Product Brochure

Spectrum Master™
Compact Handheld Spectrum Analyzer

MS2712E  100 kHz to 4 GHz  
MS2713E  100 kHz to 6 GHz
The wireless communications market is rapidly growing as the telecommunications and defense sectors continue to evolve. Whether you are installing, troubleshooting, or solving problems for military communications facilities, public safety providers, or wireless service providers, Anritsu has a solution.

Anritsu’s new Spectrum Master has been designed for technicians, installers, field radio frequency (RF) engineers, and contractors who struggle with both keeping track of the growing number of interfering signals and assessing signal quality on a wide range of increasingly complex signals. Easy-to-use, integrated and high performing, the Spectrum Master helps users address those challenges and more. Its feature-rich and compact design helps users comply to regulatory requirements, manage and maximize efficiency, improve system up-time, and increase revenue – all in a rugged and field-proven device designed to withstand even the most punishing conditions.

This next generation of Anritsu’s best-in-class Spectrum Master series is ideal for spectrum monitoring, interference analysis, RF and microwave measurements, transmitter spectrum analysis, electromagnetic field strength, signal strength mapping, and overall field analysis of cellular 2G/3G/4G, land mobile radio, Wi-Fi, and broadcast signals.

DESIGNED FOR FIELD USE
The Spectrum Master was designed specifically for field environments. Weighing less than 3.45 kg, it is small and compact and easy to carry. Its field replaceable Li-Ion battery typically lasts for more than 3 hours, and a new bright 8.4-inch color display provides visibility even in broad daylight. With an operating temperature range from -10 °C to 55 °C, a rugged case and splash proof design, the Spectrum Master works in the most extreme weather conditions with guaranteed performance anywhere and anytime.

INTEGRATED SOLUTION
The Spectrum Master is a multifunctional instrument that eliminates the need for you to carry and learn multiple instruments. It can be configured to include a broad range of parameters, including a 4 GHz or 6 GHz spectrum analyzer, an interference analyzer, 2-port transmission measurement with built-in 32V bias tee, channel scanner, power meter, high accuracy power meter, AM/FM/PM Analyzer, and GPS receiver for time/location stamping and accuracy enhancements.

In addition, the Spectrum Master can be equipped with a GSM/EDGE Analyzer, W-CDMA/HSDPA Analyzer, TD-SCDMA Analyzer, CDMA Analyzer, EVDO Analyzer, Fixed and Mobile WiMAX Analyzer, LTE Analyzer, and ISDB-T analyzer, thus eliminating the need to carry multiple instruments to the field.

EASY-TO-USE
The new Spectrum Master leverages the user interface from Anritsu’s popular MS2721B analyzer, giving users intuitive spectrum analyzer menus. A touchscreen keypad combination provides you with an intuitive menu-driven interface designed to give a familiar menu structure with quick access to popular measurements.

KEY FACTS
- 100 kHz to 4 GHz (MS2712E)
- 100 kHz to 6 GHz (MS2713E)
- One-button measurements: ACPR, Channel Power, Field Strength, Occupied BW, AM/FM/SSB Demod
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID
- 3GPP Signal Analyzers: GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
- 3GPP2 Signal Analyzers: cdmaONE/CDMA2000 1X, CDMA2000 1xEV-DO
- IEEE 802.16 Signal Analyzers: Fixed WiMAX, Mobile WiMAX
- ISDB-T Signal Analyzer
- DANL: > -162 dBm typical DANL (normalized to 1 Hz)
- Dynamic range: > 95 dB
- +33 dBm TOI typical @ 6 GHz
- < Phase Noise: -100 dBc/Hz @ 10 kHz offset
- Frequency accuracy: < ± 50 ppb with GPS on
- Detection methods: Peak, RMS, Negative, Sample, Quasi-peak
- Save-on-event: Automatically saves a sweep when crossing a limit line or at the end of the sweep.
- Gated sweep: View pulsed or burst signals only when they are on, or off.
- Three hours of battery life
- Touch-screen display
- USB port
- 8.4-inch Touchscreen TFT display
- Lightweight: < 3.45 kg
**CONFIGURATION OVERVIEW**

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrum Analyzer, 100 kHz to 4/6 GHz</td>
<td>Locates and identifies various signals over a wide frequency range. Detects signals as low as -152 dBm with phase noise better than -100 dBc/Hz.</td>
</tr>
<tr>
<td>Interference Analyzer (Option 25)</td>
<td>Includes everything you need to monitor, identify, and locate interference using the spectrogram display, RSSI, Signal ID, and signal strength meter.</td>
</tr>
<tr>
<td>GPS receiver (Option 31)</td>
<td>Provides location and UTC time information. Also improves the accuracy of the reference oscillator.</td>
</tr>
<tr>
<td>2-port Transmission Measurement (Option 21)</td>
<td>Offers high and low power settings for both active and passive measurements. Better than 80 dB dynamic range.</td>
</tr>
<tr>
<td>Bias Tee (Option 10)</td>
<td>Possesses a built-in 32 V bias tee that can be turned on as needed and applied to the RF In port.</td>
</tr>
<tr>
<td>High Accuracy Power Meter (Option 19)</td>
<td>Connects high accuracy 4, 6, 8, and 18 GHz USB power sensors with better than ±0.16 dB accuracy.</td>
</tr>
<tr>
<td>Power Meter (Option 29)</td>
<td>Makes channelized transmitter power measurements.</td>
</tr>
<tr>
<td>Channel Scanner (Option 27)</td>
<td>Measures the power of multiple transmitted signals. Scans up to 1200 channels using Script Master.</td>
</tr>
<tr>
<td>CW Signal Generator (Option 28)</td>
<td>Provides CW source to test low noise amplifiers and repeaters. (Needs external CW generator kit.)</td>
</tr>
<tr>
<td>Gated Sweep (Option 90)</td>
<td>Views pulsed or burst signals such as WiMAX, GSM, and TD-SCDMA only when they are on.</td>
</tr>
<tr>
<td>AM/FM/PM Analyzer (Option 509)</td>
<td>Analyze AM/FM/PM signals and measure FM/PM deviation, AM depth, SINAD, Total Harmonic Distortion and much more.</td>
</tr>
<tr>
<td>10 MHz Bandwidth Demod (Option 9)</td>
<td>The 10 MHz BW demod option enables users to turn the Spectrum Master into a Signal Analyzer.</td>
</tr>
<tr>
<td>GSM/GPRS/EDGE Measurements (Option 40, 41)</td>
<td>RF and Demod Measurements will enable end users to increase data rate and capacity by ensuring good signal quality.</td>
</tr>
<tr>
<td>W-CDMA/HSDPA Measurements (Option 44, 45, 65, 35)</td>
<td>Use Spectrum Master’s RF, Demod, and OTA measurements to verify frequency error, multipath signals, EVM and much more.</td>
</tr>
<tr>
<td>LTE (Option 541, 542, 546)</td>
<td>Spectrum Master’s LTE Measurements enables users to make RF, Demod, and OTA Measurements. Verify ACLR, Cell ID, Frequency Error, EVM, and much more.</td>
</tr>
<tr>
<td>TD-SCDMA/HSDPA Measurements (Option 60, 61, 38)</td>
<td>The TD-SCDMA/HSDPA analyzer includes RF, Demod, and OTA measurements and the ability to measure EVM and Peak CDE. It also includes an OTA Tau scanner.</td>
</tr>
<tr>
<td>cdmaOne/CDMA2000 1X (Option 42, 43, 33)</td>
<td>RF, Demodulation, and OTA measurements. Measure EVM, Noise floor, ACPR and much more.</td>
</tr>
<tr>
<td>Fixed and Mobile WiMAX (Option 46, 47, 66, 67, 37)</td>
<td>RF Demod, and OTA Measurements verify Cell ID, Sector ID, Preamble, EVM, RCE, and much more.</td>
</tr>
<tr>
<td>ISDB-T (Option 30, 32)</td>
<td>Make RF and demod measurements to verify Spectrum Mask and MER. Ensure digital TV transmitters are configured according to license agreements.</td>
</tr>
</tbody>
</table>
Designed for the Field

ALL CONNECTORS ARE CONVENIENTLY LOCATED ON THE TOP PANEL, LEAVING THE SIDES CLEAR FOR HANDHELD USE.
Convenient Soft Case and Tilt Bail

TILT BAILS ARE INTEGRATED INTO THE CASE AND SOFT CASE FOR BETTER SCREEN VIEWING
Anritsu’s MS2712E and MS2713E Spectrum Master spectrum analyzers provide users with high-performance for field environments and for applications requiring mobility. There is no other spectrum analyzer in this class that can deliver the same performance.

The combination of its performance and compact design makes it ideal for a broad range of activities, including spectrum monitoring, interference analysis, field strength measurements, transmitter spectrum analysis, electromagnetic field strength, signal strength mapping, and overall field analysis of cellular 2G/3G/4G, land mobile radio, Wi-Fi, and broadcast signals.

**HIGH PERFORMANCE**

The dynamic range is better than 95 dB in 10 Hz RBW, enabling measurement of very small signals in the presence of much larger signals. The picture demonstrates the dynamic range in the Spectrum Master.

**DISPLAYED AVERAGE NOISE LEVEL**

Spectrum Master delivers impressive and best-in-class DANL performance. With the built-in pre-amp, better than -152 dBm DANL can typically be realized in 10 Hz RBW and -162 dBm when normalized to 1 Hz. This low-level performance capability is essential when looking for low-level interference signals.

**GPS-ASSISTED FREQUENCY ACCURACY**

With GPS Option 0031 the frequency accuracy is < 50 ppb. This additional accuracy is important when characterizing 3GPP signals using counted frequency markers. Also all measurements can be GPS tagged for exporting to maps.

**SIMPLE BUT POWERFUL FOR FIELD USE**

Convenience is a must in the field. This is why the Spectrum Master is equipped with features that will enhance productivity in the field.

The Spectrum Master is equipped with limit lines for all user levels. You can create single limit lines and segmented limit lines in one step using the one-button limit envelope feature.

The Spectrum Master automatically sets the fastest sweep possible while still ensuring accurate measurements. This allows users to rely on the instrument to optimize accuracy and consistency.

Auto Attenuation ties the input attenuation to the reference level eliminating the need for the user to determine how much attenuation is needed.

Six regular and six delta markers can be displayed with a marker table that can be turned on as needed. The capability to measure noise level in terms of dBm/Hz or dBµV/Hz is a standard feature of the Spectrum Master.
SMART MEASUREMENTS FOR TRANSMITTER SYSTEMS

Commonly needed transmitter measurements are built in and can be accessed easily. These include field strength, occupied bandwidth, channel power, adjacent channel power ratio (ACPR), and emission mask.

**OCCUPIED BANDWIDTH**

This measurement determines the amount of spectrum used by a modulated signal. The Spectrum Master allows you to choose between two different methods of determining bandwidth: the percent-of-power method or the “x” dB down method.

**ADJACENT CHANNEL POWER RATIO**

Adjacent Channel Power Ratio is a common transmitter measurement. High ACPR will create interference for neighboring carriers. This measurement can be used to replace the traditional two-tone Intermodulation Distortion (IMD) test for system non-linear behavior.

**FIELD STRENGTH MEASUREMENTS**

The Spectrum Master can determine the effects of electromagnetic fields caused by transmitter systems. Specific antenna factors of the connected antenna are automatically taken into account, and field strength is displayed directly in dBµV/m. The Spectrum Master also supports a wide range of directional antennas. If you are using a different antenna, Master Software Tools can be used to edit the antenna list and upload the custom antenna list to the instrument to accurately measure the maximum field strength.
As the wireless industry continues to expand, more diverse uses for the radio spectrum emerge, and the number of signals that may potentially cause interference is constantly increasing.

Compounding the problem are the many sources that can generate interference, including intentional radiators, un-intentional radiators, and self interference. Interference causes Carrier-to-Interference degradation robbing the network of capacity. The goal of these measurements is to resolve interference issues as quickly as possible.

**INTERFERENCE ANALYSIS (OPTION 25)**

The interference analyzer option provides you with a spectrogram display, RSSI, signal strength meter, and signal ID. Spectrum Master’s integrated spectrum analyzer can detect signals as low as -152 dBm.

**SPECTROGRAM DISPLAY**

This option provides you with a three-dimensional display of frequency, power, and time of the spectrum activity to identify intermittent interference and track signal levels over time. The Spectrum Master allows you to save a history up to 72 hours.

**RECEIVED SINGLE STRENGTH INDICATOR (RSSI)**

You can use the Spectrum Master’s RSSI measurement to observe the signal strength of a single frequency over time, and collect data for up to 72 hours.

**SIGNAL STRENGTH METER**

The Spectrum Master’s signal strength meter can locate an interfering signal by using a directional antenna and measuring the signal strength. It displays power in Watts or dBm, in the graphical analog meter display and by an audible beep proportional to its strength.

**SIGNAL ID**

Spectrum Master’s signal ID feature in the interference analyzer can help you quickly identify the type of the interfering signal. You can configure this measurement to identify all signals in the selected band or to simply monitor one single interfering frequency. The Spectrum Master then displays results that include center frequency, signal bandwidth, and signal type (FM, GSM/GPRS/EDGE, W-CDMA/HSDPA, CDMA/EV-DO, Wi-Fi).

**AM/FM/SSB DEMODULATION**

A built-in demodulator for AM, narrowband FM, wideband FM and single sideband allows you to easily identify the interfering signal.

**CARRIER-TO-INTERFERENCE MEASUREMENT**

Spectrum Master’s carrier-to-interference measurement capability makes it simple for you to determine if the level of interference will affect users in the intended service area.
The Spectrum Master supports many different power measurements, including the channel scanner, high accuracy power meter, internal power meter, and channel power measurement.

**CHANNEL POWER**

Use Spectrum Master’s channel power measurement to determine the power and power density of a transmission channel. Using the built-in signal standard list, you can measure the channel power of a wide range of signals.

**POWER METER (OPTION 29)**

Spectrum Master’s internal power meter provides power measurements without any additional tools and is ideal for making channelized power measurements. You can display the results in both dBm and Watts. This option is easy to use and requires limited setup entries.

**HIGH ACCURACY POWER METER (OPTION 19)**

Anritsu’s high accuracy power meter option enables you to make high accuracy RMS measurements. This capability is perfect for measuring both CW and digitally modulated signals such as CDMA/EV-DO, GSM/EDGE, WCDMA/HSDPA, and P25. You can select from a wide range of USB sensors delivering better than ±0.16 dB accuracy. An additional benefit of using the USB connection is that a separate DC supply (or battery) is not needed because the necessary power is supplied by the USB port.

- **PSN50** High Accuracy RF Power Sensor, 50 MHz to 6 GHz, -30 to +20 dBm, True-RMS
- **MA24104A** Inline High Power Sensor, 600 MHz to 4 GHz, +3 to +51.76 dBm (150W), True-RMS
- **MA24106A** High Accuracy RF Power Sensor, 50 MHz to 6 GHz, -40 to +23 dBm, True-RMS
- **MA24108A** Microwave USB Power Sensor, 10 MHz to 8 GHz, -40 to +20 dBm, True-RMS
- **MA24118A** Microwave USB Power Sensor, 10 MHz to 18 GHz, -40 to +20 dBm, True-RMS
- **MA24126A** Microwave USB Power Sensor, 10 MHz to 26 GHz, -40 to +20 dBm, True-RMS

**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.

**CHANNEL SCANNER (OPTION 27)**

The channel scanner option measures the power of multiple transmitted signals, making it very useful for simultaneously measuring channel power of up to 20 channels in GSM, TDMA, CDMA, W-CDMA, HSDPA, and public safety networks. You can select the frequencies or the scanned data to be displayed, either by frequencies or the channel number. And in the custom setup menu, each channel can be custom built with different frequency bandwidth, or with channels from different signal standards. With Script Master, scans can be automated for up to 1200 channels.
2-PORT TRANSMISSION MEASUREMENTS (OPTION 21)
Spectrum Master’s 2-port transmission measurement capability allows you to make gain, isolation, and insertion loss measurements of passive and active devices such as filters, cables, attenuators, duplexers, and tower-mounted amplifiers. Transmission measurement can also be used to make antenna-to-antenna isolation measurements and for repeater testing. Two power levels provide you with high (~ 0 dBm) and low (~ -30 dBm) power settings.

BIAS TEE (OPTION 10)
The built-in bias tee can be turned on as needed to place +12V to +32V on the center conductor of the RF In port, eliminating the need for you to carry external supplies in the field.

DUPLEXERS
Fast sweep speeds, 80 dB dynamic range, and easy-to-use trace math menus make the Spectrum Master well suited for duplexer applications.
Valuable Options and Features

GPS RECEIVER (OPTION 31)
Spectrum Master’s GPS option can be used to confirm the exact measurement location (longitude, latitude, altitude) and Universal Time (UTC) information. Each trace can be stamped with location information to ensure you are taking measurements at the right location.

In addition, the GPS option enhances the frequency accuracy of the internal reference oscillator. Within three minutes of acquiring the GPS satellite, the built-in GPS receiver provides a frequency accuracy to better than 50 ppb.

CW SIGNAL GENERATOR (OPTION 28)
This option provides a CW signal generator from 2 MHz to 4 or 6 GHz. The signal at the output port can be set high (approximately 0 dBm) or low (-30 dBm). With the use of the CW Signal Generator Kit’s attenuator connected to the RF port, the level can be varied in 1 dB steps, giving you the ability to generate signals as low as -110 dBm for receiver sensitivity measurements. The included splitter divides the signal, allowing for a simultaneous power measurement.

AM/FM/PM ANALYZER
The AM/FM/PM analyzer provides analysis and display of analog modulation. Four measurement displays are provided.

The RF Spectrum display shows the spectrum with carrier power, frequency, and occupied BW. The Audio Spectrum display shows the demodulated audio spectrum along with the Rate, RMS deviation, Pk-Pk/2 deviation, SINAD, Total Harmonic Distortion (THD), and Distortion/Total. Audio Waveform display shows the time-domain demodulated waveform. Finally, there is a Summary Table Display that includes all the RF and Demod parameters.

BUILT-IN KEYBOARD
The built-in touchscreen keyboard gives you access to a fully functional keyboard, saving valuable time in the field when entering trace names. You can create shortcuts to customer-configurable user “quick names” to program frequently used words.

MENUS WITH SHORTCUT ICONS
Find your favorite measurements quickly by pressing the menu key. Create shortcuts for popular measurements, setups, and functions by simply holding down any key for more than three seconds. This display shows the menu with standard measurements and with the lower part filled with shortcut icons.

LOCAL LANGUAGE SUPPORT
Spectrum Master features eight languages, including English, Japanese, Chinese, Italian, French, German, Spanish, and Korean. Two custom user-defined languages can be uploaded into the instrument using Master Software Tools.
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.

Measurement Summary – EV-DO
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 MS2713E 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.

Signal Analyzers
- 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 Display
- Pass/Fail Limit Testing
Spectrum Master™ Compact Handheld Spectrum Analyzer Features

LTE Signal Analyzers (Options 0541, 0542, 0546)

**LTE Signal Analyzers**
The Spectrum Master features three 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)**
- Channel Spectrum
- Channel Power
- Occupied Bandwidth
- ACLR

**Modulation Measurements (10 MHz Bandwidth) (Option 0542)**
- Constellation
- Reference Signal Power
- Sync Signal Power
- EVM
- Frequency Error
- Carrier Frequency
- Cell ID
- Sector ID
- Group ID
- Control Channel Power
- RS
- P-SS
- S-SS
- PBCH
- PCFICH

**Over-the-Air Scanner (OTA) (Option 0546)**
- Synch Signal Power (Six Strongest)
- Power
- Cell ID
- Sector ID
- Group ID
- Dominance
- Auto-Save with GPS Tagging and Logging

**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.
RF Measurements

• Demodulation

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

- RF Measurements
- Demodulation

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

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

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

Carrier-to-Interference (C/I)

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

Phase Error

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

Origin Offset

Origin Offset is a measure of the DC power leaking through local oscillators and mixers. A high Origin Offset will 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.
W-CDMA/HSDPA Signal Analyzers (Options 0044, 0045 or 0065, 0035)

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.
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 – 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/Io
Tau
Pilot Power
Channel Power
Pilot Dominance
Multipath Scanner (Six)
E/Io
Tau
Channel Power
Multipath Power
IEEE 802.16 Fixed WiMAX Signal Analyzers (Options 0046, 0047)

Fixed WiMAX Signal Analyzers

The Spectrum Master features two Fixed WiMAX 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.

Adjacent Channel Power Ratio (ACPR)

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

Base Station ID

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

Relative Constellation Error (RCE)

RCE, when used Over-the-Air (OTA), is a test that is ideal for checking received signal quality. High RCE leads directly to low data rate, which creates dissatisfied customers and lowers the data capacity of the sector. Very high RCE results in dropped calls, timeouts, and inability to register.

Adjacent Subcarrier Flatness (Peak)

Adjacent Subcarrier Flatness (Peak) is measured between one sub-carrier to the next. Poor flatness will give the weaker sub-carriers a high bit error rate and lower capacity. Data will be less reliable on weak sub-carriers, creating a lower overall data rate.
Mobile WiMAX Signal Analyzers

The Spectrum Master features three Mobile WiMAX 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.

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.
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/I

E/I 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.
ISDB-T Signal Analyzers (Options 0030, 0032)

**RF Measurements – Signal Power**
The Signal Power screen showing the transmission channel power and signal field strength used to assess suitable reception coverage area.

**RF Measurements – Spectrum Mask**
The Spectrum Mask measurement is shown. ISDB-T systems in Japan and South America call for different spectrum mask specifications. Both are catered for.

**Signal Analysis – Constellation and MER**
This is the single most important signal quality measurement. Poor MER leads to higher received errors which can cause serious picture degradation.

**Modulation Error Ratio (MER)**
MER is the fundamental measurement in digital TV broadcast systems. It quantifies the modulation signal quality directly. It is essential for managing signal margin and the deterioration of equipment with time, as well as for maintaining stable broadcast services. MER is independent of modulation type so MER measurements can be easily compared.

**Delay Profile**
This function measures the difference in time and frequency of multi-path signals caused by reflections from obstacles or from other transmitters. By measuring the channel frequency response, the multi-path effect or frequency selective fading can be observed. It is important that all signals from reflections or other transmitters are received within the guard interval to prevent inter-symbol interference which will cause reception degradation. Delay Profile measurement is useful for adjusting the timing of SFN repeaters to achieve this.

**RF Measurements**
*Option 0030*
- Signal Power
- Channel Power
- Termination Voltage
- Open Terminal Voltage
- Field Strength

**ISDB-T Signal Analyzer**
The Spectrum Master features options that enable area survey measurements and the installation and field maintenance of ISDB-T digital broadcasting equipment in accordance with ARIB (Japan) and ABNT (Brazil) standards.

The user has three measurement modes to choose from depending on the his skill level and test environment: Custom, where specific measurements and setups are chosen; Easy, where some setup parameters are automatically set or detected; Batch, where the user can specify all relevant measurements, setups and channels for automatic measurement and results’ display for fast and efficient field testing.

The goal of all measurements is to ensure digital TV transmitters are configured according to license agreements and optimized for error-free reception over the entire coverage area helping to create an excellent televisual experience.

**Field Strength**
Field Strength (dBiV/m) measurement enables a technician to assess whether signals will be detected at a location with sufficient power for good TV reception. The antenna factors of the antenna used for measurement can be compensated for to facilitate easy measurement comparison.

**Measurement Modes**
*Option 0030*
- Custom
  - User specified measurement and setup parameters
- Easy
  - User specified measurements. Some setup parameters are automatically set or detected
- Batch
  - User specified measurements and channels for automatic measurement, display of results and storage

**SFN Analysis**
*Option 0032*
- Delay Profile (w/zoom)
- Inband Spectrum
- Measured Data
- Channel Power
- Delay
- DU Ratio
- Power
- Field Strength
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.

**FAST DOWNLOADS**
Download all measurements to MST with a single menu selection.

**REPORT GENERATION**
Create reports with company logo, GPS tagging information, calibration status, and serial number of the instrument for complete reporting. Add custom company logos.

**COMPARE TRACES**
Use MST to build a record of all traces. Easy-to-use trace overlay features allow for easy comparison with historical traces.

**TRACE RENAMING**
Rename hundreds of traces in minutes using the trace rename tool in MST.

**SCRIPT MASTER™**
Script Master is an automation tool that allows the user to embed the operator’s test procedure inside the Spectrum Master. 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.

**INTERFERENCE MONITORING**
Data collected on the instrument can be analyzed and diagnosed easily with MST. These applications include: Folder Spectrogram, which creates a composite file of multiple traces for quick review; an *.avi movie can be generated for playback analysis; a Histogram that allows filtering of data and that searches for the number of occurrences and the time of day; and 3D Spectrogram for in-depth analysis with 3-axis rotation viewing and zoom control.

**PRODUCT UPDATES**
The product update tool will ensure that you always use the latest instrument firmware.

**GROUP EDIT**
Add limit lines and markers to all the traces in one folder with just one click.

**FULL TRACE RETRIEVAL**
Download and archive hundreds of traces instantly to your PC without opening them.
### Ordering Information

<table>
<thead>
<tr>
<th>MS2712E</th>
<th>MS2713E</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 kHz to 4 GHz</td>
<td>100 kHz to 6 GHz</td>
<td>Spectrum Analyzer</td>
</tr>
</tbody>
</table>

#### Options

<table>
<thead>
<tr>
<th>Options MS2712E</th>
<th>Options MS2713E</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS2712E-0021 MS2713E-0021</td>
<td>2-Port Transmission Measurement</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0001 MS2713E-0001</td>
<td>Bias-Tee</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0031 MS2713E-0031</td>
<td>GPS Receiver (Requires Antenna P/N 2000-1528-R)</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0019 MS2713E-0019</td>
<td>High-Accuracy Power Meter</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0029 MS2713E-0029</td>
<td>Power Meter</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0025 MS2713E-0025</td>
<td>Interference Analyzer</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0027 MS2713E-0027</td>
<td>Channel Scanner</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0090 MS2713E-0090</td>
<td>Gated Sweep</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0028 MS2713E-0028</td>
<td>C/W Signal Generator (Requires Option 0021) (Requires CW Signal Generator Kit, P/N 69793)</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0009 MS2713E-0009</td>
<td>10 MHz BW Demod</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0040 MS2713E-0040</td>
<td>GSM/GPRS/EDGE RF Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0041 MS2713E-0041</td>
<td>GSM/GPRS/EDGE Demodulation*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0044 MS2713E-0044</td>
<td>W-CDMA/HSDPA RF Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0045 MS2713E-0045</td>
<td>W-CDMA Demodulation*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0065 MS2713E-0065</td>
<td>W-CDMA/HSDPA Demodulation*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0035 MS2713E-0035</td>
<td>W-CDMA/HSDPA Over-the-Air Measurements**</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0514 MS2713E-0514</td>
<td>LTE RF Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0542 MS2713E-0542</td>
<td>LTE Modulation Quality**</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0546 MS2713E-0546</td>
<td>LTE Over-the-Air Measurements**</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0060 MS2713E-0060</td>
<td>TD-SCDMA/HSDPA Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0061 MS2713E-0061</td>
<td>TD-SCDMA/HSDPA Demodulation*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0038 MS2713E-0038</td>
<td>TD-SCDMA/HSDPA Over-the-Air Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0042 MS2713E-0042</td>
<td>cdmaOne/CDMA2000 1X RF Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0043 MS2713E-0043</td>
<td>cdmaOne/CDMA2000 1X Demodulation*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0033 MS2713E-0033</td>
<td>cdmaOne/CDMA2000 1X Over-the-Air Measurements**</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0062 MS2713E-0062</td>
<td>CDMA2000 1xEV-DO RF Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0063 MS2713E-0063</td>
<td>CDMA2000 1xEV-DO Demodulation*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0034 MS2713E-0034</td>
<td>CDMA2000 1xEV-DO Over-the-Air Measurements**</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0046 MS2713E-0046</td>
<td>IEEE 802.16 Fixed WiMAX RF Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0047 MS2713E-0047</td>
<td>IEEE 802.16 Fixed WiMAX Demodulation*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0066 MS2713E-0066</td>
<td>IEEE 802.16 Mobile WiMAX RF Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0067 MS2713E-0067</td>
<td>IEEE 802.16 Mobile WiMAX Demodulation*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0037 MS2713E-0037</td>
<td>IEEE 802.16 Mobile WiMAX Over-the-Air Measurements</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0509 MS2713E-0509</td>
<td>AM/FM/PM Analyzer</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0030 MS2713E-0030</td>
<td>ISDB-T Digital Video Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0032 MS2713E-0032</td>
<td>ISDB-T SFN Measurements*</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0098 MS2713E-0098</td>
<td>Standard Calibration (ANSI 2540-1-1994)</td>
<td></td>
</tr>
<tr>
<td>MS2712E-0099 MS2713E-0099</td>
<td>Premium Calibration to 2540 plus test data *Requires Option 0009, **Requires Option 0009, and Option 0031</td>
<td></td>
</tr>
</tbody>
</table>
Ordering Information

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

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSN50</td>
<td>High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm</td>
</tr>
<tr>
<td>MA24104A</td>
<td>Inline High Power Sensor, 600 MHz to 4 GHz, +51.76 dBm</td>
</tr>
<tr>
<td>MA24106A</td>
<td>High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm</td>
</tr>
<tr>
<td>MA24108A</td>
<td>Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm</td>
</tr>
<tr>
<td>MA24118A</td>
<td>Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm</td>
</tr>
<tr>
<td>MA24126A</td>
<td>Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm</td>
</tr>
</tbody>
</table>

Manuals (soft copy included on MST CD and at www.us.anritsu.com)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10580-00251</td>
<td>Spectrum Master User Guide (Hard copy included)</td>
</tr>
<tr>
<td>10580-00242</td>
<td>2-Port Transmission Measurement - Bias-Tee</td>
</tr>
<tr>
<td>10580-00231</td>
<td>Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, CW Signal Generator, AM/FM/PM Analyzer</td>
</tr>
<tr>
<td>10580-00234</td>
<td>3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE</td>
</tr>
<tr>
<td>10580-00235</td>
<td>3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO</td>
</tr>
<tr>
<td>10580-00236</td>
<td>WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX</td>
</tr>
<tr>
<td>10580-00237</td>
<td>Digital TV Measurement Guide - DVB-T/H, ISDB-T</td>
</tr>
<tr>
<td>10580-00240</td>
<td>Power Meter Measurement Guide - High Accuracy Power Meter</td>
</tr>
<tr>
<td>10580-00256</td>
<td>Programming Manual</td>
</tr>
</tbody>
</table>

Troubleshooting Guides (soft copy included on MST CD and at www.us.anritsu.com)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11410-00472</td>
<td>Interference</td>
</tr>
<tr>
<td>11410-00466</td>
<td>GSM/GPRS/EDGE Base Stations</td>
</tr>
<tr>
<td>11410-00463</td>
<td>W-CDMA/HSDPA Base Stations</td>
</tr>
<tr>
<td>11410-00465</td>
<td>TD-SCDMA/HSDPA Base Stations</td>
</tr>
<tr>
<td>11410-00467</td>
<td>cdmaOne/CDMA2000 1X Base Stations</td>
</tr>
<tr>
<td>11410-00468</td>
<td>CDMA2000 1xEV-DO Base Stations</td>
</tr>
<tr>
<td>11410-00470</td>
<td>Fixed WiMAX Base Stations</td>
</tr>
<tr>
<td>11410-00469</td>
<td>Mobile WiMAX Base Stations</td>
</tr>
</tbody>
</table>

Standard Accessories (included with instrument)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10580-00251</td>
<td>Spectrum Master User Guide (includes Bias-Tee, GPS Receiver)</td>
</tr>
<tr>
<td>3-68736</td>
<td>Soft Carrying Case</td>
</tr>
<tr>
<td>633-44</td>
<td>Rechargeable Li-Ion Battery</td>
</tr>
<tr>
<td>40-168-R</td>
<td>AC-DC Adapter</td>
</tr>
<tr>
<td>806-141-R</td>
<td>Automotive Cigarette Lighter 12 VDC Adapter</td>
</tr>
<tr>
<td>3-2000-1498</td>
<td>USB A/5-pin mini-B Cable, 10 feet/305 cm</td>
</tr>
<tr>
<td>11410-00511</td>
<td>Spectrum Master™ MS2712E, MS2713E Technical Data Sheet One Year Warranty (Including battery, firmware, and software) Certificate of Calibration and Conformance</td>
</tr>
</tbody>
</table>
## Optional Accessories

### Directional Antennas

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-1411</td>
<td>822-900 MHz, N(f), 10 dBi, Yagi</td>
</tr>
<tr>
<td>2000-1412</td>
<td>885-975 MHz, N(f), 10 dBi, Yagi</td>
</tr>
<tr>
<td>2000-1413</td>
<td>1710-1880 MHz, N(f), 10 dBi, Yagi</td>
</tr>
<tr>
<td>2000-1414</td>
<td>1850-1990 MHz, N(f), 9.3 dBi, Yagi</td>
</tr>
<tr>
<td>2000-1415</td>
<td>2400-2500 MHz, N(f), 10 dBi, Yagi</td>
</tr>
<tr>
<td>2000-1416</td>
<td>1920-2170 MHz, N(f), 10 dBi, Yagi</td>
</tr>
<tr>
<td>2000-1519</td>
<td>500 MHz to 3 GHz, log periodic</td>
</tr>
</tbody>
</table>

### Portable Antennas

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-1200</td>
<td>806-866 MHz, SMA (m), 50 Ω</td>
</tr>
<tr>
<td>2000-1473</td>
<td>870-960 MHz, SMA(m), 50 Ω</td>
</tr>
<tr>
<td>2000-1035</td>
<td>896-941 MHz, SMA (m), 50 Ω (1/4 wave)</td>
</tr>
<tr>
<td>2000-1030</td>
<td>1710 to 1880 MHz, SMA (m), 50 Ω (1/2 wave)</td>
</tr>
<tr>
<td>2000-1474</td>
<td>1750 to 1850 MHz with knuckle elbow (1/2 wave)</td>
</tr>
<tr>
<td>2000-1031</td>
<td>1850 to 1900 MHz, SMA (m), 50 Ω (1/2 wave)</td>
</tr>
<tr>
<td>2000-1032</td>
<td>1920 to 1980 MHz and 2110 to 2170 MHz, SMA (m), 50 Ω</td>
</tr>
<tr>
<td>2000-1361</td>
<td>2400 to 2500 MHz, SMA (m), 50 Ω (1/2 wave)</td>
</tr>
</tbody>
</table>

### Bandpass Filters

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1030-114-R</td>
<td>806-869 MHz, N(m) - SMA(f), 50 Ω</td>
</tr>
<tr>
<td>1030-109-R</td>
<td>824 - 849 MHz, N(m) - SMA (f), 50 Ω</td>
</tr>
<tr>
<td>1030-110-R</td>
<td>880 - 915 MHz, N(m) - SMA (f), 50 Ω</td>
</tr>
<tr>
<td>1030-105-R</td>
<td>890-915 MHz Band, 0.41 dB loss, N(m) - SMA (f), 50 Ω</td>
</tr>
<tr>
<td>1030-111-R</td>
<td>1850 - 1910 MHz, N(m) - SMA (f), 50 Ω</td>
</tr>
<tr>
<td>1030-106-R</td>
<td>1710-1790 MHz Band, 0.34 dB loss, N(m) - SMA (f), 50 Ω</td>
</tr>
<tr>
<td>1030-107-R</td>
<td>1910-1990 MHz Band, 0.41 dB loss, N(m) - SMA (f), 50 Ω</td>
</tr>
<tr>
<td>1030-112-R</td>
<td>2400 - 2484 MHz, N(m) - SMA (f), 50 Ω</td>
</tr>
<tr>
<td>1030-155-R</td>
<td>2500-2700 MHz, N(m) - N(f), 50 Ω</td>
</tr>
</tbody>
</table>

### Attenuators

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1010-122</td>
<td>20 dB, 5 W, DC to 12.4 GHz, N(m)-N(f)</td>
</tr>
<tr>
<td>42NS0-20</td>
<td>20 dB, 5 W, DC to 18 GHz, N(m) - N(f)</td>
</tr>
<tr>
<td>42NS5A-30</td>
<td>30 dB, 5 W, DC to 18 GHz, N(m) - N(f)</td>
</tr>
<tr>
<td>3-1010-123</td>
<td>30 dB, 50 W, DC to 8.5 GHz, N(m)-N(f)</td>
</tr>
<tr>
<td>1010-127-R</td>
<td>30 dB, 150 W, DC to 3 GHz, N(m) - N(f)</td>
</tr>
<tr>
<td>3-1010-124</td>
<td>40 dB, 100 W, DC to 8.5 GHz, N(m)-N(f), Uni-directional</td>
</tr>
<tr>
<td>1010-121</td>
<td>40 dB, 100 W, DC to 18 GHz, N(m)-N(f), Uni-directional</td>
</tr>
<tr>
<td>1010-128-R</td>
<td>40 dB, 150 W, DC to 3 GHz, N(m) - N(f)</td>
</tr>
</tbody>
</table>

### Phase-Stable Test Port Cables, Armored w/ Reinforced Grip

(Recommended for cable & antenna line sweep applications)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1SRNFN50-1.5-R</td>
<td>1.5 m, DC to 6 GHz, N(m) - N(f), 50 Ω</td>
</tr>
<tr>
<td>1SRDFN50-1.5-R</td>
<td>1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50 Ω</td>
</tr>
<tr>
<td>1SRDN50-1.5-R</td>
<td>1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50 Ω</td>
</tr>
<tr>
<td>1SRNFN50-3.0-R</td>
<td>3.0 m, DC to 6 GHz, N(m) - N(f), 50 Ω</td>
</tr>
<tr>
<td>1SRDFN50-3.0-R</td>
<td>3.0 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50 Ω</td>
</tr>
<tr>
<td>1SRDN50-3.0-R</td>
<td>3.0 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50 Ω</td>
</tr>
</tbody>
</table>

### Phase-Stable Test Port Cables, Armored

(Recommended for use with tightly spaced connectors and other general purpose applications)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1SNNF50-1.5C</td>
<td>1.5 m, DC to 6 GHz, N(m) - N(f), 50 Ω</td>
</tr>
<tr>
<td>1SNN50-1.5C</td>
<td>1.5 m, DC to 6 GHz, N(m) - N(m), 50 Ω</td>
</tr>
<tr>
<td>1SNDF50-1.5C</td>
<td>1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(f), 50 Ω</td>
</tr>
<tr>
<td>1SND50-1.5C</td>
<td>1.5 m, DC to 6 GHz, N(m) - 7/16 DIN(m), 50 Ω</td>
</tr>
<tr>
<td>1SNNF50-3.0C</td>
<td>3.0 m, DC to 6 GHz, N(m) - N(f), 50 Ω</td>
</tr>
<tr>
<td>1SNN50-3.0C</td>
<td>3.0 m, DC to 6 GHz, N(m) - N(m), 50 Ω</td>
</tr>
</tbody>
</table>
## Optional Accessories

### Adapters

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Frequency Range</th>
<th>Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1091-26-R</td>
<td>SMA(m) - N(m), DC to 18 GHz, 50 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1091-27-R</td>
<td>SMA(f) - N(m), DC to 18 GHz, 50 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1091-80-R</td>
<td>SMA(m) - N(f), DC to 18 GHz, 50 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1091-81-R</td>
<td>SMA(f) - N(f), DC to 18 GHz, 50 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1091-172</td>
<td>BNC(f) - N(m), DC to 1.3 GHz, 50 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>510-102</td>
<td>N(m) - N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Precision Adapters

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Frequency Range</th>
<th>Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>34NN50A</td>
<td>Precision Adapter, N(m) - N(m), DC to 18 GHz, 50 Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34NFNF30</td>
<td>Precision Adapter, N(f) - N(f), DC to 18 GHz, 50 Ω</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Backpack and Transit Case

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>67135</td>
<td>Anritsu Backpack (For Handheld Instrument and PC)</td>
</tr>
<tr>
<td>760-243-R</td>
<td>Large Transit Case with Wheels and Handle</td>
</tr>
</tbody>
</table>

### Miscellaneous Accessories

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-1528-R</td>
<td>GPS Antenna, SMA(m)</td>
</tr>
<tr>
<td>69793</td>
<td>CW Signal Generator Kit</td>
</tr>
<tr>
<td>2000-1520-R</td>
<td>USB Flash Drive</td>
</tr>
<tr>
<td>2000-1374</td>
<td>External Charger for Li-Ion Batteries</td>
</tr>
</tbody>
</table>
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.

Visit us to register today: [www.anritsu.us/smiusignup](http://www.anritsu.us/smiusignup)

To receive a quote to purchase a product or order accessories, visit our online ordering site: [www.ShopAnritsu.com](http://www.ShopAnritsu.com)

**Training at Anritsu**

Anritsu has designed courses to help you stay up to date with technologies important to your job.

For available training courses visit: [www.us.anritsu.com/training](http://www.us.anritsu.com/training)