Anritsu envision : ensure

Product Brochure

BTS Master™ MT8220T

High-Performance Handheld Base Station Analyzer

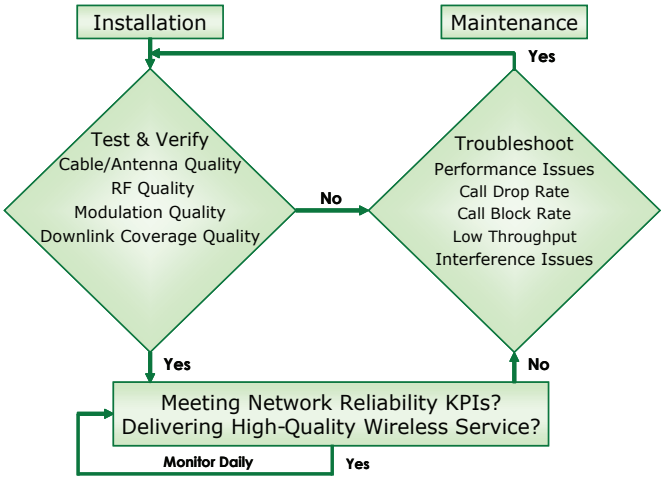
400 MHz to 6 GHz Cable and Antenna Analyzer
150 kHz to 7.1 GHz Spectrum Analyzer
10 MHz to 7.1 GHz Power Meter

BTS Master™ MT8220T Base Station Analyzer Introduction

Overview

BTS Master MT8220T utilizing Handheld InterferenceHunter™ MA2700A

BTS Master in RF Measurements Pass/Fail Mode



Installation and Maintenance Processes Supported by the BTS Master

Introduction

The BTS Master MT8220T is a high-performance, handheld base station analyzer developed specifically to advance the support of 4G wireless networks, as well as installed 2G, 3G, and WiMAX networks The BTS Master MT8220T includes:

- 20 MHz bandwidth modulation quality testing
- Vector signal generator (400 MHz to 6 GHz) for comprehensive DAS and receiver testing
- Convenient touchscreen GUI
- Sweep modes for reliable interference hunting and analysis

With over 30 analyzers to meet virtually every measurement need, standard features include:

- 2-port cable and antenna analyzer: 400 MHz to 6 GHz
- Spectrum analyzer: 150 kHz to 7.1 GHz
- Power meter: 10 MHz to 7.1 GHz
- GPS receiver with antenna
- 3-year warranty

The BTS Master MT8220T also offers many options to choose from, including:

- High-accuracy power meter
- Interference analyzer
- Channel scanner
- 3GPP wireless measurements: LTE/LTE-A FDD/TDD, GSM/GPRS/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+, NB-IoT
- 3GPP2 wireless measurements: CDMA, EV-DO
- IEEE 802.16 wireless measurements: Fixed/Mobile WiMAX
- NB-IoT measurements

The wireless measurements have three methods for verifying the performance of a base station transmitter:

- RF quality
- Modulation quality
- Downlink coverage quality

Meeting Key Performance Indicators (KPIs)

Degradation in KPIs, such as dropped call and/or blocked call rates or low data throughput 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.

Line Sweep Tools™ (LST)

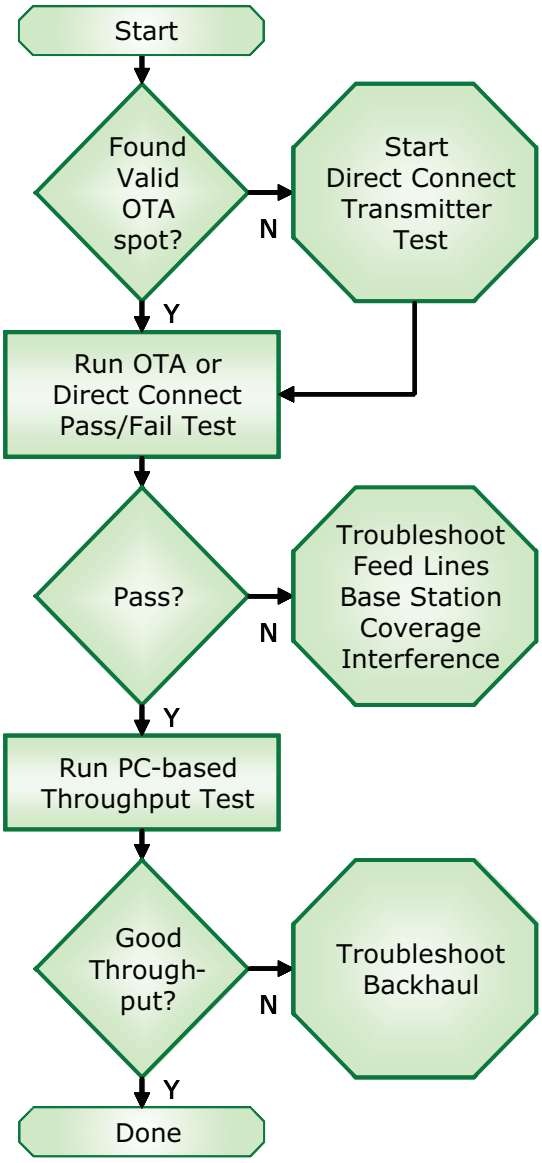
LST is a PC program that post processes cable and antenna measurement traces. It provides a powerful trace analysis and report generator for line sweepers.

Master Software Tools™ (MST)

MST is a PC program that post-processes spectrum analysis traces collected on the instrument. It provides 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 MT8220T to give you years of reliable and dependable service.

Overview (continued)



Fast Over-the-Air Pass/Fail Testing Process

The BTS Master MT8220T feature an over-the-air (OTA) pass/fail test wireless measurement. Technicians and RF engineers can quickly determine the health of a cell site with a one-step pass/fail test that verifies the quality of:

- Antenna feed line quality
- Base station RF
- 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 instrument enables the technician to troubleshoot:

- Feed lines and antenna systems
- Base station field replaceable units
- Downlink coverage issues
- Interference problems
- Uplink noise

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 services, they expect more and more in network performance. This makes it more critical than ever to meet KPI optimization goals for network availability, quality, and coverage. Ultimately, it is about eliminating reasons for demanding subscribers to churn.

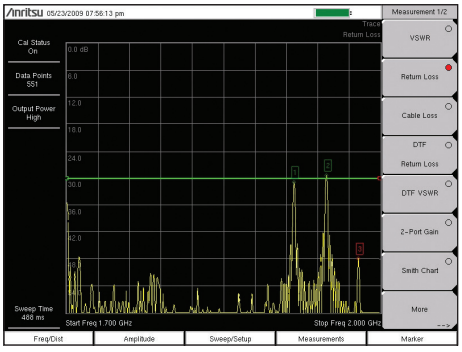
Network Maintenance and Return on Investment

By outfitting cell site technicians with a BTS Master MT8220T, an operator can attack the reasons for churn. Benchmarking undertaken by Anritsu shows that technicians equipped with base station analyzers are provided with the necessary tools to troubleshoot degrading KPIs, which in turn can reduce churn.

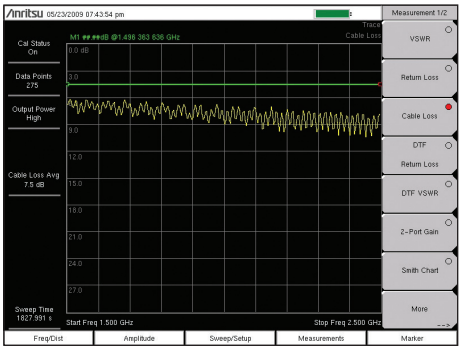
Learn what the return on investment is on equipping more technicians with the BTS Master MT8220T base station analyzers from your local Anritsu sales professional. The BTS Master MT8220T base station analyzer can become your vital tool to achieving optimal network performance.

BTS Master™ MT8220T Base Station Analyzer Features

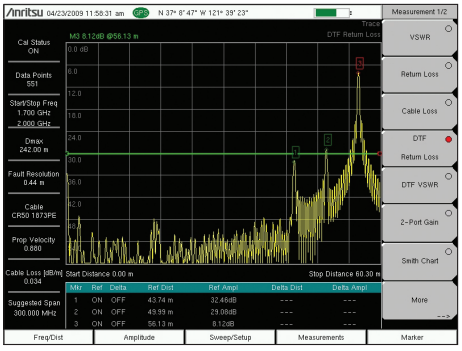
Cable and Antenna Analyzer



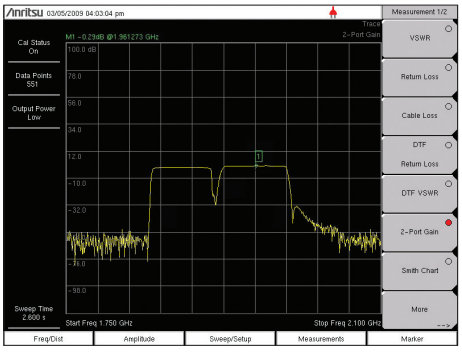
Return Loss/VSWR Measurement
Poor return loss/VSWR can damage transmitters, reduce the coverage area, increase dropped and blocked calls, and lower data rates.



Cable Loss Measurement
This is 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

The BTS Master MT8220T features a 1-port and 2-port cable and antenna analyzer and a Passive Intermodulation (PIM) analyzer 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. This minimizes dropped and blocked calls for a good customer experience.

Antenna Systems Failure Mechanisms

Maintenance is an on-going requirement as the performance of an antenna systems 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 MT8220T provides features for making measurements easier to perform and analyze test results such as:

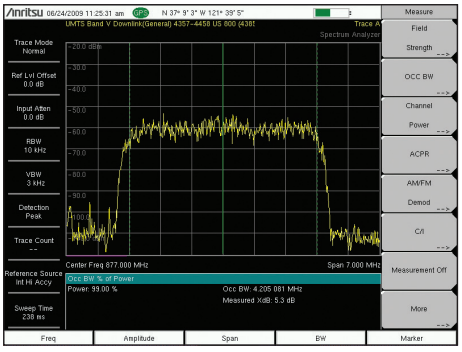
- FlexCal™ eliminates the need to recalibrate when changing frequencies
- High RF immunity for testing in harsh RF environments
- Trace overlay compares reference traces to see changes over time
- Limit lines with alarms for providing reference standards
- High power output to test tower-top components without climbing the tower
- Internal bias tee to power up TMAs for testing when offline
- GPS tagging of data to verify location of tests
- Line Sweep Tools for post-analysis and report generation

Cable and Antenna Analyzer Measurements

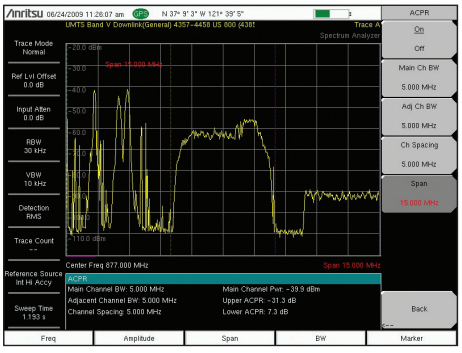
- VSWR
- Return loss
- Cable loss
- Distance-to-Fault (DTF) return loss
- Distance-to-Fault (DTF) VSWR
- 1-port phase
- 2-port phase
- 2-port gain
- Smith Chart

BTS Master™ MT8220T Base Station Analyzer Features

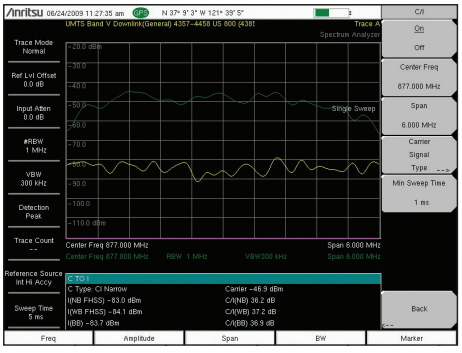
Spectrum Analyzer



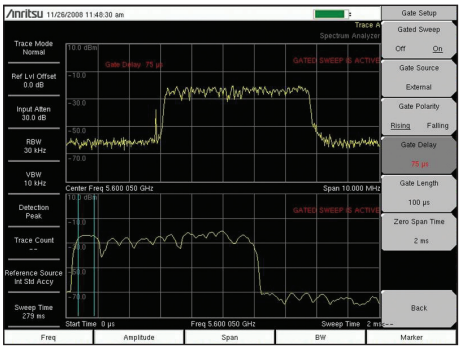
Occupied Bandwidth
Excessive occupied bandwidth can create interference with adjacent channels or be a sign of poor signal quality that can lead to dropped calls.



Adjacent Channel Power Ratio (ACPR)
High ACPR will create interference for neighboring carriers. This is also an indication of low signal quality and 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 MT8220T features a powerful spectrum analyzer with unmatched performance in a base station analyzer for:

- Sensitivity
- Dynamic range
- Phase noise
- Frequency accuracy
- Resolution bandwidth (RBW)
- Sweep speed

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 MT8220T features dedicated routines for one-button measurements. For more in-depth analysis, the technician has control over settings and features not even found on lab-grade benchtop spectrum analyzers, for instance:

- Multiple sweep detection methods — true RMS detector, quasi-peak, ...
- Multiple sweep modes including burst Detect for fast transient signal capture
- 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

GPS-Assisted Frequency Accuracy

With the standard GPS function, frequency accuracy is 2.5 x 10^{-8}. After the GPS antenna is disconnected, the accuracy is 5.0 x 10^{-8} for three days. Also all measurements can be GPS tagged for exporting to maps.

Rx Noise Floor Testing

The BTS Master MT8220T can measure the Rx noise floor on the uplink of a base station using the channel power measurement. An elevated noise floor indicates interference or PIM, and leads to call blocking, denial of services, call drops, low data rate, and low capacity.

Measurements

One-Button Measurements
- Field Strength — in dBm/m² 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

Sweep Mode
- Fast, Performance, No FFT, Burst Detect

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

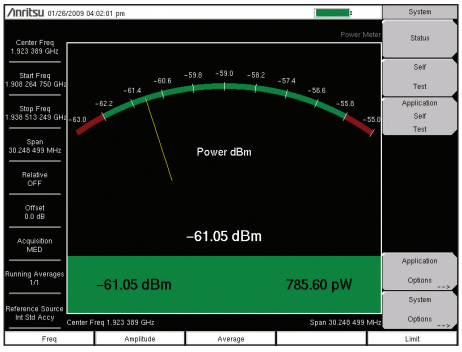
Limit Line Edit
- Frequency, Amplitude, Add/Delete Point, Add Vertical, Next Point Left/Right

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

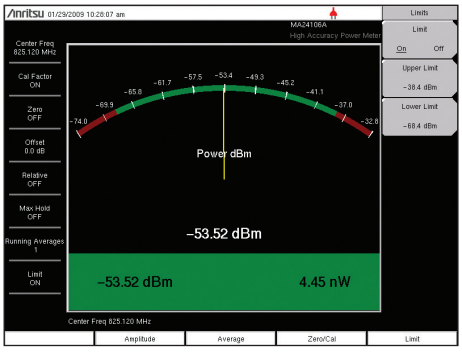
Limit Line Envelope
- Create, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope

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

Power Meter

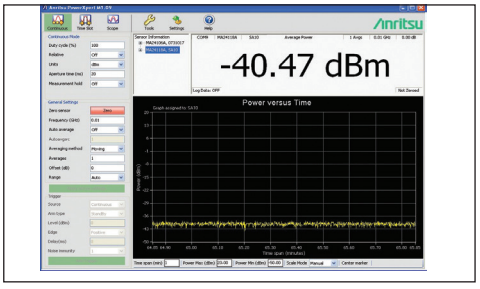


Power Meter (Built-In)
Power is displayed in an analog type display and supports both Watts and dBm. RMS averaging can be set to low, medium, or high.



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

High-Accuracy Power Meter (Option 0019)

Power Meters

The instrument offers a 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 and blocked calls.

High-Accuracy Power Meter (Option 0019)

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

- Frequency ranges:
  10 MHz to 26 GHz
- Power ranges:
  -40 dBm to +20 dBm
- Measurement uncertainties:
  ≤ ± 0.18 dB

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

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

Remote Power Monitoring via LAN

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

Power Sensors

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

MA24208A
Microwave Universal USB Power Sensor
10 MHz to 8 GHz, +20 dBm to -60 dBm

MA24218A
Microwave Universal USB Power Sensor
10 MHz to 18 GHz, +20 dBm to -60 dBm

MA24330A
Microwave CW USB Power Sensor
10 MHz to 33 GHz, +20 dBm

MA24340A
Microwave CW USB Power Sensor
10 MHz to 40 GHz, +20 dBm

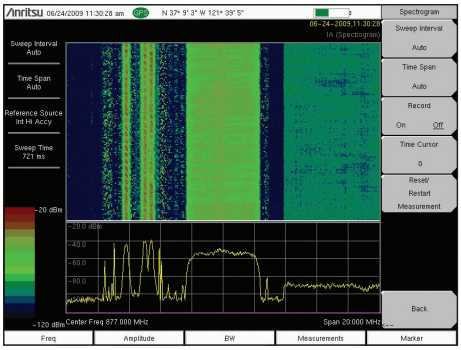
MA24350A
Microwave CW USB Power Sensor
10 MHz to 50 GHz, +20 dBm to -60 dBm

MA25100A
RF Power Indicator

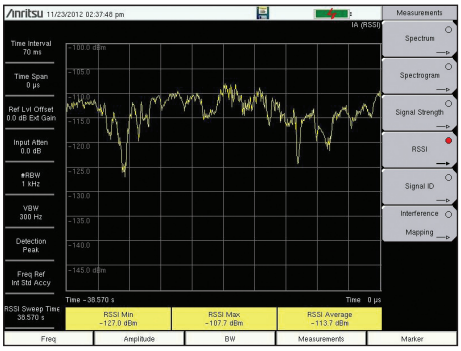
BTS Master™ MT8220T Base Station Analyzer Features

Interference Analyzer (Option 0025)

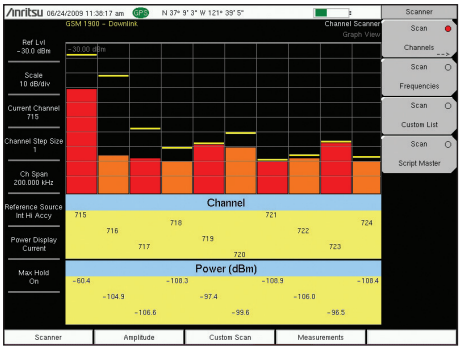
Channel Scanner (Option 0027)



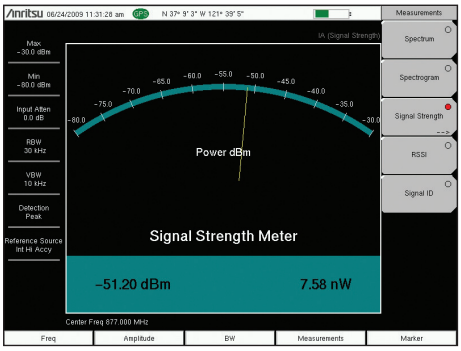
Spectrogram
For identifying intermittent interference and tracking signal levels over time for up to 1 week with an external USB flash drive.



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, also 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

This instrument 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

Several tools are provided to identify interference — either from a neighboring wireless operator, illegal repeater or jammer, or self-interference:

- Signal ID (up to 12 signals at once)
- Signal analyzer OTA scanners
- Channel scanner (up to 1200 channels, 20 at a time)

Interference Mapping

Once interference has been identified, its location can be mapped with the help of the InterferenceHunter MA2700A (see separate technical data sheet) and suitable directional antenna. Maps can be downloaded to the instrument using Anritsu's easyMap Tools™ software available from Anritsu.com.

Interference Analyzer Measurements

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

Interference Mapping
- Draw multiple bearings on on-screen maps
- Pan and zoom on-screen maps
- Support for Handheld InterferenceHunter MA2700A

Spectrum
- Field Strength — in dBm/m² 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

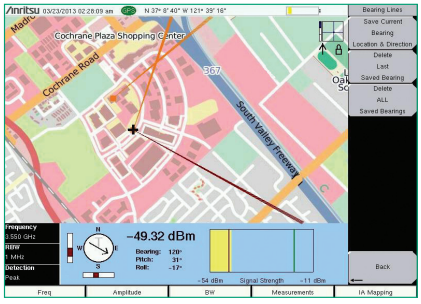
Channel Scanner

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

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

Master Software Tools
- Up to 1200 Channels
- Auto-repeat sets of 20 channels and total
- Auto-save with GPS tagging

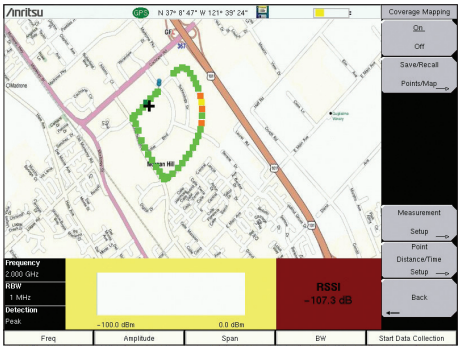
Interference Hunting
The BTS Master MT8220T can be used with the InterferenceHunter MA2700A and directional antennas to track down sources of interference.



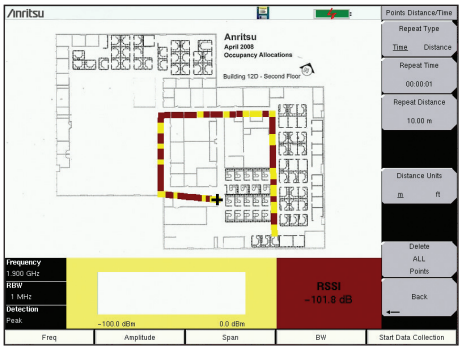
Interference Mapping
Maps can be downloaded to the instrument to help identify sources of interfering signals. Maps can be panned and zoomed to further aid the hunt for interference.

Coverage Mapping (Option 0431)

Gated Sweep (Option 0090)

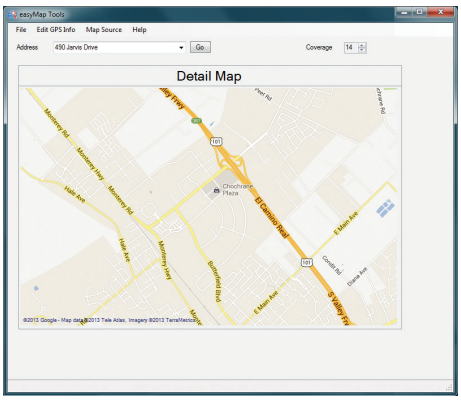


On-screen Outdoor Coverage Mapping
Enables a maintenance technician to make low cost coverage measurements to quickly verify coverage around a base station site.



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.



easyMap Tools™
easyMap 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 measurement option provides wireless service providers, public safety users, land mobile radio 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 easyMap, 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 s, 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 valid GPS signal, the instrument uses a start-walk-stop approach to record RSSI and ACPR levels. The update rate, start location, and end location can be set 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.

easyMap Tools

The easyMap Tools program creates maps on your compatible PC. Maps are created by typing in an 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. easyMap Tools also includes a GPS editor for inputting latitude and longitude information of maps from different formats.

Coverage Mapping Measurements
Spectrum Analyzer Mode
- ACPR
- RSSI

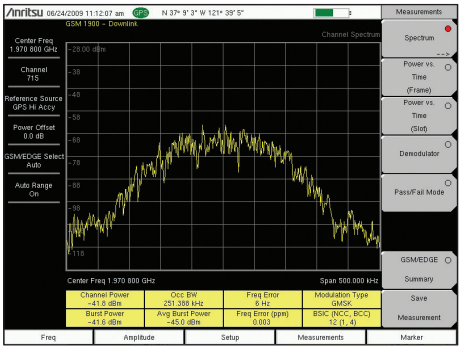
Gated Sweep
Mode
- Spectrum Analyzer, Sweep

Trigger
- External TTL

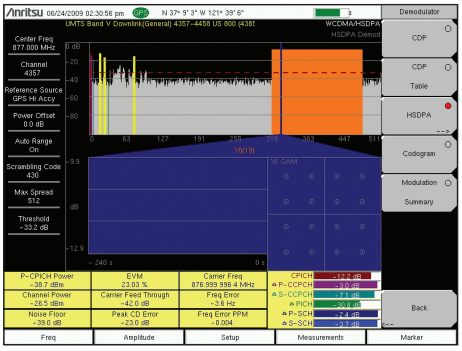
Setup
- Gated Sweep (On/Off)
- Gate Polarity (Rising, Falling)
- Gate Delay (0 ms to 65 ms typical)
- Gate Length (1 µs to 65 ms typical)
- Zero Span Time

BTS Master™ MT8220T Base Station Analyzer Features

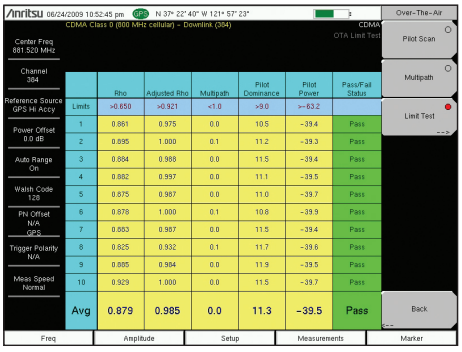
Introduction to Wireless Measurements



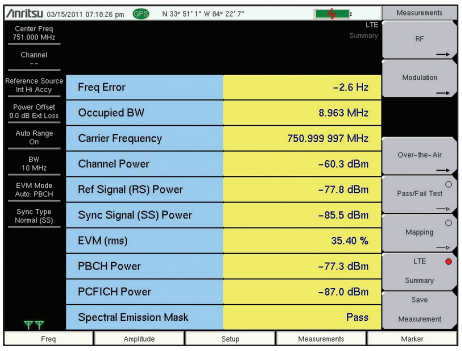
RF Measurement – GSM
High frequency error will cause calls to drop when mobiles travel at higher speed. In some cases, cell phones cannot hand-offs, or out of the cell.



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



OTA 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.

Wireless Measurements

This instrument features measurements for the major wireless standards around the world that are designed to test and verify the base station transmitters:

- RF quality
- Modulation quality
- Downlink coverage quality

The goal of these tests are to improve the KPIs associated with:

- Call drop rate
- Call block rate
- Low data throughput

By understanding which test to perform when the KPIs degrade to an unacceptable level, a technician can troubleshoot down to the FRU in the base station's transmitter chain. This minimizes the problem of costly no trouble founds (NTF) associated with card swapping. This will allow users 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 OTA with the MT8220T on commercial base stations carrying live traffic. To understand when, where, how, and why you make these measurements, Anritsu publishes Troubleshooting Guides that explain for each measurement the:

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

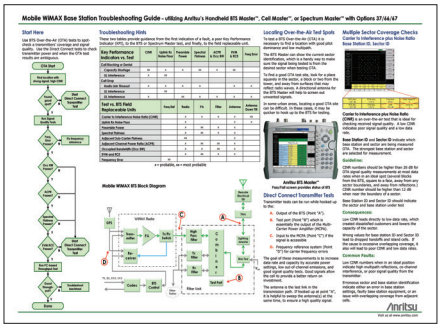
These *Troubleshooting Guides for Base Stations* are one-page each per wireless standard. They are printed on tear-resistant and smudge-resistant paper and are designed to fit in the soft case of the instrument for easy reference in the field. They are complimentary and their part numbers can be found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

- LTE Base Stations
- TD-LTE Base Stations
- GSM/GPRS/EDGE Base Stations
- W-CDMA/HSPA+ Base Stations
- CDMA Base Stations
- EV-DO Base Stations
- Fixed WiMAX Base Stations
- Mobile WiMAX Base Stations
- TD-SCDMA/HSPA+ Base Stations

Wireless Measurements
LTE/LTE-A FDD/TDD
GSM/GPRS/EDGE
W-CDMA/HSPA+
CDMA /EV-DO
Fixed and Mobile WiMAX
TD-SCDMA/HSPA+

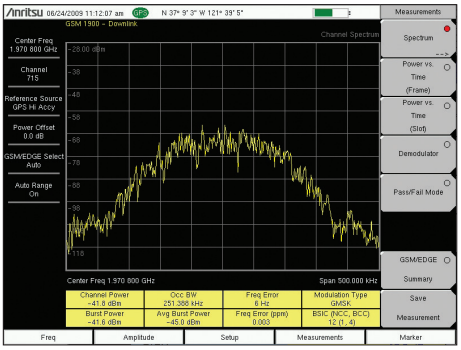
Typical Measurements
RF Measurements
Demodulation
Over-the-Air Measurements

Features
Measurement Summary Displays
Pass/Fail Limit Testing

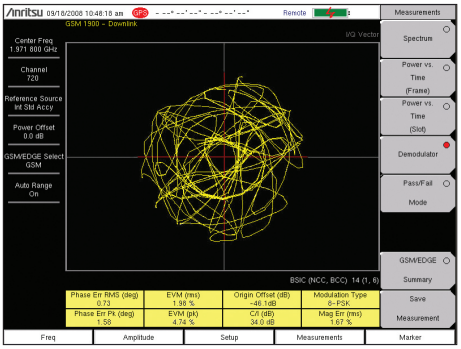


Troubleshooting Guide

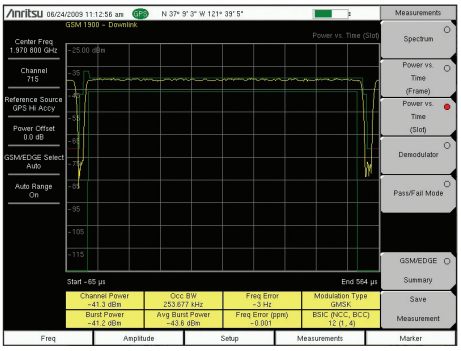
GSM/GPRS/EDGE Measurements (Option 0880)



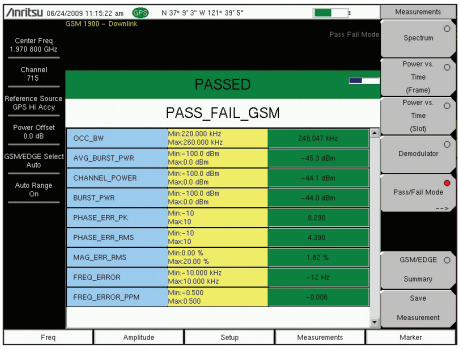
RF Measurement – Occupied Bandwidth
Excessive occupied bandwidth can create interference with adjacent channels or be a sign of poor signal quality and lead to dropped calls.



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 lead to inconsistent network behavior.

GSM/GPRS/EDGE Measurements

This instrument features two GSM/GPRS/EDGE measurement modes.

- RF measurements
- Demodulation

The goal of these measurements is to increase data rate and capacity with 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 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 worsen EVM and Phase Error measurements, and create higher dropped call rates.

Power versus Time (Slot and Frame)

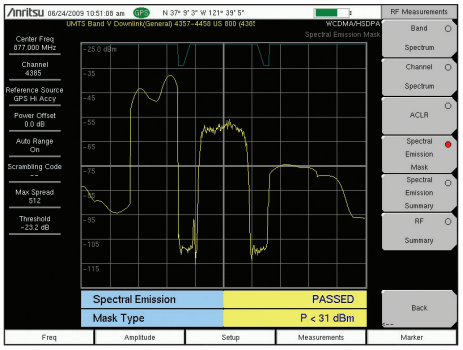
Power versus Time (Slot and Frame) should be used if the GSM base station is setup to turn RF power off between timeslots. When used OTA, this measurement can also spot GSM signals from other cells. Violations of the mask create dropped calls, low capacity, and small service area issues.

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

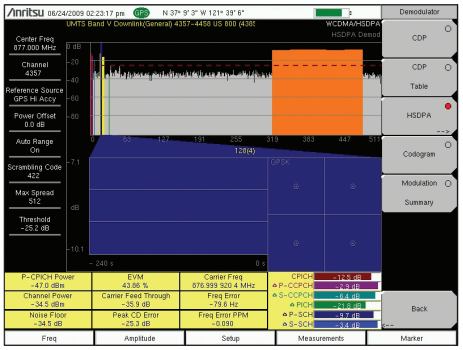
Multi-channel Spectrum
Power vs. Time (Frame/Slot)
- Channel Power
- Occupied Bandwidth
- Burst Power
- Average Burst Power
- Frequency Error
- Modulation Type
- BSIC (NCC, BCC)

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

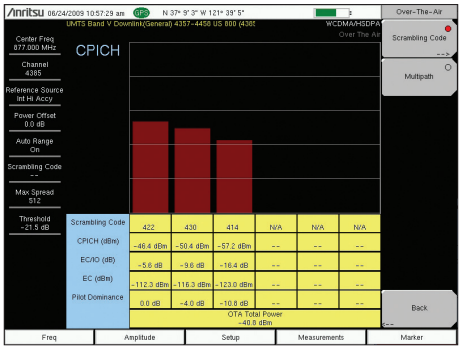
W-CDMA/HSPA+ Measurements (Option 0881)



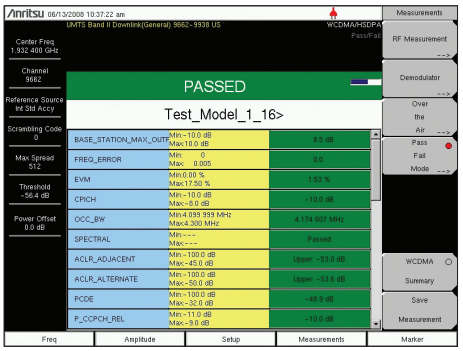
RF Measurements – Spectral Emissions Mask
The 3GPP spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



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 lead to inconsistent network behavior.

W-CDMA/HSPA+ Measurements

This instrument features three W-CDMA/HSPA+ measurement modes:

- RF measurements
- Demodulation
- OTA measurements

The goal of these measurements is to increase data rate and capacity with 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 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. This instrument 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)

PCDE is a measurement 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

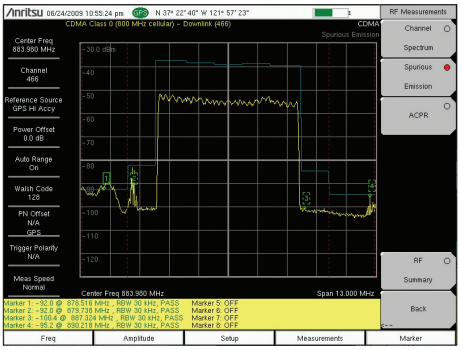
The instrument stores the five test models covering all eleven test scenarios specified in the 3GPP specification (TS 25.141) for testing base station performance and recalls these models for quick easy measurements.

RF Measurements
- Band Spectrum
- Channel Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Peak-to-Average Power
- Spectral Emission Mask
- Single carrier ACLR
- Multi-carrier ACLR

Demodulation
- 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

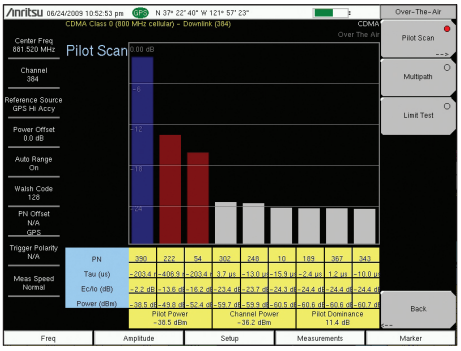
Over-the-Air (OTA) Measurements
- Scrambling Code Scanner (Six)
  - Scrambling Codes
  - CPICH
  - E_c/I_o
  - E_c
  - Pilot Dominance
  - OTA Total Power
- Multipath Scanner (Six)
  - Six Multipaths
  - Tau
  - Distance
  - RSCP
  - Relative Power
  - Multipath Power

TD-SCDMA/HSPA+ Measurements (Option 0882)

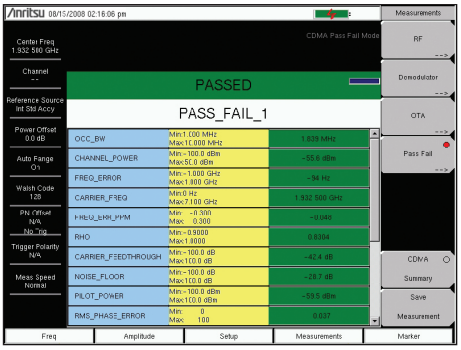


RF Measurements – Spectral Emissions Mask
The 3GPP spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.

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 uneven amplitude of sub-carriers. Data will be less reliable on weak sub-carriers, creating a lower overall data rate.



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

TD-SCDMA/HSPA+ Measurements

This instrument features three TD-SCDMA/HSPA+ measurement modes:

- RF measurements
- Demodulation
- OTA measurement

The goal of these measurements is to increase data rate and capacity with 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 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.

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, thus increasing dropped and blocked calls.

Peak Code Domain Error (PCDE)

PCDE is the EVM of the worst code and its domain displays show the traffic in a specific time slot. PCDE 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 that 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
Channel Spectrum
- Channel Power
- Occupied Bandwidth
- Left Channel Power
- Left Channel Occ B/W
- Right Channel Power
- Right Channel Occ B/W

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

Spectral Emission
RF Summary

Demodulation
Code Domain Power/Error
- (QPSK/8 PSK/16 QAM/64 QAM)
- Slot Power
- DwPTS Power
- Noise Floor
- Frequency Error
- Tau
- Scrambling Code
- EVM
- Peak EVM
- Peak Code Domain Error
- CDP Marker

Modulation Summary

Over-the-Air (OTA) Measurements
Code Scan (32)
- Scrambling Code Group
- Tau
- E_c/I_o
- DwPTS Power
- Pilot Dominance

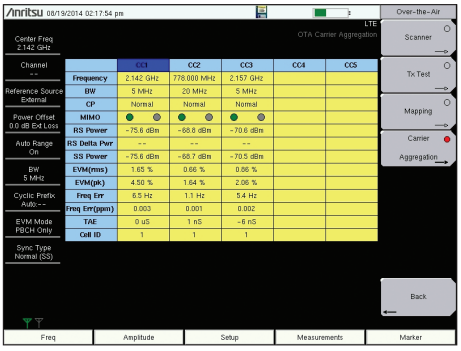
Tau Scan (Six)
- Sync-DL#
- Tau
- E_c/I_o
- DwPTS Power
- Pilot Dominance

Record
Run/Hold

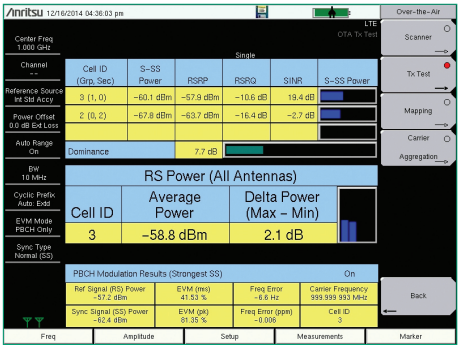
Pass/Fail (User Editable)
Pass Fail All
Pass/Fail RF
Pass Fail Demod
Measurements
- Occupied Bandwidth
- Channel Power
- Channel Power RCC
- On/Off Ratio
- Peak-to-Average Ratio
- Frequency Error
- EVM
- Peak EVM
- Peak Code Domain Error
- Tau
- Carrier Feedthrough
- Noise Floor

LTE/LTE-A FDD/TDD Measurements (Option 0883 and 886)

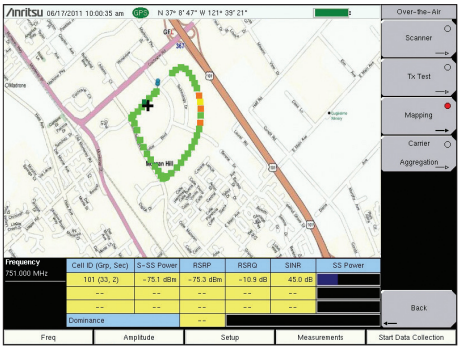
Modulation Quality — Power vs. Resource Block
A high utilization of the Resource Blocks would indicate a cell site in nearing overload and it may be appropriate to start planning for additional capacity.



OTA LTE-A Carrier Aggregation
Convenient LTE-A carrier aggregation measurement shows key performance parameters of each component carrier on one screen with minimal user setup, improving maintenance efficiency.



OTA 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.



OTA On-screen Mapping
Import map area on instrument screen to drive test downlink coverage of S-SS Power, RSRP, RSRQ, or SINR.

LTE/LTE-A FDD/TDD Signal Measurements

This instrument features three LTE measurement modes:

- RF measurements
- Modulation measurements
- OTA measurements

The goal of these measurements is to increase data rate and capacity with 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 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)

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 an 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.

eMBMS

This measurement enables a field service engineer to measure the cell ID and received eMBMS signal power. This validates that a specific cell site supports the eMBMS standard and that it is transmitting the signal correctly. The RSRP value relates specifically to the eMBMS RSRP, and if the cell site does not support eMBMS this field would show "No eMBMS detected". This instrument supports eMBMS measurements on 5 MHz and 10 MHz LTE signals.

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
Channel Spectrum
- Channel Power
- Occupied Bandwidth

Power vs. Time (TDD only)
- 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

Modulation Measurements
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, 256 QAM (Opt 886)
- 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)

Over-the-Air Measurements (OTA)
Scanner - six strongest signals
- Cell ID (Group, Sector)
- S-SS, RSRP, RSRQ, SINR
- Dominance
- Modulation Results – On/Off
- Auto Save - On/Off

Tx Test
- Scanner - three strongest signals
- 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

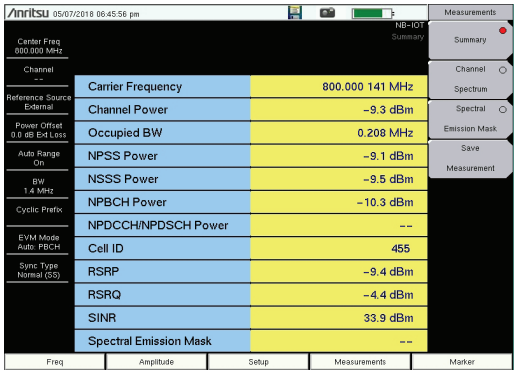
Carrier Aggregation
- Up to 5 component carriers (CC1 to CC5)
  - CP, MIMO status, RS & SS Power, EVM, Frequency Error, Time Alignment Error, Cell ID

eMBMS Test (5 MHz & 10 MHz BW Only)
- Cell ID
- RSRP

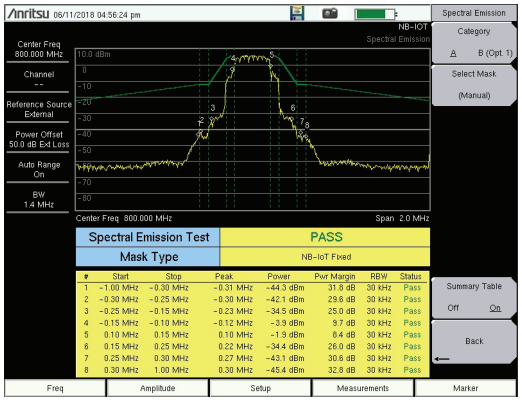
Pass/Fail (User Editable)
View Pass/Fail Limits
- All, RF, Modulation

Available Measurements
- Channel Power
- Occupied Bandwidth
- ACLR
- Frequency Error
- Carrier Frequency
- Dominance
- EVM peak, rms
- Frame EVM, rms
- Frame EVM by mod type
- RS, SS Power
- RS EVM
- P-SS, S-SS Power, EVM
- PBCH, PCFICH, PHICH, PDCCH Power, EVM
- Cell, Group, Sector ID
- OSTP
- Tx Time Alignment
- Frame Power (TDD)
- DwPTS Power (TDD)
- Transmit Off Power (TDD)
- Timing Error (TDD)

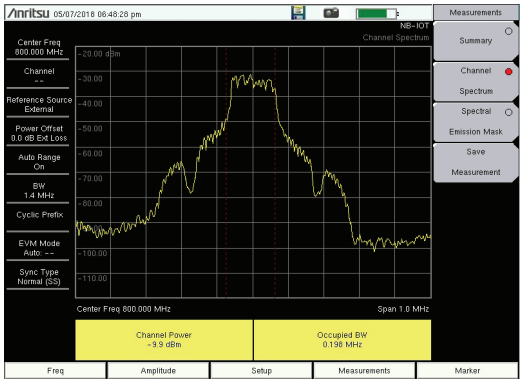
NB-IoT Analyzer (Option 887)



NB-IoT Analyzer Summary Screen



NB-IoT Analyzer Spectral Emission Mask



NB-IoT Analyzer Channel Spectrum

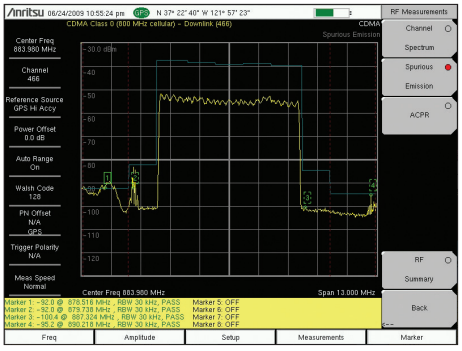
NB-IoT Analyzer (Option 887)
Narrowband Internet-of-Things (NB-IoT), also known as LTE Cat-NB1, is a cellular technology introduced in 3GPP Release 13 for providing wide-area coverage for the Internet-of-Things (IoT).

The NB-IoT analyzer is ideal for network operator installation and maintenance teams, along with their contractors, that are deploying or have already deployed NB-IoT services. This feature allows them to verify that NB-IoT services are deployed and are working as intended.

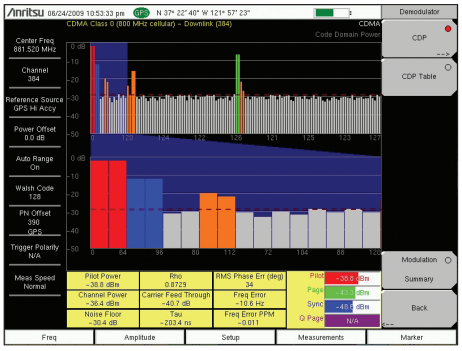
Key Features and Benefits
The NB-IoT analyzer, Option 887 has the following features:

- Summary screen showing the following RF measurements:
  - Carrier frequency
  - Channel power
  - Occupied BW
  - NPSS power
  - NSSS power
  - NPBCH power
  - NPDCH/NPDSCH power
  - Cell ID
  - RSRP
  - RSRQ
  - SINR
  - Spectral emission mask (Pass/Fail)
- Channel spectrum
- Spectral emission mask

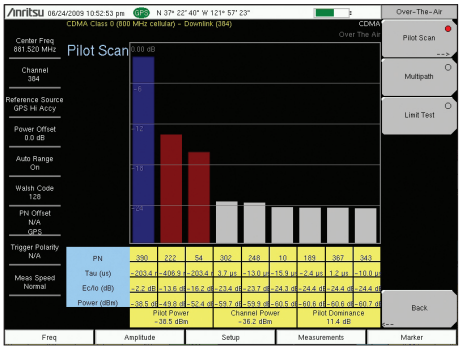
CDMA/EV-DO Measurements (Option 0884)



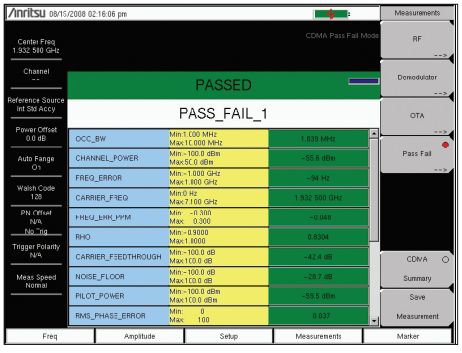
RF Measurements — Spectral Emissions Mask
The 3GPP2 spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



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.



OTA Measurements — Sync Signal Power
Check for uneven amplitude of sub-carriers. Data will be less reliable on weak sub-carriers, creating a lower overall data rate.



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

CDMA Measurements

This instrument features three CDMA measurement modes:

- RF measurements
- Demodulation
- OTA Measurements

The goal of these measurements is to increase data rate and capacity with 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 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
Channel Spectrum
- Channel Power
- Occupied Bandwidth
- Peak-to-Average Power

Spectral Emission Mask
Multi-carrier ACPR
RF Summary

Demodulation
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

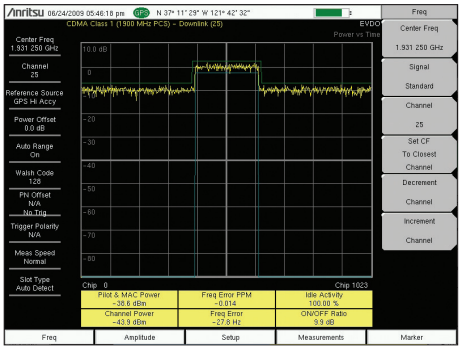
Over-the-Air (OTA) Measurements
Pilot Scanner (Nine)
- PN
- E_c/I_o
- Tau
- Pilot Power
- Channel Power
- Pilot Dominance

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

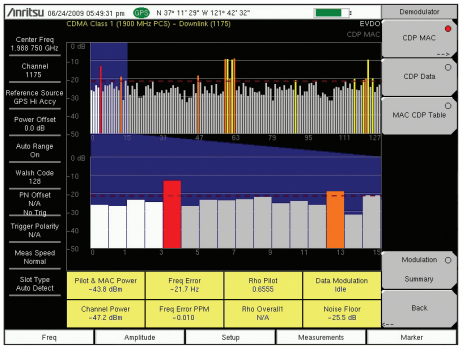
Limit Test – 10 Tests Averaged
- Rho
- Adjusted Rho
- Multipath
- Pilot Dominance
- Pilot Power
- Pass/Fail Status

Pass/Fail (User Editable)
Measurements
- Channel Power
- Occupied Bandwidth
- Peak-to-Average Power
- Spectral Mask Test
- Frequency Error
- Channel Frequency
- Pilot Power
- Noise Floor
- Rho
- Carrier Feed Through
- Tau
- RMS Phase Error
- Code Utilization
- Measured PN
- Pilot Dominance
- Multipath Power

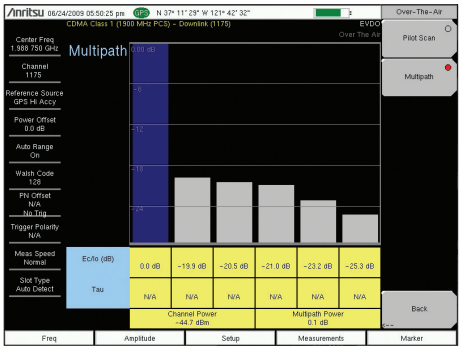
CDMA/EV-DO Measurements (Option 0884) (continued)



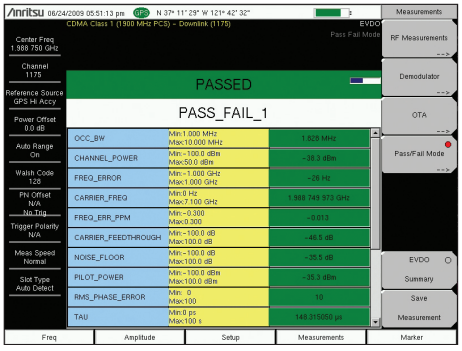
RF Measurements — Pilot and MAC Power
High values will create pilot pollution. High or low values will cause dead spots/dropped calls and cell loading imbalances/blocked calls.



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.



OTA 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 lead to inconsistent network behavior.

EV-DO Measurements

This instrument features three EV-DO measurement modes:

- RF measurements
- Demodulation
- OTA Measurements

The goal of these measurements is to increase data rate and capacity with 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 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, thus lowering 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.

OTA Pilot Power

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

RF Measurements
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

Demodulation
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

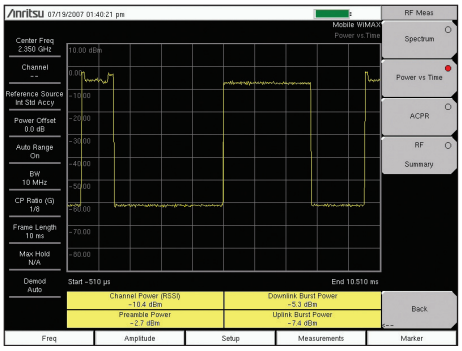
Modulation Summary

Over-the-Air (OTA) Measurements
Pilot Scanner (Nine)
- PN
- E_c/I_o
- Tau
- Pilot Power
- Channel Power
- Pilot Dominance

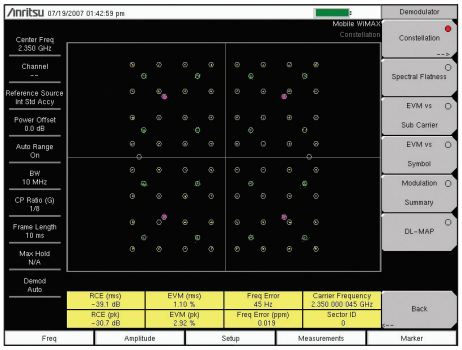
Mulitpath Scanner (Six)
- E_c/I_o
- Tau
- Channel Power
- Multipath Power

Pass/Fail (User Editable)
Measurements
- Channel Power
- Occupied Bandwidth
- Peak-to-Average Power
- Carrier Frequency
- Frequency Error
- Spectral Mask
- Noise Floor
- Pilot Floor
- RMS Phase Error
- Tau
- Code Utilization
- Measured PN
- Pilot Dominance
- Multipath Power

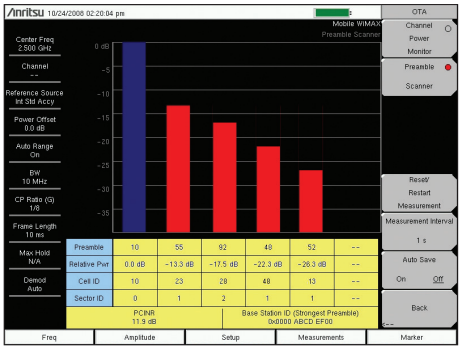
WiMAX Fixed/Mobile Measurements (Option 0885)



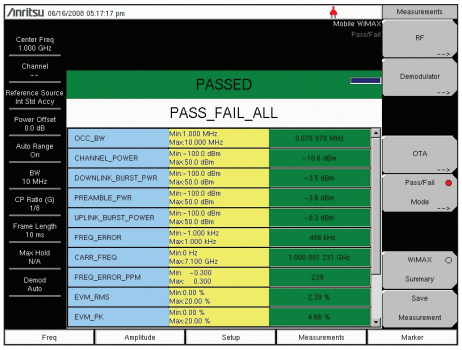
RF Measurement — Preamble Power
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



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.



OTA 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 lead to inconsistent network behavior.

WiMAX Fixed/Mobile Measurements

This instrument features two Fixed WiMAX and three Mobile WiMAX measurement modes:

- RF measurements
- Demodulation (up to 10 MHz)
- OTA Measurements (Mobile only)

The goal of these measurements is to increase data rate and capacity with 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 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 (Mobile WiMAX)

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.

EVM Relative 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 cause 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 can be used 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
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
RF Summary
Demodulation (10 MHz maximum)
Constellation
- RCE (RMS/Peak)
- EVM (RMS/Peak)
- Frequency Error
- Carrier Frequency
- CINR (Mobile only)
- Base Station ID
- Sector ID (Mobile Only)

Spectral Flatness
- Adjacent Subcarrier Flatness

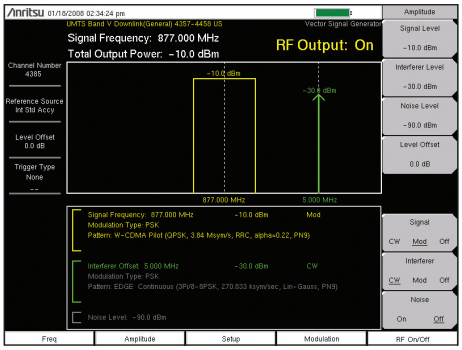
EVM vs. Subcarrier/Symbol
- RCE (RMS/Peak)
- EVM (RMS/Peak)
- Frequency Error
- CINR (Mobile only)
- Base Station ID
- Sector ID (Mobile only)

DL-MAP (Tree View) (Mobile only)
Modulation Summary
Over-the-Air (OTA) (Mobile)
Channel Power Monitor
Preamble Scanner (Six)
- Preamble
- Relative Power
- Cell ID
- Sector ID
- PCINR

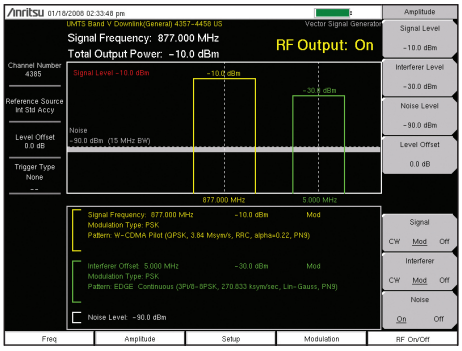
Dominant Preamble
- Base Station ID

Auto-Save with GPS Tagging and Logging
Pass/Fail (User Editable)
Pass Fail All
Pass/Fail RF
Pass/Fall Demod
Measurements
- Channel Power
- Occupied Bandwidth
- Downlink Bust Power
- Uplink Bust Power
- Preamble Power
- Crest Factor
- Frequency Error
- Carrier Frequency
- EVM
- RCE
- Sector ID (Mobile)

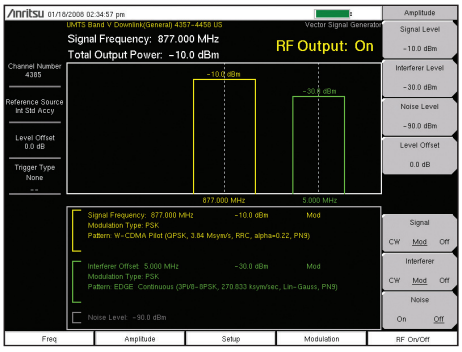
Vector Signal Generator Option (Option 0023)



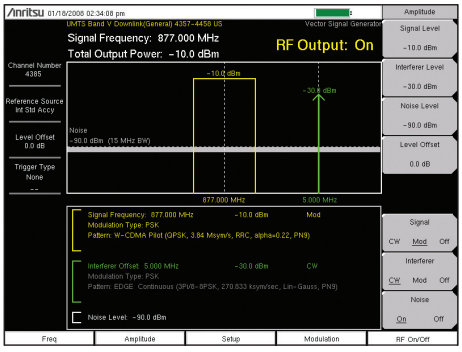
Sensitivity Test Set-up
Wanted Signal: Modulated
Interferer: CW
AWGN: Off



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)

This instrument'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

This instrument 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

This instrument 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 Mobile/WiMAX
- AM, FM
- QPSK, QAM

This instrument's 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 Pattern Converter can upload them into the instrument.

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

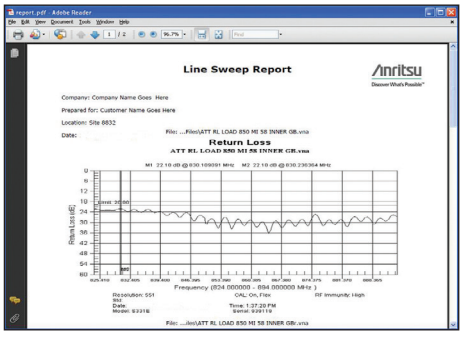
User-defined Signal Patterns
(Sampling Rate, Bandwidth)
12.500 MHz, 10 MHz
6.250 MHz, 5.0 MHz
1.625 MHz, 1.2 MHz

BTS Master™ MT8220T Base Station Analyzer Features

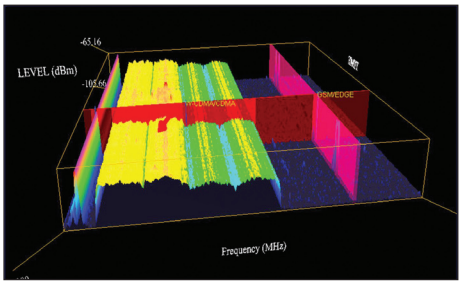
Line Sweep Tools (for your PC)

Master Software Tools (for your PC)

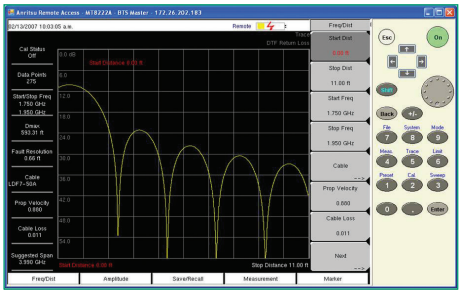
Trace Validation
Marker and limit line presets allow quick checks of traces for limit violations.



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 (LST)

LST increases productivity for those who deal with dozens of Cable and Antenna traces or passive intermodulation (PIM) traces every day.

User Interface

LST has a user interface that will be familiar to users of Anritsu's handheld software tools so the learning curve will be short.

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, and also creates:

- 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 that allows the user to embed the operator's test procedure inside the instrument for GSM/GPRS/EDGE and W-CDMA/HSPA+ signal analysis applications.

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

Remote Control

The instrument can be configured for remote control via Wi-Fi to support a variety of testing scenarios. Line of site distances of >100 m (>328 ft) have been achieved allowing a person on the ground to control the test equipment while a person at the top of the mast makes connections.

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
Ethernet, USB cable, and USB memory stick

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
Spectrum Analyzer Mode
Mobile WiMAX OTA
TS-SCDMA OTA
LTE, both FDD and TDD

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

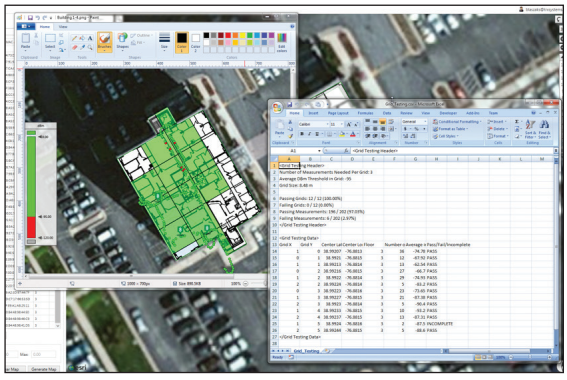
List/Parameter Editors
Traces
Antennas, Cables, Signal Standards
Product Updates
Firmware Upload
Pass/Fail
VSG Pattern Converter
Languages
Mobile WiMAX
Display

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

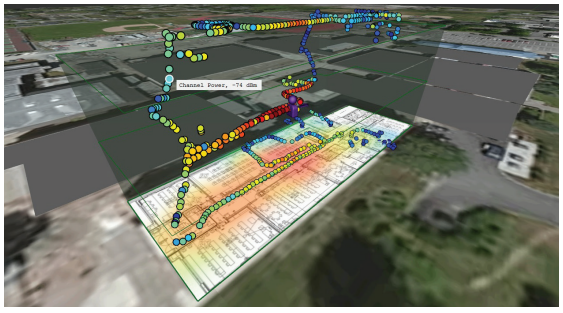
Connectivity
Ethernet, USB
Download measurements and live traces
Upload Lists/Parameters and VSG Patterns
Firmware Updates
Remote Access Tool over the Internet

MA8100A Series NEON Signal Mapper

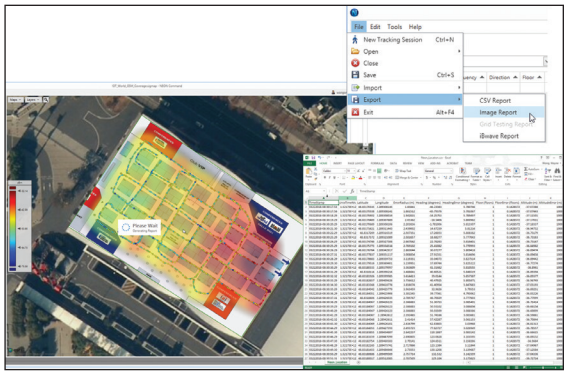
NEON Signal Mapper with Anritsu Handhelds



Support for NFPA Gridding Requirements



Automatically Generate 3D Heatmaps



Automatic Report Generation

MA8100A Series NEON® Signal Mapper*

The most powerful 3D in-building coverage mapping tool specially for Anritsu handheld Spectrum Analyzers

Anritsu's NEON Signal Mapper, a 3D in-building coverage mapping solution, is compatible with all Anritsu handheld instruments with spectrum analyzer mode. Instruments supported include: Spectrum Master™, LMR Master™, Site Master™, BTS Master, Cell Master™, and VNA Master™.

The MA8100A consists of both hardware and software from TRX Systems, a third party partner. The MA8100A consists of a TRX Systems NEON Tracking Unit, NEON Signal Mapper Software for Android devices, and NEON Command Software for a PC.

The NEON Tracking Unit supports collection and processing of sensor data that delivers 3D location information. The Tracking Unit connects to the NEON Signal Mapper application, which is run on an Android device via a Bluetooth connection.

The NEON Signal Mapper application provides an intuitive Android user interface, enabling lightly trained users to map RF signals within buildings. Users can initialize their location, start/stop mapping, and save mapping data to the cloud. RF data is captured by an Anritsu handheld spectrum analyzer product and the data is sent to the Android device via a USB connection.

The NEON Command Software, run on a PC, enables creation and visualization of 3D building maps and provides centralized access to the NEON Cloud Service to access stored maps and measurement data.

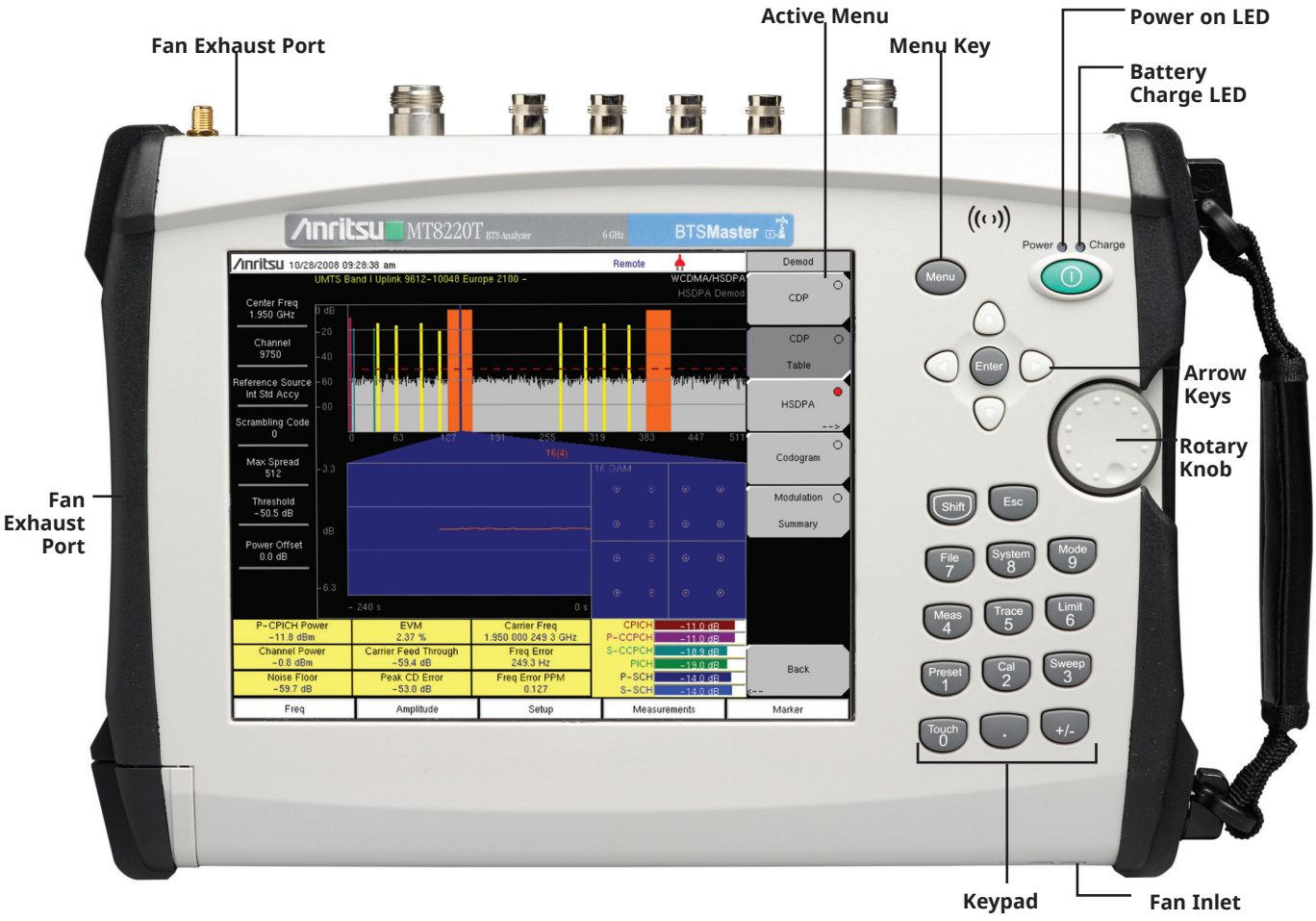
Key Features and Benefits

Integrating NEON's capability to automatically collect geo-referenced test data with Anritsu handheld spectrum analyzer products saves valuable time and money by:

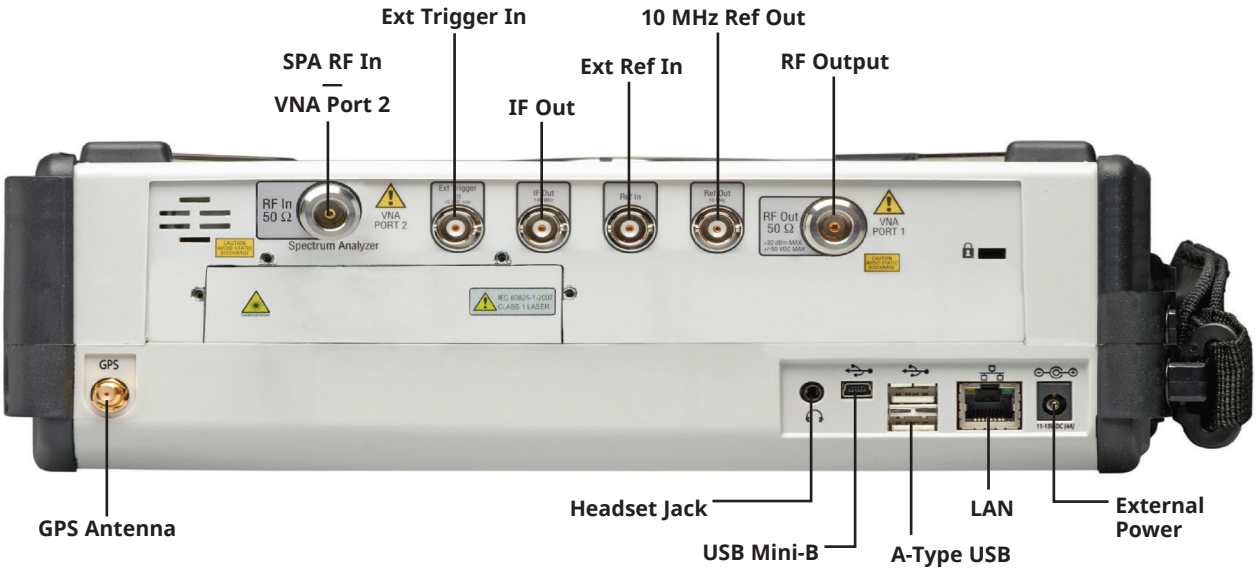
- Eliminating the need to manually perform "check-ins" at each test point by automatically calculating indoor location.
- Providing vastly more data than is possible with manual processes by recording data with every step.
- Removing typical data recording errors caused by "guesstimating" locations in large buildings through automatic indoor location and path estimation.
- Delivering actionable data in areas not easily analyzed such as stairways and elevators by recording and referencing measurements in 3D.
- Enabling quick analysis of signal coverage and faster problem resolution by delivering the industry's only geo-referenced 3D visualization.
- Provides color-graded measurement results in 2D and 3D views. Measurement values can be seen by clicking on each point. A .csv file of all measurements is also provided.

*Android device and PC are NOT included in the MA8100A. Customers must purchase their own Android device and PC.

BTS Master™ MT8220T Base Station Analyzer Features



Handheld Size: 315 mm x 211 mm x 77 mm (12.4 in x 8.3 in x 3.0 in), Lightweight: 4.6 kg (10.2 lb)



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

BTS Master™ MT8220T Ordering Information

Ordering Information

	MT8220T	Description
	400 MHz to 6 GHz	Cable and Antenna Analyzer
	150 kHz to 7.1 GHz	Spectrum Analyzer
	10 MHz to 7.1 GHz	Power Meter
	Options	**Description**
	MT8220T-0010	Bias-Tee
	MT8220T-0019	High-Accuracy Power Meter (requires external power sensor)
	MT8220T-0025	Interference Analyzer
	MT8220T-0027	Channel Scanner
	MT8220T-0089	Zero-Span IF Output
	MT8220T-0431	Coverage Mapping
	MT8220T-0090	Gated Sweep
	MT8220T-0024	I/Q Waveform Capture
	MT8220T-0023	Vector Signal Generator
	MT8220T-0880	GSM/GPRS/EDGE Measurements
	MT8220T-0881	W-CDMA/HSPA+ Measurements
	MT8220T-0882	TD-SCDMA/HSPA+ Measurements
	MT8220T-0883	LTE/LTE-A FDD/TDD Measurements
	MT8220T-0886	LTE 256 QAM Demodulation (Requires Option 883)
	MT8220T-0884	CDMA/EV-DO Measurements
	MT8220T-0885	WiMAX Fixed/Mobile Measurements
	MT8220T-0887	NB-IoT Analyzer
	MT8220T-0098	Standard Calibration to ISO/IEC 17025
	MT8220T-0099	Premium Calibration to ISO/IEC 17025 plus test data

BTS Master™ MT8220T Ordering Information

Standard Accessories (included with instrument)

Part Number	Description
2000-1686-R	Soft Carrying Case
2000-1760-R	GPS Antenna, SMA(m), 25 dB gain, 2.5 VDC to 3.7 VDC
2000-1691-R	Stylus with Coiled Tether
633-75	Rechargeable Li-Ion Battery, 7500 mAh
40-187-R	AC/DC Power Supply
806-141-R	Automotive Power Adapter, 12 VDC, 60 Watts
2000-1371-R	Ethernet Cable, 213 cm (7 ft)
3-2000-1498	USB A-mini B Cable, 305 cm (10 ft)
	Certificate of Calibration

Manuals (soft copy at www.anritsu.com)

Part Number	Description
10580-00366	BTS Master User Guide
10580-00230	Cable and Antenna Analyzer Measurement Guide
10580-00349	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
10580-00415	CPRI RF Analyzer and BBU Emulator Measurement Guide
10580-00434	OBSAI RF Analyzer Measurement Guide
10580-00367	Programming Manual
10580-00368	Maintenance Manual