Product Brochure

Anritsu

Spectrum Master™

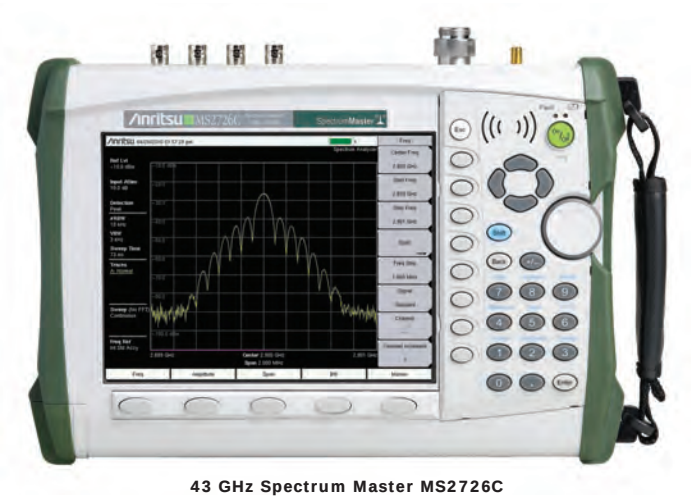
High Performance Handheld Spectrum Analyzer

MS2722C	MS2723C	MS2724C	MS2725C	MS2726C
9 kHz to 9 GHz	9 kHz to 13 GHz	9 kHz to 20 GHz	9 kHz to 32 GHz	9 kHz to 43 GHz

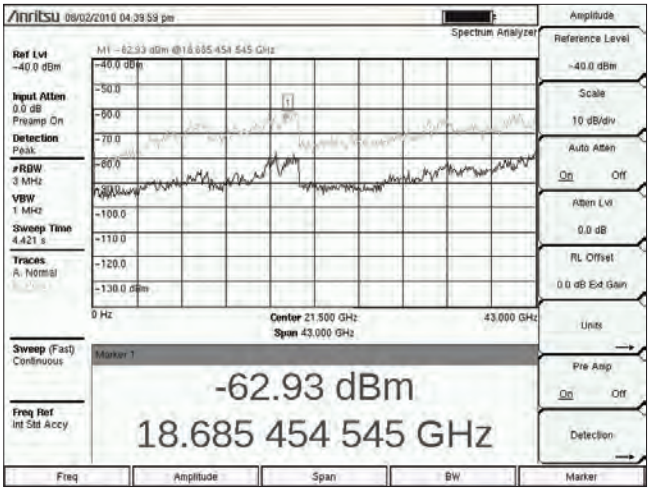
A New Generation including:
The World's First 32 and 43 GHz Handheld Spectrum Analyzers
Dynamic Range greater than 100 dB
Improved Sweep Speed – up to 100 times faster

Spectrum Master MS272xC Spectrum Analyzer Introduction

Overview

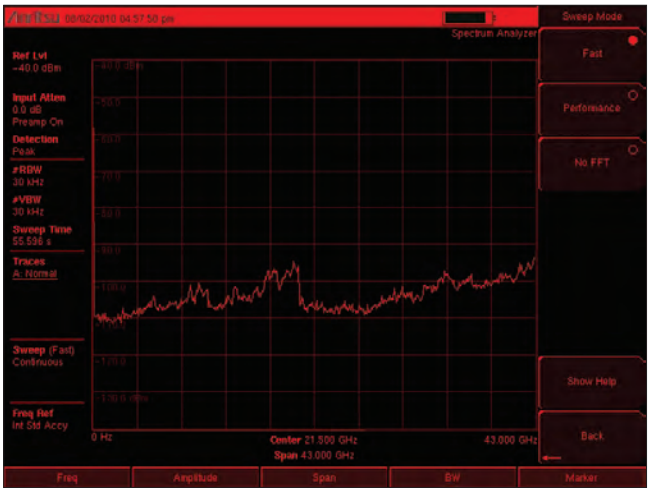


43 GHz Spectrum Master MS2726C



43 GHz Broadband Preamp Performance

Trace A Preamp on, Trace B Preamp off
Black and White View for Sunlight Viewing
Large Marker Display



Fast Sweep Mode 100x Faster

43 GHz Fast Sweep ≈ 20 sec, Performance Sweep ≈ 2000 sec
(RBW and VBW = 30 kHz)
Night Vision View for Nighttime Viewing

Introduction

Anritsu introduces its latest generation of handheld spectrum analyzers with five new models including the industry's first 32 GHz and 43 GHz models. This represents the company's highest performance handheld spectrum analyzers. In addition, exciting new features and options bring more value to the user over our previous generations:

- Five new models – 9 kHz to 9, 13, 20, 32, or 43 GHz
- Broadband preamplifiers over the whole frequency range for increased sensitivity of 20 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 GUI including 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
- 30 MHz Zero-Span IF Output for external demodulation of virtually any other wideband signal

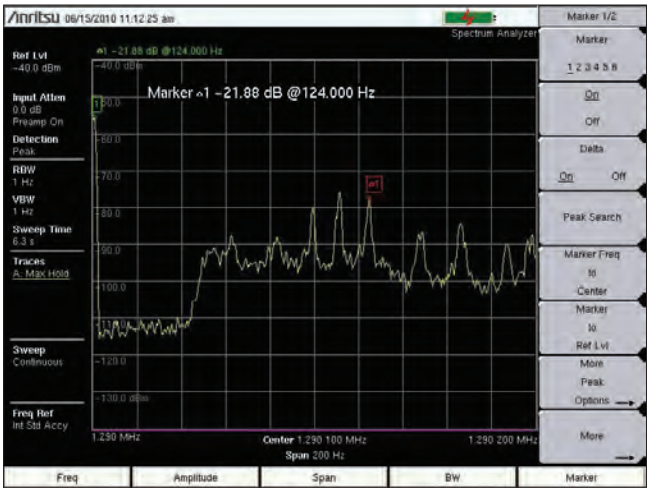
The Spectrum Master MS272xC features over 30 analyzers in one to meet virtually every measurement need. In addition to spectrum analysis a user can select optional capabilities and analyzers including:

- 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
  LTE, GSM, W-CDMA/HSPA+, TD-SCDMA/HSPA+
- 3GPP2 Signal Analyzers CDMA and EV-DO
- IEEE 802.16 Signal Analyzers
  Fixed WiMAX, Mobile WiMAX
- PIM Analyzer
- Coverage Mapping

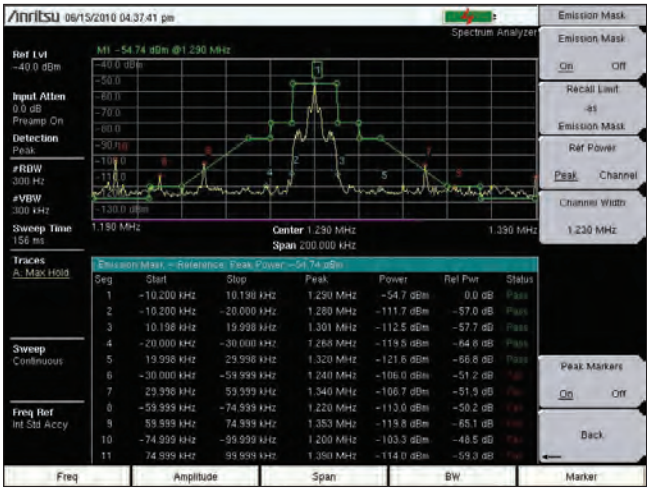
For post processing data collected on your instrument utilize Master Software Tools – a PC program included with the instrument. It provides powerful data analysis tools for spectrum clearing and interference monitoring. And the Remote Access Tool allows the user to see and control the instrument over a LAN connection.

Continuous frequency coverage from 9 kHz to 43 GHz gives the wireless professional the performance needed for the most demanding measurements. Whether your application is spectrum monitoring, hidden signal detection, RF and microwave signal measurements, microwave backhaul testing or cellular signal measurements, the Spectrum Master MS272xC family gives you the tools you need to make the job easier and more productive.

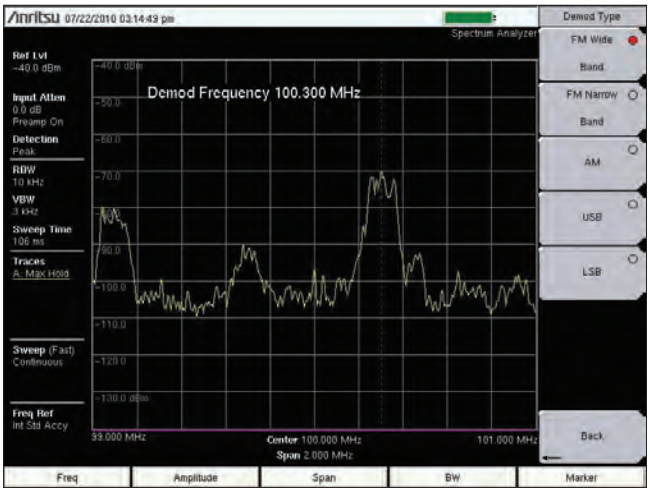
Overview (continued)



No Place for Bugs to Hide



Emission Mask



AM/FM/SSB Demodulation

Smart Measurements

The Spectrum Master family has pre-defined one-button measurements for:

- Field strength
- Occupied bandwidth
- Channel power
- Adjacent Channel Power Ratio (ACPR)
- Carrier-to-Interference (C/I)
- Emission Mask Measurements

The simple interface for these complex measurements significantly reduces test time and increases analyzer usability.

Finding signals

Hidden transmitters can be challenging to find, especially if they are operating at a 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. Bursty signals as narrow as 200 µs can be seen the first time, every time with Burst Detect sweep mode.

Fast sweep

The new fast sweep mode has the paradigm busting capability to set resolution bandwidth from 10 MHz to 30 kHz with virtually no 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.

Emission Mask

A limit line can be used as a pass/fail emission mask. 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.

AM/FM/SSB Demodulation

AM, narrowband FM, wideband FM and single sideband (both upper and lower) can be demodulated to audio. The demodulated audio can be heard through the built-in speaker or through a headset plugged into the 2.5 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.

Storage

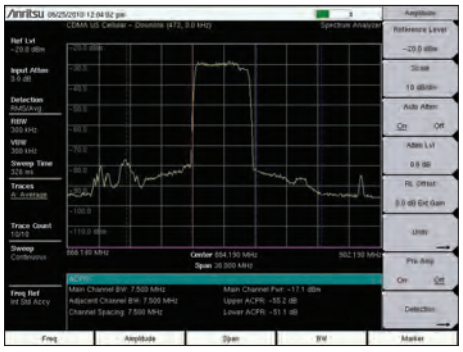
Measurements, limit lines, JPEG screen shots and setup files can be stored internally or to an external USB memory. Secure Data Operation option allows storage on external USB memory only. No data or set-up information can be stored internally.

Light Weight

Weighing about 8 pounds fully loaded, including a Li-Ion battery, the fully functional Spectrum Master MS272xC family of handheld spectrum analyzers are light enough to take anywhere, including up a tower.

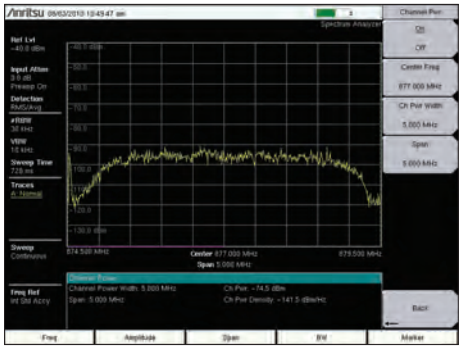
Spectrum Master MS272xC Spectrum Analyzer Features

Spectrum Analyzer



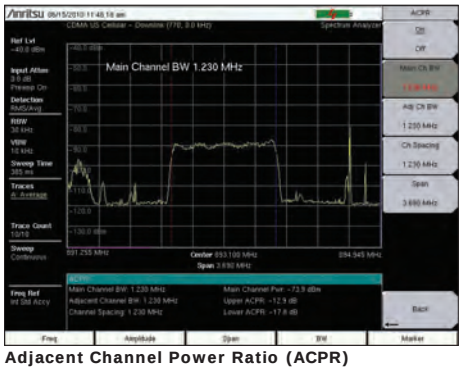
Occupied Bandwidth

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



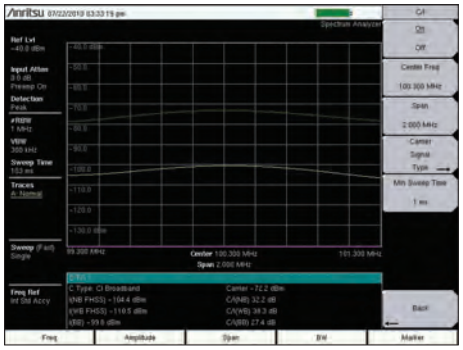
Channel Power

It is often the first thing checked on a transmitter. If a transmitter's channel power is out of adjustment, the cause may be a radio, antenna, or feedline fault.



Adjacent Channel Power Ratio (ACPR)

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



Carrier-to-Interference (C/I)

Low C/I ratios will cause coverage issues including dropped calls, blocked calls, and other handset reception problems.

Spectrum Analyzer

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

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

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

Simple But Powerful

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

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

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

GPS-Assisted Frequency Accuracy

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

Rx Noise Floor Testing

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

Measurements

One Button Measurements
- Field Strength – in dBm/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

Secure Data Option – Option 0007

Gated Sweep – Option 0090

I/Q Waveform Capture – Option 0024

Sweep Functions

Sweep Once

Sweep 10 Averages

Sweep Mode
- Fast
- Performance
- No FFT
- Burst Detect
- Show Help

Sweep Time

Auto Sweep Time On/Off

Triggering (zero span only)
- Source
- Delay
- Level
- Slope Rising/Falling
- Hysteresis
- Holdoff
- Force Trigger Once

Trace Functions

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

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

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

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

Marker Functions

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

Marker Types
- Fixed, Tracking, Noise, Frequency Counter

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

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

Limit Line Functions

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

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

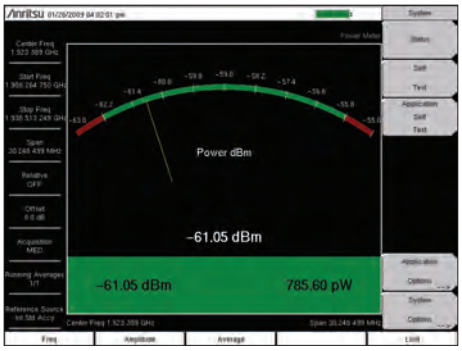
Limit Line Move
- To Current Center Frequency, By dB or Hz
- To Marker 1, Offset from Marker 1

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

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

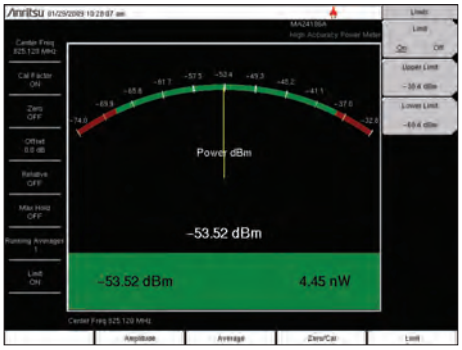
Power Meter

High Accuracy Power Meter (Option 0019)



Power Meter (built-in)

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

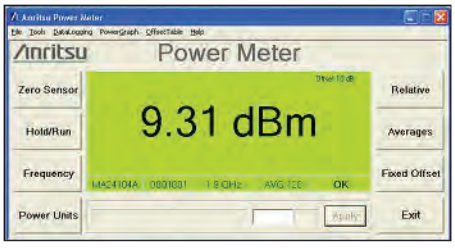


High Accuracy Power Meter (Option 0019)

Requires external power sensor with convenient connection via a USB A/mini-B cable. Use upper/lower limit activation during pass/fail measurements.

Power Sensors

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



PC Power Meter

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

Power Meters

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

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

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

High Accuracy Power Meter (Option 19)

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

- Frequency ranges: 10 MHz to 26 GHz
- Power ranges: –40 dBm to +51.76 dBm
- Measurement uncertainties: ≤ ± 0.18 dB

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

PSN50

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

MA24104A

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

MA24106A

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

MA24108A

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

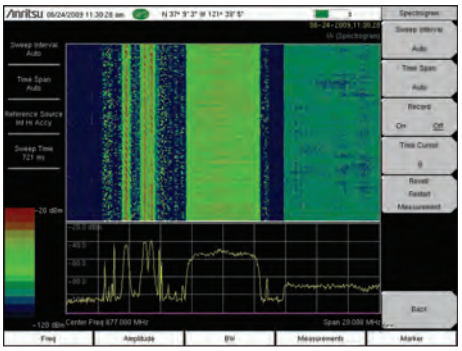
MA24118A

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

MA24126A

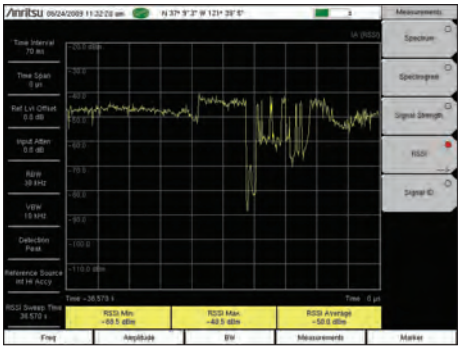
Microwave USB Power Sensor
- 10 MHz to 26 GHz
- -40 dBm to +20 dBm
- (0.1 µW to 100 mW)
- True-RMS
- Slot Power
- Burst Average Power

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



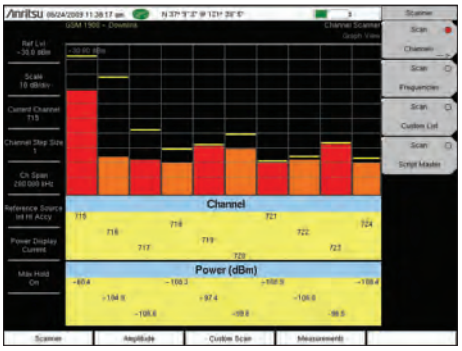
Spectrogram

For identifying intermittent interference and tracking signal levels over time for up to 72 hours with an external USB flash drive.



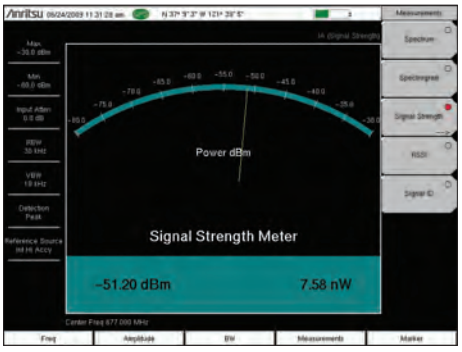
Received Signal Strength Indicator (RSSI)

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

Locating Interference

Once interference has been identified the Signal Strength Meter with its audible output beep coupled with a directional antenna makes finding the interference easier. Use Interference Mapping to triangulate the interference signal on an on-screen map.

Interference Analyzer Measurements

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

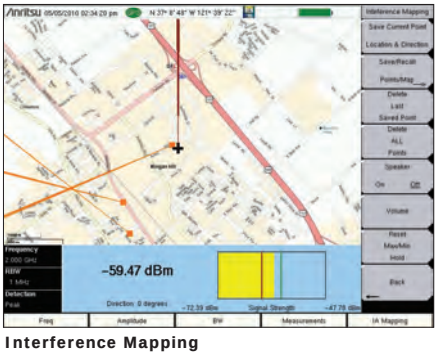
Interference Mapping
Spectrum
- Field Strength – in dBm/m² or dBmV/m
- Occupied Bandwidth - 1% to 99% of power
- Channel Power - in specified bandwidth
- ACPR - adjacent channel power ratio
- AM/FM/SSB Demodulation - audio out only
- C/I - carrier-to-interference ratio
- SEM - spectral emission mask

Channel Scanner

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

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

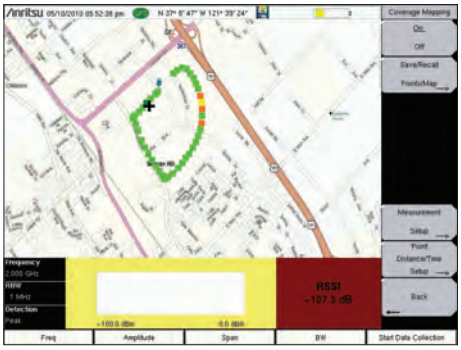
Script Master™
- Up to 1200 Channels
- Auto-repeat sets of 20 channels and total
- Auto-Save with GPS tagging



Interference Mapping

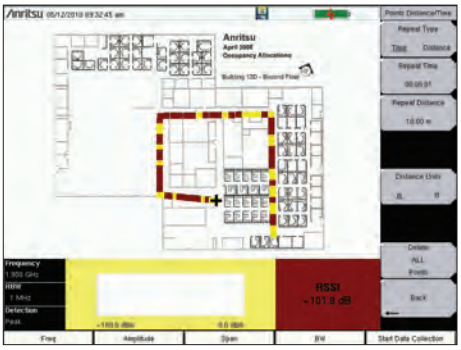
Eliminates the need to use printed maps and draw lines to triangulate location. Use on-screen maps generated with GPS coordinates with Map Master™.

Coverage Mapping (Option 0431)



On-screen Outdoor Coverage Mapping

Enables a maintenance technician to make low cost coverage measurements to quickly verify coverage around a base station site.

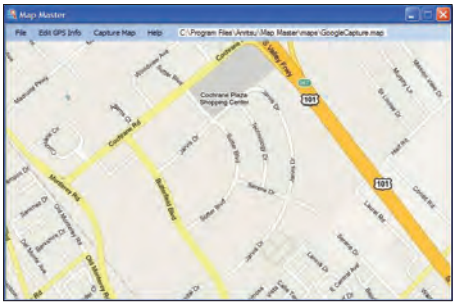


On-screen Indoor Coverage Mapping

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

Plot Coverage on PC-based Map

Once coverage data has been collected on the instrument, the data can be imported into a mapping program for further review and reporting.



Map Master™

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

Coverage Mapping

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

Outdoor Mapping

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

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

Indoor Mapping

When there is no GPS signal valid, the 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 or JPEG. Open KML files with Google Earth™. When opening up a pin in Google Earth, center frequency, detection method, measurement type, and RBW are shown on screen.

Map Master™

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

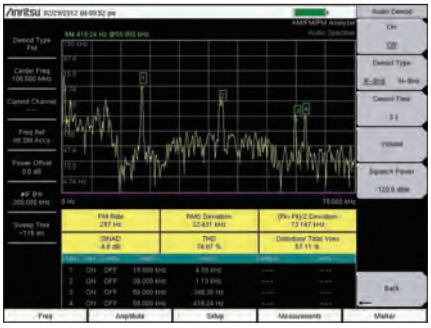
Coverage Mapping Measurements

Spectrum Analyzer Mode

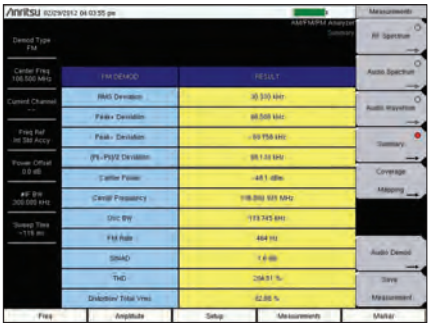
- ACPR
- RSSI

AM/FM/PM Analyzer (Option 0509)

Spectrum Master comes with AM/FM/SSB audio demodulation standard. By adding Option 0509, the instrument becomes capable of measuring, analyzing, and displaying key modulation parameters of RF Spectrum, Audio Spectrum, Audio Waveform and Demodulation Summary. The RF Spectrum View displays the spectrum analyzer 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. Each demodulation also includes an Audio Waveform oscilloscope display that shows the time-domain demodulated waveform. There is a summary display that provides a display of all the RF and demodulation parameters.

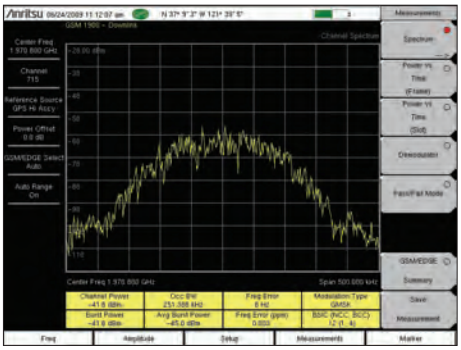


FM Audio Spectrum Showing Subcarriers



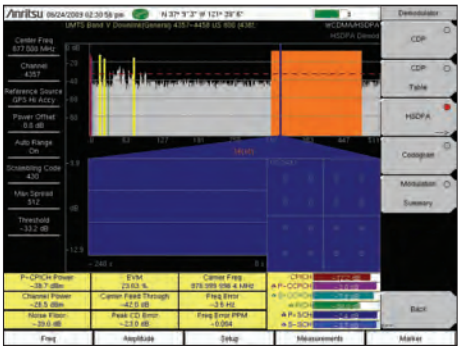
AM/FM/PM Modulation Summary

Introduction to Signal Analyzers



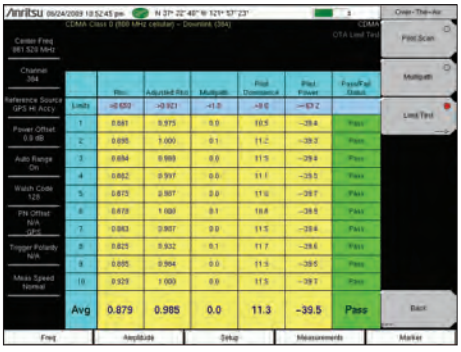
RF Measurement – GSM

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



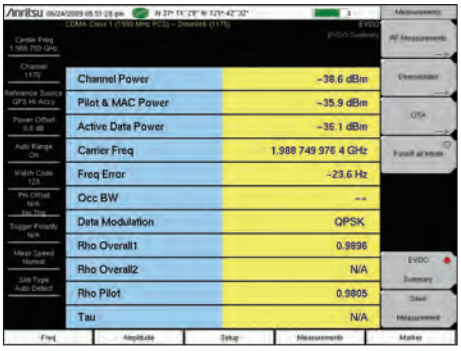
Demodulation – HSDPA

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



Over-the- Air Measurement - CDMA

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



Measurement Summary – LTE

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

Signal Analyzers

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

- RF Quality
- Modulation Quality
- Downlink Coverage Quality

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

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

By understanding which test to perform on the 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 MS272xC on commercial base stations carrying live traffic. To understand when, where, how, and why you make these measurements Anritsu publishes Troubleshooting Guides which explain for each measurement the:

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

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

- LTE Base Station 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

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

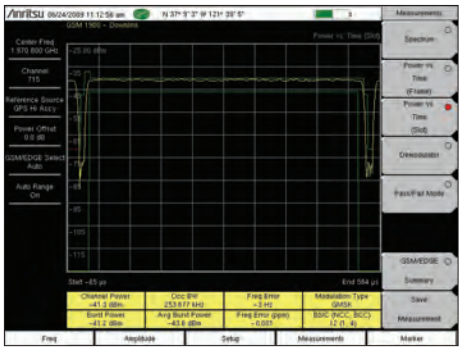
Typical Signal Analyzer Options

RF Measurements
Demodulation
Over-the-Air Measurements

Signal Analyzer Features

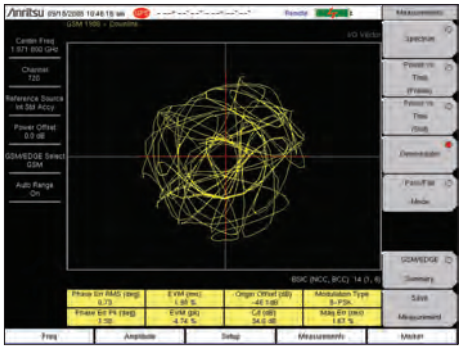
Measurement Summary Displays
Pass/Fail Limit Testing

GSM/EDGE Signal Analyzers (Options 0040, 0041)



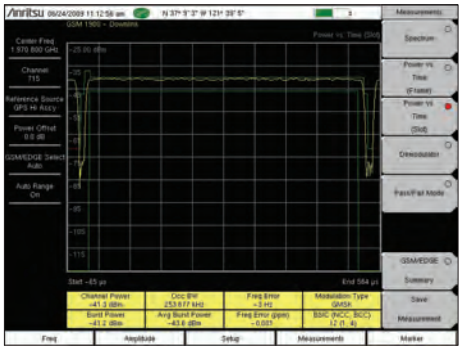
RF Measurement – Occupied Bandwidth

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



Demodulation – Error Vector Magnitude (EVM)

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



RF Measurement – Average Burst Power

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

Pass/Fail Test

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

GSM/EDGE Analyzers

The Spectrum Master features two GSM/EDGE measurement modes.

- RF Measurements
- Demodulation

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

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

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

Carrier-to-Interference (C/I)

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

Phase Error

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

Origin Offset

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

Power versus Time (Slot and Frame)

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

RF Measurements (Option 0040)

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

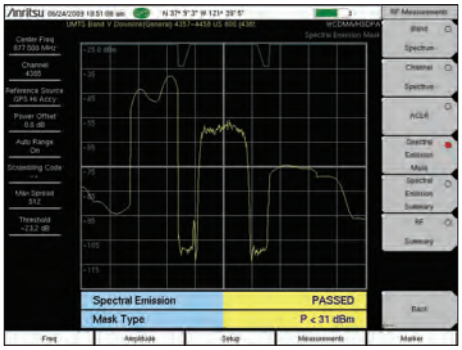
Multi-channel Spectrum

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

Demodulation (Option 0041)

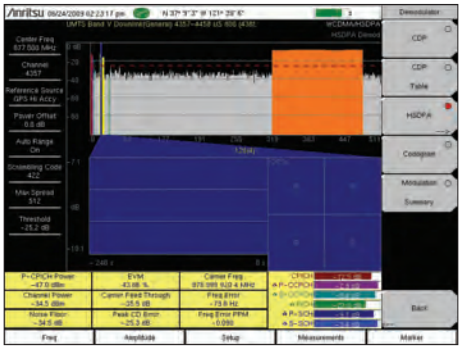
Phase Error
EVM
Origin Offset
C/I
Modulation Type
Magnitude Error
BSIC (NCC, BCC)

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



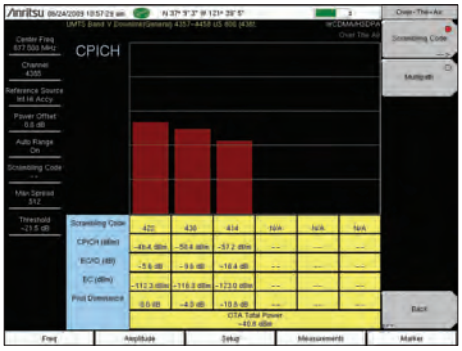
RF Measurements – Spectral Emissions Mask

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



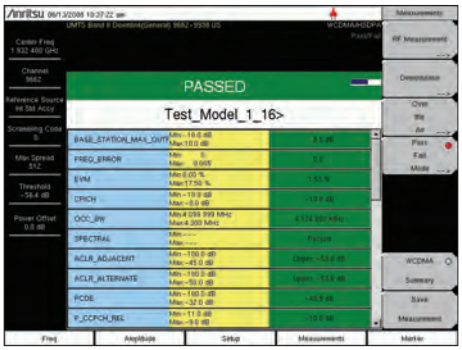
Demodulation – Error Vector Magnitude (EVM)

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



Over-the-Air Measurements – Scrambling Codes

Too many strong sectors at the same location creates pilot pollution. This leads to low data rate, low capacity, and excessive soft handoffs.



Pass/Fail Test

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

W-CDMA/HSPA+ Signal Analyzers

The Spectrum Master features four W-CDMA/HSPA+ 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 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.

RF Measurements (Option 0044)

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

Spectral Emission Mask
Single carrier ACLR
Multi-carrier ACLR

Demodulation (Option 0065)

Code Domain Power Graph
- P-CPICH Power
- Channel Power
- Noise Floor
- EVM
- Carrier Feed Through
- Peak Code Domain Error
- Carrier Frequency
- Frequency Error
- Control Channel Power
- Abs/Rel/Delta Power
  - CPICH, P-CCPCH
  - S-CCPCH, PICH
  - P-SCH, S-SCH
- HSPA+
  - Power vs. Time
  - Constellation

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

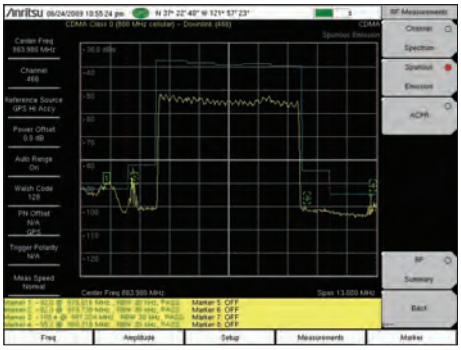
Codogram

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

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

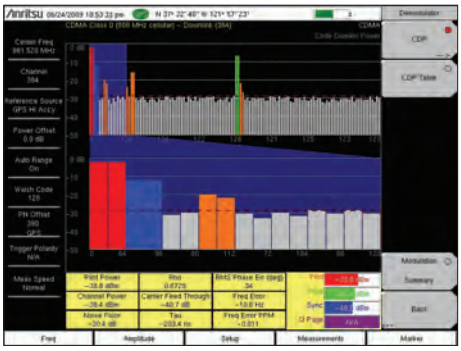
Multipath Scanner (Six)
- Six Multipaths
- Tau
- Distance
- RSCP
- Relative Power
- Multipath Power

CDMA Signal Analyzers (Options 0042, 0043, 0033)



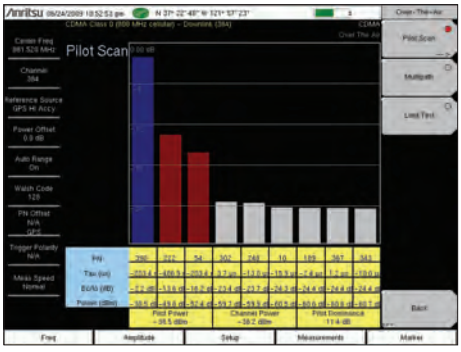
RF Measurements – Spectral Emissions Mask

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



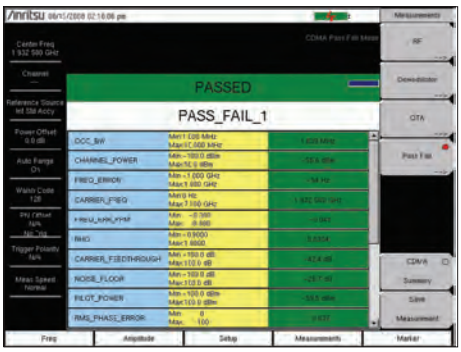
Modulation Quality – EVM

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



Over-the-Air Measurements – Sync Signal Power

Check for un-even amplitude of sub-carriers. Data will be less reliable on weak sub-carriers, creating a lower over-all data rate.



Pass / Fail Test

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

CDMA Signal Analyzers

The Spectrum Master features three CDMA measurement modes:

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

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

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

Adjacent Channel Power Ratio (ACPR)

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

RMS Phase Error

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

Noise Floor

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

E_c / I_o

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

RF Measurements (Option 0042)

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

Spectral Emission Mask

Multi-carrier ACPR

Demodulation (Option 0043)

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

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

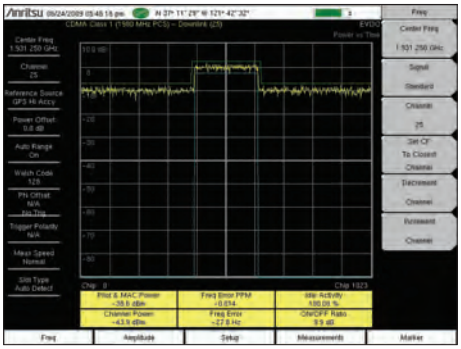
Over-the-Air (OTA) Measurements (0ption 0033)

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

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

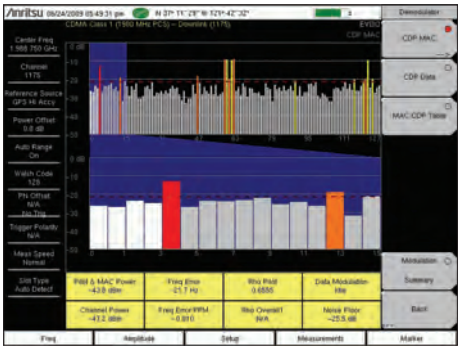
Limit Test – 10 Tests Averaged
- Rho
- Adjusted Rho
- Multipath
- Pilot Dominance
- Pilot Power
- Pass/Fail Status

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



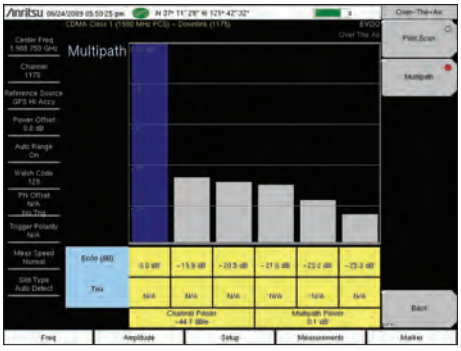
RF Measurements – Pilot and MAC Power

High values will create pilot pollution. High or low values will cause dead spots/dropped calls and cell loading imbalances/blocked calls.



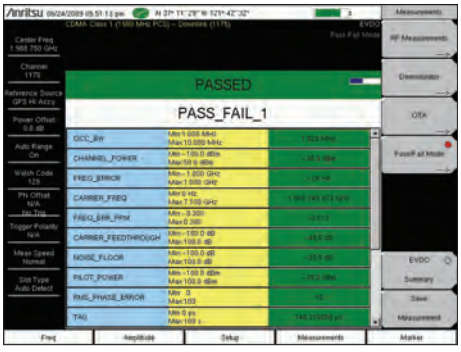
Demodulation – Frequency Error

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



Over-the-Air Measurements – Multipath

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



Pass / Fail Test

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

EV-DO Signal Analyzers

The 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 (Option 0062)

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

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

Spectral Emission Mask

Multi-carrier ACPR

Demodulation (Option 0063)

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

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

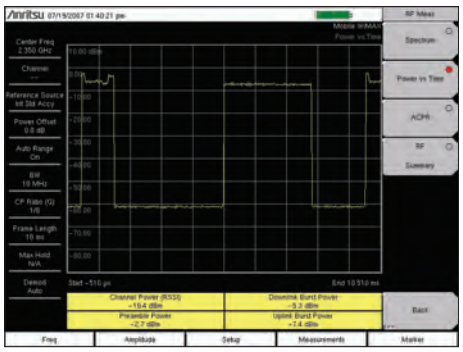
Data Code Domain Power
- Active Data Power
- Data Modulation
- Rho Pilot
- Rho Overall
- Maximum Data CDP
- Minimum Data CDP

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

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

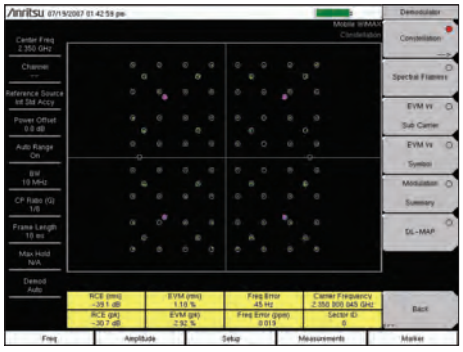
Mulitpath Scanner (Six)
- E_c/I_o
- Tau
- Channel Power
- Multipath Power

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



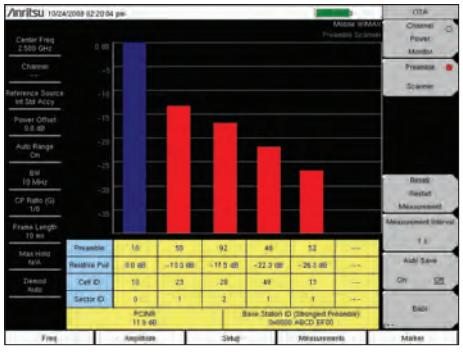
RF Measurement – Preamble Power

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



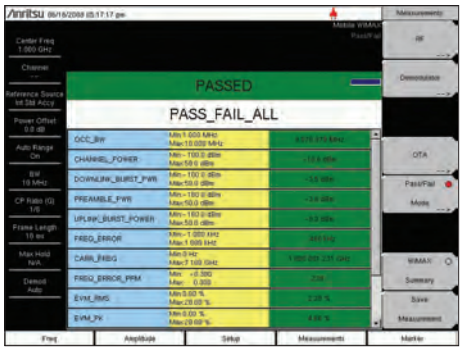
Demodulation – Frequency Error

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



Over-the-Air Measurements – PCINR

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



Pass/Fail Test

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

Fixed and Mobile WiMAX Signal Analyzers

The 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

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 for the strongest WiMAX preamble available at that spot. The Base Station ID and Sector ID information are also included so that it's easier to interpret the results. Once PCINR data is mapped, it becomes much easier to understand and troubleshoot any interference or coverage issues.

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

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

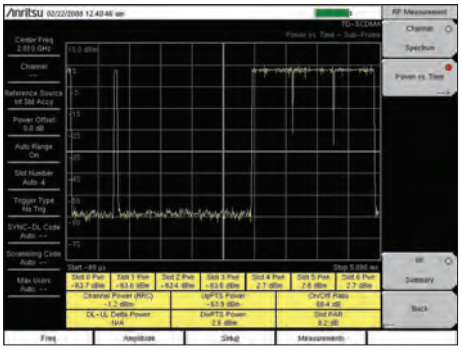
Demodulation (10 MHz maximum) (Option 0047/0067, Fixed/Mobile)

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

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

- Channel Power Monitor
- Preamble Scanner (Six)
  - Preamble
  - Relative Power
  - Cell ID
  - Sector ID
  - PCINR
- Dominant Preamble
  - Base Station ID
- Auto-Save with GPS Tagging and Logging

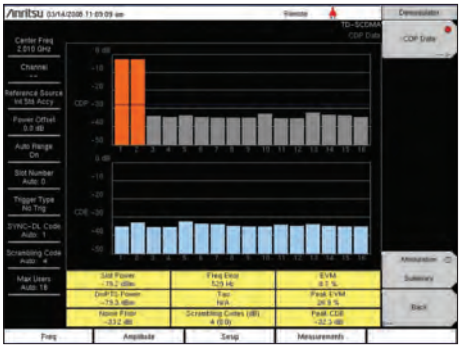
TD-SCDMA / HSPA+ Signal Analyzers (Options 0060, 0061, 0038)



RF Measurement – Time Slot Power

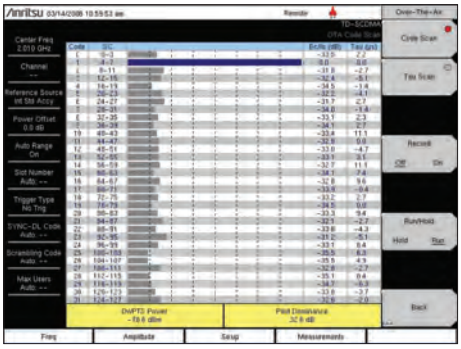
Empty downlink slots with access power will reduce the sensibility of the receiver and the size of the sector.

This will cause dropped and blocked calls.



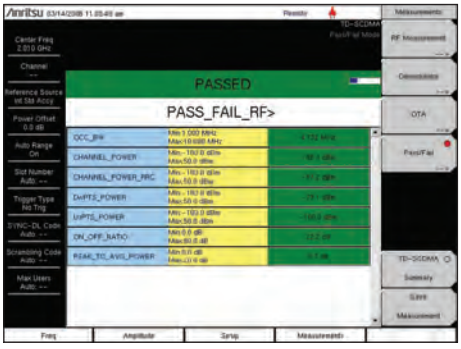
Demodulation – Scrambling Code

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



Over-the-Air Measurements – Code Scanner

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



Pass / Fail Test

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

TD-SCDMA / HSPA+ Signal Analyzers

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

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

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

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

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

Peak Code Domain Error (Peak CDE)

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

OTA Tau Scanner E_c / I_o

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

DwPTS OTA Power Mapping

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

RF Measurements (Option 0060)

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

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

Spectral Emission

Demodulation (Option 0061)

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

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

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

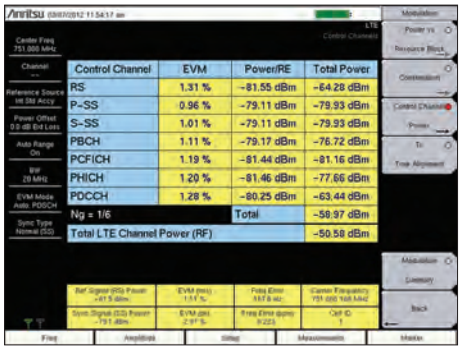
Tau Scan (Six)
- Sync-DL#
- Tau
- E_c / I_o
- DwPTS Power
- Pilot Dominance

Auto-Save with GPS Tagging and Logging

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

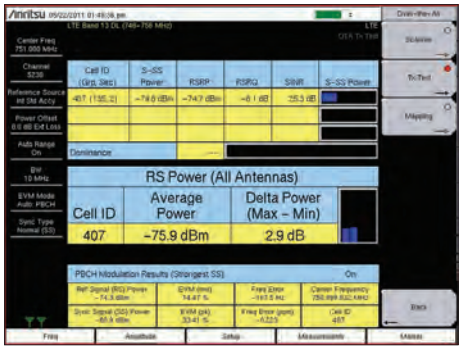
Modulation Quality – Power vs. Resource Block

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



Modulation Quality – Control Channels

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



Over-the-Air Measurements – Tx Test

By looking at the reference signals of MIMO antennas one can determine if MIMO is working properly. If the delta power is too large, there is an issue.

Over-the-Air On-screen Mapping

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

LTE and TD-LTE Signal Analyzers

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

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

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

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

Adjacent Channel Leakage Ratio (ACLR)

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

Cell ID (Sector ID, Group ID)

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

Pass/Fail Test

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

EVM

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

Mapping

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

RF Measurements (Option 0541/551 FDD/TDD)

Channel Spectrum
- Channel Power, Occupied Bandwidth

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

ACLR

Spectral Emission Mask

RF Summary

Modulation Measurements (Option 0542/552 FDD/TDD)

Power vs. Resource Block
- Active RBs, Utilization %, Channel Power, Cell ID
- OSTP, Frame EVM (Option 542 only)

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

Control Channel Power
- Bar Graph or Table View
- RS, P-SS, S-SS, PBCH, PCFICH
- PHICH, PDCCH (Option 542 only)
- Total Power (Table View)
- Modulation Results
- Tx Time Alignment (Option 542 only)

Modulation Summary

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

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

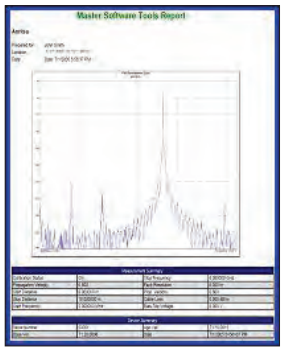
Tx Test
- Scanner – three strongest signals
- RS Power of MIMO antennas
  - Cell ID, Average Power, Delta Power (Max-Min)
  - Graph Antenna Power
- Modulation Results – On/Off

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

LTE BW = 15, 20 MHz (Option 543)

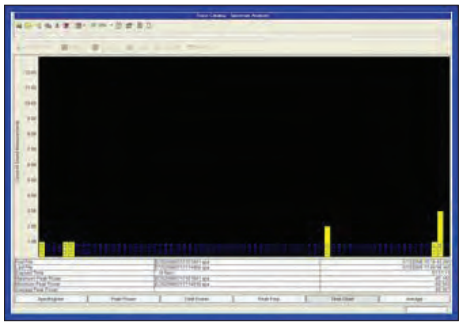
Enables 15 and 20 MHz bandwidths for:
- RF Measurements (Option 0541/551)
- Modulation Measurements (Option 0542/552)

Master Software Tools (for your PC)



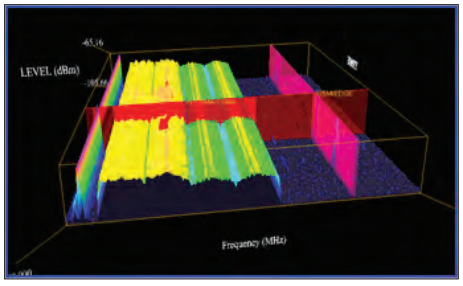
Report Generation

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



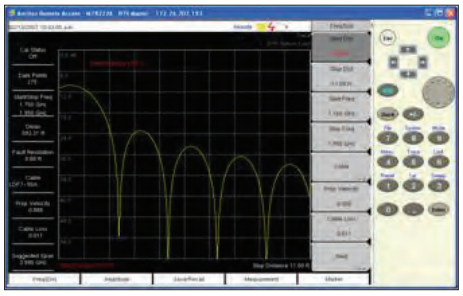
Histogram

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.

Trace Rename Utility and Group Edit

Trace Rename Utility allows a user to rename filenames, titles, and subtitles globally. Group Edit allows users to edit the actual traces simultaneously on similar files, both without opening the files.

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

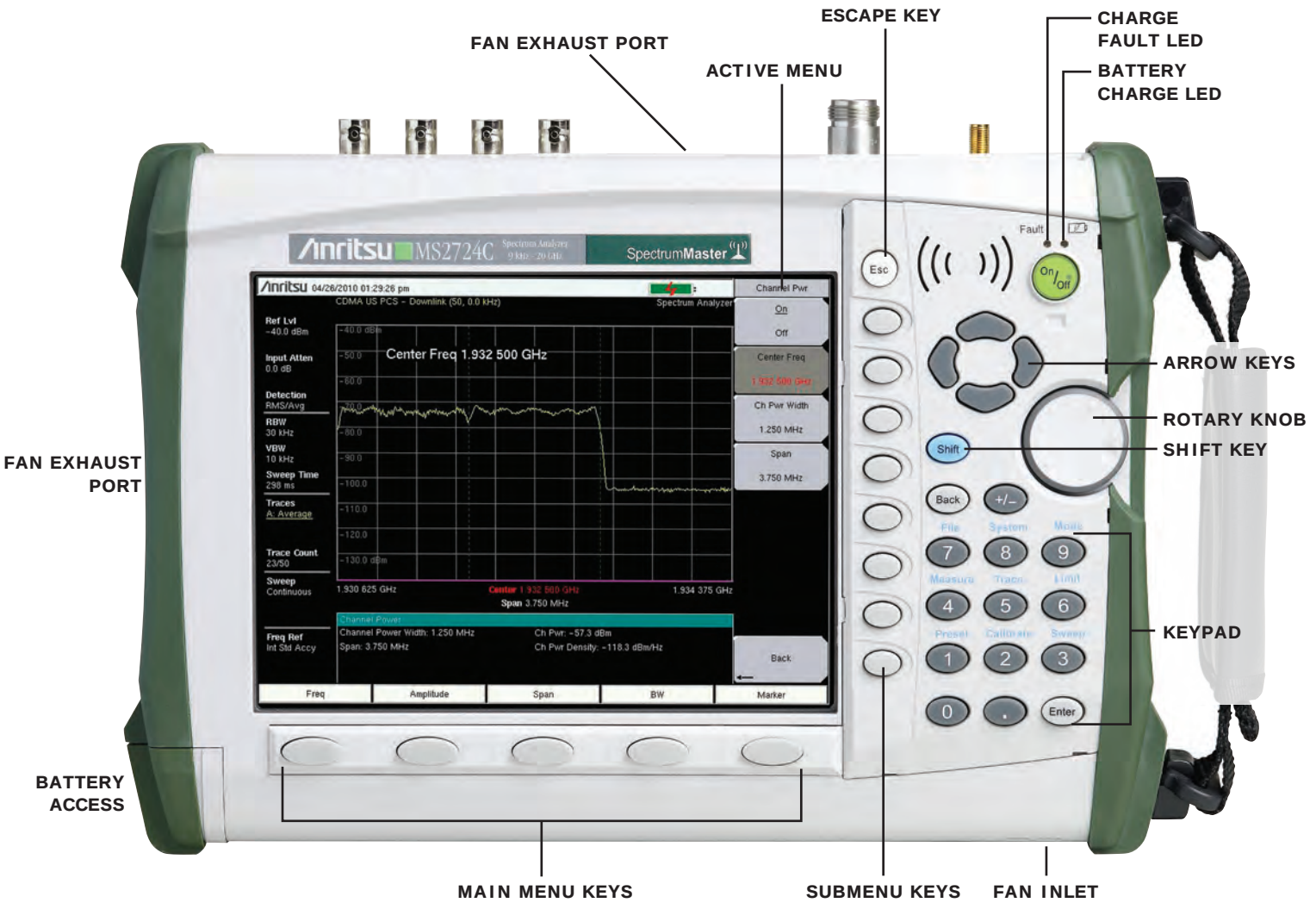
Folder Spectrogram
Folder Spectrogram – 2D View
Video Folder Spectrogram – 2D View
Folder Spectrogram – 3D View

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

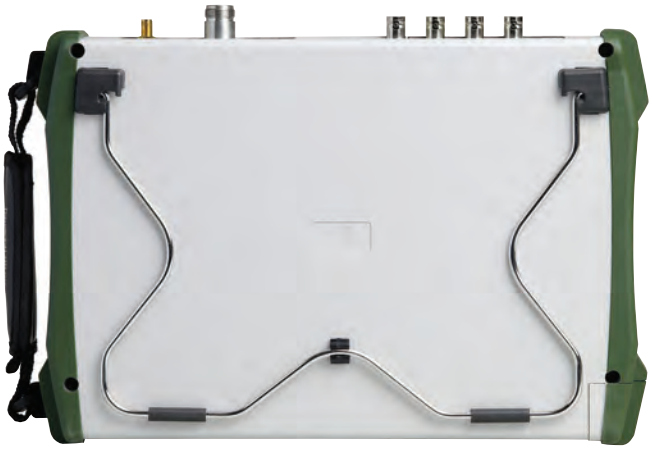
Script Master™
Channel Scanner Mode
GSM/EDGE Mode
W-CDMA/HSPA+ Mode

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

Spectrum Master MS272xC Spectrum Analyzer Features

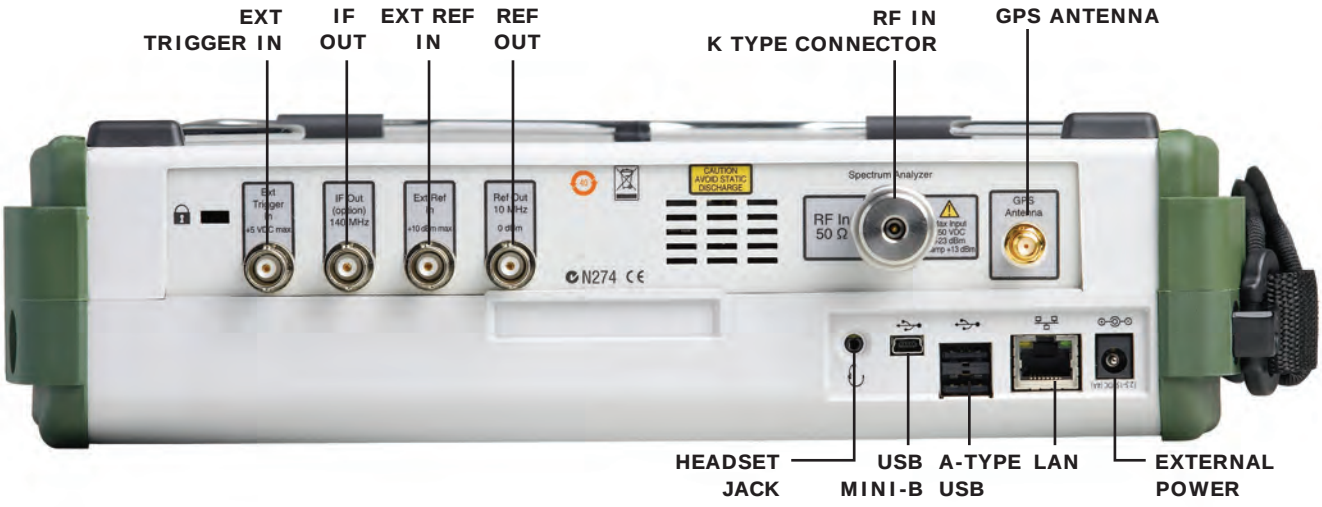


Handheld Size: 315 mm x 211 mm x 77 mm (12.4 in x 8.3 in x 3.0 in), Lightweight: 3.4 kg (7.5 lbs)

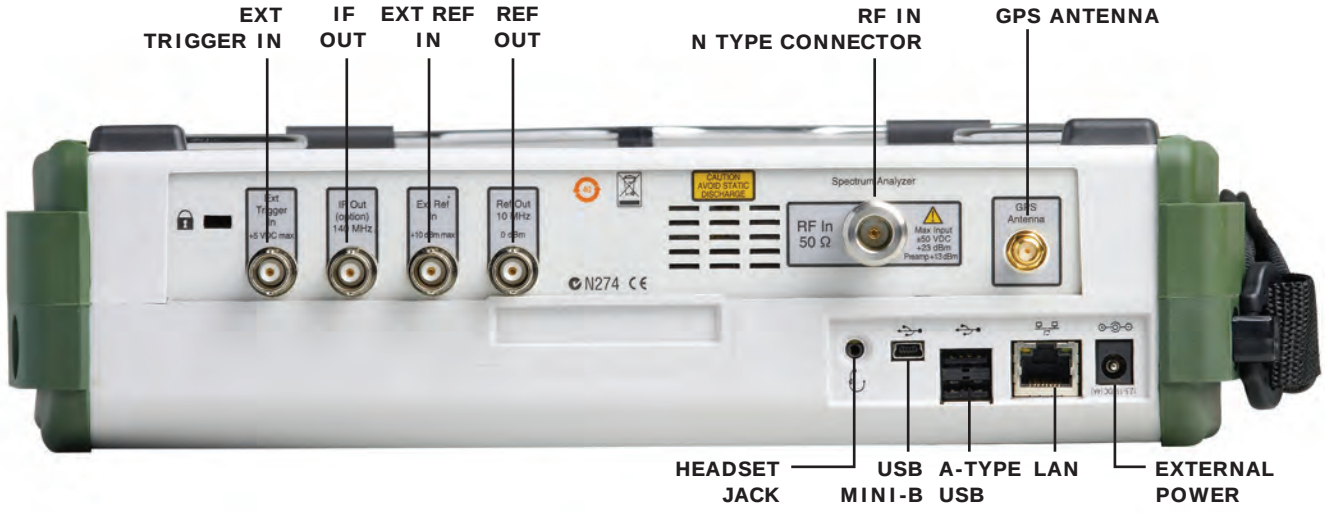


Retractable Tilt Bale Closed

Retractable Tilt Bale Opened



Connector Panel for MS2725C and MS2726C



Connector Panel for MS2722C, MS2723C and MS2724C

Spectrum Master™

High Performance Handheld Spectrum Analyzer

MS2723C

9 kHz to 13 GHz

Introduction

Anritsu's high performance handheld spectrum analyzer provides the wireless professional the performance needed for the most demanding measurements in harsh RF and physical environments. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or Wi-Fi and wireless network measurements, the Spectrum Master is the ideal instrument for making fast and reliable measurements.

Spectrum and Interference Analyzer Highlights

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI
- Dynamic Range: > 104 dB in 1 Hz RBW
- DANL: –160 dBm in 1 Hz RBW
- Phase Noise: –100 dBc/Hz @ 10 kHz offset at 1 GHz
- Frequency Accuracy: ±25 ppb with GPS On
- 1 Hz to 10 MHz Resolution Bandwidth (RBW)
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 40 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete

Capabilities and Functional Highlights

- LTE, TD-LTE
- GSM/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- CDMA, EV-DO
- Fixed, Mobile WiMAX
- AM/FM/SSB Demodulator
- Zero-span IF Output
- Gated Sweep
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter
- 4, 6, 8, 18, 26 GHz USB Sensors
- Channel Scanner
- 8.4 inch Display
- Burst Detect
- < 5 minute warm-up time
- 2.5 hour battery operation time
- Ethernet/USB Data Transfer
- MST Remote Access Tool

Spectrum Master™ MS2723C Spectrum Analyzer
Handheld Size: 315 mm x 211 mm x 77 mm (12.4 in x 8.3 in x 3.0 in), Lightweight: 3.5 kg (7.8 lb)

Spectrum Analyzer

All specifications and characteristics apply to instruments under the following conditions, unless otherwise stated: 1) Instrument within its recommended calibration cycle, 2) After 5 minutes of warm-up time, where the instrument has completely stabilized to the ambient temperature, 3) Internal frequency reference used, 4) Cable analyzer and VNA measurements applicable after standard OSL calibration is performed using Anritsu calibration components, 5) Typical data does not include guard band for measurement uncertainty and temperature variation and is not warranted, 6) All specifications subject to change without notice, 7) Recommended calibration cycle is 12 months.

Measurements

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

Setup Parameters

Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Limit Lines, Screen Shots JPEG (save only), Save-on-Event
Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy
Application Options	Impedance (50 Ω, 75 Ω, Other)

Sweep Functions

Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
Sweep Mode	Fast, Performance, No FFT, Burst Detect
Detection	Peak, RMS/Avg, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Delay, Level, Slope, Hysteresis, Holdoff, Force Trigger Once

Trace Functions

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

Marker Functions

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

Limit Line Functions

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

Frequency

Frequency Range	9 kHz to 13 GHz (tunable to 0 Hz), Preamp 100 kHz to 13 GHz
Tuning Resolution	1 Hz
Frequency Reference	Aging: ±1.0 ppm/10 years Accuracy: ±0.3 ppm (25 °C ±25 °C) + aging
Auto-sensing External Frequency Reference	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608 MHz
Frequency Span	10 Hz to 13 GHz including zero span
Sweep Time	10 µs to 600 seconds in zero span
Sweep Time Accuracy	±2 % in zero span

Bandwidth (Performance Sweep Mode)

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

Spectrum Analyzer (continued)

Spectral Purity

SSB Phase Noise at 1 GHz	–100 dBc/Hz @ 10 kHz offset from carrier (–104 dBc/Hz typical) –102 dBc/Hz @ 100 kHz offset from carrier (–107 dBc/Hz typical) –107 dBc/Hz @ 1 MHz offset from carrier (–114 dBc/Hz typical) –120 dBc/Hz @ 10 MHz offset from carrier (–129 dBc/Hz typical)

Amplitude Ranges

Dynamic Range	> 104 dB @ 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW
Measurement Range	DANL to +30 dBm
Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed
Reference Level Range	–150 dBm to +30 dBm
Attenuator Resolution	0 to 65 dB, 5 dB steps
Amplitude Units	Log Scale Modes: dBm, dBV, dBmv, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW
Maximum Continuous Input	+30 dBm Peak, ±50 VDC (≥ 10 dB Attn) +23 dBm Peak, ±50 VDC (< 10 dB Attn) +13 dBm Peak, ±50 VDC (Preamp On)

Amplitude Accuracy (single sine wave input < Ref level, and > DANL, auto attenuation, Performance Sweep Mode)

20 °C to 30 °C after 30 minute warm-up	Typical: ±0.5 dB, 100 kHz to 13 GHz Maximum: ±1.3 dB, 100 kHz to 13 GHz
–10 °C to 50 °C after 60 minute warm-up	Add ±1.0 dB, 100 kHz to 13 GHz

Displayed Average Noise Level (DANL) (RMS detection, VBW/Avg type = Log., Ref Level = –20 dBm for Preamp Off and –50 dBm for Preamp On, Performance Sweep Mode)

DANL in 1 Hz RBW, 0 dB attenuation	Preamp Off	Preamp On
10 MHz to 4 GHz	–141 dBm	–160 dBm
> 4 GHz to 9 GHz	–134 dBm	–156 dBm
> 9 GHz to 13 GHz	–129 dBm	–152 dBm

Spurs (0 dB input attenuation, Performance Sweep Mode)

Residual Spurs	Preamp Off (RF input terminated)	–90 dBm 9 kHz to 13 GHz
	Preamp On (RF input terminated)	–100 dBm 1 MHz to 13 GHz
Input-Related Spurs	(–30 dBm input, span < 1.7 GHz)	–60 dBc, –70 dBc typical

Third-Order Intercept (TOI) (–20 dBm tones 100 kHz apart, –20 dBm Ref level, 0 dB input attenuation, Preamp Off)

2.4 GHz	+15 dBm
50 MHz to 13 GHz	+20 dBm typical

P1dB

< 4 GHz	+5 dBm typical
4 GHz to 13 GHz	+12 dBm typical

Second Harmonic Distortion

50 MHz	–54 dBc
< 4 GHz	–60 dBc typical
> 4 GHz	–75 dBc typical

VSWR

(> 10 dB input attenuation)

< 13 GHz	1:5:1 typical

Spectrum Analyzer (continued)

Secure Data Option (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.

AM/FM/PM Demodulation Analyzer Option (Option 509)

Spectrum Master comes with AM/FM/SSB audio demodulation standard. By adding Option 509, the instrument becomes capable of measuring, analyzing, and displaying key modulation parameters of RF Spectrum, Audio Spectrum, Audio Waveform, and Demodulation Summary. The RF Spectrum View displays the spectrum analyzer 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. Each demodulation also includes an Audio Waveform oscilloscope display that shows the time-domain demodulated waveform. A summary display provides a list of all the RF and demodulation parameters.

GPS Receiver Option (option 31)

Setup	On/Off, Antenna Voltage 3.3/5.0 V, GPS Info **Note:** Anritsu GPS antennas (2000-1528-R and 2000-1652-R) require 5 VDC
GPS Time/Location Indicator	Time, Latitude, Longitude, and Altitude on display Time, Latitude, Longitude, and Altitude with trace storage
High Frequency Accuracy	Spectrum Analyzer, Interference Analyzer, Signal Analyzers
when GPS Antenna is connected	< ±25 ppb with GPS On, 3 minutes after satellite lock in selected mode
GPS Lock – after antenna is disconnected	< ±50 ppb for 3 days, 0 °C to 50 °C ambient temperature
Connector	SMA, female

High Accuracy Power Meter (option 19, Requires external USB Power Sensor)

Setup Parameters

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

Power Sensor Model	PSN50	MA24104A/105A	MA24106A	MA24108/18/26A
Description	High Accuracy RF Power Sensor	Inline High/Peak Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	600 MHz to 4 GHz (**MA24104A**) 350 MHz to 4 GHz (**MA24105A**)	50 MHz to 6 GHz	10 MHz to 8 GHz (**MA24108A**) 10 MHz to 18 GHz (**MA24118A**) 10 MHz to 26 GHz (**MA24126A**)
Connector	Type N(m), 50 Ω	Type N(f), 50 Ω (**MA24104A**) Type N(f), 50 Ω (**MA24105A**)	Type N(m), 50 Ω	Type N(m), 50 Ω (**MA24108/18A**) Type K(m), 50 Ω (**MA24126A**)
Dynamic Range	–30 dBm to +20 dBm (0.001 mW to 100 mW)	+3 dBm to +51.76 dBm (2 mW to 150 W)	–40 dBm to +23 dBm (0.1 µW to 200 mW)	–40 dBm to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurands	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	±0.16 dB[1]	±0.17 dB[2]	±0.16 dB[1]	±0.18 dB[3]
Datasheet (for complete specifications)	11410-00414	11410-00483 (**MA24104A**) 11410-00621 (**MA24105A**)	11410-00424	11410-00504
Notes:	**1.** Total RSS measurement uncertainty (0 °C to 50 °C) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors. **2.** Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor. **3.** Expanded uncertainty with K=2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.			

Coverage Mapping (Option 431)

Measurements

Indoor Mapping	RSSI, ACPR
Outdoor Mapping	RSSI, ACPR

Setup Parameters

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

I/Q Waveform Capture (option 24, Requires option 9)

General

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

Interference Analyzer (Option 25)

Measurements

Spectrum	Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I)
Spectrogram	Collect data up to 72 hours
Signal Strength	Gives visual and aural indication of signal strength
Received Signal Strength Indicator (RSSI)	collect data up to one week Gives visual and aural indication of signal strength
Signal ID	up to 12 signals Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi only) Closest Channel Number Number of Carriers Signal-to-Noise Ratio (SNR) > 10 dB
Interference Mapping	Save current point location and direction Save/Recall points/map Delete last saved point Delete all points Speaker on/off Volume Reset Max/Min hold
Application Options	Impedance (50 Ω, 75 Ω, Other)

Channel Scanner (option 27)

General

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Custom List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	9 kHz to 13 GHz
Frequency Accuracy	±10 Hz + Time base error
Measurement Range	–110 dBm to +30 dBm
Application Options	Impedance (50 Ω, 75 Ω, Other)

Gated Sweep (option 90)

General

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

Zero Span IF Output (option 89)

General

Mode	Spectrum Analyzer/Span/Zero Span
IF Frequency	140 MHz
Output Level	–40 dBm to –20 dBm typical
Reference Level	–43 dBm to +30 dBm (Preamp Off) –60 dBm to –40 dBm (Preamp On)
IF Bandwidths	Up to 30 MHz (3 dB bandwidth)
RF Attenuation	Auto
Connector	BNC female

GSM/EDGE Signal Analyzers (Options 40, 41)

Measurements

RF (option 40)	Demodulation (option 41)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum -Channel Power -Occupied Bandwidth -Burst Power -Average Burst Power -Frequency Error -Modulation Type -BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) -Channel Power -Occupied Bandwidth -Burst Power -Average Burst Power -Frequency Error -Modulation Type -BSIC (NCC, BCC)	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC)	RF Measurements and Demodulation can be made OTA. There are no additional OTA Measurements.	Measurements -Channel Power -Occupied Bandwidth -Burst Power -Average Burst power -Frequency Error -Phase Error -EVM -Origin Offset -C/I -Magnitude Error Script Master™

Setup Parameters

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

RF Measurements (option 40)

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

Demodulation (option 41)

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

W-CDMA/HSPA+ Signal Analyzers (Options 44, 65, 35)

Measurements

RF (option 44)	Demodulation (option 65)	Over-the-Air (OTA) (option 35)	Pass/Fail (User Editable)
Band Spectrum Channel Spectrum -Channel Power -Occupied Bandwidth -Peak-to-Average Power Spectral Emission Mask Single carrier ACLR Multi-carrier ACLR RF Summary	Code Domain Power Graph -P-CPICH Power -Channel Power -Noise Floor -EVM -Carrier Feed Through -Peak Code Domain Error -Carrier Frequency -Frequency Error -Control Channel Power -Abs/Rel/Delta Power –CPICH, P-CCPCH –S-CCPCH, PICH –P-SCH, S-SCH HSPA+ -Power vs. Time -Constellation Code Domain Power Table -Code, Status -EVM, Modulation Type -Power, Code Utilization -Power Amplifier Capacity Codogram Modulation Summary	Scrambling Code Scanner (Six) -Scrambling Codes -CPICH -Ec/Io -Ec -Pilot Dominance -OTA Total Power Multipath Scanner (Six) -Six Multipaths -Tau -Distance -RSCP -Relative Power -Multipath Power	Measurements Max Output Power Frequency Error EVM CPICH Occupied Bandwidth Spectral Mask ACLR PCDE P-CCPCH S-CCPCH Code Spread 3 PICH Code 128 Script Master™ Test Models -1 (16), (32), (64) -2 -3 (16), (32) -4 (+CPICH), (-CIPCH) -5 (2 HS), (4 HS), (8 HS)

Setup Parameters	
Scrambling Code, Threshold	Auto, Manual
User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
Maximum Spreading Factor	256, 512
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Marker	Six Markers, Table On/Off
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements
RF Measurements	(option 44)
RF Channel Power Accuracy	±1.25 dB, ±0.7 dB typical, (temperature range 15 °C to 35 °C)
Occupied Bandwidth Accuracy	±100 kHz
Adjacent Channel Leakage Ratio (ACLR)	–54 dB/–59 dB ±0.8 dB @ 5 MHz/10 MHz offset, typical, Bands I to VI, VIII to XIV, XVII –54 dB/–57 dB ±1.0 dB @ 5 MHz/10 MHz offset, typical, Band VII
Demodulation	(option 65)
W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
HSPA+ Modulations	QPSK, 16 QAM, 64 QAM
EVM Accuracy	±2.5 %, 6 % = EVM = 25 %
Residual EVM	2.5% typical
Code Domain Power	±0.5 dB for code channel power > –25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
CPICH (dBm) Accuracy	±0.8 dB typical
Over-the-Air (OTA) Measurements (option 35)	
Scrambling Code Scanner	Six strongest Scrambling Codes
Multipath Scanner	Multipath power of six signals relative to strongest pilot

CDMA Signal Analyzers (option 42, 43, 33)

Measurements

RF (option 42)	Demodulation (option 43)	Over-the-Air (OTA) (0ption 33)	Pass/Fail (User Editable)
Channel Spectrum -Channel Power -Occupied Bandwidth -Peak-to-Average Power Spectral Emission Mask Multi-carrier ACPR RF Summary	Code Domain Power Graph -Pilot Power -Channel Power -Noise Floor -Rho -Carrier Feed Through -Tau -RMS Phase Error -Frequency Error -Abs/Rel/ Power –Pilot –Page –Sync –Q Page Code Domain Power Table -Code -Status -Power -Multiple Codes -Code Utilization Modulation Summary	Pilot Scanner (Nine) -PN -Ec/Io -Tau -Pilot Power -Channel Power -Pilot Dominance Multipath Scanner (Six) -Ec/Io -Tau -Channel Power -Multipath Power Limit Test – 10 Tests Averaged -Rho -Adjusted Rho -Multipath -Pilot Dominance -Pilot Power -Pass/Fail Status	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

Setup Parameters

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

RF Measurements (option 42)

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

Demodulation (option 43)

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

Over-the-Air (OTA) Measurements (option 33)

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

EV-DO Signal Analyzers (option 62, 63, 34)

Measurements

RF (option 62)	Demodulation (option 63)	Over-the-Air (OTA) (option 34)	Pass/Fail (User Editable)
Channel Spectrum -Channel Power -Occupied Bandwidth -Peak-to-Average Power Power vs. Time -Pilot & MAC Power -Channel Power -Frequency Error -Idle Activity -On/Off Ratio Spectral Emission Mask Multi-carrier ACPR RF Summary	MAC Code Domain Power Graph -Pilot & MAC Power -Channel Power -Frequency Error -Rho Pilot -Rho Overall -Data Modulation -Noise Floor MAC Code Domain Power Table -Code -Status -Power -Code Utilization Data Code Domain Power -Active Data Power -Data Modulation -Rho Pilot -Rho Overall -Maximum Data CDP -Minimum Data CDP Modulation Summary	Pilot Scanner (Nine) -PN -Ec/Io -Tau -Pilot Power -Channel Power -Pilot Dominance Mulitpath Scanner (Six) -Ec/Io -Tau -Channel Power -Multipath Power	Measurements -Channel Power -Occupied Bandwidth -Peak-to-Average Power -Carrier Frequency -Frequency Error -Spectral Mask -Noise Floor -Pilot Power -RMS Phase Error -Tau -Code Utilization -Measured PN -Pilot Dominance -Mulitpath Power

Setup Parameters

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

RF Measurements (option 62)

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

Demodulation (option 63)

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

Over-the-Air (OTA) Measurements (option 34)

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

LTE Signal Analyzers (Options 541, 542, 543, 546)

Measurements

RF (option 541)	Modulation (option 542)	Over-the-Air (OTA) (option 546)	Pass/Fail (User Editable)
Channel Spectrum -Channel Power -Occupied Bandwidth ACPR Spectral Emission Mask -Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) -RB Power (PDSCH) -Active RBs, Utilization % -Channel Power, Cell ID -OSTP, Frame EVM by modulation Constellation -QPSK, 16 QAM, 64 QAM -Modulation Results –Ref Signal Power (RS) –Sync Signal Power (SS) –EVM – rms, peak, max hold –Frequency Error – Hz, ppm –Carrier Frequency –Cell ID Control Channel Power -Bar Graph or Table View -RS, P-SS, S-SS -PBCH, PCFICH, PHICH, PDCCH -Total Power (Table View) -EVM Tx Time Alignment Modulation Summary -Includes EVM by modulation Antenna Icons -Detects active antennas (1 or 2)	Scanner -Cell ID (Group, Sector) -S-SS Power, RSRP, RSRQ, SINR -Dominance -Modulation Results – On/Off Tx Test -Scanner -RS Power of MIMO antennas –Cell ID, Average Power –Delta Power (Max-Min) –Graph of Antenna Power –Modulation Results – On/Off Mapping –On-screen –S-SS Power, RSRP, RSRQ, or SINR	View Pass/Fail Limits -All, RF, Modulation Available Measurements -Channel Power -Occupied Bandwidth -ACLR -Frequency Error -Carrier Frequency -Dominance -EVM peak, rms -RS Power, EVM -SS, P-SS, S-SS Power, EVM -PBCH Power, EVM -PCFICH Power, EVM -PHICH Power, EVM -PDCCH Power, EVM -Cell, Group, Sector ID -OSTP -Tx Time Alignment

Setup Parameters

Frequency	E-UTRA bands 1 - 5, 7 - 14, 17 - 21, 23 - 25 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Bandwidth	1.4, 3, 5, 10, 15, 20 MHz (15, 20 MHz requires option 543)
Span	Auto, 1.4, 3, 5, 10, 15, 20, 30 MHz
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
EVM Mode	Auto, PBCH only, Max Hold
Save/Recall	Setup, Measurement, JPEG (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

RF Measurements (option 541)

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

Modulation Measurements (option 542)

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

BW = 15 MHz, 20 MHz (option 543)

Bandwidths	15 MHz, 20 MHz

Over-the-Air (OTA) Measurements (option 546)

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

TD-LTE Signal Analyzers (Options 551, 552, 543, 556)

Measurements

RF (option 551)	Modulation (option 552)	Over-the-Air (OTA) (option 556)	Pass/Fail (User Editable)
Channel Spectrum -Channel Power -Occupied Bandwidth Power vs. Time -Frame View -Sub-Frame View -Total Frame Power -DwPTS Power -Transmit Off Power -Cell ID -Timing Error ACLR Spectral Emission Mask -Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) -RB Power (PDSCH) -Active RBs, Utilization % -Channel Power, Cell ID Constellation -QPSK, 16 QAM, 64 QAM -Modulation Results –Ref Signal Power (RS) –Sync Signal Power (SS) –EVM – rms, peak, max hold –Frequency Error – Hz, ppm –Carrier Frequency –Cell ID Control Channel Power -Bar Graph or Table View -RS, P-SS, S-SS -PBCH, PCFICH -Total Power (Table View) -Modulation Results Modulation Summary Antenna Icons -Detects active antennas (1 or 2)	Scanner -Cell ID (Group, Sector) -S-SS Power, RSRP, RSRQ, SINR -Dominance -Modulation Results – On/Off Tx Test -Scanner -RS Power of MIMO antennas –Cell ID, Average Power –Delta Power (Max-Min) –Graph of Antenna Power –Modulation Results – On/Off Mapping –On-screen –S-SS Power, RSRP, RSRQ, or SINR	View Pass/Fail Limits -All, RF, Modulation Available Measurements -Channel Power -Occupied Bandwidth -ACLR -Frequency Error -Carrier Frequency -Dominance -EVM peak, rms -RS Power -SS, P-SS, S-SS Power -PBCH Power -PCFICH Power -Cell, Group, Sector ID -Frame Power -DwPTS Power -Transmit Off Power -Timing Error

Setup Parameters

Frequency	E-UTRA bands 33 - 43 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Bandwidth	1.4, 3, 5, 10, 15, 20 MHz (15, 20 MHz requires option 543)
Span	Auto, 1.4, 3, 5, 10, 15, 20, 30 MHz
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
EVM Mode	Auto, PBCH only, Max Hold
Trigger	No Trigger/Ext Trigger, Rising/Falling
Save/Recall	Setup, Measurement, JPEG (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

RF Measurements (option 551)

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

Modulation Measurements (option 552)

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

BW = 15, 20 MHz (option 543)

Bandwidths	15 MHz, 20 MHz

Over-the-Air (OTA) Measurements (option 556)

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

Fixed and Mobile WiMAX[1] Signal Analyzers (Options 46, 47, 66, 67, 37)

Measurements

RF (option 46 - Fixed) (option 66 - Mobile)	Demodulation (option 47 - Fixed) (option 67 - Mobile)	Over-the-Air (OTA) (option 37 - Mobile)	Pass/Fail (User Editable)
Channel Spectrum -Channel Power -Occupied Bandwidth Power vs. Time -Channel Power -Preamble Power -Downlink Burst Power (Mobile) -Uplink Burst Power (Mobile) -Data Burst Power (Fixed) -Crest Factor (Fixed) ACPR RF Summary	Constellation -RCE (RMS/Peak) -EVM (RMS/Peak) -Frequency Error -CINR (Mobile) -Base Station ID -Sector ID (Mobile) Spectral Flatness -Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol -RCE (RMS/Peak) -EVM (RMS/Peak) -Frequency Error -CINR (Mobile) -Base Station ID -Sector ID (Mobile) DL-MAP (Tree View) (Mobile) Modulation Summary	Channel Power Monitor Preamble Scanner (Six) -Preamble -Relative Power -Cell ID -Sector ID -PCINR -Dominant Preamble –Base Station ID	Pass Fail All Pass/Fail RF Pass Fail Demod Measurements Channel Power Occupied Bandwidth Downlink Bust Power Uplink Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency EVM RCE Sector ID (Mobile)

Setup Parameters

Fixed WiMAX Frequency Ranges	2.3 to 2.7 GHz, 3.3 to 3.8 GHz, 5.25 to 5.875 GHz
Mobile WiMAX Frequency Ranges	2.3 to 2.7 GHz, 3.3 to 3.8 GHz
Fixed WiMAX Bandwidth	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00 MHz
Fixed WiMAX Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
Fixed WiMAX Span	5, 10, 15, 20 MHz
Fixed WiMAX Frame Length	2.5, 5.0, 10.0 msec
Mobile WiMAX Zone Type	PUSC
Mobile WiMAX DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
Mobile WiMAX Bandwidths	3.50, 5.00, 7.00, 8.75, 10.00 MHz
Mobile WiMAX Cyclic Prefix Ratio (CP)	1/8
Mobile WiMAX Span	5, 10, 20, 30 MHz
Mobile WiMAX Frame Lengths	5, 10 msec
Mobile WiMAX Demodulation	Auto, Manual, FCH
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (option 46 – Fixed, option 66 – Mobile)

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

Demodulated Signal Analyzer (option 47 – Fixed, option 67 – Mobile)

Frequency Error	±10 Hz + time base error, 99% confidence level
Fixed WiMAX Residual EVM (rms)	3% typical, 3.5% maximum (RF Input –50 dBm to +20 dBm)
Mobile WiMAX Residual EVM (rms)	2.5% typical, 3.0% maximum, (RF Input –50 dBm to +20 dBm)

Over-the-Air (OTA) Measurements (option 37)

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

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

TD-SCDMA / HSPA+ Signal Analyzers (Options 60, 61, 38)

Measurements

RF Measurements (Option 60)	Demodulation (Option 61)	Over-the-Air (OTA) (Option 38)	Pass/Fail (User Editable)
Channel Spectrum -Channel Power -Occupied Bandwidth -Left Channel Power -Left Channel Occ B/W -Right Channel Power -Right Channel Occ B/W Power vs. Time -Six Slot Powers -Channel Power (RRC) -DL-UL Delta Power -UpPTS Power -DwPTS Power -On/Off Ratio -Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error -(QPSK/8 PSK/16 QAM) -Slot Power -DwPTS Power -Noise Floor -Frequency Error -Tau -Scrambling Code -EVM -Peak EVM -Peak Code Domain Error -CDP Marker Modulation Summary	Code Scan (32) -Scrambling Code Group -Tau -Ec/Io -Pilot Dominance Tau Scan (Six) -Sync-DL# -Tau -Ec/Io -DwPTS Power -Pilot Dominance Record Run/Hold	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

Setup Parameters

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

RF Measurements (option 60)

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

Demodulation (option 61)

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

Over-the-Air (OTA) Measurements (option 38)

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

General Specifications

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

Setup Parameters

System	Status (Temperature, Battery Info, S/N, Firmware Ver, IP Address, Options Installed) Self Test, Application Self Test GPS (see Option 31)
System Options	Name, Date and Time, Ethernet Configuration, Display, Volume Display (Brightness, Default Colors, Black and White, Night Vision, High Contrast) Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, User defined) Share Center Frequency and Power Offset between Modes Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots JPEG (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Internal Trace/Setup Memory	> 13,000 traces
External Trace/Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

Connectors

RF In	Type N, female, 50 Ω, Maximum Input +30 dBm, ±50 VDC
GPS	SMA female
External Power	5.5 mm barrel connector, 12 to 15 VDC, < 5.0 Amps
LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset Jack	2.5 mm 3-wire headset jack
External Reference In	BNC, female, 50 Ω, Maximum Input –10 dBm to +10 dBm
External Reference Out	BNC, female, 50 Ω, 10 MHz
External Trigger	BNC, female, 50 Ω, Maximum Input ±5 VDC
IF Out	BNC, female, 50 Ω, 140 MHz

Display

Size	8.4 in
Resolution	800 x 600

Battery

Type	Li-Ion
Battery Operation	3 hours, typical

Electromagnetic Compatibility

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

Safety

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

Environmental

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

Size and Weight

Size	315 mm x 211 mm x 77 mm, (12.4 in x 8.3 in x 3.0 in)
Weight	3.5 kg, (7.8 lb)

Master Software Tools (for your PC)

Database Management	
Full Trace Retrieval	Retrieve all traces from instrument into one PC directory
Trace Catalog	Index all traces into one catalog
Trace Rename Utility	Rename measurement traces
Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
DAT File Converter	Converts HHST files to MST file format and vice-versa
Data Analysis	
Trace Math and Smoothing	Compare multiple traces
Data Converter	Convert from/to Return Loss/ VSWR/ Cable Loss/ DTF and also into Smith Charts
Measurement Calculator	Translates into other units
Report Generation	
Report Generator	Includes GPS, power level, and calibration status along with measurements
Edit Graph	Change scale, limit lines, and markers
Report Format	Create reports in HTML for PDF format
Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
Notes	Annotate measurement Map Point
Mapping	(GPS Required)
Spectrum Analyzer Mode	MapInfo, MapPoint
Mobile WiMAX OTA Option	Google Earth, Google Maps, MapInfo
Folder Spectrogram	(Spectrum Monitoring for Interference Analysis and Spectrum Clearing)
Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)
List / Parameter Editors	
Traces	Add, delete, and modify limit lines and markers
Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
Product Updates	Auto-checks Anritsu Web site for latest revision firmware
Firmware Upload	Upload new firmware into the instrument
Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
VSG Pattern Converter	Import user-defined patterns (ASCII text or MATLAB file format required)
Languages	Add up to two languages or modify non-English language menus
Mobile WiMAX	DL-MAP Parameters
Display	Modify display settings
Script Master™	
Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
GSM/GPRS/EDGE or W-CDMA/HSPA+ Mode	Automate Signal Analysis testing requirements with annotated how-to pictures
Connectivity	
Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
Download	Download measurements and live traces to PC for storage and analysis
Upload	Upload measurements from PC to instrument
Firmware Updates	Product Update: download latest firmware version
Remote Access Tool	Remote control and monitoring of instrument (via Ethernet port) over the Internet

Ordering Information

	MS2723C	Description
	9 kHz to 13 GHz	Spectrum Analyzer
	Options	
	MS2723C-0007	Secure Data Operation
	MS2723C-0019	High-Accuracy Power Meter (requires Power Sensor)
	MS2723C-0031	GPS Receiver (requires Antenna P/N 2000-1528-R or 2000-1652-R)
	MS2723C-0025	Interference Analyzer (recommend Option 31)
	MS2723C-0027	Channel Scanner
	MS2723C-0089	Zero-Span IF Output
	MS2723C-0431	Coverage Mapping (requires Option 31)
	MS2723C-0509	AM/FM/PM Analyzer
	MS2723C-0090	Gated Sweep
	MS2723C-0009	I/Q Demodulation Hardware
	MS2723C-0024	I/Q Waveform Capture[a]
	MS2723C-0040	GSM/EDGE RF Measurements[a]
	MS2723C-0041	GSM/EDGE Demodulation[a]
	MS2723C-0044	W-CDMA/HSPA+ RF Measurements[a]
	MS2723C-0065	W-CDMA/HSPA+ Demodulation[a]
	MS2723C-0035	W-CDMA/HSPA+ Over-the-Air (OTA) Measurements[a]
	MS2723C-0060	TD-SCDMA/HSPA+ Measurements[a]
	MS2723C-0061	TD-SCDMA/HSPA+ Demodulation[a]
	MS2723C-0038	TD-SCDMA/HSPA+ Over-the-Air (OTA) Measurements[a] (recommend Option 31)
	MS2723C-0541	LTE RF Measurements[a]
	MS2723C-0542	LTE Modulation Measurements[a]
	MS2723C-0546	LTE Over-the-Air (OTA) Measurements[a] (recommend Option 31)
	MS2723C-0543	15 MHz and 20 MHz LTE Modulation Measurements[a] (requires Option 541, 542, 551 or 552)
	MS2723C-0551	TD-LTE RF Measurements[a]
	MS2723C-0552	TD-LTE Modulation Measurements[a]
	MS2723C-0556	TD-LTE Over-the-Air (OTA) Measurements[a] (recommend Option 31)
	MS2723C-0042	CDMA RF Measurements[a]
	MS2723C-0043	CDMA Demodulation[a]
	MS2723C-0033	CDMA Over-the-Air (OTA) Measurements[b]
	MS2723C-0062	EV-DO RF Measurements[a]
	MS2723C-0063	EV-DO Demodulation[a]
	MS2723C-0034	EV-DO Over-the-Air (OTA) Measurements[b]
	MS2723C-0046	Fixed WiMAX RF Measurements[a]
	MS2723C-0047	Fixed WiMAX Demodulation[a]
	MS2723C-0066	Mobile WiMAX RF Measurements[a]
	MS2723C-0067	Mobile WiMAX Demodulation[a]
	MS2723C-0037	Mobile WiMAX Over-the-Air (OTA) Measurements[a] (recommend Option 31)
	MS2723C-0098	Standard Calibration (ANSI Z540-1-1994)
	MS2723C-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)

a.Requires Option 9

b.Requires Option 9 and Option 31

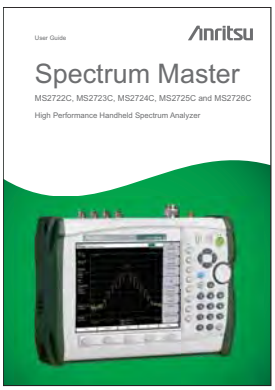
Power Sensors

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

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

Manuals

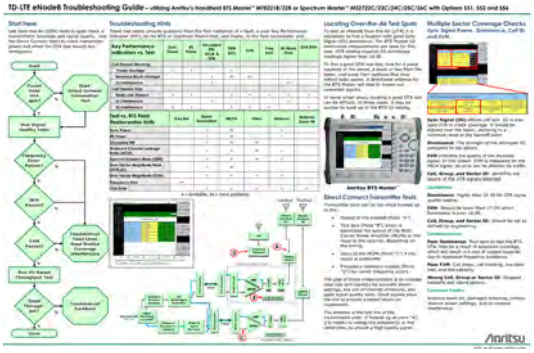
(soft copy included on Handheld Instruments Documentation Disc and at www.anritsu.com)



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc (included)
10580-00277	Spectrum Master User Guide (Hard copy included), - GPS Receiver
10580-00244	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, IF Output
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+, LTE, TD-LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00278	Spectrum Master Programming Manual
10580-00279	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
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations

Standard Accessories (included with instrument)

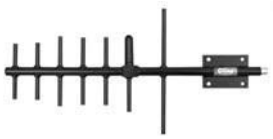
Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00277	Spectrum Master User Guide (includes GPS Receiver)
2300-498	Master Software Tools (MST) CD Disc
2000-1685-R	Soft Carrying Case
633-44	Rechargeable Li-Ion Battery (for replacement, use high-capacity battery, part number 633-75)
40-187-R	AC/DC Power Supply
806-141-R	Automotive Cigarette Lighter 12 Volt DC Adapter
2000-1371-R	Ethernet Cable, 7 feet/213 cm
3-2000-1498	USB A-mini B Cable, 10 feet/305 cm
11410-00524	MS2723C Spectrum Master Technical Data Sheet

One Year Warranty (Including battery, firmware, and software)

Certificate of Calibration and Conformance

Optional Accessories

Directional Antennas



Part Number	Description
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1659-R	698 MHz to 787 MHz, 8 dBd gain
2000-1660-R	1425 MHz to 1535 MHz, 12 dBd gain
2000-1617	600 MHz to 21 GHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic

Portable Antennas

Part Number	Description
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 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
2000-1616	20 MHz to 21000 MHz, omnidirectional, N(f), 50 Ω
2000-1487	VHF/UHF, Telescopic Whip antenna, straight or 90°, BNC(m), 50 Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)

Mag Mount Broadband Antenna

Part Number	Description
2000-1647-R	Cable 1: 698–1200 MHz 2 dBi peak gain, 1700–2700 MHz 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 2: 3000–6000 MHz 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 10 ft GPS Dual voltage 3 VDC or 5 VDC
2000-1645-R	694-894 MHz 3 dBi peak gain, 1700-2700 MHz 3 dBi peak gain, N(m), 50 Ω, 10 ft
2000-1646-R	750-1250 MHz 3 dBi peak gain, 1650-2000 MHz 5 dBi peak gain, 2100-2700 MHz 3 dBi peak gain, N(m), 50 Ω, 10 ft
2000-1648-R	1700-6000 MHz 3 dBi peak gain, N(m), 50 Ω, 10 ft

Bandpass Filters

Part Number	Description
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50 Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50 Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(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 Band, 0.34 dB loss, N(m) to SMA(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(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 787 MHz, N(m) to N(f), 50 Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50 Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50 Ω

Attenuators

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

Adapters

Part Number	Description
1091-26-R	SMA(m) 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
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50 Ω, w/ Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

Precision Adapters

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

Miscellaneous Accessories

Part Number	Description
2000-1528-R	GPS Antenna, SMA(m) with 15 ft cable requires 5 Vdc
2000-1652-R	GPS Antenna, SMA(m) with 1 foot cable, requires 5 Vdc
2000-1374	External Charger for Li-Ion Batteries
633-75	High Capacity Battery Pack, 7000 mAh
66864	Rack Mount Kit, Master Platform

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

The Master Users Group is an organization dedicated to providing training, technical support, networking opportunities and links to Master product development teams. As a member you will receive the Insite Quarterly Newsletter with user stories, measurement tips, new product news and more.

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