Product Brochure

BTS Master™

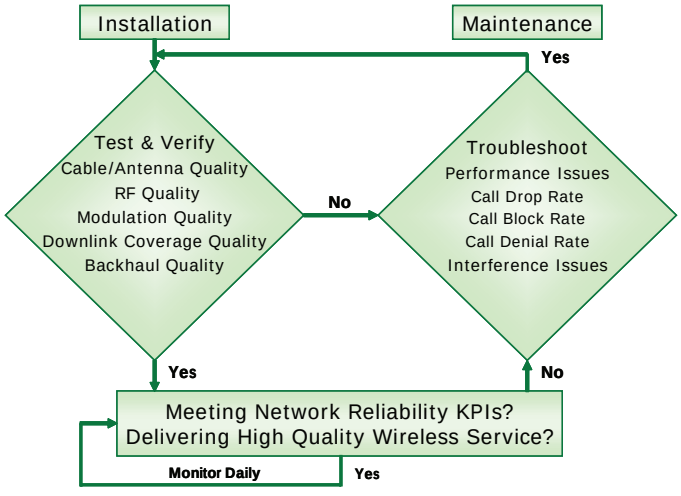
High-Performance Handheld Base Station Analyzer Featuring 20 MHz LTE Signal Quality Measurements

MT8221B	MT8222B	
400 MHz to 4 GHz	400 MHz to 6 GHz	Cable and Antenna Analyzer
150 kHz to 7.1 GHz	150 kHz to 7.1 GHz	Spectrum Analyzer
10 MHz to 7.1 GHz	10 MHz to 7.1 GHz	Power Meter

BTS Master™ Base Station Analyzer Features

Overview

BTS Master in Pass/Fail Mode



Installation and Maintenance Processes Supported by the BTS Master

Introduction

The BTS Master MT8221B and MT8222B are high-performance handheld base station analyzers that have been specifically developed to support the emerging 4G standards as well as installed 2G, 3G and WiMAX networks. The MT822xB platform introduces:

- 20 MHz LTE modulation quality testing
- Vector Signal Generator (400 MHz to 6 GHz) for comprehensive receiver testing
- 30-MHz Zero-Span IF Output for external demodulation of virtually any other wideband signal

The BTS Master features over 30 analyzers in one to meet virtually every measurement need. Standard features are:

- 2-port Cable and Antenna Analyzer: 400 MHz to 4/6 GHz
- Spectrum Analyzer: 150 kHz to 7.1 GHz
- Power Meter: 10 MHz to 7.1 GHz

A user can select from many options including:

- High Accuracy Power Meter
- Interference Analyzer
- Channel Scanner
- 3GPP Signal Analyzers
  LTE, GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA
- 3GPP2 Signal Analyzers
  cdmaONE/CDMA2000 1X, CDMA2000 1xEV-DO
- IEEE 802.16 Signal Analyzers
  Fixed WiMAX, Mobile WiMAX
- Backhaul Analyzers: E1, T1, T3/T1

Signal Analyzers have three methods for verifying the performance of a base station transmitter by measuring:

- RF Quality
- Modulation Quality (10 MHz standard, 20 MHz optional)
- Downlink Coverage Quality

Meeting Key Performance Indicators (KPIs)

Degradation in KPIs, such as dropped call and/or blocked call rates due to a malfunction at the cell site or due to interference, can be easily and accurately diagnosed down to the base station field replaceable unit (FRU) or the offending interfering signal with the BTS Master.

Line Sweep Tools (LST)

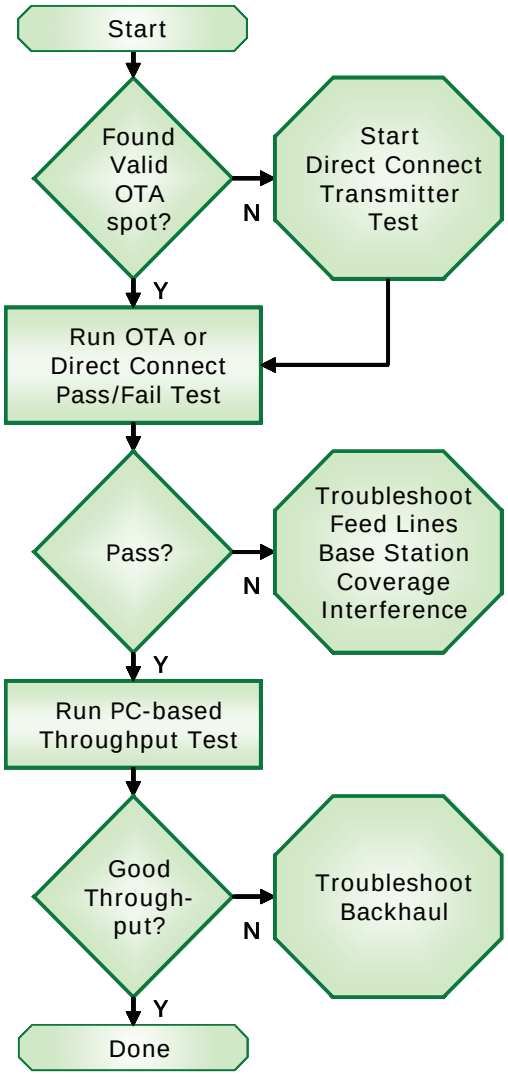
LST is a PC program that post processes Antenna, Cable, and PIM traces. It provides a powerful trace analysis and report generator for line sweepers.

Master Software Tools (MST)

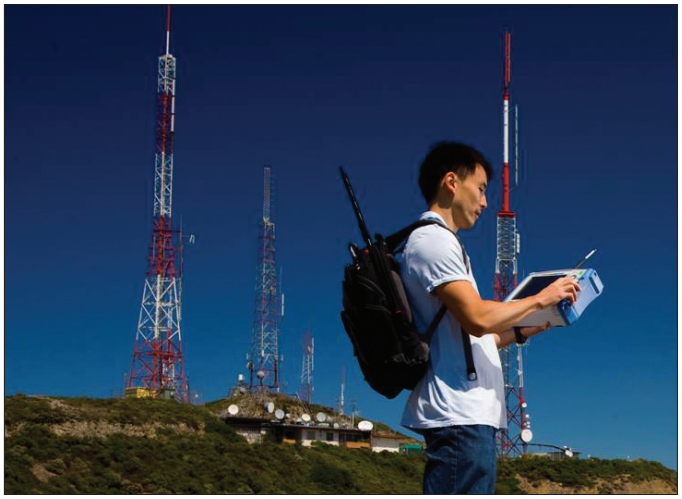
MST is a PC program that post processes spectrum analysis traces collected on your instrument. It provides a powerful data analysis tools for spectrum clearing and interference monitoring.

With Anritsu's design know-how and demanding production testing and performance verification you can count on the BTS Master to give you years of reliable dependable service.

Overview (continued)



Fast Over-the-Air Pass/Fail Testing Process



Troubleshooting Fast

An Anritsu exclusive is its Signal Analysis Over-the-Air (OTA) Pass/Fail Tests. Technicians and RF engineers can quickly determine the health of a cell site with a one-step Pass/Fail test. A one-step OTA Pass/Fail test verifies:

- Antenna Feed Line Quality
- Base Station RF Quality
- Base Station Modulation Quality

If a cell site passes, the technician can move on to the next cell site. If the test fails, the BTS Master equips the technician to troubleshoot:

- Feed lines and antenna systems
- Base station field replaceable units
- Downlink coverage issues
- Interference problems
- Backhaul bit-error-rates

By quickly determining the health of the cell site with Pass/Fail testing, the cell site technician becomes more productive and the BTS Master equips him with the tools to properly diagnose the root-cause of the problem minimizing costly no trouble found parts and service calls.

Network Reliability

Studies have shown that network reliability plays a significant part in subscriber churn. Leading reasons stated for churn are:

- Dropped calls
- Poor coverage
- Network outages

As wireless users come to depend more and more on their wireless service they expect more and more in network performance. This makes it more critical than ever to meet your KPI optimization goals for network availability, network quality, and network coverage. Ultimately it is about eliminating reasons for demanding subscribers to churn.

Network Maintenance and Return on Investment

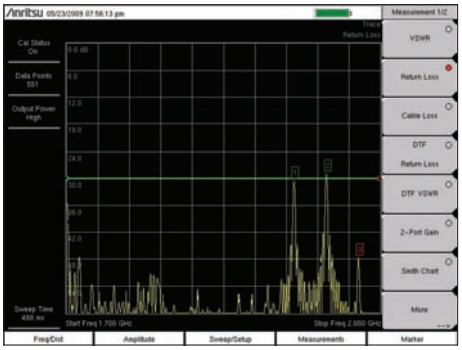
By outfitting cell site technicians with BTS Masters an operator can attack these reasons for churn. Benchmarking undertaken by Anritsu has shown that technicians equipped with base station analyzers provide them with the necessary tools to troubleshoot degrading KPIs which in turn can reduce churn.

Learn what the return on investment is on equipping more technicians with the BTS Master Base Station Analyzers from your local Anritsu sales professional. The BTS Master Base Station Analyzer can become your vital tool to achieving optimal network performance.

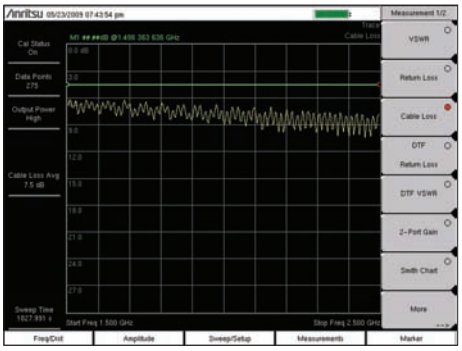
BTS Master™ Base Station Analyzer Features

Cable and Antenna Analyzer

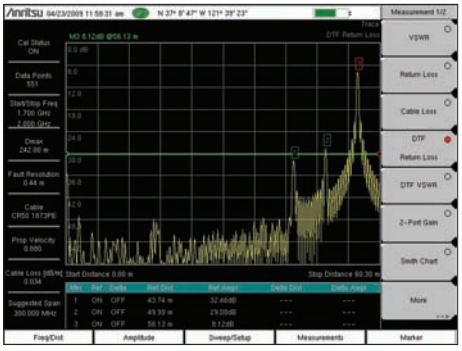
PIM Analyzer



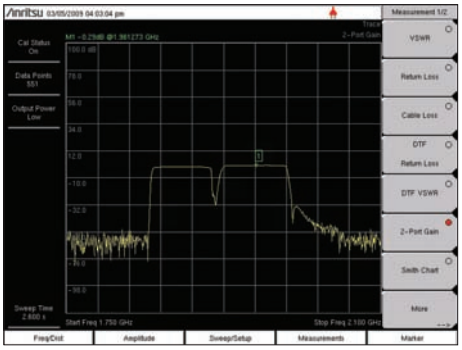
Return Loss/VSWR Measurement
Poor Return Loss/VSWR can damage transmitters, reduce the coverage area, increase dropped and blocked calls, and lower data rates.



Cable Loss Measurement
This an important commissioning check. Excessive loss reduces the coverage area and can mask return loss issues, creating false good readings later.



Distance-to- Fault (DTF) Measurement
DTF can be used to identify and locate faulty cable components or connector pairs with poor Return Loss/ VSWR in meters or feet.



2-port Gain Measurement
Poor antenna isolation on base stations and repeaters and degraded tower mounted amplifiers can cause dropped and blocked calls.

Cable and Antenna Analyzer PIM Analyzer

The BTS Master features 1-port and 2-port Cable and Antenna Analyzer and a PIM Analyzer to be able to test and verify the performance of nearly every feed-line and antenna component. This includes:

- Connectors
- Cables/Jumpers
- Antenna Isolation
- Diplexers/Duplexers
- Tower Mounted Amplifiers

The goal of these measurements is to maximize the coverage, data rate and capacity with problem-free antenna systems minimizing dropped calls and blocked calls for a good customer experience.

Antenna Systems Failure Mechanisms

Maintenance is an on-going requirement as antenna systems' performance can degrade at any point in time due to:

- Loose connectors
- Improperly weatherized connectors
- Pinched cables
- Poor grounding
- Corroded connectors
- Lightning strikes
- Strong winds misaligning antennas
- Rain getting into cables
- Bullet holes/nails in the cable
- Intermodulation of multiple signals

Making Measurements Easier

The BTS Master provides features for making measurements easier to perform and to analyze test results such as:

- FlexCal™ eliminates the need to recalibrate when changing frequencies
- High RF Immunity for testing in harsh RF environments
- Trace Overlay compares reference traces to see changes over time
- Limit Lines and Alarming for providing reference standards
- High Power output to test tower-top components without climbing the tower
- Internal Bias-Tee to power up TMAs for testing when off-line
- GPS tagging of data to verify location of tests
- Line Sweep Tools for post-analysis and report generation

PIM Analyzer

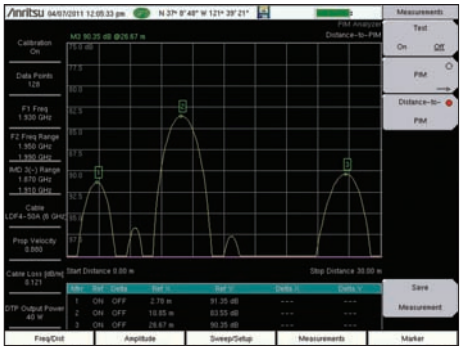
The PIM Analyzer measures the 3rd, 5th, or 7th order intermodulation products in the receive band of two high power tones generated by the 40 Watt PIM Master. To learn more about PIM and finding the location of PIM with the Distance-to-PIM™ option see the PIM Master™ product brochure 11410-00546.

Cable and Antenna Analyzer Measurements

- VSWR
- Return Loss
- Cable Loss
- Distance-to-Fault (DTF) Return Loss
- Distance-to-Fault (DTF) VSWR
- 1-port Phase
- 2-port Phase
- 2-port Gain
- Smith Chart

PIM Analyzer Measurements (Requires PIM Master™)

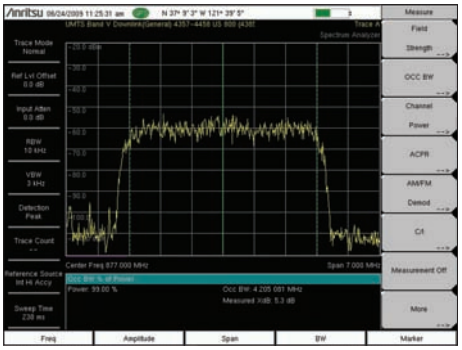
- PIM
- Noise Floor
- Distance-to-PIM™ (DTP)
- (see PIM Master Product Brochure 11410-00546)



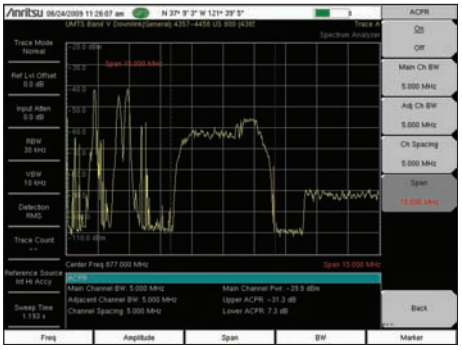
Distance-to-PIM Measurement

BTS Master™ Base Station Analyzer Features

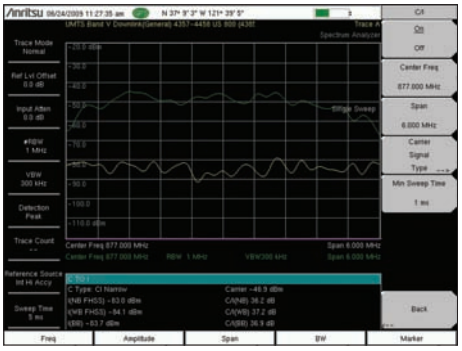
Spectrum Analyzer



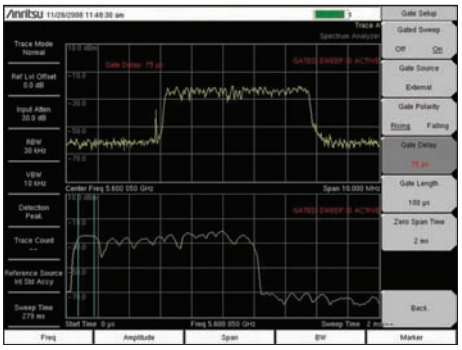
Occupied Bandwidth
Excessive occupied bandwidth can create interference with adjacent channels or be a sign of poor signal quality, leading to dropped calls.



Adjacent Channel Power Ratio (ACPR)
High ACPR will create interference for neighboring carriers. This is also an indication of low signal quality and low capacity, which can lead to blocked calls.



Carrier-to-Interference (C/I)
Low C/I ratios will cause coverage issues including dropped calls, blocked calls, and other handset reception problems.



Gated Sweep – Option 0090
The gate is in the off-time of this WiMAX signal, which would let the user see interfering signals or user signals when the base station is not transmitting.

Spectrum Analyzer

The BTS Master features the most powerful handheld spectrum analyzer for field use with unmatched performance such as:

- Sensitivity
- Dynamic Range
- Phase Noise
- Frequency Accuracy
- Resolution Bandwidth (RBW)

The goal of the Spectrum Analyzer's measurements is to be able to monitor, measure, and analyze RF signals and their environments. It finds rogue signals, measures carriers and distortion, and verifies base stations' signal performance. It validates carrier frequency and identifies desired and undesired signals.

Simple But Powerful

The BTS Master features dedicated routines for one-button measurements and for more in-depth analysis the technician has control over the setting and features not even found on lab-grade benchtop spectrum analyzers, for instance:

- Multiple sweep detection methods – true RMS detector, quasi-peak, ...
- Multiple traces and control – three traces, trace math, ...
- Advanced marker functions – noise marker, frequency counter, ...
- Advanced limit line functions – one-button envelope creation, relative, ...
- Save-on-Event – automatically saves a sweep when crossing a limit line
- Gated sweep - view pulsed or burst signals only when they are on, or off
- I/Q waveform capture - transfer captured signals for further analysis and troubleshooting

The BTS Master automatically sweeps as fast as possible for the selected settings consistent with accurate results.

GPS-Assisted Frequency Accuracy

With GPS Option 0031 the frequency accuracy is 25 ppb (parts per billion). After the GPS antenna is disconnected, the accuracy is 50 ppb for three days. Also all measurements can be GPS tagged for exporting to maps.

Rx Noise Floor Testing

The BTS Master can measure the Rx Noise Floor on the uplink of a base station using the channel power measurement. An elevated noise floor indicates interference and leads to call blocking, denial of services, call drops, low data rate, and low capacity.

Measurements

One Button Measurements
- Field Strength – in dBm/m^2 or dBmV/m
- Occupied Bandwidth - 1% to 99% of power
- Channel Power - in specified bandwidth
- ACPR - adjacent channel power ratio
- AM/FM/SSB Demodulation - audio out only
- C/I - carrier-to-interference ratio

Gated Sweep – Option 0090

I/Q Waveform Capture – Option 0024

Sweep Functions

Sweep
- Single/Continuous, Manual Trigger, Reset, Minimum Sweep Time

Detection
- Peak, RMS, Negative, Sample, Quasi-peak

Triggers
- Free Run, External, Video, Change Position, Manual

Trace Functions

Traces
- 1-3 Traces (A, B, C), View/Blank, Write/Hold

Trace A Operations
- Normal, Max Hold, Min Hold, Average, Number of Averages, (always the live trace)

Trace B Operations
- A → B, B←→C, Max Hold, Min Hold

Trace C Operations
- A → C, B←→C, Max Hold, Min Hold, A - B → C, B - A → C, Relative Reference (dB), Scale

Marker Functions

Markers
- 1-6 Markers each with a Delta Marker, or Marker 1 Reference with 6 Delta Markers

Marker Types
- Fixed, Tracking, Noise, Frequency Counter

Marker Auto-Position
- Peak Search, Next Peak (Right/Left), Peak Threshold %, To Channel, To Center, To Reference Level, Delta Marker to Span

Marker Table
- 1-6 markers' frequency & amplitude plus delta markers' frequency offset & amplitude

Limit Line Functions

Limit Lines
- Upper/Lower, Limit Alarm, Default Limit

Limit Line Edit
- Frequency, Amplitude, Add/Delete Point, Add Vertical, Next Point Left/Right

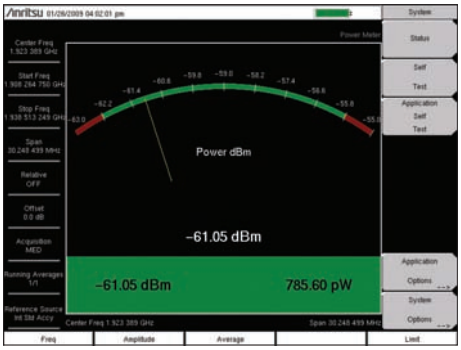
Limit Line Move
- To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1

Limit Line Envelope
- Create, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope

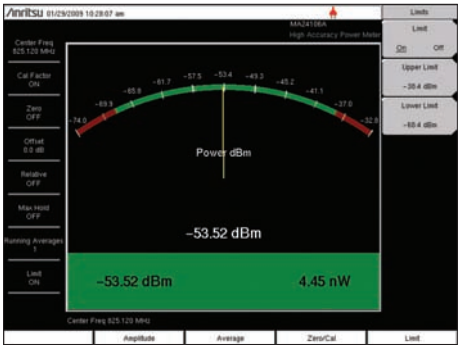
Limit Line Advanced
- Absolute/Relative, Mirror, Save/Recall

Power Meter

High Accuracy Power Meter (Option 0019)

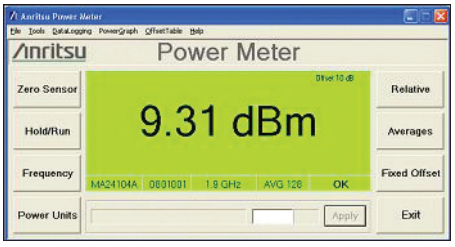


Power Meter (built-in)
Power is displayed in an analog type display and, supports both watts and dBm. RMS averaging can be set to low, medium, or high.



High Accuracy Power Meter (Option 0019)
Requires external power sensor with convenient connection via a USB A/mini-B cable. Use upper/ lower limit activation during pass/fail measurements.

Power Sensors
Anritsu offers a family of Power Sensors for your power measurement requirements. They are compact enough to fit in your shirt pocket.



PC Power Meter
These power sensors can be used with a PC running Microsoft Windows® via USB. A front panel display makes the PC appear like a traditional power meter.

Power Meters

The BTS Master offers as standard a built-in Power Meter utilizing the Spectrum Analyzer and an optional High Accuracy Power Meter requiring external power sensors.

Setting the transmitter output power of a base station properly is critical to the overall operation of a wireless network. A 1.5 dB change in power levels means a 15% change in coverage area.

Too much power means overlapping coverage which translates into cell-to-cell self interference. Too little power, too little coverage, creates island cells with non-overlapping cell sites and reduced in-building coverage. High or low values will cause dead zones/dropped calls, lower data rates/reduced capacity near cell edges, and cell loading imbalances/blocked calls.

High Accuracy Power Meter (Option 19)

For the most accurate power measurement requirements select the high accuracy measurement option with a choice of sensors with:

- Frequency ranges: 10 MHz to 18 GHz
- Power ranges: –40 dBm to +51.76 dBm
- Measurement uncertainties: ≤ ± 0.18 dB

These sensors enable users to make accurate measurements for CW and digitally modulated signals for 2G/3G and upcoming 4G wireless networks.

The power sensor easily connects to the BTS Master via a USB A/mini-B cable. An additional benefit of using the USB connection is that a separate DC supply (or battery) is not needed since the necessary power is supplied by the USB port.

PC Power Meter

These power sensors can be used with a PC running Microsoft Windows® via USB. They come with PowerXpert™ application, a data analysis and control software. The application has abundant features, such as data logging, power versus time graph, big numerical display, and many more, that enable quick and accurate measurements.

Remote Power Monitoring via LAN

A USB-to-LAN hub converter enables power monitoring via the Internet across continents, if desired.

Power Sensors

PSN50
High Accuracy RF Power Sensor
- 50 MHz to 6 GHz
- Type N(m), 50 Ω
- -30 dBm to +20 dBm
- (.001 mW to 100 mW)
- True-RMS

MA24104A
Inline High Power Sensor
- 600 MHz to 4 GHz
- +3 dBm to +51.76 dBm
- (2 mW to 150 W)
- True-RMS

MA24106A
High Accuracy RF Power Sensor
- 50 MHz to 6 GHz
- -40 dBm to +23 dBm
- (0.1 µW to 200 mW)
- True-RMS

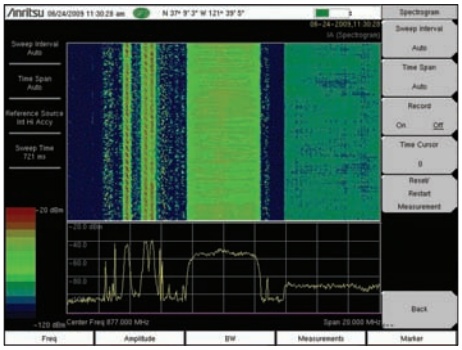
MA24108A
Microwave USB Power Sensor
- 10 MHz to 8 GHz
- -40 dBm to +20 dBm
- (0.1 µW to 100 mW)
- True-RMS
- Slot Power
- Burst Average Power

MA24118A
Microwave USB Power Sensor
- 10 MHz to 18 GHz,
- -40 dBm to +20 dBm
- (0.1 µW to 100 mW)
- True-RMS
- Slot Power
- Burst Average Power

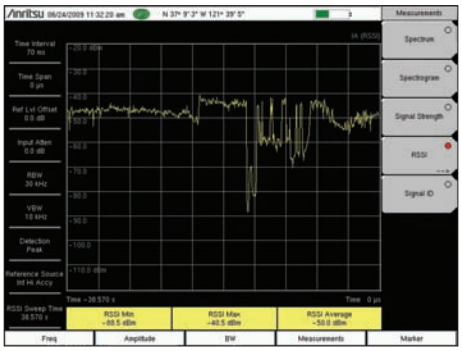
MA24126A
Microwave USB Power Sensor
- 10 MHz to 26 GHz,
- -40 dBm to +20 dBm
- (0.1 µW to 100 mW)
- True-RMS
- Slot Power
- Burst Average Power

BTS Master™ Base Station Analyzer Features

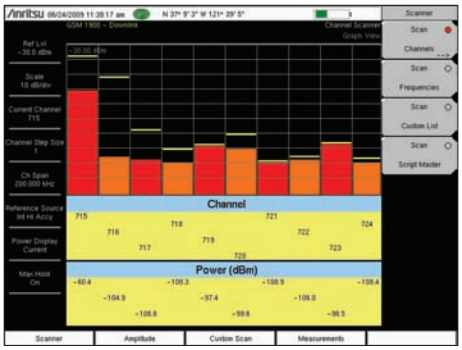
Interference Analyzer (Opton 0025) Channel Scanner (Option 0027)



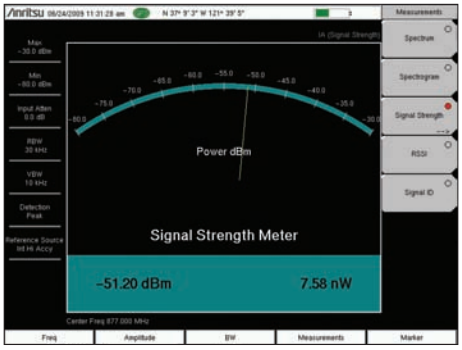
Spectrogram
For identifying intermittent interference and tracking signal levels over time for up to 1 week with an external USB flash drive.



Received Signal Strength Indicator (RSSI)
Used to observe the signal strength of a single frequency over time. Data can be collected for up to one week with an external USB flash drive.



Channel Scanner
Works on any signal and is useful when looking for IM or harmonics. Can help spot signals widely separated in frequency that turn on and off together.



Signal Strength Meter
Can locate an interfering signal, by using a directional antenna and measuring the signal strength and by an audible beep proportional to its strength.

Interference Analyzer (Option 0025) Channel Scanner (Option 0027)

Interference is a continuously growing problem for wireless network operators. Compounding the problem are the many sources that can generate interference such as:

- Intentional Radiators
- Unintentional Radiators
- Self Interference

Interference causes Carrier-to-Interference degradation robbing the network of capacity. In many instances interference can cause an outage to a sector, a cell, and/or neighboring cells. The goal of these measurements is to resolve interference issues as quickly as possible.

Monitoring Interference

The BTS Master offers many tools for monitoring intermittent interferers over time to determine patterns:

- Spectrogram
- Received Signal Strength Indicator
- Remote Monitoring over the Internet
- Save-on-Event – crossing a limit line

Master Software Tools for your PC features diagnostic tools for efficient analysis of the data collected during interference monitoring. These features include:

- Folder Spectrogram – creates a composite file of multiple traces for quick review
- Movie playback – playback data in the familiar frequency domain view
- Histogram – filter data and search for number of occurrences and time of day
- 3D Spectrogram – for in-depth analysis with 3-axis rotation viewing control

Identifying Interference

The BTS Master provides several tools to identify the interference – either from a neighboring wireless operator, illegal repeater or jammer, or self-interference:

- Signal ID (up to 12 signals at once)
- Signal Analyzer Over-the-Air Scanners
- Channel Scanner (up to 1200 channels, 20 at a time)

Locating Interference

Once interference has been identified the Signal Strength Meter with its audible output beep coupled with a directional antenna makes finding the interference easier.

Interference Analyzer Measurements

Spectrogram
Signal Strength Meter
Received Signal Strength Indicator (RSSI)
Signal ID (up to 12 signals)
- FM
- GSM/GPRS/EDGE
- W-CDMA/HSDPA
- CDMA/EV-DO
- Wi-Fi

Spectrum
- Field Strength – in dBm/m^2 or dBmV/m
- Occupied Bandwidth - 1% to 99% of power
- Channel Power - in specified bandwidth
- ACPR - adjacent channel power ratio
- AM/FM/SSB Demodulation - audio out only
- C/I - carrier-to-interference ratio
- SEM - spectral emission mask

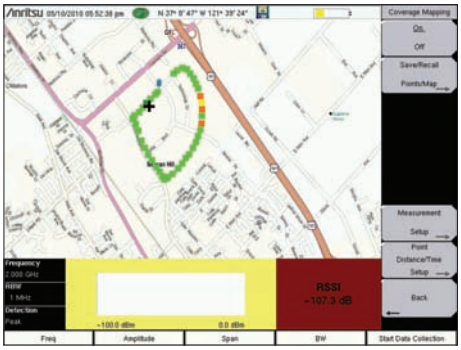
Channel Scanner

Scan
- 20 channels at once, by frequency or channel
- Noncontiguous channels
- Different channel bandwidths in one scan

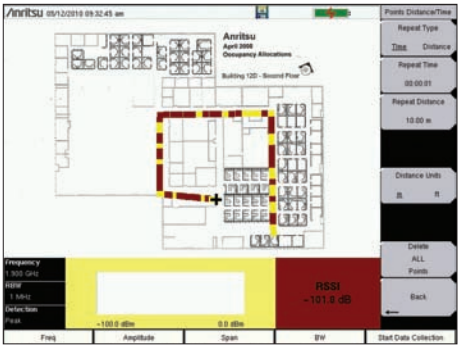
Display
- Current plus Max hold display
- Graph View
- Table View

Script Master™
- Up to 1200 Channels
- Auto-repeat sets of 20 channels and total
- Auto-Save with GPS tagging

Coverage Mapping (Option 0431)

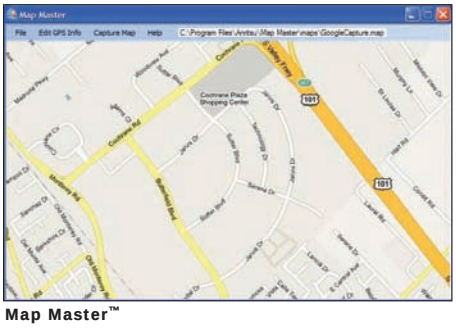


On-screen Outdoor Coverage Mapping
Enables a maintenance technician to make low cost coverage measurements to quickly verify coverage around a base station site.



On-screen Indoor Coverage Mapping
Import an image of an office floor plan and use the start-walk-stop method to record coverage strength. Validates coverage for enterprise accounts.

Plot Coverage on PC-based Map
Once coverage data has been collected on the instrument, the data can be imported into a mapping program for further review and reporting.



Map Master™
Map Master is a PC-based program that allows you to capture maps with GPS coordinates that can be imported into the instrument via a USB drive.

Coverage Mapping

There is a growing demand for low cost coverage mapping solutions. Anritsu's Coverage Mapping measurements option provides wireless service providers, public safety users, land mobile ratio operators, and government officials with indoor and outdoor mapping capabilities.

Outdoor Mapping

With a GPS antenna connected to the instrument and a valid GPS signal, the instrument monitors RSSI and ACPR levels automatically. Using a map created with Map Master, the instrument displays maps, the location of the measurement, and a special color code for the power level. The refresh rate can be set up in time (1 sec, minimum) or distance.

The overall amplitude accuracy coupled with the GPS update rate ensures accurate and reliable mapping results.

Indoor Mapping

When there is no GPS signal valid, the BTS Master uses a start-walk-stop approach to record RSSI and ACPR levels. You can set the update rate, start location, and end location and the interpolated points will be displayed on the map.

Export KML Files

Save files as KML or JPEG. Open KML files with Google Earth™. When opening up a pin in Google Earth, center frequency, detection method, measurement type, and RBW are shown on screen.

Map Master™

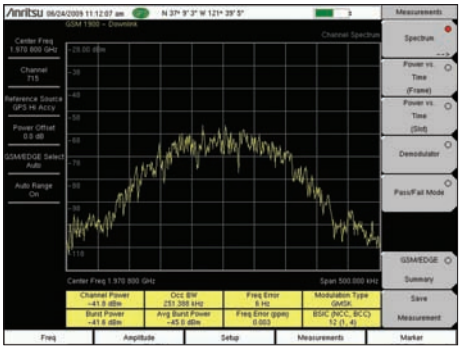
The Map Master program creates maps on your PC compatible with the BTS Master. Maps are created by typing in the address or by converting existing JPEG, TIFF, BMP, GIF, and PNG files to MAP files. Utilizing the built-in zoom in and zoom out features, it is easy to create maps of the desired location on your PC and transfer to the instrument with a USB flash drive. Map Master also includes a GPS editor for inputting latitude and longitude information of maps from different formats.

Coverage Mapping Measurements

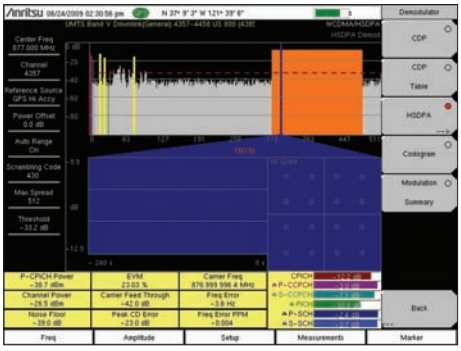
Spectrum Analyzer Mode
- ACPR
- RSSI

BTS Master™ Base Station Analyzer Features

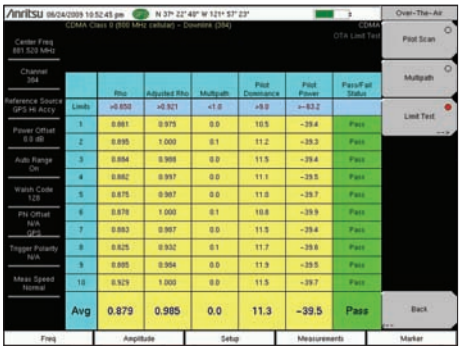
Introduction to Signal Analyzers



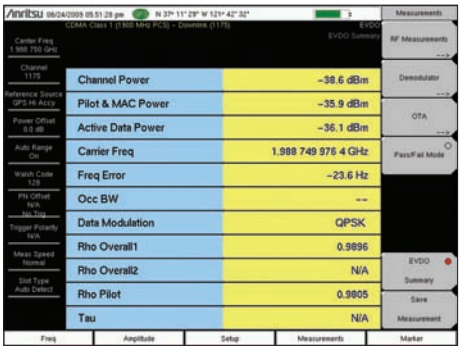
RF Measurement – GSM
High Frequency Error will cause calls to drop when mobiles travel at higher speed. In some cases, cell phones cannot hand off into, or out of the cell.



Demodulation – HSDPA
This is the single most important signal quality measurement. Poor EVM leads to dropped calls, low data rate, low sector capacity, and blocked calls.



Over-the- Air Measurement - CDMA
Having low multi-path and high pilot dominance is required for quality Rho measurements OTA. Poor Rho leads to dropped and blocked calls, and low data rate.



Measurement Summary – LTE
Having a summary of all key measurements is a quick way for a technician to see the health of the base station and record the measurements for reference.

Signal Analyzers

The BTS Master features Signal Analyzers for the major wireless standards around the world. The Signal Analyzers are designed to test and verify the:

- RF Quality
- Modulation Quality
- Downlink Coverage Quality

of the base stations' transmitters. The goal of these tests are to improve the Key Performance Indicators (KPIs) associated with:

- Call Drop Rate
- Call Block Rate
- Call Denial Rate

By understanding which test to perform on the BTS Master when the KPIs degrade to an unacceptable level, a technician can troubleshoot down to the Field Replacement Unit (FRU) in the base station's transmitter chain. This will minimize the problem of costly no trouble founds (NTF) associated with card swapping. This will allow you to have a lower inventory of spare parts as they are used more efficiently.

Troubleshooting Guides

The screen shots on this page are all measurements made over-the-air with the MT822xB on commercial base stations carrying live traffic. To understand when, where, how, and why you make these measurements Anritsu publishes Troubleshooting Guides which explain for each measurement the:

- Guidelines for a good measurement
- Consequences of a poor measurement
- Common faults in a base station

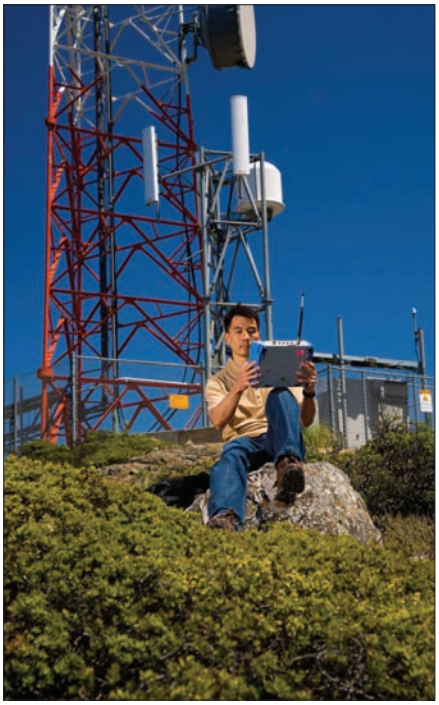
These *Troubleshooting Guides for Base Stations* are one-page each per Signal Analyzer. They are printed on tear-resistant and smudge-resistant paper and are designed to fit in the soft case of the instrument for easy reference in the field. They are complimentary and their part numbers can be found in the ordering information.

- LTE Base Stations
- GSM/GPRS/EDGE Base Stations
- W-CDMA/HSDPA Base Stations
- CDMA2000 1X Base Stations
- CDMA2000 1xEV-DO Base Stations
- Fixed WiMAX Base Stations
- Mobile WiMAX Base Stations
- TD-SCDMA/HSDPA Base Station

Signal Analyzers
LTE
GSM/GPRS/EDGE
W-CDMA/HSDPA
cdmaOne/CDMA2000 1X
CDMA2000 1xEV-DO
Fixed WiMAX
Mobile WiMAX
TD-SCDMA

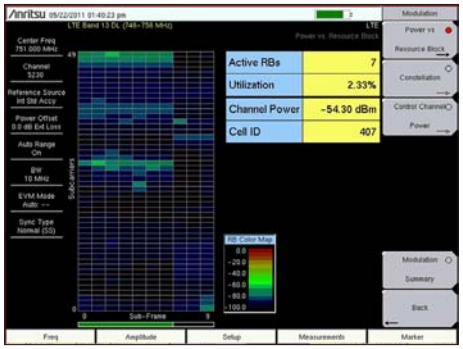
Typical Signal Analyzer Options
RF Measurements
Demodulation
Over-the-Air Measurements

Signal Analyzer Features
Measurement Summary Displays
Pass/Fail Limit Testing

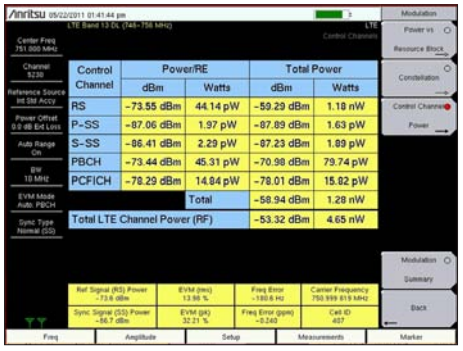


BTS Master™ Base Station Analyzer Features

LTE and TD-LTE Signal Analyzers (Options 0541, 0542, 0543, 0546, 0551, 0552, 0556)



Modulation Quality – Power vs. Resource Block
A high utilization of the Resource Blocks would indicate a cell site in nearing overload and it may be appropriate to start planning for additional capacity.



Modulation Quality – Control Channels
High values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.

Over-the-Air Measurements – Tx Test
By looking at the reference signals of MIMO antennas one can determine if MIMO is working properly. If the delta power is too large, there is an issue.

Over-the-Air On-screen Mapping
With Map Master™ import map area on instrument screen to drive test downlink coverage of S-SS Power, RSRP, RSRQ, or SINR.

LTE and TD-LTE Signal Analyzers

The BTS Master features three LTE and TD-LTE measurement modes:

- RF Measurements
- Modulation Measurements
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Adjacent Channel Leakage Ratio (ACLR)

Adjacent Channel Leakage Ratio (ACLR) measures how much BTS signal gets into neighboring RF channels. ACLR checks the closest (adjacent) and the second closest (alternate) channels. Poor ACLR can lead to interference with adjacent carriers and legal liability. It also can indicate poor signal quality which leads to low throughput.

Cell ID (Sector ID, Group ID)

Cell ID indicates which base station is being measured OTA. The strongest base station at your current location is selected for measurement. Wrong values for Cell ID lead to inability to register. If the cause is excessive overlapping coverage, it also will lead to poor EVM and low data rates.

Pass/Fail Test

Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior.

EVM

High values will create larger areas of cell-to-cell interference and create lower data rates near cell edges.

Mapping

On-screen mapping allows field technicians to quickly determine the downlink coverage quality in a given geographic location. Plot S-SS Power, RSRP, RSRQ or SINR with five user definable thresholds. All parameters are collected for the three strongest signals and can be saved as *.kml and *.mtd (tab delimited) for importing to third party mapping programs for further analysis.

RF Measurements (Option 0541/551 FDD/TDD)

Channel Spectrum
- Channel Power, Occupied Bandwidth

Power vs. Time (TDD only)
- Total Frame Power, DwPTS Power
- Transmit Off Power, Cell ID
- Timing Error, Frame/Sub-Frame View

ACLR

Spectral Emission Mask

RF Summary

Modulation Measurements (Option 0542/552 FDD/TDD)

Power vs. Resource Block
- Active RBs, Utilization %, Channel Power, Cell ID

Constellation
- QPSK, 16 QAM, 64 QAM
- Modulation Results
  - RS Power, SS Power, EVM, Freq Error, Carrier Frequency, Cell ID

Control Channel Power
- Bar Graph or Table View
- RS, P-SS, S-SS, PBCH, PCFICH
- Total Power (Table View)
- Modulation Results

Modulation Summary

Over-the-Air Measurements (OTA) (Option 0546/556 FDD/TDD)

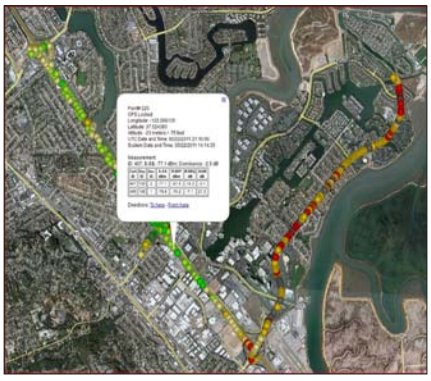
Scanner – six strongest signals
- Cell ID (Group, Sector)
- S-SS, RSRP, RSRQ, SINR, Dominance

Tx Test
- Scanner – three strongest signals
- RS Power of MIMO antennas
  - Cell ID, Average Power, Delta Power (Max-Min)
  - Graph Antenna Power
- Modulation Results – On/Off

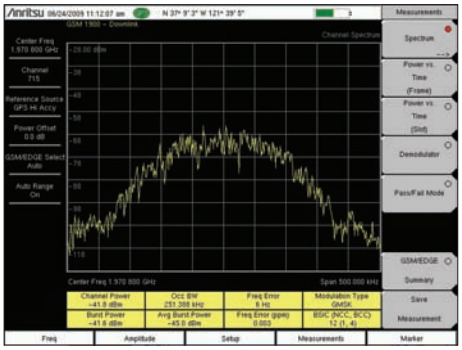
Mapping
- On-screen S-SS, RSRP, RSRQ, or SINR
- Scanner – three strongest signals

LTE BW = 15, 20 MHz (Option 543)

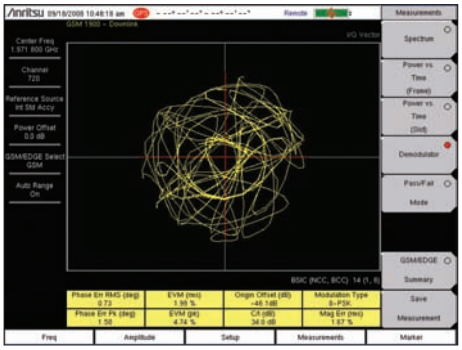
Enables 15 and 20 MHz bandwidths for:
- RF Measurements (Option 0541/551)
- Modulation Measurements (Option 0542/552)



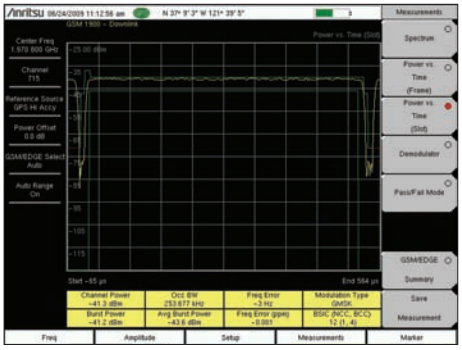
GSM/GPRS/EDGE Signal Analyzers (Options 0040, 0041)



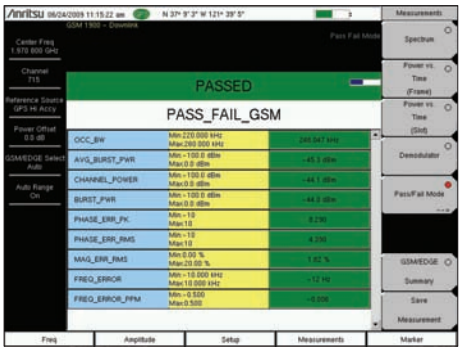
RF Measurement – Occupied Bandwidth
Excessive occupied bandwidth can create interference with adjacent channels or be a sign of poor signal quality, leading to dropped calls.



Demodulation – Error Vector Magnitude (EVM)
This is the single most important signal quality measurement. Poor EVM leads to dropped calls, low data rate, low sector capacity, and blocked calls.



RF Measurement – Average Burst Power
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values create dropouts and dead zones.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior

GSM/GPRS/EDGE Analyzers

The BTS Master features two GSM/GPRS/EDGE measurement modes.

- RF Measurements
- Demodulation

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

For easy identification of which cell you are measuring the Base Station Identity Code (BSIC) gives the base station ID, the Network Color Code (NCC) identifies the owner of the network, and the Base Station Color Code (BCC) provides the sector information.

Carrier-to-Interference (C/I)

C/I indicates the quality of the received signal. It also can be used to identify areas of poor signal quality. Low C/I ratios will cause coverage issues including dropped calls, blocked calls, and other handset reception problems.

Phase Error

Phase Error is a measure of the phase difference between an ideal and actual GMSK modulated voice signal. High phase error leads to dropped calls, blocked calls, and missed handoffs.

Origin Offset

Origin Offset is a measure of the DC power leaking through local oscillators and mixers. A high Origin Offset will lower EVM and Phase Error measurements and create higher dropped call rates.

Power versus Time (Slot and Frame)

Power versus Time (Slot and Frame) should be used if the GSM base station is setup to turn RF power off between timeslots. When used OTA, this measurement can also spot GSM signals from other cells. Violations of the mask create dropped calls, low capacity, and small service area issues.

RF Measurements (Option 0040)

Channel Spectrum
- Channel Power
- Occupied Bandwidth
- Burst Power
- Average Burst Power
- Frequency Error
- Modulation Type
- BSIC (NCC, BCC)

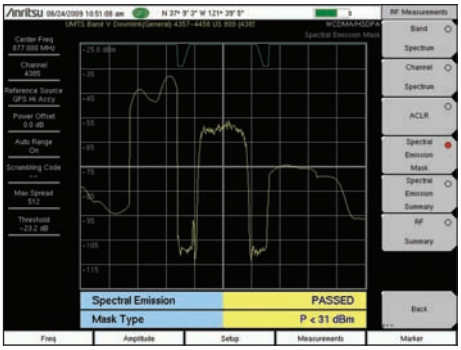
Multi-channel Spectrum

Power vs. Time (Frame/Slot)
- Channel Power
- Occupied Bandwidth
- Burst Power
- Average Burst Power
- Frequency Error
- Modulation Type
- BSIC (NCC, BCC)

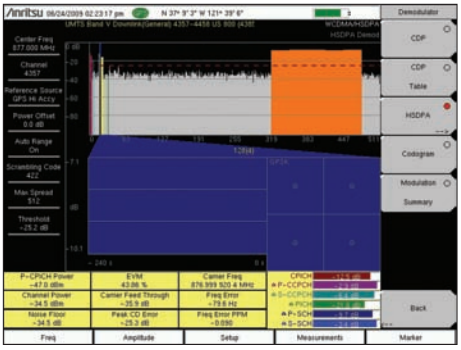
Demodulation (Option 0041)

Phase Error
EVM
Origin Offset
C/I
Modulation Type
Magnitude Error
BSIC (NCC, BCC)

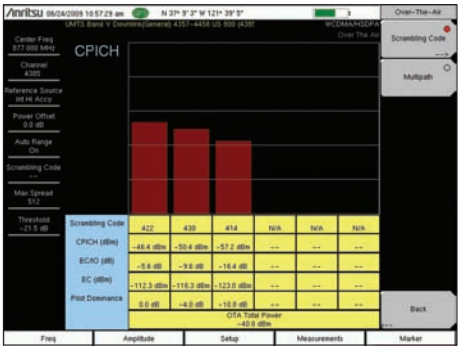
W-CDMA/HSDPA Signal Analyzers (Options 0044, 0045 or 0065, 0035)



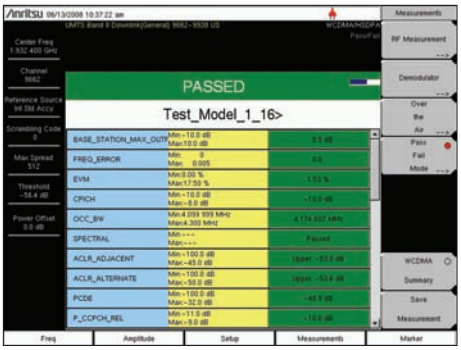
RF Measurements – Spectral Emissions Mask
The 3GPP spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



Demodulation – Error Vector Magnitude (EVM)
This is the single most important signal quality measurement. Poor EVM leads to dropped calls, low data rate, low sector capacity, and blocked calls.



Over-the-Air Measurements – Scrambling Codes
Too many strong sectors at the same location creates pilot pollution. This leads to low data rate, low capacity, and excessive soft handoffs.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior

W-CDMA/HSDPA Signal Analyzers

The BTS Master features four W-CDMA/HSDPA measurement modes:

- RF Measurements
- Demodulation (two choices)
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the Node B off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Frequency Error

Frequency Error is a check to see that the carrier frequency is precisely set. The BTS Master can accurately measure Carrier Frequency Error OTA if the instrument is GPS enabled or in GPS holdover. Calls will drop when mobiles travel at higher speed. In some cases, cell phones cannot hand off into, or out of the cell.

Peak Code Domain Error (PCDE)

Peak Code Domain Error is a measure of the errors between one code channel and another. High PCDE causes dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls.

Multipath

Multipath measurements show how many, how long, and how strong the various radio signal paths are. Multipath signals outside tolerances set by the cell phone or other UE devices become interference. The primary issue is co-channel interference leading to dropped calls and low data rates.

Pass/Fail Mode

The BTS Master stores the five test models covering all eleven test scenarios specified in the 3GPP specification (TS 25.141) for testing base station performance and recalls these models for quick easy measurements.

RF Measurements
(Option 0044)
Band Spectrum
Channel Spectrum
- Channel Power
- Occupied Bandwidth
- Peak-to-Average Power

Spectral Emission Mask
Single carrier ACLR
Multi-carrier ACLR

Demodulation
(Option 0045 or 0065)
Code Domain Power Graph
- P-CPICH Power
- Channel Power
- Noise Floor
- EVM
- Carrier Feed Through
- Peak Code Domain Error
- Carrier Frequency
- Frequency Error
- Control Channel Power
- Abs/Rel/Delta Power
  - CPICH, P-CCPCH
  - S-CCPCH, PICH
  - P-SCH, S-SCH
- HSDPA (Option 0065 only)
  - Power vs. Time
  - Constellation

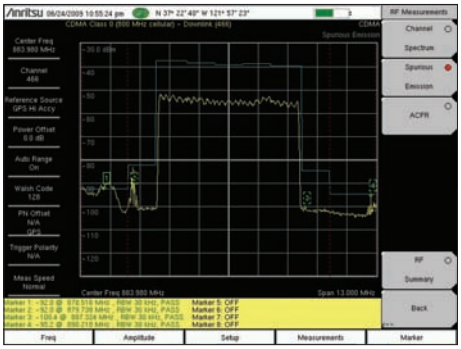
Code Domain Power Table
- Code, Status
- EVM, Modulation Type
- Power, Code Utilization
- Power Amplifier Capacity

Codogram

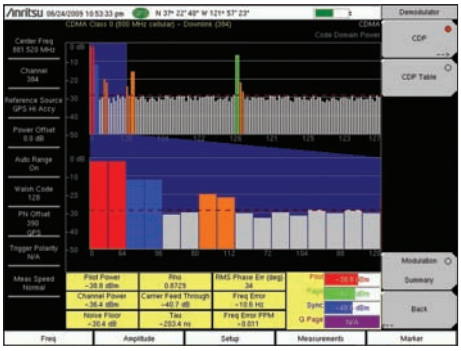
Over-the-Air (OTA) Measurements
(Option 0035)
Scrambling Code Scanner (Six)
- Scrambling Codes
- CPICH
- E_c/I_o
- E_c
- Pilot Dominance
- OTA Total Power

Multipath Scanner (Six)
- Six Multipaths
- Tau
- Distance
- RSCP
- Relative Power
- Multipath Power

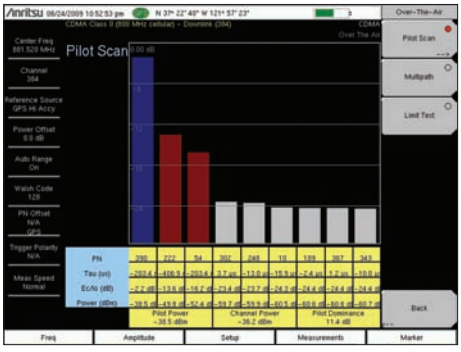
cdmaOne/CDMA2000 1X Signal Analyzers (Options 0042, 0043, 0033)



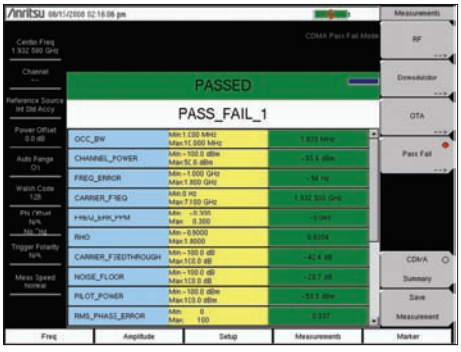
RF Measurements – Spectral Emissions Mask
The 3GPP spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



Modulation Quality – EVM
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



Over-the-Air Measurements – Sync Signal Power
Check for un-even amplitude of sub-carriers. Data will be less reliable on weak sub-carriers, creating a lower over-all data rate.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior.

CDMA Signal Analyzers

The BTS Master features three CDMA measurement modes:

- RF Measurements
- Demodulation
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Adjacent Channel Power Ratio (ACPR)

ACPR measures how much of the carrier gets into neighboring RF channels. ACPR, and multi-channel ACPR, check the closest (adjacent) and second closest (alternate) RF channels for single and multicarrier signals. High ACPR will create interference for neighboring carriers. This is also an indication of low signal quality and low capacity, which can lead to blocked calls.

RMS Phase Error

RMS Phase Error is a measure of signal distortion caused by frequency instability. Any changes in the reference frequency or the radio's internal local oscillators will cause problems with phase error. A high reading will cause dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls.

Noise Floor

Noise Floor is the average level of the visible code domain noise floor. This will affect Rho. A high noise floor will result in dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls.

E_c / I_o

E_c/I_o indicates the quality of the signal from each PN. Low E_c/I_o leads to low data rate and low capacity.

RF Measurements (Option 0042)

Channel Spectrum
- Channel Power
- Occupied Bandwidth
- Peak-to-Average Power

Spectral Emission Mask
Multi-carrier ACPR

Demodulation (Option 0043)

Code Domain Power Graph
- Pilot Power
- Channel Power
- Noise Floor
- Rho
- Carrier Feed Through
- Tau
- RMS Phase Error
- Frequency Error
- Abs/Rel/ Power
  - Pilot
  - Page
  - Sync
  - Q Page

Code Domain Power Table
- Code
- Status
- Power
- Multiple Codes
- Code Utilization

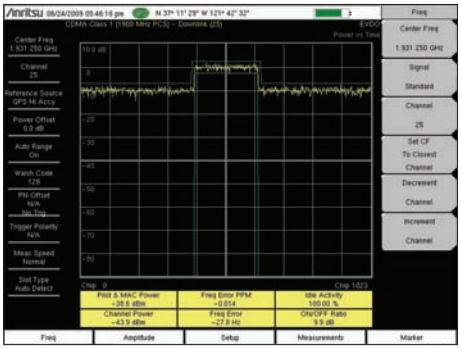
Over-the-Air (OTA) Measurements (0ption 0033)

Pilot Scanner (Nine)
- PN
- E_c/I_o
- Tau
- Pilot Power
- Channel Power
- Pilot Dominance

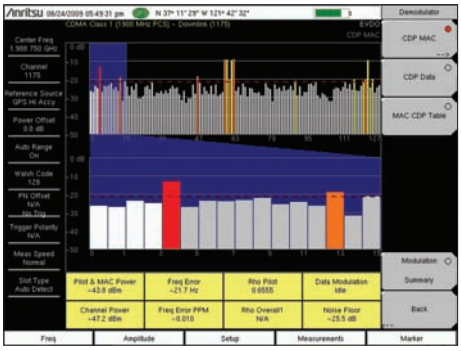
Multipath Scanner (Six)
- E_c/I_o
- Tau
- Channel Power
- Multipath Power

Limit Test – 10 Tests Averaged
- Rho
- Adjusted Rho
- Multipath
- Pilot Dominance
- Pilot Power
- Pass/Fail Status

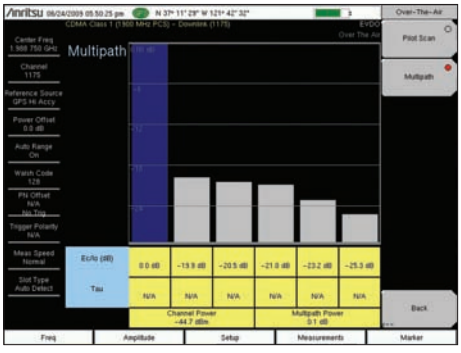
CDMA2000 1xEV-DO Signal Analyzers (Options 0062, 0063, 0034)



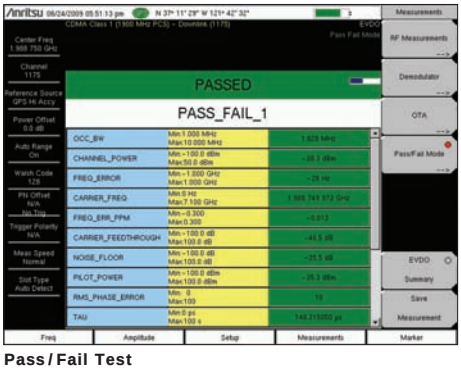
RF Measurements – Pilot and MAC Power
High values will create pilot pollution. High or low values will cause dead spots/dropped calls and cell loading imbalances/blocked calls.



Demodulation – Frequency Error
Calls will drop when mobiles travel at higher speed. In some cases, cell phones cannot hand off into, or out of the cell, creating island cells.



Over-the-Air Measurements – Multipath
Too much Multipath from the selected PN Code is the primary issue of co-channel interference leading to dropped calls and low data rates.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior.

EV-DO Signal Analyzers

The BTS Master features three EV-DO measurement modes.

- RF Measurements
- Demodulation
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Spectral Emission Mask (SEM)

SEM is a way to check out-of-channel spurious emissions near the carrier. These spurious emissions both indicate distortion in the signal and can create interference with carriers in the adjacent channels. Faults leads to interference and thus, lower data rates for adjacent carriers. Faults also may lead to legal liability and low in-channel signal quality.

Rho

Rho is a measure of modulation quality. Rho Pilot, Rho Mac, and Rho Data are the primary signal quality tests for EV-DO base stations. Low Rho results in dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls. This is the single most important signal quality measurement.

PN Codes

PN Code overlap is checked by the pilot scanner. Too many strong pilots create pilot pollution which results in low data rate, low capacity, and excessive soft handoffs.

Over-the-Air (OTA) Pilot Power

OTA Pilot Power indicates signal strength. Low OTA Pilot Power causes dropped calls, low data rate, and low capacity.

RF Measurements (Option 0062)

Channel Spectrum
- Channel Power
- Occupied Bandwidth
- Peak-to-Average Power

Power vs. Time
- Pilot & MAC Power
- Channel Power
- Frequency Error
- Idle Activity
- On/Off Ratio

Spectral Emission Mask

Multi-carrier ACPR

Demodulation (Option 0063)

MAC Code Domain Power Graph
- Pilot & MAC Power
- Channel Power
- Frequency Error
- Rho Pilot
- Rho Overall
- Data Modulation
- Noise Floor

MAC Code Domain Power Table
- Code
- Status
- Power
- Code Utilization

Data Code Domain Power
- Active Data Power
- Data Modulation
- Rho Pilot
- Rho Overall
- Maximum Data CDP
- Minimum Data CDP

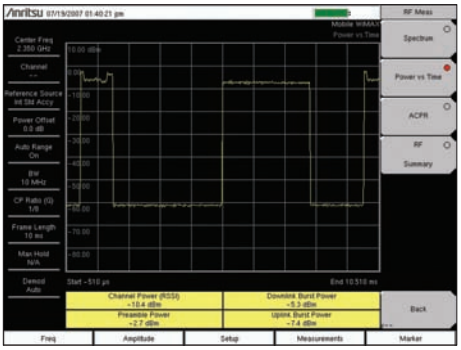
Over-the-Air (OTA) Measurements (Option 0034)

Pilot Scanner (Nine)
- PN
- E_c/I_o
- Tau
- Pilot Power
- Channel Power
- Pilot Dominance

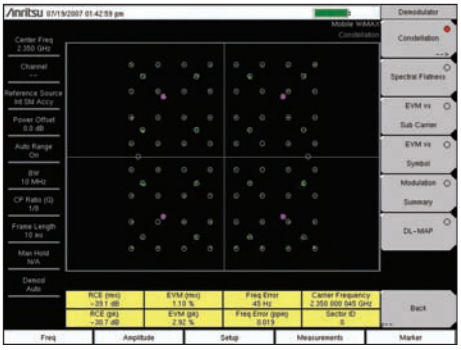
Mulitpath Scanner (Six)
- E_c/I_o
- Tau
- Channel Power
- Multipath Power

BTS Master™ Base Station Analyzer Features

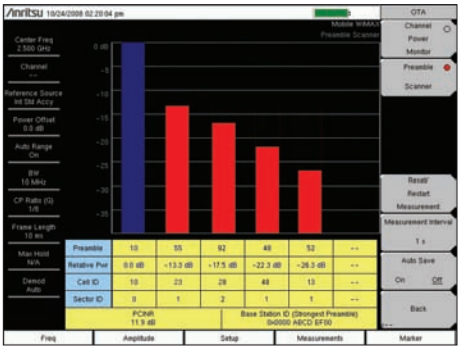
Fixed and Mobile WiMAX Signal Analyzers (Options 0046, 0047, 0066, 0067, 0037)



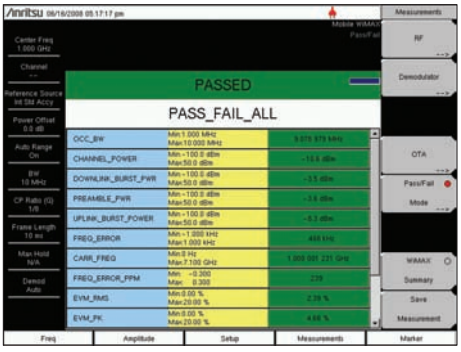
RF Measurement – Preamble Power
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



Demodulation – Frequency Error
Calls will drop when user's equipment travels at high speed. In severe cases, handoffs will not be possible at any speed, creating island cells.



Over-the-Air Measurements – PCINR
A low Physical Carrier to Interference plus Noise Ratio (PCINR) indicates poor signal quality, low data rate and reduced sector capacity.



Pass/Fail Test
Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior.

Fixed and Mobile WiMAX Signal Analyzers

The BTS Master features two Fixed WiMAX and three Mobile WiMAX measurement modes:

- RF Measurements
- Demodulation (up to 10 MHz)
- Over-the Air Measurements (OTA) (Mobile only)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Cell ID, Sector ID, and Preamble

Cell ID, Sector ID, and Preamble show which cell, sector, and segment are being measured OTA. The strongest signal is selected automatically for the additional PCINR and Base Station ID measurement. Wrong values for cell, sector and segment ID lead to dropped handoffs and island cells. If the cause is excessive coverage, it also will lead to large areas of low data rates.

Error Vector Magnitude (EVM) Reletive Constellation Error (RCE)

RCE and EVM measure the difference between the actual and ideal signal. RCE is measured in dB and EVM in percent. A known modulation is required to make these measurements. High RCE and EVM causes low signal quality, low data rate, and low sector capacity. This is the single most important signal quality measurement.

Preamble Mapping (Mobile WiMAX)

Preamble Scanner can be used with the GPS to save scan results for later display on a map. PCINR ratio for the strongest WiMAX preamble available at that spot. The Base Station ID and Sector ID information are also included so that it's easier to interpret the results. Once PCINR data is mapped, it becomes much easier to understand and troubleshoot any interference or coverage issues.

RF Measurements (Option 0046/0066, Fixed/Mobile)

Channel Spectrum
- Channel Power
- Occupied Bandwidth

Power vs. Time
- Channel Power
- Preamble Power
- Downlink Burst Power (Mobile only)
- Uplink Burst Power (Mobile only)
- Data Burst Power (Fixed only)
- Crest Factor (Fixed only)

ACPR

Demodulation (10 MHz maximum) (Option 0047/0067, Fixed/Mobile)

Constellation
- RCE (RMS/Peak)
- EVM (RMS/Peak)
- Frequency Error
- CINR (Mobile only)
- Base Station ID
- Carrier Frequency
- Sector ID

Spectral Flatness
- Adjacent Subcarrier Flatness

EVM vs. Subcarrier/Symbol
- RCE (RMS/Peak)
- EVM (RMS/Peak)
- Frequency Error
- CINR (Mobile only)
- Base Station ID
- Sector ID (Mobile only)

DL-MAP (Tree View) (Mobile only)

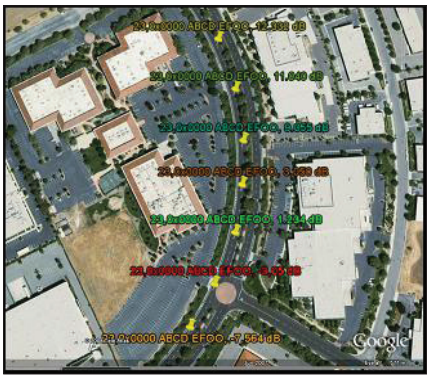
Over-the-Air (OTA) (Option 0037 Mobile only)

Channel Power Monitor

Preamble Scanner (Six)
- Preamble
- Relative Power
- Cell ID
- Sector ID
- PCINR

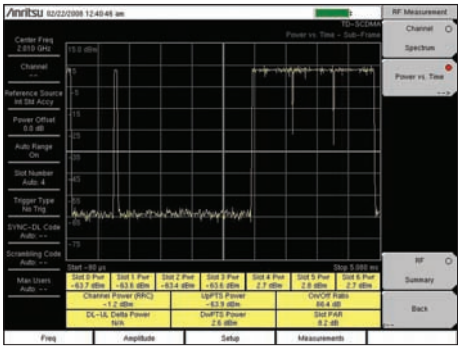
Dominant Preamble
- Base Station ID

Auto-Save with GPS Tagging and Logging



BTS Master™ Base Station Analyzer Features

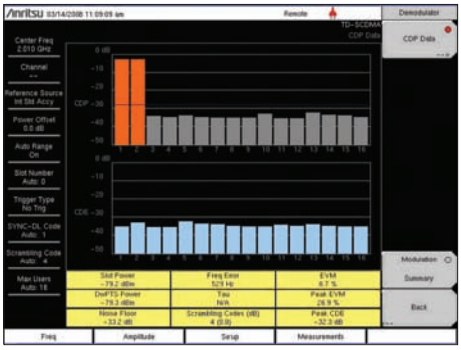
TD-SCDMA/HSDPA Signal Analyzers (Options 0060, 0061, 0038)



RF Measurement – Time Slot Power

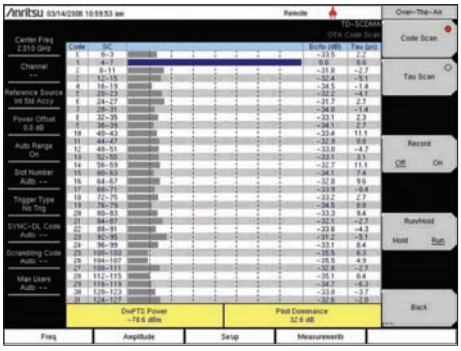
Empty downlink slots with access power will reduce the sensibility of the receiver and the size of the sector.

This will cause dropped and blocked calls.



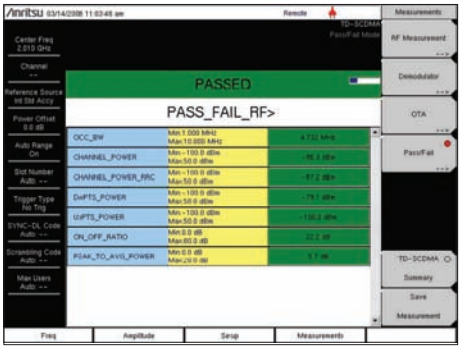
Demodulation – Scrambling Code

Scrambling Code measurements provide a check for the BTS settings. Scrambling Code errors can cause a very high dropped call rate on hand off.



Over-the-Air Measurements – Code Scanner

Excessive sync codes produce too much co-channel interference, which leads to lower capacity, low data rate and excessive handoffs.



Pass/Fail Test

Set up common test limits, or sets of limits, for each instrument. Inconsistent settings between base stations, leads to inconsistent network behavior.

TD-SCDMA/HSDPA Signal Analyzers

The BTS Master features three TD-SCDMA/HSDPA measurement modes:

- RF Measurements
- Demodulation
- Over-the Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Error Vector Magnitude (EVM) EVM is the ratio of errors, or distortions, in the actual signal, compared to a perfect signal. EVM faults will result in poor signal quality to all user equipment. In turn, this will result in extended hand off time, lower sector capacity, and lower data rates, increasing dropped and blocked calls.

Peak Code Domain Error (Peak CDE)

Peak CDE is the EVM of the worst code. Code Domain displays show the traffic in a specific time slot. Peak CDE faults will result in poor signal quality to all user equipment. In turn, this will result in extended hand off time, lower sector capacity, and lower data rates.

OTA Tau Scanner E_c/I_o

E_c/I_o faults indicate excessive or inadequate coverage and lead to low capacity, low data rates, extended handoffs, and excessive call drops.

DwPTS OTA Power Mapping

DwPTS OTA Power when added to E_c/I_o gives the absolute sync code power which is often proportional to PCCPCH (pilot) power. Use this to check and plot coverage with GPS. Coverage plots can be downloaded to PC based mapping programs for later analysis. Poor readings will lead to low capacity, low data rates, excessive call drops and call blocking.

RF Measurements (Option 0060)

Channel Spectrum
- Channel Power
- Occupied Bandwidth
- Left Channel Power
- Left Channel Occ B/W
- Right Channel Power
- Right Channel Occ B/W

Power vs. Time
- Six Slot Powers
- Channel Power (RRC)
- DL-UL Delta Power
- UpPTS Power
- DwPTS Power
- On/Off Ratio
- Slot Peak-to-Average Power

Spectral Emission

Demodulation (Option 0061)

Code Domain Power/Error
- (QPSK/8 PSK/16 QAM)
- Slot Power
- DwPTS Power
- Noise Floor
- Frequency Error
- Tau
- Scrambling Code
- EVM
- Peak EVM
- Peak Code Domain Error

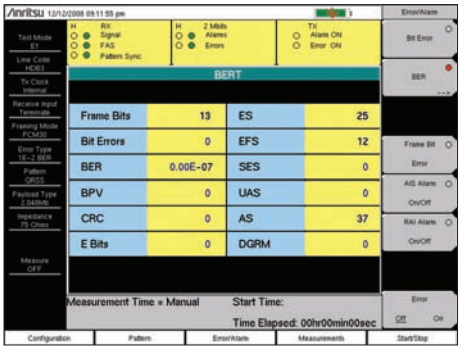
Over-the-Air (OTA) Measurements (Option 0038)

Code Scan (32)
- Scrambling Code Group
- Tau
- E_c/I_o
- DwPTS Power
- Pilot Dominance

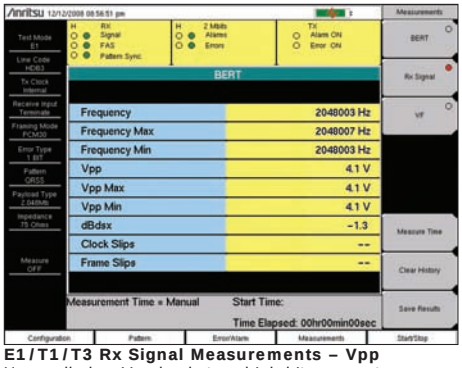
Tau Scan (Six)
- Sync-DL#
- Tau
- E_c/I_o
- DwPTS Power
- Pilot Dominance

Auto-Save with GPS Tagging and Logging

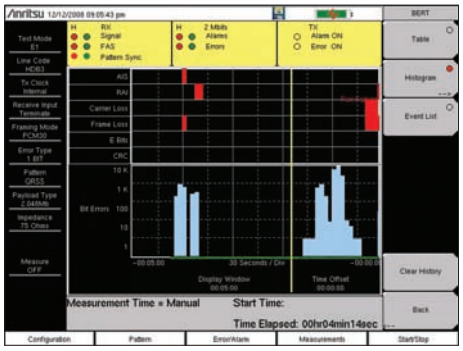
Backhaul Analyzers (Options 0051, 0052, 0053)



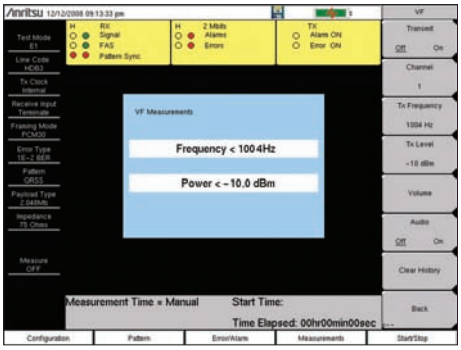
E1/T1/T3 Bi-Polar Violation (BPV)
BPVs occur when the polarity does not switch every time a "1" is transmitted. BPVs are symptoms of low signal quality and result in lower, or no, throughput.



E1/T1/T3 Rx Signal Measurements – Vpp
Unusually low Vpp leads to a high bit error rate or alarms, loss of sync and loss of carrier. Unusually high Vpp leads to signal clipping and bit errors.



Histogram – Cyclic Redundancy Check (CRC)
CRC errors result in a lower overall throughput for the T1 link. CRC errors can indicate problems bad enough to shut down the link.



VF Channel Measurements
Verifies the level and frequency of the VF Channel. Through the speaker the tester can make an audible assessment of the signal quality of the circuit.

Backhaul Analyzers

The BTS Master features three Backhaul Analyzer measurement modes:

- E1 Analyzer
- T1 Analyzer
- T3/T1 Analyzer

The goal of these measurements is to maximize throughput for the cell site so the base station can operate at maximum call capacity and data rates for a good customer experience.

Wireless operators need to test the backhaul circuits prior to acceptance from the Telco and for troubleshooting faults. When troubleshooting cell site technicians or RF engineers first step is to decide if the fault is on the Telco side of the demarcation point or on the wireless operator's side, since that determines who needs to fix the fault.

When identifying faults, the troubleshooting can often be done by monitoring an in-service signal, looking for data related errors. However, in some cases, in-service testing is not enough, and an out-of-service test must be performed.

E1/T1/T3 Bit Error Rate Test (BERT)

A Bit Error Rate Test will measure how accurately a backhaul circuit can send and receive data. BER testing is always an out-of-service activity. Errors will cause re-transmissions and a lower over-all data rate. Large numbers of errors will shut down the circuit.

Frame Loss

Frame Loss counts errors in the framing bits. Framing errors do not accumulate as fast as other errors. When monitored for extended periods of time, framing errors can become a valuable indication of signal quality. Frame Loss results in lower, or no, throughput.

Carrier Loss

Carrier Loss keeps track of times that the carrier is interrupted which means the line is dropped and the cell site is off the air.

Frequency Accuracy

Frequency refers to the number of bits per second on the backhaul line. Poor frequency accuracy leads to slipped frames and data loss.

E1 Measurements (Option 0052)

Error Detection
- Frame Bits, Bit Errors, BER, BPV, CRC, E Bits

Error Analysis
- Errored Seconds (ES)
- Error Free Seconds (EFS)
- Severely Errored Seconds (SES)
- Unavailable Seconds (UAS)
- Available Seconds (AS)
- Degraded Minutes (DGRM)

Rx Signal
- Frequency, Vpp (Max/Min), dBdsx, Clock Slips, Frame Slips

VF
- Frequency, Power

T1 Measurements (Option 0051)

Error Detection
- Frame Bits, Bit Errors, BER, BPV, CRC, PATLS

Error Analysis
- Errored Seconds (ES)
- Error Free Seconds (EFS)
- Severely Errored Seconds (SES)
- Unavailable Seconds (UAS)
- Available Seconds (AS)
- Degraded Minutes (DGRM)

Rx Signal
- Frequency, Vpp (Max/Min), dBdsx, Clock Slips, Frame Slips

VF
- Frequency, Power

T3 Measurements (Option 0053)

Error Detection
- Frame Bits, Bit Errors, BER, BPV, Lof Count, P-bit Errors, C-bit Errors, FEBE Errors

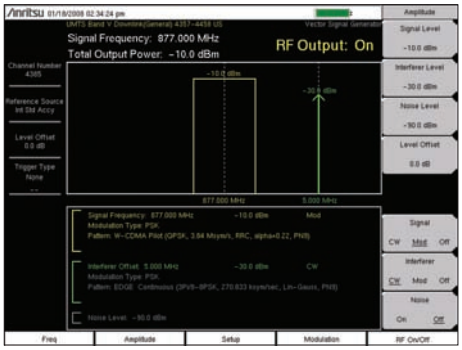
Error Analysis
- Excess Zeros
- Errored Seconds (ES)
- Error Free Seconds (EFS)
- Severely Errored Seconds (SES)
- Unavailable Seconds (UAS)
- Available Seconds (AS)
- Degraded Minutes (DGRM)
- Pattern Loss Seconds (PATLS)

Rx Signal
- Frequency, Vpp (Max/Min), dBdsx

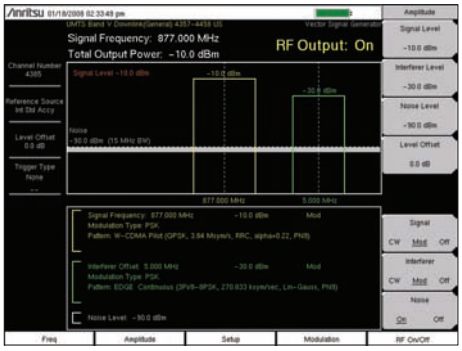
VF
- Frequency, Power

BTS Master™ Base Station Analyzer Features

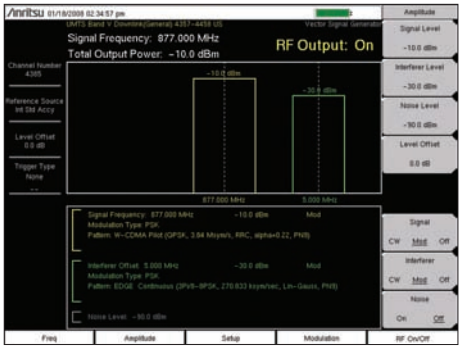
Vector Signal Generator Option (Option 0023)



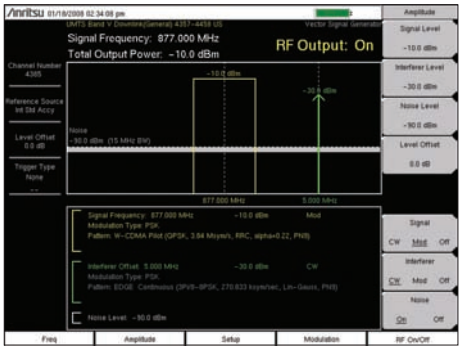
Sensitivity Test Set-up
Wanted Signal: Modulated
Interferer: CW
AWGN: Off



Adjacent Channel Selectivity Test Set-up
Wanted Signal: Modulated
Interferer: Modulated
AWGN: On



Blocking Test Set-up
Wanted Signal: Modulated
Interference: Modulated
AWGN: Off



Intermodulation Rejection Test Set-up
Wanted Signal: Modulated
Interferer: CW
AWGN: On

Vector Signal Generator (VSG)

The BTS Master's Vector Signal Generator is designed to be a signal source to facilitate base station field testing of the receiver's basic performance when it comes to:

- Sensitivity
- Adjacent Channel Selectivity
- Blocking
- Intermodulation Rejection

The BTS Master has the flexibility to generate three signals in a variety of combinations:

- Modulated, CW, AWGN (Additive White Gaussian Noise)
- Wanted Signals (modulated or CW)
  - One signal at 10 MHz or less (with no interferer present)
  - One signal at 5 MHz or less (with interferer present)
  - With or without AWGN
- Interferer (modulated or CW)
  - One interferer at 5 MHz or less
  - With or without AWGN

The BTS Master has the ability to output complex waveforms. As an example, you generate a W-CDMA signal and a GSM interferer. It offers the capability to generate complex waveforms including:

- LTE, TD-LTE
- W-CDMA, HSPA
- TD-SCDMA, TD-HSPA
- GSM, GPRS, EDGE
- CDMA2000 1X, 1x EV-DO
- Fixed WiMAX, Mobile WiMAX
- AM, FM
- QPSK, QAM

The BTS Master VSG has an output power range to meet most testing requirements from -124 dBm to 0 dBm.

Users can define their patterns in either MATLAB® or ASCII. Master Software Tools Patter Converter can upload them into the BTS Master.

At the initial release the MT822xB will have a set of basic signals and other patterns will be added on a periodic basis.

(Check the Technical Datasheet for the latest specifications and pattern offerings.)

Set-up Parameters
Frequency
Amplitude
Trigger (for modulated signals)
Pattern Manager
Modulation
Modulation Edit
RF (On/Off)

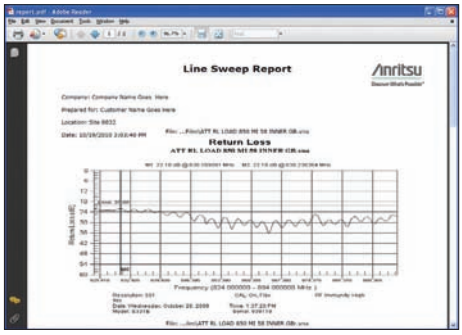
Standard Signal Patterns
AM
FM
Pulsed CW
EDGE – Continuous
W-CDMA Pilot
DECT 16 QAM – Continuous
DECT 64 QAM – Continuous
DVB-C
J.83C Digital Cable
64 QAM – US Digital Cable

User-defined Signal Patterns
(Sampling Rate, Bandwidth)
12.500 MHz, 10 MHz
6.250 MHz, 5.0 MHz
1.625 MHz, 1.2 MHz

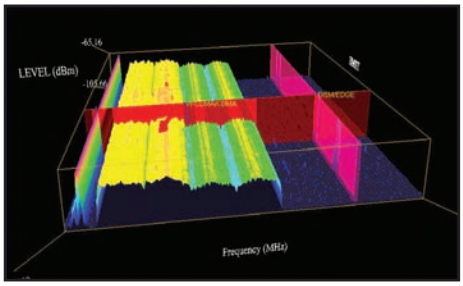
BTS Master™ Base Station Analyzer Features

Line Sweep Tools and Master Software Tools (for your PC)

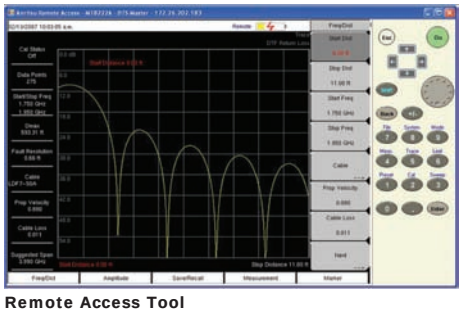
Trace Validation
Marker and Limit Line presets allow quick checks of traces for limit violations



Report Generation
Create reports with company logo, GPS tagging information, calibration status, and serial number of the instrument for complete reporting.



3D Spectrogram
For in-depth analysis with 3-axis rotation viewing, threshold, reference level, and marker control. Turn on Signal ID to see the types of signals.



Remote Access Tool
The Remote Access Tool allows supervisors to remotely view and control the instrument over the Internet.

Line Sweep Tools

Line Sweep Tools increases productivity for people who deal with dozens of Cable and Antenna traces, or Passive Inter-Modulation (PIM) traces, every day.

User Interface

Line Sweep Tools has a user interface that will be familiar to users of Anritsu's Hand Held Software Tools. This will lead to a short learning curve.

Marker and Limit Line Presets
Presets make applying markers and a limit line to similar traces, as well as validating traces, a quick task.

Renaming Grid
A renaming grid makes changing file names, trace titles, and trace subtitles from field values to those required for a report much quicker than manual typing and is less prone to error.

Report Generator
The report generator will generate a professional looking PDF of all open traces with additional information such as contractor logos and contact information.

Master Software Tools

Master Software Tools (MST) is a powerful PC software post-processing tool designed to enhance the productivity of technicians in data analysis and testing automation.

Folder Spectrogram
Folder Spectrogram – creates a composite file of up to 15,000 multiple traces for quick review, also create:

- Peak Power, Total Power, and Peak Frequency plotted over time
- Histogram – filter data and plot number of occurrences over time
- Minimum, Maximum, and Average Power plotted over frequency
- Movie playback – playback data in the familiar frequency domain view
- 3D Spectrogram – for in-depth analysis with 3-axis rotation viewing control

Script Master™

Script Master is an automation tool which allows the user to embed the operator's test procedure inside the BTS Master for GSM/EDGE and W-CDMA/HSDPA. This feature is available for GSM/EDGE and W-CDMA/HSDPA applications.

Using Channel Scanner Script Master, the user can create a list of up to 1200 channels and let the BTS Master sequence through the channels 20 at a time, automatically making measurements.

Line Sweep Features

Presets
7 sets of 6 markers and 1 limit line
Next trace capability

File Types
Input: HHST DAT, VNA Measurements: Return Loss (VSWR), Cable Loss, DTF-RL, DTF-VSWR, PIM
Output: LS DAT, VNA, CSV, PNG, BMP, JPG, PDF

Report Generator
Logo, title, company name, customer name, location, date and time, filename, PDF, HTML, all open traces

Tools
Cable Editor
Distance to Fault
Measurement calculator
Signal Standard Editor
Renaming Grid

Interfaces
Serial, Ethernet, USB

Capture Plots to
Screen, Database, DAT files, JPEG, Instrument

Master Software Tools Features

Database Management
Full Trace Retrieval
Trace Catalog
Group Edit
Trace Editor

Data Analysis
Trace Math and Smoothing
Data Converter
Measurement Calculator

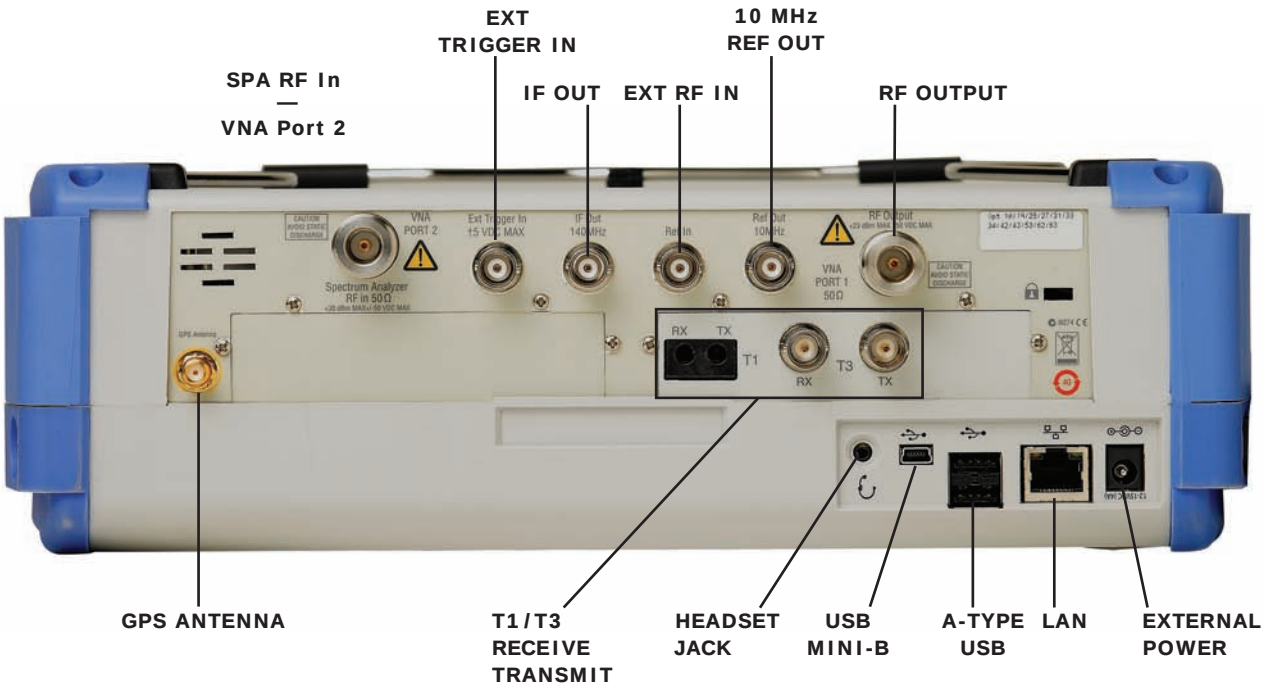
Mapping (GPS Required)
Spectrum Analyzer Mode
Mobile WiMAX OTA Option
TS-SCDMA OTA Option
LTE, both FDD and TDD Options

Folder Spectrogram
Folder Spectrogram – 2D View
Video Folder Spectrogram – 2D View
Folder Spectrogram – 3D View

List/Parameter Editors
Traces
Antennas, Cables, Signal Standards
Product Updates
Firmware Upload
Pass/Fail
VSG Pattern Converter
Languages
Mobile WiMAX
Display

Script Master™
Channel Scanner Mode
GSM/GPRS/EDGE Mode
W-CDMA/HSDPA Mode

Connectivity
Ethernet, USB
Download measurements and live traces
Upload Lists/Parameters and VSG Patterns
Firmware Updates
Remote Access Tool over the Internet



All Connectors are conveniently located on the top panel, leaving the sides clear for handheld use

BTS Master™

High Performance Handheld Base Station Analyzer

MT8221B	MT8222B	
400 MHz to 4.0 GHz	400 MHz to 6.0 GHz	Cable and Antenna Analyzer
150 kHz to 7.1 GHz	150 kHz to 7.1 GHz	Spectrum Analyzer
10 MHz to 7.1 GHz	10 MHz to 7.1 GHz	Power Meter

Introduction

Anritsu introduces its next generation high performance handheld Base Station Analyzer for installation and maintenance of wireless networks. The BTS Master features the latest support for HSPA+ and LTE and is a future-proof platform with 20 MHz demodulation bandwidth and a Vector Signal Generator for receiver testing.

Cable and Antenna Analyzer Highlights

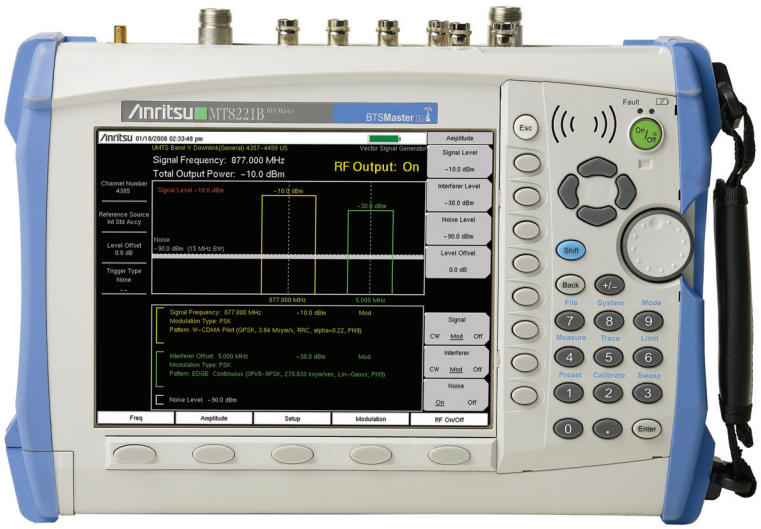
- Measurements: RL, VSWR, Cable Loss, DTF, Phase, Gain
- 2-port Gain Measurement Uncertainty: < 0.45 dB
- 2-port Dynamic Range: > 80 dB
- RF Immunity: +17 dBm on-channel, +10 dBm on-frequency
- Calibration: OSL and FlexCal™
- Bias Tee: 32 V internal

Spectrum and Interference Analyzer Highlights

- Measurements: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID
- Dynamic Range: > 95 dB in 1 Hz RBW
- DANL: –163 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz @ 10 kHz offset
- Frequency Accuracy: ± 25 ppb with GPS On

Capabilities and Functional Highlights

- LTE, TD-LTE
- GSM/GPRS/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- CDMA, EV-DO
- Fixed, Mobile WiMAX
- PIM Analyzer
- Vector Signal Generator
- Zero-span IF Output
- Gated Sweep
- GPS information on stored traces
- Standard Internal Preamp
- Internal Power Meter
- High Accuracy Power Meter
- USB Power Sensors, up to 26 GHz
- Channel Scanner
- < 5 minute warm-up time
- Backhaul Analyzers E1, T1, T3
- 2.5 hour battery operation time
- Ethernet/USB Data Transfer
- MST Remote Access Tool
- Line Sweep Tools



BTS Master™ MT822xB Base Station Analyzer featuring Vector Signal Generator
Handheld Size: 315 mm x 211 mm x 94 mm (12.4 in x 8.3 in x 3.7 in), Lightweight: 4.9 kg (10.8 lb)

Cable and Antenna Analyzer

Measurements

Measurements	VSWR, Return Loss, Cable Loss, Distance-to-Fault (DTF) VSWR, Distance-to-Fault (DTF) Return Loss, 1-port Phase, 2-port Phase, 2-port Gain, Smith Chart

Setup Parameters

Frequency	Start/Stop, Signal Standard, Start Cal
DTF	Start/Stop, DTF Aid, Units (m/ft), Cable Loss, Propagation Velocity, Cable, Windowing
Windowing	Rectangular, Normal Side Lobe, Low Side Lobe, Minimum Side Lobe
Amplitude	Top, Bottom Auto Scale, Full Scale
Sweep	Run/Hold, Single/Continuous, RF Immunity (High/Low), Data Points, Averaging/Smoothing, Output Power (High/Low)
Data Points	137, 275, 551
Markers	Markers 1 to 6 each with a Delta Marker, Marker to Peak/Valley, Marker Table (On/Off), All Markers Off
Traces	Recall, Copy to Display Memory, No Trace Math, Trace + Memory, Trace - Memory, Trace Overlay (On/Off)
Limit Line	On/Off, Single Limit, Multi-segment (41), Limit Alarm, Clear
Limit Line Edit	Frequency, Amplitude, Add Point, Delete Point, Next Point Left, Next Point Right, Move Limit
Calibration	Start Cal, 1/2-port, Low/High Power, Standard/FlexCal™, DUT Connector, Configure DUT
Save/Recall	Setups, Measurements, Screen Shots (JPEG - save only)
Application Options	Bias-Tee (On/Off)

Frequency

Frequency Range	400 MHz to 4 GHz (MT8221B), 400 MHz to 6 GHz (MT8222B)
Frequency Accuracy	± 3.0 ppm
Frequency Resolution	1 kHz (RF immunity low) 100 kHz (RF immunity high)

Output Power

High	–7 dBm, typical, 1 or 2-port
Low	–40 dBm, typical, 2-port

Dynamic Range

400 MHz to 3.0 GHz	80 dB
> 3.0 GHz to 4.0 GHz	70 dB

Interference Immunity

On-Channel	+17 dBm @ >1.0 MHz from carrier frequency
On-Frequency	+10 dBm within ±10 kHz from the carrier frequency

Measurement Speed

Return Loss	≤ 4.5 ms/data point, RF immunity low, typical
Distance-to-Fault	≤ 4.5 ms/data point, RF immunity low, typical

Return Loss

Measurement Range	0 to 60 dB
Resolution	0.01 dB

VSWR

Measurement Range	1:1 to 65:1
Resolution	0.01

Cable Loss

Measurement Range	0 to 30 dB
Resolution	0.01 dB

2-Port Gain

Measurement Range	–120 to +100 dB
Resolution	0.01 dB

Cable and Antenna Analyzer (continued)

Distance-to-Fault

Vertical Range Return Loss	0 dB to 60 dB
Vertical Range VSWR	1 to 65
Fault Resolution (m)	$(1.5 \times 10^8 \times vp) / \Delta F$ (vp = velocity propagation constant, ΔF is F2-F1 in Hz)
Horizontal Range (m)	0 to (Data Points-1) x Fault Resolution, to a maximum of 1500 m (4921 ft)

Phase (1- and 2-Port)

Measurement Range	–180° to +180°
Resolution	0.01°

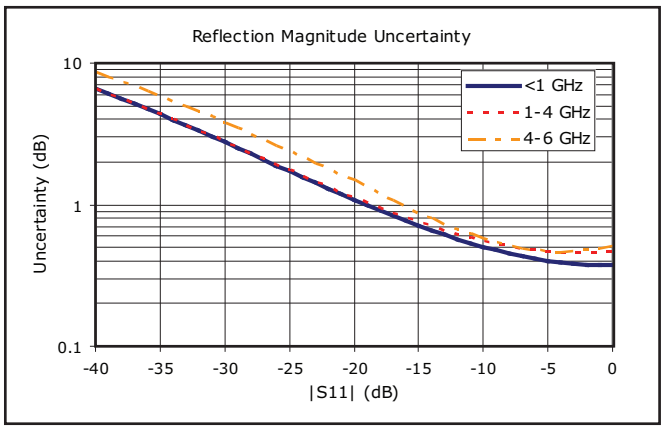
Smith Chart

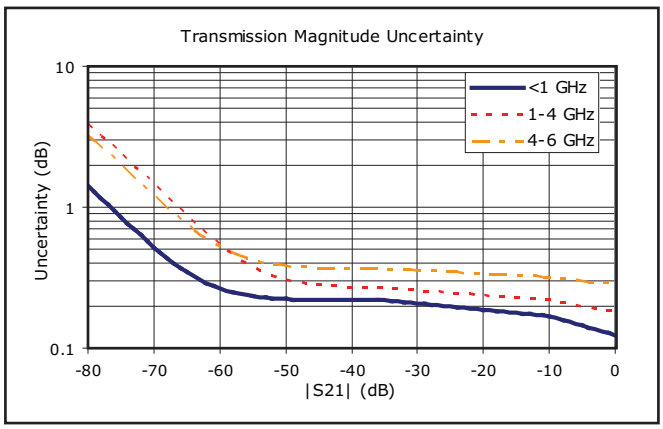
Resolution	0.01

Measurement Accuracy

Corrected Directivity	> 42 dB

Measurement Uncertainty





Bias-Tee (Option 0010)

General

Setup	On/Off, Voltage, Current (Low/High)
Voltage Range	+12 V to +32 V
Current (Low/High)	250 mA/450 mA, 1 A surge for 100 ms
Resolution	0.1 V

PIM Analyzer

(Requires PIM Master™) See Product Brochure 11410-00546

Spectrum Analyzer

Measurements

Smart Measurements	Field Strength (dBm/m^2, dBW/m^2, V/m, A/m, Watt/m^2, Watt/cm^2, or dBmV/m) Occupied Bandwidth (measures 99 % to 1 % power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask) Coverage Mapping (requires Option 0431) IQ Waveform Capture (requires Option 0024)

Setup Parameters

Frequency	Center/Start/Stop, Span, Frequency Step, Frequency Offset, Signal Standard, Channel #
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/WBW, Span/RBW
Application Options	Bias-Tee (On/Off), Impedance (50 Ω, 75 Ω, Other)

Sweep Functions

Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type, Gated Sweep (see Option 0090)
Detection	Peak, RMS, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Change Position, Manual

Trace Functions

Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
Trace B Operations	A → B, B ← → C, Max Hold, Min Hold
Trace C Operations	A → C, B ← → C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale

Marker Functions

Markers	Markers 1–6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off
Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
Marker Table	1–6 markers frequency and amplitude plus delta markers frequency offset and amplitude

Limit Line Functions

Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall

Frequency

Frequency Range	150 kHz to 7.1 GHz (usable to 0 Hz)
Maximum Continuous Input	+30 dBm
Tuning Resolution	1 Hz
Frequency Reference	Aging: ± 1.0 ppm/10 years
Frequency Span	Accuracy: ± 0.3 ppm (25 °C ± 25 °C) + aging 10 Hz to 7.1 GHz including zero span
Sweep Time	Minimum 100 ms, 10 µs to 600 s in zero span
Sweep Time Accuracy	± 2 % in zero span

Bandwidth

Resolution Bandwidth (RBW)	1 Hz to 3 MHz in 1–3 sequence ±10 % (1 MHz max in zero-span) (–3 dB bandwidth)
Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth)
RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (–6 dB bandwidth)
VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
VBW/Average Type	Linear/Log

Spectral Purity

SSB Phase Noise	–100 dBc/Hz @ 10 kHz, 20 kHz and 30 kHz offset from carrier –102 dBc/Hz @ 100 kHz offset from carrier

Spectrum Analyzer (continued)

Amplitude Ranges

Dynamic Range	> 95 dB (600 MHz, 3.5 GHz), 2/3 (TOI-DANL) in 1 Hz RBW
Measurement Range	DANL to +30 dBm
Display Range	1 dB to 15 dB/div in 1 dB steps, ten divisions displayed
Reference Level Range	–120 dBm to +30 dBm
Attenuator Resolution	0 dB to 65 dB, 5.0 dB steps
Amplitude Units	Log Scale Modes: dBm, dBV, dBmv, dBµV, dBW, dBA Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW, fA, pA, nA, µA, mA, A

Amplitude Accuracy (Power level > –50 dBm)

Input attenuation	Preamp Off (≤ 35 dB)	Preamp Off (40 to 55 dB)	Preamp Off (60 to 65 dB)	Preamp On (0 or 10 dB)
150 kHz to ≤10 MHz	± 1.50 dB	± 1.50 dB	± 1.50 dB	-
150 kHz to 4.0 GHz	-	-	-	± 1.50 dB
>10 MHz to 4.0 GHz	± 1.25 dB	± 1.75 dB	± 1.75 dB	-
>4.0 GHz to 6.5 GHz	-	± 1.75 dB	± 1.75 dB	-
>4.0 GHz to 7.1 GHz	± 1.75 dB	-	-	± 1.75 dB
>6.5 GHz to 7.1 GHz	-	± 2.00 dB	± 3.00 dB	-

Displayed Average Noise Level (DANL)

	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
DANL in 1 Hz RBW, 0 dB attenuation	Maximum	Typical	Maximum	Typical
3 MHz to 1.0 GHz	–137 dBm	–150 dBm	–161 dBm	–163 dBm
> 1.0 GHz to 2.2 GHz	–133 dBm	–147 dBm	–159 dBm	–160 dBm
> 2.2 GHz to 4.0 GHz	–133 dBm	–143 dBm	–156 dBm	–159 dBm
> 4.0 GHz to 7.1 GHz	–130 dBm	–138 dBm	–154 dBm	–156 dBm

Spurs

Residual Spurs	Preamp Off (RF input terminated, 0 dB input attenuation) –90 dBm, 150 kHz to 3.2 GHz –84 dBm, > 3.2 GHz to 7.1 GHz
Exceptions	–70 dBm @ 3200 MHz Preamp On (RF input terminated, 0 dB input attenuation) –100 dBm. 10 MHz to 7.1 GHz
Exceptions	–95 dBm @ 50, 100, 150 MHz
Input-Related Spurious	(0 dB attenuation, –30 dBm input, span <1.7 GHz, carrier offset > 4.5 MHz) –60 dBc, –70 dBc typical
Exceptions	–40 dBc, –60 dBc typical @ 1672 MHz

Third-Order Intercept (TOI)

Preamp Off	
600 MHz	+8 dBm typical
3.5 GHz	+9 dBm typical

Second Harmonic Distortion

Preamp Off	–50 dBc maximum –70 dBc typical

VSWR

<4.0 GHz	1:5:1 typical
4.0 GHz to 7.1 GHz	1.8:1 typical

Power Meter

General

Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Full Band
Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	Acquisition Fast/Med/Slow, # of Running Averages
Limits	Limit On/Off, Limit Upper/Lower
Frequency Range	10 MHz to 7.1 GHz
Span	1 kHz to 100 MHz
Display Range	–140 dBm to +30 dBm, ≤ 40 dB span
Measurement Range	–120 dBm to +30 dBm
Offset Range	0 to +100 dB
VSWR	1.5:1 typical
Maximum Power	+30 dBm without attenuator
Accuracy	Same as Spectrum Analyzer
Application Options	Impedance (50 Ω, 75 Ω, Other)

High Accuracy Power Meter (Option 19) (Requires external USB Power Sensor)

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108A/18A/26A
Description	High Accuracy RF Power Sensor	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz
Connector	Type N(m), 50 Ω	Type N(f), 50 Ω	Type N(m), 50 Ω	Type N(m), 50 Ω (8/18 GHz) Type K(m), 50 Ω (26 GHz)
Dynamic Range	–30 dBm to +20 dBm (0.001 mW to 100 mW)	+3 dBm to +51.76 dBm (2 mW to 150 W)	–40 dBm to +23 dBm (0.1 µW to 200 mW)	–40 dBm to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	± 0.16 dB[1]	± 0.17 dB[2]	± 0.16 dB[1]	± 0.18 dB[3]
Data Sheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504

Notes:
1. Total RSS measurement uncertainty (0 ºC to 50 ºC) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
2. Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
3. Expanded uncertainty with K=2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

GPS Receiver Option (Option 0031) (Antenna sold separately)

General

Setup	On/Off, Antenna Voltage 3.3/5.0 V, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, Signal Analyzers
GPS Lock Accuracy	when GPS Antenna is connected: ± 25 ppb with GPS On, 3 minutes after satellite lock in selected mode after antenna is disconnected: ± 50 ppb for 3 days, 0 ºC to 50 ºC ambient temperature
Connector	SMA, female

Coverage Mapping (Option 0431)

Measurements

Indoor Mapping	RSSI, ACPR
Outdoor Mapping	RSSI, ACPR

Setup Parameters

Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW
Measurement Setup	ACPR, RSSI
Point Distance / Time Setup	Repeat Type Time Distance
Save Points Map	Save KML, JPEG
Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid

Interference Analyzer (Option 0025)

Measurements

Spectrum	Field Strength
	Occupied Bandwidth
	Channel Power
	Adjacent Channel Power (ACPR)
	AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only)
	Carrier-to-Interference ratio (C/I)
Spectrogram	Collect data up to one week
Signal Strength	Visual and audible indication of signal strength
Received Signal Strength Indicator (RSSI)	Collect data up to one week
	Gives visual and aural indication of signal strength
Signal ID	Up to 12 signals
	Center Frequency
	Bandwidth
	Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi)
	Closest Channel Number
	Number of Carriers
	Signal-to-Nose Ratio (SNR) > 10 dB
Interference Mapping	Draw multiple bearings of signal strength from GPS location on on-screen map
	Pan and Zoom on-screen maps
	Support for MA2700A Handheld Interference Hunter (see Optional Accessories)
Application Options	Bias-Tee (On/Off), Impedance (50 Ω, 75 Ω, Other)

Channel Scanner (Option 0027)

General

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 s/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	150 kHz to 7.1 GHz
Frequency Accuracy	± 10 Hz + Time base error
Measurement Range	–110 dBm to +30 dBm
Application Options	Bias-Tee (On/Off), Impedance (50 Ω, 75 Ω, Other)

Gated Sweep (Option 0090)

General

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off)
	Gate Polarity (Rising, Falling)
	Gate Delay (0 ms to 65 ms typical)
	Gate Length (1 µs to 65 ms typical)
	Zero Span Time

Zero Span IF Output (Option 0089)

General

Mode	Spectrum Analyzer/Span/Zero Span
Center Frequency	140 MHz ± 130 kHz
Output Level	–25 dBm typical
Reference Level	–57 dBm to +30 dBm (Preamp Off)
	–87 dBm to –40 dBm (Preamp On)
IF Bandwidths	Up to 30 MHz (3 dB bandwidth)
Connector	BNC female

I/Q Waveform Capture (Option 0024)

General

Mode	Spectrum Analyzer
Capture Mode	Single or Continuous
Trigger	Free Run, External (Rising/Falling), Delay
Maximum Capture Length	800 ms
Maximum Sample Rate	40 MHz
Maximum Signal Bandwidth	32 MHz

Vector Signal Generator (Option 0023)

Setup Parameters

Frequency	Frequency, Signal Standard, Channel Number, Interferer Offset
Amplitude	Signal/Interferer/Noise Level in dBm, Level Offset, Signal (CW/Modulated/Off), Interferer (CW/Modulated/Off), Noise (On/Off)
Trigger (for modulated signals)	Type (None/Positive/Negative), Delay, Manual, Pattern Manager
Pattern Manager	Add, Erase
Modulation	Signal Pattern Select, Interferer Pattern Select, Edit
Modulation Edit	Analog, Digital, Custom, Spectrum Inversion (Normal/Reverse)
RF	On/Off
Active Pattern Memory	256 MB
Frequency Range	400 MHz to 6 GHz
Frequency Resolution	1 Hz
Frequency Accuracy	± 0.3 ppm (25 °C ± 25 °C) + aging
Output Power	–124 to 0 dBm, CW –124 to –8 dBm, Modulated/Noise/Multicarrier
Step Size	0.1 dB nominal
Bandwidth	1 signal to 10 MHz or 2 signals to 5 MHz each + AWGN
Waveform Addition	Desired Signal + Interfering Signal + AWGN

Level Accuracy, Single Channel (≥ 30 minutes warm-up after 1 hour non-operating at 15 °C to 35 °C ambient, excludes load VSWR effects)

	(400 MHz to 2.0 GHz)		(>2.0 to 4.0 GHz)		(>4.0 to 6.0 GHz)	
VSG Output Power	CW Mode	W-CDMA	CW Mode	W-CDMA	CW Mode	W-CDMA
–46 dBm to 0 dBm	± 1.0 dB	-	± 1.2 dB	-	± 1.2 dB	-
–46 dBm to –8 dBm	-	± 1.4 dB	-	± 1.4 dB	-	± 1.8 dB
–84 dBm to < –46 dBm	± 1.1 dB	± 1.4 dB	± 1.3 dB	± 1.4 dB	± 1.3 dB	± 2.0 dB
–104 dBm to < –84 dBm	± 1.4 dB	± 1.5 dB	± 1.4 dB	± 1.5 dB	± 1.4 dB	± 2.0 dB
–124 dBm to < –104 dBm	± 1.7 dB	± 1.7 dB	± 1.7 dB	± 1.7 dB	± 1.7 dB	± 2.4 dB

Standard Signal Patterns

AM (Frequency/Depth)	400 Hz/5 %, 1 kHz/10 %, 3 kHz/20 %, 5 kHz/30 %, 10 kHz/50 %, 15 kHz/70 %, 20 kHz/90 %
FM (Rate/Deviation)	1 kHz/100 Hz, 5 kHz/500 Hz, 10 kHz/1 kHz, 50 kHz/5 kHz, 100/10 kHz, 500 kHz/50 kHz, 500 kHz/100 kHz, 500 kHz/500 kHz
Pulsed CW (Duty Cycle/Period)	50 %/0.1 ms (10 kHz), 50 %/1 ms (1 kHz), 50 %/2.5 ms (400 Hz)
EDGE – Continuous	3Pi/8-8 PSK, 270.833 ksym/s, Linearized Gaussian filtered, Data = PN9
W-CDMA Pilot	QPSK, 3.84 Msym/s, RRC filtered, alpha = 0.22, Data = PN9
DECT 16 QAM – Continuous	1.152 Msym/s, RRC filtered, alpha = 0.5, Data = PN9
DECT 64 QAM – Continuous	16 QAM, 6.84 Msym/s, RRC filtered, alpha = 0.15, Data = PN9
DVB-C	1.152 Msym/s, RRC filtered, alpha = 0.5, Data = PN9
J.83C Digital Cable	16 QAM, 5 Msym/s, RRCC filtered, alpha = 0.13
64 QAM – US Digital Cable	5.056941 Msym/s, RRC filtered, alpha = 0.18

User-defined Signal Patterns

Input Waveform for MST Pattern Converter	ASCII Text or MATLAB® file format		
Number of Waveforms	≤ 1000		
Sampling Rate	12.500 MHz	6.250 MHz	1.625 MHz
Bandwidth	10.0 MHz	5.0 MHz	1.2 MHz
Time	≤ 4 s	≤ 8 s	≤ 32 s
Length	N x 8 Samples	N x 4 Samples	N x 4 Samples

TD-SCDMA/HSPA+ Signal Analyzers (Options 0060, 0061, 0038)

Measurements

RF (Option 0060)	Demodulation (Option 0060)	Over-the-Air (OTA) (Option 0038)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W	Code Domain Power/Error (QPSK/8 PSK/16 QAM/64 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error CDP Marker	Code Scan (32) Scrambling Code Group Tau E_c/I_o Pilot Dominance	View Pass/Fail Limits All, RF, Demod
Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power	Modulation Summary	Tau Scan (Six) Sync-DL# Tau E_c/I_o DwPTS Power Pilot Dominance	Available Measurements Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Carrier Feedthrough Noise Floor
Spectral Emission		Record Run/Hold	
RF Summary			

Setup Parameters

Slot Selection	Auto, 0-6
Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
SYNC-DL Code	Auto, 0-31
Scrambling/Midamble Code	Auto, 0-127
Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
Measurement Speed	Fast, Normal, Slow
User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
Demodulation Type	Auto, QPSK, 8 PSK, 16 QAM, 64 QAM
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Hold/Run, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0060)

RF Channel Power Accuracy (RRC)	± 1.5 dB, ± 1.0 dB typical, (slot power –40 dBm to +10 dBm)
Frequency Error	± 20 Hz + time base error, in the presence of a downlink slot

Demodulation Measurements (Option 0061)

Supported Modulation	QPSK, 8 PSK, 16 QAM, 64 QAM
Residual EVM (rms)	3 % typical, P-CCPH slot power > –50 dBm
PN Offset	Within 1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical
Timing Error (Tau) for Dominant SYNC-DL	± 0.2 µs (external trigger)
Spreading Factor	1, 16

Over-the-Air (OTA) Measurements (Option 0038)

Code Scanner	32 Sync Codes and associated Scrambling Code Groups
Tau Scanner	Six strongest Sync Codes
Auto Save	Yes
GPS Tagging and Logging	Yes

LTE Signal Analyzers (Options 0541, 0542, 0543, 0546)

Measurements

RF (Option 0541)	Modulation (Option 0542)	Over-the-Air (OTA) (Option 0546)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth ACPR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization % Channel Power, Cell ID OSTP, Frame EVM by modulation Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH, PHICH, PDCCH Total Power (Table View) EVM Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1 or 2)	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Auto Save - On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results - Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power SS, P-SS, S-SS Power PBCH Power PCFICH Power Cell, Group, Sector ID OSTP Tx Time Alignment

Setup Parameters

Frequency	E-UTRA bands 1 - 14, 17 - 21, 23 - 28 (tunable 10 MHz to 4.0 GHz)
	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20 (15 and 20 requires Option 0543)
Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous
EVM Mode	Auto, PBCH only, Max Hold
Save/Recall	Setup, Measurement, JPEG (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

RF Measurements (Option 0541)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +10 dBm)

Modulation Measurements (Option 0542)

RS Power Accuracy	± 1.0 dB typical, (RF input -50 dBm to +10 dBm)
Frequency Error	± 10 Hz + time base error, 99 % confidence level
Residual EVM (rms)	2.0 % typical (E-UTRA Test Model 3.1, RF Input -50 dBm to +10 dBm)

BW = 15 MHz, 20 MHz (Option 0543)

Bandwidths	15 MHz, 20 MHz

Over-the-Air (OTA, Option 0546) Measurements

Scanner	Six strongest signals if present
	Auto Save – Sync Signal Power and Modulation Results with GPS tagging
Tx Test	Scanner – three strongest signals if present
	RS Power – strongest signal
Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal
	Scanner – three strongest signals if present
	Save and Export Mapping data: *.kml, *.mtd (tab delimited)

TD-LTE Signal Analyzers (Options 0551, 0552, 0543, 0556)

Measurements

RF (Option 0551)	Modulation (Option 0552)	Over-the-Air (OTA) (Option 0556)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Frame View Sub-Frame View Total Frame Power DwPTS Power Transmit Off Power Cell ID Timing Error ACLR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization % Channel Power, Cell ID Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH Total Power (Table View) Modulation Results Antenna Icons Detects active antennas (1 or 2) Modulation Summary	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Auto Save - On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results - Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power SS, P-SS, S-SS Power PBCH Power PCFICH Power Cell, Group, Sector ID Frame Power DwPTS Power Transmit Off Power Timing Error

Setup Parameters

Frequency	E-UTRA bands 33 - 44 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20 (15 and 20 requires Option 0543)
Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
EVM Mode	Auto, PBCH only, Max Hold
Trigger	No Trigger/Ext Trigger, Rising/Falling
Save/Recall	Setup, Measurement, JPEG (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

RF Measurements (Option 0551)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –30 dBm to +10 dBm)

Modulation Measurements (Option 0552)

RS Power Accuracy	± 1.0 dB typical, (RF input –30 dBm to +10 dBm)
Frequency Error	± 10 Hz + time base error, 99 % confidence level
Residual EVM (rms)	2.0 % typical (E-UTRA Test Model 3.1, RF Input –30 dBm to +10 dBm)

BW = 15, 20 MHz (Option 0543)

Bandwidths	15 MHz, 20 MHz

Over-the-Air (OTA) Measurements (Option 0556)

Scanner	Six strongest signals if present Auto Save – Sync Signal Power and Modulation Results with GPS tagging
Tx Test	Scanner – three strongest signals if present RS Power – strongest signal
Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: *.kml, *.mtd (tab delimited)

GSM/GPRS/EDGE Signal Analyzers (Options 0040, 0041)

Measurements

RF (Option 0040)	Demodulation (Option 0041)	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC)	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC)	There are no additional OTA Measurements. RF and Demodulation Measurements can be made OTA	Available Measurements Channel Power Occupied Bandwidth Burst Power Average Burst power Frequency Error Phase Error EVM Origin Offset C/I Magnitude Error

Setup Parameters

GSM/EDGE Select	Auto, GSM, EDGE
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screen	Overall Measurements

RF Measurements (Option 0040)

Frequency Error	± 10 Hz + time base error, 99 % confidence level
Occupied Bandwidth	Bandwidth containing 99 % of the total power transmitted on a single channel
Burst Power Error	± 1.5 dB, ± 1 dB typical, (–50 dBm to +20 dBm)

Demodulation Measurements (Option 0041)

GSMK Modulation Quality (RMS Phase)	
Measurement Accuracy	± 1 deg
Residual Error (GSMK)	1 deg
8 PSK Modulation Quality (EVM)	
Measurement Accuracy	± 1.5 %
Residual Error (8 PSK)	2.5 %

W-CDMA/HSPA+ Signal Analyzers (Options 0044, 0065, 0035)

Measurements

RF (Option 0044)	Demodulation (Option 0065)	Over-the-Air (OTA) (Option 0035)	Pass/Fail (User Editable)
Band Spectrum Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single carrier ACLR Multi-carrier ACLR RF Summary	Code Domain Power Graph P-CPICH Power Channel Power Noise Floor EVM Carrier Feed Through Peak Code Domain Error Carrier Frequency Frequency Error Control Channel Power Abs/Rel/Delta Power CPICH, P-CCPCH S-CCPCH, PICH P-SCH, S-SCH HSPA+ Power vs. Time Constellation Code Domain Power Table Code, Status EVM, Modulation Type Power, Code Utilization Power Amplifier Capacity Codogram Modulation Summary	Scrambling Code Scanner (Six) Scrambling Codes CPICH E_c/I_o E_c Pilot Dominance OTA Total Power Multipath Scanner (Six) Six Multipaths Tau Distance RSCP Relative Power Multipath Power	Available Measurements Max Output Power Frequency Error EVM CPICH Occupied Bandwidth Spectral Mask ACLR PCDE P-CCPCH S-CCPCH Code Spread 3 PICH Code 128 Script Master™ Test Models 1 (16), (32), (64) 2 3 (16), (32) 4 (+CPICH), (-CPICH) 5 (2 HS), (4 HS), (8 HS)

Setup Parameters

Scrambling Code, Threshold	Auto, Manual
User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
Maximum Spreading Factor	256, 512
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Marker	Six Markers, Table On/Off
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0044)

RF Channel Power Accuracy	± 1.25 dB, ± 0.7 dB typical, (temperature range 15 ºC to 35 ºC)
Occupied Bandwidth Accuracy	± 100 kHz
Adjacent Channel Leakage Ratio (ACLR)	–54 dB/–59 dB ± 0.8 dB @ 5 MHz/10 MHz offset, typical, Bands I - VI, VIII – XIV, XVII –54 dB/–57 dB ± 1.0 dB @ 5 MHz/10 MHz offset, typical, Band VII

Demodulation Measurements (Option 0065)

W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
HSPA+ Modulations	QPSK, 16 QAM, 64 QAM
Frequency Error	± 10 Hz + time base error, 99 % confidence level
EVM Accuracy	± 2.5 %, 6 % ≤ EVM ≤ 25 %
Residual EVM	2.5 %
Code Domain Power	± 0.5 dB for code channel power > –25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
CPICH (dBm) Accuracy	± 0.8 dB typical

Over-the-Air (OTA) Measurements (Option 0035)

Scrambling Code Scanner	Six strongest Scrambling Codes
Multipath Scanner	Multipath power of six signals relative to strongest pilot

CDMA Signal Analyzers (Options 0042, 0043, 0033)

Measurements

RF (Option 0042)	Demodulation (Option 0043)	Over-the-Air (OTA) (Option 0033)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Multi-carrier ACPR RF Summary	Code Domain Power Graph Pilot Power Channel Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Frequency Error Abs/Rel/ Power Pilot Page Sync Q Page Code Domain Power Table Code Status Power Multiple Codes Code Utilization Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power Limit Test – 10 Tests Averaged Rho Adjusted Rho Multipath Pilot Dominance Pilot Power Pass/Fail Status	Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Mask Test Frequency Error Channel Frequency Frequency error Pilot Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Code Utilization Measured PN Pilot Dominance Multipath Power

Setup Parameters

PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Number of Carriers	1 to 5
Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0042)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +20 dBm)

Demodulation Measurements (Option 0043)

Frequency Error	± 10 Hz + time base error, 99 % confidence level (in slow mode)
Rho Accuracy	± 0.005, for Rho > 0.9
Residual Rho	> 0.995, typical, > 0.99 maximum, (RF input –50 to +20 dBm)
PN Offset	1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical, relative to channel power
Tau	± 0.5 µs typical, ± 1.0 µs maximum

Over-the-Air (OTA) Measurements (Option 0033)

Pilot Scanner	Nine strongest pilots
Multipath Scanner	Multipath power of six signals relative to strongest pilot
Limit Test	Average of ten tests compared to limit

EV-DO Signal Analyzers (Options 0062, 0063, 0034)

Measurements

RF (Option 0062)	Demodulation (Option 0063)	Over-the-Air (OTA) (Option 0034)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Power vs. Time Pilot & MAC Power Channel Power Frequency Error Idle Activity On/Off Ratio Spectral Emission Mask Multi-carrier ACPR RF Summary	MAC Code Domain Power Graph Pilot & MAC Power Channel Power Frequency Error Rho Pilot Rho Overall Data Modulation Noise Floor MAC Code Domain Power Table Code Status Power Code Utilization Data Code Domain Power Active Data Power Data Modulation Rho Pilot Rho Overall Maximum Data CDP Minimum Data CDP Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Mulitpath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power	Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Carrier Frequency Frequency Error Spectral Mask Noise Floor Pilot Power RMS Phase Error Tau Code Utilization Measured PN Pilot Dominance Mulitpath Power

Setup Parameters

PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Slot Type	Auto, Active, Idle
Number of Carriers	1 to 5
Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0062)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +20 dBm)

Demodulation Measurements (Option 0063)

EV-DO Compatibility	Rev 0 and Rev A
Frequency Error	± 10 Hz + time base error, 99 % confidence level
Rho Accuracy	± 0.01, for Rho > 0.9
Residual Rho	> 0.995 typical, > 0.99, maximum (RF input –50 dBm to +20 dBm)
PN Offset	Within 1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical, relative to channel power
Tau	± 0.5 µs typical, ± 1.0 µs maximum

Over-the-Air (OTA) Measurements (Option 0034)

Pilot Scanner	Nine strongest pilots
Multipath Scanner	Multipath power of six signals relative to strongest pilot

Fixed WiMAX Signal Analyzers (Options 0046, 0047)

Measurements

RF (Option 0046)	Demodulation (Option 0047)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Sector ID (Mobile) Modulation Summary	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	Available Measurements Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Base Station ID

Setup Parameters

Bandwidth (MHz)	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00
Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
Span (MHz)	5, 10, 15, 20
Frame Length (ms)	2.5, 5.0, 10.0
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0046) (temperature range 15 °C to 35 °C)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +20 dBm)

Demodulation Measurements (Option 0047) (temperature range 15 °C to 35 °C)

Frequency Error	0.07 ppm + time base error, 99 % confidence level
Residual EVM (rms)	3 % typical, 3.5 % maximum (RF Input –50 dBm to +20 dBm)

Mobile WiMAX[1] Signal Analyzers (Options 0066, 0067, 0037)

Measurements

RF (Option 0066)	Demodulation (Option 0067)	Over-the-Air (OTA) (Option 0037)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Downlink Burst Power Uplink Burst Power Spectral Emission Mask ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error CINR Base Station ID Sector ID DL-MAP (Tree View) Modulation Summary	Channel Power Monitor Preamble Scanner (Six) Preamble Relative Power Cell ID Sector ID PCINR Dominant Preamble Base Station ID Auto Save - On/Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Downlink Burst Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID

Setup Parameters

Zone Type	PUSC
DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
Bandwidths (MHz)	3.50, 5.00, 7.00, 8.75, 10.00
Cyclic Prefix Ratio (CP)	1/8
Span (MHz)	5, 10, 20, 30
Frame Lengths (ms)	5, 10
Demodulation	Auto, Manual, FCH
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0066) (temperature range 15 °C to 35 °C)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input −50 dBm to +20 dBm)

Demodulation Measurements (Option 0067) (temperature range 15 °C to 35 °C)

Frequency Error	0.02 ppm + time base error, 99 % confidence level
Residual EVM (rms)	2.5 % typical, 3.0 % maximum, (RF Input −50 dBm to +20 dBm)

Over-the-Air (OTA) Measurements (Option 0037)

Channel Power Monitor	Over time (one week), measurement time interval 1 s to 60 s
Preamble Scanner	Six Strongest Preambles
Auto Save	Yes
GPS Logging	Yes

1. Mobile WiMAX conforms to IEEE Std. 802.16e-2005, WiMAX Forum® Air Interface - Mobile System Profile - Release 1.0 Certified, System Profiles according to WMF-T24-001-R010v07.

Backhaul Analyzers T1 Bit-Error-Rate Tester (BERT) (Option 0051)

Measurements

Error Detection	Frame Bits, Bit Errors, BER, BPV, CRC, PATLS
Error Analysis (ITU G-821)	Errored Seconds (ES), Error Free Seconds (EFS), Severely Errored Seconds (SES), Unavailable Seconds (UAS), Available Seconds (AS), Degraded Minutes (DGRM)
Rx Signal	Frequency (± 5 ppm, Max/Min), Vpp (± 5 %) (Max/Min), dBdsx, Clock Slips, Frame Slips
VF	Frequency (100 Hz to 3000 Hz, ± 3 Hz), Power (–40.0 dBm to +3.0 dBm, ± 0.2 dBm)
Status (Historical and Current)	Rx (Signal, Frame Sync, Pattern Sync), DS1 (Alarms, Errors, B8ZS)
Status (Current)	Tx (Alarm On, Error On, Loop On)

Setup Parameters

BERT Display	Table, Histogram, Event List, Clear History
VF	Tx (Off/On), Channel (1-24), Tx Freq, Tx Level (–30 dBm to 0 dBm), Volume, Audio, Clear
Line Code	AMI, B8ZS
Tx Clock	Internal (1.544 MHz ± 5 ppm), Recovered, External
Tx LBO	0.0 dB, –7.5 dB, –15.0 dB
Rx Configuration	Terminate (100 Ω balanced), Monitor (Connect via 20 dB pad in DSX, 20 dB flat gain) Bridge (≥ 1000 Ω, –36 dB to +6 dB)
I/O Connector	Bantam
Framing	ESF, SF-D4
Payload	T1 (1.544 Mbps), Fractional T1 (Nx64, 64, 56, 16, 8 kbps)
Pulse Shapes	Conform to ANSI T1.403 and ITU G.703
Patterns	QRSS, PRBS (2-9, 2-11, 2-15, 2-20, 2-23), All Ones, All Zeros, 1-in-8 (1-in-7), 2-in-8, 3-in-24 T1 Daly, Six User defined (≤ 32 bits), Inverse Patterns (On/Off), Remote Loop Up/Down
Loopback Modes	CSU, NIU, Link Type (In-Band, Data-Link), Self Loop Up/Down, Loop Code User Defined
Error Insertion	Bit Error, Bit Error Rate (BER), BPV, Frame Bit Error, Error (On/Off)
Alarm Insertion	AIS On/Off (Blue Alarm), RAI On/Off (Yellow Alarm)
Data Log	1 minute to 3 days

Backhaul Analyzers E1 Bit-Error-Rate Tester (BERT) (Option 0052)

Measurements

Error Detection	Frame Bits, Bit Errors, BER, BPV, CRC, E Bits
Error Analysis (ITU G-821)	Errored Seconds (ES), Error Free Seconds (EFS), Severely Errored Seconds (SES), Unavailable Seconds (UAS), Available Seconds (AS), Degraded Minutes (DGRM)
Rx Signal	Frequency (± 5 ppm, Max/Min), Vpp (± 5 %) (Max/Min), dBdsx, Clock Slips, Frame Slips
VF	Frequency (100 Hz to 3000 Hz), Power (–40.0 dBm to +3.0 dBm, ± 0.2 dBm)
Status (Historical and Current)	Rx (Signal, FAS, Pattern Sync), E1 (Alarms, Errors)
Status (Current)	Tx (Alarm On, Error On)

Setup Parameters

BERT Display	Table, Histogram, Event List, Clear History
VF	Tx (Off/On), Channel (1-31), Tx Freq, Tx Level (–30 dBm to 0 dBm), Volume, Audio, Clear
Line Code	AMI, HDB3
Tx Clock	Internal (2.048 MHz ± 5 ppm), Recovered, External
Rx Input	Terminate (RJ48 120/75 Ω balanced, BNC 75 Ω unbalanced, –43 dB to +6 dB) Bridge (≥ 1000 Ω, –43 dB to +6 dB) Monitor (Connect via 20 dB pad in DSX, 20 dB flat gain)
Framing	PCM30, PCM30 CRC-4, PCM31, PCM31 CRC-4
Pulse Shapes	Conform to ITU G.703
Payload	E1 (2.048 Mbps), Fractional E1 (N x 64, 64, 16, 8 kbps)
Patterns	QRSS, PRBS (2-9, 2-11, 2-15, 2-20, 2-23), All Ones, All Zeros, 1010, 1-in-8 (1-in-7), 2-in-8, 3-in-24, Six User defined (≤ 32 bits), Inverse Patterns (On/Off)
Loopback Mode	Self loop
Error Insertion	Bit Error, Bit Error Rate (BER), Frame Bit Error, Error (On/Off)
Alarm Insertion	AIS (On/Off) (Blue Alarm), RAI (On/Off) (Yellow Alarm)
Data Log	1 minute to 3 days

Backhaul Analyzers T3 Bit-Error-Rate Tester (BERT) (Option 0053)

Measurements

Error Detection	Frame Bits, Bit Errors, BER, BPV, Lof Count, P-bit Errors, C-bit Errors, FEBE Errors
Error Analysis (ITU G-821)	Excess Zeros, Errored Seconds (ES), Error Free Seconds (EFS), Severely Errored Seconds (SES), Unavailable Seconds (UAS), Available Seconds (AS), Degraded Minutes (DGRM), Pattern Loss Seconds (PATLS)
Rx Signal	Frequency (± 5 ppm, Max/Min), Vpp (± 5 %) (Max/Min), dBdsx
VF	Frequency (100 Hz to 3000 Hz, ± 3 Hz), Power (–30.0 dBm to +0.0 dBm, ± 0.2 dBm)
Status (Historical and Current)	Rx (Signal, Frame Sync, Pattern Sync), DS3 (Alarms, Errors, DS3ZS)
Status (Current)	Insert (Alarm On, Error On, Loop On)

Setup Parameters

BERT Display	Table, Histogram, Event List, Clear History
VF	Tx (Off/On), Channel #, Tx Freq, Tx, Level, Volume, Audio (On/Off)
Line Code	AMI, B3ZS
Tx Clock	Internal (44.736 MHz ± 5 ppm), Recovered
Tx LBO	Low, DSX
Rx Input	DS1 (Bantam connector 100 Ω balanced) DS3 (BNC 75 Ω unbalanced) Monitor (Connect via 20 dB pad in DSX)
Framing	M13, C-Bit, Unframed
Test Mode	Auto, DS3, DS1
Pulse Shapes	Carrier present, Frame ID and Sync, Pattern ID and Sync
Patterns	QRSS, PRBS (2-9, 2-11, 2-15, 2-20, 2-23), All Ones, All Zeros, 1010, 1-in-8 (1-in-7), 2-in-8, 3-in-24 T1 Daly, Six User defined (≤ 32 bits), Inverse Patterns (On/Off), Loop Up/Down
Loopback Modes	Stuff Bit, DS3 C-Bit FEAC, DS3 Self Loop
Error Insertion	Bit Error, BPV, DS3 Frame Bit Error, C-bit, P-bit, FEBE, Error Insert (On/Off)
Alarm Insertion	AIS (Blue Alarm), RAI (Yellow Alarm), Idle Alarm, Alarm (On/Off)
Data Log	1 minute to 3 days

DS1 Test Mode

Measurements

Error Detection	Frame Bits, Bit Errors, BER, BPV, CRC, PATLS
Error Analysis (ITU G-821)	Errored Seconds (ES), Error Free Seconds (EFS), Severely Errored Seconds (SES), Unavailable Seconds (UAS), Available Seconds (AS), Degraded Minutes (DGRM)
Rx Signal	Frequency (± 5 ppm, Max/Min), Vpp (± 5 %) (Max/Min), dBdsx, Clock Slips, Frame Slips
VF	Frequency (100 Hz to 3000 Hz, ± 3 Hz), Power (–40.0 dBm to +3.0 dBm, ± 0.2 dBm)
Status (Historical and Current)	Rx (Signal, Frame Sync, Pattern Sync), DS1 (Alarms, Errors, B8ZS)
Status (Current)	Tx (Alarm On, Error On, Loop On)

Setup Parameters

BERT Display	Table, Histogram, Event List, Clear History
VF	Tx (Off/On), Channel (1-24), Tx Freq, Tx Level (–30 to 0 dBm), Volume, Audio, Clear
Line Code	AMI, B8ZS
Tx Clock	Internal (1.544 MHz ± 5 ppm), Recovered, External
Tx LBO	0.0 dB, –7.5 dB, –15.0 dB
Rx Input	Terminate (Bantam connector 100 Ω balanced) Monitor (Connect via 20 dB pad in DSX, 20 dB flat gain) Bridge (≥ 1000 Ω, –36 dB to +6 dB)
Framing	ESF, SF-D4
Payload	T1 (1.544 Mbps), Fractional T1 (Nx64, 64, 56, 16, 8 kbps)
Pulse Shapes	Conform to ANSI T1.403 and ITU G.703
Patterns	QRSS, PRBS (2-9, 2-11, 2-15, 2-20, 2-23), All Ones, All Zeros, 1-in-8 (1-in-7), 2-in-8, 3-in-24 T1 Daly, Six User defined (≤ 32 bits), Inverse Patterns (On/Off), Remote Loop Up/Down
Loopback Mode	CSU, NIU, Link Type (In-Band, Data-Link), Self Loop Up/Down, Loop Code User Defined
Error Insertion	Bit Error, Bit Error Rate (BER), BPV, Frame Bit Error, Error (On/Off)
Alarm Insertion	AIS On/Off (Blue Alarm), RAI On/Off (Yellow Alarm)
Data Log	1 minute to 3 days

General Specifications

All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) Apply when using internal reference and performance sweep mode; 3) Subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

Setup Parameters

System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed)
	Self Test, Application Self Test, GPS (see Option 0031)
System Options	Name, Date and Time, Ethernet Configuration, Volume
	Display (Brightness, Blank, Default, Black & White, Night Vision, High Contrast, Invert Black & White)
	Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, User Defined)
	Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save As, Save Meas, Save, Save On Event, Recall Meas, Recall, Copy, Delete
Save/Recall	Setups, Measurements, Screen Shots (JPEG - save only)
Delete	By File Type, All, Selected
Internal Trace/Setup Memory	> 30,000 traces
External Trace/Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

Connectors

RF Out	Type N, female, 50 Ω, Maximum Input +23 dBm, ± 50 VDC, (Reflection In)
RF In	Type N, female, 50 Ω, Maximum Input +30 dBm, ± 50 VDC
GPS	SMA. female
T1	Bantam Jacks (Option 0051)
T3	BNC (Option 0053)
E1	RJ48C and BNC (Option 0052)
External Power	5.5 mm barrel connector, 12 VDC to 14.5 VDC, < 5.0 A
LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
USB Interface	Two Type A, Connect Flash Drive and Power Sensor
	5-pin mini-B, Connect to PC for data transfer
Headset Jack	2.5 mm barrel connector
External Reference In	BNC, female, 50 Ω, Maximum Input +10 dB
Reference Out	BNC, female, 50 Ω, 10 MHz
External Trigger In/Clock Recovery	BNC, female, 50 Ω, Maximum Input ± 5 VDC
IF Out	BNC, female, 50 Ω, 140 MHz

Display

Size	8.4 in
Resolution	800 x 600

Battery

Type	Li-Ion
Battery Operation	2.5 hours, typical

Electromagnetic Compatibility

European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and
	Low Voltage Directive 73/23/EEC, 93/68/EEC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11

Safety

Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Company supplied Power Supply

Environmental

Operating Temperature	–10 °C to 55 °C
Maximum Humidity	85 %
Shock	MIL-PRF-28800F Class 2
Storage	–51 °C to 71 °C
Altitude	4600 m, operating and non-operating

Size and Weight

Size	315 mm x 211 mm x 94 mm, (12.4 in x 8.3 in x 3.7 in)
Weight	4.9 kg, (10.8 lb)

Line Sweep Tools (for your PC)

Trace Capture

Browse to Instrument	View and copy traces from the test equipment to your PC using Windows Explorer
Open Legacy Files	Open DAT files captured with Hand Held Software Tools v6.61
Open Current Files	Open VNA or DAT files
Capture Plots to	The Line Sweep Tools screen, DAT files, Database, or JPEG

Traces

Trace Types	Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith Chart, and PIM
Trace Formats	DAT, VNA, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF

Report Generation

Report Generator	Includes GPS location along with measurements
Report Format	Create reports in HTML or PDF format
Report Setup	Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo
Trace Setup	1 Trace Portrait Mode, 2 Trace Portrait Mode, 1 Trace Landscape Mode

Trace Validation

Presets	7 presets allow "one click" setting of up to 6 markers and one limit line
Marker Controls	6 regular Markers, Marker Peak, Marker valley, Marker between, and frequency entry
Delta Markers	6 Delta markers
Limit Line	Enable and drag or value entry - also works with presets
Next Trace Button	Next Trace and Previous Trace - arrow keys allow quick switching between traces

Tools

Cable Editor	Allows creation of custom cable parameters
Distance to Fault	Converts a Return Loss trace to a Distance to Fault trace
Measurement Calculator	Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power
Signal Standard Editor	Creates new band and channel tables
Renaming Grid	36 user definable phrases for creation of file names, trace titles, and trace subtitles

Connectivity

Connections	Ethernet, USB Cable, USB Memory

Master Software Tools (for your PC)

Mapping (GPS Required)

Spectrum Analyzer Mode	MapInfo, MapPoint
Mobile WiMAX OTA, LTE OTA Options	Google Earth, Google Maps, MapInfo

Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)

Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - Playback (Frequency and/or Time Domain)

List/Parameter Editors

Traces	Add, delete, and modify limit lines and markers
Product Updates	Auto-checks Anritsu website for latest revision firmware
Firmware Upload	Upload new firmware into the instrument
Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
Languages	Add custom language or modify non-English language menus

Script Master™

Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
GSM/GPRS/EDGE or W-CDMA/HSPA+ Mode	Automate Signal Analysis testing requirements with annotated how-to pictures

Connectivity

Connections	Connect to PC using USB or Ethernet

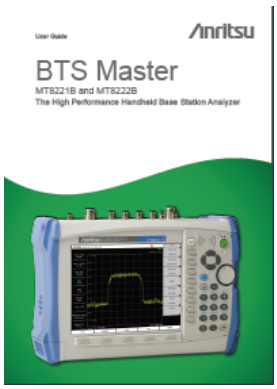
Ordering Information – Instrument Options

	MT8221B	MT8222B	Description
	400 MHz to 4 GHz	400 MHz to 6 GHz	Cable and Antenna Analyzer
	150 kHz to 7.1 GHz	150 kHz to 7.1 GHz	Spectrum Analyzer
	10 MHz to 7.1 GHz	10 MHz to 7.1 GHz	Power Meter
	Options		
	MT8221B-0010	MT8222B-0010	Bias-Tee
	MT8221B-0031	MT8222B-0031	GPS Receiver (requires antenna)
	MT8221B-0019	MT8222B-0019	High-Accuracy Power Meter (requires external power sensor)
	MT8221B-0025	MT8222B-0025	Interference Analyzer (recommend Option 0031)
	MT8221B-0027	MT8222B-0027	Channel Scanner
	MT8221B-0089	MT8222B-0089	Zero-Span IF Output
	MT8221B-0431	MT8222B-0431	Coverage Mapping (requires Option 0031)
	MT8221B-0090	MT8222B-0090	Gated Sweep
	MT8221B-0024	MT8222B-0024	I/Q Waveform Capture
	MT8221B-0023	MT8222B-0023	Vector Signal Generator
	MT8221B-0040	MT8222B-0040	GSM/EDGE RF Measurements
	MT8221B-0041	MT8222B-0041	GSM/EDGE Demodulation
	MT8221B-0044	MT8222B-0044	W-CDMA/HSPA+ RF Measurements
	MT8221B-0065	MT8222B-0065	W-CDMA/HSPA+ Demodulation
	MT8221B-0035	MT8222B-0035	W-CDMA/HSPA+ Over-the-Air Measurements
	MT8221B-0060	MT8222B-0060	TD-SCDMA/HSPA+ RF Measurements
	MT8221B-0061	MT8222B-0061	TD-SCDMA/HSPA+ Demodulation
	MT8221B-0038	MT8222B-0038	TD-SCDMA/HSPA+ Over-the-Air Measurements (recommend Option 0031)
	MT8221B-0541	MT8222B-0541	LTE RF Measurements (BW = ≤ 10 MHz)
	MT8221B-0542	MT8222B-0542	LTE Modulation Measurements (BW = ≤ 10 MHz)
	MT8221B-0546	MT8222B-0546	LTE Over-the-Air Measurements (recommend Option 0031)
	MT8221B-0543	MT8222B-0543	15 MHz and 20 MHz, LTE Modulation Measurements (requires Option 0541, 0542, 0551 or 0552)
	MT8221B-0551	MT8222B-0551	TD-LTE RF Measurements (BW = ≤ 10 MHz)
	MT8221B-0552	MT8222B-0552	TD-LTE Modulation Measurements (BW = ≤ 10 MHz)
	MT8221B-0556	MT8222B-0556	TD-LTE Over-the-Air Measurements (recommend Option 0031)
	MT8221B-0042	MT8222B-0042	CDMA RF Measurements
	MT8221B-0043	MT8222B-0043	CDMA Demodulation
	MT8221B-0033	MT8222B-0033	CDMA OTA Measurements (requires Option 0031)
	MT8221B-0062	MT8222B-0062	EV-DO RF Measurements
	MT8221B-0063	MT8222B-0063	EV-DO Demodulation
	MT8221B-0034	MT8222B-0034	EV-DO OTA Measurements (requires Option 0031)
	MT8221B-0046	MT8222B-0046	Fixed WiMAX RF Measurements
	MT8221B-0047	MT8222B-0047	Fixed WiMAX Demodulation
	MT8221B-0066	MT8222B-0066	Mobile WiMAX RF Measurements
	MT8221B-0067	MT8222B-0067	Mobile WiMAX Demodulation
	MT8221B-0037	MT8222B-0037	Mobile WiMAX OTA Measurements (recommend Option 0031)
	MT8221B-0051	MT8222B-0051	T1 Analyzer (mutually exclusive with Options 0052, 0053)
	MT8221B-0052	MT8222B-0052	E1 Analyzer (mutually exclusive with Options 0051, 0053)
	MT8221B-0053	MT8222B-0053	T3/T1 Analyzer (mutually exclusive with Options 0051, 0052)
	MT8221B-0098	MT8222B-0098	Standard Calibration to ISO/IEC 17025:2005
	MT8221B-0099	MT8222B-0099	Premium Calibration to ISO/IEC 17025:2005 plus test data

Power Sensors (for complete ordering information see the respective data sheets of each sensor)

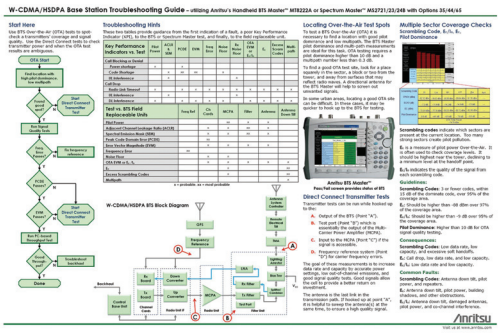
Part Number	Description
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm

Manuals (soft copy included on Handheld Instruments Documentation Disc and at www.anritsu.com)



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00207	BTS Master User Guide
10580-00230	Cable and Antenna Analyzer Measurement Guide
10580-00244	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00232	Vector Signal Generator Measurement Guide
10580-00234	3GPP Signal Analyzer Measurement Guide
10580-00235	3GPP2 Signal Analyzer Measurement Guide
10580-00236	WiMAX Signal Analyzer Measurement Guide
10580-00238	Backhaul Analyzer Measurement Guide
10580-00208	Programming Manual
10580-00209	Maintenance Manual

Troubleshooting Guides (soft copy at www.anritsu.com)



Part Number	Description
11410-00473	Cable, Antenna and Components
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00566	LTE eNodeB Base Stations
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00463	W-CDMA/HSDPA Base Stations
11410-00465	TD-SCDMA/HSDPA Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations
11410-00552	T1/DS1 Backhaul Testing
11410-00553	E1 Backhaul Testing

Standard Accessories (included with instrument)

Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
2000-1686-R	Soft Carrying Case
2300-577	Anritsu Software Tool Box for Handheld RF Instruments Disc
633-75	Rechargeable Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Power Adapter, 12 VDC, 60 Watts
3-806-152	Cat 5e Crossover Patch Cable, 213 cm (7 ft)
2000-1371-R	Ethernet Cable, 213 cm (7 ft)
3-2000-1498	USB A-mini B Cable, 305 cm (10 ft)
1091-27-R	Type-N male to SMA female adapter
1091-172-R	Type-N male to BNC female adapter

One Year Warranty (Including battery, firmware, and software)
Certificate of Calibration and Conformance

Optional Accessories

Calibration Components, 50 Ω

Part Number	Description
OSLN50-1	Precision Open/Short/Load, N(m), 42 dB, 6.0 GHz, 50 Ω
OSLNF50-1	Precision Open/Short/Load, N(f), 42 dB, 6.0 GHz, 50 Ω
2000-1618-R	Precision Open/Short/Load, 7/16 DIN(m), DC to 6.0 GHz 50 Ω
2000-1619-R	Precision Open/Short/Load, 7/16 DIN(f), DC to 6.0 GHz 50 Ω
22N50	Open/Short, N(m), DC to 18 GHz, 50 Ω
22NF50	Open/Short, N(f), DC to 18 GHz, 50 Ω
SM/PL-1	Precision Load, N(m), 42 dB, 6.0 GHz
SM/PLNF-1	Precision Load, N(f), 42 dB, 6.0 GHz

Calibration Components, 75 Ω

Part Number	Description
22N75	Open/Short, N(m), DC to 3 GHz, 75 Ω
22NF75	Open/Short, N(f), DC to 3 GHz, 75 Ω
26N75A	Precision Termination, N(m), DC to 3 GHz, 75 Ω
26NF75A	Precision Termination, N(f), DC to 3 GHz, 75 Ω
12N50-75B	Matching Pad, DC to 3 GHz, 50 Ω to 75 Ω

Adapters

Part Number	Description
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
1091-417-R	N(m) to QMA(f), DC to 6 GHz, 50 Ω
1091-418-R	N(m) to QMA(m), DC to 18 GHz, 50 Ω
510-90-R	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50 Ω
510-91-R	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50 Ω
510-92-R	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω
510-93-R	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω
510-96-R	7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50 Ω
510-97-R	7/16 DIN(f) to 7/16 DIN(f), DC to 7.5 GHz, 50 Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50 Ω with Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

Precision Adapters

Part Number	Description
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω

Phase-Stable Test Port Cables, Armored w/ Reinforced Grip (Recommended for cable & antenna line sweep applications)

Part Number	Description
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω

InterChangeable Adaptor Phase Stable Test Port Cables, Armored w/Reinforced Grip (recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the Reinforced grip series cables. Now you can also change the adaptor interface on the grip to four different connector types)

Part Number	Description
15RCN50-1.5-R	1.5 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50 Ω
15RCN50-3.0-R	3.0 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50 Ω

Phase-Stable Test Port Cables, Armored (ideal for use with tightly spaced connectors and other general use applications)

Part Number	Description
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(m), 50 Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω
15NNF50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-5.0C	5.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω

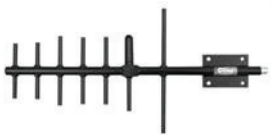
Miscellaneous Accessories

Part Number	Description
2000-1528-R	GPS Antenna, SMA(m) with 15 ft cable
2000-1652-R	GPS Antenna, SMA(m) with 1 ft cable
2000-1733-R	Passive GPS Antenna
2000-1374	External Charger for Li-Ion Batteries
2000-1689	EMI Near Field Probe Kit
MA2700A	Handheld Interference Hunter (For full specifications, refer to the MA2700A Technical Data Sheet 11410-00692)

Backpack and Transit Case

Part Number	Description
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

Directional Antennas



Part Number	Description
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12.2 dBd, Yagi
2000-1617	600 MHz to 21 GHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic
2000-1677-R	300 MHz to 3000 MHz, SMA(m), 50 Ω, 3 m cable (9.8 ft) 0 to 6 dBi gain @ 950 MHz, log periodic

Portable Antennas

Part Number	Description
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 to 2170 MHz, SMA(m), 50 Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)

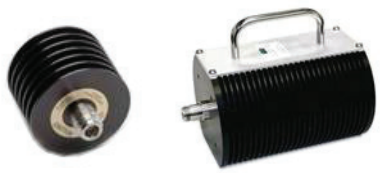
Mag Mount Broadband Antenna

Part Number	Description
2000-1647-R	Cable 1: 698 MHz to 1200 MHz 2 dBi peak gain, 1700 MHz to 2700 MHz 5 dBi peak gain, N(m), 50 Ω, 3 m (9.8 ft) Cable 2: 3000 MHz to 6000 MHz 5 dBi peak gain, N(m), 50 Ω, 3 m (9.8 ft) Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 3 m (9.8 ft)
2000-1645-R	694 MHz to 894 MHz 3 dBi peak gain, 1700 MHz to 2700 MHz 3dBi peak gain, N(m), 50 Ω, 3 m (9.8 ft)
2000-1646-R	750 MHz to 1250 MHz 3 dBi peak gain, 1650 MHz to 2000 MHz 5 dBi peak gain, 2100 MHz to 2700 MHz 3 dBi peak gain, N(m), 50 Ω, 3 m (9.8 ft)
2000-1648-R	1700 MHz to 6000 MHz 3 dBi peak gain,N(m), 50 Ω, 3 m (9.8 ft)

Bandpass Filters

Part Number	Description
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50 Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50 Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50 Ω
1030-105-R	890 MHz to 915 MHz, N(m) to N(f),50 Ω
1030-106-R	1710 MHz to 1790 MHz, N(m) to N(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz, N(m) to N(f), 50 Ω
1030-149-R	High Pass, 150 MHz, N(m) to N(f), 50 Ω
1030-150-R	High Pass, 400 MHz, N(m) to N(f), 50 Ω
1030-151-R	High Pass, 700 MHz, N(m) to N(f), 50 Ω
1030-152-R	Low Pass, 200 MHz, N(m) to N(f), 50 Ω
1030-153-R	Low Pass, 550 MHz, N(m) to N(f), 50 Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50 Ω
1030-179-R	777 MHz to 797 MHz, N(m) to N(f), 50 Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50 Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50 Ω

Attenuators



Part Number	Description
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

T1/E1 Extender Cables

Part Number	Description
806-16-R	Bantam Plug to Bantam Plug
3-806-116	Bantam Plug to BNC
3-806-117	Bantam Y Plug to RJ48
3-806-169	1.8 m (72 in) BNC to BNC, 75 1/2 RG59 Type Coax Cable
806-176-R	Bantam Plug to Alligator Clips

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