Anritsu envision : ensure

Product Brochure

Spectrum Master™

High Performance Handheld Spectrum Analyzer

MS2720T

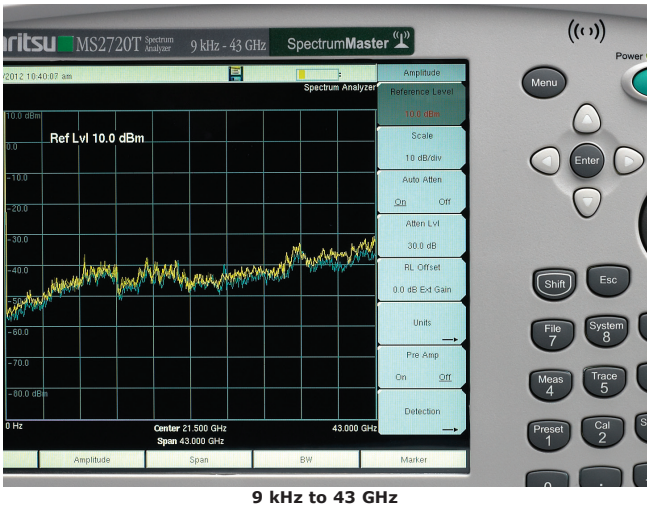
9 kHz to 9 GHz, 13 GHz, 20 GHz, 32 GHz, 43 GHz

Taking the World's First 32 GHz and 43 GHz Handheld Spectrum Analyzers to the Next Level of Performance

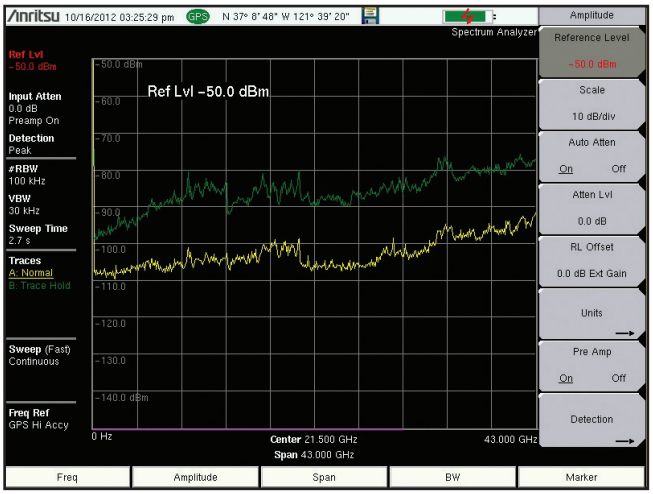
- Tracking Generators that cover 9, 13 and 20 GHz!
- Burst Detect™ included with every instrument
- Preamplifiers up to 43 GHz included in every instrument
- Dynamic Range greater than 106 dB
- Touch Screen User Interface
- Display modes for daylight visibility, color, monochrome and night vision
- 9 GHz model optimized for AM/FM broadcast proofing
- Three year warranty

Spectrum Master™ MS2720T Spectrum Analyzer Introduction

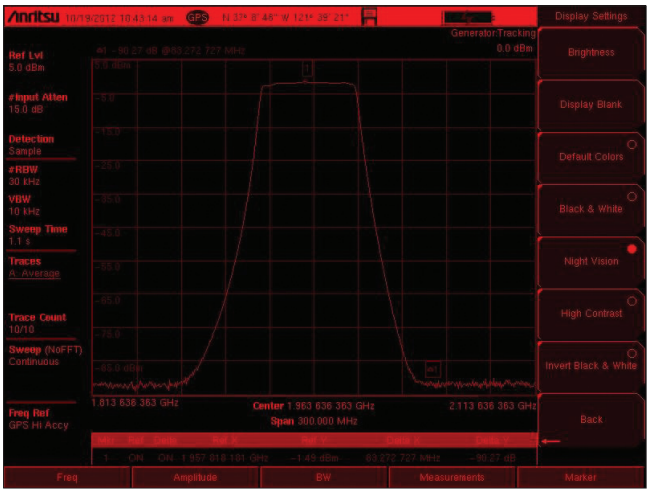
Overview



9 kHz to 43 GHz
MS2720T Option 0743



Broadband Preamplifier from 0 to 43 GHz



Tracking generator in night-vision display mode

Introduction
Operating convenience is of paramount importance when equipment is used in the field.

To achieve greater operating convenience several parameters are tied to related parameters. The input attenuation value by default is tied to the reference level, reducing the number of parameters a field technician may have to set. Also the RBW/VBW ratio and the span/RBW ratio default to values that meet most user's needs but can be changed by users to meet specific needs, further easing the technician's burden and reducing the chances of errors.

Measurement flexibility is important for lab use. Resolution bandwidth and video bandwidth can be independently set to meet a user's measurement needs. In addition the input attenuator value can be set by the user and the preamplifier can be turned on or off as needed.

For maximum flexibility, sweeping can be set to free run, or to do a single sweep. In zero span, the sweep can free run, be set to trigger when a signal meets or exceeds a certain power level or it can be externally triggered. The span can be set anywhere from 10 Hz to 9, 13, 20, 32 or 43 GHz in addition to zero span.

Continuous frequency coverage from 9 kHz to 43 GHz with option 743 gives the wireless professional the performance you need for the most demanding measurements.

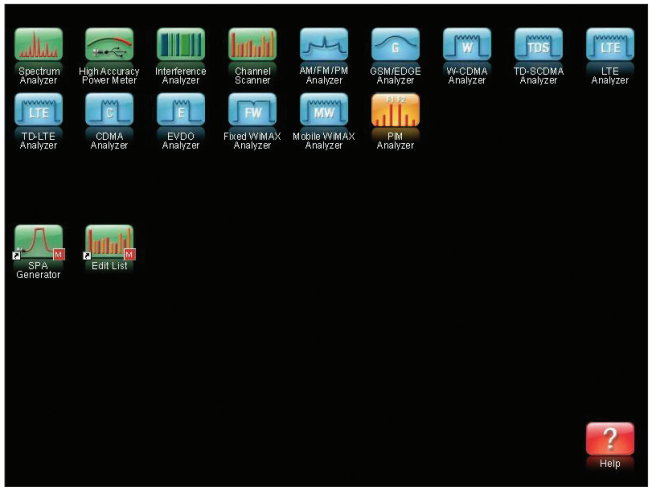
Whether your need is for spectrum monitoring, hidden signal detection, RF and microwave signal measurements, microwave backhaul testing or cellular signal measurements, the Spectrum Master family gives you the tools you need to make the job easier and more productive. Improved phase noise and faster sweep speeds earn this instrument a home on the lab bench for general purpose spectrum analyzer measurements.

The built-in AM/FM/SSB demodulator simplifies the job of identifying interfering signals.

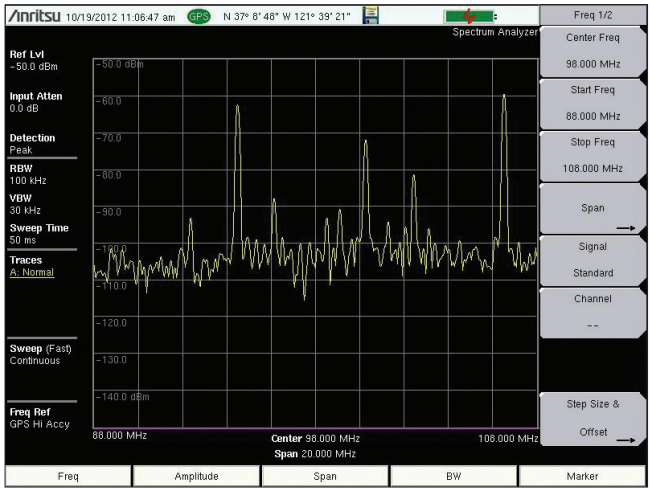
Tracking generator options covering 9 kHz to 9, 13 and 20 GHz are available.

- Broadband preamplifiers over the whole frequency range for increased sensitivity of 14 dB
- Four Sweep Modes – Fast, Performance, No FFT and Burst Detect™
- Resolution Bandwidths from 1 Hz to 10 MHz
- New triggering choices including hysteresis, hold-off, and delay
- More zero-span capabilities including 10 MHz RBW & VBW
- Enhanced Spectrum Analyzer touch screen GUI including a large marker display choice
- Choice of display options for readability – normal, black and white, night vision, high contrast
- On-screen Interference Mapping as part of the Interference Analysis option
- LTE Measurements up to 20 MHz Bandwidth
- 30 MHz wide Zero-Span IF Output at 140 MHz for external demodulation or analysis of virtually any wideband signal

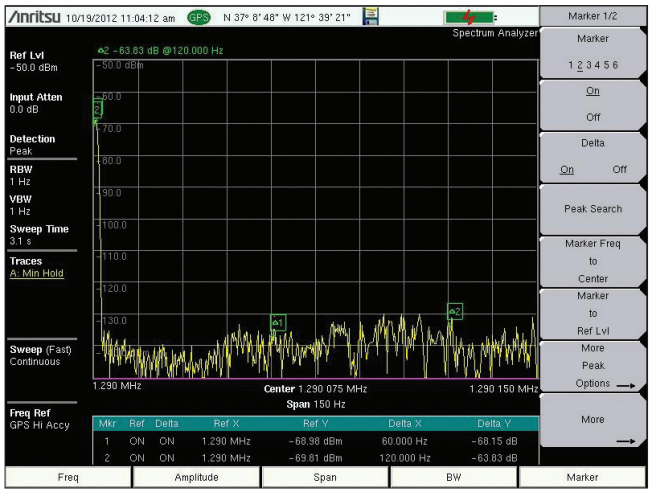
Overview (continued)



The MS2720T has a touch menu with user-defined shortcuts



The MS2720T is Anritsu's fastest sweeping handheld spectrum analyzer



Low Phase Noise and wide dynamic range leaves no place to hide a transmitter

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

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

Fast Sweep

The new fast sweep mode has the paradigm-busting capability to set resolution bandwidth from 10 MHz to 30 kHz with very little effect on sweep speed. The sweep speed with a 30 kHz bandwidth is about the same as it is when using a 10 MHz RBW. You can now select your sensitivity without the need for long sweep times.

Burst Detect

Being able to reliably detect bursty signals is vital in the efforts to find intermittent or bursty emitters. Using burst detect, emitters as narrow as 200 µs can be captured the first time, every time.

Touch Screen

The MS2720T includes a touch screen user interface. On the touch screen menu the user can add shortcut buttons for any menu button or file on the instrument. Using this capability, a setup file can be recalled with a single press of the touch screen.

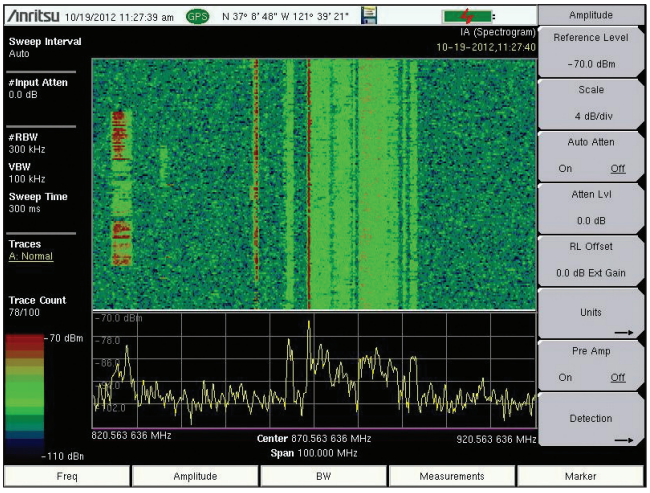
Tracking Generators

The 9 GHz, 13 GHz and 20 GHz instruments can be equipped with a tracking generator that covers 9 kHz to the top frequencies of the instrument. Power output is leveled and adjustable from 0 dBm to –40 dBm in 0.1 dB steps over the full temperature range of the instrument: –10 °C to +55 °C.

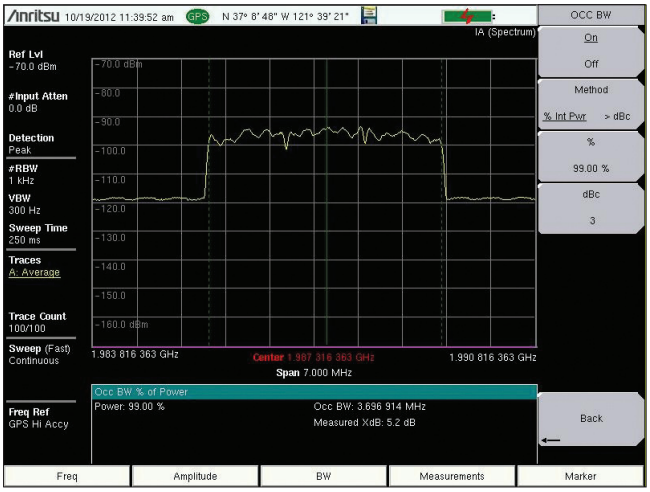
Finding Signals

Hidden transmitters can be challenging to find, especially if they are operating at frequencies very near a high power transmitter. With Spectrum Master you get the powerful combination of low phase noise, wide RBW range down to 1 Hz, and wide dynamic range. Even if a transmitter is hidden within 10 Hz of a strong AM carrier, it can be seen with Spectrum Master. The trace display choices and detector choices combine to make it easy to detect intermittent signals in the presence of steady signals, and burst detect makes direction finding bursty signals easier than it has ever been.

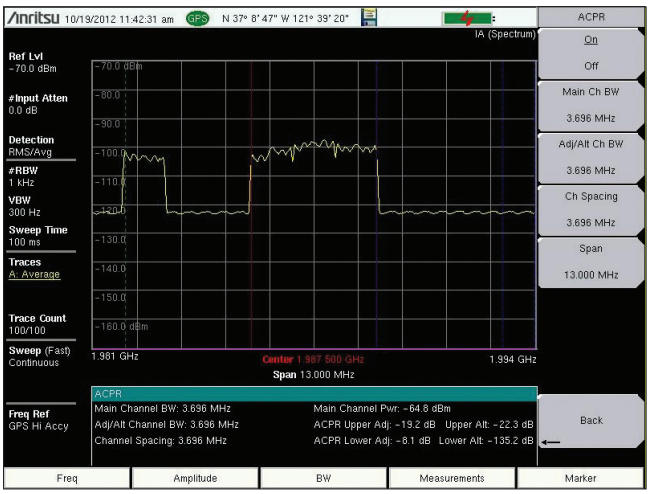
Overview (continued)



Spectrogram in Interference Analysis option 25



Built-in Occupied Bandwidth measurement



Adjacent Channel Power Ratio (ACPR) is also built-in

Interference Analysis

Interference is an ever-growing concern for anyone who transmits a signal over the air. Spectrum Master is ideally suited for tracking down interference with its great lineup of interference measuring capability. Spectrogram shows you what is happening over time so spotting intermittent interferers becomes easy. Signal strength measurement, coupled with a directional antenna, makes finding rogue transmitters much easier. You can even get an audio indicator of the strength of the signal so you can find the transmitter without having to watch the display.

Storage

Measurements, limit lines, JPEG screen shots and setup files can be stored internally or to an external USB memory. There is sufficient internal memory to store thousands of spectrum analyzer traces. By using external USB memory, tens of thousands of measurements, limit lines and setup files or hundreds of JPEG screen shots can be saved and easily transferred onto a computer.

Smart Measurements

The Spectrum Master family has dedicated routines for one-button measurements of field strength, channel power, occupied bandwidth, Adjacent Channel Power Ratio (ACPR) C/I, Spectrum Emission Mask, and Spurious Emissions. These are increasingly critical measurements for today's wireless communication systems. The simple interface for these complex measurements significantly reduces test time and increases analyzer usability.

Field Strength

By using an antenna for which antenna factors are known, the instrument calculates the field strength either in dBm/m^2, dBV/m, dBmV/m, dBµV/m, Volts/meter, $Watts/m^2$, $Watts/cm^2$, dbW/m^2, A/m, or dbA/m.

Occupied Bandwidth

This measurement determines the amount of spectrum used by a modulated signal. You can choose between two different methods of determining bandwidth: the percent of power method or the "x" dB down method, where "x" can be from 1 dB to 100 dB down the skirts of the signal.

Channel Power

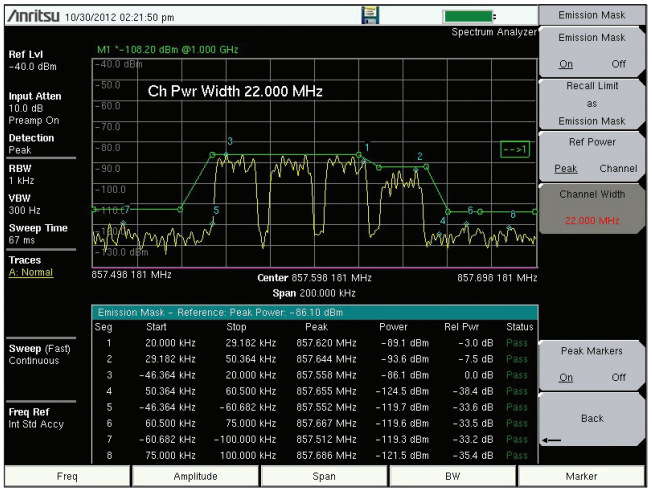
This smart measurement delivers the total power integrated across a specified channel bandwidth. The user can enter the center frequency and the channel width or it can be automatically set by selecting a signal standard and channel number in the frequency menu.

Adjacent Channel Power Ratio

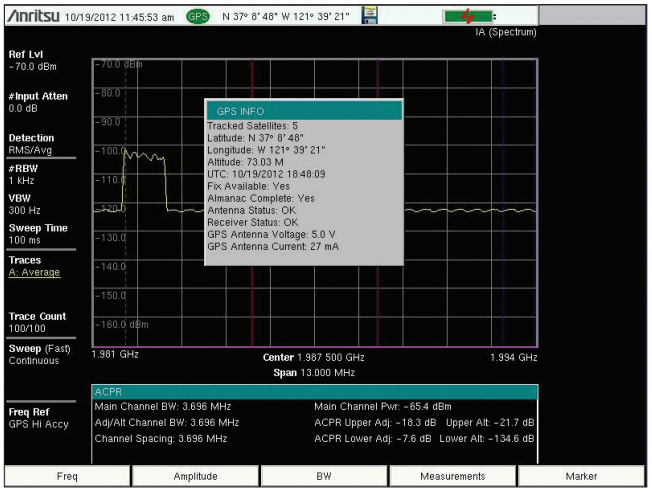
A common transmitter measurement is that of adjacent channel leakage power. This is the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel, and is used to replace the traditional two-tone intermodulation distortion (IMD) test for system non-linear behavior.

The result of an ACPR measurement is expressed as a power ratio between the main and adjacent or alternate channels. In order to calculate the upper and lower adjacent channel values, the Spectrum Master allows the adjustment of four parameters to meet specific measurement needs: main channel center frequency, measurement channel bandwidth, adjacent channel bandwidth and channel spacing. When an air interface standard is specified in the Spectrum Master, all these values are automatically set to the normal values for that standard.

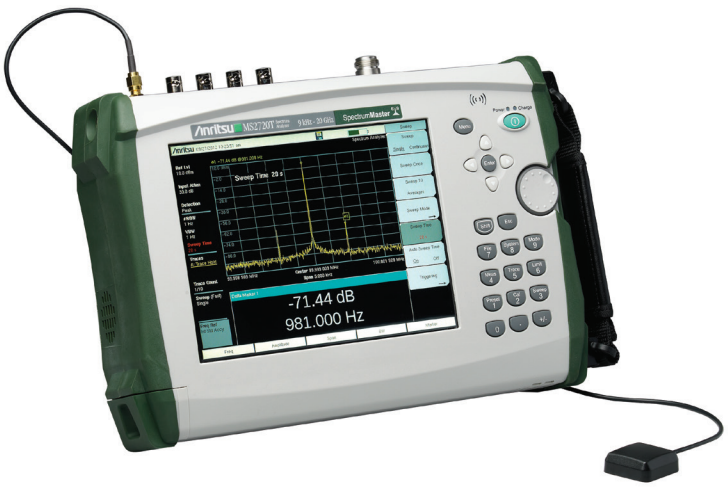
Overview (continued)



Emission Mask measurement shows pass/fail for every segment



GPS status indicator taken indoors



Location and time stamp measurements with GPS, option 31

Carrier to Interference (C/I) Measurement

As more 802.11 access points are installed, there is an increasing level of interference in the 2.4 GHz and 5.8 GHz bands occupied by this service and other devices such as cordless telephones. This measurement capability makes it simple for an access point installer to determine if the level of interference is sufficient to cause difficulty for users in the intended service area, and can show the need to change to another access channel. The wide frequency coverage of the Spectrum Master makes this the only spectrum analyzer you need to install and maintain a wide variety of 802.11 wireless networks.

Emission Mask

A limit line can be used as a pass/fail emission mask. The limit line is automatically adjusted up or down, based either on the peak amplitude, or the channel power. A table shows for each segment of the emission mask if the signal passed or failed for that segment. Peak markers can be turned on to automatically show the highest signal in each segment of the mask.

Spurious Emissions

For measuring spurious emissions over a wide frequency range, up to 32 segments can be created. Each segment can have different frequency, RBW, VBW, and Detection settings. A sloped limit line is available for each segment. The instrument can automatically save the results of each segment, either as a simple pass/fail result, or with complete trace data and a screen-shot image.

AM/FM/SSB Demodulation

AM, narrowband FM, 25 kHz, 12.5 kHz and 6.25 kHz, wideband FM and single sideband (both upper and lower) can be demodulated to audio, all with proper de-emphasis. The demodulated audio can be heard through the built-in speaker or through a headset plugged into the 3.5 mm headset jack. The signal to be demodulated can be anywhere in the frequency range of the instrument and does not have to be within the current sweep range of the instrument, nor is it tied to a marker. The demodulation bandwidth is automatically set for each modulation format to assure ease of operation. There is no need to fuss with RBW and video filters to get proper demodulation.

GPS (Option 31)

With GPS Option 31 the frequency accuracy is 25 ppb (parts per billion) after achieving a GPS lock. After the GPS antenna is disconnected, accuracy is maintained at 50 ppb or better for up to three days. Also all saved measurements are GPS tagged for exporting to maps when the instrument has a GPS fix. Three GPS antennas are available, 2000-1528-R with a 15 foot cable, 2000-1652-R with a 1 foot cable, and 2000-1760-R that can be screwed directly onto the instrument. Order the antenna or antennas that meet your needs.

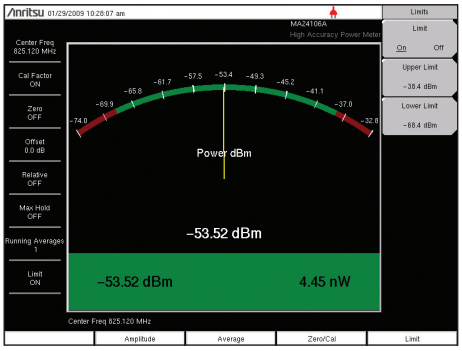
IQ Capture (Option 24)

Option 24, IQ Waveform Capture captures the raw data for the user-selected center frequency and for the duration of the user-selected capture length.

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

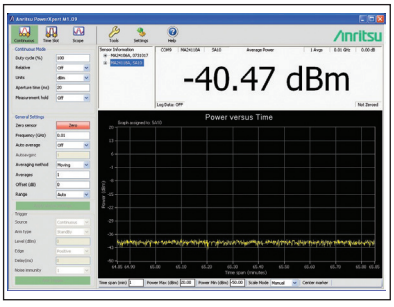
Power Meter

High Accuracy Power Meter (Option 0019)



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 Spectrum Master offers 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 50 GHz
- Power ranges:
  -60 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 4G wireless networks.

The power sensor easily connects to the Spectrum 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

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

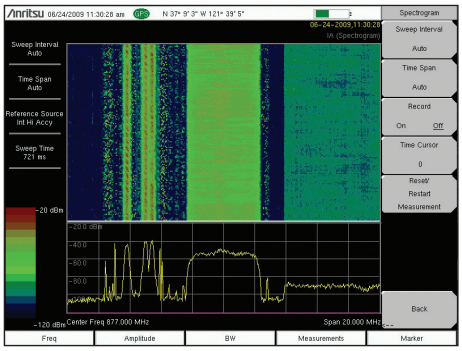
MA24340A
Microwave CW USB Power Sensor
10 MHz to 40 GHz, +20 dBm

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

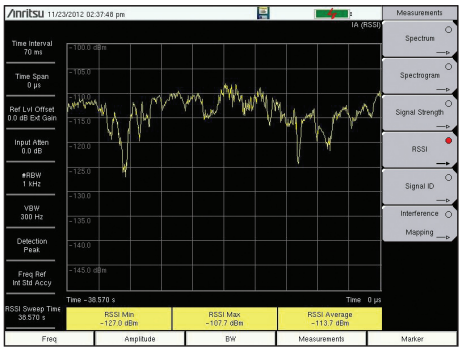
MA25100A
RF Power Indicator

Spectrum Master™ MS2720T Spectrum Analyzer Features

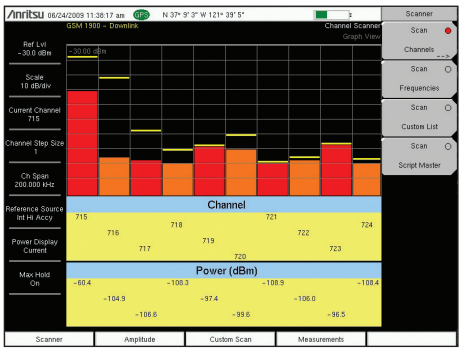
Interference Analyzer (Opton 0025) Channel Scanner (Option 0027)



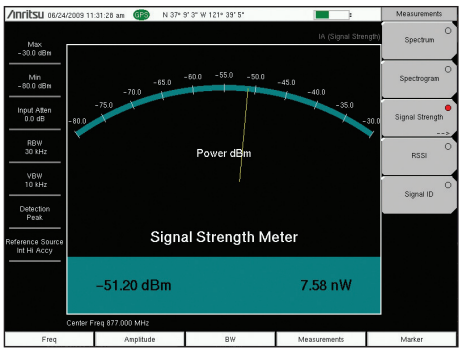
Spectrogram
For identifying intermittent interference and tracking signal levels over time for up to 1 week with an external USB flash drive.



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 Spectrum 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 Spectrum 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)

Interference Mapping

Once interference has been identified, its location can be mapped with the help of the MA2700A Interference Hunter™ (see separate technical data sheet) and suitable directional antenna. Maps can be downloaded to the Spectrum Master 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 MA2700A Handheld Interference Hunter

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

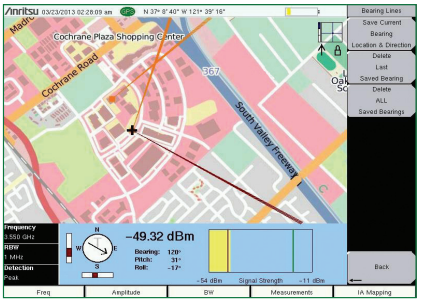
Channel Scanner

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

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

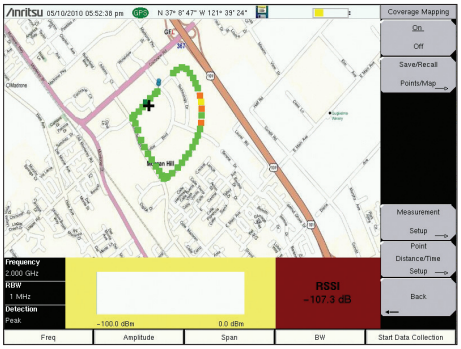
Interference Hunting
The Spectrum Master can be used with the MA2700A Interference Hunter and directional antennas to track down sources of interference.



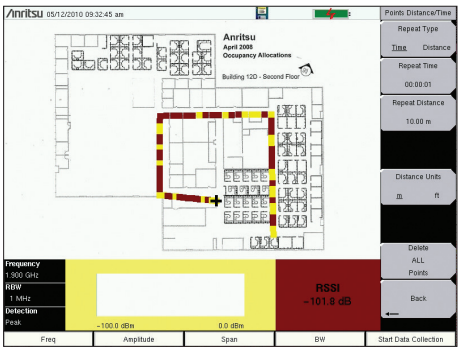
Interference Mapping
Maps can be downloaded to the Spectrum Master to help identify sources of interfering signals. Maps can be panned and zoomed to further aid the hunt for interference.

Spectrum Master™ MS2720T Spectrum Analyzer Features

Coverage Mapping (Option 0431)



Coverage Mapping outdoors



Coverage Mapping indoors

Measurement results saved in KML format and displayed using Google Earth™

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 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 Map Master Anritsu easyMap Tools, the instrument displays maps, the location of the measurement, and a 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

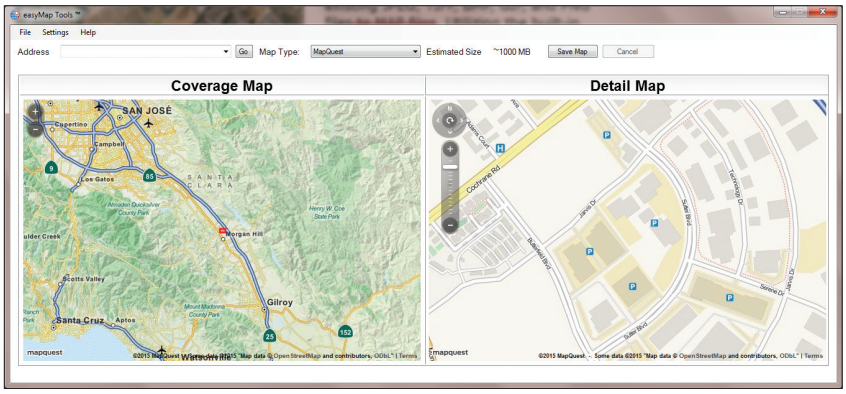
When there is no GPS signal valid, the Spectrum Master uses a start-walk-stop approach to record RSSI and ACPR levels. You can set the update rate, start location, and end location and the interpolated points will be displayed on the map.

Export KML Files

Save files as KML tab-delimited 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 PC compatible with the Spectrum Master. Maps are created by typing in the address or by converting existing JPEG, TIFF, BMP, GIF, and PNG 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. The easyMap program also includes a GPS editor for inputting latitude and longitude information of maps from different formats.



easyMap Tools

Gated Sweep (Option 0090)

Coverage Mapping Measurements

Spectrum Analyzer Mode
- ACPR
- RSSI

Gated Sweep

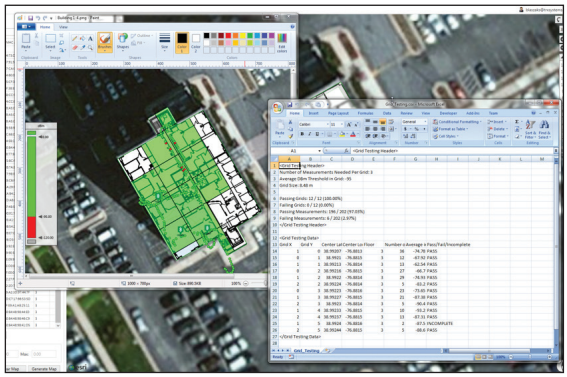
Mode
- Spectrum Analyzer, Sweep

Trigger
- External TTL, IF Power

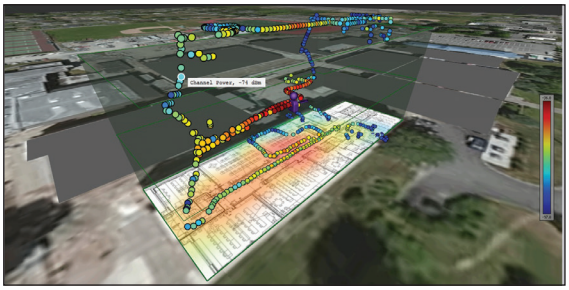
Setup
- Gated Sweep (On/Off) IF Trigger Level
- Gate Polarity (Rising, Falling)
- Gate Delay (0 ms to 65 ms typical)
- Gate Length (1 µs to 65 ms typical)
- Gate View Settings

MA8100A Series TRX NEON Signal Mapper

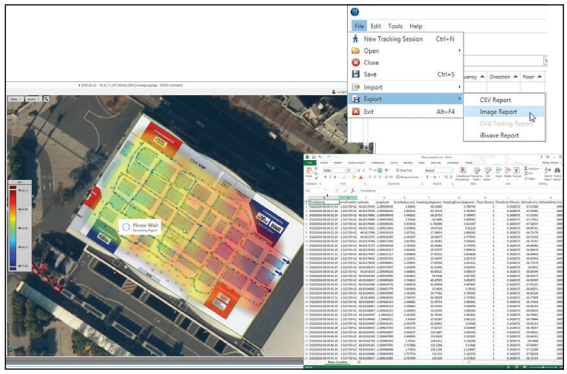
NEON Signal Mapping with Anritsu Handhelds



Support for NFPA Gridding Requirements



Automatically generate 3-D Heatmaps



Automatic Report Generation

MA8100A Series TRX NEON® Signal Mapper*

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

Anritsu's TRX 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-xxx consists of both hardware and software from TRX Systems, a 3rd party partner. The MA8100A-xxx consists of a TRX Systems NEON Tracking Unit, NEON Signal Mapper Software for Android devices, and NEON Command Software for a PC.

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

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

Key Features and Benefits

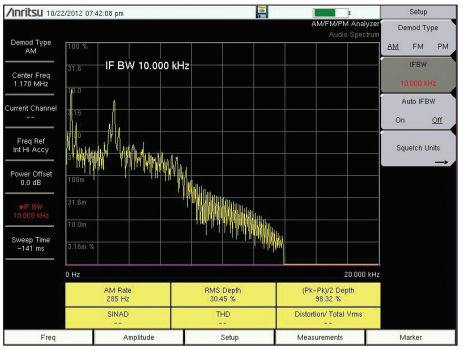
Integrating NEON's capability to automatically collect geo-referenced test data with Anritsu handheld spectrum analyzer products saves valuable time and money by:

- 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.

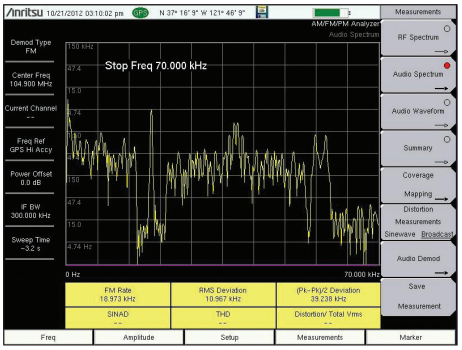
*Android device and PC are NOT included in the MA8100A-xxx. Customers must purchase their own Android device and PC.

AM/FM/PM Analyzer (Option 0509)

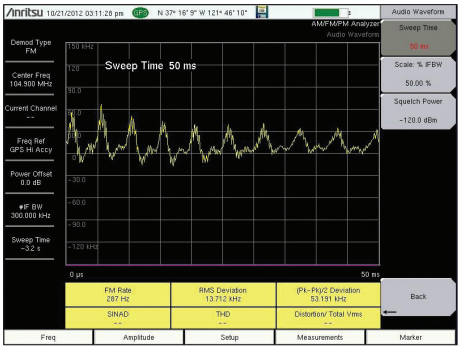
Secure Data Operation (option 0007)



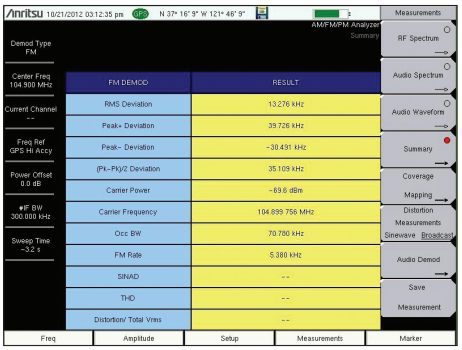
AM audio spectrum



FM with sub carriers



Demodulated audio waveform



Modulation Summary

AM/FM/PM Analyzer

Spectrum Master comes with AM/FM/SSB audio demodulation as standard. By adding Option 509, the instrument becomes capable of measuring, analyzing, and displaying key modulation parameters of the RF Spectrum, Audio Spectrum, Audio Waveform and even includes a demodulation summary. Amplitude Modulation (AM), Frequency Modulation (FM), and Phase Modulation (PM) are fully supported.

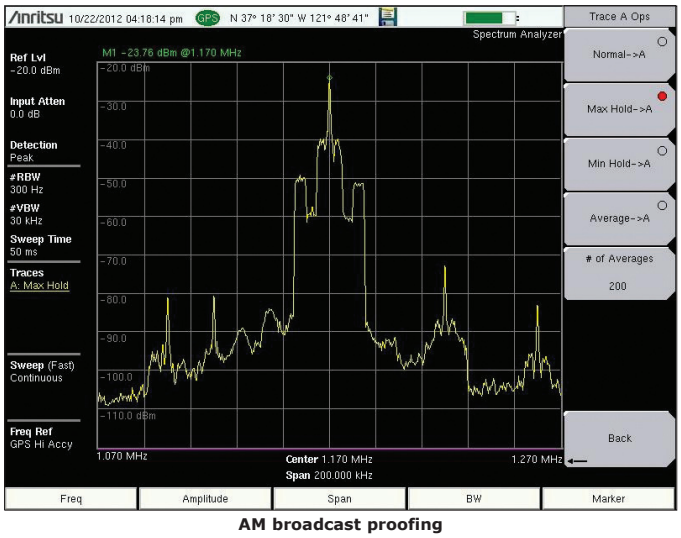
- The **RF Spectrum View** displays the spectrum with carrier power, frequency, and occupied BW.
- **Audio Spectrum** shows the demodulated audio spectrum along with the Rate, RMS deviation, Pk-Pk/2 deviation, SINAD, Total Harmonic Distortion (THD), and Distortion/ Total.
- An **Audio Waveform** oscilloscope display is included with all three modulation formats that shows the time-domain demodulated waveform.
- The **Modulation Summary** display shows all of the RF and modulation parameters for each modulation format on one screen.
- **Zero Span IF Output** (Option 89) provides an IF Output signal centered at 140 MHz with bandwidth up to 32 MHz.

Secure Data Operation (Option 7)

For highly secure data handling requirements, this software option prevents the storing of measurement setup or data information onto any internal file storage location. Instead, setup and measurement information is stored only to the external USB memory location. A simple factory default reset prepares the Spectrum Master for transportation while the USB memory remains behind in the secure environment. The Spectrum Master cannot be switched between secure and non-secure operation by the user once configured for secure data operation.

Light Weight

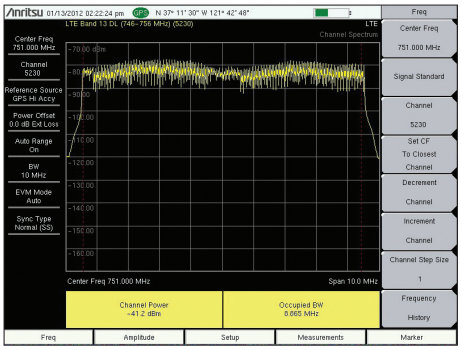
Weighing about 4.4 lg (9.8 lb) fully loaded, including a Li-Ion battery, this fully functional handheld spectrum analyzer is light enough to take anywhere, including up a tower.



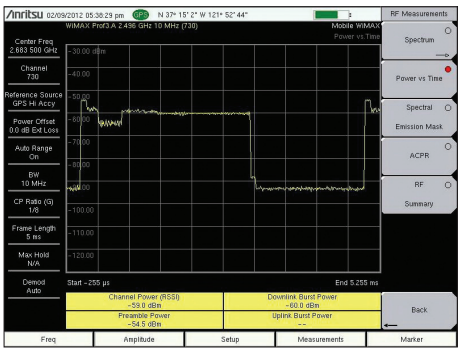
AM broadcast proofing

Spectrum Master™ MS2720T Spectrum Analyzer Features

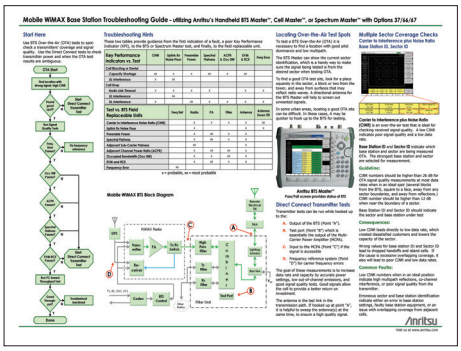
Introduction to Wireless Measurements



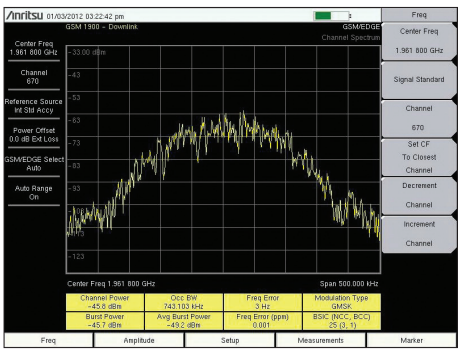
LTE signal



WiMAX signal



Troubleshooting guide



GSM signal

Wireless Measurements

The Spectrum Master features Wireless Measurements for the major wireless standards around the world. The Wireless Measurements are designed to test and verify the following base station transmitter performance:

- RF Quality
- Modulation Quality
- Downlink Coverage

The goal of these tests is 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 Spectrum 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 MS2720T 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/TD-LTE Base Stations
- GSM/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 Station

Signal Analyzers

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

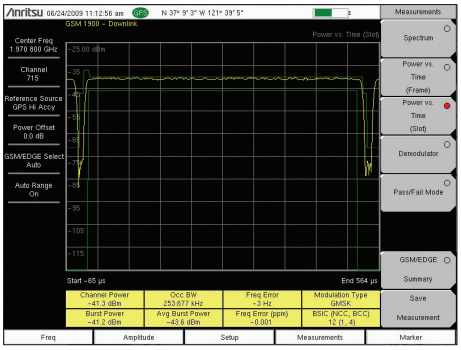
Typical Signal Analyzer Measurements

RF Measurements
Modulation Quality Measurements
Over-the-Air Measurements

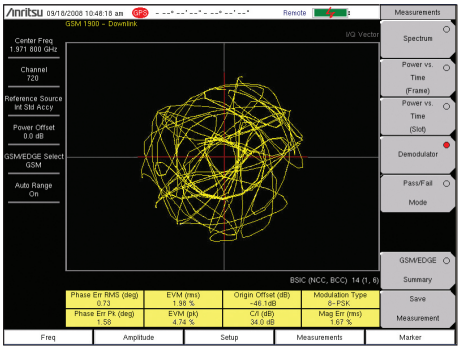
Signal Analyzer Features

Measurement Summary Displays
Pass/Fail Limit Testing

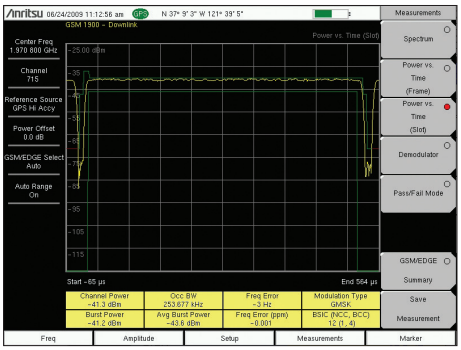
GSM/GPRS/EDGE Measurements (Option 880)



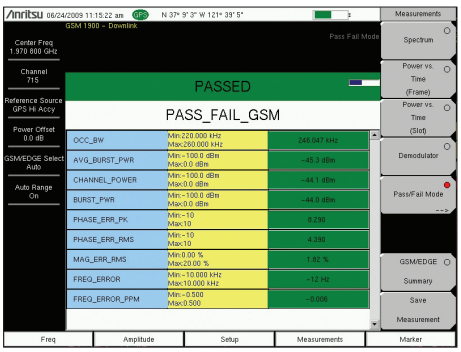
RF Measurement – Occupied Bandwidth
Excessive occupied bandwidth can create interference with adjacent channels or be a sign of poor signal quality, leading to dropped calls.



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 Spectrum 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 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 set up 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)

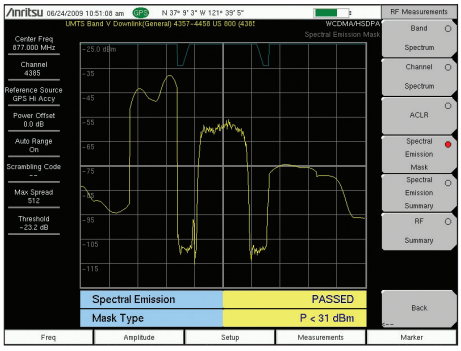
Multi-channel Spectrum

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

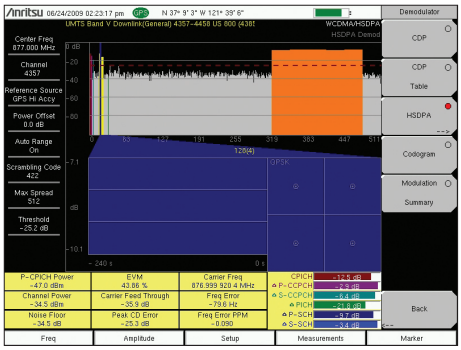
Demodulation

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

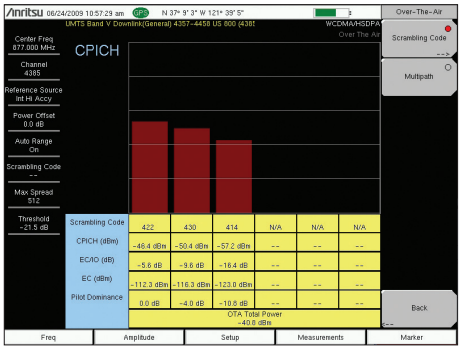
W-CDMA/HSPA+ Measurements (Option 881)



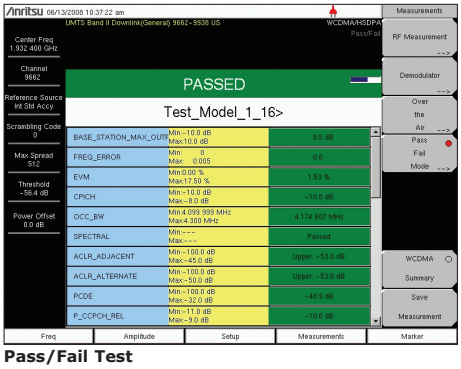
RF Measurements – Spectral Emissions Mask
The 3GPP spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



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/HSPA+ Signal Analyzers

The Spectrum Master features three W-CDMA/HSPA+ measurement types:

- 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 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 Spectrum 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 Spectrum 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.

EMF Test

When used in combination with option 444 (Electromagnetic Field Test) and an appropriate Anritsu isotropic antenna, true calibrated isotropic field strength measurements are possible. These can also be extrapolated to full-power operation from a CPICH measurement, if the correct factor is known.

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

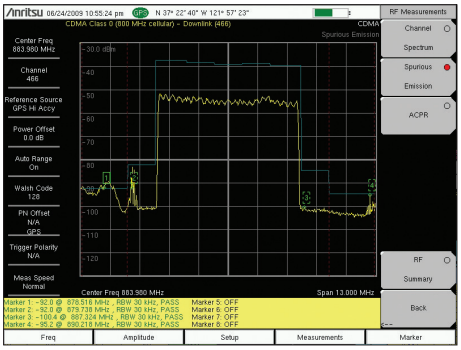
Over-the-Air (OTA) Measurements

Scrambling Code Scanner (Six)
- Scrambling Codes
- CPICH
- E_c/I_o
- E_c
- Pilot Dominance
- OTA Total Power

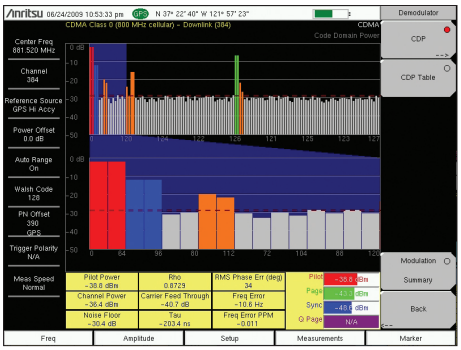
Multipath Scanner (Six)
- Six Multipaths
- Tau
- Distance
- RSCP
- Relative Power
- Multipath Power

EMF Measurements (with option 444)
- P-CPICH signals are measured and displayed for each Scrambling Code measured
  - Actual
  - Total Max
  - Avg/Meas
  - Total Avg
  - Total Min
  - Actual/Field Strength
  - Max/Field Strength
  - Avg/Field Strength
  - Min/Field Strength
  - Total Avg/Field Strength
- Total for all Scrambling Codes
- Field Strength (total power)

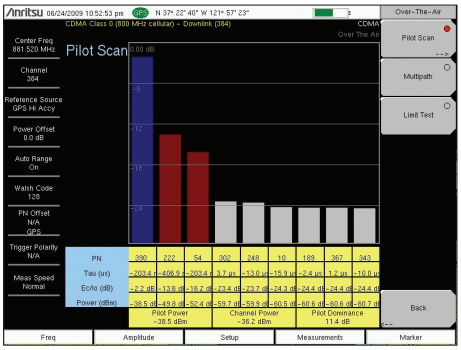
TD-SCDMA/HSPA+ Measurements (Option 882)



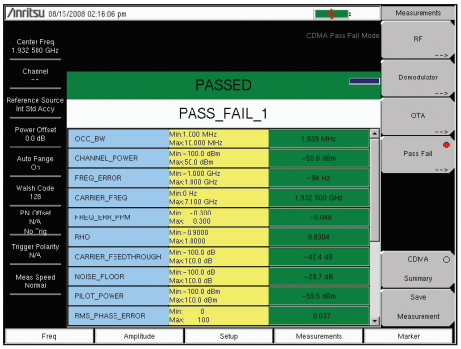
RF Measurements – Spectral Emissions Mask
The 3GPP spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



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 leads to inconsistent network behavior.

TD-SCDMA/HSPA+ Measurements

The Spectrum Master features three TD-SCDMA/HSPA+ measurement types:

- 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) 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
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
- Seven 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 (option 31 GPS required)
- 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

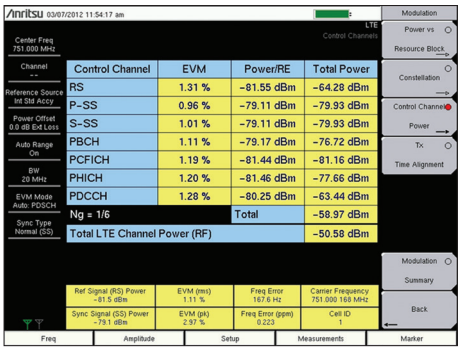
Tau Scan (Six)
- Sync-DL#
- Tau
- E_c/I_o
- DwPTS Power
- Pilot Dominance

Record
Run/Hold

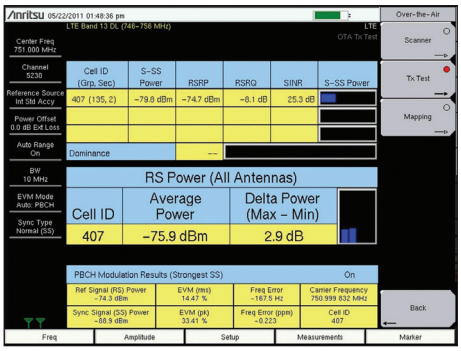
Pass/Fail (User Editable)
Pass Fail All
Pass/Fail RF
Pass Fail Demod
Measurements
- Occupied Bandwidth
- Channel Power
- Channel Power RCC
- On/Off Ratio
- Peak-to-Average Ratio
- Frequency Error
- EVM
- Peak EVM
- Peak Code Domain Error
- Tau
- Carrier Feedthrough
- Noise Floor

LTE FDD/TDD Measurements (Option 883 and 886)

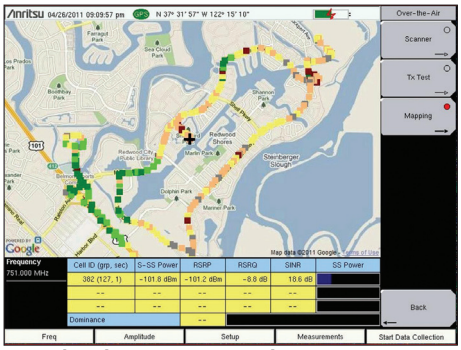
Modulation Quality – Power vs. Resource Block
A high utilization of the Resource Blocks would indicate a cell site in nearing overload and it may be appropriate to start planning for additional capacity.



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 easyMap Tools™ import map area on instrument screen to drive test downlink coverage of S-SS Power, RSRP, RSRQ, or SINR.

LTE FDD/TDD Signal Measurements

The Spectrum Master features three LTE measurement types:

- 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 Spectrum 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
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

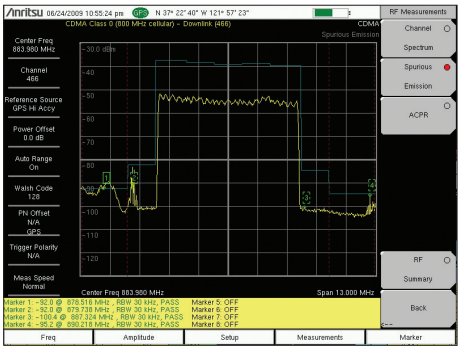
Mapping (requires option 31 GPS)
- On-screen
  - S-SS, RSRP, RSRQ, or SINR

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

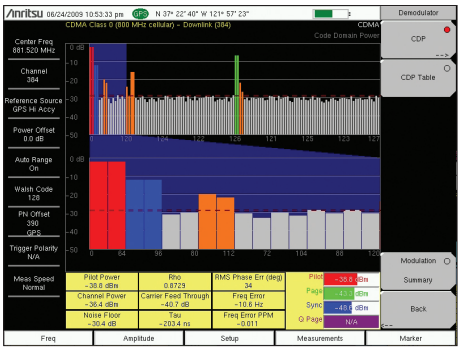
Pass/Fail (User Editable)
View Pass/Fail Limits
- All, RF, Modulation

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)

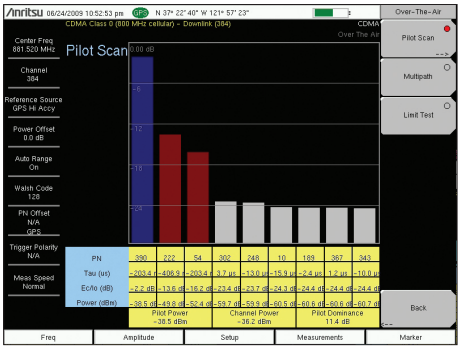
CDMA/EV-DO Measurements (Option 884)



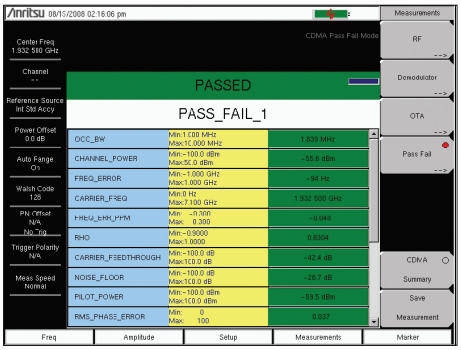
RF Measurements – Spectral Emissions Mask
The 3GPP2 spectral emission mask is displayed. Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.



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.



Over-the-Air Measurements – Pilot Scan
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, leads to inconsistent network behavior.

CDMA Measurements

The Spectrum Master features three CDMA measurement types:

- 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
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

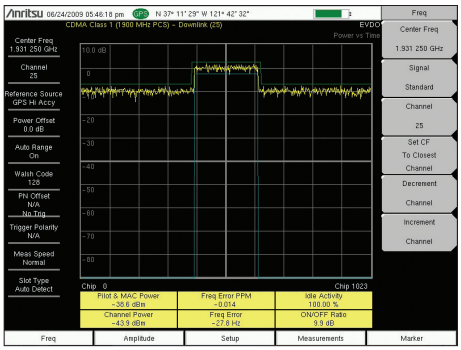
Over-the-Air (OTA) Measurements
Pilot Scanner (Nine)
- PN
- E_c/I_o
- Tau
- Pilot Power
- Channel Power
- Pilot Dominance

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

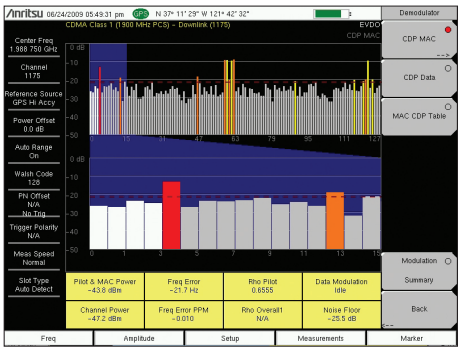
Limit Test – 10 Tests Averaged
- Rho
- Adjusted Rho
- Multipath
- Pilot Dominance
- Pilot Power
- Pass/Fail Status

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

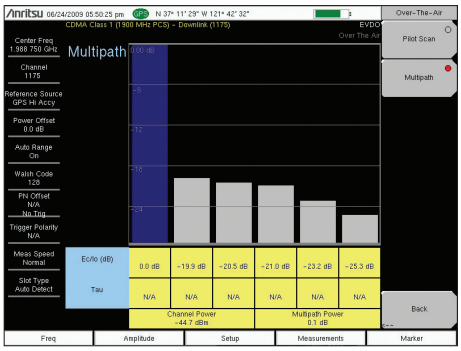
CDMA/EV-DO Measurements (Option 884)



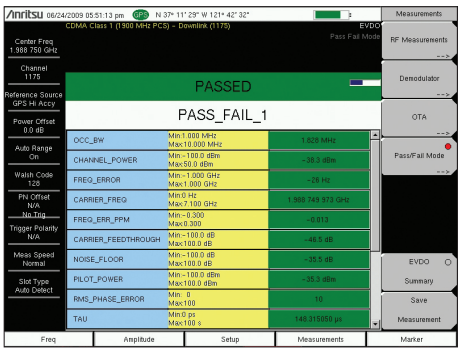
RF Measurements – Pilot and MAC Power
High values will create pilot pollution. High or low values will cause dead spots/dropped calls and cell loading imbalances/blocked calls.



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 Measurements

The Spectrum 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
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

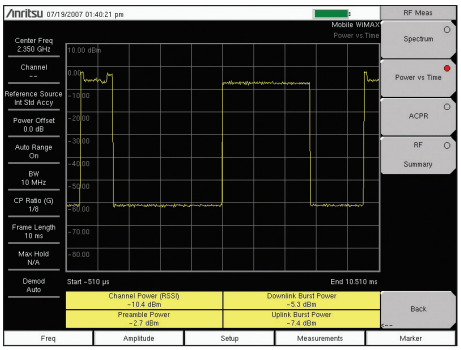
Modulation Summary

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

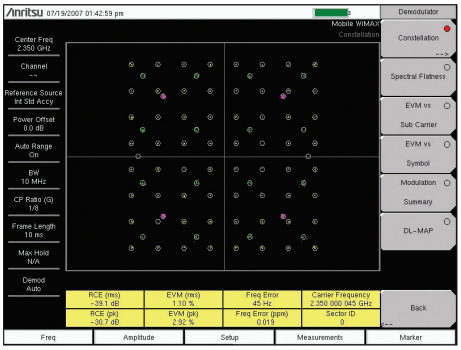
Mulitpath Scanner (Six)
- E_c/I_o
- Tau
- Channel Power
- Multipath Power

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

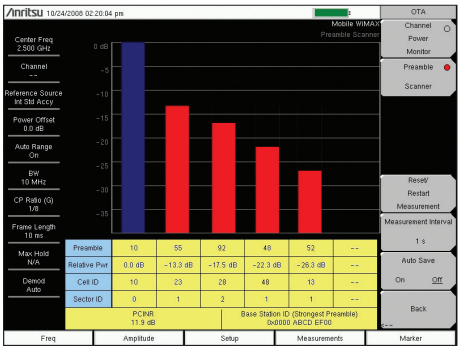
WiMAX Fixed/Mobile Measurements (Option 885)



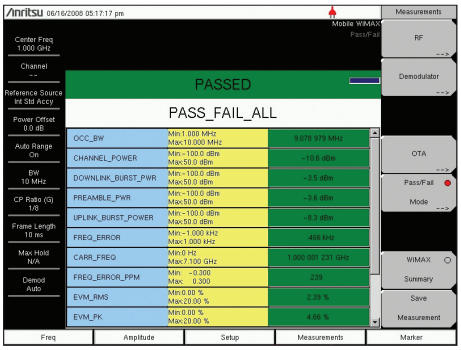
RF Measurement – Preamble Power
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



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.

WiMAX Fixed/Mobile Measurements

The Spectrum 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 (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.

Error Vector Magnitude (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 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 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

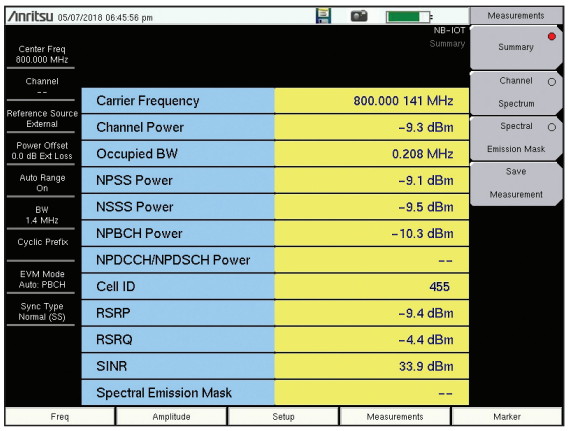
Over-the-Air (OTA) (Mobile)
Channel Power Monitor
Preamble Scanner (Six)
- Preamble
- Relative Power
- Cell ID
- Sector ID
- PCINR

Dominant Preamble
- Base Station ID

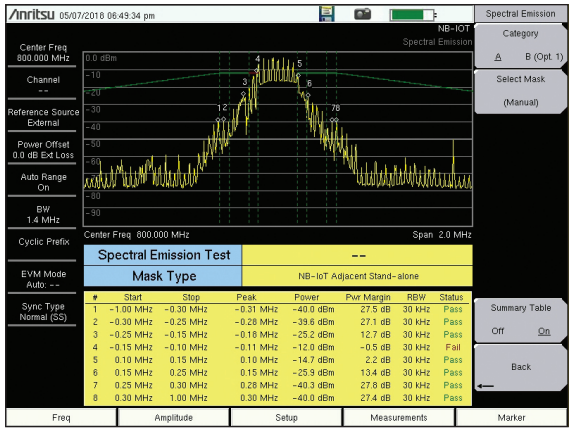
Auto-Save with GPS Tagging and Logging

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)

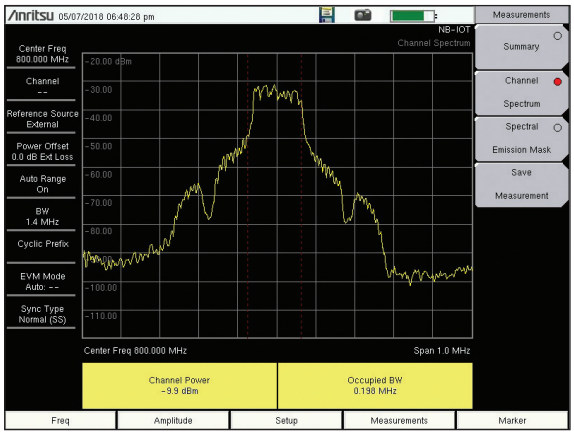
NB-IoT Analyzer (Option 887)



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 field installation and maintenance teams to verify that NB-IoT services are deployed and are working as intended.

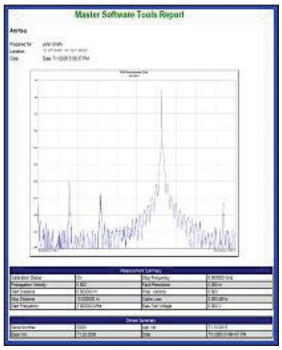
Key Features and Benefits

The NB-IoT analyzer, Option 887 has the following features:

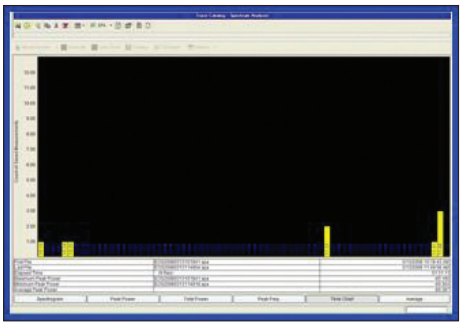
- Summary screen showing the following RF measurements:
  - Carrier Frequency
  - Channel Power
  - Occupied BW
  - NPSS Power
  - NSSS Power
  - NPBCH Power
  - NPDCH/NPDSCH Power
  - Cell ID
  - RSRP
  - RSRQ
  - SINR
  - Spectral Emission Mask (Pass/Fail)
- Channel Spectrum
- Spectral Emission Mask

Spectrum Master™ MS2720T Spectrum Analyzer Features

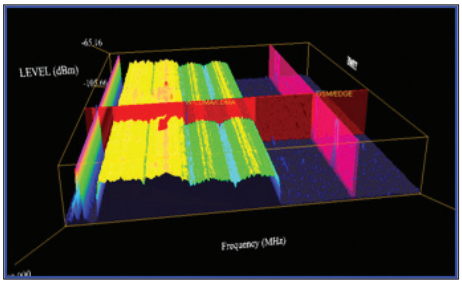
Master Software Tools (for your PC)



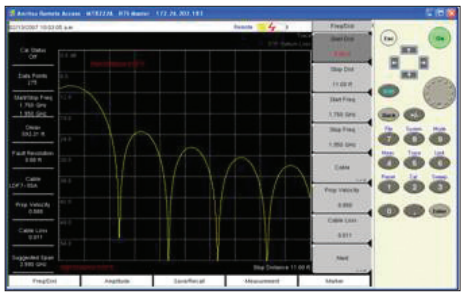
Report Generation
Create reports with company logo, GPS tagging information, calibration status, and serial number of the instrument for complete reporting.



Histogram
Once certain frequencies have been identified, the data can be filtered and displayed in a histogram with the number of occurrences and time of day.



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.

Master Software Tools

Master Software Tools (MST) is a powerful PC software post-processing tool designed to enhance the productivity of technicians in report generation, 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 Spectrum Master. This feature is available for GSM, W-CDMA/HSPA+ and Channel Scanner applications.

In W-CDMA/HSPA+ and GSM the user can include instructions in the form of pictures and text to help the technicians configure their setup prior to the test. One test can be configured to run across both W-CDMA and GSM modes.

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

Database Management
Full Trace Retrieval
Trace Catalog
Trace Rename Utility
Group Edit
Trace Editor
DAT File Converter

Data Analysis
Trace Math and Smoothing
Data Converter
Measurement Calculator

Report Generation
Report Generator
Edit Graph
Report Format
Export Measurements
Notes

Mapping (GPS Required)
Spectrum Analyzer Mode
Mobile WiMAX OTA Option
TD-SCDMA OTA Option
LTE/TD-LTE OTA Option

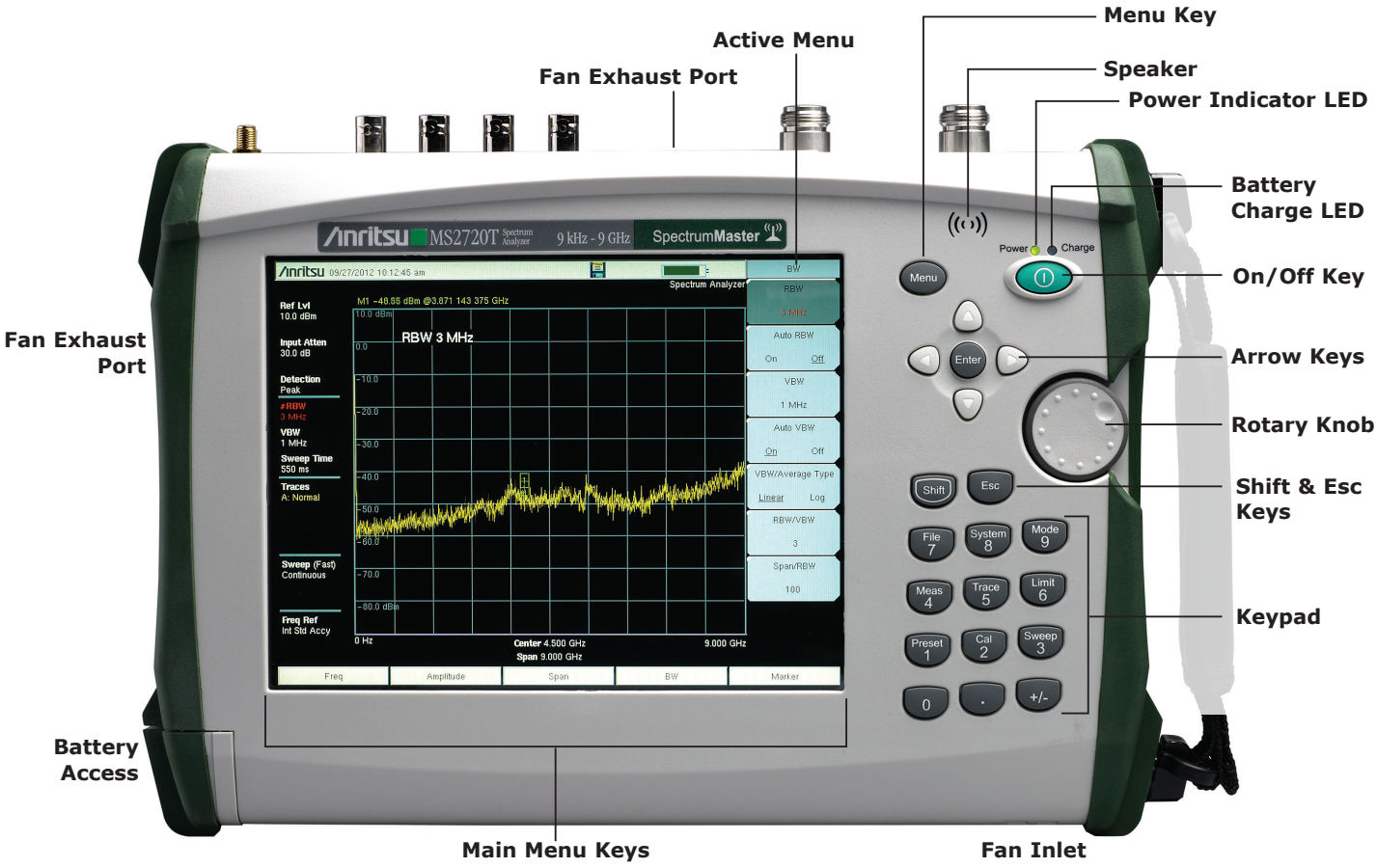
Folder Spectrogram
Folder Spectrogram – 2D View
Video Folder Spectrogram – 2D View
Folder Spectrogram – 3D View

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

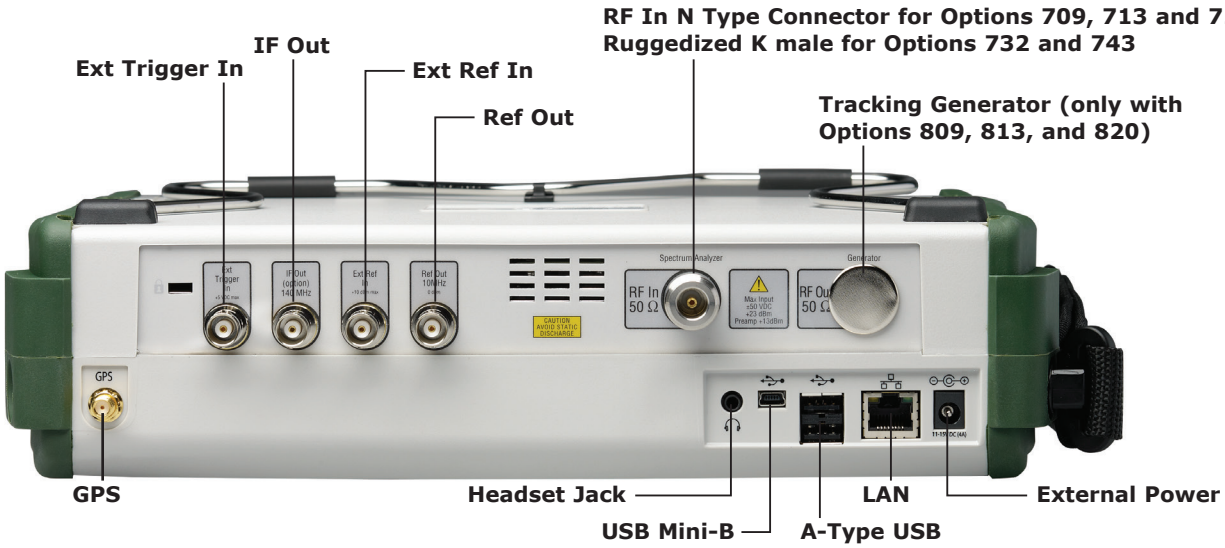
Script Master™
Channel Scanner Mode
GSM/EDGE Mode
W-CDMA/HSPA+ Mode

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

Spectrum Master™ MS2720T Spectrum Analyzer Features



Handheld Size: 315 mm x 211 mm x 77 mm, (12.4 in x 8.3 in x 3.0 in)
Lightweight: 3.7 kg to 4.4 kg (8.1 lb to 9.8 lb) depending on Frequency Option and Tracking Generator



Connector Panel for MS2720T

Spectrum Master™ MS2720T Spectrum Analyzer Ordering Information

Ordering Information — Instrument Options

Part Number	Description
MS2720T	Spectrum Master (requires option 709, 713, 720, 732, or 743)
MS2720T-0709	Frequency Range 9 kHz to 9 GHz
MS2720T-0713	Frequency Range 9 kHz to 13 GHz
MS2720T-0720	Frequency Range 9 kHz to 20 GHz
MS2720T-0732	Frequency Range 9 kHz to 32 GHz
MS2720T-0743	Frequency Range 9 kHz to 43 GHz
MS2720T-0809	9 GHz Tracking Generator (requires option 709)
MS2720T-0813	13 GHz Tracking Generator (requires option 713)
MS2720T-0820	20 GHz Tracking Generator(requires option 720)
MS2720T-0025	Interference Analyzer (Option 31 is recommended)
MS2720T-0027	Channel Scanner
MS2720T-0431	Coverage Mapping (requires Option 31 for full functionality)
MS2720T-0444	EMF Measurements (requires Anritsu Isotropic Antenna)
MS2720T-0509	AM/FM/PM Measurements (Option 431 required for full functionality)
MS2720T-0024	I/Q Waveform Capture (requires Option 9)
MS2720T-0089	Zero Span IF Output
MS2720T-0090	Gated Sweep
MS2720T-0019	High-Accuracy Power Meter (requires USB Power Sensor, sold separately)
MS2720T-0009	Demodulation Hardware
MS2720T-0880	GSM/GPRS/EDGE Measurements (requires Option 9)
MS2720T-0881	W-CDMA/HSPA+ Measurements (requires Option 9, Option 31 recommended)
MS2720T-0882	TD-SCDMA/HSPA+ Measurements (requires Option 9, Option 31 required for full functionality)
MS2720T-0883	LTE FDD/TDD Measurements (requires Option 9, Option 31 required for full functionality)
MS2720T-0884	CDMA/EV-DO Measurements (requires Option 9, Option 31 required for full functionality)
MS2720T-0885	WiMAX Fixed/Mobile Measurements (requires Option 9, Option 31 required for full functionality)
MS2720T-0886	LTE 256 QAM Demodulation (requires Option 883)
MS2720T-0887	NB-IoT Analyzer (requires Option 9)
MS2720T-0007	Secure Data Operation
MS2720T-0031	GPS Receiver (requires GPS Antenna, sold separately) - 2000-1528-R GPS Antenna, SMA(m) with 5 m (15 ft) cable, requires 5 VDC - 2000-1652-R GPS Antenna, SMA(m) with 0.3 m (1 ft) cable, requires 3.3 VDC of 5 VDC - 2000-1760-R GPS Antenna, SMA(m) with no cable, 2.5 VDC to 3.7 VDC
MS2720T-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1
MS2720T-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1 Provides everything included with Option 98 plus test report and uncertainty data.

Spectrum Master™ MS2720T Spectrum Analyzer Ordering Information

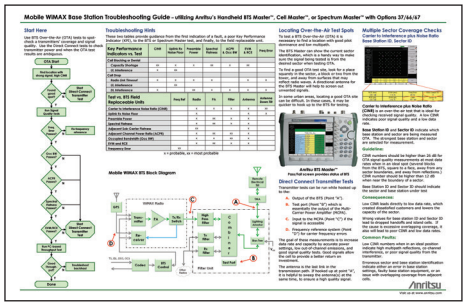
Power Sensors (For complete ordering information see the respective datasheets of each sensor)

Part Number	Description
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 dBm to +51.76 dBm
MA24106A	RF USB 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
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 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
MA25100A	RF Power Indicator

Manuals (soft copy included at www.anritsu.com)

Part Number	Description
10580-00340	Spectrum Master User Guide
10580-00349	Spectrum Analyzer Measurement Guide
10580-00339	Tracking Generator Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00234	3GPP Signal Analyzer Measurement Guide
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00341	Spectrum Master Programming Manual
10580-00342	Spectrum Master Maintenance Manual

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



Part Number	Description
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00566	LTE eNodeB
11410-00615	TD-LTE eNodeB
11410-00463	W-CDMA/HSPA+ Base Stations
11410-00465	TD-SCDMA/HSPA+ Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00469	Mobile WiMAX Base Stations
11410-00470	Fixed WiMAX Base Stations

Standard Accessories (included with instrument)

Part Number	Description
2000-1691-R	Sytlus with Coiled Tether
2000-1685-R	Soft Carrying Case
2000-1797-R	Touchscreen Proctecitve Film, 8.4 in (one factory installed, one spare)
633-75	High Capacity Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Power Adapter, 12 Volt DC, 60 W
2000-1371-R	Ethernet Cable, 7 ft/213 cm
3-2000-1498	USB A-mini B Cable, 10 ft/305 cm
	Certificate of Calibration and Conformance

Spectrum Master™ MS2720T Spectrum Analyzer Ordering Information

Optional Accessories

GPS Antennas

Part Number	Description
2000-1528-R	GPS Antenna, SMA(m) with 5 m (15 ft) cable, requires 5 VDC
2000-1652-R	GPS Antenna, SMA(m) with 0.3 m (1 ft) cable, requires 3.3 VDC or 5 VDC
2000-1760-R	GPS Antenna, SMA(m), 25 dB gain, 2.5 VDC to 3.7 VDC

Directional Antennas

Part Number	Description
2000-1411-R	824 MHz to 896 MHz, N(f), 12.3 dBi, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 12.6 dBi, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 12.3 dBi, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 11.4 dBi, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 14.1 dBi, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 14.3 dBi, Yagi
2000-1659-R	698 MHz to 787 MHz, N(f), 10.1 dBi, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 14.3 dBi, Yagi
2000-1715-R	Directional Antenna. 698 MHz to 2500 MHz, N(f), gain of 2 dBi to 10 dBi, typical
2000-1726-R	Antenna, 2500 MHz to 2700 MHz, N(f), 14.1 dBi, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 7000 MHz, N(f), 5.1 dBi, typical
2000-1748-R	Antenna, Log Periodic, 1 to 18 GHz, N(f), 6 dBi, typical
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N(f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N(f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N(f)
2000-1812-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N(f), 7.1 dBi
2000-1825-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N(f), 7.1 dBi

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 MHz 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 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
2000-1751-R	698 MHz to 960 MHz, 1710 MHz to 2100 MHz, 2500 MHz to 2700 MHz, SMA(m), 2 dB, typical, 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)

Isotropic Antenna

Part Number	Description
2000-1791-R	Isotropic Antenna, 700 MHz to 6000 MHz, N(m)
2000-1792-R	Isotropic Antenna, 30 MHz to 3000 MHz, N(m)
2000-1800-R	Isotropic Antenna, 9 kHz to 300 MHz, N(m)

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, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 10 ft
2000-1946-R	Cable 1: 617 MHz to 960 MHz, 3 dBi peak gain, 1710 MHz to 3700 MHz, 4 dBi peak gain, N(m), 50 Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 10 ft
2000-1645-R	694 MHz to 894 MHz, 3 dBi peak gain, 1700 MHz to 2700 MHz, 3 dBi peak gain, N(m), 50 Ω, 10 ft
2000-1646-R	750 MHz to 1250 MHz, 3 dBi peak gain, 1650 MHz to 2700 MHz, 5 dBi peak gain
2000-1648-R	1700 MHz to 6000 MHz, 3 dBi peak gain,N(m), 50 Ω, 10 ft

Optional Accessories (continued)

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
1030-105-R	890 MHz to 915 MHz, N(m) to N(f), 50 Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(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
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(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 798 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
2000-1734-R	Bandpass Filter, 699 MHz to 715 MHz, N(m) and N(f), 50 Ω
2000-1735-R	Bandpass Filter, 776 MHz to 788 MHz, N(m) and N(f), 50 Ω
2000-1736-R	Bandpass Filter, 815 MHz to 850 MHz, N(m) and N(f), 50 Ω
2000-1737-R	Bandpass Filter, 1711 MHz to 1756 MHz, N(m) and N(f), 50 Ω
2000-1738-R	Bandpass Filter, 1850 MHz to 1910 MHz, N(m) and N(f), 50 Ω
2000-1739-R	Bandpass Filter, 880 MHz to 915 MHz, N(m) and N(f), 50 Ω
2000-1740-R	Bandpass Filter, 1710 MHz to 1785 MHz, N(m) and N(f), 50 Ω
2000-1741-R	Bandpass Filter, 1920 MHz to 1980 MHz, N(m) and N(f), 50 Ω
2000-1742-R	Bandpass Filter, 832 MHz to 862 MHz, N(m) and N(f), 50 Ω
2000-1743-R	Bandpass Filter, 2500 MHz to 2570 MHz, N(m) and N(f), 50 Ω
2000-1799-R	Bandpass Filter, 2305 MHz to 2320 MHz, N(m) and N(f), 50 Ω

Adapters

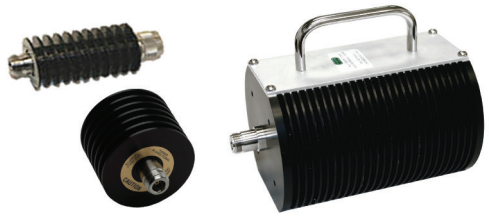
Part Number	Description
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-417-R	N(m) to QMA(f), DC to 6 GHz, 50 Ω
1091-418-R	N(m) to QMA(m), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 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
71693-R	Ruggedized K(f) to Type N(f)
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

Optional Accessories (continued)

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	Attenuator, 40 dB, 100 W, DC to 8.5 GHz, N(f) to N(m) output, Uni-directional
1010-121	Attenuator, 40 dB, 100 W, DC to 18 GHz, N(f) to N(m) output, Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

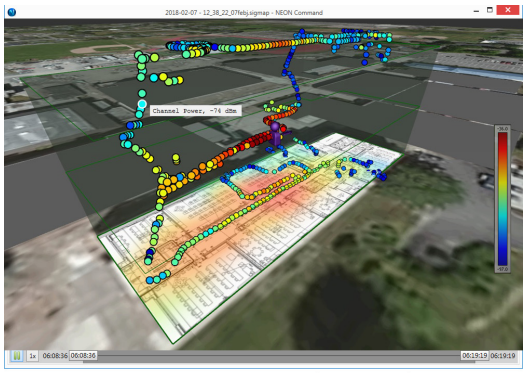
Miscellaneous Accessories

Part Number	Description
2000-1374	External Charger for Li-Ion Batteries
633-75	Rechargeable Li-ion Battery, 7500 mAh
2000-1689	EMI Near Field Probe Kit
MA2700A	Handheld Interference Hunter (For full specifications, refer to the MA2700A Technical Data Sheet 11410-00692)
2000-1884-R	PIM Hunter™ Test Probe (For full specifications, refer to the 2000-1884-R Technical Data Sheet 11410-00999)
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	Touchscreen Protective Film, 8.4 in
2000-1798-R	Port Extender, DC to 6 GHz, N(m) to N(f)
66864	Rack Mount Kit, Master Platform
MA25401A	Atomic Clock External 10 MHz Frequency Reference (see 11410-01134 for details)

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 56 cm x 45.5 cm x 26.5 cm (22.07” x 17.92” x 10.42”)
760-261-R	Transit Case, space for MA2700A, antennas, filters, instrument inside softcase, and other interference hunting accessories/tools
760-271-R	Transit Case for Portable Directional Antennas and Port Extender 52.4 cm x 42.8 cm x 20.6 cm (20.62” x 16.87” x 8.12”) (for 2000-1777-R, 2000-1778-R, 2000-1779-R, 2000-1798-R)

MA8100A TRX NEON Singal Mapper



Part Number	Description
MA8100A-001	TRX NEON® Signal Mapper with Anritsu Integration and Tracking Unit. Includes 1 year TRX NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service.
MA8100A-003	TRX NEON® Signal Mapper with Anritsu Integration and Tracking Unit. Includes 3 years TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service.
MA8100A-005	TRX NEON® Signal Mapper with Anritsu Integration and Tracking Unit. Includes 5 years TRX NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service.
MA8100A-100	TRX NEON® Signal Mapper with Anritsu Integration and Tracking Unit. Includes Perpetual TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service.
2300-574	1 year TRX NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service. Cannot be ordered separately from P/N MA8100A-001. See P/N 2300-612 for renewal.
2300-575	3 years TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service. Cannot be ordered separately from P/N MA8100A-003. See P/N 2300-613 for renewal.
2300-576	5 years TRX NEON Software License with 5 years of maintenance and support and 3 years of Cloud Service. Cannot be ordered separately from P/N MA8100A-005. See P/N 2300-614 for renewal.
2300-606	Perpetual TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service. Part number cab also be used to order a perpetual licesnse after a limited term license has expired.
2300-612	Renewal of 1 year TRX NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service.