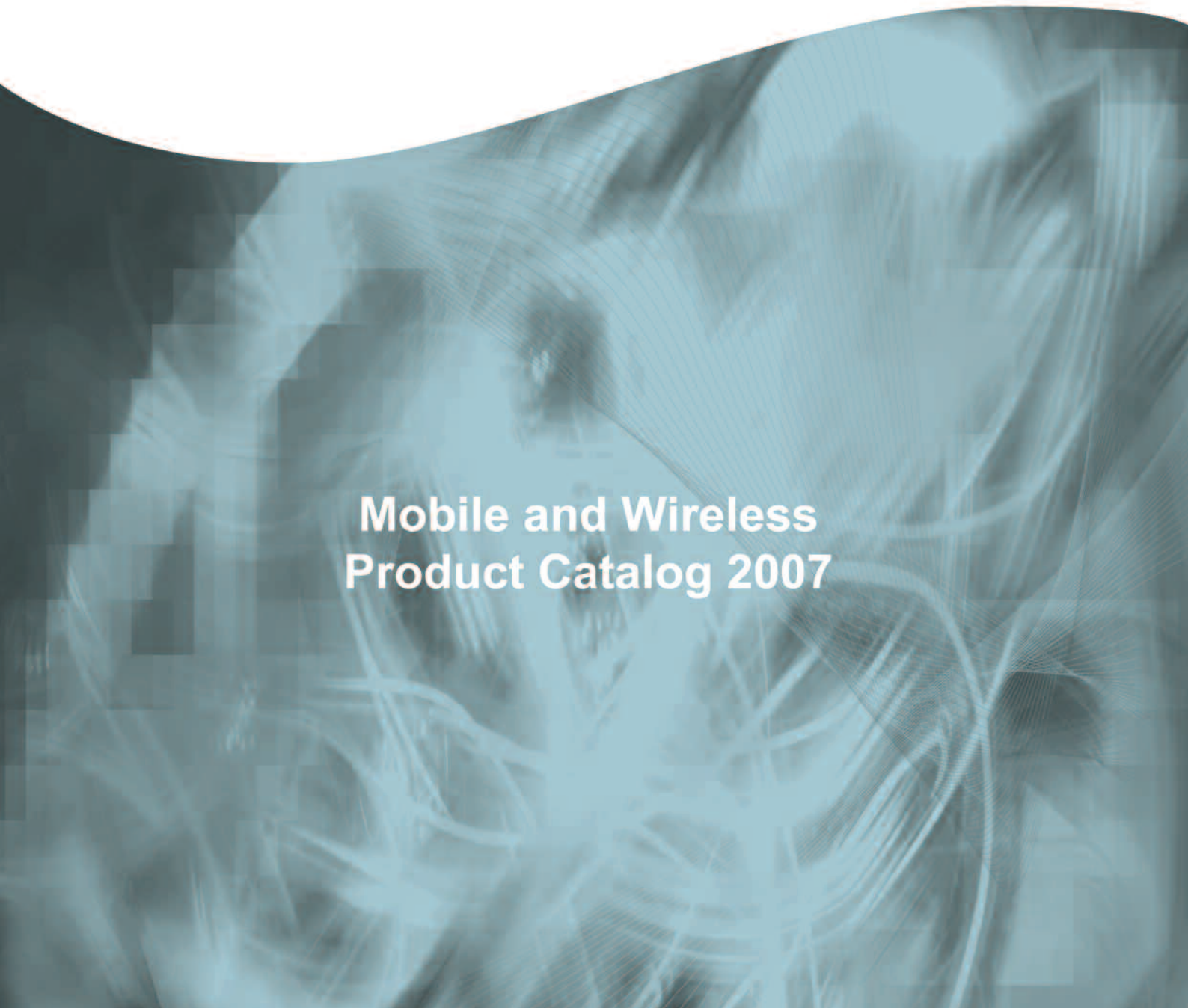
Discover What's Possible®

Anritsu

ELECTRONIC MEASURING INSTRUMENTS



Mobile and Wireless Product Catalog 2007

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With R&D and manufacturing facilities in Japan, the U.S., and Europe, Anritsu operates a worldwide test and measurement business. As technological innovations in information and communication systems progress, Anritsu supports the enhancement of wireline and wireless communications through its "original and high-level" test and measurement solutions.
Anritsu is focusing on the information and communications markets which are undergoing major changes. Networks are becoming IP- and optical-based, and Triple Play services (high-speed Internet, IP phone services, and TV and video-on-demand) based on FTTx technology are being deployed. In the mobile communications field, 3G mobile services are rolling out rapidly. Handsets with payment capabilities, music players, TV and radio tuners, and WLAN and Bluetooth interfaces are appearing on the market. In addition, research and development of fixed and mobile convergence for all-IP-based networks has begun.

As these new services and their supporting networks converge, and ubiquitous networks emerge to form the basis of a safe, secure, and comfortable society, Anritsu is working to create new test and measurement technologies and solutions. NetTest A/S, which has outstanding technology in network monitoring, joined the Anritsu Group in August 2005 and became Anritsu A/S. This acquisition greatly expanded the business domain of the Anritsu Group. Now, Anritsu provides solutions for high-speed digital, optical, RF/microwave, and mobile communications systems, as well as for their mobile, FTTx, and WiMAX access networks and sophisticated network convergence service operations. Anritsu continues to contribute to a safe, secure, and comfortable society through its total solutions, which cover test and measurement of semiconductor chips, modules, and equipment that contribute to enhanced performance and Quality of Service (QoS) throughout the world's networks.

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, 2005)
– Sales volume: 84,039 million yen (consolidated, year ended March 31, 2005)
– Employees: 3,610 (consolidated, as of March 31, 2005)

Anritsu Worldwide

Anritsu Corporation (Japan)
Anritsu Company (U.S.A.)
Anritsu EMEA Ltd. (U.K.)
Anritsu Company Ltd. (Hong Kong)
Anritsu Electronics Ltd. (Canada)
Anritsu Eletrônica Ltda. (Brazil)
Anritsu S.A. (France)
Anritsu GmbH (Germany)
Anritsu S.p.A. (Italy)
Anritsu EMEA Ltd. (Spain)
Anritsu AB (Sweden/Finland)
Anritsu A/S (Denmark)
Anritsu EMEA Ltd. (United Arab Emirates)
Anritsu Company Ltd. (Beijing Representative Office: P.R. China)
Anritsu Electronics (Shanghai) Co., Ltd. (Service Center: P.R. China)
Anritsu Company, Inc. (Taiwan)
Anritsu Pte. Ltd. (Korea)
Anritsu Pte. Ltd. (Singapore)
Anritsu Pty. Ltd. (Australia)
Anritsu Pte. Ltd. India Branch (India)

For the latest product updates visit *www.anritsu.com*

Keep up to date on the latest product specifications, literature and Anritsu news on www.anritsu.com. Access Anritsu's regional websites to see local events, training and upcoming conferences.

Below is a list of other Anritsu Electronic Measuring Instruments Catalogs you can order by filling out the inserted Business Reply Card or visiting *www.us.anritsu.com/emicatalog*

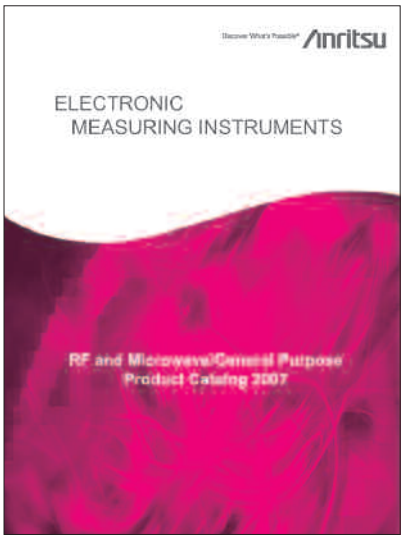
Handheld/Portable Field Instruments

- Access Master OTDR for FTTx test
- W-CDMA Area Tester
- Cell Master Base Station Analyzer
- Handheld Spectrum Analyzers
- Network Data Analyzer
- Wideband Peak Power Meter
- Optical Time Domain Reflectometer
- Optical Loss Test Set
- OTDR, Optical Handy Power Meter
- Power Meters
- Site Master Cable and Antenna Analyzers
- Node B Analyzer
- Network Performance Testers

Digital, SONET/SDH, IP and Optics Test

Multiple test instruments including:

- Bit Error Rate Testers
- Optical Measuring Instruments
- SONET/SDH and Internet Protocol Testers
- Chromatic Dispersion Measurement Module
- Polarization Mode Dispersion Analyzer
- Fiber Microscope
- Visual Fault Locator
- Fiber Identifier



RF and Microwave/General Purpose Test

- Automatic Calibrators
- Frequency Counters
- Vector Network Analyzers
- PIM-S System
- Power Amplifier Test System
- Power Meters
- Scalar Network Analyzers
- Signal Analyzers
- Synthesized Level Generators
- Signal Generators
- Spectrum Analyzers
- Tower Mounted Amplifier Test System
- Vector Network Analyzers

2007 Anritsu EMI Catalog CD ROM

Visit www.us.anritsu.com/emicatalog to download the full version of the 2007 Electronic Measuring Instruments Catalog in PDF format, or to order the catalog on CD ROM.

Order by model number

When ordering, please specify the model number and name of the instrument desired, for example, “MP1570A SONET/SDH/PDH/ATM Analyzer.” 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 “Custom-made 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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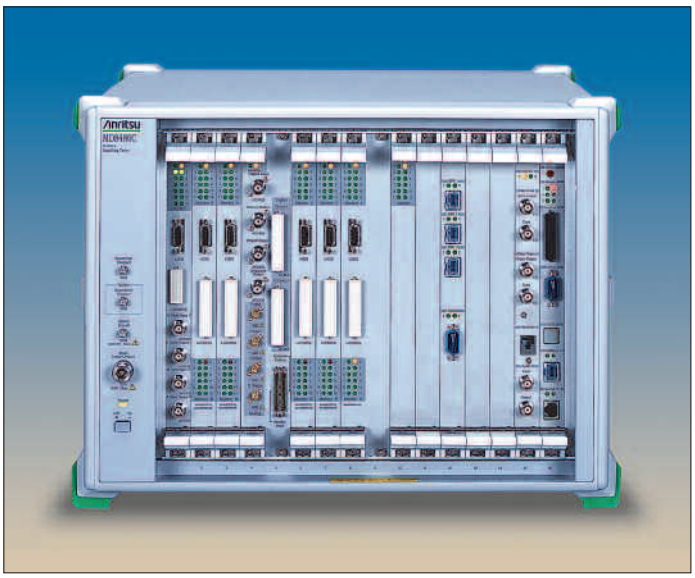
All-in-One Solution for W-CDMA/HSPA and GSM/GPRS/EGPRS Chipset and UE Development

MD8480C W-CDMA Signalling Tester

The MD8480C 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, etc.), 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: Requires two MD8480C units
∗3: Enhanced GPRS
∗4: Handover Testing between W-CDMA/HSPA and GSM/EGPRS at Voice/Data Communications

(For further information see page 13)

RF Conformance Test System Supporting Most Approved Test Cases

ME7873F W-CDMA TRX/Performance Test System
ME7874F W-CDMA RRM Test System

The ME7873F W-CDMA TRX/Performance Test System is for testing the Tx and Rx characteristics of W-CDMA User Equipment (UE) in accordance with measurement items*1 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*2) can also be measured by installing the ME7873F-10 RRM Test Addition option. In addition, all Inter-RAT tests, including handover tests, can be performed.
The ME7874F W-CDMA RRM Test System 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. Both of 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.

∗1 In principle, defined by GCF Work Item*5 and targeting measurement items certified by GCF/PTRCB
∗2 RRM: Abbreviation for Radio Resource Management
∗3 This is based on GCF and PTCRB test case approvals following the GCF and PTCRB meeting in July 2006.
∗4 Not supported by RRM tests
∗5 Work Item: Name for test item group for each function chosen by GCF for test items for certifying UE conformance

(For further information see page 27)

All-in-One Unit Supporting RF Tx and Rx Tests of W-CDMA/HSDPA, GSM/GPRS/EGPRS, and CDMA2000 1X/1xEV-DO Mobile Phones

MT8820B Radio Communication Analyzer

The major Tx and Rx characteristics of W-CDMA/HSDPA, GSM/GPRS/EGPRS, CDMA2000® 1X (IS-2000), and CDMA2000 1xEV-DO terminals can be measured with one MT8820B unit by installing the dedicated optional measurement software and hardware.
The MT8820B advanced DSP and Parallelphone™ technologies cut manufacturing and inspection times dramatically.
Furthermore, the MT8820B has separately controllable dual RF, AF, GPIB, and Ethernet connectors, significantly improving manufacturing efficiency by reducing production costs and saving space.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA – USA).

(For further information see page 34)

All-in-One Unit Supporting RF Tx and Rx Tests of 2G, 2.5G, 3G and 3.5G Mobile Phones

MT8815B Radio Communication Analyzer

The major Tx and Rx characteristics of W-CDMA/HSDPA, GSM/GPRS/EGPRS, CDMA2000® 1X (IS-2000), and CDMA2000 1xEV-DO terminals can be measured with one MT8815B unit by installing the dedicated optional measurement software and hardware supporting multi-systems.
The MT8815B detects detailed items with higher accuracy using additional tests and measurements. Combining the MT8815B with the MT8510B Service Tester covers all requirements from Go/No-Go testing at Service Points to repairs at Advanced Repair Centers.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA – USA).

(For further information see page 38)

Small RNC Simulator for Manufacturing, Installing and Maintaining W-CDMA Base Stations

MD8391A RNC Simulator

Anritsu has developed a small portable RNC Simulator MD8391A, for manufacturing, installation and commissioning and maintaining Node B. The typical W-CDMA system shows MD8391A positioned as a Radio Network Controller (RNC) between a Node B and a core network.
Using MD8391A RNC Simulator permits an easy and cost-effective configuration of a Node B test environment, eliminating the need for a very expensive actual RNC and core network.

(For further information see page 53)

Test Bluetooth Modules and Products with a Bluetooth Interface

MT8852B *Bluetooth*® Test Set

2.4 GHz Reference *Bluetooth* Transceiver

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 1.1, 1.2 and 2.0. MT8852B establishes a Test Mode connection with the EUT (Equipment Under Test) using standard signaling, then runs a selected test script that comprises of 8 standard rate test cases and 6 EDR test cases. Pre programmed “Full” and “Quick Test” scripts plus user-defined scripts are selectable. MT8852B is ideal for qualification and production testing of new Bluetooth 2.0 EDR products including mobile phones, PDAs, notebook PCs and headsets.
BlueTest2 production test software is supplied as standard with MT8852B and has been enhanced to support both standard rate and EDR measurements. BlueTest2 software eliminates the need to write custom production test software, thus ensuring the testing of new products in the shortest possible time. Optional BlueSuite Pro3 PC software gives graphical displays of standard rate and EDR packets including power burst profile and constellation diagrams. BlueSuite Pro3 also includes automated sensitivity search routines and measurements of the performance of all 79 channels on a single graph. MT8852B supports options for Adaptive Frequency Hopping testing and Headset/Handsfree profile emulation.

(For further information see page 58)

For Performing Area Tests and Maintenance of W-CDMA and GSM Base Stations

ML8740B Area Scanner

W-CDMA: 2110 to 2170 MHz, GSM: 925 to 960 MHz, 1805 to 1880 MHz

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.

(For further information see page 61)

For High Speed Testing of 802.11 Wireless LAN Devices

MT8860B WLAN Test Set

2.4 GHz 802.11b/g frequency bands

The MT8860B 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 MT8860B 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 MT8860B also reduces test system costs, increases production throughput and delivers the most flexible WLAN test system available.

(For further information see page 55)

Handheld Vector Network and Spectrum Analysis for General Purpose Applications

MS2024A/34A VNA Master

VNA 2 MHz to 4 GHz / Spectrum Analysis 100 kHz 4 GHz

MS2026A/36A VNA Master

VNA 2 MHz to 6 GHz / Spectrum Analysis 100 kHz 7.1 GHz

Anritsu Company introduces the VNA Master MS2034A and MS2036A that offer integrated 6 GHz vector network analyzer (VNA), 7.1 GHz spectrum analyzer, and power meter capability in a single handheld, battery-operated, rugged instrument. The multi-function capability of the MS2034A/MS2036A allow them to serve as single-instrument solutions for phase matching cables, identifying sources of interference, and troubleshooting transmitters in a variety of aerospace, defense and general purpose systems anytime, anywhere.

(For further information see page 66)

The Most Advanced Ultra-portable Spectrum Analyzer Available

MS2721B/23B/24B High Performance Handheld Spectrum Analyzers

9 kHz to 20 GHz

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. Now includes quasi-peak detector and CISPR bandwidths.

(For further information see page 73

Shield Box Suitable for Testing Mobile Phones

MA8120E Shield Box

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.

(For further information see page 42)

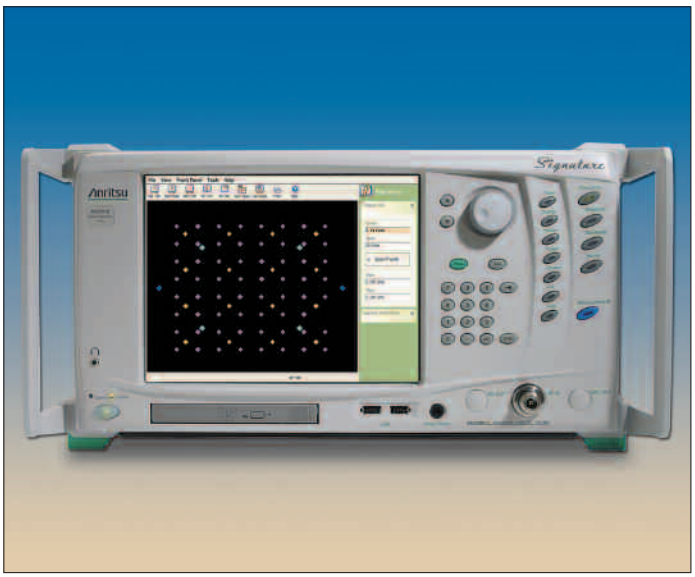
A New Plateau in Signal Analysis for Providing Exceptional Engineering Insight

MS2781B Signature™ High Performance Signal Analyzer

100 Hz to 8 GHz

The MS2781B Signature High Performance Signal Analyzer is a combined high performance spectrum analyzer and a high performance vector signal analyzer. Signature expands the ability to analyze RF and digitally modulated signals by offering seamless connectivity with MATLAB® and Simulink® from The MathWorks. Engineers can view measurement results through custom MATLAB and Simulink analysis giving exceptional insight into the performance of new designs. Signature can help make tomorrows communications systems a reality today.

(For further information see page 75)

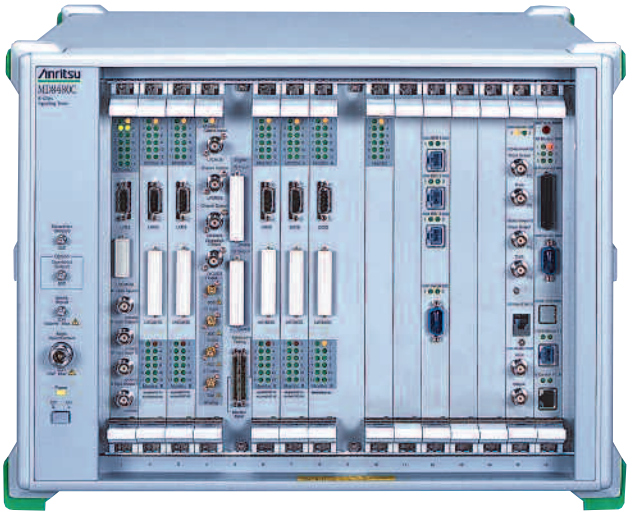


W-CDMA SIGNALLING TESTER
MD8480C

GPIB

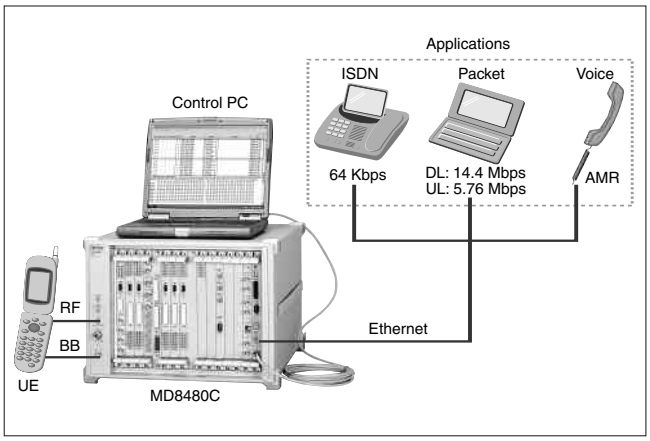
All-in-One Solution for W-CDMA/HSPA and GSM/GPRS/EGPRS Chipset and UE Development

NEW



The MD8480C 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, etc.), 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: Requires two MD8480C units
∗3: Enhanced GPRS
∗4: Handover Testing between W-CDMA/HSPA and GSM/EGPRS at Voice/Data Communications



Features

- Supports 3GPP Release 6 (HSUPA) and Release 5 (HSDPA)
- Full HSDPA/HSUPA Support for All UE Categories
- Data Throughput Test (DL 14.4 Mbps/UL 5.76 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, etc.)
- 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]
The standard MD8480C configuration has transmit and receive functions for a single W-CDMA base station. Installing this option in a single MD8480C unit supports W-CDMA transmit and receive functions for up to four base stations.
∗ 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. It can also be installed in the standard configuration supporting one W-CDMA base station.

• HSUPA Base Station [MU848072C-02 HSUPA]
This option adds the HSUPA functions for up to four base stations to the W-CDMA BTS Unit. It can also be installed in the standard configuration supporting one W-CDMA base station.

• 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 modules can be installed in one MD8480C, supporting the GSM TRX function for each of each of two base stations.*
*When two TDMA2 (MU848060C) modules 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 200 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
W-CDMA Signaling Tester Tx Diversity [MX848001A-01]
This option supports the Tx diversity functions, including TSTD, STTD, Closed Loop Mode 1 and Closed Loop Mode 2. It requires more than one BTS unit (MU848072C1 – 2BTS) as the additional base station option.

· HSDPA Diversity Function
HSDPA Tx Diversity [MX848001C-11]
This option supports the Tx diversity function for HSDPA/HSUPA. It requires the W-CDMA Tx diversity function (MX848001A-01).

· Compressed Mode Function
W-CDMA Signaling Tester Compressed Mode [MX848001A-02]
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
W-CDMA Signaling Tester W-CDMA CSD [MX848001A-06]
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 function requires the MU848055C.

· W-CDMA Ciphering
Ciphering [MX848041C]
This option*1 adds support for ciphering functions to KASUMI (3GPP standards integrity ciphering algorithm).

· HSDPA Ciphering
HSDPA Ciphering [MX848041C-10]
This option*1 adds supports for ciphering functions to KASUMI (3GPP standards integrity ciphering algorithm).
*1: The integrity function is also supported even without this option.

• GSM/GPRS/EGPRS Related

· GSM CSD Function
W-CDMA Signalling Tester GSM CSD [MX848001A-04]
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 function requires the MU848055C.

· GSM Frequency Hopping Function
W-CDMA Signalling Tester GSM Frequency Hopping [MX848001A-05]
This option supports the GSM frequency hopping function, permitting frequency hopping in GSM communications channels at a frame sync of 4.62 ms. It requires an Additional RF Unit (MD8480B-02 or MD8480C-03).

· GSM/GPRS Ciphering
GSM/GPRS 2 Ciphering [MX848045C]
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
W-CDMA Signaling Tester Router Connection [MX848001A-03]
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 Encode/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.

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.

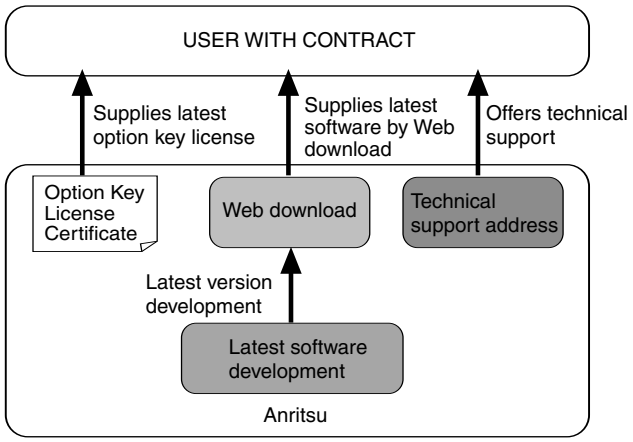
· 3-year Extended Warranty Service [MD8480C-ES310]*3

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	15 ksps
		S-CPICH	15 ksps
		AICH	15 ksps
		PICH	15 ksps
PCCH	PCH	S-CCPCH	15 ksps to 480 ksps
CCCH/DCCH/DTCH	FACH		
MCCH, MSCH, MTCH			
DCCH + DTCH	DCH	DPDCH	7.5 ksps to 960 ksps
		DPCCH	7.5 ksps to 960 ksps
	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

• Coding Test Channels

Logical	Transport	Physical	Symbol Rate
CCCH/DCCH/DTCH	RACH	PRACH	15 ksps to 120 ksps
DCCH/DTCH	DCH	DPDCH	15 ksps to 960 ksps
		DPCCH	15 ksps
	E-DCH*2	E-DPDCH*2	15 ksps to 960 ksps x 4 code
		E-DPCCH*2	15 ksps
		HS-DPCCH*1	15 ksps

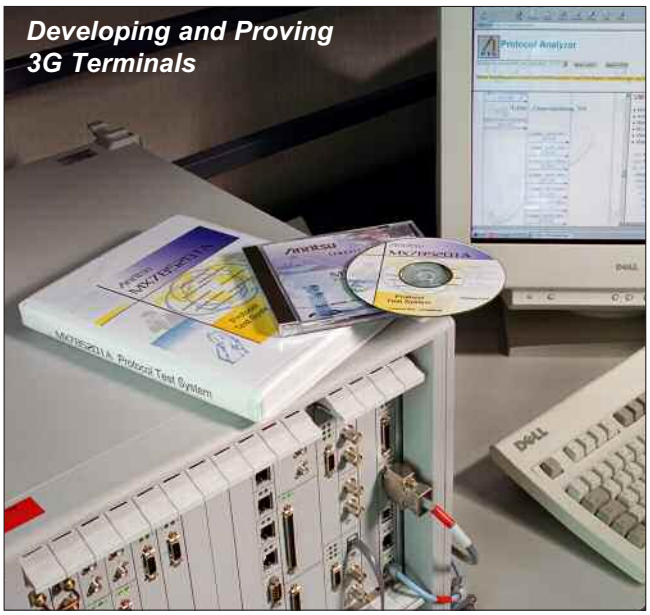
*1: MU848072C-01 HSDPA is required
*2: MU848072C-02 HSUPA is required

• **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 Kbps + 32 Kbps	1xDPCH (15 ksps)	1xDPDCH (240 ksps)
		12.2 Kbps + 64 Kbps	1xDPCH (15 ksps)	1xDPDCH (240 ksps)
		12.2 Kbps + 384 Kbps	1xDPCH (15 ksps)	1xDPDCH (960 ksps)
	Voice + ISDN 1B	12.2 Kbps + 64 Kbps	1xDPCH (15 ksps)	1xDPDCH (240 ksps)

W-CDMA PROTOCOL TEST SYSTEM (PTS) MX785201A

W-CDMA VIRTUAL SIGNALING TESTER (VST) MX785101A



The MX785201A PTS (Protocol Test System) and MX785101A VST (Virtual Signaling Tester) are a family of test and verification tools for 3G wireless products. They 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. They provide a common user interface, thus reducing operator learning time as development progresses and migrates over the range of Anritsu's 3G development tools. In addition, test procedures generated for the PTS can be run on the VST and vice versa. This enables test procedures to be developed very early in the development cycle and to evolve as the user equipment evolves. A substantial saving in the investment in development of test procedures can be realized.

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
- Re-use of test cases on VST (Virtual Signaling Tester) and PTS (Protocol Test System)

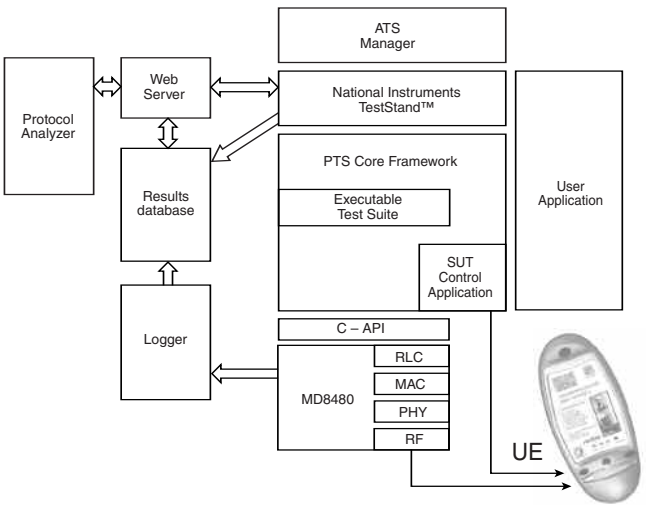
PTS

The MX785201A PTS software is combined with the MD8480 W-CDMA Signaling 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 and VST software component runs on a Windows® 2000/XP PC. They 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

The Layer 2 protocol stack and Layer 3 test tools are functionally equivalent to those used in the Anritsu VST (Virtual Signaling Tester).
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

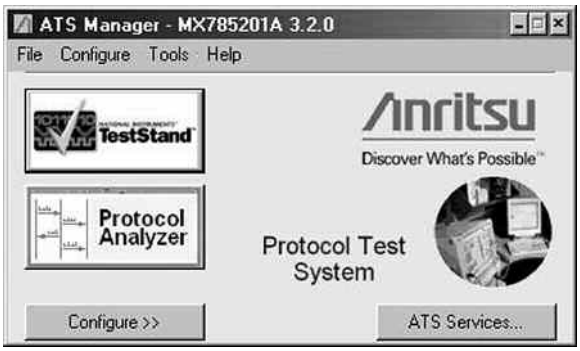
VST

The MX785101A VST software provides an environment to exercise Layer 3 and Layer 2 signaling protocols defined within the Third Generation Partnership Project (3GPP). When linked to the customer's signaling protocol software development environment, Layer 3 and Layer 2 Test Procedures running on the VST platform enable verification and subsequent validation of the signaling protocol Software Under Test (SUT) prior to integration with UE RF and baseband hardware.
The VST runs on a standard Windows PC. The SUT may reside on any machine that can be connected via a TCP/IP port to the Windows PC running the VST. In order to interface to the VST, the UE Abstract Layer 1 and UE Adapter software components are required for the Software Under Test. The VST Network Abstract Layer 1 and adapter components can be used as a starting point to develop these components. The Abstract Layer 1 has also been developed in such a way that users can easily customize it in order to simulate specific features of the air interface.

Evolution with 3GPP

The capabilities of the VST & PTS continue to evolve and additional capabilities are added in-line with the changing 3GPP specifications. The PTS runs the 3GPP Conformance Test Suite as defined in TS34.123. 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

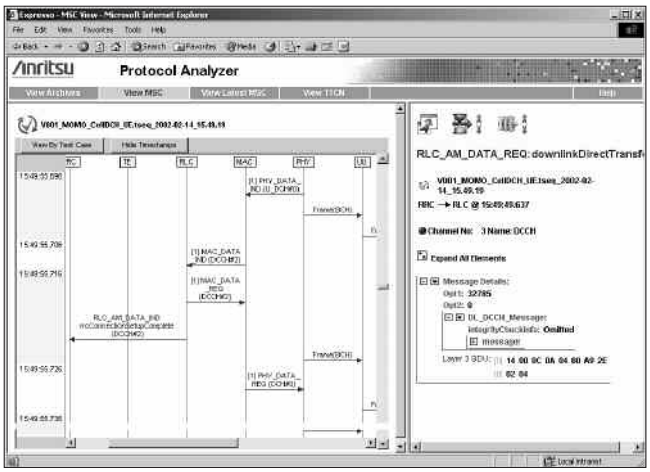
A thin RRC is provided to load NAS messages into RRC direct transfer messages and unload NAS messages from RRC direct transfer messages transparently.

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.

Developer Library

The Developer Library provides a proven set of TTCN test scripts that have been tested on real terminals and complements the Integration Library. These test cases provide a more flexible test capability and allow experienced designers to exercise their terminals beyond the requirements of 3GPP. This library is supplied in source code form.

HSDPA Library

There is an additional HSDPA Library available for HSDPA testing on PTS.

Conformance Testing

Anritsu offers a range of solutions designed to meet specific customer requirements for UE protocol conformance testing based on the 3GPP standards.

Standard PTS/VST Product

The 3GPP Adapter Option of the PTS/VST enables users to run 3GPP protocol conformance tests. PTS/VST includes 3GPP RAN#5 approved test cases from 3GPP TS34.123 in ETS form as standard. New test cases are introduced every 3 months with the update of the PTS software. These are appropriate for pre-conformance and verification testing in a R&D Lab.

GCF/PTCRB Conformance Test Toolkits

These packages are designed for formal UE validation and pre-conformance testing of the GCF/PTCRB Work Items. The toolkits includes:

- GCF/PTCRB Approved Test Cases
- GCF/PTCRB Approved PTS Software Release
- RFI Certificate of GCF/PTCRB Approvals
- Product Release Notes
- Operations and Installation Manuals
- GCF/PTCRB Current Exceptions/Issues
- Test Time Estimates
- Copy of GCF/PTCRB Approval Submission Documentation

The annual support contract provides an update following each quarterly GCF (Global Certification Forum) CAG approval meeting. Please see separate datasheet for MX785220A Conformance Test Toolkits for further details.

Options Available

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 or MX785101A VST. The IP Driver provides access to User-Plane packet data and routes that data through a PC onto a conventional data network.

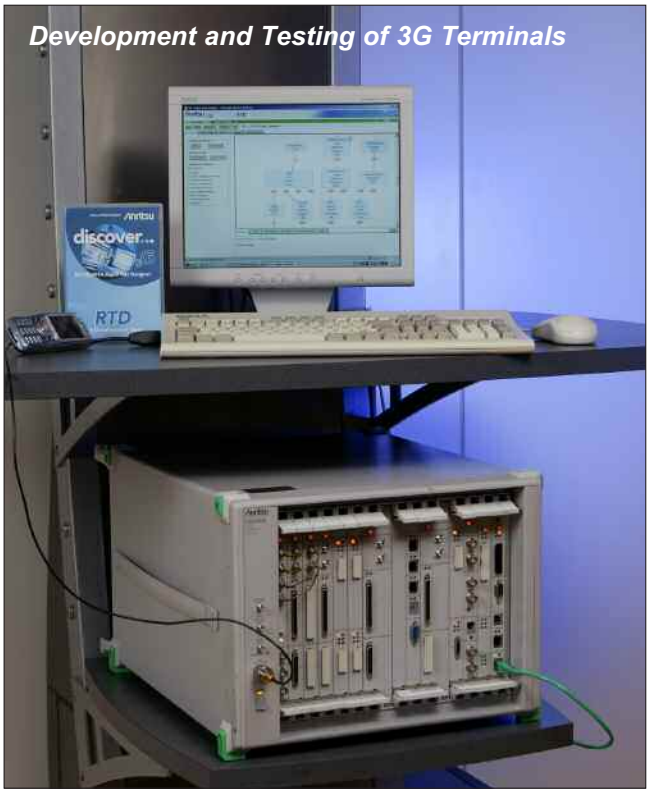
Key features include multiple primary and secondary PDP contexts with single UE support. Traffic Flow Templates routing for secondary context is also supported. All protocols run over IPv4 and fully flexible IP address allocation is supported.

MX785201A-43 Rapid Test Designer

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.

W-CDMA RAPID TEST DESIGNER (RTD)
MX786201A



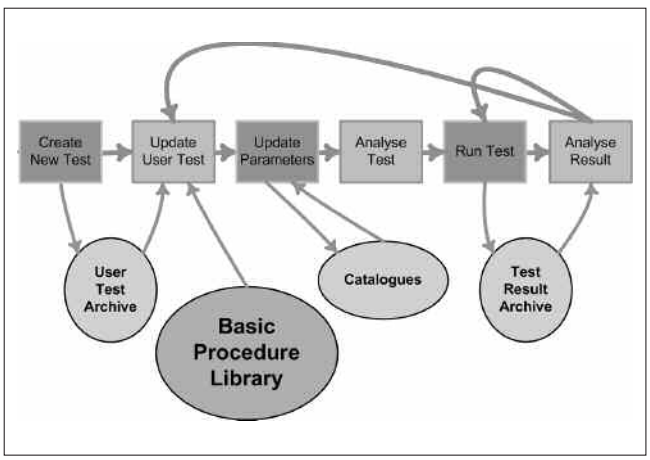
The Rapid Test Designer (RTD) is a revolutionary new tool which speeds up the testing of UMTS Terminals significantly by greatly simplifying the way in which tests are created, executed and analyzed.
The RTD presents an intuitive and interactive graphical environment for designing test cases, coupled 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 WCDMA Signaling 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 signaling 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 HSDPA 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.

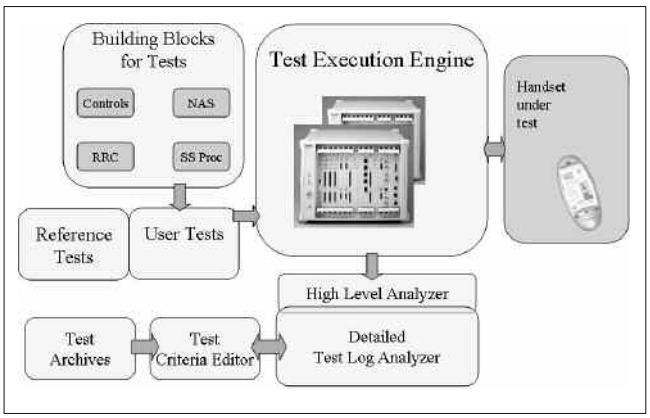


The Iterative test process, which cycles between Design, Test Analysis, Test Execution and Results Analysis

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

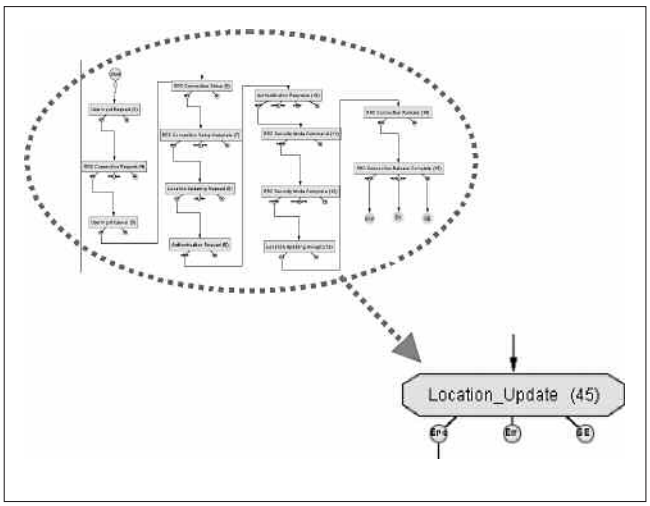
In addition to test control and system simulator control procedures, the RTD provides support for a set of procedures similar to those defined in 3GPP standards. The procedures are divided into the following groups:

- 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 Signaling 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.

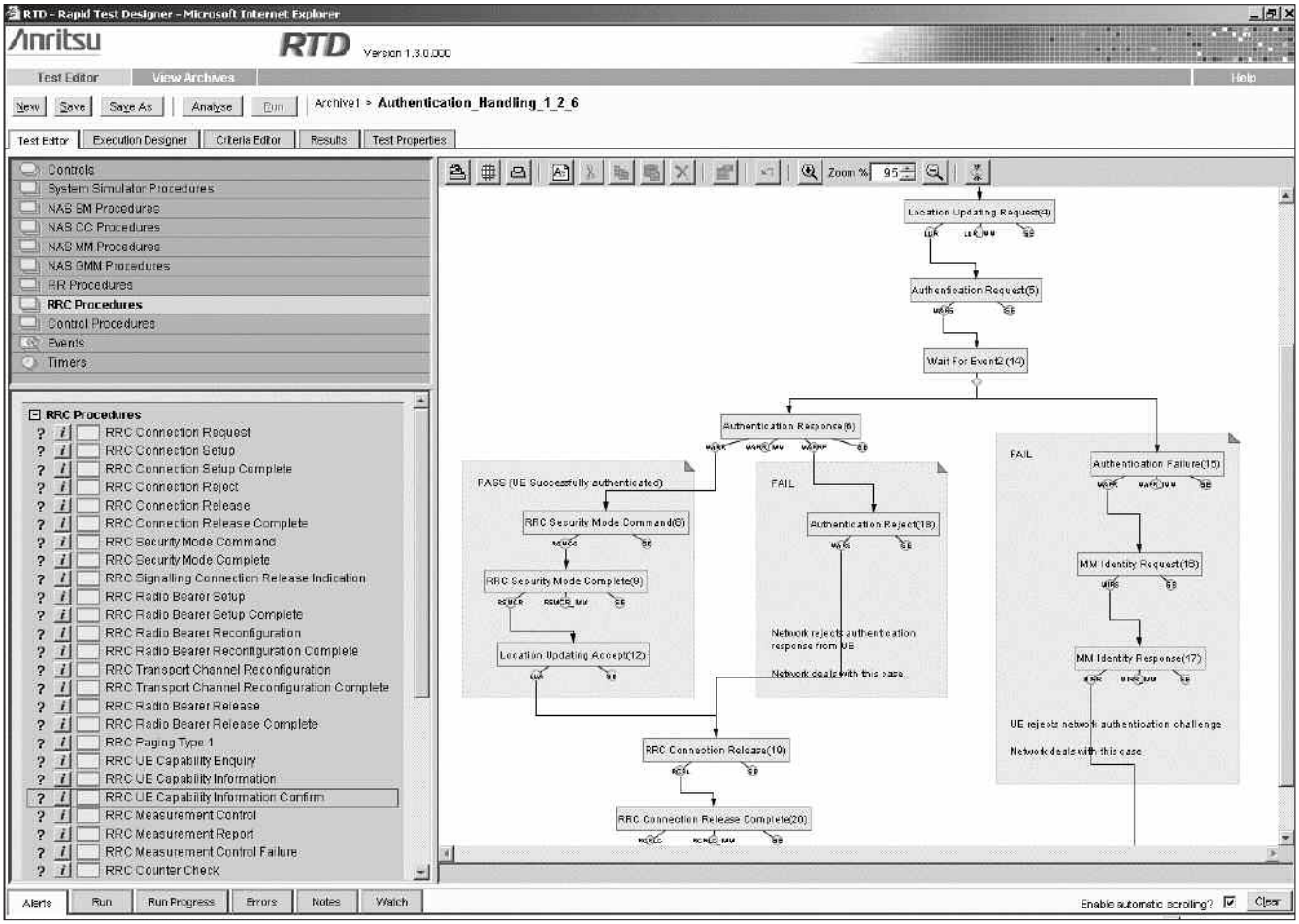


There are also Loops, Delays, including waiting for events, Interactive dialogs and Free form notes to construct a test. The RTD provides "Drag and Drop" selection of procedures, guidance on available procedures suitable at any point in the test, Addition/deletion of graphical test constructs, group 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

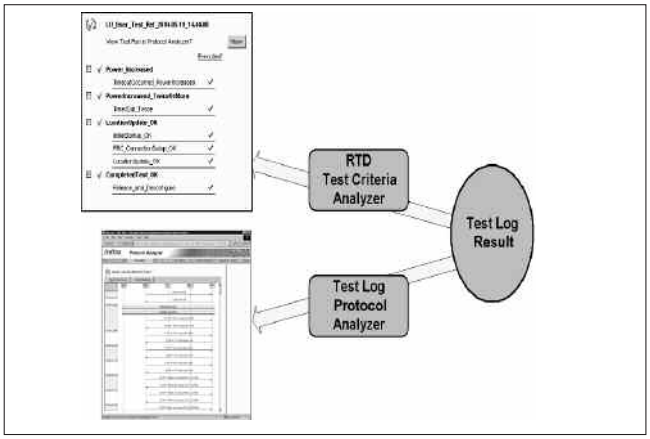
RTD defines the success or failure of a test execution at a high level by the means of test criteria. Test criteria are defined as the route taken through the procedures making up an RTD test, the content of incoming messages and the time between significant events. After running a test, the RTD uses 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.

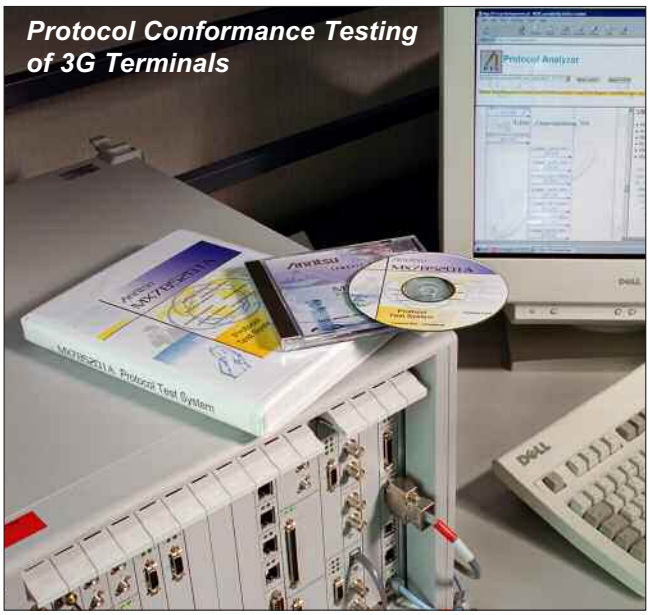
Catalogue Manager

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).

GCF/PTCRB CONFORMANCE TEST TOOLKITS
MX785220A



- **MX785220A**
TS34.123 Protocol Conformance Test Toolkit for Core Software

Features

- Designed for GCF/PTCRB certification of WCDMA and dual mode terminals
- Delivers TS34.123 TTCN conformance test cases defined in GCF Work Items
- Can be used for UE validation and GCF/PTCRB certification through an accredited test lab
- Enables UE manufacturers to carry out pre-conformance testing in a cost-effective manner
- Contains the specific executable conformance test cases and PTS test environment required by the GCF/PTCRB for terminal certification
- Regularly updated to deliver new and re-validated test cases once they are approved by the GCF/PTCRB

Introduction

A key part of the market introduction of a new 3G mobile phone is to prove that it conforms to the 3GPP standards. This is done through a formal conformance testing process defined by the Global Certification Forum (GCF) and agreed by its members, made up of the 3G manufacturers and the network operators. A similar process is defined by the PCS Type Certification Review Board (PTCRB) for US frequency bands.
For signaling protocols the mobile terminal must pass the conformance tests defined in 3GPP specification TS34.123.
For 3GPPP Release 99 terminals the GCF/PTCRB has defined an initial set of high priority test cases that must be run against a WCDMA or dual mode terminal. These test are detailed in GCF Work Item 010. Currently there are approximately 400 tests in WI-010.
Further Work Items have been defined to cover Release 99 Enhancements (WI-012), Release 4/5 features (WI-013) and HSDPA (WI-014).
The Anritsu Protocol Test System (PTS) has been designed to run all the TTCN conformance test cases in TS34.123. MX785220A Comformance Test Toolkit delivers the WI-10, WI-12, WI-13 and WI-14 test cases for PTS.

Applications

The Toolkits have been designed for both pre-conformance testing and formal GCF/PTCRB certification of 3G mobiles.
For GCF/PTCRB accredited test labs, either within a manufacturer's own organisation or an independent test house, the toolkits provides the correct PTS environment required for UE certification.
The cost of using an independent test house for conformance testing can be very high, requiring several weeks' time in the test lab. The Toolkits enables manufacturers to prepare as much as possible in advance of formal certification by replicating the GCF/PTCRB test environment in their own lab.
These toolkits will also be important to network operators who may use the GCF approved test cases as the basis of mobile acceptance testing from their suppliers or require their UE suppliers to test against the latest GCF/PTCRB approved test cases.

Toolkit Overview

MX785220A and the Work Item options will deliver validated and GCF approved test cases in each of packages. Additional test cases will be added to MX785220A once they are approved by the GCF and have been validated and approved on the PTS platform. The GCF approves new test cases at its CAG meetings, held every three months.
Newly approved GCF test cases and re-validated test cases will be supplied through regular Toolkit updates. These are supplied as part of the associated Annual Software Update and Maintenance Contract, MX785220A-20.

Independent Validation through RFI Limited

Anritsu use RFI Limited, a leading conformance test house based in the UK, to independently validate the conformance test cases on the PTS platform. RFI are fully accredited for validation testing and have many years experience in validating 2G and 2.5G test systems. RFI are a GCF/PTCRB accredited test house who independently validates the PTS and submits the results to the GCF/PTCRB for approval.

Content of the GCF/PTCRB Conformance Test Toolkits

The toolkit contains the test cases and PTS software required to replicate the GCF/PTCRB validated tests on the PTS. This includes:

- Specific PTS software version used for validation and approved by the GCF/PTCRB
- Validated and GCF/PTCRB approved conformance test cases in Executable Test Suite (ETS) form
- Operation manual, installation manual and release notes
- RFI Certificate of GCF/PTCRB approvals
- Copy of GCF/PTCRB approvals submission documentation

Details of which test cases are currently supplied in the Toolkits is available on request.
Any MD8480B/C firmware or FPGA software that may also be required will be provided as part of the PTS annual software upgrade and maintenance contract and delivered through Anritsu's local support organisation.
Note that the toolkits can be used only with an existing valid PTS test system license and cannot be used in isolation.

Licensing

Each toolkit is licensed on a per seat basis. A single user license will enable one PTS user to access and run the test cases in that toolkit.

Support

Support of the toolkits is provided through an annual software update and maintenance contract (MX785220A-20). The user must also have a valid software update and maintenance contract for his PTS system.

System Requirements

The exact hardware and software configuration required for an individual test case or toolkit depends on the test resource requirements defined within the test(s). Details are available on request.

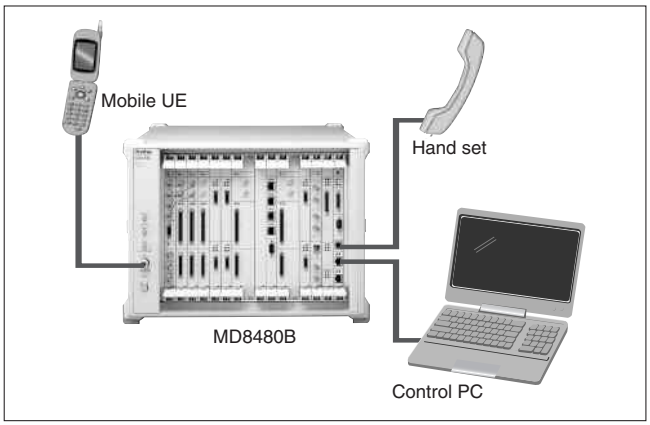
NSL PLATFORM
MX848055A

Pre-validation of 3G UE Interoperability Testing (IOT)

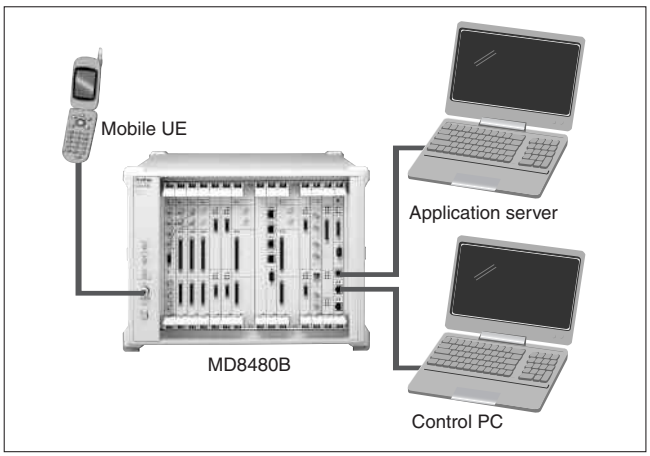
- **Dramatically reduces the costs for IOT**
- **Created based on operational experience of FOMA*1 Services*2**
- **Reliable operation verified by a commercial 3G UE*3**
- **Complies with the March 2003 3GPP Specifications**
- **Supports Voice, Packet, Video, Multicall and Supplementary services**

*1: FOMA is a registered trademark of NTT DoCoMo, Inc.
*2: This does not assure connectivity with a real BTS.
*3: The UE was designed for NTT DoCoMo, Inc.

The NSL (Network Simulation Library) is a PC software product that offers pre-validation of interoperability testing (IOT) between a 3G UE and a 3G network when it is used in combination with the MD8480B WCDMA Signaling Tester functioning as a BTS simulator. The MX848055A NSL Platform enables execution of test cases provided in the optional NSL Scenario Basic Pack (MX848055A-01) or NSL Scenario Advanced Pack (MX848055A-02) using a GUI (Graphical User Interface) execution environment with an easy-to-view display of test items and results.
The MX848055A-01 NSL Scenario Basic Pack enables simulation of the basic overall operation of various services such as Voice, Packet (IP/PPP), Video Call, SMS, and Multicall.
The MX848055A-02 NSL Scenario Advanced Pack enables simulation of more complex overall operation of these services, such as a handover test and rate change. Thus, tests can be performed while considering actual operation status.



Configuration of Voice Testing



Configuration of Packet Testing

Supported Test Cases

NSL Scenario Basic Pack (91 TCs)	Video Call	Originate (UE/Network), Release (UE/Network)
	Multi Call	Voice + Packet
	Packet (IP/PPP)	Originate (UE), Release (UE/Network)
	Registration	Combined Attach (CS/PS), Detach
	SMS	Originate, Terminate
	Supplementary Service	Call Forward, Call Waiting, CLI Notification
	UDI	Originate (UE), Release (UE/Network)
	Voice (AMR) Call	Originate (UE/Network), Terminate (UE/Network)
NSL Scenario Advanced Pack (182 TCs)	Video Call	Handover, Reallocation, ReEstabilish
	Periodic RA/LA Updating	
	Multi Call	Handover, Rate Change, Reallocation
	Packet (IP/PPP)	Handover, Rate Change, Periodic Cell Update, Reallocation
	Registration	Combined Attach (CS/PS)
	SMS	Handover, Reallocation
	Supplementary Service	Call Waiting, CLI Notification
	UDI	Handover, ReEstablish
	Voice (AMR) Call	Handover, ReEstablish, DTMF

Configuration

MX848055A NSL Platform
MX848055A-01 NSL Scenario Basic Pack
MX848055A-02 NSL Scenario Advanced Pack
MX848055A-TS110 Technical Support Service
MX848055A-TS121 MX848055A-01 Technical Support Service
MX848055A-TS122 MX848055A-02 Technical Support Service

Required System

Refer to each detailed data sheet for configuration detail.

MD8480B	MD8480B Minimum Configuration (V5.10)
	MU848053A RX Baseband
	MU848055A ISDN
	MU848057A Frame Coder
	MU848058A TX Baseband x 2
	MD8480B-02 Additional RF Unit
	MX848041A Ciphering (V5.10)
Control PC	Windows2000 Professional SP4 (English/Japanese)*1
	Pentium4*2 1 GHz or more
	Memory 256 MB or more
	Hard disk space 2 GB or more
	Display 1024 x 768 pixel (XGA) or more
	Microsoft Internet Explorer 6.0 or later*1
	Unoccupied USB port x 1, Ethernet (100BASE-TX/10BASE-T) port x 1
USIM	P0027 Test USIM (Anritsu)*3

∗1: Microsoft, Windows and Internet Explorer are a registered trademark of the Microsoft Corporation in the USA and other countries..
∗2: Pentium is a registered trademark of the Intel Corporation.
∗3: The operation of this software has been verified by above USIM.

W-CDMA TRX/PERFORMANCE TEST SYSTEM ME7873F

W-CDMA RRM TEST SYSTEM ME7874F

CE

RF Conformance Test System Supporting Most Approved Test Cases

NEW

ME7873F with ME7873F-10 (Option)

Features

• Test System Supporting Most GCF*1/PTCRB*2 Approved Test Cases*3

The ME7873F W-CDMA TRX/Performance Test System is for testing the Tx and Rx characteristics of W-CDMA User Equipment (UE) in accordance with measurement items*4 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*5) can also be measured by installing the ME7873F-10 RRM Test Addition option. In addition, all Inter-RAT tests, including handover tests, can be performed.

The ME7874F W-CDMA RRM Test System 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.

Both of 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 Signaling Tester, these Test Platforms support the testing of W-CDMA UE with non-call-processing conditions as well as loopback conditions*6.

∗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 January 2007.

∗4 In principle, defined by GCF Work Item*7 and targeting measurement items certified by GCF/PTRCB

∗5 RRM: Abbreviation for Radio Resource Management

∗6 Not supported by RRM tests

∗7 Work Item: Name for test item group for each function chosen by GCF for test items for certifying UE conformance

New Technology Test Bench

• Supports National Frequency Bands

Not only does this system support 3GPP Band I (2.1 GHz) used in both Europe and Japan, it also supports Band II (1.9 GHz), IV (1/1.7 GHz), and V (850 MHz) used in N. America as well as Band VI (850 MHz) and IX (1.7 GHz) currently used only in Japan. 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.

• Supports New Technologies, Including HSDPA

The system offers the user a choice of upgrade options with the test items required to support additional technologies, such as WI*-013 (Release4/Release5)/WI*-014 (HSDPA).

∗: Abbreviation for Work Item

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.

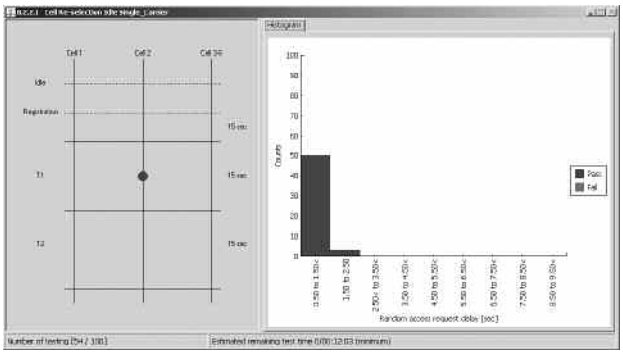
In addition, Anritsu engineers perform calibration when installing the system at acceptance inspection, eliminating the need for operators to perform this complex calibration and correction work.

∗: Patent applied for

• 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.

• Test Condition and Results Distribution at-a-Glance
RRM tests display the transitions in connection conditions, which is useful for understanding the connection status at any time.
Additionally, test items and results are displayed as a histogram indicating the PASS/FAIL rates for multiple operations and making it easy to identify equipment operation trends.



Test Conditions Screen

• 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.

• Equipment Expandability
Using the optional MN7462A-01 4 Antenna Connection supports continuous measurement of up to four UE units*.
*: The standard configuration supports one UE unit.

Supported Test Items and Options

For detailed test cases, contact our sales representative.

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)	
	7	√ (Option)	
	8	√ (Option)	√ (Option)
WI-014	5	√ (Option)	
	6	√ (Option)	
	9	√ (Option)	

*: Work Item is the name for test groups chosen by GCF indicating test items required for UE conformance certification.

SIGNALING TESTER
MD8470A

CE

Benchtop Mobile Communications Network

NEW

Excellent Eco Product
Lightweight
Power saving

In today's wireless communication market, packet data services and third generation systems are growing globally. Factors for succeeding in the wireless communication business are shifting from basic communication technology to the ability to plan and develop attractive mobile devices and services. The MD8470A supports wireless application engineers in accelerating the development and reducing the test cycle of these ever-increasing product and service requirements.

Features

- A single platform implements functional testing of mobile terminal applications such as voice calling, video calling, contents download and messaging.
- Call processing is performed by simple operations
  W-CDMA: Voice/Video call/Packet/SMS/MMS
  GSM/GPRS/EGPRS: Voice/Packet/SMS/MMS
  CDMA2000®: Voice/Packet/SMS
  TD-SCDMA: Voice/Packet/SMS
- Supports multiple communication systems
  W-CDMA, GSM/GPRS/EGPRS, CDMA2000®, TD-SCDMA
- Wide frequency coverage (400 MHz to 2.7 GHz).

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA – USA).

- **Single platform implements functional testing of UE applications such as voice calling, video calling, contents download and massaging.**

The MD8470A Signaling Tester offers the optimum solution for mobile UE application development. It supports the processes required for various application developments such as voice calling, packet communications including browser/contents download, video calling, SMS/MMS massaging and end-to-end UE communications. Also, the PPP server function is incorporated. The MD8470A serves as an effective tool for establishing an integrated simulation environment in application development.
In addition, Ethernet, ISDN, handset and serial I/O interfaces are provided for various data communication services.

Call Processing using Simple Operations

- **W-CDMA: Voice/Video call/Packet/SMS/MMS**
- **GSM/GPRS/EGPRS: Voice/Packet/SMS/MMS**
- **CDMA2000: Voice/Packet/SMS**
- **TD-SCDMA: Voice/Packet/SMS**

The MD8470A Signaling Tester supports basic call processing for W-CDMA (Voice call/Video call/Packet Communications/SMS/MMS), GSM/GPRS/EGPRS (Voice call/Packet Communications/SMS/MMS), CDMA2000 (Voice call/Packet Communications/SMS) 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, GSM/GPRS/EGPRS, CDMA2000, TD-SCDMA**

The MD8470A Signaling Tester complies with the GSM/GPRS/EGPRS, W-CDMA, CDMA2000 and TD-SCDMA standards regulating the world's major 2.5G and 3G 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 (426W x 221.5H x 281D mm) is ideal for configuring an on-the-bench personal simulation environment.

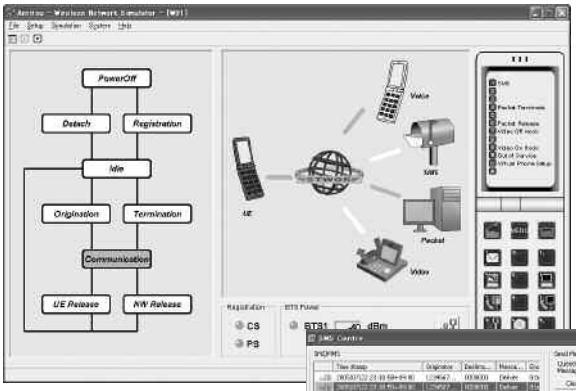
*: Windows® is a registered trademark of Microsoft Corporation in the USA and other countries.

MX847010A W-CDMA/GSM Simulation Kit

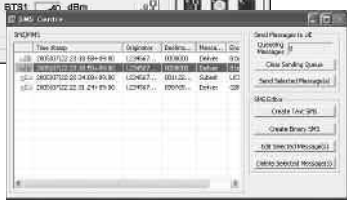
• Simple Application Testing

WNS: Wireless Network Simulator

The WNS is a software application for simulating an interactive mobile network on the MD8470A Signaling 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 Center)

Main Functions of WNS/SMSC

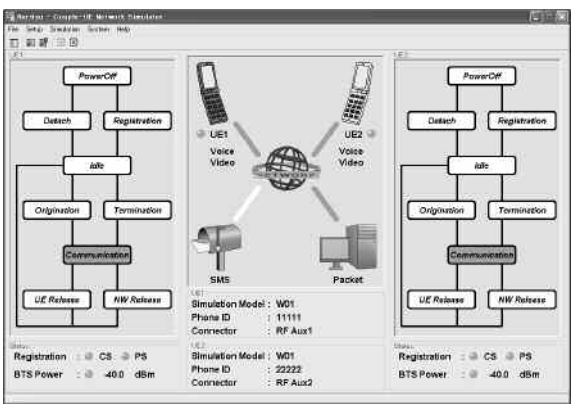
Supported Bearers	W-CDMA	• Voice (MO/MT), Packet (MO/MT), Video Call [Loopback] (MO/MT), MultiCall
	GSM/GPRS/EGPRS*2	• Voice (MO/MT), Packet (MO/MT)
Setup Parameters	Common	• Client IP address setting/Server IP address setting/Router connection setting • RF Level setting
	W-CDMA	• Channel setting • Registration Type setting • Activation Time setting (Voice, Packet, Video, MultiCall) • Packet Window Size setting • Packet Rate setting (DL64/UL64, DL128/UL64, DL384/UL64) • Video Phone setting (ISDN/Loopback)
	GSM/GPRS/EGPRS*2	• 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/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*3 • 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 • 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-01 EGPRS Software
∗3: Requires separate MMS application server

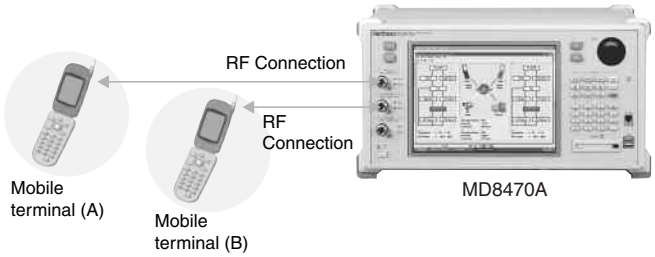
• Simple End-to-End UE Test Environment

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 applications.



CNS (Couple-UE Network Simulator)



End-to-End UE Test

CNS (Couple-UE Network Simulator) End-to-End UE Tests

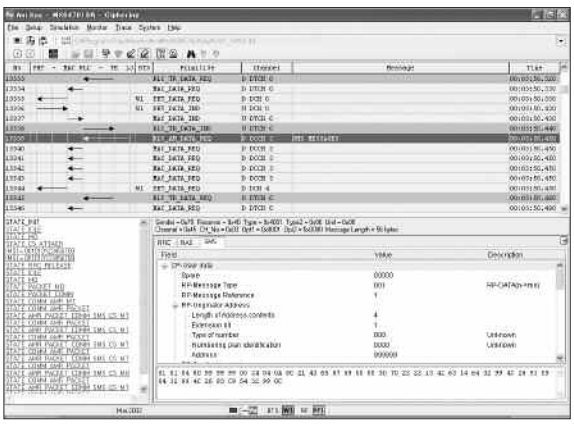
	Required Hardware	Supported End-to-End UE Tests
W-CDMA End-to-End UE Test	MD8470A-01: Second RF Option MU847010A : W-CDMA Signaling Unit x 2	End-to-End voice call test End-to-End video call test End-to-End SMS, MMS*3 test
GSM End-to-End UE Test	MD8470A-01: Second RF Option MU847020B : GSM Signaling Unit x 2	End-to-End voice call test End-to-End SMS, MMS*3 test
W-CDMA/GSM End-to-End UE Test	MD8470A-01: Second RF Option MU847010A : W-CDMA Signaling Unit MU847020B : GSM Signaling 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 Signaling 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 signaling messages and user data during simulation in real time
Trace log save/load	Saves (Binary/Text/Packet/H.245) 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

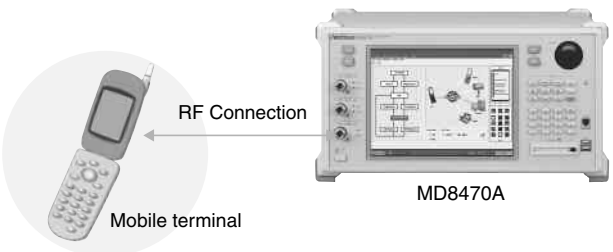
*: Supports RR, CC, MM, GMM, and SM

MX847010A-01 EGPRS Software

• Testing Application Functions Using EGPRS

MX847010A-01 EGPRS Software

The MD8470A Signaling Tester with MX847010A-01 EGPRS Software* and MU847020B GSM Signaling 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

Supported Functions

• W-CDMA Test Functions

MU847010A W-CDMA Signaling 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	○	—	○ *10, *11
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 packet call	Performs application tests utilizing packet data communications by connecting to server	○ *2	○	○ *2
UE terminated packet call	Performs application tests utilizing packet data communications by connecting to server	○	—	—
Packet call released from UE		○	○	○
Packet call released from NW (Network)		○	—	○
Packet Preservation	Releases RRC Connection while maintaining PDP Context	○	—	—
Multiple PDP Context	Performs Multi Session packet communications test	—	—	○
UE originated PPP packet call	Performs PPP (Built-in server/Serial) packet data communication test	—	—	○
PPP packet call released from UE	Performs PPP (Built-in server/Serial) packet data communication test	—	—	○
PPP packet call released from NW	Performs PPP (Built-in server/Serial) packet data communication test	—	—	○
UE originated/terminated Unrestricted Digital Information	*3	—	—	○ *10
Unrestricted Digital Information released from UE	*3	—	—	○ *10
Unrestricted Digital Information released from NW	*3	—	—	○ *10
Multi call	Performs packet and voice call test simultaneously etc.*4	○	○	—
SMS transmission/reception	Performs SMS (7bit-ASCII, Unicode, Binary) test*5	○	○	○
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*5	○	—	—
MMS transmission/reception	Performs MMS transmission/reception test*6	○	○	—
MMS transmission/reception (End-to-End UE test)	Performs end-to-end MMS test between two UE*6	○ *1	○	—
Cell Broadcast	Performs W-CDMA Cell Broadcast test	—	—	○
Supplementary service	Offers various sample scenarios of supplementary service such as Multiparty/Call waiting/USSD etc.	—	—	○ *10
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*7	—	—	△
InterRAT Testing (Inter-system Handover)	Performs W-CDMA ↔ GSM/GPRS/EGPRS*8 Inter-RAT tests (Cell Reselection/Voice/Packet)*12	—	—	○

○: Can be supported by WNS, CNS or sample scenarios

△: Can be supported by creating scenarios

• GSM/GPRS/EGPRS Test Functions

MU847020B GSM Signaling 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	○	—	○ *10, *11
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*8	○	○	○
UE terminated EGPRS packet call	Performs application tests utilizing packet data communications by connecting to server*8	○	—	—
EGPRS packet call released from UE	*8	○	○	○
EGPRS packet call released from NW	*8	○	—	—
Packet Preservation	Releases RRC Connection while maintaining PDP Context	○	—	—
Multiple PDP Context	Performs Multi Session packet communications test (GPRS/ EGPRS*8)	—	—	△
DTM (Dual Transfer Mode)	Performs Dual Transfer Mode (Class5/9/11) for GSM (CS:Voice) and GPRS/ EGPRS*8 (PS: Packet communications)*13	—	—	○
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*5	○	○	○
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*5	○	—	—
MMS transmission/reception	Performs MMS transmission/reception test*6	○	○	—
MMS transmission/reception (End-to-End UE test)	Performs end-to-end MMS test between two UE*6	○ *1	○	—
Cell Broadcast	Performs GSM Cell Broadcast test*9	—	—	○
Supplementary service	Offers various sample scenarios of supplementary service such as Multiparty/Call waiting/USSD etc.	—	—	○ *10
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*14	—	—	△
InterRAT Testing (Inter-system Handover)	Performs W-CDMA ↔ GSM/GPRS/EGPRS*8 Inter-RAT tests (Cell Reselection/Voice/Packet)*12	—	—	○

○: Can be supported by WNS, CNS or sample scenarios
△: Can be supported by creating scenarios

∗1: Two MD8470A units
∗2: Can change rate (DL:64 Kbps/128 Kbps/384 Kbps)
∗3: Uses ISDN interface option (MU847090B)
∗4: Read the MD8470A Signaling Tester catalog for details.
∗5: Uses SMSC (SMC Center)
∗6: Requires separate MMS application sever
∗7: Requires W-CDMA Ciphering Software option (MX847011A)
∗8: Requires EGPRS Software option (MX847010A-01)
∗9: Uses CBC (Cell Broadcast Centre)
∗10 : Provided by web download service of MD8470A support service (MX847010A-20)
∗11 : Supported only with Test SIM
∗12 : Requires MD8470A-01 Second RF Option, MU847010A W-CDMA Signaling Unit, and MU847020B GSM Signaling Unit
∗13 : DTM Test requires MU847020B GSM Signaling Unit
∗14 : Requires MX847021A GSM/GPRS Ciphering Software Option

RADIO COMMUNICATION ANALYZER
MT8820B
30 MHz to 2.7 GHz

CE GPIB

The One Box Tester Supporting W-CDMA/HSDPA, GSM/GPRS/EGPRS, CDMA2000® 1X/1xEV-DO

NEW

• 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/HSDPA, GSM/GPRS/EGPRS, CDMA2000® 1X (IS-2000), and CDMA2000 1xEV-DO 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.

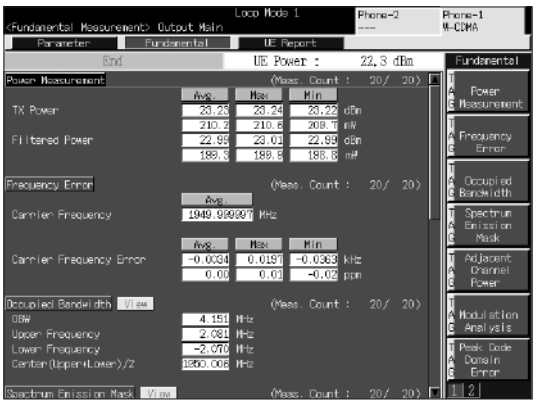
• Parallelphone™ Measurement
When the Parallelphone Measurement option is installed in the MT8820B main frame, two different mobile terminals can be connected and tested simultaneously with a single MT8820B using its second RF, AF, GPIB, and Ethernet port. This functionality significantly improves manufacturing efficiency by reducing production osts (return on investment and energy saving) and space.

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)
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 MX882001C)
MX882002C	CDMA2000 1X	Tx and Rx measurements of mobile terminals including call processing (requires MT8820B-003)
MX882003C	CDMA2000 1xEV-DO	Tx and Rx measurements of access terminals including call processing (requires MT8820B-003, MT8820B-004 and MX882002C)

* For W-CDMA terminal connectivity, contact Anritsu sales representative. Please refer to an individual catalogue 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.

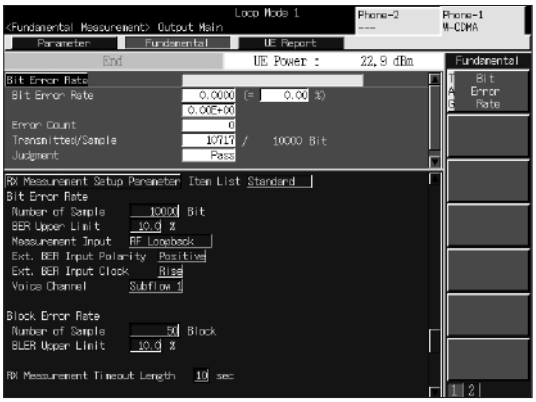
• Occupied Frequency Bandwidth
This test measures the occupied frequency bandwidth of the W-CDMA terminal. The ratio of the frequency bandwidth to the total power can be changed in the range of 80.0% to 99.9%.

• Adjacent Channel Power
Adjacent channel power is measured according to each communication system.
In W-CDMA, the power can be measured in ±5 MHz, ±10 MHz from center frequency. In GSM, the power of 25 points can be measured in ±2 MHz from center frequency.

• Spectrum Waveform Display
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 W-CDMA, the bit error rate can be measured by the loopback test mode specified in the 3GPP standards.



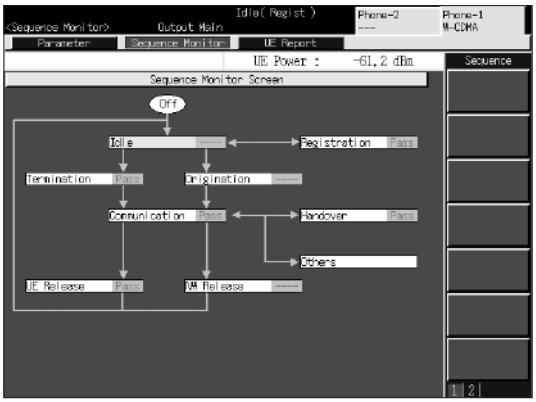
Example of Error Rate Measurement (W-CDMA)

External Packet Data

• Packet Communication Data Transfer Test
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) 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).

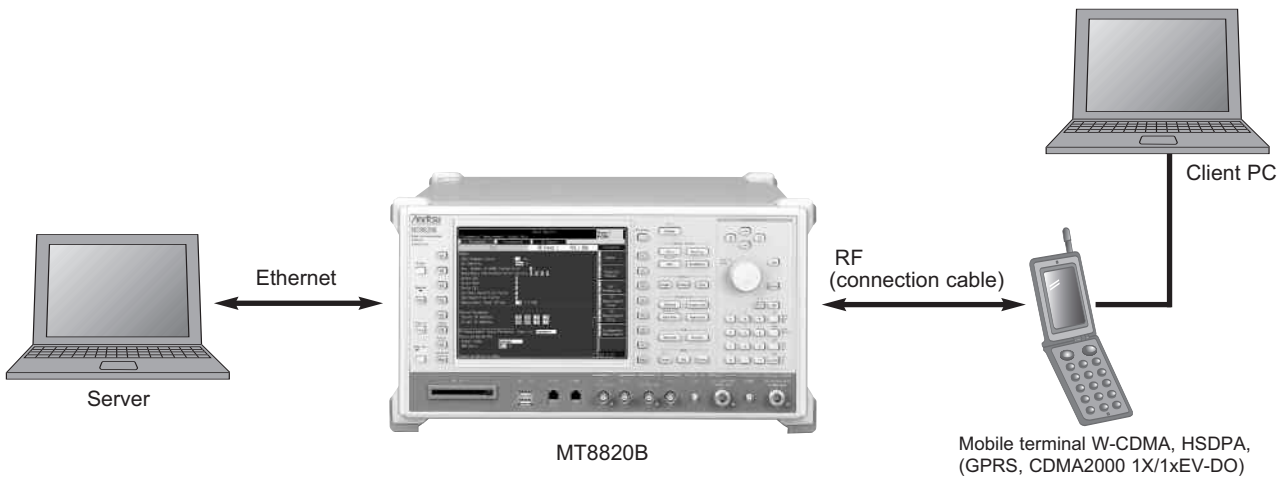
Call Processing Function

• Connection Tests
The call processing function enables performance of various connection tests including location registration, terminal call origination, network call origination, terminal disconnect and network disconnect. During a call, the user's speech can be echoed back from the terminal to provide a simple voice communication test.



Example of Sequence Monitor (W-CDMA)

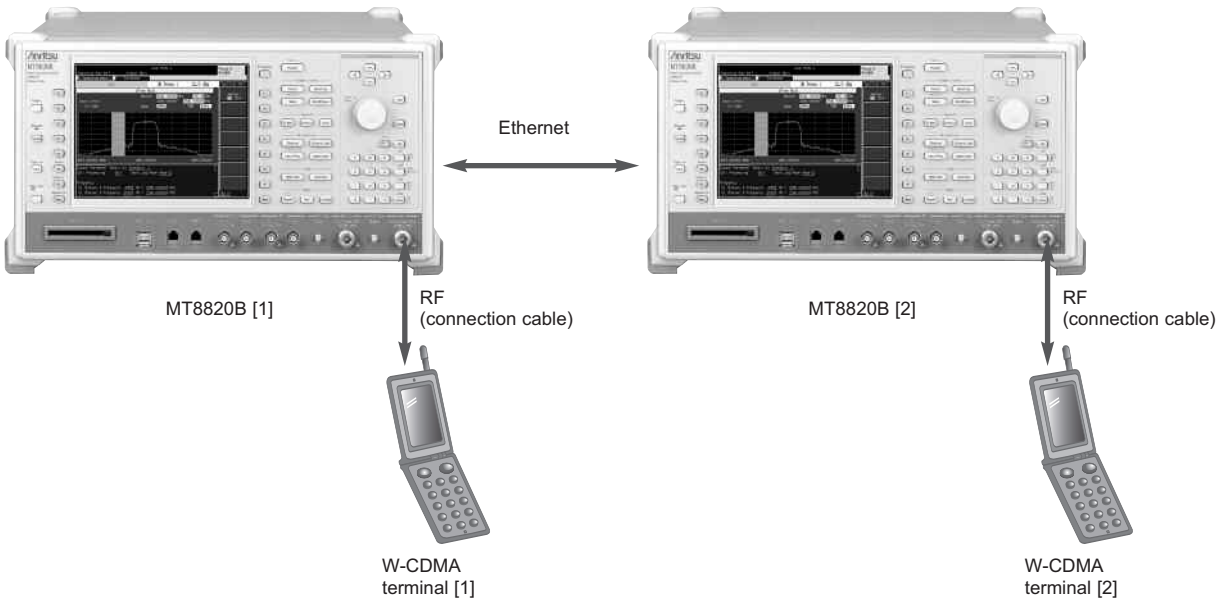
• Mobile Terminal Report Monitor
Mobile terminal status can be displayed based on the measurement report that the terminal sends back to the tester. "RX Level" monitoring shows the down-link RF signal level received by the terminal.



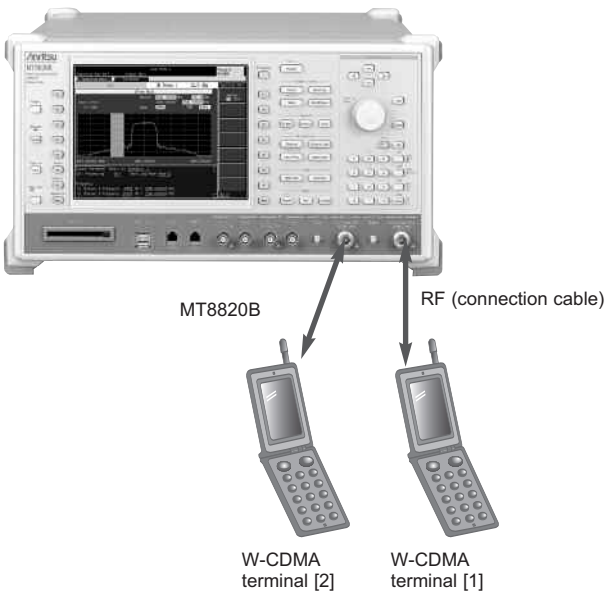
Sample MT8820B connection

• W-CDMA Video Phone Test

End-to-end video communication between two W-CDMA terminals supporting a video phone can be tested via the Ethernet port in the back panel of the MT8820B using the MX88205xC-003 W-CDMA Video Phone Test. 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)

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 “ALL MEAS? 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.

Options

• W-CDMA Measurement Hardware (MT8820B-001)

The MT8820B-001 W-CDMA measurement hardware can measure the main test items of transmission and reception characteristics for 3G W-CDMA conforming to 3GPP in combination with MX882000C W-CDMA Measurement Software and MX88205xC W-CDMA call Process Software.

• TDMA Measurement Hardware (MT8820B-002)

The MT8820B-002 TDMA measurement hardware can measure the main test items of transmission and reception characteristics for GSM/GPRS that is most spread in the world in combination with MX882001C GSM Measurement Software.

The combined use of MX882001C-011 EGPRS Measurement Software enables the measurement of main Tx and Rx characteristics on EGPRS, which is the high-speed version of GPRS.

• CDMA Measurement Hardware (MT8820B-003)

This option can measure the major transmission/reception characteristics on the third-generation CDMA2000 1X terminals conforming to 3GPP2, in combination with the MX882002C CDMA2000 Measurement Software.

• Audio Board (MT8820B-011)

The MX882000C-001 W-CDMA (MX882001C-001 GSM) Voice Codec is optional software that brings real-time voice encoding and decoding to the W-CDMA (GSM) Measurement Software. Installation of this and the MT8820B Option 011 (audio board) achieves end-to-end communication testing with handsets. In addition, the audio measuring function enables transmission/reception audio measurements to be performed while a call is connected.

RADIO COMMUNICATION ANALYZER
MT8815B
30 MHz to 2.7 GHz

CE GPIB

For Mobile Phone Service and Repair

NEW

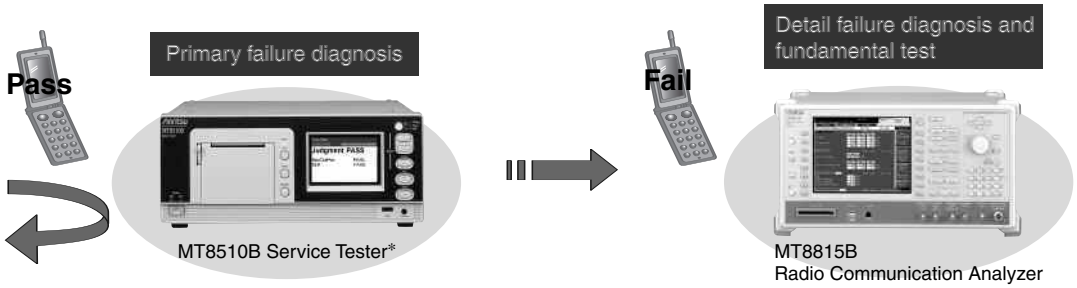
Service Platform for 2G to 3.5G Mobile Phones

The MT8815B Radio Communication Analyzer is a multisystem platform for testing /HSDPA,GSM/GPRS/EGPRS,CDMA2000® 1X/1xEV-DO and AMPS mobile phones.
A single cabinet supports detailed fault diagnosis and testing of all main mobile phone transmission/reception items.

Combining the MT8510B Service Tester with the MT8815B covers Service Point to Repair Center systems for all W-CDMA/GSM and GSM mobile phones.
The MT8510B troubleshoots faults using simple pass/fail evaluation, while the MT8815B diagnoses fault details by using additional tests and higher-accuracy measurements.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA – USA).

Model for W-CDMA/GSM Mobile Phones

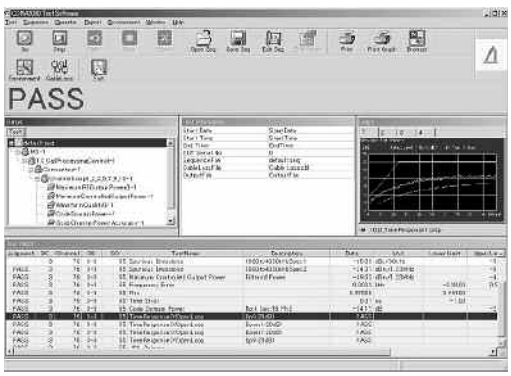


*: Read the MT8510B datasheet for details.

Detailed Failure Diagnosis

The easy-to-use MX881580A Mobile Phone Test Software is installed in an external PC to edit test sequences and set pass/fail threshold values for each test item.
The user can repeat tests of failed items to pinpoint the mobile phone failure based on a test report.

MX881580A Mobile Phone Test Software for W-CDMA/GSM/GPRS/EGPRS/CDMA2000 mobile phones

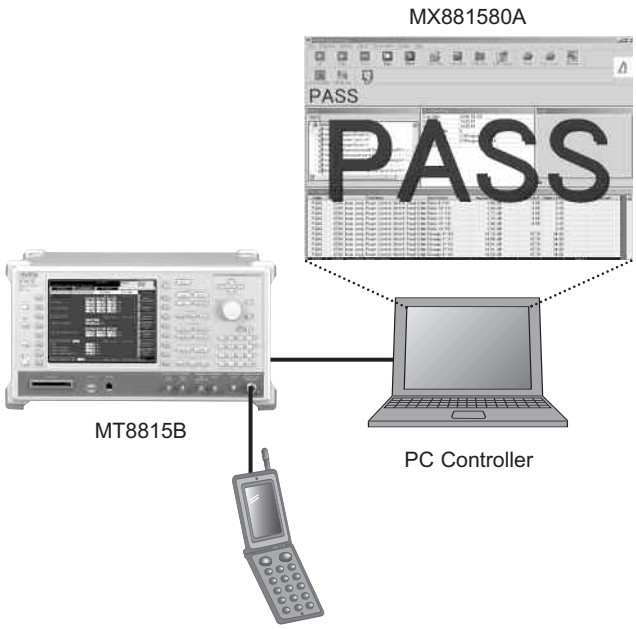


• **Test Sequence Screen**
Provides flexible editing for test sequences, selecting test items, and changing test order and number of tests

• **Graph**
Waveform display for transmitter tests

• **Test Information Screen**
Displays test information, such as running test sequence file, test date, and measurement time

• **Test Report**
Displays test report
(Users can set pass/fail thresholds.)



SERVICE TESTER
MT8510B

All-in-one W-CDMA and GSM Go/No-Go Testing

Excellent Eco Product
Lightweight
Power saving

- **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.

Shield Box

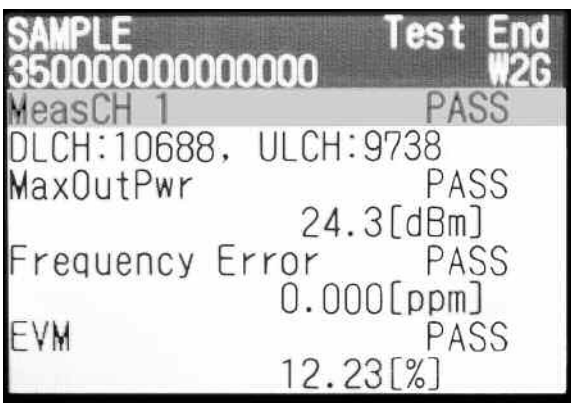
- **Simple Operation**

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.

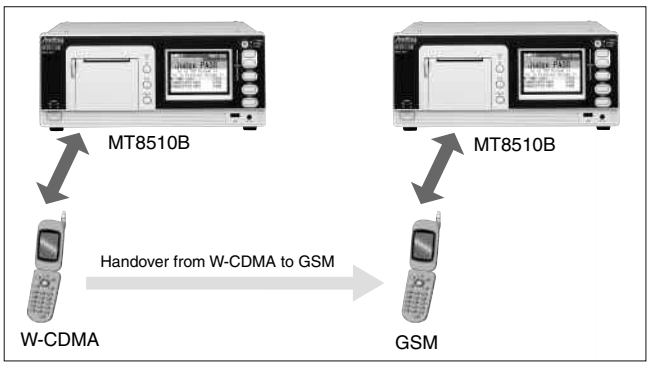


Example of measured results

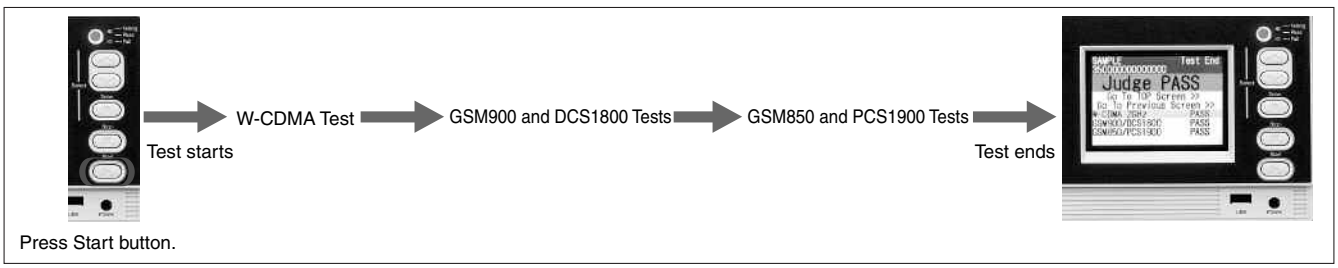
Supports Intersystem Handover Control

• 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



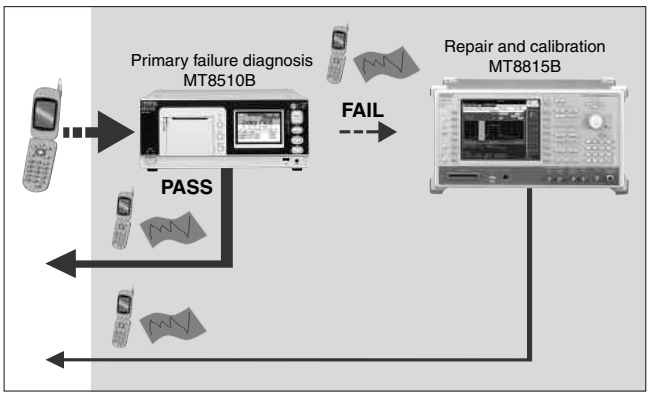
W-CDMA and GSM Sequence Test

• Multiband Support

The MT8510B meets the multiband specifications ensuring compliance with future designated W-CDMA frequency bands.

• Maintenance Solution

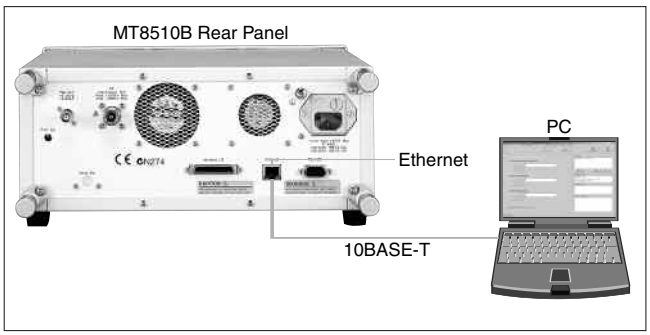
Anritsu's total maintenance solution offers customers the MT8510B for primary fault diagnosis and the MT8815B for repair and calibration.



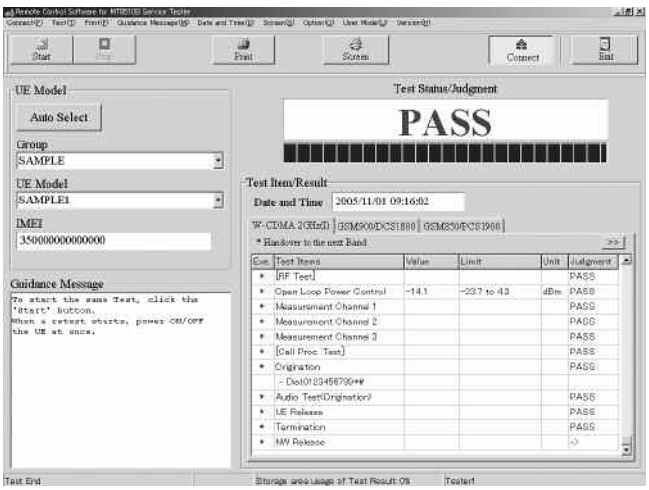
Service Center Testing

• 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

SHIELD BOX
MA8120E

Shield Box Suitable for Testing Mobile Phones

NEW

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.

VECTOR SIGNAL GENERATOR
MG3700A

250 kHz to 3 GHz, 250 kHz to 6 GHz (Option)

CE GPIB

Supports the Evaluation of Wireless Communications Evolving into the 4th Generation

Excellent Eco Product
Lightweight
Power saving

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.
Furthermore, 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 generation software can create waveform pattern data for transfer to the MG3700A via 100BASE-TX Ethernet. In addition, IQ sample data files (ASCII) created using general EDA (Electronic Design Automation) tools such as MATLAB® can also be converted to waveform patterns for the MG3700A.
And a customized waveform pattern are easy to generate too.

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 typical (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 the communication systems are bundled as standard:
W-CDMA/HSDPA, GSM/EDGE, CDMA2000® 1X/1xEV-DO
Wireless LAN (IEEE802.11a/b/g), PDC, PHS, AWGN,
Bluetooth®*2, 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*3, TDMA*3, CDMA2000 1xEV-DO*3,
Multi-carrier*3, Mobile WiMAX*3, DVB-T/H*3

*1: Read the MX370x Series Software Catalog for details.
*2: *Bluetooth* and related logos are owned by the Bluetooth SIG, Inc., and are used by Anritsu under license. Other trademarks and trade names belong to their respective owners.
*3: A license key must be installed in the main frame.

MATLAB is a registered trademark of The Math works, Inc.
CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA – USA).

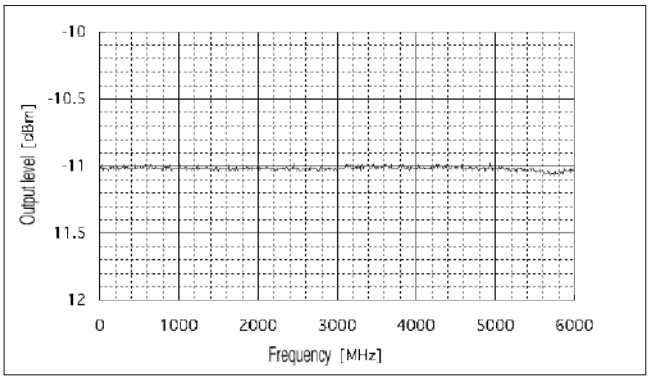
• High Level Accuracy
Absolute level accuracy:
±0.5 dB typ (≥–120 dBm 25 MHz ≤fc ≤3 GHz, E-ATT*)
±0.8 dB typ (≥–120 dBm 3 GHz <fc ≤6 GHz, E-ATT*)
±0.5 dB typ (≥–120 dBm 25 MHz ≤fc ≤3 GHz, M-ATT*)
±0.8 dB typ (≥–100 dBm 3 GHz <fc ≤6 GHz, M-ATT*)
* E-ATT: Electronic attenuator, M-ATT: Mechanical attenuator

• Wide Vector Modulation Bandwidth
A wider RF modulation bandwidth of 120 MHz is achieved using internal baseband signal generation.
Furthermore, 150 MHz vector modulation bandwidth is supported up to 6 GHz using the external IQ input.

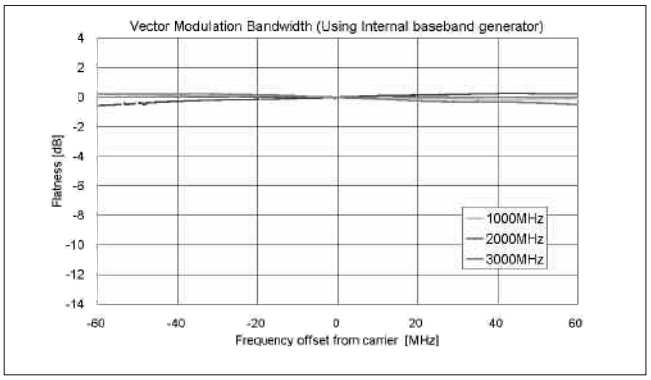
• High-speed Transfer over 100BASE-TX Ethernet
Wideband high-speed communication systems require transmission of long waveform patterns. To transfer long patterns at high speed, the MG3700A supports 100BASE-TX LAN connections. When the waveform patterns of two or more MG3700A systems must be updated, 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 very high (14 Mbyte/s typ). If the hard disk fails, it can be changed using the optional HDD ASSY.

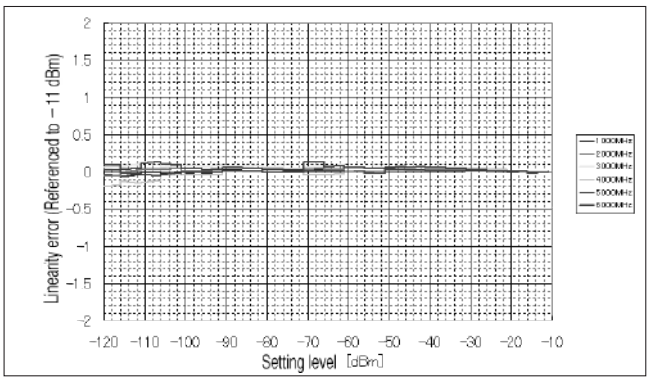
• Up to 2 GB Waveform Memory
The large-capacity waveform memory can be save many waveform patterns.
Waveform patterns are read from the hard disk and saved to memory for instant outputted without accessing the hard disk again.



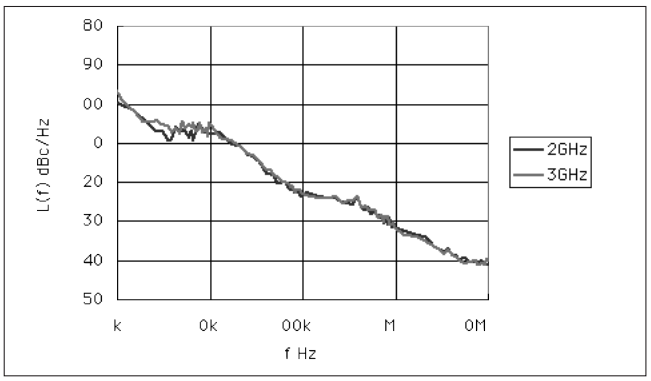
Frequency Characteristic



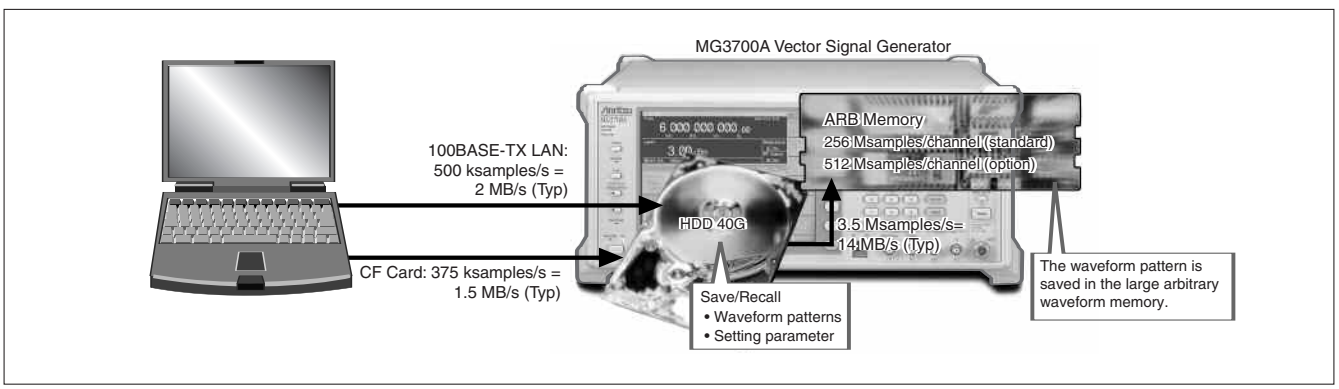
Vector Modulation Bandwidth (Using external IQ input)



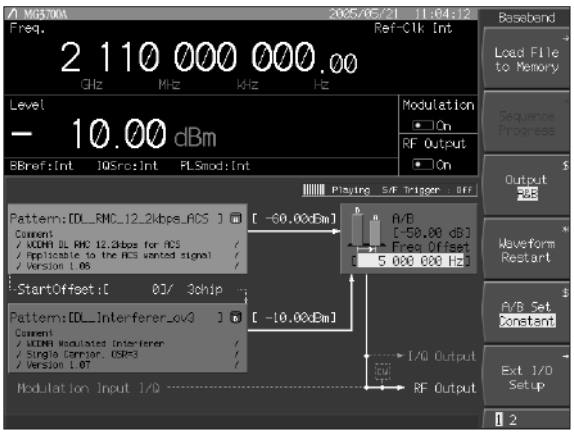
Linearity



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 ACS: Adjacent Channel Selectivity or Blocking characteristics, one MG3700A can output both the Wanted Signal + Interfere Signal and Wanted Signal + AWGN. The level ratio accuracy is excellent because digital processing is used for adjustment and S/N.



Wanted Signal + Interfering Signal Screen

• Built-in Standard 20 Mbps BER
The built-in BER analyzer supports easy BER measurement of the receiving characteristics.
Input bit rate: 1 Kbps to 20 Mbps
Measurable BER: 0% to 1%
A BER option supports measurement from 100 bps to 120 Mbps (next page).

• 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.

Model: MX370001A
Name: TD-SCDMA Waveform Pattern
Waveform patterns for transmission/reception test of 3GPP 1.28 Mcps TDD Option (TD-SCDMA)

Model: MX370002A
Name: 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:

Model: MX370101A
Name: HSDPA/HSUPA IQproducer
Parameters can be changed and the required waveform patterns can be generated for HSDPA Uplink/Downlink and HSUPA E-DPDCH/EDPCCH.

Model: MX370102A
Name: 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.

Model: MX370103A
Name: CDMA2000 1xEV-DO IQproducer
Parameters can be changed and the required waveform patterns can be generated for CDMA2000 1xEV-DO Forward/Reverse signals.

Model: MX370104A
Name: 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.

Model: MX370105A
Name: Mobile WiMAX IQproducer
Some parameters of the DL/UL-MAP and DCD/UCD, etc., MAC management messages can be set. The generated waveform pattern can be used for part** of the IEEE802.16e standard (8.4.13 Receiver Requirement).
**: Excludes Function tests (HO etc.) that cannot be done only with a signal generator.]

Model: MX370106A
Name: 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.

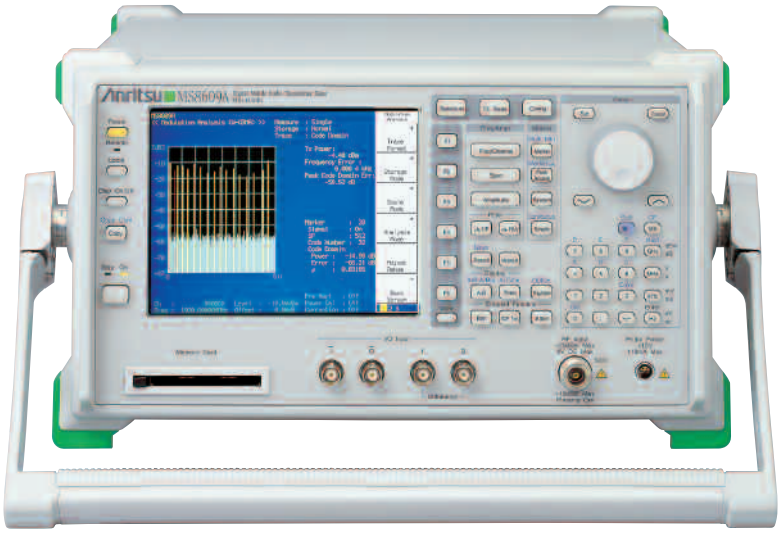
*: Read the MX370x Series Software catalog for details.

DIGITAL MOBILE RADIO TRANSMITTER TESTER
MS8609A
9 kHz to 13.2 GHz

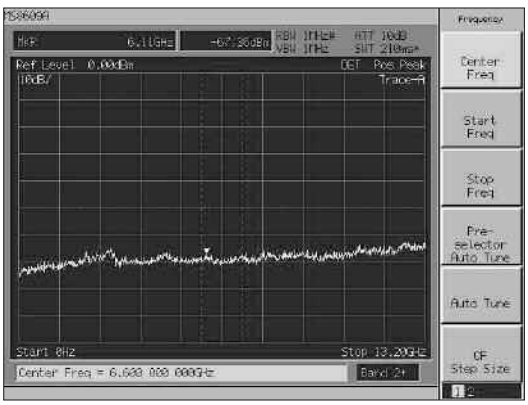
GPIB Ethernet OPTION

For Evaluation of 2G and 3.5G Communication Standards

Excellent Eco Product
Lightweight
Power saving
Small size
(Conventional product ratio)



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 MHz, 5 MHz, 10 MHz, 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)

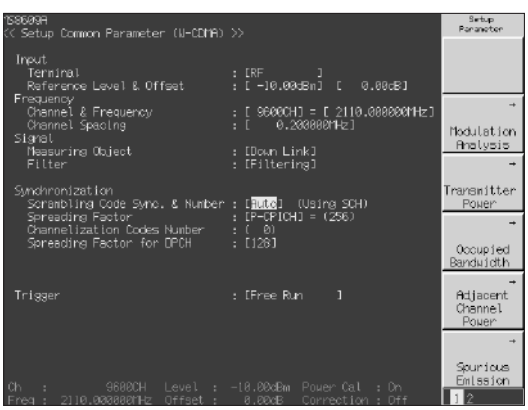
• Level
Maximum input level: +20 dBm
Input attenuator: 0 to 62 dB (2 dB steps)
1 dB gain compression: +3 dBm (≥500 MHz)
Two tone 3rd order distortion: ≤–85 dBc (0.1 to 3.2 GHz)

• 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

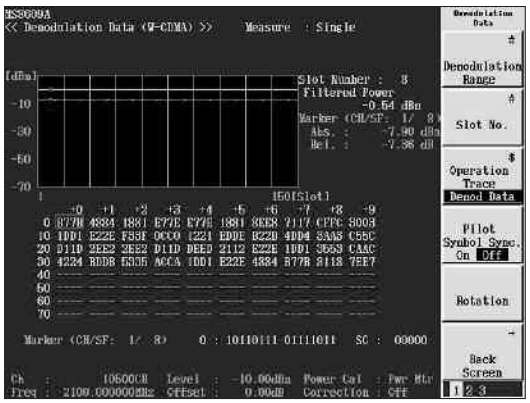
• Parameter Setup
Measurement parameters such as modulation accuracy and code domain power, etc., are set on the screen shown below.
Measurement is easy using a soft-key menu after setting measurement parameters.



• 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.

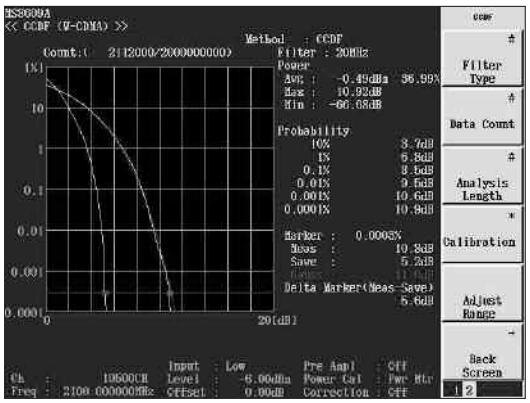
• Modulation Accuracy Measurement
The modulation accuracy of base stations and mobile UE can be measured and modulation analysis of multiple waveforms can be performed. The residual vector error (rms) accuracy is high (1%, typ.).

• Demodulation Data Monitoring
After de-spreading, up to 10 frames of demodulation data can be evaluated.

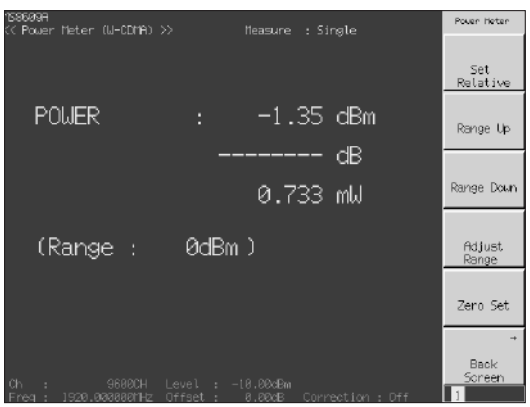


• I/Q Level Measurement
This function measures and displays each I and Q input voltage (rms, p-p value). The units are dBmV or mV.

• 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.

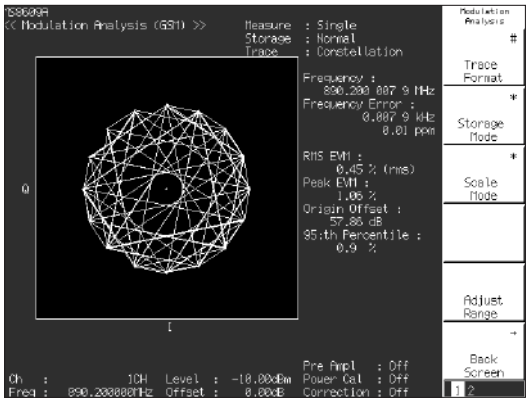
• Modulation Accuracy Measurement
The modulation accuracy is high. (The residual phase error of GMSK modulation is <0.5˚ rms and the residual EVM of 8PSK modulation is <1.0% rms.)

• 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).

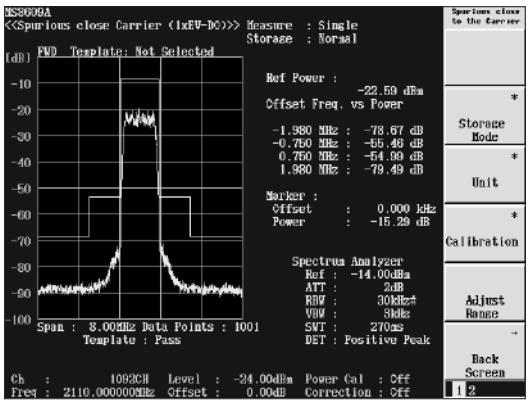
• BTS Code Domain Analysis
Only 2 seconds are required for code domain analysis of 1xRTT signals, and RC* 1 through RC5 can be measured.
The spreading factor of each code is detected automatically and displayed on-screen.
*: Radio Configuration

• 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.

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA–USA).

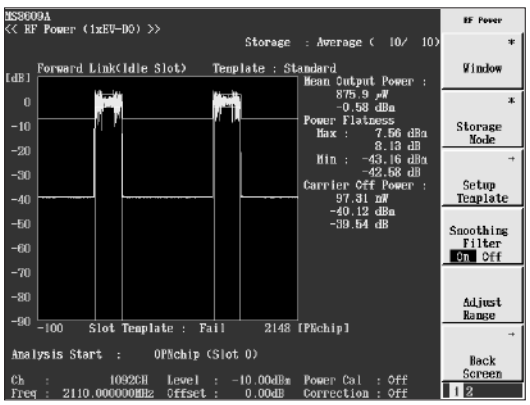


• Spurious Measurement
A frequency table can be set up at spurious measurement to provide PASS/FAIL measurement results. Fifteen frequencies and limit values can be input.

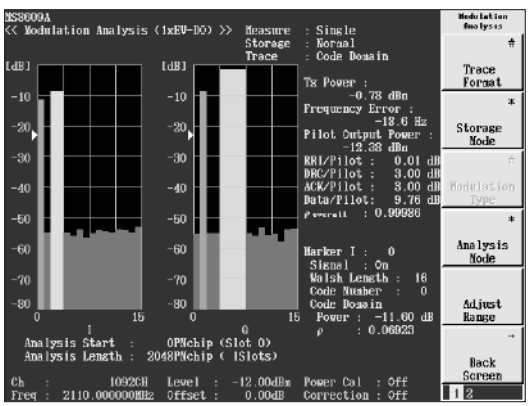
MX860904A
CDMA2000® 1xEV-DO Measurement Software

• 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.



• 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.



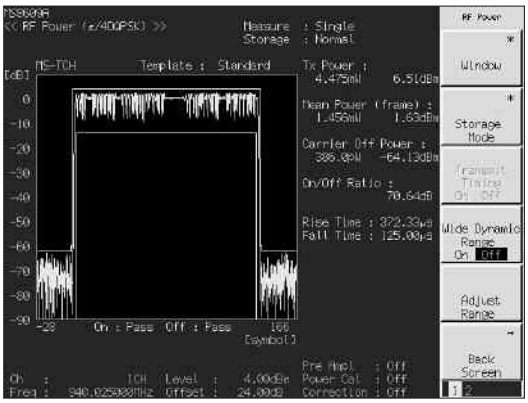
• Spurious Close to Carrier Measurement
Spurious close to the carrier is measured using the spectrum analyzer function. The template PASS/FAIL evaluation is displayed on-screen.

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.

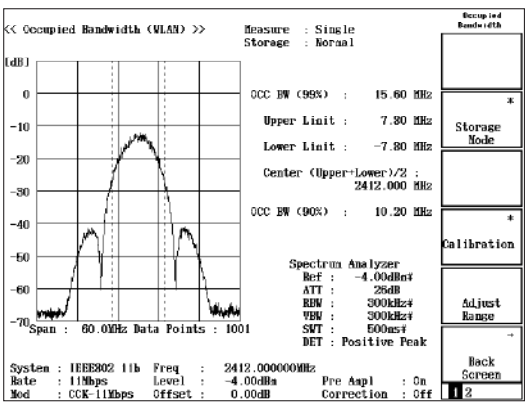
MX860930A Wireless LAN Measurement Software

• 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.

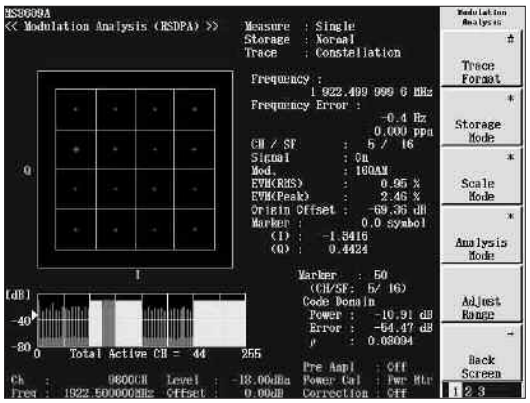
• Spurious
This displays the measured results for spurious, including frequency, level, PASS/FAIL results, specifications, RBW and VBW in three sweep modes on three screens.
Measured results are evaluated automatically and PASS/FAIL is displayed by comparison with a preset limit.

• Macro Function (Batch Processing)
Each item listed below can be batch measured and evaluated against preset values.

For details and specifications, see the data sheet.

MX860950A HSDPA Measurement Software

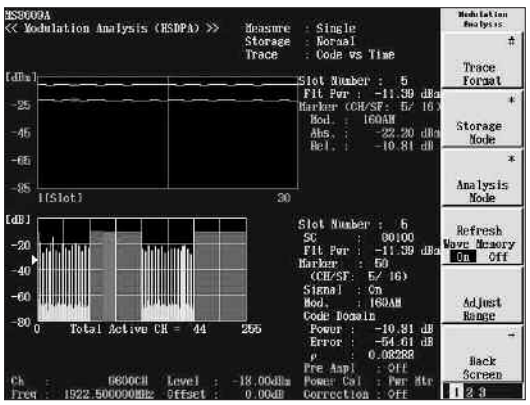
• Modulation Analysis (Constellation)
The displayed pattern can be selected from either constellation only or constellation + code domain. The constellation of the code channel selected at the code domain screen is displayed.



• 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.

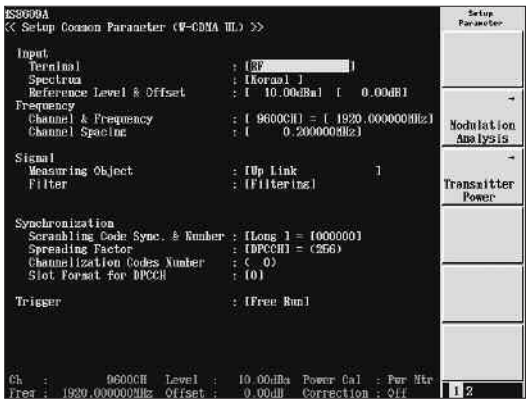
• CCDF Measurement
The displayed pattern can be selected from either CCDF for instantaneous power, and average power difference or APD. The CCDF for multi carriers can be measured.

• 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.

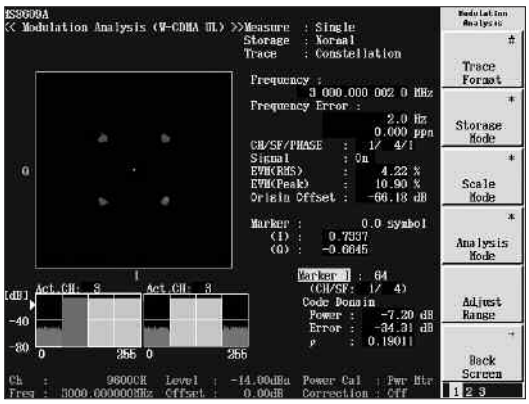
• Spurious Measurement
There are three spurious measurement methods: Spot, Sweep and Search. Up to 15 frequencies and limit values can be set in a table and measurement results are displayed with a limit evaluation.

MX860951A
W-CDMA Release5 Uplink Measurement Software

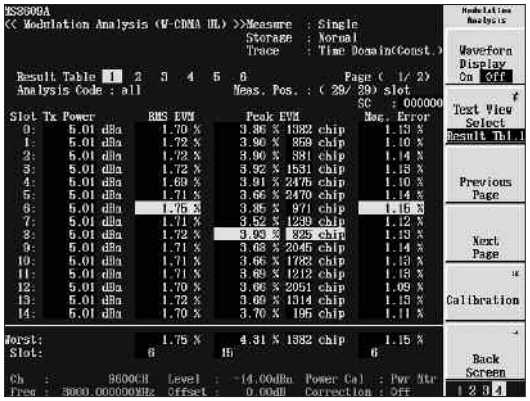
• Parameter Settings
This screen is used to set basic parameters, such as frequency and signal type. Operation is simple after completing each setting.



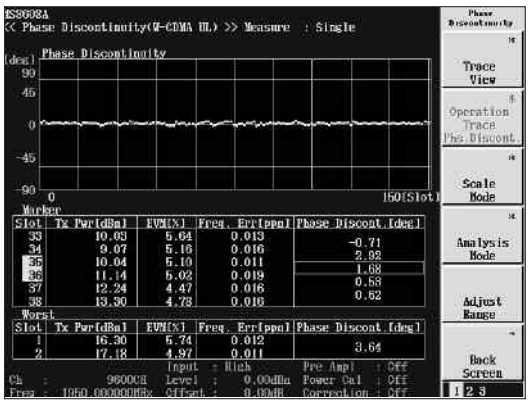
• Modulation Analysis Measurement [1]
The results for modulation analysis, such as frequency error, EVM and PCDE are all displayed on a screen. Also, the user can view the constellation of the code selected on the code domain screen.



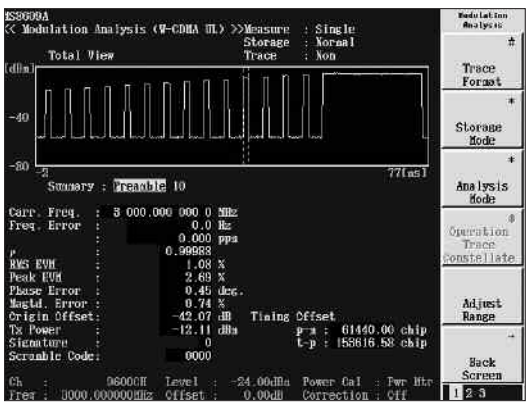
• Modulation Analysis Measurement [2]
Test results such as Tx Power, RMS EVM and Peak EVM per slot are listed on-screen, helping the user detect slot-dependent degradation easily.



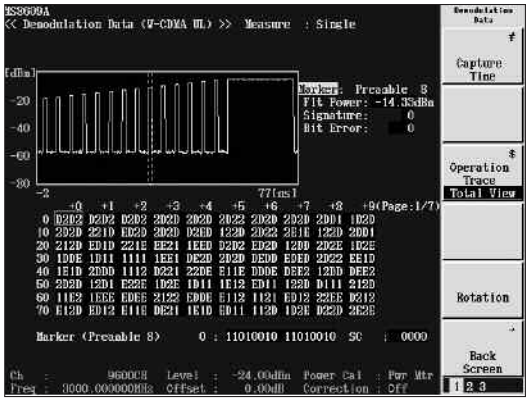
• Phase Discontinuity Measurement
Test results such as Tx Power, EVM, Frequency Error and Phase discontinuity per slot, and Worst values are displayed on a single screen, allowing the user to understand the analysis results instantaneously.



• 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.

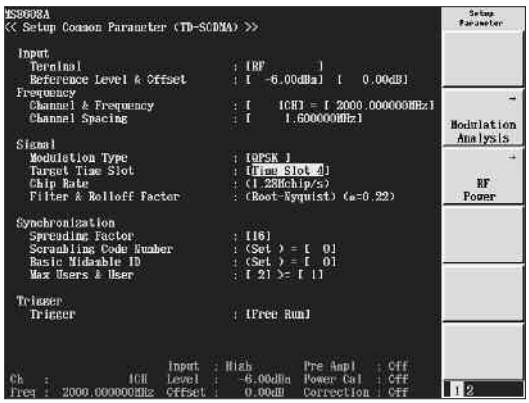


The demodulated data of the Preamble or Message is displayed. Data in the Preamble that is different from ideal data strings defined by the standards is shown in red to help the user find errors quickly.

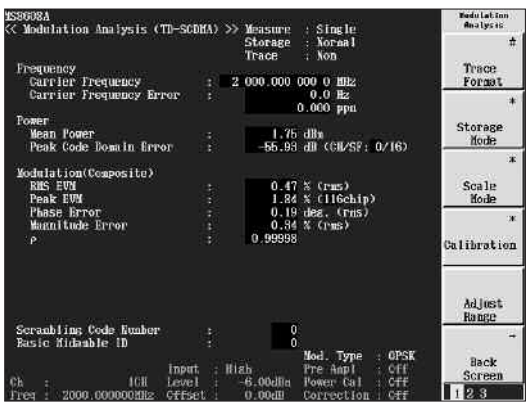


MX860960A TD-SCDMA Measurement Software

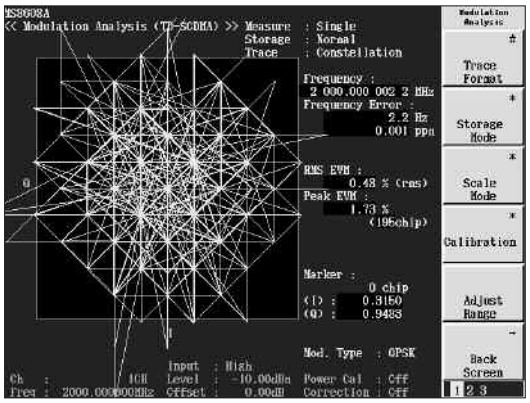
• Parameter Settings
This screen is used to set basic parameters, such as frequency and signal type. Measurement is simple after completing each setting.



• Modulation Analysis Measurement [1]
Results such as frequency error, EVM, and PCDE as well as modulation analysis results are displayed together.

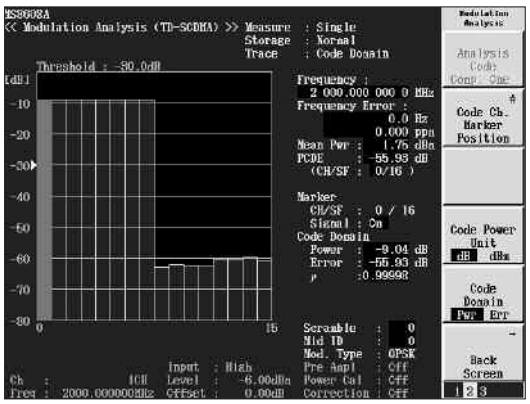


Various display methods, such as Phase Error and Magnitude Error can be chosen. High-accuracy measurements are performed, reducing residual vector error (rms) to 0.8% (typ.).

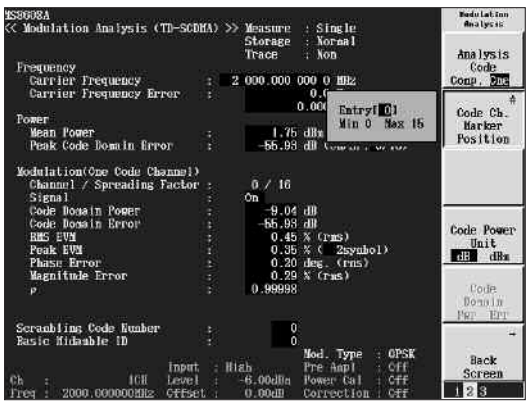


• Modulation Analysis Measurement [2]

The power of each code can be visualized using code domain displays (Code Domain Power, Code Domain Error).

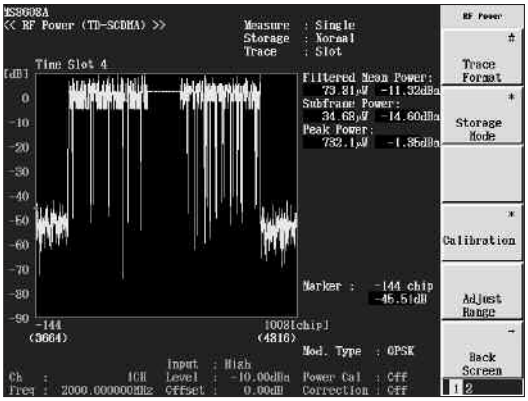


Each code channel can be analyzed and the results for the marked code channel position displayed.

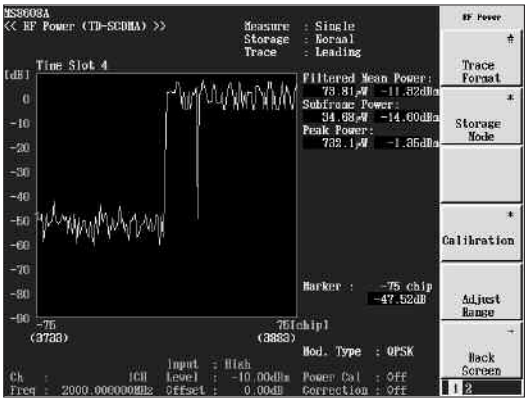


• RF Power Measurement

The specified burst is searched from DwPTS and the RF power is measured. The Filtered Mean Power, Subframe Power, and Peak Power are listed.



There are four display methods: Slot, Subframe, Leading, and Trailing. These displays support flexible use matching the measurement conditions.

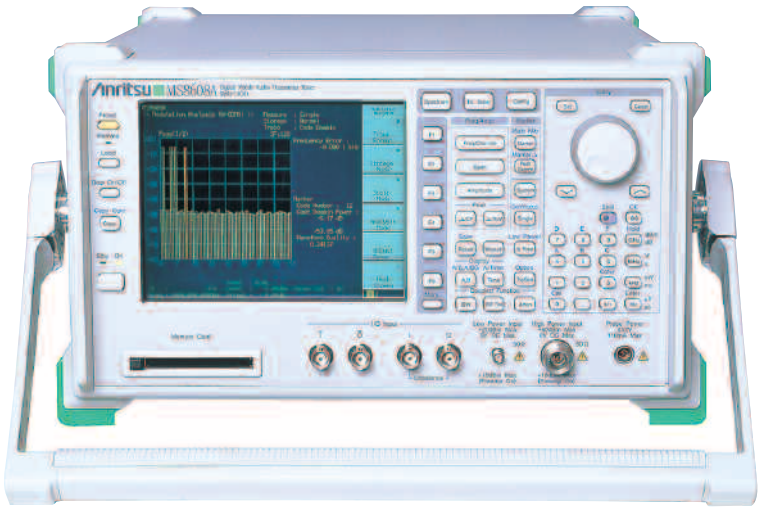


DIGITAL MOBILE RADIO TRANSMITTER TESTER
MS8608A

9 kHz to 7.8 GHz

CE GPIB Ethernet OPTION

For Evaluation of 2G 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)

RNC SIMULATOR
MD8391A

CE

Small RNC Simulator for Manufacturing, Installation and Maintaining W-CDMA base Stations

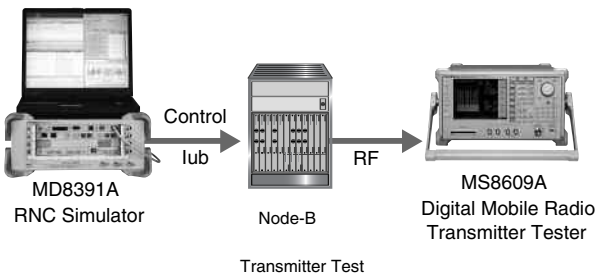
NEW

- Small and light weight: <10 kg
- HSDPA Iub simulator conforming to 3GPP Release5
- Easy scenario scripting by GUI (Option)
- Perform U-Plane data testing

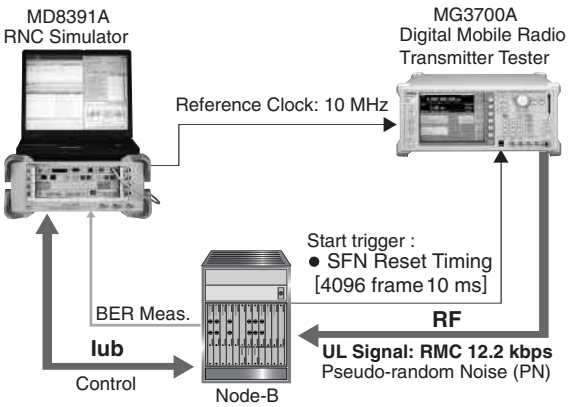
The MD8391A is small portable RNC simulator for manufacturing, installation and commissioning Node B.
Using MD8391A RNC Simulator permits an easy and cost-effective configuration of a Node B test environment, eliminating the need for a very expensive actual RNC and core network.

Features

• Node B RF Testing
The 3GPP TS25.141 Base Station (BS) conformance testing (FDD) RF Test is performed by combining the MD8391A with a Digital Mobile Radio Transmitter Tester (Tx Tester), and Vector Signal Generator (VSG). When running the transmitter test using the MD8391A, Node B can be controlled from the Iub interface by configuring the Test Model. Additionally, at the Receiver Test, Node B can be controlled in the Receiver Test state to receive the Uplink RMC (Reference Measurement Channel) and measure the BER (Bit Error Rate).

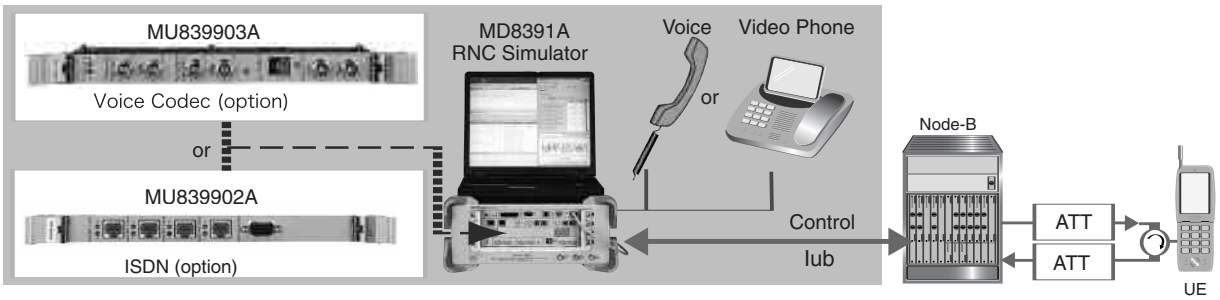


Transmitter Test

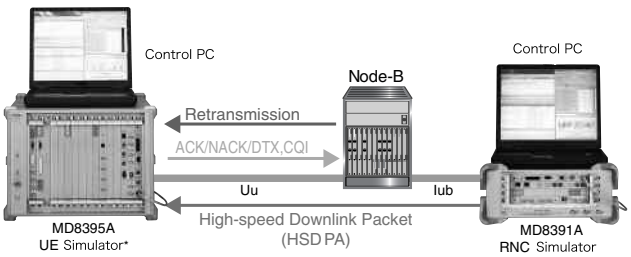


Receiver Test

• Integration Test: AMR Voice Call Test / Video Phone Call Test



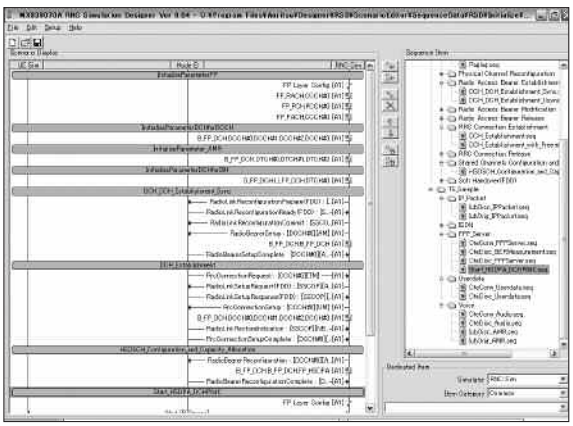
• Node B Functional Testing in Combination with UE Simulator
When the MD8391A is used in combination with Anritsu's UE MD8395A*1, a Node B Functional Test environment is easily configured for Performance Evaluation of various Node B functions, such as Node B HSDPA Retransmission Control and the Throughput Test using RNC Simulation for the Iub side and UE Simulation for the Uu side.



*1 : MD8395A is custom-order product

Options

• MX839070A RNC Simulation Designer (RSD) (Software Option)
Using the GUI interface provided by these tools makes it easy to create a Test Model control scenario matching Node B specifications and to run and change message sequences according to later specification changes.



• MU839001A RNC L2
This option adds the Sub Layer function for MAC (Medium Access Control), and RLC (Radio Link Control). It is required when sending and receiving RRC (Radio Resource Control) messages and for application test by using MU839903A Voice Codec or MU839902A ISDN.

• MU839902A ISDN
This option adds and ISDN Interface to the main unit. It is used in conjunction with the MU839001A RNC L2 for connecting a videophone terminal.

• MU839903A Voice Codec
This AMR Voice Codec module is used in conjunction with the MU839001A RNC L2 to inspect AMR voice communications between the UE connected to Node B and the handset connect to the MD8391A.

• MU839904A Performance Analyzer
This module expands the BER measurement functions, permitting bit error rate measurement of up to 8 transport channels (TrCHs). (It is possible to measure BER for up to three TrCHs in one FP (Frame Protocol) without using the Performance Analyzer.)

Interface Modules and Slots

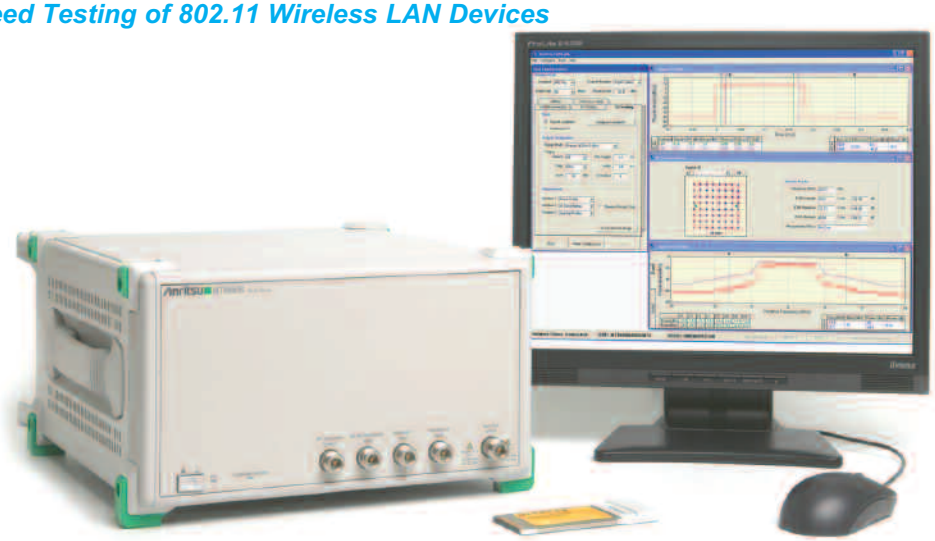
Module and Name		Standard Accessory	Module Selection		
		Slot1	Slot2	Slot3	Slot4
MU839000A	RNC Control Module	√			
Interface Module					
MU839011A	ATM156 M		√	√	
MU839012A	ATM1.5/2 M		√	√	
MU839013A	ATM6.3 M		√	√	
MU839014A	ATM25 M		√	√	
MU839021A	Ethernet 10/100 M		√	√	
Option Module					
MU839001A	RNC L2			√	
MU839904A	Performance Analyzer			√	
MU839902A	ISDN				√
MU839903A	Voice Codec				√

WLAN TEST SET
MT8860B
2.4 GHz 802.11b/g frequency bands

CE GPIB

For High Speed Testing of 802.11 Wireless LAN Devices

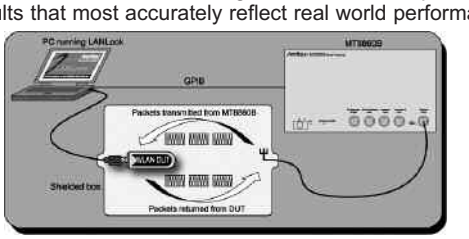
NEW



The MT8860B 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 MT8860B 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 MT8860B also reduces test system costs, increases production throughput and delivers the most flexible WLAN test system.
The MT8860B 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 MT8860B 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 supplier.
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 MT8860B through a GPIB interface.

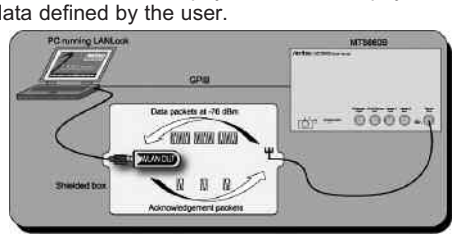
Key features
- Integrated test set for 802.11b/g transmitter and receiver measurements
- “Network” mode – allows devices to be tested by using standard WLAN protocols to establish a connection to the DUT
- Packet loopback feature for simplified DUT transmitter measurements
- Built-in reference radio for calibrated receiver Packet Error Ratio (PER) measurements
- “Direct” mode – allows WLAN devices to be tested with the support of test mode software from the silicon supplier
- Transmission of user defined WLAN packets
- Built-in transmitter analyzer
- Shorter test system design time
- High-speed transmitter measurements including power burst profile, spectral mask, spectral flatness, Error Vector Magnitude (EVM), frequency and CCDF.
- LANLook software for instrument configuration and results display
- LANTest software for production test requirements

Network mode measurements
The MT8860B built-in reference radio simulates either a standard WLAN Access Point (AP) or client device/station (STA). It establishes a connection to the DUT using standard protocol in either Infrastructure or Ad-Hoc modes. When Network mode is selected, WLAN transmitters and receivers are tested without the need for test mode software from the silicon supplier, further simplifying measurement setup.
In Network mode, the device is tested under exactly the same conditions as when the device is integrated with a host product. This gives results that most accurately reflect real world performance.



"Network" mode transmitter testing

MT8860B quickly tests DUT transmitter performance using the “Packet Loopback” feature. Packet loopback uses standard protocol such that any DUT will return the packet configured by the user and transmitted by the MT8860B. This eliminates the need for any special test mode software from the chip set supplier.
WLAN packets are automatically generated by the MT8860B with the preamble, MAC address, payload data rate, payload length and payload data defined by the user.



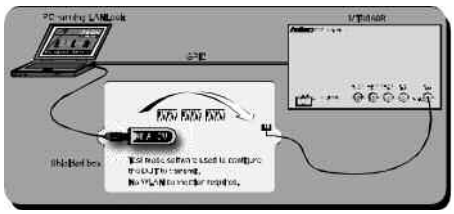
"Network" mode receiver testing

Receiver sensitivity testing is performed by transmitting defined packets to the DUT from the reference radio at levels down to –100 dBm.

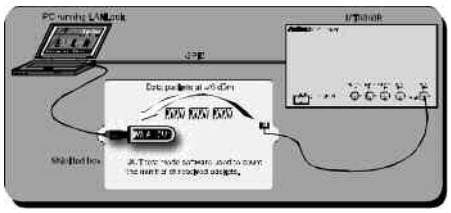
The MT8860B counts the returned acknowledgement (ACK) packets to calculate the Packet Error Rate (PER). The use of a reference radio eliminates any need to pre-configure a signal generator with custom packets and allows testing to be performed at different data rates and packet lengths directly. This measurement technique also eliminates any requirement for proprietary test mode software from the chip set supplier to read the number of packets received. The same test program can therefore be used to test any chip set.

Direct mode measurements

In Direct mode, the MT8860B tests both WLAN transmitters and receivers without having to first establishing a connection with the DUT. Typically Test Mode software supplied by the DUT chipset supplier must be used to configure the DUT for testing.
When configured for Direct mode measurements, the MT8860B acts as a transmitter analyzer and WLAN signal source. This is the mode of operation most similar to test stations that use spectrum analyzers, power meters and gold radios for device testing.
Test mode software from the chipset supplier configures the WLAN device to continuously transmit packets to the MT8860B. The MT8860B triggers on the incoming packets and performs all the selected transmitter measurements in parallel. In this mode, the chipset suppliers test mode software must be used to configure the DUT transmitters channel number, data rate and packet structure.
To measure the DUT receiver sensitivity in Direct mode, the DUT must be configured to count received packets using the chipset suppliers test mode software. The MT8860B transmits defined packets to the DUT including a user-configurable MAC address.
Typically the chipset suppliers test mode software reads a register in the DUT and displays the number of received packets in a window on the PC. Depending on the sophistication of the test mode software, these packets may be broken down to data packets, beacons and management packets.
When testing a receiver in Direct mode, it is not possible to use LANLook for automated PER measurements or receiver sensitivity searches.



"Direct" mode transmitter testing



"Direct" mode receiver testing

Supported Measurements

802.11b Standard

IEEE Reference	Test Name	Limit
18.4.7.1	Transmit power levels	Follows national regulatory requirements for 2.4 GHz ISM band
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 ower-down ramp	< 2 µs
18.4.7.7	RF carrier suppression	–15 dB for unscrambled 1010 payload
18.4.7.8	Transmit modulation accuracy	< 0.35 EVM peak for highest data rate
18.4.8.1	Receiver minimum input sensitivity	PER < 8% for –76 dBm input, 11 Mbps
18.4.8.2	Receiver maximum input level	PER < 8% for –10 dBm input, 11 Mbps
18.4.8.3	Receiver adjacent channel rejection	ACR > 35 dB with PER < 8%, @ 25 MHz separation (requires 2nd signal source)

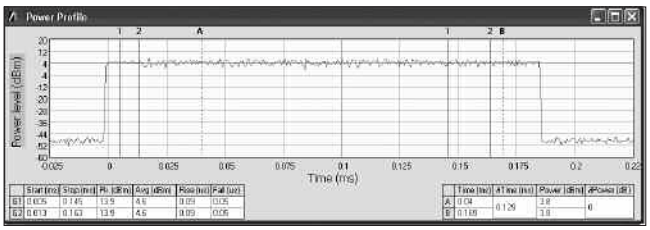
MT8860B Software Support

Two PC based software programs are supplied as standard with the MT8860B 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 MT8860B 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 design verification 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 and 802.11g 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. For each measurement script, a channel number and data rate is specified. 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. Once a test plan has been executed, a test report is produced which contains all the measured data, the limits applied, and a pass/fail indication. Test reports are automatically written to an Access database, but can also be printed or saved as an html file. LANTest is written in VB.net 2003® and full source code is provided, giving users the freedom to make their own modifications as required.
Both LANLook and LANTest communicate with the MT8860B using a conventional GPIB interface.

802.11g Standard

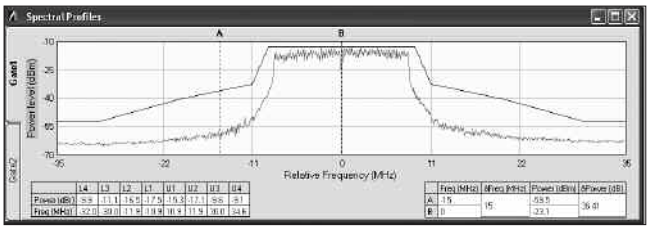
IEEE Reference	Test Name	Limit
19.4.7.1	Transmitter power levels	Follows national regulatory requirements for 2.4 GHz ISM band
19.5.4 (17.3.9.2)	Transmitter spectrum mask	Defined limit mask
19.4.7.2	Transmit center frequency tolerance	± 25 ppm
19.4.7.3	Symbol clock frequency tolerance	± 25 ppm
19.4.7 (17.3.9.6.1)	Transmitter center frequency leakage	–15 dB relative to overall output power
19.4.7 (17.3.9.6.2)	Transmitter spectral flatness	± 2 dB maximum deviation for subcarrier 1 to 16, (+2 to –4 dB for subcarrier 17 to 26)
19.7.2.7 (17.3.9.6.3)	Transmitter constellation error	–25 dB RMS EVM for 54Mbps
19.5.1 (17.3.10.1)	Receiver minimum input sensitivity	PER < 10% for –65 dBm input, 54 Mbps
19.5.2	Receiver adjacent channel rejection	PER < 10%, 3 dB interferer (requires 2nd signal source)
17.3.10.3	Receiver non- adjacent channel rejection	PER < 10%, 3 dB interferer (requires 2nd signal source)
19.5.3	Receiver maximum input level	PER < 10% for –20 dBm input

Example measurements



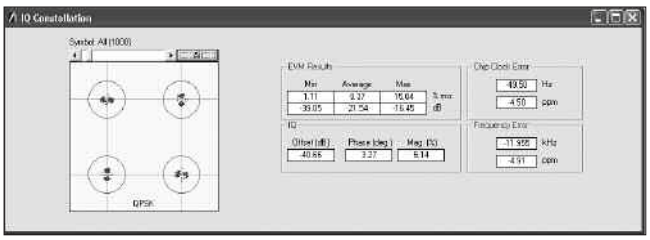
Power burst profile

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. For 802.11g OFDM modulations, peak and crest factor measurements can be displayed.



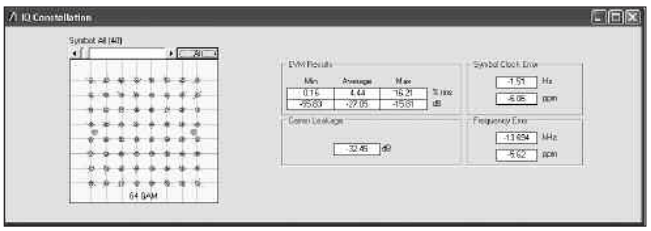
Spectral profiles

The MT8860B automatically applies the spectral limit mask for either 802.11b or 802.11g transmitters with a results table that displays the pass/fail status of each of the mask elements. The gates in the power profile display are used to define the time period over which the spectrum is calculated, providing 2 spectral displays (1 for each gate). This is 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 provided.



EVM (802.11b/g DSSS)

Error Vector Magnitude (EVM) is an excellent measurement of the overall transmitter quality. A poor EVM figure will typically result in a high packet error rate (PER) in the WLAN connection.
The MT8860B measures the EVM of 802.11b/g DSSS modulated carriers. The standard requires that the peak EVM of 1000 chips does not exceed 35%. The MT8860B measures both average (rms) and peak EVM for fast pass/fail analysis. In addition to EVM, the MT8860B measures IQ offset, rms phase and magnitude error, chip clock error and center frequency error. A graphical display of the IQ constellation diagram is provided.

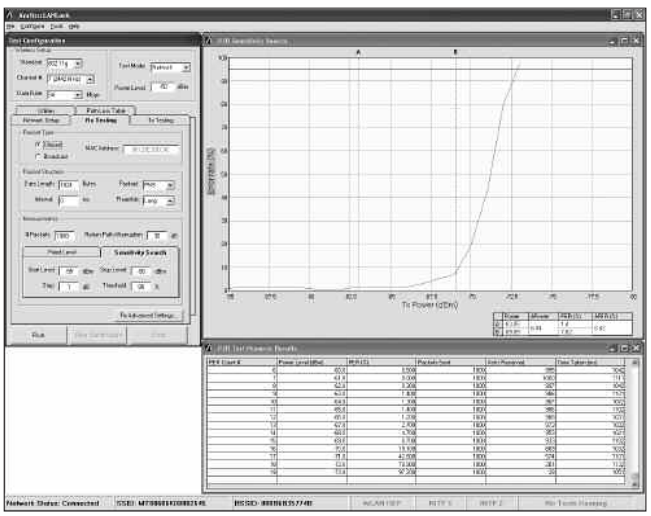


EVM (802.11g OFDM)

The MT8860B measures the EVM of 802.11g OFDM modulated carriers. Numeric results are given for EVM. Furthermore, graphical displays of the IQ constellation diagram, EVM against channel and EVM against symbol are provided. As a result, detailed analysis of the modulation distortion can be performed. In addition to the EVM results, the MT8860B also measures carrier leakage, symbol clock error and center frequency error. The MT8860B has a residual EVM figure of <2% and a best in class measurement update rate of typically 300 ms for all parameters.

Receiver PER (automated measurements in Network mode only)

In Network mode, the MT8860B has the unique ability to perform automated sensitivity search measurements on any 802.11b/g device without the need for proprietary chipset supplier test mode 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 receiver sensitivity test specification. The number of packets to be tested at each power level can be defined with the 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 MT8860B 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.

Bluetooth TEST SET
MT8852B
2.4 GHz Reference *Bluetooth* Transceiver

Test Bluetooth Modules and Products with a Bluetooth Interface

NEW

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 1.1, 1.2 and 2.0.
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

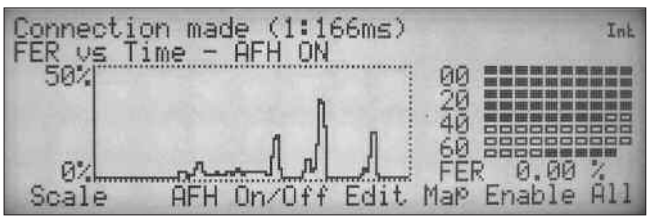
- **Compliant with *Bluetooth* 1.1, 1.2 and 2.0 core specification RF test suite**
  MT8852B is fully compliant with the *Bluetooth* core specifications 1.1, 1.2 and 2.0 (EDR). All supported RF test cases can be used to confirm a product meets the exact requirements of the radio specification.
- **One 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 Psuedo 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,



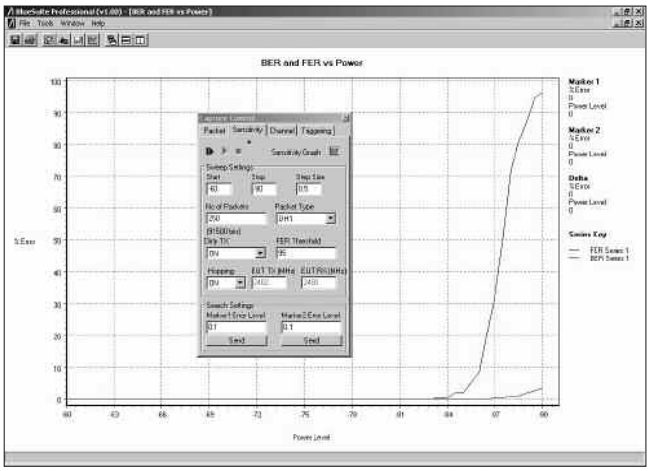
Frame Error Rate against time with AFH active

the FER will decrease as the channels are removed from the hopping plan.

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.

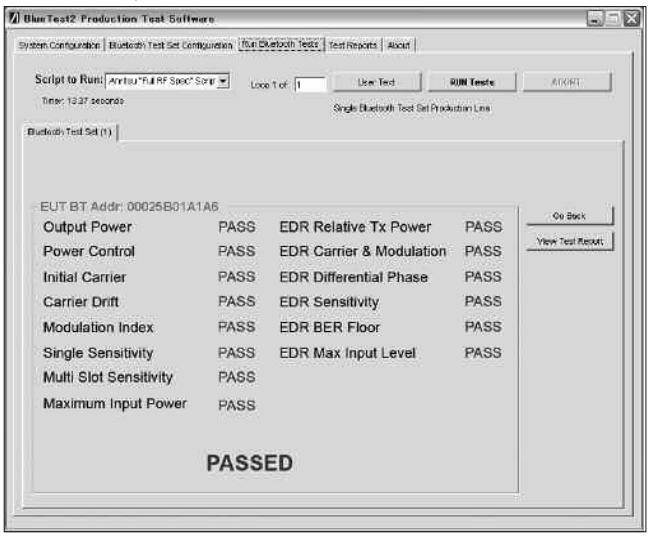
Automatic sensitivity search measurements display the FER/BER performance of an EUT with decreasing power into the receiver. Tests can be performed on all supported standard rate and EDR packet types

BlueTest2 program automates production test software with test script generator and results data base

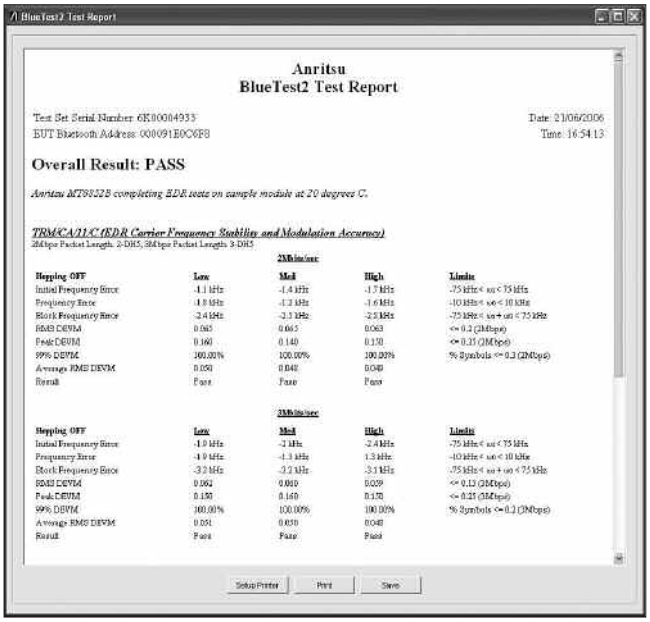
BlueTest2 software increases the efficiency of *Bluetooth* testing on the production line. The software provides a remote means to control and run *Bluetooth* tests on up to 16 MT8852B units simultaneously. Tests can be performed quickly and easily, plus script and configuration settings can be copied 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



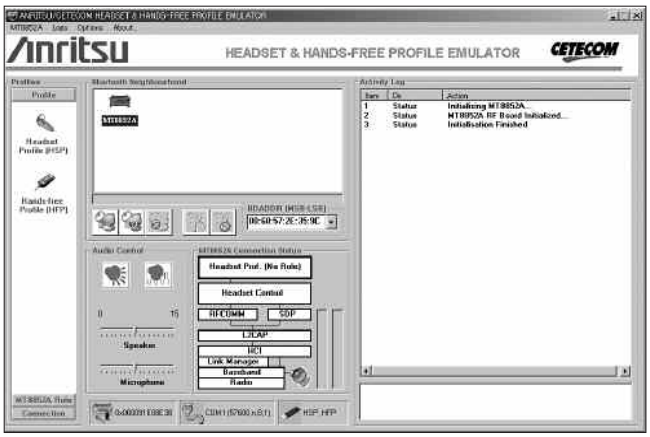
A detailed test report is automatically archived and can be printed in report format with user comments

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 Comunicaciones 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 1kHz 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.

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

NEW

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.

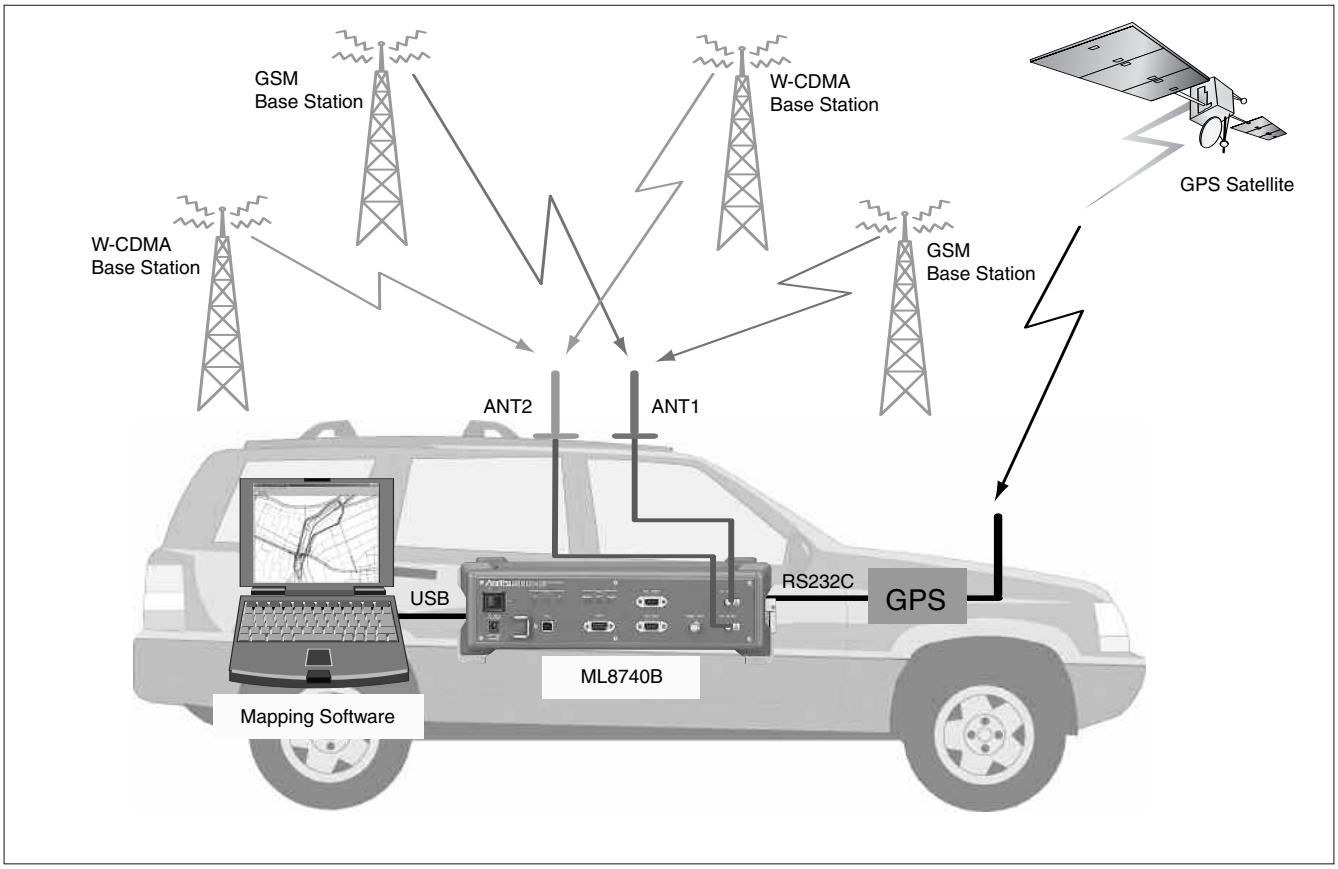
- **Specific Distance Measurement Using Car Speed Pulses**

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.

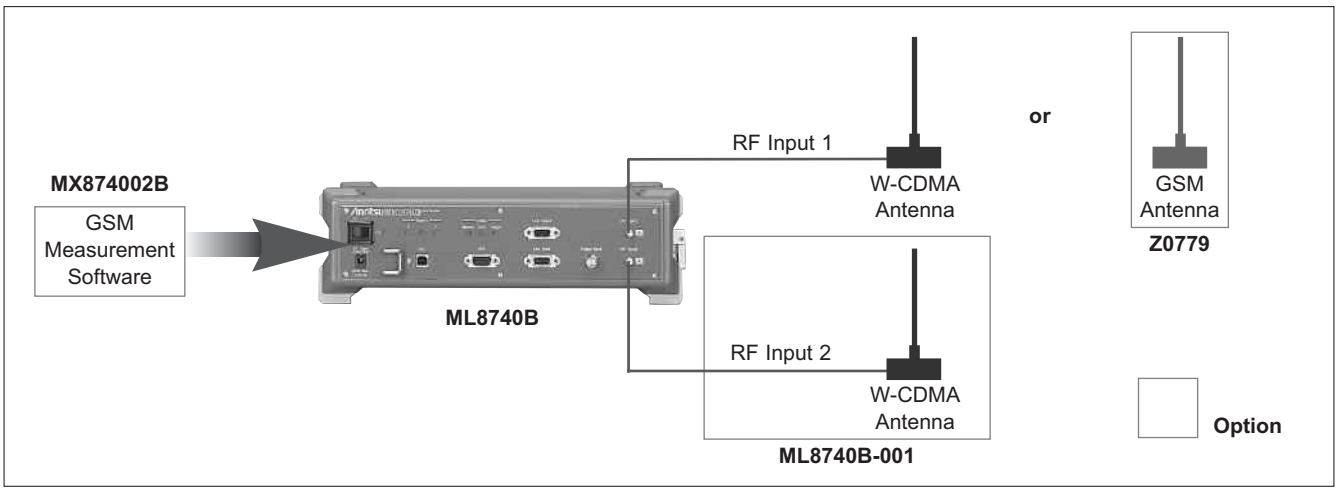
- **5-hour Battery Operation**

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 Option
MX874002B GSM Measurement Software
Z0779 900 MHz/1800 MHz Vehicle Antenna

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 Two Carrier Measurement Function and 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 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.

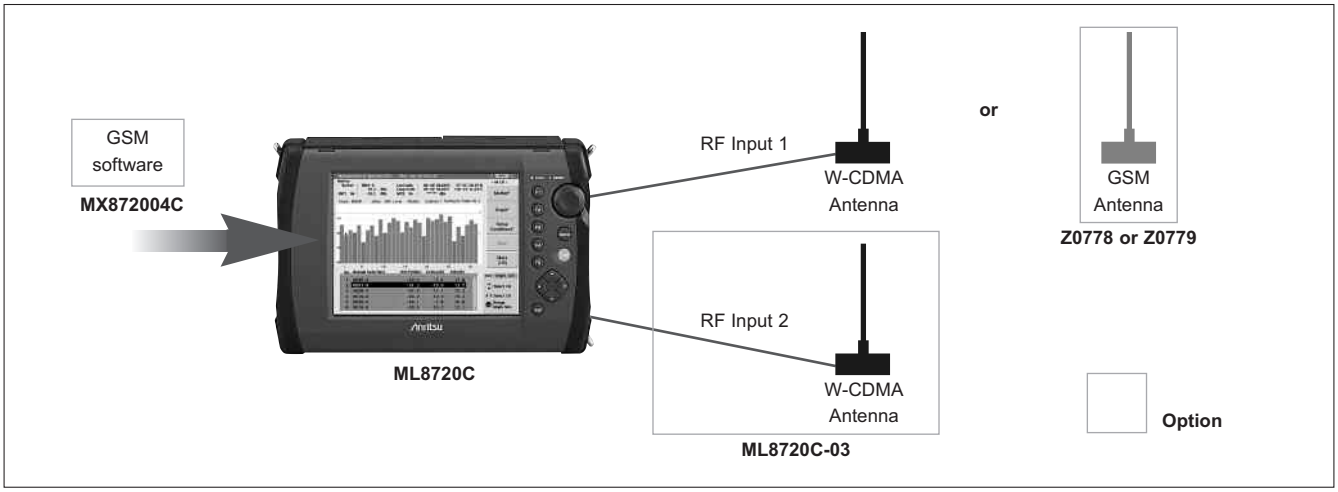
• High-speed and High-accuracy Area Analysis
RSCP, Ec/No, and SIR can be measured at 30 cm intervals (using specified base station and single-channel measurements) while travelling at 100 km/h in a monitoring vehicle to provide fast and accurate area analysis.

• 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

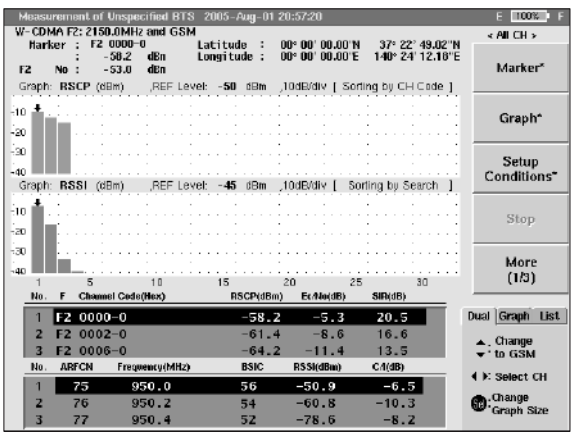
	ML8720C	ML8720C-03	MX872004C	Z0778 or Z0779
W-CDMA (1 carrier)	Required			
W-CDMA (2 carrier)	Required	Required		
W-CDMA or GSM selectable	Required		Required	Required
W-CDMA and GSM simultaneously	Required	Required	Required	Required

ML8720C Area Tester
ML8720C-03 Two Carrier Measurement Option
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.

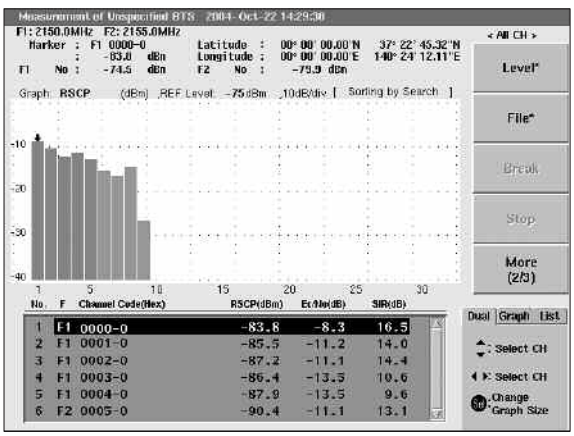


W-CDMA x 2 Measurements

• 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.



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).

Application 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*1.

VNA MASTER

MS2024A/34A

VNA 2 MHz to 4 GHz / Spectrum Analysis 100 kHz 4 GHz

MS2026A/36A

VNA 2 MHz to 6 GHz / Spectrum Analysis 100 kHz 7.1 GHz

CE Ethernet

Handheld Vector Network and Spectrum Analysis for General Purpose Applications

NEW

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 (100 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 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 |S11| <30 dB
- <±0.5 dB uncertainty and <±4 degrees uncertainty for |S21| <10 dB
- >70 dB dynamic
- Smith Charts, Phase, and Group Delay measurements

Spectrum Analysis Features

- Broad spectrum analysis (100 kHz to 7.1 GHz)
- Wide dynamic range (up to 100 dB)
- Excellent DANL (with preamp): –153 dBm in 10 Hz RBW
- Superior Single Side Band (SSB) Phase Noise of <–100 dBc/Hz at 10 kHz offsets
- Fast sweep speed of 200 ms in 10 MHz span
- Powerful markers: 6 markers, 7 marker modes, and marker table display

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
- 64 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 Reflectomtry (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 S11 and S21 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 100 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)

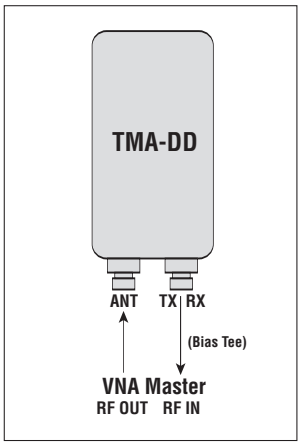
With the Anritsu 560 series detectors, technicians can accurately measure broadband power up to 50 GHz. These high precision detectors significantly help minimize mismatch uncertainty with detector flatness better than 0.5 dB up to 18 GHz.

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 +24V in 3V steps.

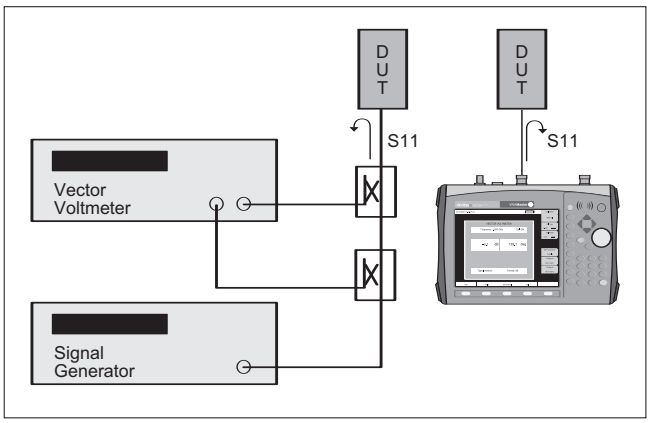


Vector Voltmeter (Option 15)

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.

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 –154 dBm, 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 (5m) cable for the car, truck or any other useful surface.

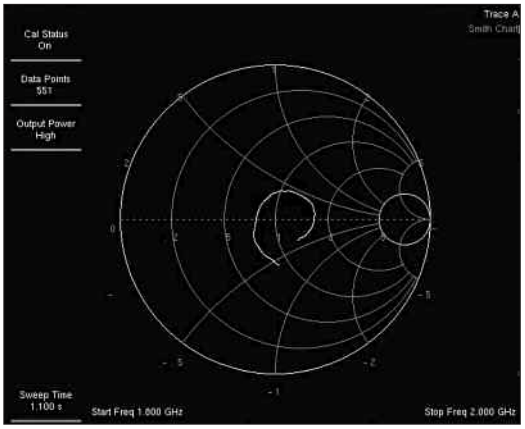
Master Software Tools

Each VNA Master ships with a test assistant: a copy of Anritsu's Master Software Tools for Windows® 2000/XP.

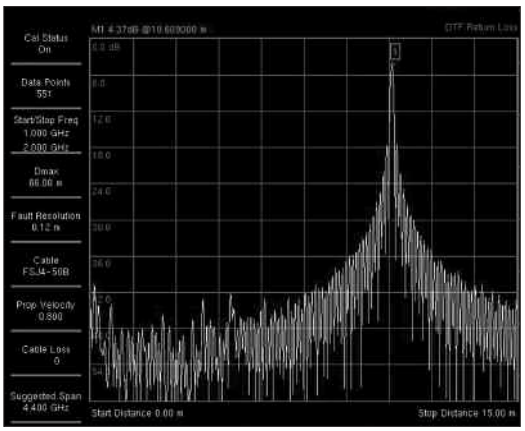
This allows an operator to add the processing capabilities of a PC and this software utility to the VNA Master to form a powerful and flexible measurement solution for both network and spectrum analysis. For automation, the VNA Master also supports remote programming via the Ethernet interface.

Connect VNA Master to a PC for archiving and additional analysis.

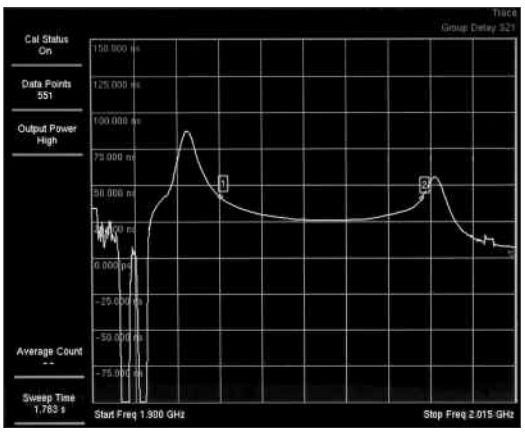
Typical Vector Network Analyzer Measurements



S11 Smith Chart

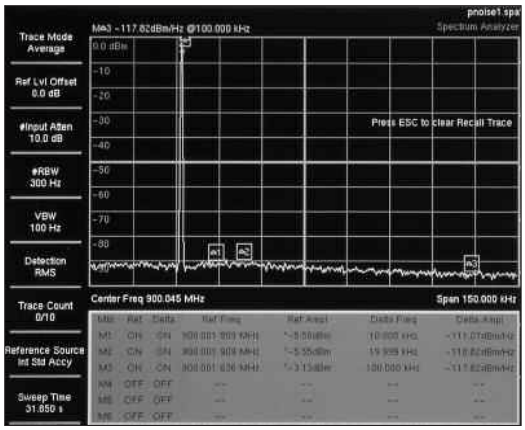


Distance-To-Fault

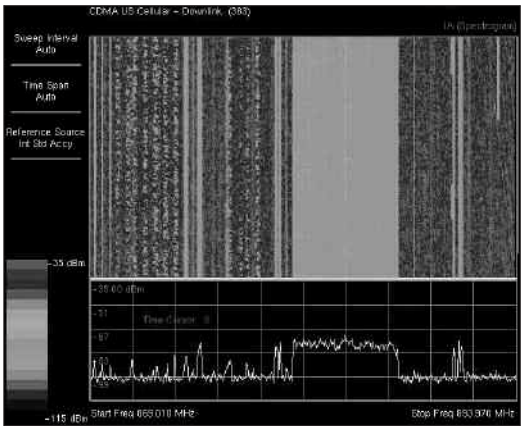


S21 Log Magnitude / Group Delay

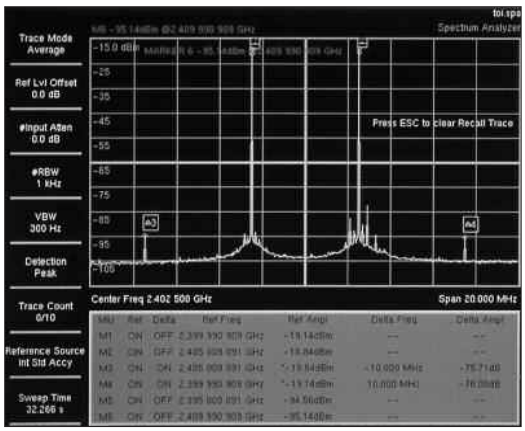
Typical Spectrum Analyzer Measurements



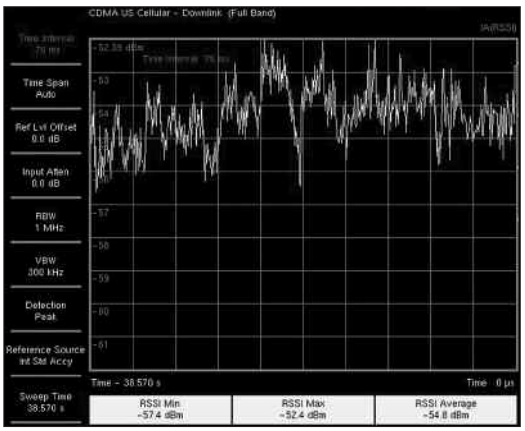
Phase Noise



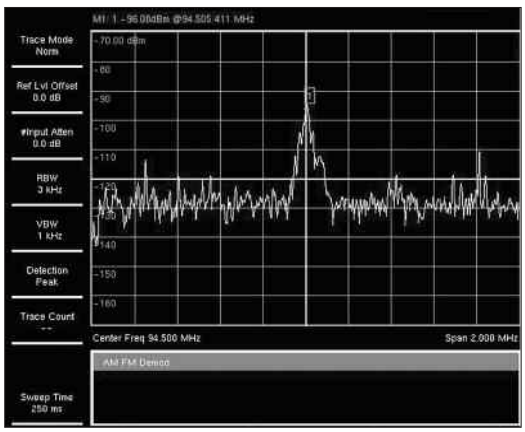
With Option 25, spectrogram measurements identifies intermittent interference.



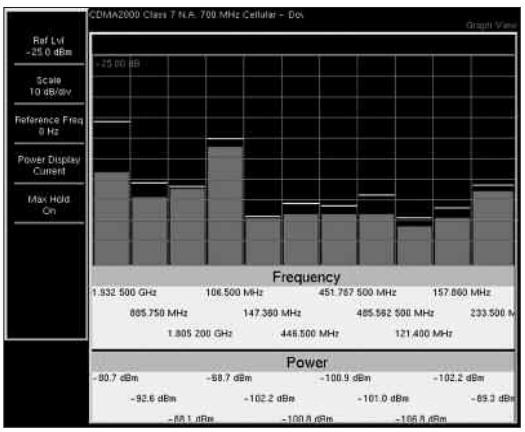
Signal Measurements



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.

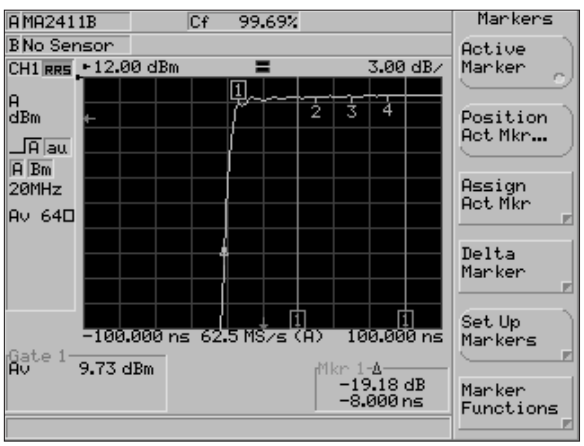
WIDEBAND PEAK POWER METERS
ML2490A Series

10MHz to 50GHz*

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 ML2480A 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 ML2480A 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.



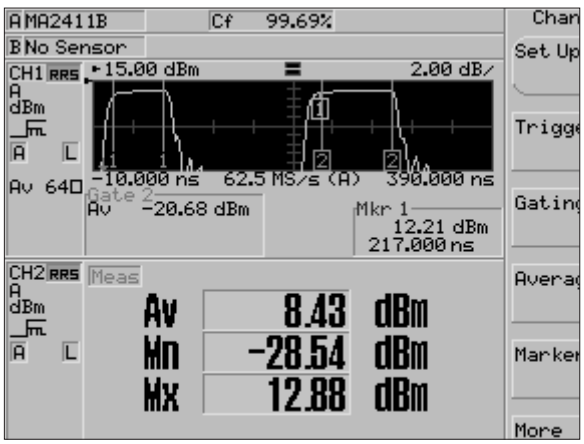
Fast Rise Time Measurements

* 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 7s 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 1ns 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 1ns 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 synchronise 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 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 8ns rise time, and a 1ns 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 ML2480A 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.
PC screen can be set for continous update so that changes to the device or system under test can be viewed instantly. Alternatively, plots can be archived for later analysis.

• **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 continous update so that changes to the device or system under test can be viewed instantly. Alternatively, plots can be archived for later analysis.

• **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.

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 IMT-2000 (2 GHz band) service for third-generation mobile radio communication has started. Bluetooth has been adopted for close-range radio communication between portable remote terminals and peripheral equipment, and R&D of MMAC, IEEE802.11a, and HiperLAN2 (High Performance European Radio Local Area Network Type 2) for higher speed access have been conducted in various countries.
The MS2681A/2683A/2687B spectrum analyzer delivers optimum performance over a wide dynamic range (156 dB, typical value), wide resolution bandwidth (20 MHz), to high-speed sweep (refresh rate of 20 times/s), required for evaluating next-generation radio communication systems and devices.
It can be used not only as a spectrum analyzer but also to perform various measurements easily and quickly by installing measurement software.

• 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.

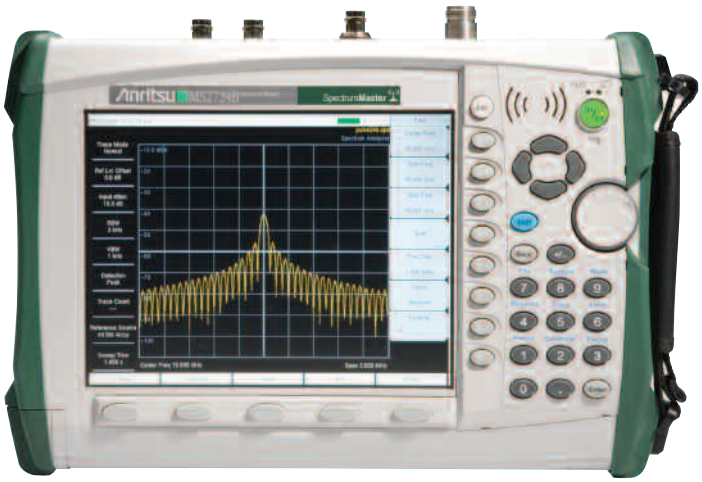
HIGH PERFORMANCE HANDHELD SPECTRUM ANALYZERS
MS2721B/23B/24B

9 kHz to 20 GHz

CE Ethernet

The Most Advanced Ultra-portable Spectrum Analyzer on the Market, Featuring Unparalleled Performance at a Modest Price

NEW



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. Now 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 options
- GPS Receiver option
- Tracking Generator option (MS2721B only)
- Now includes quasi-peak detector and CISPR bandwidths

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.

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 or dBmV/meter^2.

HIGH PERFORMANCE SIGNAL ANALYZER
MS2781B Signature™
100 Hz to 8 GHz

CE GPIB

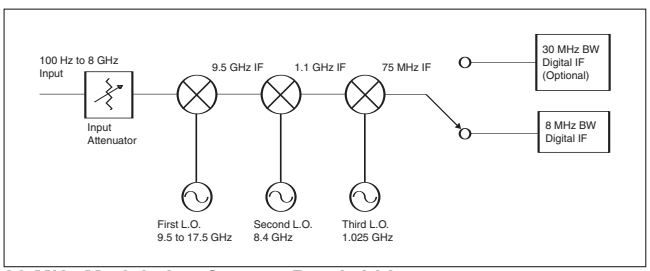
A New Plateau in Signal Analysis for Providing Exceptional Engineering Insight into Wireless Communication Products

NEW

The MS2781B Signature High Performance Signal Analyzer is a combined high performance spectrum analyzer and a high performance vector signal analyzer. Signature expands the ability to analyze RF and digitally modulated signals by offering seamless connectivity with MATLAB® and Simulink® from The MathWorks. Engineers can view measurement results through custom MATLAB and Simulink analysis giving exceptional insight into the performance of new designs. Signature can help make tomorrows communications systems a reality today.

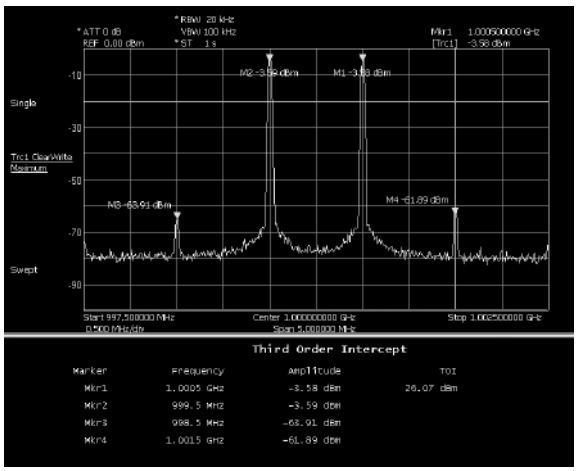
Features
- Fundamentally mixed, single band architecture covers 100 Hz to 8 GHz
- Suite of RF and Modulation measurements such as TOI, Channel Power, available Phase Noise and various modulation quality options eases measurement tasks
- Capture and analyze complex modulated signals with up to 50 MHz bandwidth
- Exceptional ease of use through innovative touchscreen interface
- Windows® XP Professional environment for exceptional connectivity
- MATLAB® connectivity allows simultaneous analysis while taking a measurement

Performance and functions
100 Hz to 8 GHz
The 100 Hz to 8 GHz frequency range is covered in one band as illustrated in the RF block diagram. This one-band approach improves performance. Resolution bandwidths ranging from 0.1 Hz to 8 MHz support improved sensitivity and demodulation of wideband signals.

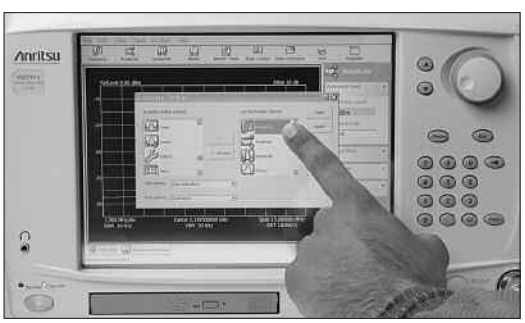


30 MHz Modulation Capture Bandwidth
Option 22 provides a 30 MHz (50 MHz with anti-alias filtering turned off) capture bandwidth to allow vector signal analysis on wideband signals such as WiMAX (802.16).

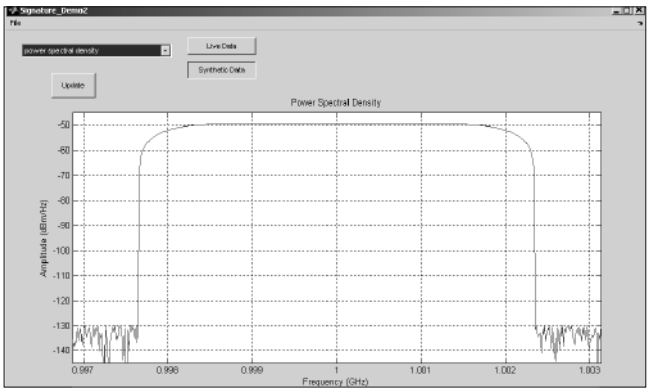
+22 dBm TOI and –167 dBm DANL
+22 dBm Third Order Intercept (TOI) performance and –167 dBm Displayed Average Noise Level (DANL) support intermodulation measurements on high performance devices such as multi-carrier power amplifiers. World's best Dynamic Range Figure of Merit (TOI – Noise Figure) of +6 dBm.



Open Windows XP
The fully functional, built-in, open Windows PC and Windows XP user interface makes the MS2781B easy to connect with and easy to use.



MATLAB Connectivity
Option 40, MATLAB connectivity, makes it possible to view custom analysis with measurements.



30 MHz Modulation Capture Bandwidth (Option 22)
Option 22 allows single FFT spectrum and I-Q vector measurements to 30 MHz and enables vector signal analysis capability (Option 38) with wider bandwidth signals (up to 50 MHz with anti-alias filtering turned off). Baseband differential I & Q inputs are also added.

Comprehensive W-CDMA/HSDPA Measurements (Option 30)
Option 30, W-CDMA/HSDPA Measurements, allows a wide variety of Modulation Quality measurements on Base Station (Node B) transmitters and related components. Combined with the standard RF measurements in Signature, these provide a complete suite of measurements for Engineering use, both in R&D and Manufacturing.

Fully Integrated Vector Signal Analysis (Option 38)
Option 38, QAM/PSK Modulation Analysis, allows you to select the symbol rate, modulation type, and filtering to demodulate captured signals. Measurements include EVM, carrier leakage, and I-Q imbalance. Symbol table, constellation and vector diagrams enhance viewing of measurement results.

WiMAX (802.16d/e) measurements (Option 41)
Mobile and Fixed WiMAX Modulation Measurements provides all the key measurements for your WiMAX device, including Relative Constellation Error (RCE), Carrier Frequency Offset, I/Q Offset, Constellation Diagrams, RCE versus Symbol, and RCE versus sub-carrier.

Integrated Compatibility with Industry-Leading Simulation Tools

Signature expands the ability to analyze RF signals with industry-leading simulation and analysis tools from The MathWorks. A 30 day free evaluation version of MATLAB is available with Signature along with example applications. See http://www.mathworks.com/anritsu for details. The MathWorks products provide analysis, visualization and modeling tools.

BIT ERROR RATE TESTER
MP8931A

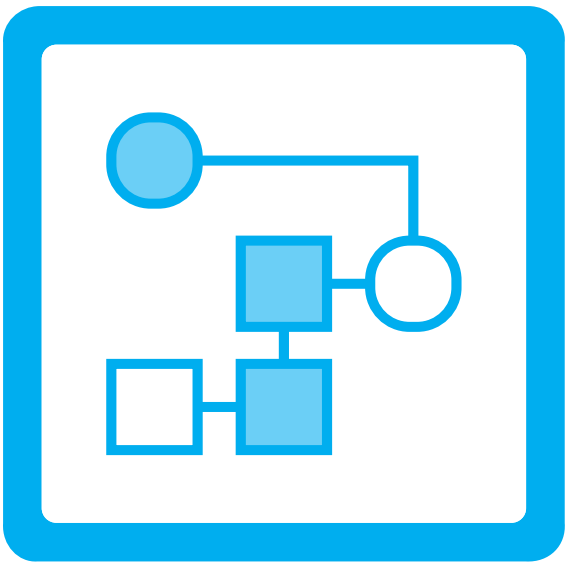
CE GPIB

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.

Features

- 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/RS232C I/F
- Small design (thin case)

* DVB-ASI: Digital Video Broadcasting - Asynchronous Serial Interface
DVB-SPI: Digital Video Broadcasting - Synchronous Parallel Interface



MONITORING AND SERVICE ASSURANCE

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GSM, GPRS/EDGE and 3G Optimization,
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INTEGRATED OSS SERVICE ASSURANCE SOLUTIONS

MasterClaw Service Assurance Platform

CE

Introduction

Wireless operators, fixed line operators and VoIP service providers 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.

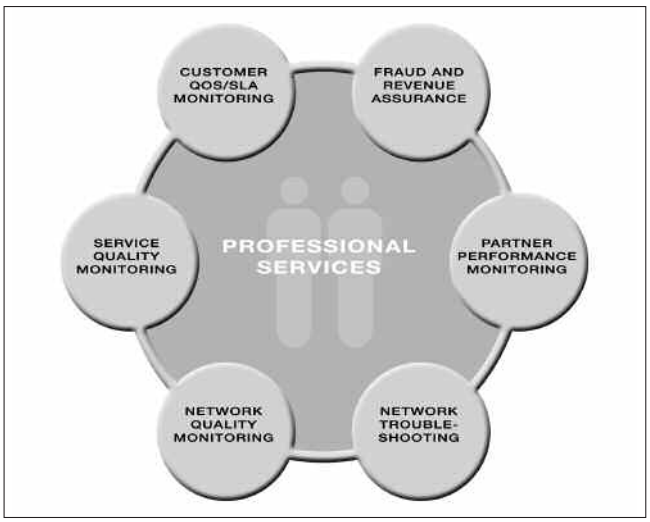


Figure 1. Core Solution Areas

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 and VoIP/SS7 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 provides 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).

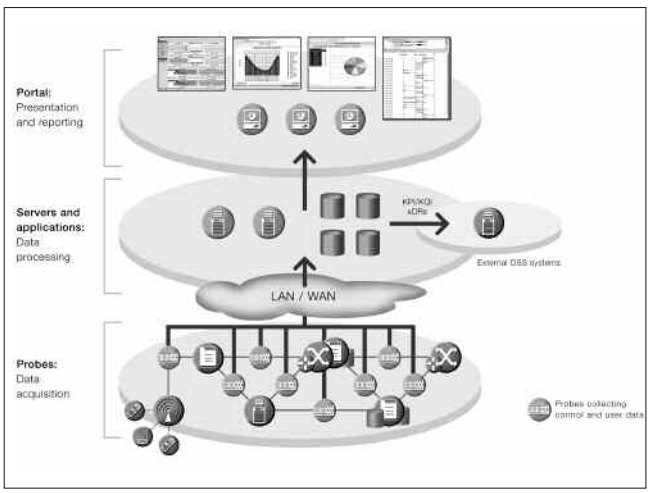


Figure 2. MasterClaw's distributed system architecture

The Service Assurance applications within the MasterClaw framework builds on the data feed from the non-intrusive monitoring probes deployed in the network. Advanced Call- and Session Trace and Protocol Analysis applications are together with real-time dashboard graphs and traffic monitoring applications vital tools for operational personnel managing the network infrastructure. In addition to these network-related applications MasterClaw offers state-of-the-art data warehouse capabilities that turn network data in to business critical information for operators and service providers. A combination of real-time applications and historical reporting offers an integrated quality of service monitoring universe joining the network resource perspective with the service, customer and partner perspectives.
KPIs and aggregated KQIs are reported via an intuitive and personalized real-time Web interface, and as comprehensive reports. The KPIs and KQIs represent well defined service quality measurement points on which both internal and external Service Level Agreements (SLA) may be defined.
With its outset in the low-level signaling data and user data captured in the network, MasterClaw offers its users full drill-down-and drill-up capabilities. This allows users via call trace diagrams to drilldown to individual signal messages or message data (Protocol Data Units - PDUs), 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, OSS-J and SNMP. 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, or export of KPIs/KQIs.

Data Acquisition – Intelligent Probes

HW Architecture

The non-intrusive MasterClaw probes are based on a unique, highly modular and high density HW platform ensuring minimum CAPEX for the MasterClaw monitoring solution. Any given probe consists of a CPU board and one or more front end link units, as illustrated below. Individual probes are hosted in MasterClaw sub-racks (see requirements in Table 2) which can accommodate up to 10 probes each, where different protocols can be mixed in any combination.

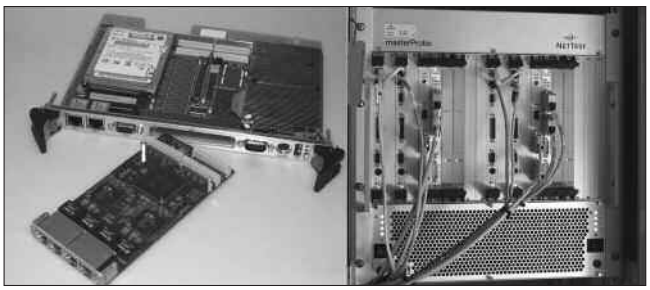


Figure 3. MasterClaw probe, with link units, CPU boards and sub-racks

To cover the needs of multi-technology converged networks, virtually any network link and technology is covered via the wide range of link units such as 10/100/1000 Mbps Ethernet, 1000Mbps Optical, E1/T1 ATM or TDM, STM1/OC3 SDH/SONET, E1/T1 Frame Relay etc. The probes (data acquisition layer) interwork with the central MasterClaw servers making up the data processing layer via TCP/IP over Ethernet.

SW Architecture – Distributed Logic

As illustrated in the figure below the probe hosts 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.

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.

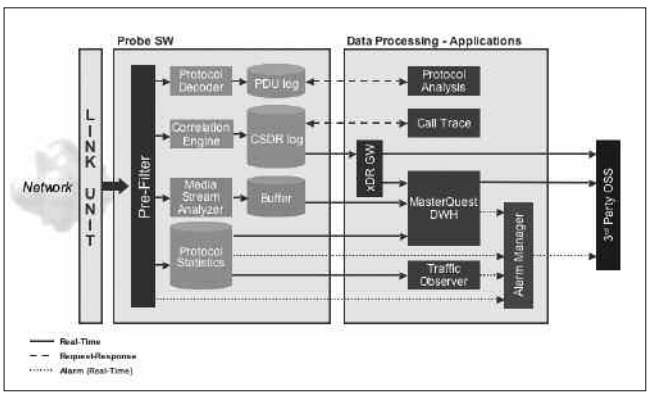


Figure 4. SW and HW architecture of MasterClaw probes, with selective applications

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 local processing power in the probe allows for various forms for analysis of the signaling. This is for example used for real-time voice quality monitoring where the quality of live customer voice calls is rated according to MOS (Mean Opinion Score). For both VoIP networks and traditional circuit switched networks MasterClaw supports the payload based analysis using Psytechnics Speech Monitor (PSM) that is a waveform based analysis that is conformant to ITU P.561, P.562 and P.563. In addition to this MasterClaw also supports the parameter based analysis of the perceived voice quality using Psytechnics Speech IP Monitor (PSI) that computes the MOS value from the RTCP header information. In addition to voice quality monitoring algorithms, the probes may be equipped with corresponding algorithms for video quality monitoring or various forms for content scanning applications, such as virus scanning.

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 DWM may incorporate data from other sources as well.

Integration with External OSS Systems

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 well above 100 million data records per day.

As the MasterClaw probe infrastructure provides a reliable and consistent source of performance and quality of service metrics, MasterClaw is an important source of information deploying Service Quality Management solutions in the broader sense. Anritsu actively supports the OSS/J initiative and any KPI or KQI information in the data warehouse may be propagated to external OSS systems via open APIs.

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.

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.

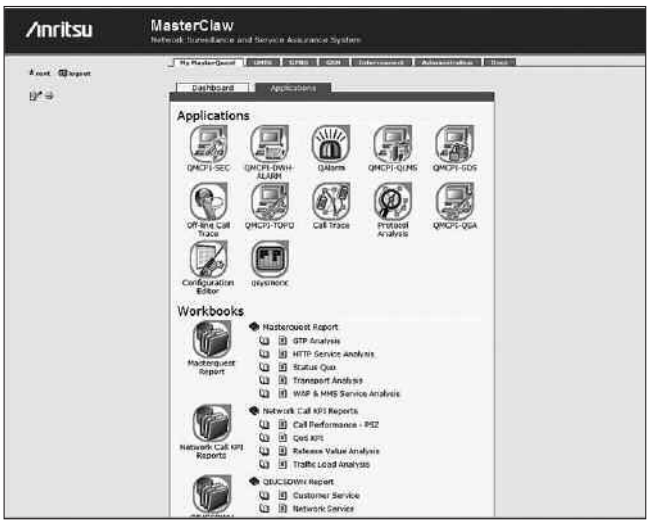


Figure 5. MasterClaw quick application launch portal

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.

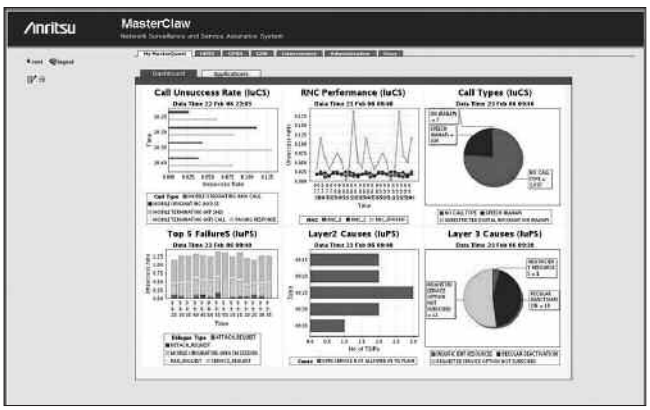


Figure 6. User configured portal – Dashboard elements

As all applications are browser based, MasterClaw may be accessed from anywhere using any ordinary workstation.

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 (see Table 1).

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 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 network MasterClaw allows for end-to-end cross domain tracing e.g., H323/SIP/ISUP calls and H323/RTP/SIP sessions across the SS7 and VoIP network domains where decoding is made on several layers including the IP, UDP, SIP, MEGACO/H248, ISUP and MTP.

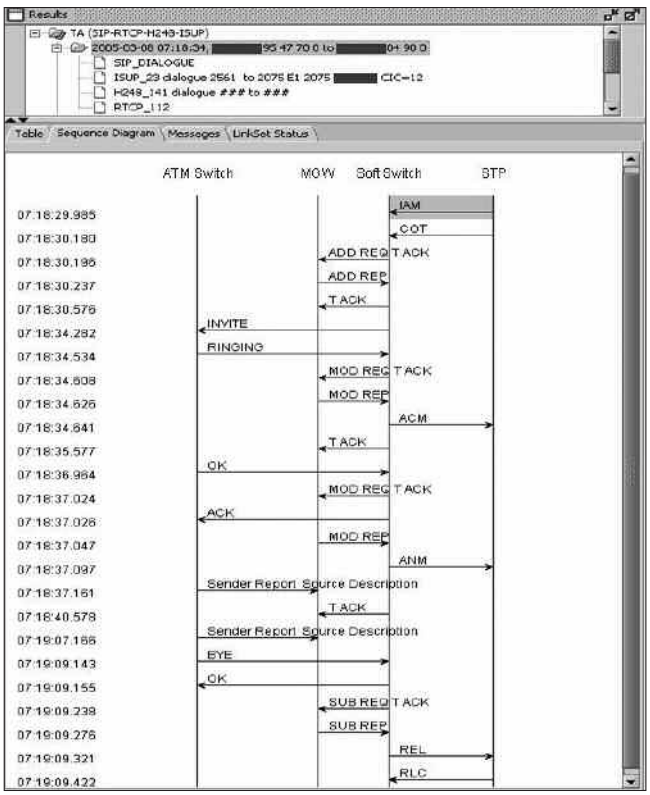


Figure 7. Cross domain Call and Session Trace

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 allows 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.

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 configurabl

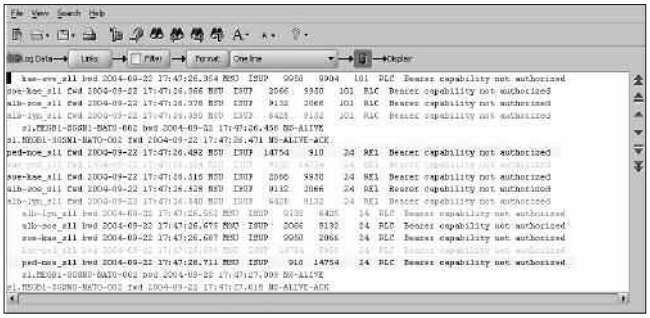


Figure 8. Protocol Analysis result

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 ware-house application that can be applied to any protocol or network technology giving access to thousands of user-defined 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 parameter

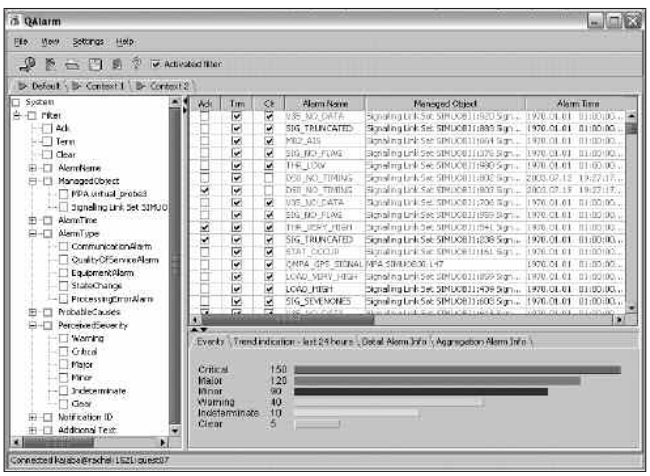


Figure 9. MasterClaw Alarm Manager

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.

MasterClaw's integrated service assurance solution provides an integrated monitoring universe, feeding a wide range of different user categories, including operational network personnel, network planners, product 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.

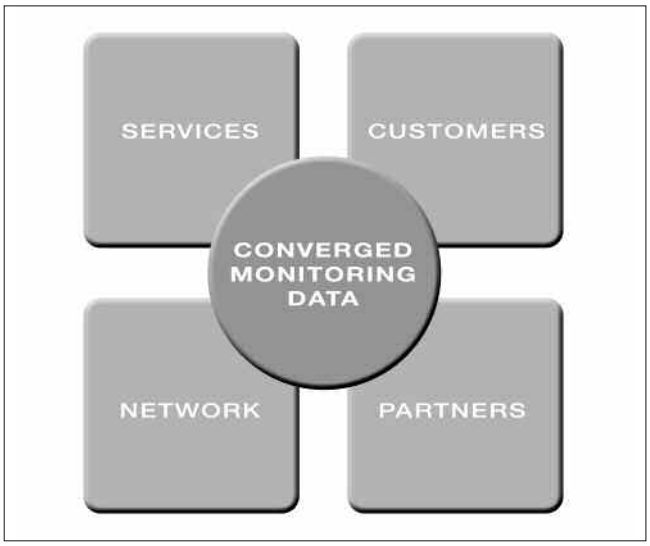


Figure 10. MasterClaw's Integrated Service Quality and Performance Monitoring Framework

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.

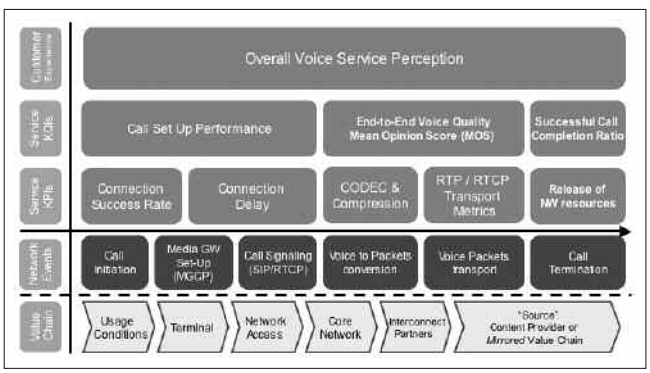


Figure 11. Service Quality Components in a traditional Voice Service

Real-Time- vs. Analytical Monitoring
No-one questions that information is power, 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.

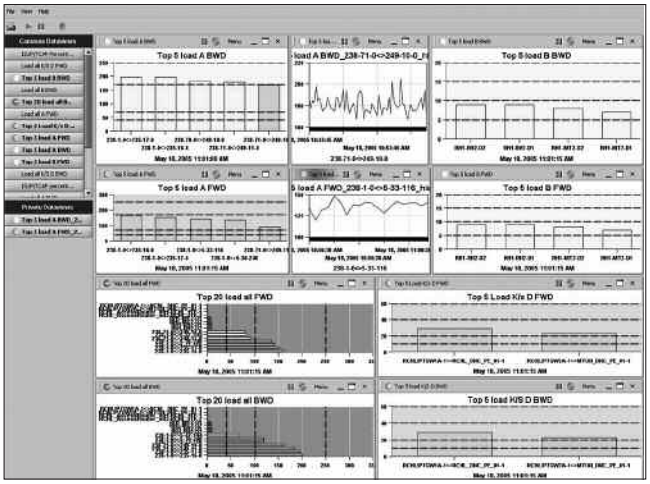


Figure 12. Traffic Observer provides real-time overview of the network and service performance

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 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.

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. Different KQI reports exist for different services such as voice, MMS, GPRS, etc.
Apart from providing valuable service quality information, the service reports also provide important performance metrics vital for the management and optimization of the service portfolio. Based on the reporting provided by MasterClaw, operators and service providers can get a clear overview of the usage profile of different services, with respect to usage volume, basic usage profile (time of day, day in week, etc) and advanced usage profiles where parameters such as user profile, handset type (based on IMEI) and location may be taken into consideration. These reports provide critical business intelligence 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.

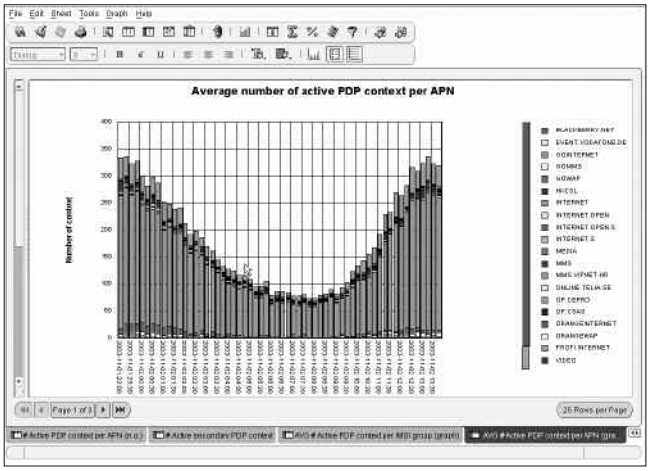


Figure 13. Service usage profile per service category

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. The customer centric reports allows for targeted monitoring and follow-up of individual larger customers or larger communities of general users. 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.

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.
MasterClaw offers a set of security solutions including real-time detection of harmful network traffic such as mass calls and SPAM attacks. Further, the distributed MasterClaw probes can be equipped with virus scanning algorithms for detection of harmful content.
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, etc.

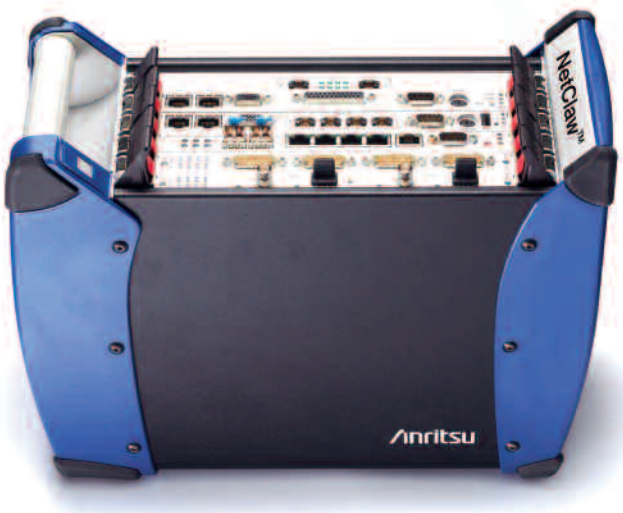
Table 1. Solution and application overview

Solution Area	MasterClaw Applications
MasterClaw Core System	MasterClaw Portal MasterClaw Dashboard MasterClaw Application Trigger MasterClaw SMS Welcome MasterClaw System Monitor MasterClaw Security Administration MasterClaw Data warehouse alarm Configuration Tool MasterClaw General Data Store Configuration Tool MasterClaw Link and Message Configuration Tool MasterClaw Roaming Statistics Configuration Tool MasterClaw Alarm Definition Tool MasterClaw Topology Configuration Tool MasterClaw Configuration Tool MasterClaw Fraud Configuration Tool
Network Troubleshooting	MasterClaw Protocol Analysis MasterClaw Session and Call Trace MasterClaw Alarm Manager MasterClaw Protocol Event Collector
Network Quality Monitoring	MasterClaw Traffic Observer MasterClaw Link and Message Statistics MasterClaw SS7 Performance Statistics MasterClaw RANAP Performance Statistics MasterClaw RADIUS Access Analysis MasterClaw Network Call Performance KPI MasterClaw Content Performance Manager (Gi) MasterClaw VoIP Service Quality and Network Performance Manager MasterClaw UMTS Wireless Data Access KPI (IuPS) MasterClaw UMTS Wireless Circuit Access KPI (IuCS) MasterClaw GSM Access KPI MasterClaw TCAP KPI MasterClaw Link Validation Tool
Fraud and Revenue Assurance	MasterClaw Real-time Fraud Sentry MasterClaw Data Gateway MasterClaw Billing Verification
Service Quality Monitoring	MasterClaw SS7 Call Quality Statistics MasterClaw GPRS Access KPI (Gb) MasterClaw Content Performance Manager (Gi) MasterClaw Service Quality KPI (Gn) MasterClaw VoIP Service Quality and Network Performance Manager MasterClaw SMS KPI MasterClaw TCAP KPI MasterClaw IP Service KPI (Gn)
Partner Performance Monitoring	MasterClaw Interconnect Partner KPI MasterClaw Roaming KPI MasterClaw Content Performance Manager (Gi)

NETWORK AND SERVICE PERFORMANCE ANALYZER
NetClaw

CE

Network and Service Performance Analyzer for Fixed and Mobile Networks



NetClaw is the latest generation of protocol analyzers from Anritsu. It has been designed with advanced applications for service testing, network monitoring, and data acquisition for existing and next-generation networks across GSM, GPRS/EDGE, UMTS, and VoIP, SS7, IN and ISDN networks. Packed in one single convenient box and designed with a true client-server architecture, NetClaw proves a highly reliable and scalable solution for both remote and local operation.

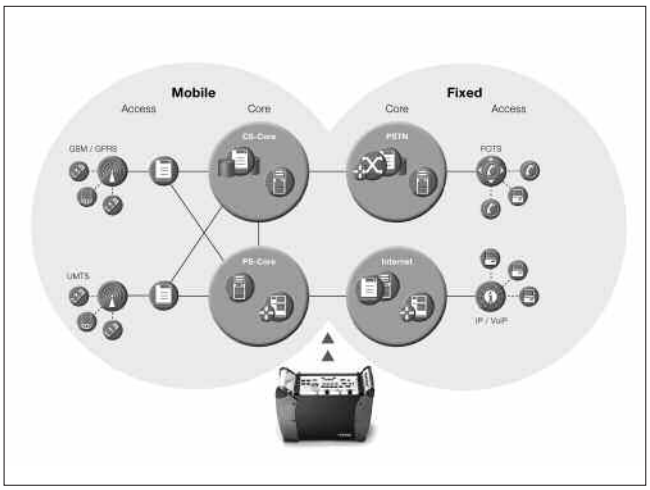


Figure 1. Troubleshooting and optimization across mobile access and core networks.

Capable of capturing and storing network and service data operators can use NetClaw for real-time data analysis, such as protocol decoding, sequencing, and real-time multi-level protocol analysis of a wide range of mobile access and core protocols across GSM, GPRS/EDGE, UMTS, SS7, and IP domains. You may also use the NetClaw for high-speed data capture for post-processing analysis by Anritsu's post-processing tool, Compass Wireless for troubleshooting and optimization of mobile access networks.

The fast and simple setup - only 3 clicks to results - greatly facilitates the deployment of the testing platform in the organization allowing technical personnel to focus on solving problems.

The intuitive workflow of the NetClaw allows operators to test new 3G standards and interoperability of multiple technologies across converged networks with focus on sessions and signaling sequences to speed deployment.

Platform Features

Multi-level Protocol Analysis

NetClaw decodes captured data in a wide range of mobile access and fixed core networks protocols, including GSM, GPRS/EDGE, UMTS, VoIP, SS7, IN, and ISDN technologies. This allows you to carry out troubleshooting on the fly without deploying an external post-processing tool, thus accelerating trouble resolution.

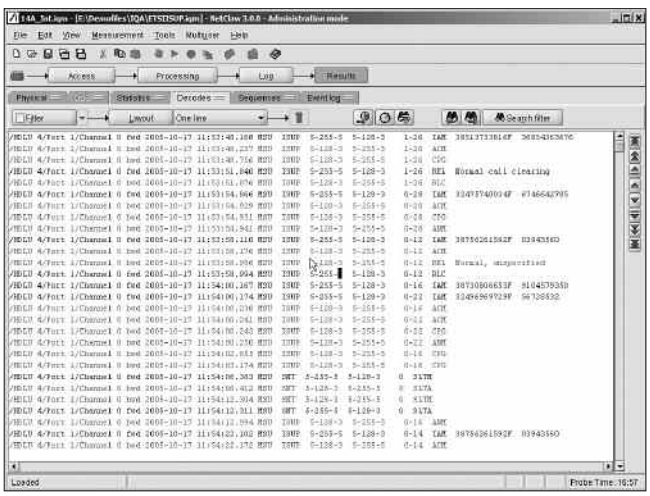


Figure 2. NetClaw provides multi-level protocol analysis. with message-sequence view toggling.

Sequence Recognizer

NetClaw includes a powerful sequence recognizer that automatically recognizes and groups all related messages in a transaction, removing the requirement for manually correlating related messages. Each sequence consists of a correlated string of associated data units providing immediate access to the level of detail required.

The sequence recognizer makes it fast and easy to track calls, events and sessions. And the advanced sorting and filtering of parameters supported by the application significantly reduces the time to isolate specific faults or hot spots.

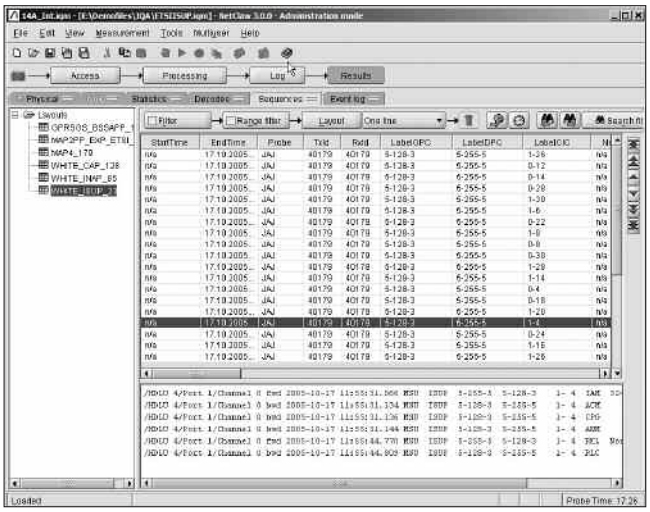


Figure 3. NetClaw sequence recognizer expedites the troubleshooting process.

Statistics and Filtering

NetClaw includes powerful and advanced statistical processing capabilities with user-defined KPIs, providing intuitive statistical information in the troubleshooting process. NetClaw presents physical, link and message statistics, and in certain cases also application layer statistics for all protocols.

The NetClaw enables you to define threshold values for any numerical statistics parameter in order to raise alarms. Alarm notifications are supported on-screen, via e-mail or SNMP traps.

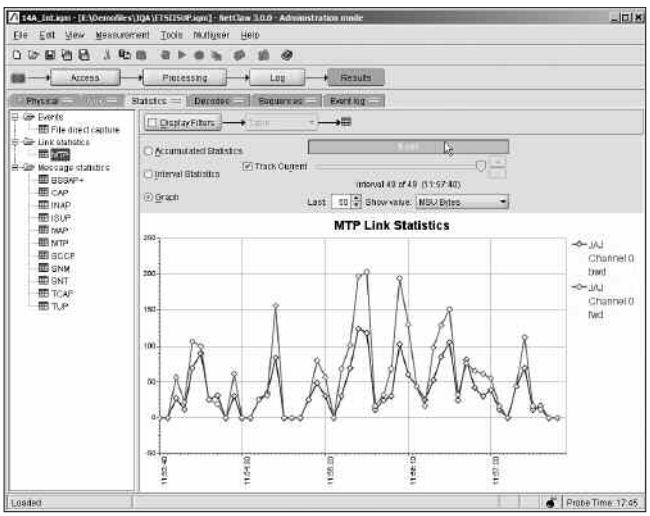


Figure 4. You can view statistics in trend graphs.

NetClaw also features filter and data logging. The filtering includes both pre-filtering of captured data and display filtering. Different filtering methods are supported, including classic, one-step and quick correlation filtering

Client-server Architecture

The NetClaw architecture is client-server based, supporting both local and remote operation.

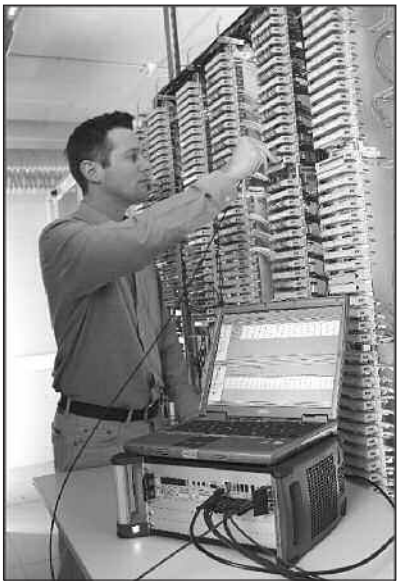


Figure 5. NetClaw can be operated locally or remotely.

The client application resides on a laptop or a PC that can be connected to the NetClaw, either directly or via an IP network. This allows you to identify and resolve network troubles from a centralized location with minimum delay.

Multi-user Support

The innovative NetClaw multi-user capabilities empowers up to eight people to simultaneously utilize the features of the platform. Rather than spending time and money on having several independent systems up and running, NetClaw enables multiple users to analyze different parts of the monitored network – simultaneously but completely independent of each other.

Comprehensive Online Help

NetClaw features a comprehensive, yet intuitive online help, including reference guide, protocol help with detailed specs on all layers, tutorials and a quick reference guide - simply at the click of a mouse. The online help minimizes the need for printed user manuals and facilitates your daily work routines.

Coloring of Decodes

NetClaw includes support for coloring of decodes. It's possible to automatically color decodes based on link and link direction.

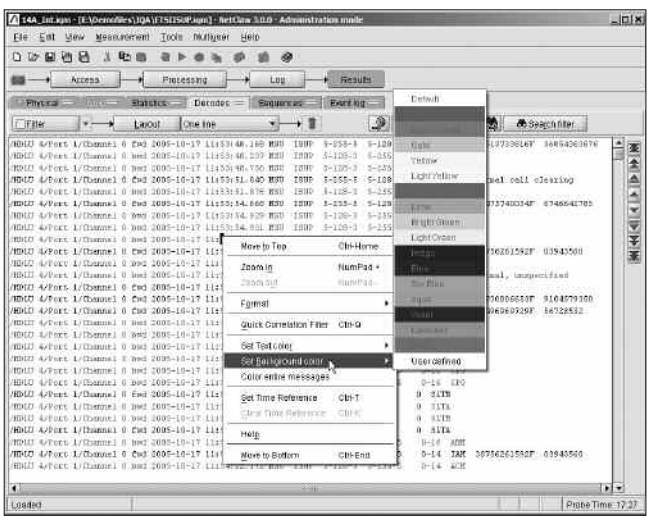


Figure 6. Decode coloring speeds detection of link and link direction.

Find Text
The Find Text feature enables you to search for specific text in decodes and sequences views. The feature supports both case sensitive and non-case sensitive text searches, as well as text searches based on wildcards.

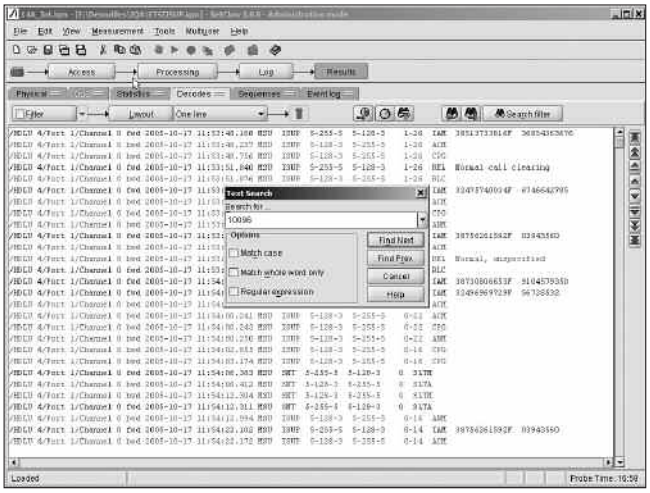


Figure 7. The Find Text feature.

Data Exporting
NetClaw supports exports of decoded data to ASCII or Excel formats, either as comma or tabulator separated.

Options

VoIP Quality of Service Analysis
For VoIP service providers it's key to ensure high voice quality as perceived by the end customer. In addition to the VoIP protocol analysis capabilities of NetClaw, the VoIP QoS Monitor supports voice quality analysis of MOS (Mean Opinion Score), jitter, delay, and echo and packet loss. With the consistent look and feel of the QoS Graphic User Interface users will feel immediately at home.

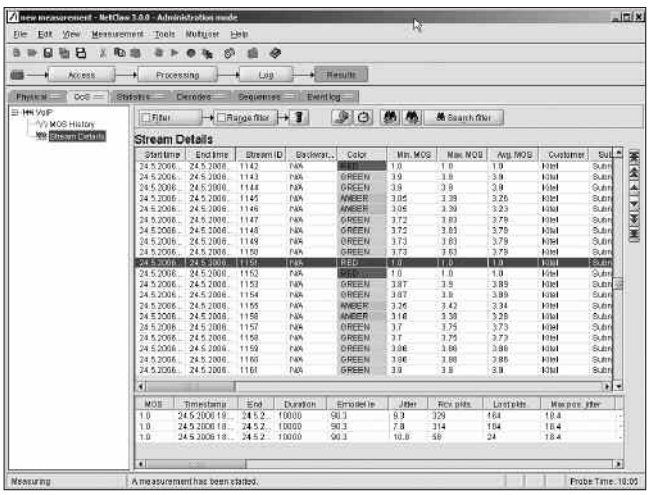


Figure 8. VoIP QoS analysis main window.

GPRS Gb Deciphering
The GPRS Gb deciphering option allows you to use NetClaw for capturing data on ciphered GPRS Gb links. Both GEA-1 and GEA-2 algorithms are supported. With the centralized GPRS Gb Key Server NetClaw is a powerful solution for continuously capturing updates of cipher keys, thus ensuring a very high deciphering rate.

UMTS Iub and Iur Deciphering
Using the NetClaw UMTS Iub/Iur deciphering option you can capture data on ciphered UTRAN links. With the centralized UTRAN key and context server, NetClaw is a powerful solution for continuously capturing real-time as well as historical updates of cipher keys, thus ensuring a very high deciphering rate and maximum insight of the traffic flows.

Offline Browsing
Using the Offline Browser you can view protocol decodes by loading a trace file containing a measurement. This allows you to browse the protocol decodes without being connected to a NetClaw unit.

Hardware Configuration
To meet your requirements NetClaw supports a flexible hardware configuration, with a modular cPCI design comprising the NetClaw Control Unit (ICU) processor, a number of slots for Link Units (LUs) and additional Protocol Processor Units (PPUs).

NetClaw can be delivered as a portable rack or a fixed-mounted 19" sub-rack solution. The portable rack can house up to six (6) single slot cPCI Link Units or processors. It's offered as a portable light weight chassis with AC power supply and space for five (5) Link Units or PPUs.

NetClaw can be configured in three different modes:
- Stand-alone capture mode as a high-capacity capture unit for data capture for post-processing by Anritsu's Compass Wireless software tool
- Stand-alone analyzer mode, with real-time and offline statistics and protocol analysis of services and network hot spots
- MasterClaw connected mode for remote configuration as a normal MasterClaw acquisition card, supporting all MasterClaw applications

Control Unit Specifications – Fixed Networks

NetClaw Control Unit (NCU)
- Storage capacity
  – 100 GB hard disk
- Memory
  – 512 MB RAM OR
  – 2 GB RAM
- Processor
  – Intel Pentium M, 1.6 GHz CPU
- Ports
  – VGA, Keyboard, Mouse, Serial, USB, LAN/WAN

NetClaw Support Unit (NSU)
Used with the enhanced VoIP QoS solution
- Memory
  – 512 MB RAM OR
  – 2 GB RAM

Control Unit Specifications – Mobile Networks

NetClaw Control Unit (NCU)
- Storage capacity
  – 100 GB hard disk
- Memory
  – 512 MB RAM OR
- Processor
  – Intel Pentium M, 1.6 GHz CPU
- Ports
  – VGA, Keyboard, Mouse, Serial, USB, LAN/WAN

NetClaw Support Unit (NSU)
Used for PPU bundled with STM1/OC3 link unit, or as stand alone UMTS deciphering server
- Memory
  – 512 MB RAM OR
  – 2 GB RAM (for UMTS deciphering)
- Processor
  – Intel Pentium M, 1.6 GHz CP

Link Unit Specifications
NetClaw supports flexible Link Unit configurations for data capture across mobile and fixed networks.

E1/DS1 Link Unit
- 8 full duplex ports (E1/DS1) per Link Unit
- Up to 4 E1/DS1 Link Units per NetClaw unit
- Individual setup of each channel
  – 16 Kbps, 56 Kbps and Nx64 Kbps
- Full selection of all channels from all input links
- Multi-pin connectors for high-port density on Link Units
- Selection of input impedance on each port is possible
  – High Z, 75, 100 or 120 Ohm
- Automatic configuration of balanced and unbalanced input
- Captures data from SS7, GSM, and GPRS interfaces
  – SS7 Narrowband - MTP
  – SS7 High Speed Links (HSLs) - Extended MTP2 (Q.703 Annex A)
  – ATM HSL (SS7 over ATM) E1/T1
  – LAPD
  – Frame relay
  – PCU Frames for GPRS Abis (all major vendors supported)

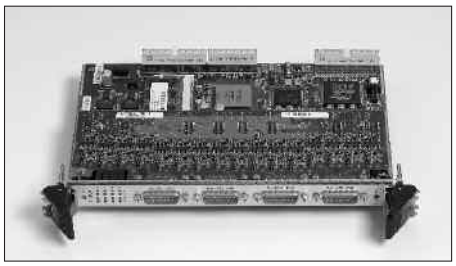


Figure 9 The HDLU (High Density Link Unit) single slot unit.

STM-1/OC3 ATM Link Unit for UMTS Monitoring
- 4 optical ports Rx/Rx (SFP w LC connector)
- Single mode (multi-mode selectable as option)
- 256 VP/VC pairs per card
- 255 CID (sub-channels) per AAL2 channel
  – I.e. a total of 256 x 255 CID (AAL2 sub-channels) are supported per card
- Up to 2 Link Units per Q503 based analyzer
- Auto-configuration of fixed channels such as NBAP, ALCAP and FACH/RACH
- Real-time auto tracking of dynamic channels, such as DCH for optimal utilization of analyzer bandwidth
- Capture control:
  – Pre-filtering
  – Configurable payload truncation
  – Transport channel filtering
  – Logical channel filtering

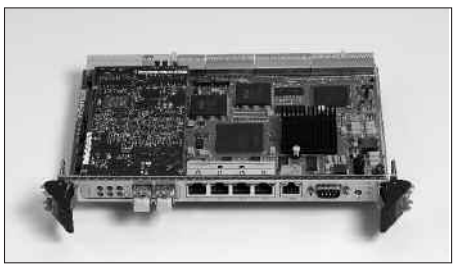


Figure 10 The STM-1 HDLU single slot unit.

STM-1/Channelized Link Unit
- 1 full duplex STM-1 port
- Electrical I/F: 75 Ohm Coax with support of 20/26 dB linear attenuation
- Optical I/F (option): SFP w LC connector
- Single slot: Up to 4 Link Units per NetClaw unit
- 8 E1 tributaries per Link Unit
- Individual setup of each channel
  – 16 Kbps, 56 Kbps and Nx64 Kbps
- All logical channels can be selected independently from any of the selected tributaries
- Captures data from SS7 interfaces, GSM and GPRS interfaces
  – MTP
  – LAPD
  – Frame relay
  – Extended MTP2 (Q.703 Annex A)
  – PCU Frames for GPRS Abis (all major vendors supported
  – ATM HSL (SS7 over ATM on channelized STM1)

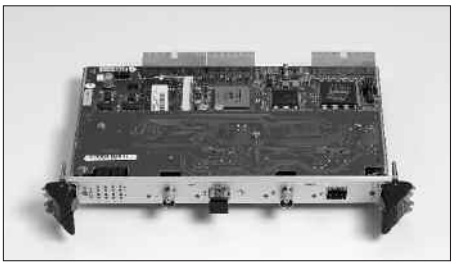


Figure 11 The STM-1 channelized single slot unit.

Ethernet Link Unit
- 4 full duplex Ethernet ports
- Electrical I/F
  – 4 RJ 45 copper connectors
  – Auto sensing speed, simplex/duplex, flow control, and detection of polarity and cable lengths
  – Supports LX and SX transceivers
  – Full compliance to IEEE 802.3z
- Single slot
  – Up to 2 Link Units per unit
  – 10/100/1000 Mbps throughput

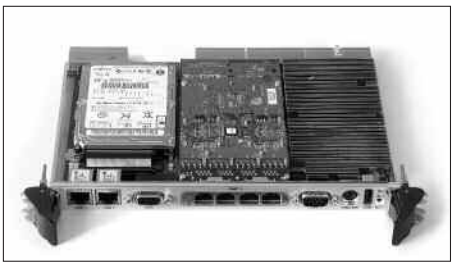


Figure 12 Ethernet Link Unit.

General specifications – Portable Rack
- Size (W x H X L): 37 x 14.5 x 27 cm / 14.5" x 5.7" x 10.6"
- AC mains: 100 – 240 VAC, 50 – 60 Hz
- Weight: 5-8 kg. / 11-18 lbs. (depending on configuration)

Protocol Stacks Supported by NetClaw*1 for Wireline Networks

VoIP	• H.248/MEGACO, BICC, GCP: – IP: RFC 791, RFC 790, RFC 760, RFC 1063, RFC 1108, RFC1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113 – SCTP: RFC 2960 – UDP: RFC 768 – TCP: RFC 793, RFC 1072, RFC 1323, RFC 1146, RFC 1644, RFC 1693, RFC 2018, RFC 2385, RFC 2883 – BICC: ITU-T Q.1902 – M3UA: RFC 2719 – MTP-3b: ITU-T Q.701, 702, 703 (07/96), 704, Q. 706, Q. 707 – SSCOP: ITU-T Q.2110 (09/94) – H248/GCP: ITU-T H.248.1 (05/2002) • ITU-T H.323: – IP: RFC 791, RFC 790, RFC 760 RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475 – UDP: RFC 768 – TCP: RFC 793, RFC 1072, RFC 1323, RFC 1146, RFC 1644 RFC 1693, RFC 2018, RFC 2385, RFC 2883 – DNS: RFC 2822, RFC 1035 – RTP/RTCP: RFC 3550, RFC 3551 – RTCP (XR): RFC 3611 – H.323: ITU-T H.323 (07/2003) – H.225.0: ITU-T H.225.0 (07/2003) – Q.931: ITU-T Q.931 (05/1998) – H.235: ITU-T H.235 (08/2003) – H.245: ITU-T H.245 (07/2003) – TPKT: RFC 1006 (section 6) • IETF RTP, RTCP: – RTP/RTCP: RFC 3550, RFC 3611 • IETF SIP, SIP-T: – IP: RFC 791, RFC 790, RFC 760, RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113 – TCP: RFC 793, RFC 1072, RFC 1323, RFC 1146, RFC 1644, RFC 1693, RFC 2018, RFC 2385, RFC 2883 – UDP: RFC 768 – SIP: RFC 3261, Downward compatible to SIP - draft-ietf-sip-rfc2543bis-09 Standard – RFC 2543, SIP INFO method - RFC 2976, SIP for Telephones - RFC 3372, Reliability of Provisional Responses in SIP - RFC 3262, SIP - Specific Event Notification - RFC 3265, Downward compatible to SIP - draft-ietf-sip-rfc2543bis-07.txt – SDP: RFC 2327 – Bellcore ISUP: GR-246-CORE issue 8, December 2003, Chapters T1.113 – Whitebook ISUP: ITU-T Q.761, ITU-T Q.762, ITU-T Q.763 (12/99), Addendum ITU-T Q.763 (03/01), Corrigendum ITU-T Q.763 (07/01), ITU-T Q.763 Amendment 2, 12/2002, ITU-T Q.764 (12/99), ITU-T Q.765, ITU-T Q.765.1 (05/98) • IETF SMPP: – IP: RFC 791, RFC 790, RFC 760 RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113 – TCP: RFC 793, RFC 1072, RFC 1323, RFC 1146, RFC 1644, RFC 1693, RFC 2018, RFC 2385, RFC 2883 – SMPP: Short Message Peer to Peer Protocol Specification V3.4 Document Version: - 12-OCT-1999 Issue 1.2 • IETF MGCP: – MGCP: RFC 3435, RFC 2705 – UDP: RFC 768 – IP: RFC 791, RFC 790, RFC 760 RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113
IUP	• IUP – White MTP: ITU-T Q.701 03-93, ITU-T Q.702, ITU-T Q.703 07-96, ITU-T Q.705 03-93, ITU-T Q.2210 (MTP-3B) 07-96, ITU-T 704 03 93 – White SNM: ITU-T Q.704 (07/96), ITU-T Q.2210 (High speed link support) 07-96 – White SNT: ITU-T Q.707 (93) – White SCCP: ITU-T Q.711 (07/96), ITU-T Q.712 (07/96), ITU-T Q.713 (03/01), ITU-T Q.714 (07/96) and ITU-T Q.715 (07/96) – White ISUP: ITU-T Q.761, ITU-T Q.762, ITU-T Q.763 (12/99) + Addendum ITU-T Q.763, (03/01) + Corrigendum ITU-T Q.763 (07/01), ITU-T, Q763 Amendment 2, 12/2002, ITU-T Q.764 (12/99), ITU-T Q.765, ITU-T Q.765.1 (05/98) – ETSI ISUP V3: EN 300 356 V3.2.2 (1998-08) – ETSI ISUP V4: EN 300 356 V4.1.1 (1999 -09) – Brazil ISUP: Telecomunica'es Brasileiras - Telebras 220-250-732 Issue 02 – China Mobile ISUP: Technical Specification of ISUP. Directorate General of Telecommunication of Ministry of Post and Telecommunication P.R.C., 1996.2 and – UK ISUP: PNO-ISC specification, No. 007 (ISUP), Issue 2.4 – German ISUP: Zeichengabe im ZZN7; Version 3.0.0, German Extension ISUP: Entgeltinformation für Endkunden über Netzgrenzen AOC99 1.0.0, 08.September 1998, Herausgegeben vom Arbeitskreis technische und betriebliche Fragen der Numerierung und Netzzusammenschaltung. Erarbeitet vom Unter-Arbeitskreis Billing Zeichengabe im ZZN7 V3.0.0 08.09.1998, Herausgegeben vom Arbeitskreis technische und betriebliche Fragen der Numerierung und Netzzusammenschaltung. Erarbeitet vom Unter- Arbeitskreis Signalisierung (UAK-S) Spezifikation Ursprungsnetzbetreiberkennung (ONIP), Version 0.1.0-fd, Stand 20.11.2001 – White TCAP: ITU-T Q.771 (06/97), ITU-T Q772 (06/97), ITU-T Q773 (06/97), ITU-T Q774 (06/97) and ITU-TQ.775 (06/97) – MAP4: 3GPP (2002-01) TS 29.002 V4.6.0, Release 4 • IUP: PNO-ISC/INFO/004 Issue 2, October 1999 & PNOISC/SPEC/006 Issue 3, May 1999 • UKISUP: PNO-ISC/SPEC/007 Issue 2.4, July 2000 & Q.763 (12/99) + Q.763 Addemdum1 (03/01) • Enveloped ISUP: PNO-ISC/INFO/004 Issue 2, October 1999 • Enveloped DPNSS1: BT NETWORK REQUIREMENTS NUMBER 188 Issue 6, January 1995

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Protocol Stacks Supported by NetCLAW*1 for Wireline Networks

ETSI V5.1/5.2	• LAPV5: LAPV5-EF: ETSI EN 300 324-1 V2.1.1 (2000-04), LAPV5-DL: ETSI EN 300 347-1 V2.2.2 (1999-12), LAPD: ETSI ETS 300 125, September 1991 • PSTN: ETSI EN 300 324-1 V2.1.1 (2000-04) • PROTECTION: ETSI EN 300 347-1 V2.2.2 (1999-12) • LINK CTRL: ETSI EN 300 347-1 V2.2.2 (1999-12) • CONTROL: ETSI EN 300 347-1 V2.2.2 (1999-12) • BCC: ETSI EN 300 347-1 V2.2.2 (1999-12) • ISDN: ETSI EN 300 403-1 V1.3.2(1999-11), ETSI EN 300 403-2 V1.3.1(2000-08) • ISDN SS: ETS 300 125, September 1990, ETS 300 196-1, August 1993 (Generic Functional Protocol for SS), ETS 300 182, April 1993 (Advice of Charge), ETS 300 185:1992 (Conference call), ETS 300 195-1: February 1995, ETS 300 130:1992 (Malicious Call Id), ETS 300 138:1992 (Closed User group), ETS 300 286:1993 (User-to-User), ETS 300 210:1992 (Freephone), EN 300 052-1:1998 (Multiple Subscriber Number), EN 300 055-1:1998 (Terminal Portability), EN 300 058-1:1998 (Call Waiting), EN 300 061-1:1998 (Subaddressing), EN 300 064-1:1998 (Direct Dialing In), EN 300 093-1:1998 (CLIR), EN 300 097-1:1998 (COLP), EN 300 098-1:1998 (COLR), EN 300 092-1:2001 (CLIP), EN 300 141-1:1998 (HOLD), EN 300 122-1:1998 (Generic key pad protocol), EN 300 188-1:1998 (Three Party), EN 300 207-1:1997 (Diversion), EN 300 359-1:2000 (CCBS) • L2ML: ETSI ETS 300 125, September 1991
cdmaOne	• IS-41C/D: – Message Transfer Part (MTP): GR-246-CORE issue 1, December 1994, Revision 2, December 1996, Chapters T1.112 – Signaling Connection Control Part (SCCP): GR-246-CORE issue 1, December 1994, Revision 2, December 1996, Chapters T1.112 – Signaling Network Management (SNM): GR-246-CORE issue 1, December 1994, Revision 2, December 1996, Chapters T1.111.4 – Signaling Network Testing (SNT): GR-246-CORE issue 1, December 1994, Revision 1, December 1995, Chapters T1.111.7 – ISDN User Part (ISUP): GR-246-CORE issue 1, December 1994, Revision 2, December 1996, Chapters T1.113 – T1.607: ANSI T1.607-1990 ISDN Layer 3 Signaling Spec. for Circuit-Switched Bearer Service – Transaction Capabilities Application Part (TCAP): GR-246-CORE issue 1, December 1994, Revision 2, December 1996, Chapters T1.114.1-4 – TCAP Operations: GR-246-CORE issue 1, December 1994, Revision 2, December 1996, Chapter T1.114.5 – IS-41 D: TIA/EIA/IS-41-D, December 1997. Cellular Radio telecommunications Intersystem Operations – IS-41 C: TIA/EIA/IS-41-C, February 1996, Cellular Radio telecommunications Intersystem Operations – IS-824: TIA/EIA/IS-824, November 1999, Generic Broadcast Teleservice Transport Capability-Network Perspective – IS-826: TIA/EIA/IS-826 August 2000, Wireless Intelligent Network Capabilities for Pre-paid Charging – IS-771: TIA/EIA/IS-771, July 1999, Wireless Intelligent Network – TIA-751: TIA-751, January 2002, TIA/EIA-41-D Modifications to Support IMSI – TIA-764: TIA-764, January 2002, TIA/EIA-41-D Enhancements for Wireless Calling Name Feature Descriptions • IS-634B – BSAP, BSMAP and DTAP LAYER: TIA/EIA-634-B FOR MC-BS Interface for Public Wireless Communication systems – MTP: GR-246-CORE issue 1, December 1994, Revision 2, December 1996, Chapters T1.111 – SNM: GR-246-CORE issue 1, December 1994, Revision 2, December 1996, Chapters T1.111.4 – SNT: GR-246-CORE issue 1, December 1994, Revision 1, December 1995, Chapters T1.111.7
GSM	• ETSI GSM A interface: – MTP: ITU-T Q.701, 702, 703 (07-96), 704, Q.706, and Q.707 – SNM: ITU-T Q.704 (07/96), Q.2210 (High speed link support) – SNT: ITU-T Q.707 (93) – SCCP: ITU-T Q.711 (07/96), Q.712 (07/96), Q.713 (03/01), Q.714 (07/96), Q.715 (07/96) – BSSMAP: (Release 6)- 3GPP TS 48.008 V6.7.0 (2004-11), (Release 5)-3GPP TS 48.008 V5.12.0 (2004-05), (Release 4) - 3GPP TS 3GPP TS 48.008 V4.10.0 (2003-09), (Release 1999) - 3GPP TS 08.08 V8.15.0 (2003-09), (Release 98) - GSM 08.08 v7.7.0 – DTAP: TS 100 940, September 2000 version 7.9.0 (GSM 04.08 Phase 2+) – BSSAP: (Release 4) 3GPP TS 48.006 V4.0.0 (2001-04), (Release 1999) 3GPP TS 08.06 V8.0.1 (2002-05), (Release 98) GSM 08.06 v7.0.1 – CC, GMM, MM, SM: 3GPP (Release 6) TS 24.008 V6.6.0 (2004-09), 3GPP (Release 5) TS 24.008 V5.12.0 (2004-06) 3GPP (Release 4): 3GPP TS 24.008 V4.7.0, 3GPP (Release 99): 3GPP TS 24.008 V3.9.0 • ETSI GSM A interface: – SMS: (Release 6) 3GPP TS 23.040 V6.2.0 (2003-09), (Release 6) 3GPP TS 24.011 V6.0.0 (2003-09), (Release 5) 3GPP TS 23.040 V5.6.0 (2003-06), (Release 4) 3GPP TS 24.011 V4.1.1 (2002-06), (Release 1999) 3GPP TS 24.011 V3.6.0 (2001-03) – SS: (Release 6) 3GPP TS 24.080 V6.2.0 (2004-12), (Release 5) 3GPP TS 24.080 V5.5.0 (2004-12), (Release 4) 3GPP TS 24.080 V4.3.0 (2002-06), (Release 1999) 3GPP TS 24.080 V3.7.0 (2002-06) – RR: (Release 6) 3GPP TS 44.018 V6.10.0 (2004-11) – RRC: (Release 6) 3GPP TS 44.118 V6.3.0 (2004-07), (Release 5) 3GPP TS 44.018 V5.19.0 (2005-01), (Release 5) 3GPP TS 44.118 V5.10.0 (2004-07), (Release 4) 3GPP TS 44.018 V4.15.0 (2003-07), (Release 1999) 3GPP TS 04.18 V8.19.0 (2003-07) • ETSI GSM Abis interface: – LAP-D according to prETS 300 595: 1993 (GSM 08.56 v4.0.0) – Traffic Management: GSM 08.58 version 5.7.0 – Network management: GSM 08.59 version 3.0.0 – Layer 2 management: GSM 08.56 version 3.1.0 – CC, MM, RR: prETS 300 940 1998 (GSM 04.08 v7.4.0 January 2000) – Short Message Service: prETS 300 942 1997 (GSM 04.11 v7.0.0 August 1999) and prETS 300 901 1998 (GSM 03.40 v7.4.0 December 1999) – DTAP layer: prETS 300 950 1998 (GSM 04.80 v7.4.0 January 2000) • Ericsson GSM Abis R10 interface: – LAPD: Draft prETS 300 595:1993 (GSM 08.56 v4.0.0) – Traffic Management: 210/155, 19-HSC 103 12/4 Uen, Interwork Description BSC-BTS traffic description, 2003-08-14 – Operations & Maintenance: 6/155, 19-HSC 103 12/4 Uae, Abis O&M interface, part 1 Model, 2003-08-14 – Layer 2 Management: GSM 08.56 version 3.1.0 – DTAP: TS 100 940, September 2000 version 7.9.0 (GSM 04.08 Phase 2+) – CC, GMM, MM, SM: 3GPP (Release 99): 3GPP TS 24.008 V3.9.0, 3GPP (Release 4): 3GPP TS 24.008 V4.7.0 – SMS: (Release 1999) 3GPP TS 24.011 V3.6.0 (2001-03), (Release 4) 3GPP TS 24.011 V4.1.1 (2002-06) – SS: (Release 1999) 3GPP TS 24.080 V3.7.0 (2002-06), (Release 4) 3GPP TS 24.080 V4.3.0 (2002-06) – RR: (Release 1999) 3GPP TS 04.18 V8.19.0 (2003-07), (Release 4) 3GPP TS 44.018 V4.15.0 (2003-07)

Continued on next page

GPRS	• 3GPP Gb interface – LAPF and PVC: Q.922 (Geneva 1992), Q.933 (03/93), Q.933 (10/95) – IP: RFC 791 , RFC 790 , RFC 760 , RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113 – UDP: RFC 768 – NS: TS 101 299 V6.1.0 Release 1997 (1998-07), TS 101 299 V8.0.0 Release 1999 (2000-06), 3GPP TS 48.016 V4.3.0 Release 4 (2003-07) – BSSGP: TS 101 343 V6.3.0 Release 1997 (1999-07), TS 101 343 V8.3.0 Release 1998 (2000-04), 3GPP TS 08.18 V8.10.0 Release 1999 (2002-05), 3GPP TS 48.018 V4.5.0 Release 4 (2002-05) – LLC: TS 101 351 V6.3.0 Release 1997 (1999-03), TS 101 351 V8.3.0 Release 1999 (2000-02), 3GPP TS 04.64 V8.7.0 Release 1999 (2001-12), 3GPP TS 44.064 V4.3.0 Release 4 (2002-03) – SNDCP: TS 101 297 V6.3.0 Release 1997 (1999-03), TS 101 297 V8.0.0 Release 1999 (2000-02), 3GPP TS 04.65 V8.2.0 Release 1999 (2001-09) – 3GPP TS 44.065 V4.2.0 Release 4(2002-03) – GMM/SM: GMM/SM and SMS are reusing from DTAP – DTAP: GSM 04.08 V5.11.0 & GSM V6.3.0 (1999-04) – GSM 04.08 V7.4.0 – GSM 08.08 V8.5.0 – 3GPP TS 24.11 V3.6.0 Release 1999 (2001-03) • 3GPP Gb interface – 3GPP TS 24.008 V3.15.0 Release 1999 (2003-03) – 3GPP TS 24.008 V4.12.0 Release 4(2003-09) – SMS: GSM 04.08 V7.4.0 Release 1998 (1999-12), 3GPP TS 24.011 V3.6.0 Release 1999 (2001-03), 3GPP TS 24.011 V4.1.1 Release 4(2002-06) – TOM: 3GPP TS 04.64 V8.7.0 Release 1999 (2001-12), 3GPP TS 44.064 V4.3.0 Release 4(2002-03) • 3GPP Gn interface: – IP: RFC 791, RFC 790, RFC 760 RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113 – TCP: RFC 761, RFC 793 – UDP: RFC 768 – SCTP: RFC 3286 – OSPF: RFC 768 – DNS: RFC 1035 , RFC 1034 • 3GPP Gi interface: – IP: RFC 791, RFC 790, RFC 760, RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113 – UDP: RFC 768 – TCP: RFC 793, RFC 1072, RFC 1323, RFC 1146, RFC 1644, RFC 1693, RFC 2018, RFC 2385, RFC 2883 – OSPF: RFC 2328 – WTP: WAP-224-WTP-20010710-a – WSP: WAP-230-WSP-20010705-a – DNS: RFC 1035 - Domain Names – implementation specification, RFC 2822 - Internet Message Format – RADIUS: RFC 2865, Radius Extensions RFC 2869, Radius Accounting RFC 2866 – MMS: MMS-3GPP TS 23.140 version 5.4.0 Release 5, WAP-205-MMSArchOverview-20010425-a, WAP-206-MMSCTR-20020115-a, WAP-209-MMSEncapsulation-20020105-aUMTS (Core)
UMTS	• 3GPP Iu-CS & Iu-PS interface: – MTP3B: ITU-T Q.701(03/93), ITU-T Q.702, ITU-T Q.703(07/96), ITU-T Q.705 03-93, ITU-T Q.2210 (MTP-3B) 07-96 – SCCP: ITU-T Q.711 (07/96), ITU-T Q.712 (07/96), ITU-T Q.713 (03/01), ITU-T Q.714 (07/96), ITU-T Q.715 (07/96 – SNM: ITU-T Q.704 (07/96), Q.2210 (07/96) (High speed link support) – SNT: ITU-T Q.707 (93) – IP: RFC 791, RFC 790, RFC 760, RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113 – SCTP: RFC 2960 – M3UA: RFC 3332 – RANAP: 3GPP (Rel 6): 3GPP TS 25.413 V6.1.0, (Release 4) 3GPP TS 25.413 V4.2.0, (Release 99) 3GPP TS 25.413 V3.7.0 – ALCAP: ITU-T Q.2630.2 AAL type 2 signaling protocol - Capability set 2 – CC, MM, GMM, SM: 3GPP (Release 4) : 3GPP TS 24.008 V4.7.0, 3GPP (Release 1999) : 3GPP TS 24.008 V3.9.0 – SMS: 3GPP (Release 4) TS 24.011 V4.1.1 (200 2-06), 3GPP (Release 1999) TS 24.011 V3.6.0 (200 1-03) – SS: 3GPP (Release 4) TS 24.080 V4.3.0 (2002-06), 3GPP (Release 1999) TS 24.080 V3.7.0 (2002-06) – RR: 3GPP (Release 4) TS 44.018 V4.15.0 (2003-07), 3GPP (Release 1999) TS 04.18 V8.19.0 (2003-07) • 3GPP Iub interface: – SSCOP: ITU -T B -ISDN ATM Adaptation Layer Service Specific Connection Oriented Protocol (SSCOP) - Q2110 (07/94) – RRC: 3GPP TS 25.331 v4.11.0: Radio Resource Control (Release 4) – NBAP: 3GPP TS 25.433 v 4.10.0 UTRAN Iub Interface NBAP Signaling (Release 4) – ALCAP: ITU -T Q.2630.2 AAL type 2 signaling protocol - Capability set 2 – Overall UTRAN Description: 3GPP TS 25.401 v4.6.0: UTRAN Overall Description (Release 4) – CC, GMM, MM, SM: 3GPP (Release 4): 3GPP TS 24.008 V4.7.0 (Release 4), 3GPP (Release 99): 3GPP TS 24.008 V3.9.0 – SMS: 3GPP TS 24.011 V4.1.1 (2002-06) (Release 4), 3GPP TS 24.011 V3.6.0 (2001-03) (Release 1999) – SS: 3GPP TS 24.080 V4.3.0 (2002-06) (Release 4), 3GPP TS 24.080 V3.7.0 (2002-06) (Release 1999) – RR : (Release 4) 3GPP TS 44.018 V4.15.0 (2003-07), (Release 1999) 3GPP TS 04.18 V8.19.0 (2003-07) • 3GPP Iur interface (AAL5 and AAL2): – RRC: 3GPP TS 25.331 v4.11.0: Radio Resource Control (Release 4) – Overall UTRAN Description: 3GPP TS 25.401 v4.6.0: UTRAN Overall Description (Release 4) – CC, GMM, MM, SM: 3GPP (Release 4): 3GPP TS 24.008 V4.7.0 (Release 4), 3GPP (Release 99): 3GPP TS 24.008 V3.9.0 – SMS: 3GPP TS 24.011 V4.1.1 (2002-06) (Release 4), 3GPP TS 24.011 V3.6.0 (2001-03) (Release 1999) – SS: 3GPP TS 24.080 V4.3.0 (2002-06) (Release 4), 3GPP TS 24.080 V3.7.0 (2002-06) (Release 1999) – RR : (Release 4) 3GPP TS 44.018 V4.15.0 (2003-07), (Release 1999) 3GPP TS 04.18 V8.19.0 (2003-07) – White MTP: ITU-T Q.701 03-93, ITU-T Q.702, ITU-T Q.703 07-96, ITU-T Q.705 03-93, ITU-T Q.2210 (MTP-3B) 07-96, ITU-T 704 03 93 – MTP-3B: ITU-T Q.2210 (MTP-3B) 07-96 – SCCP: ITU-T Q.711 (07/96), ITU-T Q.712 (07/96), ITU-T Q.713 (03/01), ITU-T Q.714 (07/96) and ITU-T Q.715 (07/96) – SNM: ITU-T Q.704 (07/96), ITU-T Q.2210 (High Speed Link support) 07-96 – SNT: ITU-T Q.707 (93) – IP: RFC 791, RFC 790, RFC 760, RFC 1063, RFC 1108, RFC 1122, RFC 1399, RFC 1475, RFC 1770, RFC 2113

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UMTS	• 3GPP Iur interface (AAL5 and AAL2): – SSCOP: 3GPP (Release 4/99) ITU-T Q.2110 (07/1994) BISDN ATM Adaptation Layer Service Specific Connection Protocol (SSCOP) – SCTP: RFC 2960 – MTP-3: User Adaptation Layer – M3UA: RFC 3332 – RNSAP: 3GPP (Release 4): 3GPP TS 25.423 V4.10.0 – 3GPP (Release 99): 3GPP TS 25.423 V3.13.0 – ALCAP: ITU-T Q.2630.2 AAL type 2 signaling protocol - Capability set 2 – Overall UTRAN Description: 3GPP (Release 4) TS 25.401 v4.6.0 – CC, GMM, MM, SM: 3GPP (Release 4): 3GPP TS 24.008 V4.7.0, 3GPP (Release 99): 3GPP TS 24.008 V3.9.0 – SMS: (Release 4) 3GPP TS 24.011 V4.1.1 (2002-06), (Release 1999) 3GPP TS 24.011 V3.6.0 (2001-03) – SS: (Release 4) 3GPP TS 24.080 V4.3.0 (2002-06), (Release 1999) 3GPP TS 24.080 V3.7.0 (2002-06) – RR: (Release 4) 3GPP TS 44.018 V4.15.0 (2003-07), (Release 1999) 3GPP TS 04.18 V8.19.0 (2003-07)

∗1 As supported by NetClaw V 3.0. For most recent information please contact your Anritsu representative.

GSM, GPRS/EDGE AND 3G OPTIMIZATION, TROUBLESHOOTING AND MAINTENANCE

Compass Wireless

Optimization, Troubleshooting and Maintenance of GSM, GPRS/EDGE and UMTS Radio Access Networks

Compass Wireless is Anritsu's next-generation post-analysis software tool for in-depth signaling analysis of radio access networks across GSM, GPRS/EDGE and UMTS domains – in a single application. Technologies and network interfaces are supported via an unmatched "plug-in" license structure that easily lets you select exactly those technologies needed for your analysis.

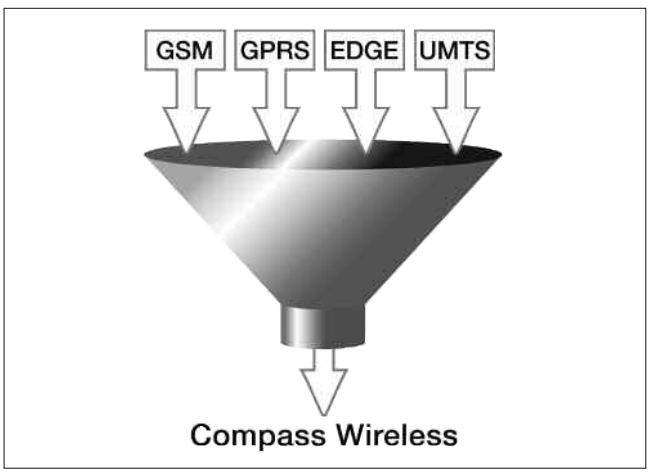

Figure 1. Compass Wireless is a single multi-technology application for troubleshooting, optimization and maintenance across mobile access networks.

With Compass Wireless you gain the expertise to quickly and effectively troubleshoot, optimize and maintain your 2G, 2.5G, 2.75G and 3G access network and network parameters with a user-centric view. Key functionality includes Key Performance Indicators (KPIs), overall statistics and correlation of A-interface/Gb and Abis interface procedures with full decoding.

Capable of processing live subscriber traffic captured by a large number of protocol analyzers and network monitoring probes, including Anritsu's NetClaw and MasterClaw solutions, Compass Wireless is the only solution on the market to provide instant problem overview with direct access to details of all affected calls while providing a true picture of customer experience.

Starting with high-level summary information, Compass Wireless delivers service providers with a prioritized list of problem areas and KPIs. From there, they are offered fast drill-down to in-depth metrics and functionality, such as user tracing, call tracing and protocol analysis. Proactive actions can then be taken to resolve network-critical issues. As a result, operators can rapidly pinpoint typical issues, such as congestion, interference, radio cell coverage, and equipment, handover failures and roaming problems with no need for drive testing tools. This optimizes QoS, minimizes churn and ultimately ensures more revenue minutes in the network.

The state-of-the-art Compass engine provides the fastest post-processing time and largest database storage in the market for rapid handling of very large traffic files. This is possible due to Compass' ability to analyze and index traffic files in an efficient and intelligent manner, thus handling subsequent requests for subscriber traces and in-depth drilling in a few seconds. The Compass engine analyzes and correlates subscriber activities both across interfaces and throughout the file storing this into the database in a way that allows drilling down and across.

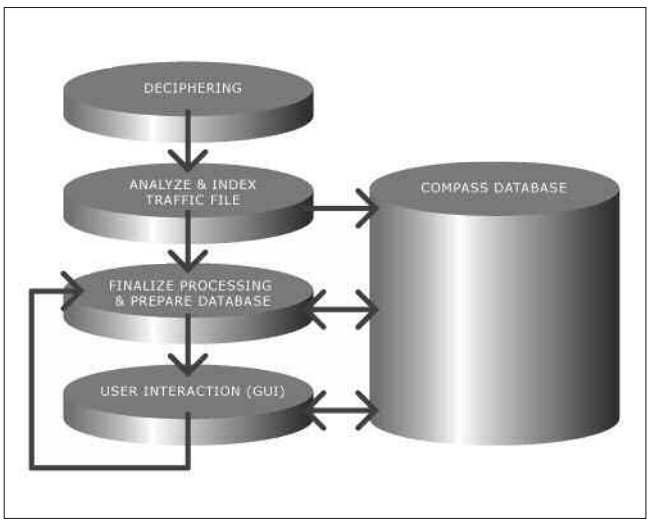

Figure 2 The Compass Wireless engine processes very large traffic files in just a few minutes.

Compass Wireless may also be used as an add-on to optimize the usage of your existing test equipment, such as drive test tools. Here Compass can aid by defining where and when it's sensible to carry out drive testing

Compass is easily installed on a normal desktop or a laptop PC, and comes with a modern platform with an easy-to-use and highly customizable graphical user interface and a database technology with a rich help support system. This helps operators simplify the internal work processes and allow engineers to use their time as effectively as possible.

Standard Reports

In one single tool Compass Wireless combines more than 600 statistical results and features for GSM, GPRS and UMTS. With that, it brings a new level of power and performance utilizing the state-of-the-art platform.

The vast list of predefined statistics and KPIs includes analysis of dropped calls, handover problems, path loss and neighbor list in addition to session analysis, service performance and throughput, as well as TBF and retransmission statistics

All statistics are presented in sheets and graphs. Statistics related to causes may be classified by the user allowing you to determine whether a cause is successful or non-successful in your network.

Customized Filters and Aggregations

With Compass Wireless is it possible to create very advanced aggregation and filter expressions. The aggregation and filters can be made on any of the more than 600 sheets/tables presented in Compass Wireless.

Many of the sheets/tables already have predefined aggregations and filters but if these do not fulfill your needs you can add additional aggregations and filters to the sheet/table in a flexible manner by generating the correct expression for the desired aggregation or filter.

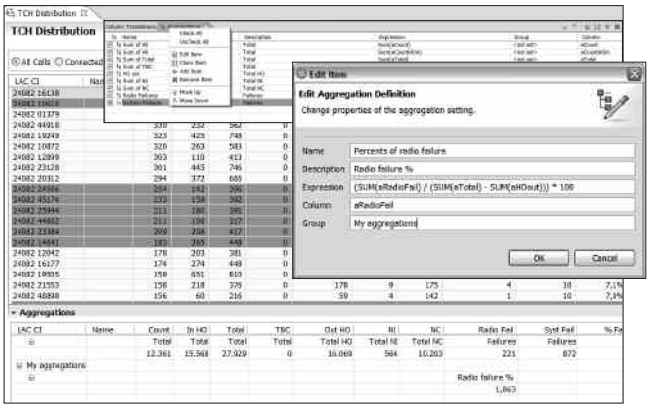

Figure 3. Customizing filters and aggregations

Selected Features

Radio Network Analysis

Compass Wireless can be used to quickly identify errors related to customer complaints or optimizing the radio network. Unlike traditional drive testing that takes place along a pre-defined route measuring only downlink signals, Compass analysis builds on measurement reports generated by all active subscribers in your network, and the BTS in both uplink and downlink direction. Graphics, including signal strength and quality based on cell level, TRX or individual subscribers are available.

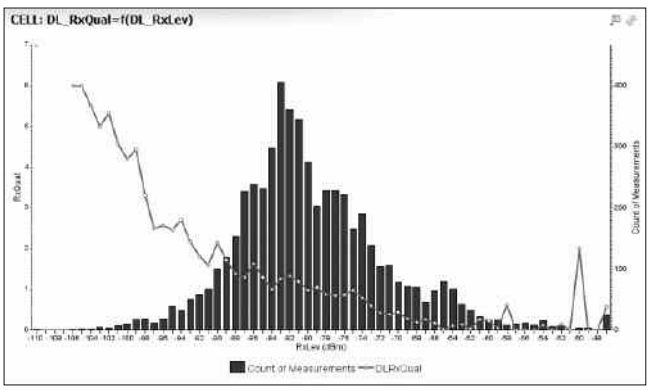

Figure 4. Uplink quality versus uplink level.

Compass Wireless analyzes uplink and downlink quality levels as well as receive-levels of neighbor cells. These results may be used to verify radio cell coverage and interference. You can also check if poor cells parameters are the cause of the problems or relate to the BTS hardware or antenna.

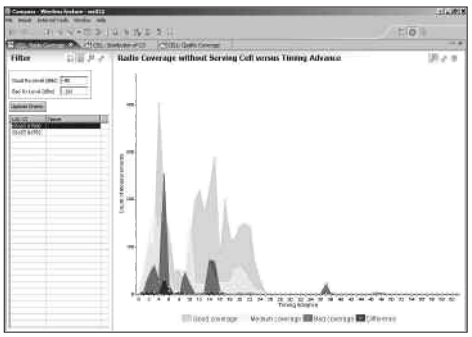

Figure 5. Quality distribution versus Timing Advance.

The call correlation across interfaces not only provides you with statistics on dropped calls, but also the actual root cause.

Session Analysis

From user plane and session analysis, Compass Wireless provides statistics on well-known ports, such as HTTP, FTP, WAP, POP and MMS with analysis on throughput, response time, retransmission, dropped connections, dropped sessions, packet loss and Round Trip Time for TCP sessions.

Compass Wireless provides statistics on overall session throughput per cell with the ability to drill down on each PDP context and get similar statistics for each subscriber and session. Each session is listed with all control plane and user plane packets.

Overall statistics, such as the most used APNs, session success rate and DNS answer and timing statistics are also available.

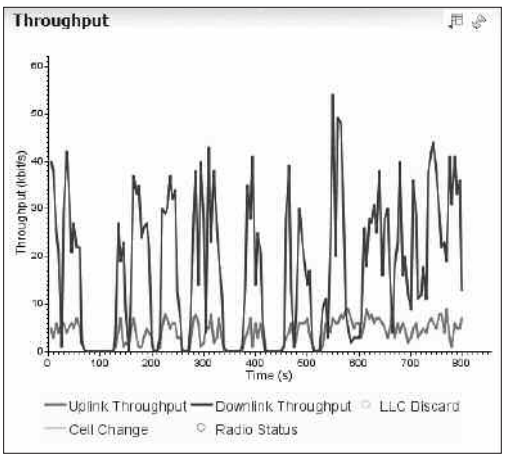

Figure 6. Throughput for a specific session.

Radio/PCU Analysis

The data flow is determined by factors as flow control and TBF assignment. Compass Wireless shows MS and BVC bucket leak rate and reports changes to cells and the performance of timeslot and TBF allocation.

In addition, Compass Wireless helps establish the availability, possible congestion, the required time to establish a radio circuit, and the number of bytes and frames being discarded.

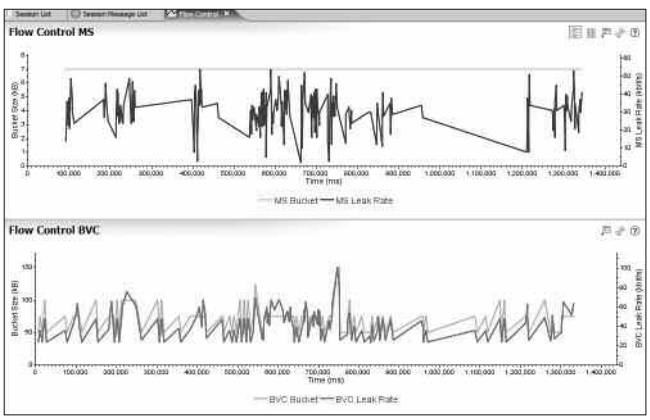

Figure 5 Flow control for a specific session.

Supported Features by Compass Wireless for GSM*1

BSS analysis	• BSS causes by event, location and category • SCCP UDT analysis • Analysis of terrestrial PCM usage, errors, holding time, allocation and time slot distribution • Equipment failures
Logical channels analysis	• SDCCH analysis by In-HO, Out-HO, MOC, MOT, emergency services, SMS-O, SMS-T, call reestablishment and defined cell group • TCH analysis: Congestion, dropped calls, speech rate, successful assigned, and defined group • CCCH Analysis • Traffic channel type and count of usage
SMS analysis	• CP, RP, TP, RP-TP failure, activity, SME distribution, status reports, RP cause • SMS length distribution, service center timing, application layer distribution • SUBMIT/STATUS report timing, full decoding of SMS text
Mobility analysis	• Handover analysis by source and target cell, success, failures, cell relationships, incoming-HO, outgoing-HO, intra cell-HO failure and the cause of handover • PLMN and roaming analysis with information of originating network and roaming cell
GSMR analysis	• Group calls and priority distribution • Support for VGCS (Voice Group Call Service) • Support for VBS (Voice Broadcast Service) • Support for eMLPP (enhanced Multi-Level Precedence and Pre-emption Service)
Subscriber analysis	• Subscriber trace based on IMSI and/or TMSI or IMEI • Count of HPLMN distribution • Called/calling number analysis, call cause analysis • Initial location updated with entering cell • Roaming analysis (see Roaming Analysis in separate box) • DTMF analysis • Dropped called analysis
Cell group analysis	• MOC/MOT calls • Handover SDCCH distribution • TCH distribution
Paging analysis	• Paging analysis by LAC, by cell • Paging response time analysis • Paging request type distribution • Paging group analysis
Call management distribution	• Location Update (periodic and normal) and attachment distribution • Voice group/voice broadcast distribution • Distribution of procedure type MOC, MOT, SMS-O, SMS-T, SS-O, SS-T, call reestablishment and emergency calls
User-definable settings and configurations	• Cell names, dual band cells, cell groups • Network name based on IMSI prefix (MNC+MCC) • Mobile type based on IMEI (TAC+FAC) • Good/bad Rx Level thresholds, TMA gain, BTS power • Group of selected calls (CSN) • Definition of warning levels in any column with coloring of warning figures • Thresholds settings to trigger alarms in alarm report • Cause category definition for each procedure and location
Network synthesis	• QoS statistics by LAC, BSS, cell type, channel type, class mark • HO statistics by LAC, BSS, cell type, channel type, class mark • Source/target HO statistics by LAC, BSS, cell type, channel type, class mark • End statistics by LAC, BSS, cell type, channel type, class mark
Mobile analysis	• MS power class and speech rate analysis • Mobile equipment analysis
Quick filter	• A-interface call filtering on cell, category, end, cause with or without Location Update, SDDCH phase, connected, TCH assigned, HO in SDCCH, etc. • Handover filtering on source and target cell on cause, type, category, etc. • Abis call filtering on TRX, channel type, time slot, Timing Advance, etc.
Codec analysis	• Dropped calls per speech version • A-ter message type statistics, correlation of A-ter messages and decoding • AMR support
Overall reports	• File processing report, cell report and warning and alarm report
After statistics	• GSM Ater Message type and procedure correlation
Roaming analysis	• Acquired roamers, location update per roamers, activity per roamer, predicting lost roamers • PLMN analysis • Roamer traffic by cell and origin
Timing statistics	• Handover request/required procedure timing • Location update, alert time and disconnection timing
Radio analysis	• UL/DL RxQual versus UL/DL RxLev per cell, dual band cell and per TRX • Radio coverage and C/I graphics • Quality coverage, measurement, power, balance, RxLev, RxQual per timing advance per cell and per TRX • Neighbor cell analysis • FR/HR usage, channel configuration • Handover failures per target timeslot • Interference level analysis • RSI causes, dropped calls per Timing Advance

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Supported Features for Compass Wireless for GPRS and EDGE*1

Signaling and cause analysis	• Count of Layer 3 messages with direction indication • Count of LLC messages with direction indication • Count of BSSGP messages with direction indication • Count of Network Service messages with direction indication • Count of cause statistics per type, total, per cell and MS • RIM Message List
User-definable settings and configurations	• Cell names, cell groups • Network name based on IMSI prefix (MNC+MCC) • Mobile type based on IMEI (TAC+FAC) • Start and stop time interval to process a part of a file only • Highlight settings with coloring of values complying to defined thresholds • Advanced filter and sorting using logical and arithmetic expressions • Advanced aggregations such as sum, minimum, maximum, average, standard deviation etc.
Timing statistics	• BVC block duration • Network name based on IMSI prefix (MNC+MCC) • Mobile type based on IMEI (TAC+FAC) • GMM, SM, BSSGP procedure timing, avg., min, max per cell
Total, successful and failed signaling Gb procedures (GMM, SM, BSSGP)	• Procedures by type and per cell with filter capability on cells • Procedures by type • Procedures by defined group of cells • Routing area update with target and source cells • PDP sessions activation per APN • Routing area update
Quality of Service	• Requested and negotiated PDP QoS per class and value
Cell analysis	• Overall cell changes and timing with source and target cell • Cell reselection timing with source and target cell • Distribution of uplink/downlink throughput per cell or total
Session statistics	• List of PDP context with application analysis, data volume uplink and downlink, APN, session timing and session termination cause • Drill-down from session list to individual session, to control and user plane messages • Collapse or expand user plane messages (SNDCP) • IP analysis, including source and destination IP address and port • Uplink/downlink throughput by time graph per session, with indication of LLC discarded, cell change and radio status message • Uplink/downlink data volume by time graph per session • Uplink/downlink TCP window size per session and port with indication of retransmissions • Uplink/downlink TCP sequence number graph per session and port with indication of retransmissions and packet loss • Uplink/downlink and total Round Trip Time per session and port • Cell statistics with uplink and downlink throughput versus number of active mobile stations • MS and BVC flow control stated in bucket size and leak rate by time • Cell change timing during active session indicating source and target cell • Session correlation of Abis and Gb signaling • Session termination and retainability statistics • APN distribution • Cell change analysis during session • Discrete throughput distribution for all cells or per cell for downlink and uplink
Transmitted volume	• Uplink/downlink LLC volume of data by cell • LLC discarded frames and bytes for all cells or per cell • Uplink/downlink user plane IP volume of data by SAPI and cell
DNS, WAP, MMS, HTTP and other well-known port statistics	• WAP abnormal event statistics • DNS abnormal event statistics • DNS query and answer statistics with count and timing • WAP server statistics with answer and WTP timing analysis • MMS message statistics • MMS fetch and post timing statistics graphs with duration versus MMS size • Failed fetch and post MMS statistics per session with reason • HTTP download time graph
Frame relay statistics	• Total and user plane throughput per Gb channel versus time in Kbytes/s or frames/s • Count of BECN and FECN versus time (for Gb over frame relay)
TCP statistics	• Uplink/downlink volume, retransmission, packet loss, number of connections, out of sequence per session • Connection statistics with volume, retransmitted bytes and percentage of volume in uplink and downlink direction • Mobile Station statistics with connection count, volume, retransmission percentage for uplink and downlink • Cell statistics with connection count, volume, retransmission percentage for uplink and downlink • Throughput per connection and port with volume, average throughput in uplink and downlink. • TCP RST flag statistics per session and connection • Connection establish timing analysis per session and connection • Connection failure analysis per session and connection • Average Round Trip Time per cell in uplink and downlink direction • Average Round Trip Time per MS in uplink and downlink direction • TCP windows analysis including size and status
Subscriber/Mobile Station statistics	• List of subscribers with HPLMN and phone type • MS by session and IP address • GPRS MS multi-slot class analysis • Messages sent and received by specific MS • Signaling procedures by specific MS • List of PDP sessions by specific MS

Continued on next page

Abis/TRAU/PCU/radio statistics	• Layer 2 elements count • RLC/MAC message count • Abis procedure errors with drill-down to actual sequences and/or TBFs • Abis error list, such as: Repeated assignment, Previous TBF without end, TBF release for unknown TBF, etc. • Uplink an downlink radio resource usage during TBF • Event and cause statistics • TBF statistics: Count of TFI changed, average throughput, repetitive blocks, no data sent, released by PCU • TBF message list • TRX list showing statistics by timeslots • TRAU frame usage (PDCH), total count and burst count • PDCH usage graph • Uplink and downlink coding scheme versus received signal level • Reassembling of TBF frames • Reassembling of LLC from RLC/MAC frames • Radio measurement graphs with count of block error, coding scheme change and RXLEV and C values for uplink and downlink • Downlink and uplink coding scheme graph by RLC/MAC blocks
Alcatel GSL statistics	• GSL message statistics • Successful, failed and total count of procedure types and per cell • Drill from overall statistics to individual procedures and message decoding • Event statistics • Count of allocated PDCH by sector, BTS and TRX
MPA Gr statistics	• MAP/TCAP message statistics count • Error cause statistics • Distribution of operation codes by successful, failed, error and total • Drill from operation codes overview to individual procedures and Gr message decoding
Overall report	• File report with source, interface information and indication of errors • Cell list of found cells, DLCIs and BVCIs • Gb error procedure report
EDGE support	• EDGE RLC/MAC data block decoding and EGPRS decoding • EDGE TBF management and TBF list indicating EDGE/non EDGE TBFs • LLC PDU reassembling • Gb & Abis EDGE correlation (Abis only for Ericsson and Alcatel – special attention required) • MCS and CS coding scheme distribution per TRX • Data sent per coding scheme versus radio measurements
Gb deciphering tool	• Deciphers Gb traffic • Supports GEA1 • MAP release ’98, phase 2 and phase 2+

∗1 As supported by Compass Wireless V 1.0. For most recent information please contact your Anritsu representative.

ISO9001/14000

IP Network, Wireless and Precision products contained in this catalogue are manufactured under a quality system and environment management system in conformance to the ISO international standard.

Factory name	Conformed standard	Qualification number	Qualified date	Qualification organization
Atsugi factory	ISO9001	JQA-0316	Nov. 15, 1993	Japan Quality Assurance Organization (JQA)
	ISO14001	JQA-EM0210	Aug. 28, 1998	
Tohoku Anritsu	ISO9002	JQA-0737	Dec. 28, 1994	
	ISO14001	JQA-EM0210	Aug. 28, 1998	
England factory	ISO9001	FS22679	May 24, 1999	BSI Quality Assurance
	ISO14001	EMS54120	Mar. 15, 2000	
U.S.A factory	ISO9001: 2000	6495	Apr. 27, 1995	The Seal of National Quality Assurance Limited Registered to A2LA
	ISO/IEC 17025	2160.01	Mar. 18, 2004	

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

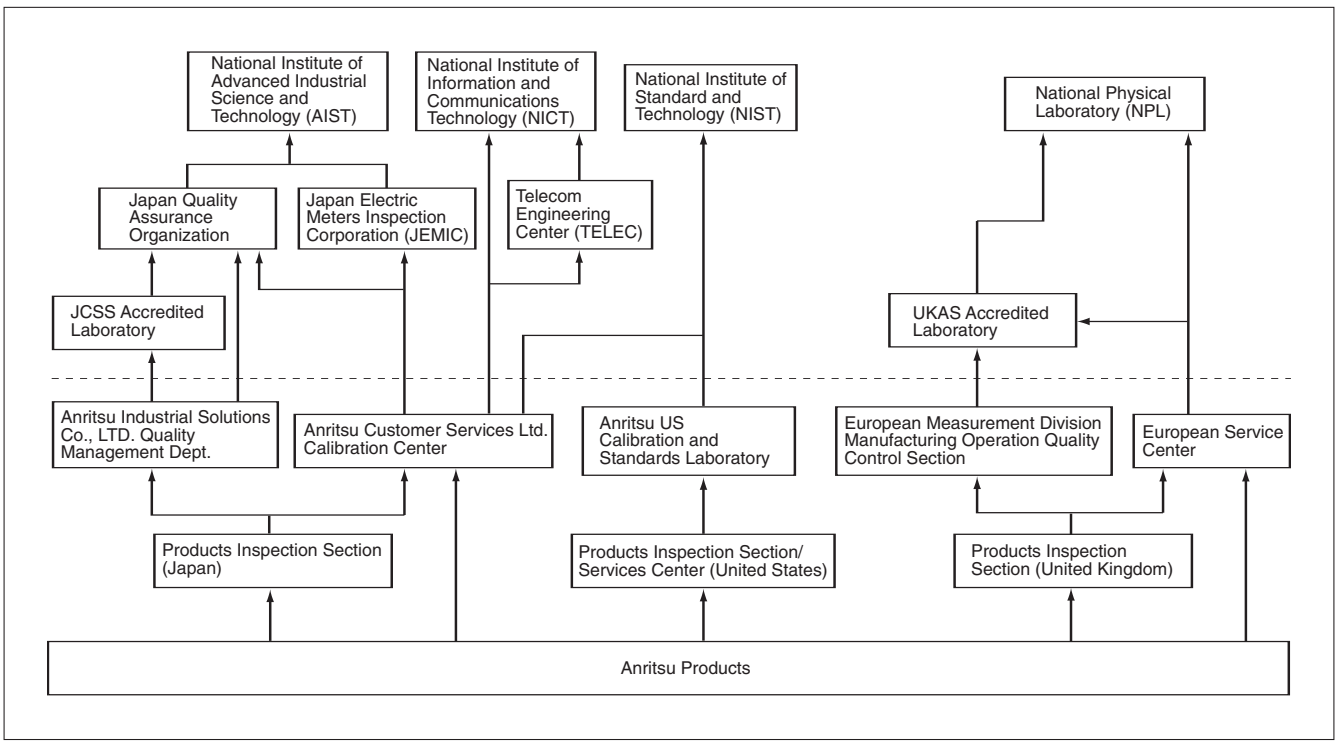
For parts generally used in each measuring instrument, quality improvement and standardization are actively promoted. All field data is analyzed, arranged and completely made known to each department while required actions are taken for reliability improvement.

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 Basic and General Terms in Metrology (VIM; 1993), traceability is defined as "the property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons." Anritsu's system to ensure traceability is shown below.

Measurements made by Anritsu's laboratory's are traceable to national, international, or intrinsic standards, where such standards are available.



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