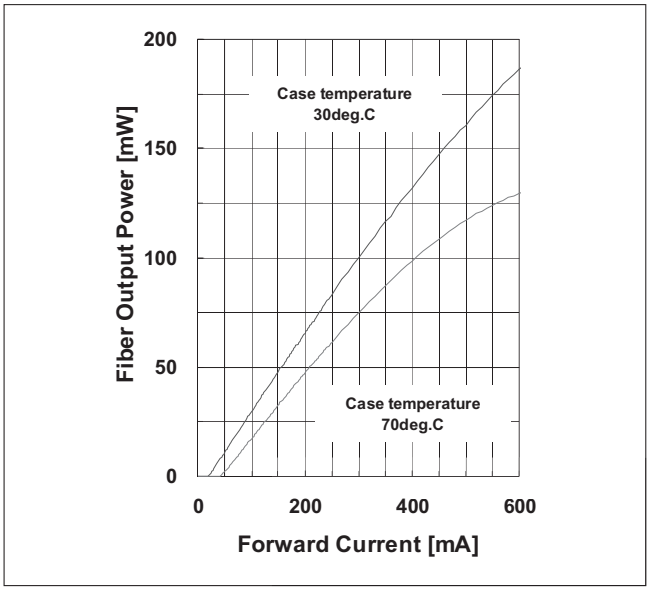


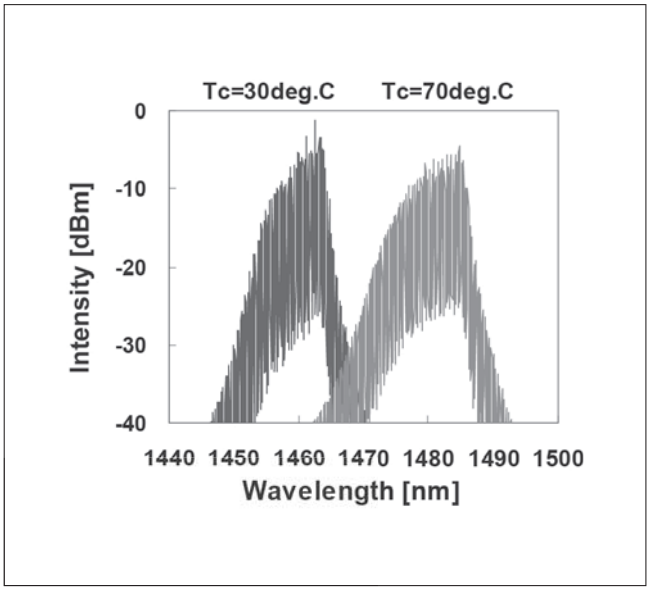
Pin Configuration

No.	Function
1	LD Cathode
2	Case (Anode)
3	NC

Pin Configuration

IL Characteristics & Spectrum



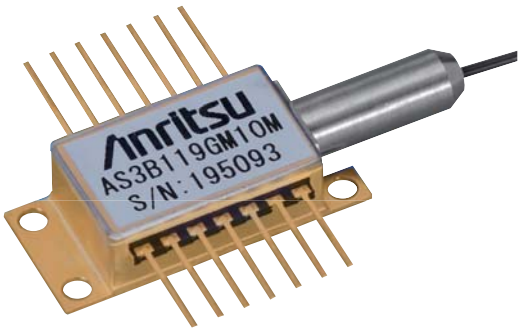


1.55 µm SLD MODULE

AS3B119GM10M/AS5B125EM50M/AS6B118GM50M

RoHS Compliant

NEW



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

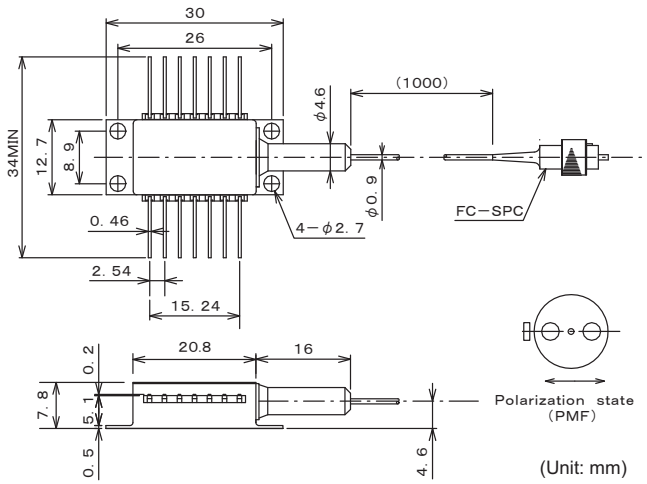
Features

- 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

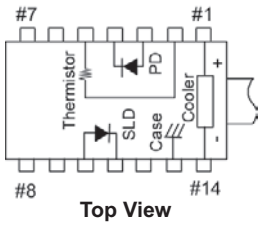
Absolute Maximum Ratings (T_{SLD} = 25 deg.C)

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		

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

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) x 1.2
Polarization state of SLD is aligned parallel to the slow axis.

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