Product Brochure

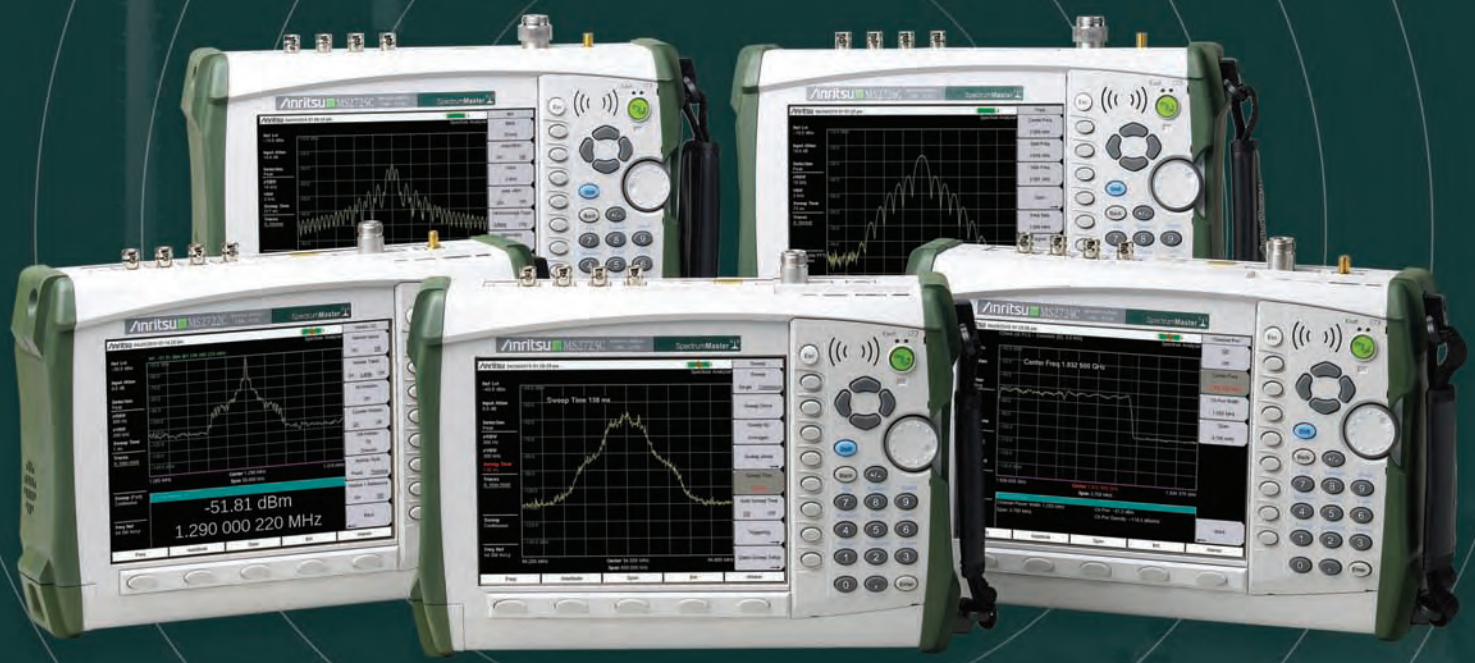
Anritsu

Spectrum Master™

High Performance Handheld Spectrum Analyzer

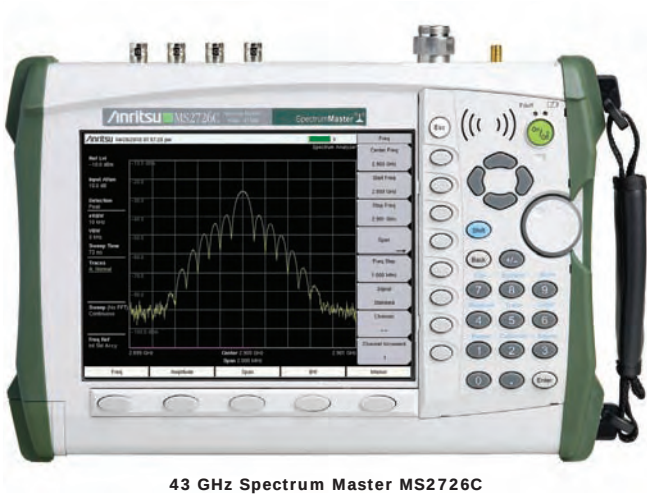
MS2722C	MS2723C	MS2724C	MS2725C	MS2726C
9 kHz to 9 GHz	9 kHz to 13 GHz	9 kHz to 20 GHz	9 kHz to 32 GHz	9 kHz to 43 GHz

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

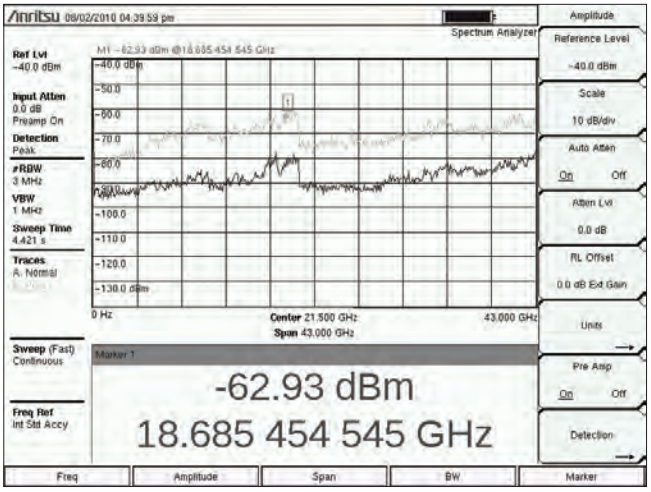


Spectrum Master MS272xC Spectrum Analyzer Introduction

Overview

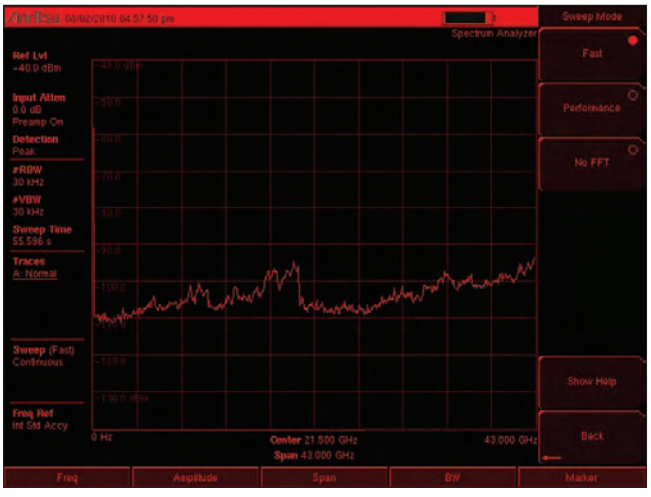


43 GHz Spectrum Master MS2726C



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
- Three Sweep Modes – Fast, Performance, and No FFT
- 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

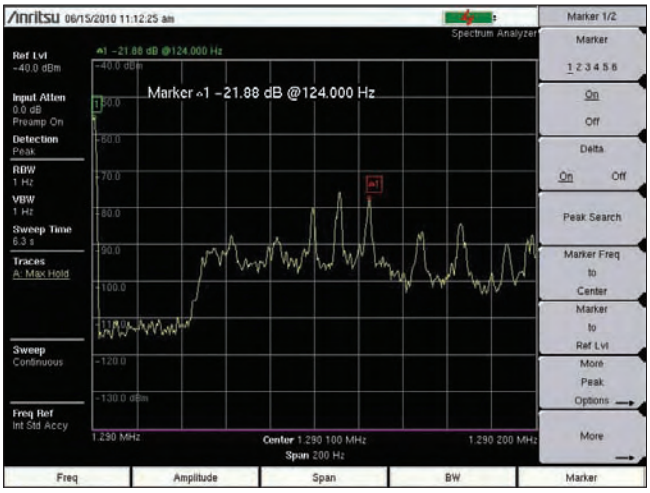
The Spectrum Master MS272xC features over 30 analyzers in one to meet virtually every measurement need. In addition to spectrum analysis a user can select optional capabilities and analyzers including:

- High Accuracy Power Meter
- Interference Analyzer
- Channel Scanner
- 30 MHz Zero-Span IF Output
- GPS Receiver
  Increase frequency accuracy, geo-tag data collection
- Secure data operation
- 3GPP Signal Analyzers
  LTE, GSM/EDGE, W-CDMA/HSPA+,
  TD-SCDMA/HSDPA
- 3GPP2 Signal Analyzers
  CDMA2000 1X, CDMA2000 1xEV-DO
- IEEE 802.16 Signal Analyzers
  Fixed WiMAX, Mobile WiMAX
- PIM Analyzer

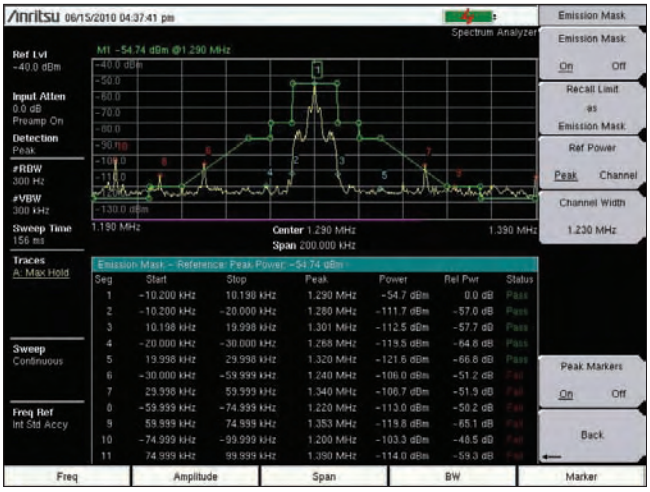
For post processing data collected on your instrument utilize Master Software Tools – a PC program included with the instrument. It provides powerful data analysis tools for spectrum clearing and interference monitoring. And the Remote Access Tool allows the user to see and control the instrument over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

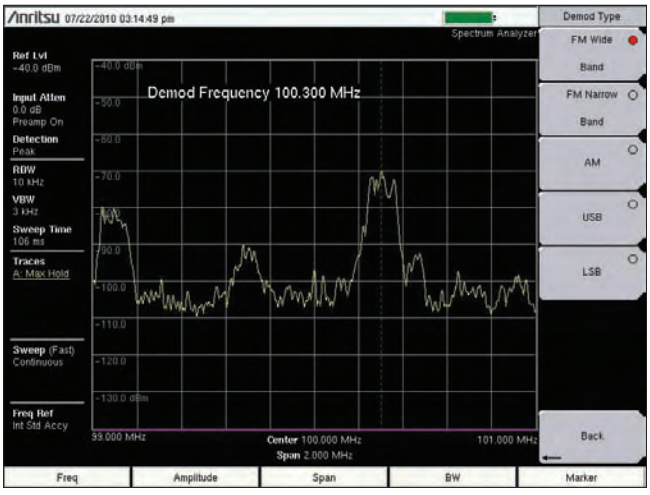
Overview (continued)



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)

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.

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

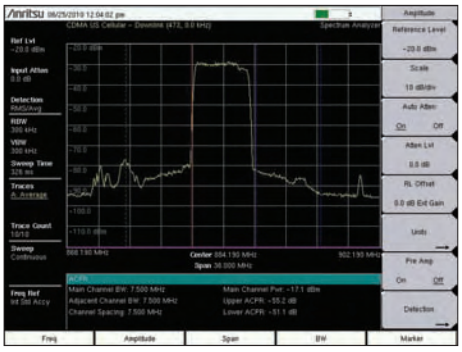
Measurements, limit lines, JPEG screen shots and setup files can be stored internally or to an external USB memory. Secure Data Operation option allows storage on external USB memory only. No data or set-up information can be stored internally.

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.

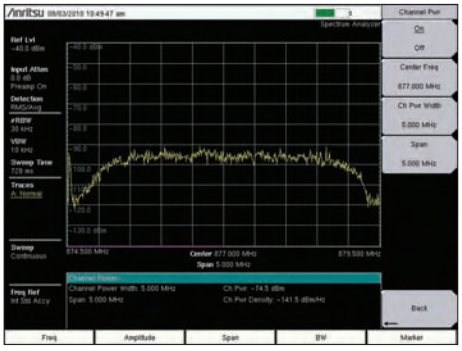
Spectrum Master MS272xC Spectrum Analyzer Features

Spectrum Analyzer



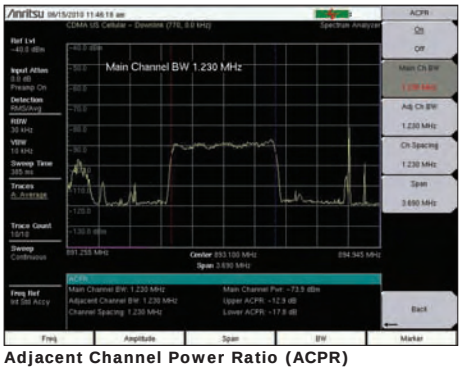
Occupied Bandwidth

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



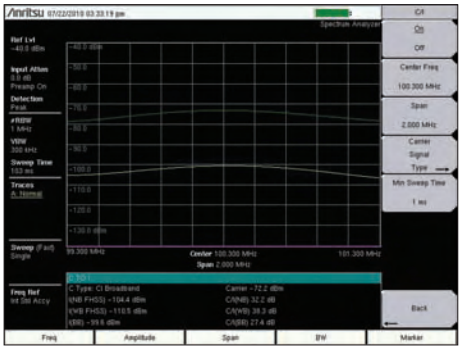
Channel Power

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 rouge 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 s 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

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

Sweep Functions

Sweep Once

Sweep 10 Averages

Sweep Mode
- Fast
- Performance
- No FFT
- 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

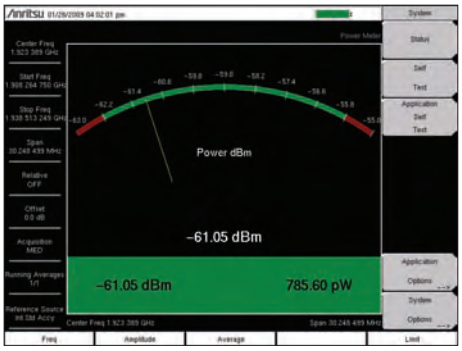
Limit Line Edit
- Frequency, Amplitude, Add/Delete Point, Add Vertical, Next Point Left/Right

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

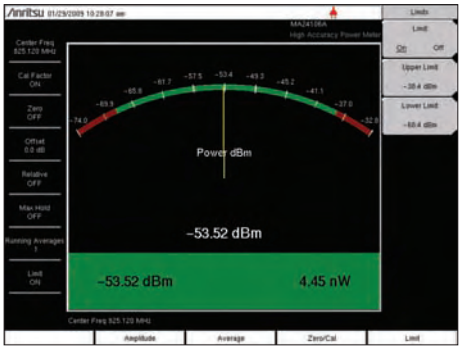
Limit Line Advanced
- Absolute/Relative, Mirror, Save/Recall

Power Meter



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.

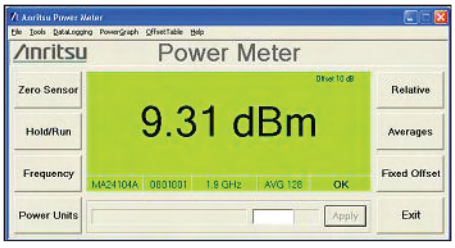


High Accuracy Power Meter (Option 0019)

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.

High Accuracy Power Meter (Option 0019)

Power Meters

The Spectrum Master offers 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 wireless network. A 1.5 dB change in power levels means a 15% change in coverage area.

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

High Accuracy Power Meter (Option 19)

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

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

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

The power sensor easily connects to the 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

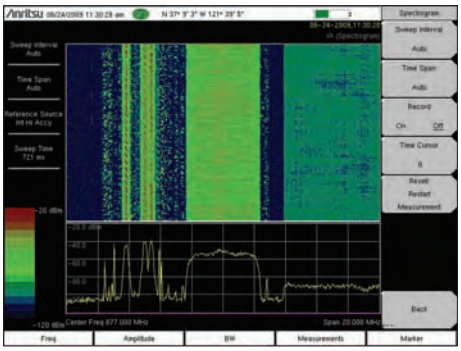
MA24118A

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

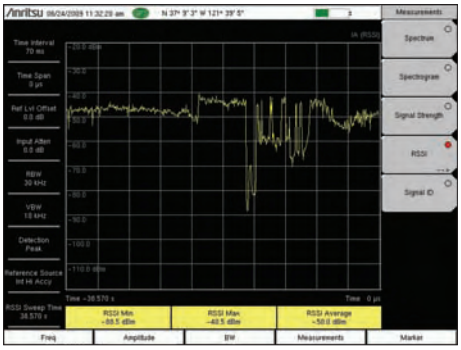
Microwave USB Power Sensor
- 10 MHz to 26 GHz,
- -40 dBm to +20 dBm
- (0.1 µW to 100 mW)
- True-RMS
- Slot Power
- Burst Average Power

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



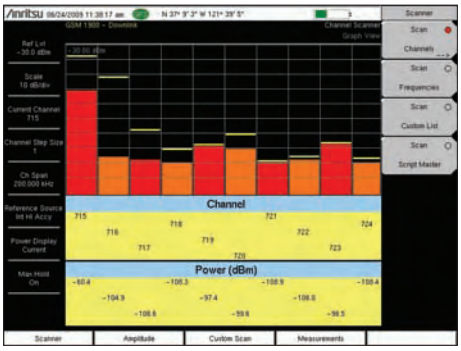
Spectrogram

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



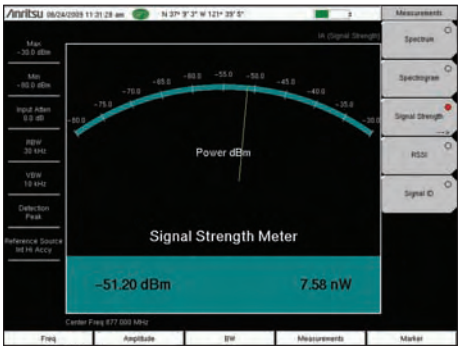
Received Signal Strength Indicator (RSSI)

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

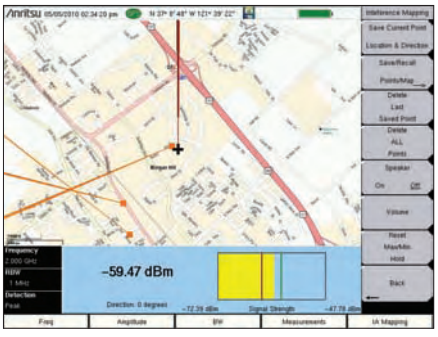
Interference Mapping
Spectrum
- Field Strength – in dBm/m² or dBmV/m
- Occupied Bandwidth - 1% to 99% of power
- Channel Power - in specified bandwidth
- ACPR - adjacent channel power ratio
- AM/FM/SSB Demodulation - audio out only
- C/I - carrier-to-interference ratio
- SEM - spectral emission mask

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

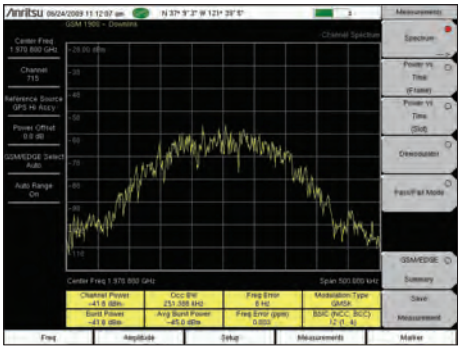


Interference Mapping

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

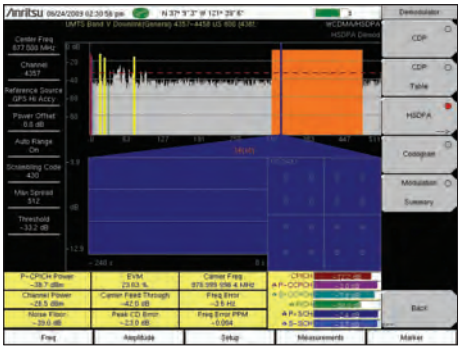
Spectrum Master MS272xC Spectrum Analyzer Features

Introduction to Signal Analyzers



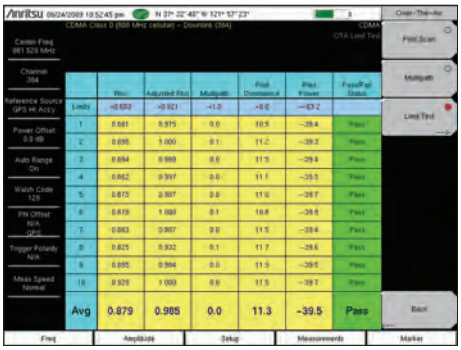
RF Measurement – GSM

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



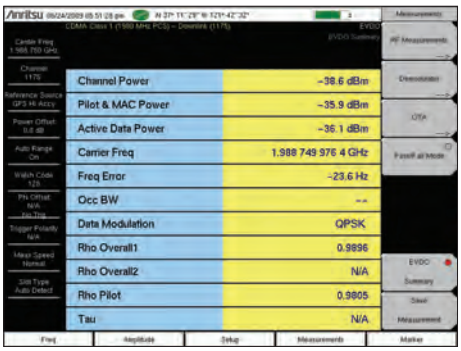
Demodulation – HSDPA

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



Over-the- Air Measurement - CDMA

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



Measurement Summary – LTE

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

Signal Analyzers

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

Signal Analyzers

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

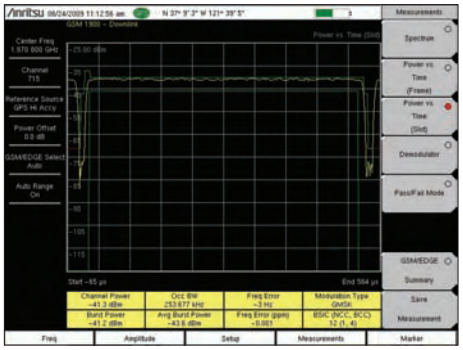
Typical Signal Analyzer Options

RF Measurements
Demodulation
Over-the-Air Measurements

Signal Analyzer Features

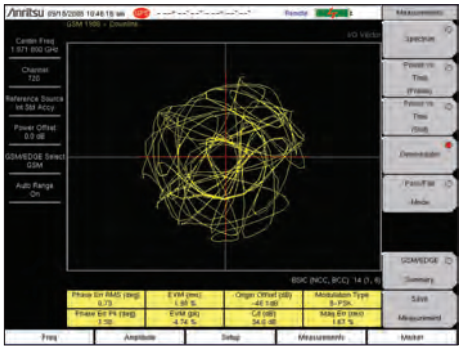
Measurement Summary Displays
Pass/Fail Limit Testing

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



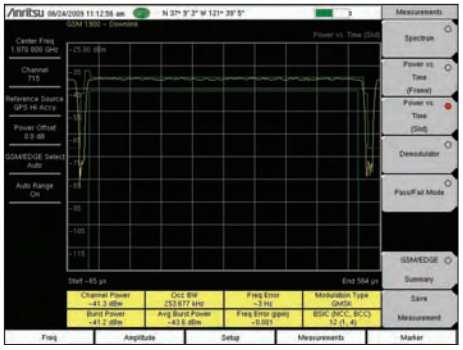
RF Measurement – Occupied Bandwidth

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



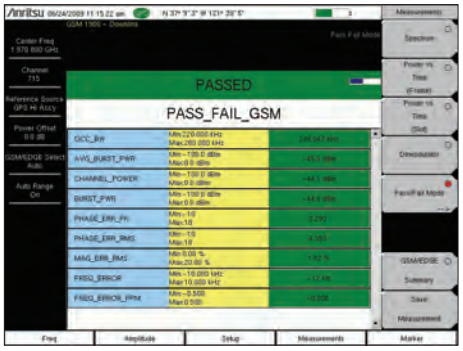
Demodulation – Error Vector Magnitude (EVM)

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



RF Measurement – Average Burst Power

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



Pass/Fail Test

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

GSM/GPRS/EDGE Analyzers

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

- RF Measurements
- Demodulation

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

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

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

Carrier-to-Interference (C/I)

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

Phase Error

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

Origin Offset

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

Power versus Time (Slot and Frame)

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

RF Measurements (Option 0040)

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

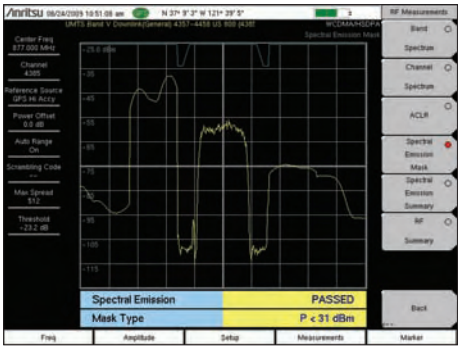
Multi-channel Spectrum

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

Demodulation (Option 0041)

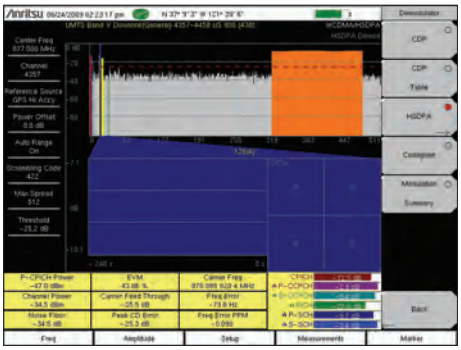
Phase Error
EVM
Origin Offset
C/I
Modulation Type
Magnitude Error
BSIC (NCC, BCC)

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



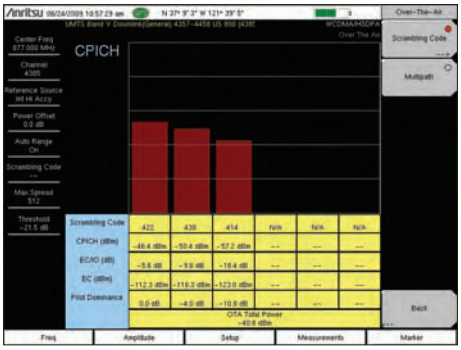
RF Measurements – Spectral Emissions Mask

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



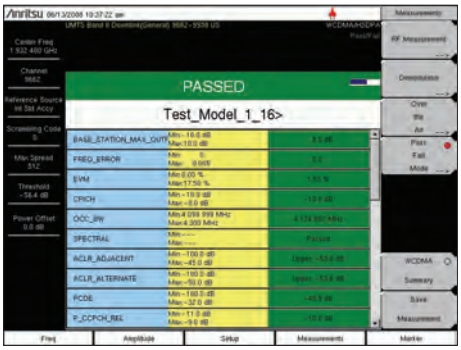
Demodulation – Error Vector Magnitude (EVM)

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



Over-the-Air Measurements – Scrambling Codes

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



Pass / Fail Test

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

W-CDMA / HSDPA Signal Analyzers

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

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

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

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

Frequency Error

Frequency Error is a check to see that the carrier frequency is precisely correct. 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

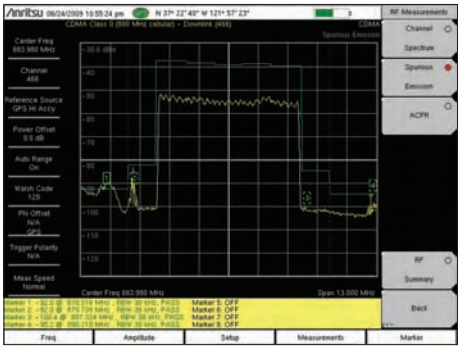
Demodulation (Option 0045 or 0065)

- Code Domain Power Graph
  - P-CPICH Power
  - Channel Power
  - Noise Floor
  - EVM
  - Carrier Feed Through
  - Peak Code Domain Error
  - Carrier Frequency
  - Frequency Error
  - Control Channel Power
  - Abs/Rel/Delta Power
    - CPICH, P-CCPCH
    - S-CCPCH, PICH
    - P-SCH, S-SCH
  - HSDPA (Option 0065 only)
    - Power vs. Time
    - Constellation
- Code Domain Power Table
  - Code, Status
  - EVM, Modulation Type
  - Power, Code Utilization
  - Power Amplifier Capacity
- Codogram

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

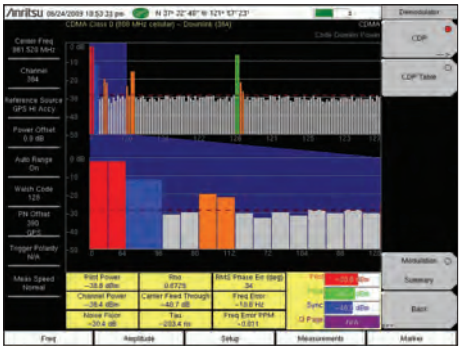
- Scrambling Code Scanner (Six)
  - Scrambling Codes
  - CPICH
  - E_c/I_o
  - E_c
  - Pilot Dominance
  - OTA Total Power
- Multipath Scanner (Six)
  - Six Multipaths
  - Tau
  - Distance
  - RSCP
  - Relative Power
  - Multipath Power

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



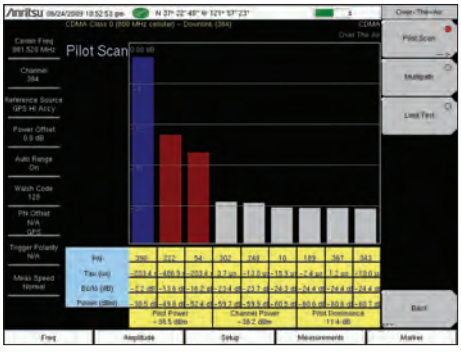
RF Measurements – Spectral Emissions Mask

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



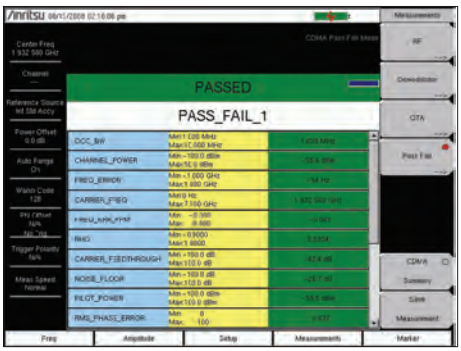
Modulation Quality – EVM

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



Over-the-Air Measurements – Sync Signal Power

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



Pass/Fail Test

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

CDMA Signal Analyzers

The 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 Ec/Io leads to low data rate and low capacity.

RF Measurements (Option 0042)

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

Spectral Emission Mask

Multi-carrier ACPR

Demodulation (Option 0043)

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

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

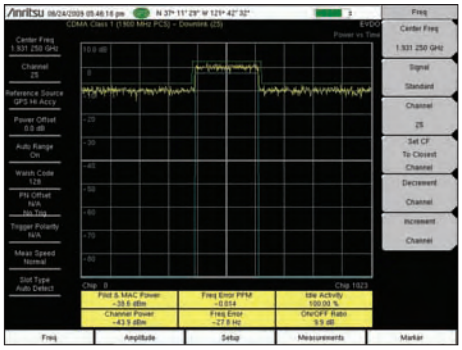
Over-the-Air (OTA) Measurements (0ption 0033)

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

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

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

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

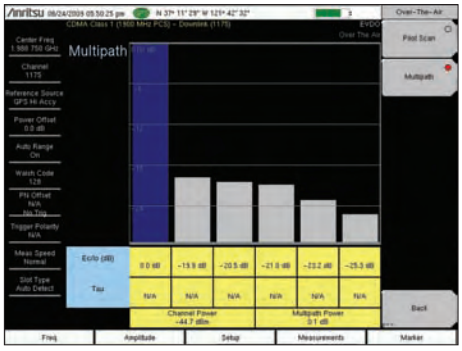


RF Measurements – Pilot and MAC Power

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

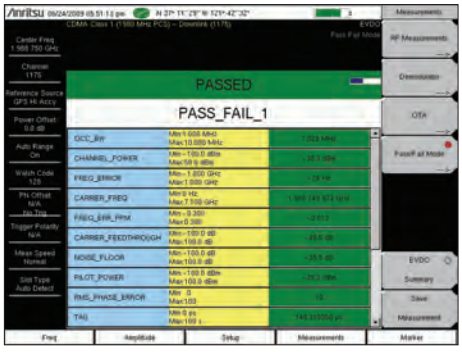
Demodulation – Frequency Error

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



Over-the-Air Measurements – Multipath

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



Pass/Fail Test

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

EV-DO Signal Analyzers

The 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

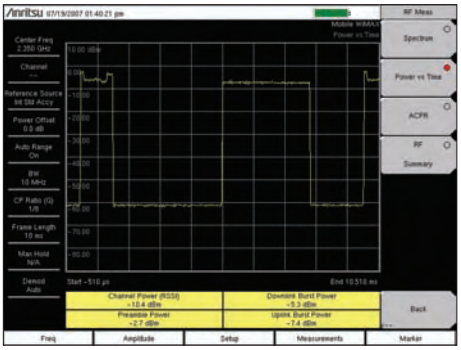
Data Code Domain Power
- Active Data Power
- Data Modulation
- Rho Pilot
- Rho Overall
- Maximum Data CDP
- Minimum Data CDP

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

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

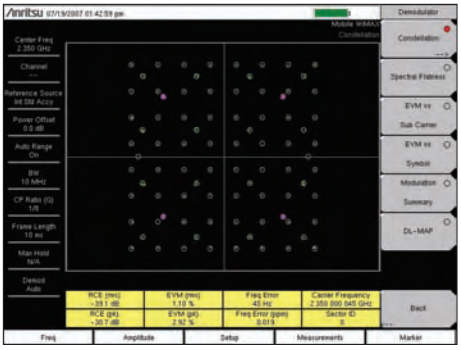
Mulitpath Scanner (Six)
- E_c/I_o
- Tau
- Channel Power
- Multipath Power

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



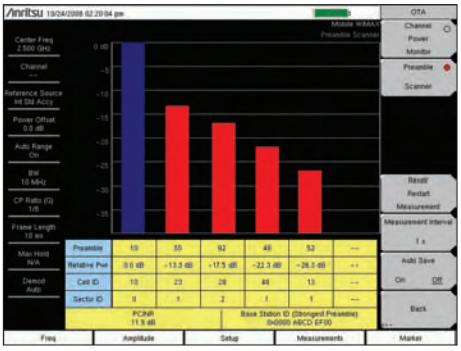
RF Measurement – Preamble Power

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.



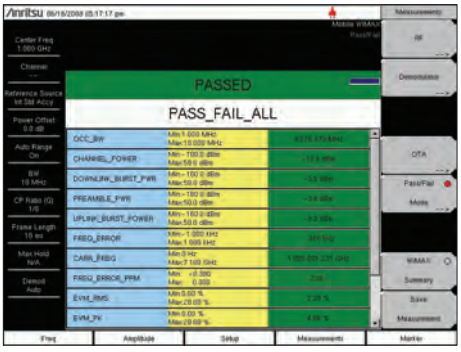
Demodulation – Frequency Error

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

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)

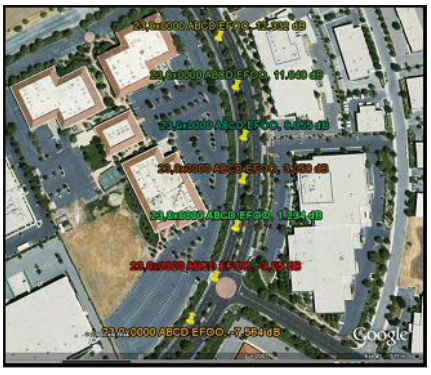
Over-the-Air (OTA) (Option 0037 Mobile only)

Channel Power Monitor

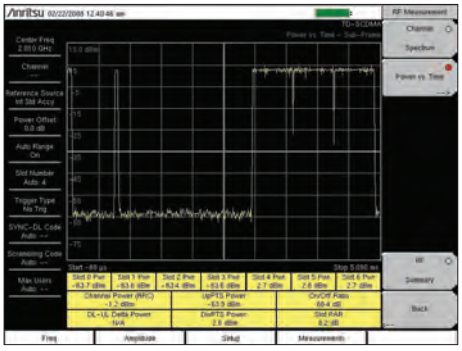
Preamble Scanner (Six)
- Preamble
- Relative Power
- Cell ID
- Sector ID
- PCINR

Dominant Preamble
- Base Station ID

Auto-Save with GPS Tagging and Logging



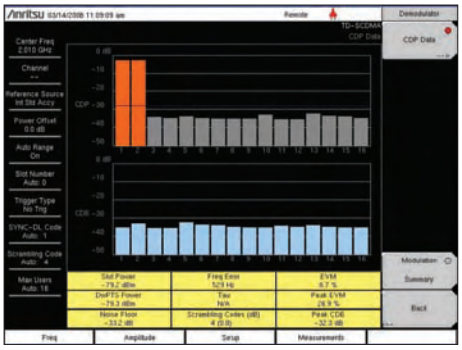
TD-SCDMA / HSDPA Signal Analyzers (Options 0060, 0061, 0038)



RF Measurement – Time Slot Power

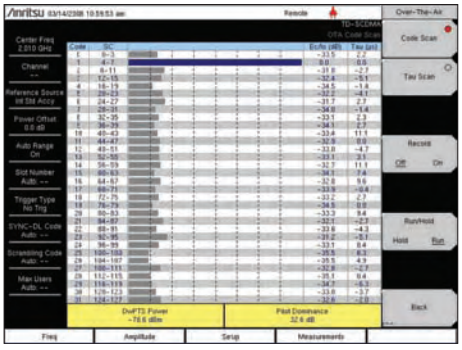
Empty downlink slots with access power will reduce the sensibility of the receiver and the size of the sector.

This will cause dropped and blocked calls.



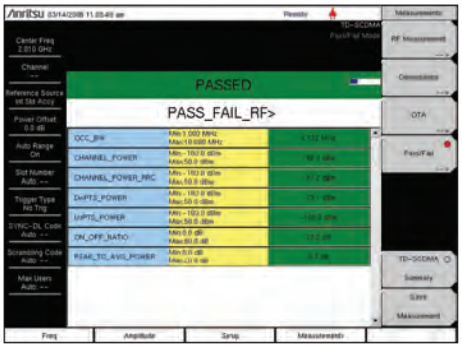
Demodulation – Scrambling Code

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



Over-the-Air Measurements – Code Scanner

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



Pass / Fail Test

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

TD-SCDMA / HSDPA Signal Analyzers

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

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

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

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

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

Peak Code Domain Error (Peak CDE)

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

OTA Tau Scanner E_c / I_o

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

DwPTS OTA Power Mapping

DwPTS OTA Power when added to Ec/ Io 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)

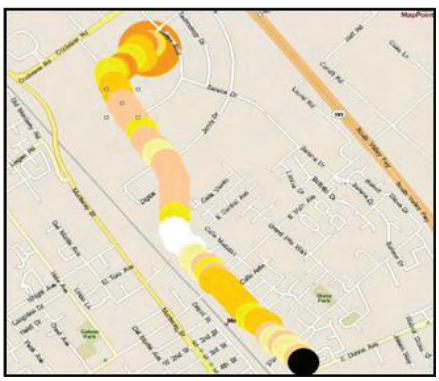
Code Domain Power/Error
- (QPSK/8 PSK/16 QAM)
- Slot Power
- DwPTS Power
- Noise Floor
- Frequency Error
- Tau
- Scrambling Code
- EVM
- Peak EVM
- Peak Code Domain Error

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

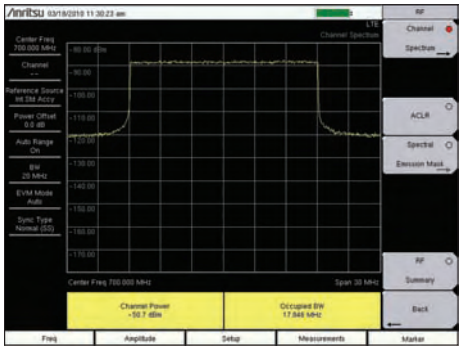
Code Scan (32)
- Scrambling Code Group
- Tau
- E_c / I_o
- DwPTS Power
- Pilot Dominance

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

Auto-Save with GPS Tagging and Logging

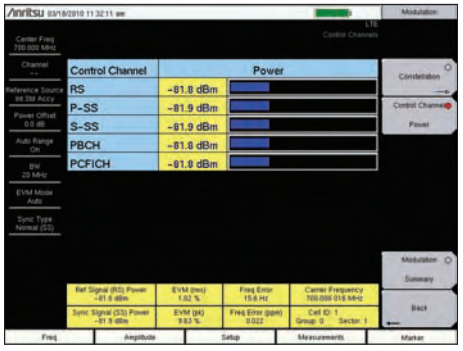


LTE and TD-LTE Signal Analyzers (Options 0541, 0542, 0543, 0546, 0551, 0552, 556)



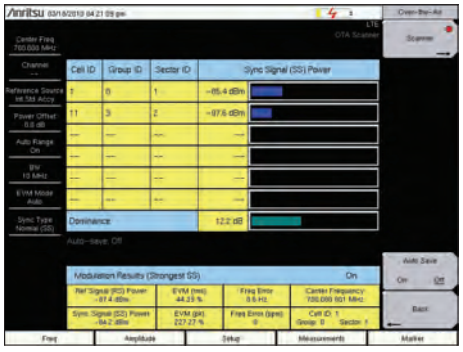
RF Measurements – Occupied Bandwidth

The bandwidth that contains 99% of the total carrier power. Excessive occupied bandwidth means excessive adjacent channel interference.



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.

LTE and TD-LTE Signal Analyzers

The Spectrum Master features three FDD-LTE measurement modes and three TDD-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

Frequency Error

Frequency Error is a check to see that the carrier frequency is precisely correct. 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.

Sync Signal Mapping

Sync Signal Scanner can be used with the GPS to save scan results for later display on a map. The EVM of the strongest synch signal available at that spot is also recorded. The Cell, Sector, and Group ID information is also included so that it's easier to interpret the results. Once the Synch Signals are mapped, it becomes much easier to understand and troubleshoot any interference or coverage issues.

RF Measurements (Option 0541/0551, 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 View
- Sub-Frame View

ACLR

Spectral Emission Mask

RF Summary

Modulation Measurements (Option 0542/0552, FDD/TDD)

Constellation
- Reference Signal Power
- Sync Signal Power
- EVM
- Frequency Error, Carrier Frequency
- Cell ID

Control Channel Power (table and graph views)
- RS, P-SS, S-SS, PBCH, PCFICH Power
  - Power/RE
  - Total Power in dBm/Watts
  - Total LTE Channel Power
- EVM
- Frequency Error
- Carrier Frequency
- Cell ID

Modulation Summary

Over-the-Air Scanner (OTA) (Option 0546/0556 FDD/TDD)

Sync Signal Power (Six Strongest)
- Power
- Cell ID
- Sector ID
- Group ID

S-SS Dominance

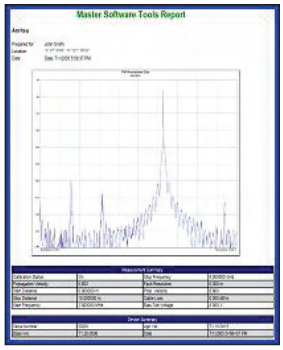
Modulation Results

Auto-Save with GPS tagging and logging

LTE options also require Option 0031, GPS Receiver, and if wider LTE bandwidths are needed, Option 0543, "LTE BW = 15, 20 MHz."

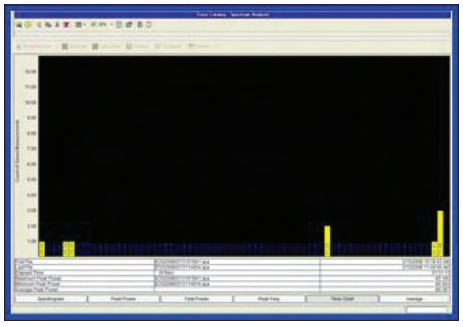
Spectrum Master MS272xC Spectrum Analyzer Features

Master Software Tools (for your PC)



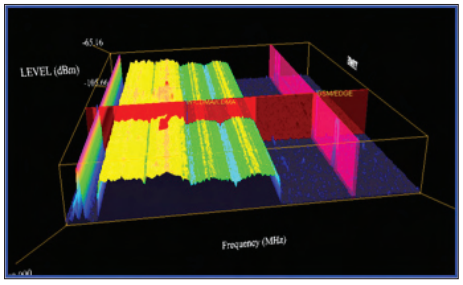
Report Generation

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



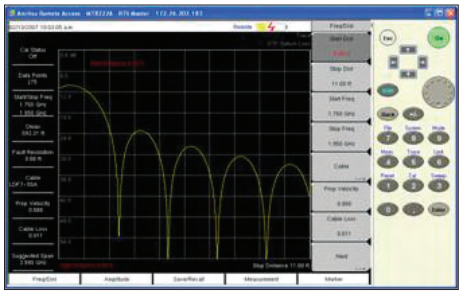
Histogram

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



3D Spectrogram

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



Remote Access Tool

The Remote Access Tool allows supervisor's 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.

Trace Editor

For VNA traces, select markers to peak and valley and displays individual values for Return Loss, Cable Loss, VSWR, Magnitude, Phase and milliRho. For SPA measurements set limit line envelopes, edit limit lines segments and turn on and off segments. Also, edit frequency and amplitude parameters.

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/EDGE, WCDMA/HSDPA and Channel Scanner applications.

In W-CDMA/HSDPA and GSM/EDGE 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
TS-SCDMA OTA Option

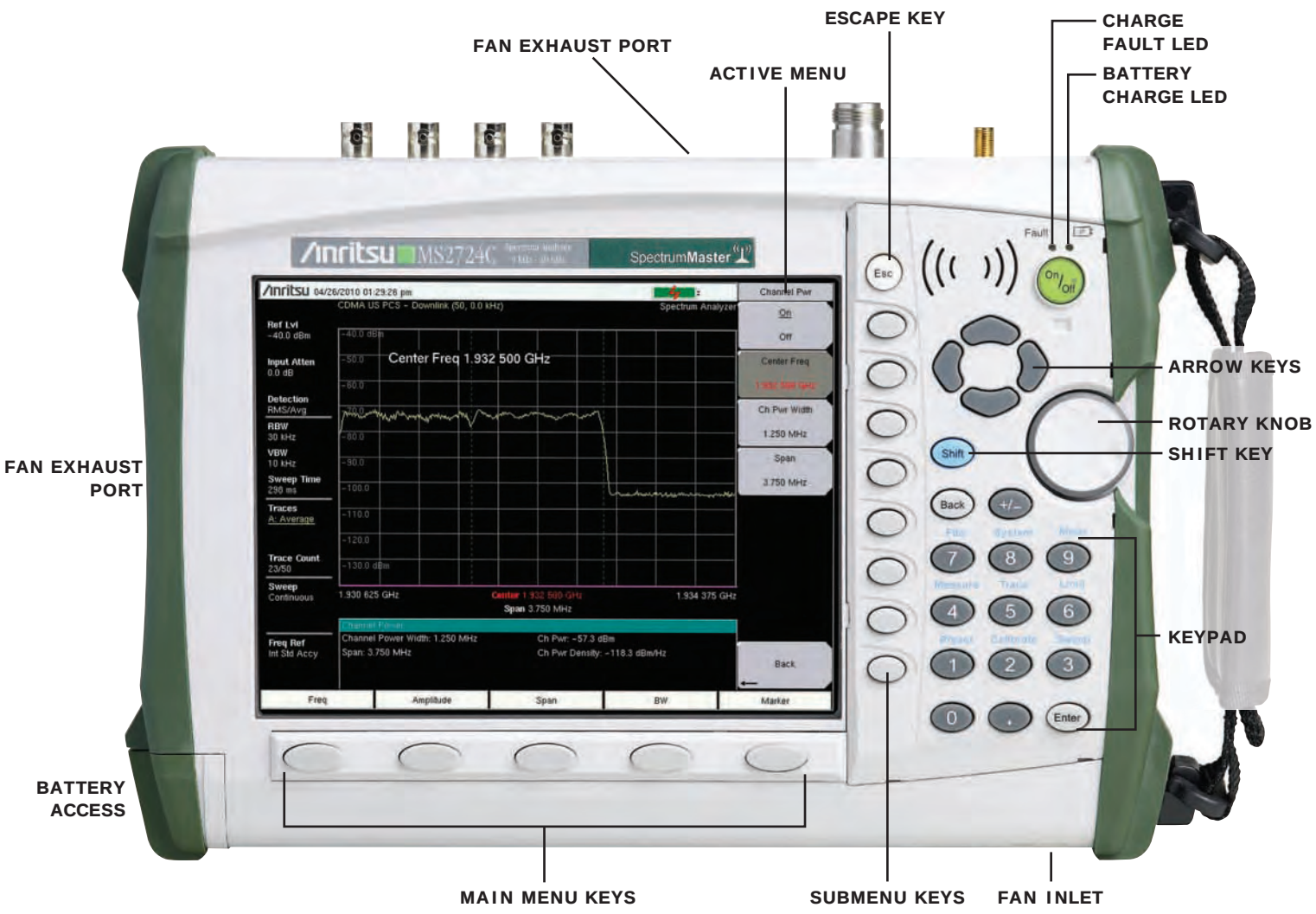
Folder Spectrogram
Folder Spectrogram – 2D View
Video Folder Spectrogram – 2D View
Folder Spectrogram – 3D View

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

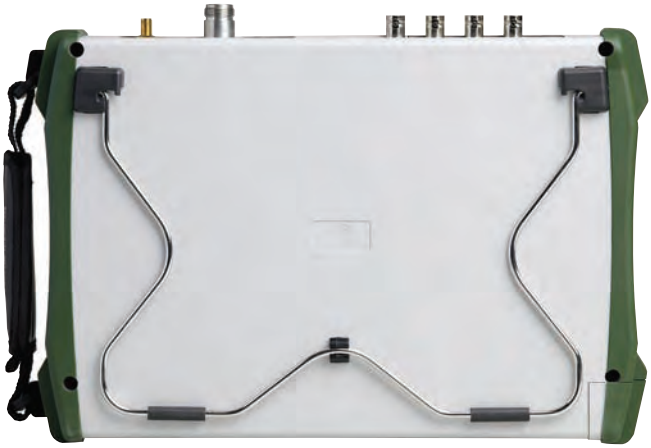
Script Master™
Channel Scanner Mode
GSM/GPRS/EDGE Mode
W-CDMA/HSDPA Mode

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

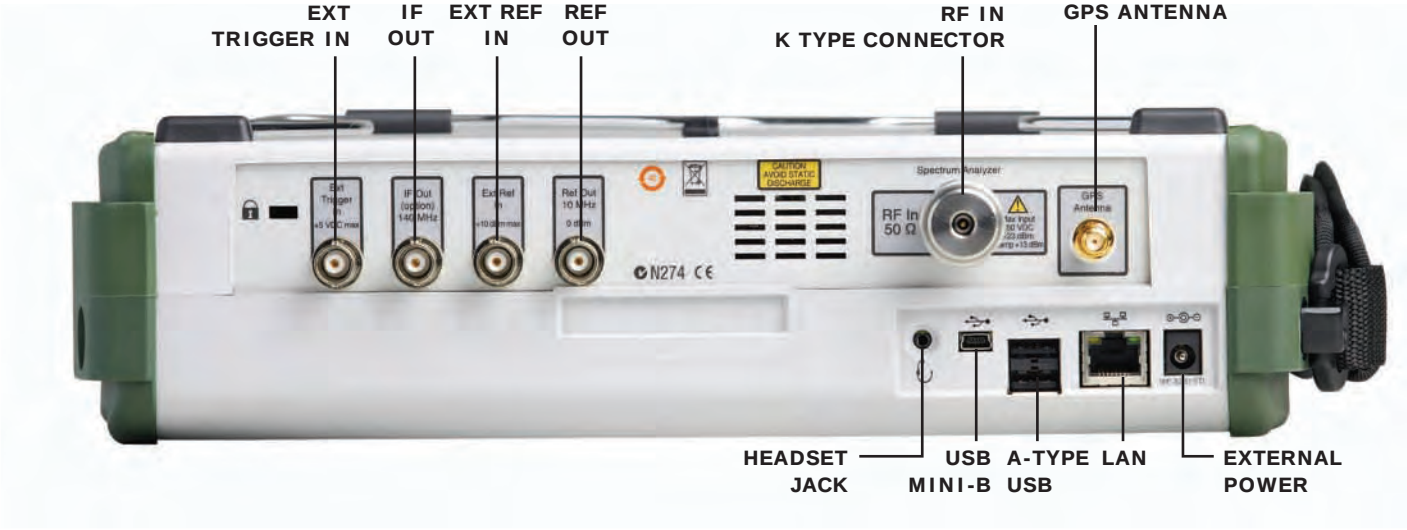


Handheld Size: 315 mm x 211 mm x 77 mm (12.4 in x 8.3 in x 3.0 in), Lightweight: 3.4 kg (7.5 lbs)

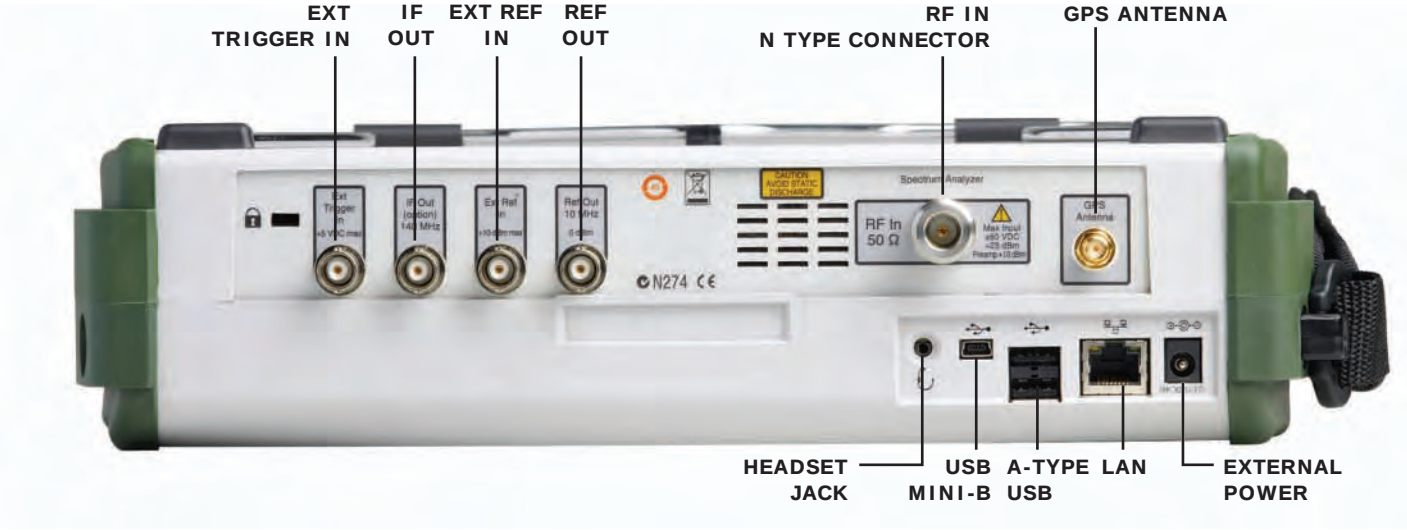


Retraceable Tilt Bale Closed

Retraceable Tilt Bale Opened



Connector Panel for MS2725C and MS2726C



Connector Panel for MS2722C, MS2723C and MS2724C

Spectrum Master MS272xC Spectrum Analyzer Ordering Information

Ordering Information — Options

	MS2722C	MS2723C	MS2724C	MS2725C	MS2726C	Description
	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	Spectrum Analyzer
	MS2722C-0007	MS2723C-0007	MS2724C-0007	MS2725C-0007	MS2726C-0007	Secure Data Operation
	MS2722C-0019	MS2723C-0019	MS2724C-0019	MS2725C-0019	MS2726C-0019	High Accuracy Power Meter (requires Power Sensor)
	MS2722C-0031	MS2723C-0031	MS2724C-0031	MS2725C-0031	MS2726C-0031	GPS Receiver (requires Antenna P/N 2000-1528-R)
 	MS2722C-0025	MS2723C-0025	MS2724C-0025	MS2725C-0025	MS2726C-0025	Interference Analysis
	MS2722C-0027	MS2723C-0027	MS2724C-0027	MS2725C-0027	MS2726C-0027	Channel Scanner
	MS2722C-0089	MS2723C-0089	MS2724C-0089	MS2725C-0089	MS2726C-0089	Zero Span IF Output
	MS2722C-0009	MS2723C-0009	MS2724C-0009	MS2725C-0009	MS2726C-0009	IQ Demodulation Hardware
	MS2722C-0040	MS2723C-0040	MS2724C-0040	MS2725C-0040	MS2726C-0040	GSM/GPRS/EDGE RF Measurements*
	MS2722C-0041	MS2723C-0041	MS2724C-0041	MS2725C-0041	MS2726C-0041	GSM/GPRS/EDGE RF Demodulation*
	MS2722C-0035	MS2723C-0035	MS2724C-0035	MS2725C-0035	MS2726C-0035	W-CDMA/HSDPA OTA Measurements**
	MS2722C-0044	MS2723C-0044	MS2724C-0044	MS2725C-0044	MS2726C-0044	W-CDMA/HSDPA RF Measurements*
	MS2722C-0045	MS2723C-0045	MS2724C-0045	MS2725C-0045	MS2726C-0045	W-CDMA RF Demodulation*
	MS2722C-0065	MS2723C-0065	MS2724C-0065	MS2725C-0065	MS2726C-0065	W-CDMA/HSDPA Demodulation*
	MS2722C-0038	MS2723C-0038	MS2724C-0038	MS2725C-0038	MS2726C-0038	TD-SCDMA Over-the-Air (OTA) Measurements*
	MS2722C-0060	MS2723C-0060	MS2724C-0060	MS2725C-0060	MS2726C-0060	TD-SCDMA RF Measurements*
	MS2722C-0061	MS2723C-0061	MS2724C-0061	MS2725C-0061	MS2726C-0061	TD-SCDMA RF Demodulation*
	MS2722C-0541	MS2723C-0541	MS2724C-0541	MS2725C-0541	MS2726C-0541	LTE RF Measurements*
	MS2722C-0542	MS2723C-0542	MS2724C-0542	MS2725C-0542	MS2726C-0542	LTE Modulation Measurements*
	MS2722C-0546	MS2723C-0546	MS2724C-0546	MS2725C-0546	MS2726C-0546	LTE Over-the-Air (OTA) Measurements*
	MS2722C-0543	MS2723C-0543	MS2724C-0543	MS2725C-0543	MS2726C-0543	LTE Bandwidths 15 MHz and 20 MHz (requires 0541 or 0542)
	MS2722C-0551	MS2723C-0551	MS2724C-0551	MS2725C-0551	MS2726C-0551	TD-LTE RF Measurements*
	MS2722C-0552	MS2723C-0552	MS2724C-0552	MS2725C-0552	MS2726C-0552	TD-LTE Modulation Measurements*
	MS2722C-0556	MS2723C-0556	MS2724C-0556	MS2725C-0556	MS2726C-0556	TD-LTE Over-the-Air (OTA) Measurements*
	MS2722C-0042	MS2723C-0042	MS2724C-0042	MS2725C-0042	MS2726C-0042	CDMA RF Measurements*
	MS2722C-0043	MS2723C-0043	MS2724C-0043	MS2725C-0043	MS2726C-0043	cdmaOne/CDMA2000 1xRTT Demoduation*
	MS2722C-0033	MS2723C-0033	MS2724C-0033	MS2725C-0033	MS2726C-0033	cdmaOne/CDMA2000 1xRTT Over-the-Air (OTA) Measurements**
	MS2722C-0034	MS2723C-0034	MS2724C-0034	MS2725C-0034	MS2726C-0034	EV-DO Over-the-Air (OTA) Measurements**
	MS2722C-0062	MS2723C-0062	MS2724C-0062	MS2725C-0062	MS2726C-0062	EV-DO RF Measurements*
	MS2722C-0063	MS2723C-0063	MS2724C-0063	MS2725C-0063	MS2726C-0063	EV-DO Demodulation*
	MS2722C-0046	MS2723C-0046	MS2724C-0046	MS2725C-0046	MS2726C-0046	Fixed WiMAX RF Measurements*
	MS2722C-0047	MS2723C-0047	MS2724C-0047	MS2725C-0047	MS2726C-0047	Fixed WiMAX RF Demodulation*
	MS2722C-0037	MS2723C-0037	MS2724C-0037	MS2725C-0037	MS2726C-0037	Mobile WiMAX Over-the-Air (OTA) Measurements*
	MS2722C-0066	MS2723C-0066	MS2724C-0066	MS2725C-0066	MS2726C-0066	Mobile WiMAX RF Measurements*
	MS2722C-0067	MS2723C-0067	MS2724C-0067	MS2725C-0067	MS2726C-0067	Mobile WiMAX Demodulation*
	MS2722C-0098	MS2723C-0098	MS2724C-0098	MS2725C-0098	MS2726C-0098	Standard Calibration (ANSI Z540-1-1994)
	MS2722C-0099	MS2723C-0099	MS2724C-0099	MS2725C-0099	MS2726C-0099	Premium Calibration to ANSI Z540-1-1994 plus test data

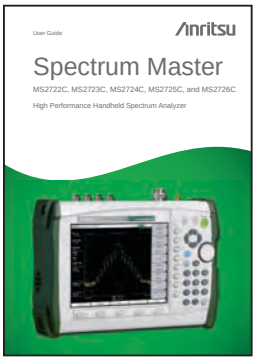
* Requires Option 0009
** Requires Option 0009, Option 0031

Spectrum Master MS272xC Spectrum Analyzer Ordering Information

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

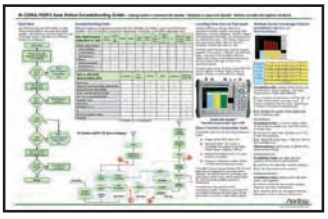
Part Number	Description
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24104A	Inline High Power Sensor, 600 MHz to 4 GHz, + 51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm

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



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00277	Spectrum Master User Guide (Hard copy included) - Bias-Tee, 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/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00278	Programming Manual
10580-00279	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 Testing
11410-00463	W-CDMA/HSDPA Base Stations
11410-00465	TD-SCDMA/HSDPA Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations

Standard Accessories (included with instrument)

Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00277	Spectrum Master User Guide (includes Bias-Tee and GPS Receiver)
2300-498	Master Software Tools (MST) CD Disc
65729	Soft Carrying Case
633-44	Rechargeable Li-Ion Battery
40-168-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
11410-00529	MS2722C Spectrum Master Technical Data Sheet
11410-00524	MS2723C Spectrum Master Technical Data Sheet
11410-00525	MS2724C Spectrum Master Technical Data Sheet
11410-00526	MS2725C Spectrum Master Technical Data Sheet
11410-00527	MS2726C Spectrum Master Technical Data Sheet
	One Year Warranty (Including battery, firmware, and software) Certificate of Calibration and Conformance

Spectrum Master MS272xC Spectrum Analyzer Ordering Information

Optional Accessories

Directional Antennas

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
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21000 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic

Portable Antennas

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, N(f), 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)

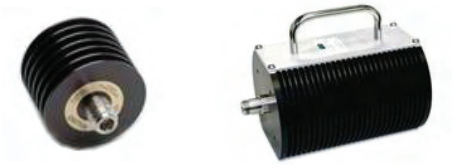
Mag Mount Broadband Antenna

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
2000-1645-R	694-894 MHz 3 dBi peak gain, 1700-2700 MHz 3dBi 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

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

Attenuators



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)

Optional Accessories (continued)

Adapters

1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50 Ω, w/ Reinforced Grip
71693-R	Ruggedized K(f) to Type N(f)
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

Precision Adapters

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

2000-1528-R	GPS Antenna, SMA(m)
69793	CW Signal Generator Kit
2000-1520-R	USB Flash Drive
2000-1374	External Charger for Li-Ion Batteries

Backpack and Transit Case

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

Notes

Notes

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