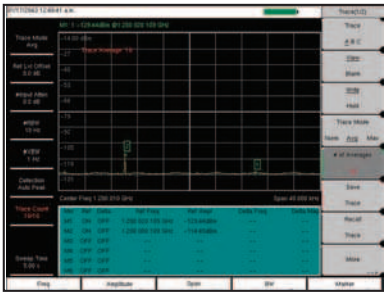# ≤−153 dBm Displayed Average Noise Level Typical @ 1 GHz

Unprecedented in handheld battery powered spectrum analyzers, the sensitivity of the Spectrum Master family delivers the ability to measure very low level signals. Coupled with a wide range of resolution bandwidth choices, you can configure the Spectrum Master to meet your most challenging measurement needs.
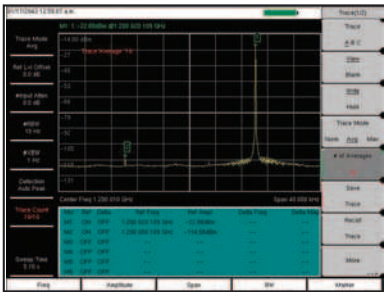
As the spectrum becomes more and more congested, the ability to measure low level signals becomes more and more important not only for interference detection but also for wireless system planning.

Tracking Generator
USB Connector for Flash Drive
Headset 2.5 mm
USB Device Jack
LAN Connector
Battery Charger Input
Speaker
On/Off Button
Directional Buttons
Rotary Knob
Soft Keys
Dual Function Keypad

3

Field Use

Measuring a Small Signal

Wide Dynamic Range — Measuring a small signal in the presence of a very large signal

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

The input attenuation value can be tied to the reference level, reducing the number of parameters a field technician may have to set. The RBW/VBW and the span/RBW ratios can be set to values that are best for the measurements being made, further easing the technician's burden and reducing the chances of errors.
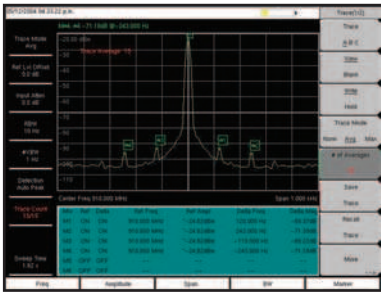
Over 1000 traces with names up to 40 characters long may be saved in the 256 MB non-volatile compact flash memory. These traces can later be copied into a PC using the built-in USB 2.0 connector or the 10/100 Mbit Ethernet connection. Measurements may also be saved directly to Compact Flash or USB Flash Drive.

Commonly needed measurements are built in. These include field strength, occupied bandwidth, channel power, adjacent channel power ratio, AM/FM/ SSB demodulation and carrier to interference (C/I) ratio measurements.

The Spectrum Master family has very wide dynamic range, allowing measurement of very small signals in the presence of much larger signals. These pictures show a measurement of a –114 dBm signal with and without the presence of a –22 dBm signal only 20 kHz away.

W-CDMA/HSDPA Signal Analyzer	824 to 894 MHz Band V, VI 1710 to 2170 MHz Band I, II, III, IV 2300 to 2700 MHz
W-CDMA/HSDPA Signal Analyzer	W-CDMA/HSDPA RF Meas W-CDMA Demod W-CDMA/HSDPA Demod W-CDMA/HSDPA OTA
GSM/GPRS/EDGE Signal Analyzer	380 to 400 MHz T-GSM 380 410 to 430 MHz T-GSM 410 450 to 468 MHz GSM 450 478 to 496 MHz GSM 480 698 to 746 MHz GSM 710 747 to 792 MHz GSM 750 806 to 866 MHz T-GSM 810 824 to 894 MHz GSM 850 890 to 960 MHz GSM 900 880 to 960 MHz E-GSM 900 876 to 960 MHz R-GSM 900 870 to 921 MHz T-GSM 900 1710 to 1880 MHz DCS 1800 1850 to 1990 MHz PCS 1900
GSM/GPRS/EDGE Signal Analyzer	GSM/GPRS/EDGE RF Meas GSM/GPRS/EDGE Demod
GPS	Location Indicator Enhance Frequency Reference Oscillator Accuracy

Lab Use

Powerline related sidebands on a synthe-sized signal generator

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

For maximum flexibility, sweep triggering can be set to free run, or to do a single sweep. In zero span, the sweep can be set to trigger when a signal meets or exceeds a certain power level or it can be externally triggered.

The span can be set anywhere from 10 Hz to 7.1, 13, or 20 GHz in addition to zero span.

Using battery-powered equipment to measure powerline related sidebands on a signal source removes any question as to the source of the sidebands.

Continuous frequency coverage from 9 kHz to 20 GHz gives the wireless professional the performance needed for the most demanding measurements.

Whether your need is for spectrum monitoring, WiFi and WiFi5 installation and testing, RF and microwave signal measurements or cellular signal measurements, the Spectrum Master family gives you the tools you need to make the job easier and more productive. The built-in AM/FM/SSB demodulator simplifies the job of identifying interfering signals.
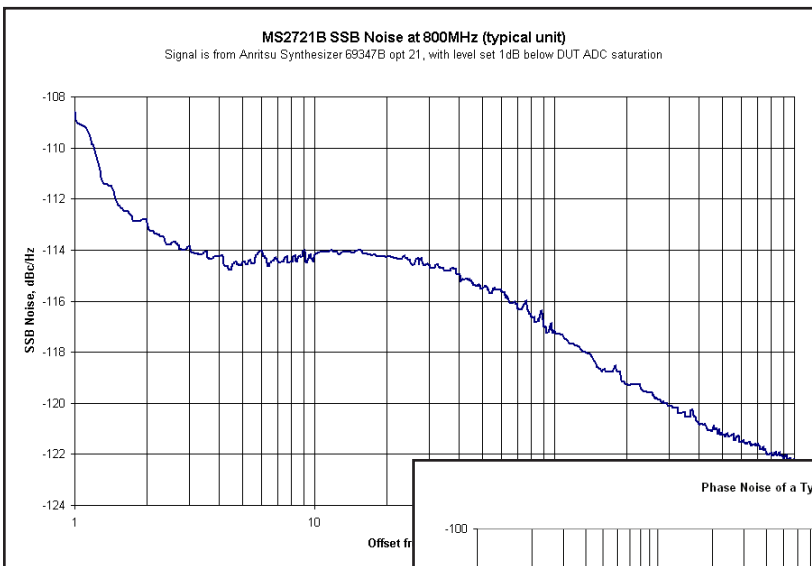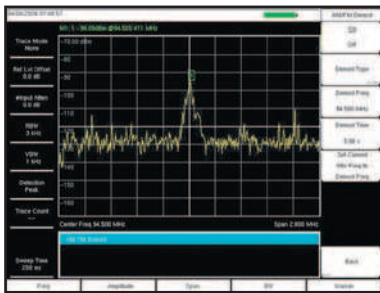

Typical MS2721B Phase Noise Performance
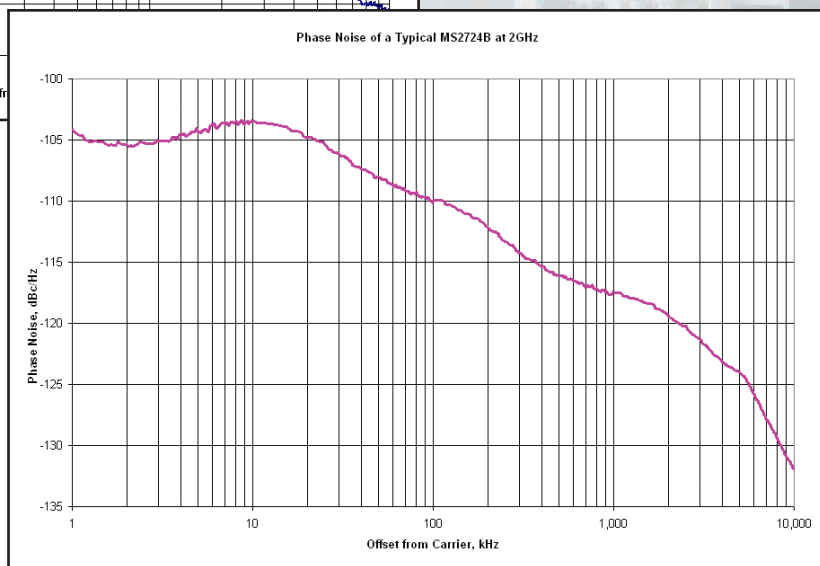
Typical MS2724B Phase Noise Performance

Features

AM, FM and SSB Demodulation

Multiple Language Support

Segmented Limit Lines

Light Weight

Weighing about seven pounds fully loaded, including a Li-Ion battery, this fully functional handheld spectrum analyzer is light enough to take anywhere, including up a tower.
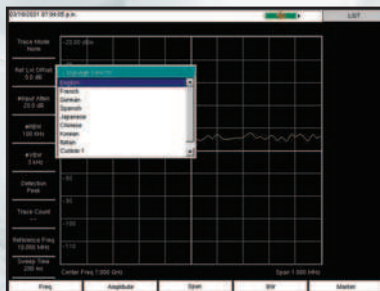
AM/FM/SSB Demodulation

A built-in demodulator for AM, narrowband FM, wideband FM and single sideband (selectable USB and LSB) allows a technician to easily identify interfering signals. The demodulated audio can be heard either through the built-in speaker or through a standard cellphone headset. A demodulation marker is provided for easy tuning.

Remote Tools

Imagine sitting at your desk while controlling an Spectrum Master that is miles away, seeing the screen display and operating with an interface that looks exactly like the instrument itself. That is what Remote Tools lets you do.

Local Language Support

The Spectrum Master features eight languages English, Spanish, German, French, Japanese, Chinese, Italian and Korean, two custom user-defined languages can be uploaded into the instrument using Master Software Tools, supplied with the instrument.

Fast Sweep Speed

The Spectrum Master automatically sets the fastest sweep consistent with accurate measurements, and sweep speed in zero span can be set from 10 microseconds up to 600 seconds. This is faster and more flexible than any portable spectrum analyzer on the market today, simplifying the capture of intermittent interference signals.

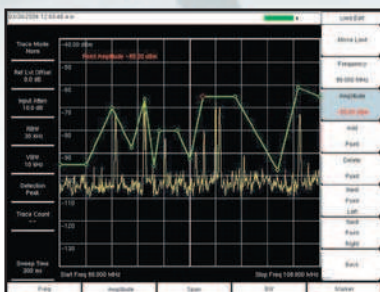## +43 dBm Maximum Safe Input Level

Because the MS2721B can survive an input signal of +43 dBm (20 watts) without damage, you can rest assured that the MS2721B can survive in even the toughest RF environments. Maximum continuous input for measurement is +30 dBm. For the MS2723B and MS2724B the maximum safe input is +30 dBm.

Spectrum Monitoring

A critical function of any spectrum analyzer is the ability to accurately view a portion of the RF and microwave spectrum. The Spectrum Master performs this function admirably thanks to the wide frequency range and excellent dynamic range. A built-in 256 MB compact flash memory module allows over 1,000 traces to be stored. The Compact Flash connector allows compact flash memory to expand the trace storage without limit. A 512 Mb compact flash module can hold over 13,000 spectrum analyzer sweeps. USB Flash Drives may be used for convenient transfer of data.

Limit Lines

The Spectrum Master includes two types of limit lines, lower limit lines and upper limit lines. Limit lines may be used either for visual reference or for pass/fail criteria by implementing limit alarms. Limit alarm failures are reported if a signal is above the upper limit line or below the lower limit line. Each limit line may consist of up to 40 segments.

Transmissive Color Display

The MS2721B, MS2723B and MS2724B 21.5 cm (8.5 in.) SVGA color transmissive LCD display screen is readable outdoors.

IF Output (Option 89) (MS2723B and MS2724B only)

Option 89 adds an IF Output connector to the instrument. The IF Output provides access to the 37.8 MHz IF signal at user selectable bandwidths of 16 MHz, 10 MHz, 7 MHz, or IF bandwidths corresponding to any of the selectable RBW filter bandwidths.

Multiple Markers simplify data analysis such as on this CDP display.

Multiple Markers

Display up to six markers on screen in Spectrum Analyzer mode each with delta marker. Or choose one reference marker with six delta markers. Noise marker and frequency counter marker can be selected. In W-CDMA/HSDPA mode the six markers can display the selected code power, code EVM and type of code.

Noise Markers

The capability to measure noise level in terms of dBm/Hz or dBµV/Hz is a standard feature of the Spectrum Master.

Frequency Counter Markers

The Spectrum Masters have frequency counter markers with resolution to 1 Hz. Add the GPS option to get complementary accuracy.

Functions	
Quasi-Peak Detector	When the quasi-peak detector is selected 200 Hz, 9 kHz, and 120 kHz RBW are enabled.
Multiple Marker	Display up to six markers on screen, each marker includes a delta marker.
Marker Table	Display a table of up to six marker frequency and amplitude values plus delta marker frequency offset and amplitude.
Upper/Lower Limit Fixed and Segmented	Each upper and lower limit can be made up of between one and 40 segments.
Marker 1 Reference	Sets marker 1 to be the reference for six delta markers. Ideal for broadcast proofing and medical telemetry monitoring.
Fixed or Tracking Markers	User can choose whether reference markers track signal amplitude or are fixed when the associated delta marker is turned on.

Smart Measurements	
Occupied Bandwidth	Measures 99% to 1% power bandwidth of a spectrum.
Channel Power	Measures the total power in a specified bandwidth.
C/I	Measures the carrier to interference ratio in a specified bandwidth.
ACPR	Measures power levels in the channels immediately above and below the center channel.
Field Strength	Uses antenna calibration tables to measure dBm/meter² or dBmV/meter.
AM/FM/SSB Demodulation	Allows the user to listen to interfering signals. De-emphasis is included for narrow-band FM and wideband FM. Upper Sideband and Lower Sideband demodulation includes a BFO that can be tuned ±10 kHz from the center frequency.

# Lab Grade Spectrum Analysis in a Handheld Package

Smart Measurements

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

Fast Sweep Speed

The Spectrum Master automatically sets the fastest possible sweep consistent with accurate measurements, and sweep speed in zero span can be set from 10 microseconds to 600 seconds. This is faster and more flexible than any portable spectrum analyzer on the market today, simplifying the capture of intermittent interference signals.

Carrier to Interference Measurement

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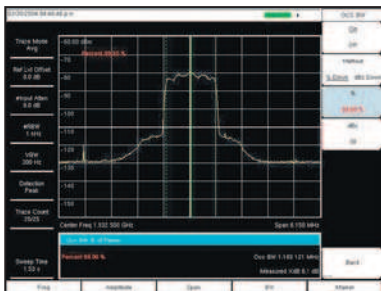
Occupied Bandwidth

Occupied Bandwidth

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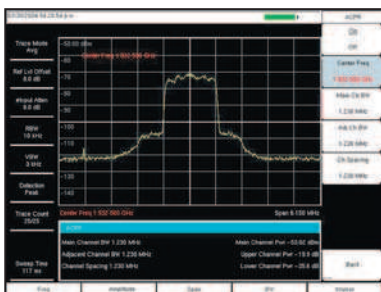

Adjacent Channel Power Ratio

Adjacent Channel Power Ratio

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

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

Extend the Functionality with Valuable Options
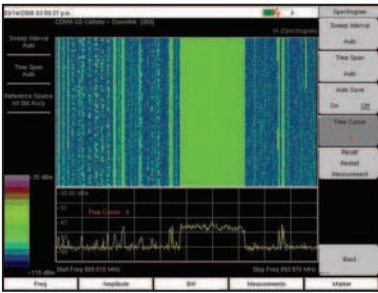
With Option 25, spectrogram measurements identify intermittent interference.

Interference Analyzer (Option 25)

With its built-in low-noise preamplifier, the Spectrum Master with interference analyzer option provides the ability to identify and locate interfering signals down to the noise floor, allowing technicians to better address the quality issues that affect user service.

Spectrogram

The Spectrogram display is a three dimensional display of frequency, power, and time of the spectrum. It is applicable for identifying intermittent interference and tracking signal levels over time. The Spectrum Master can save data for up to 72 hours.
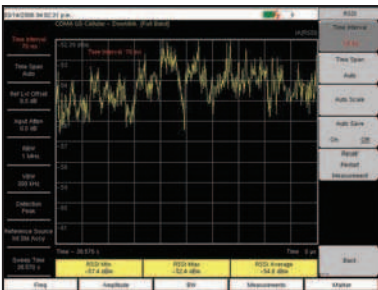
With Option 25, RSSI analyzes the signal strength of a signal over time.

RSSI

The received signal strength indicator is useful to observe the signal strength of a single frequency over time. Data can be collected for up to 72 hours.

The Signal Strength Meter can be used to locate an interfering signal.

Signal Strength Meter

The Signal Strength meter locates an interfering signal by measuring the strength of the interfering signal. Power is displayed in Watts, dBm and in the graphical analog meter display. The strength of the signal is also indicated by an audible beep.

The Field Strength measurement is included to the Signal Strength Meter menu for quick determination of calibrated field strength.
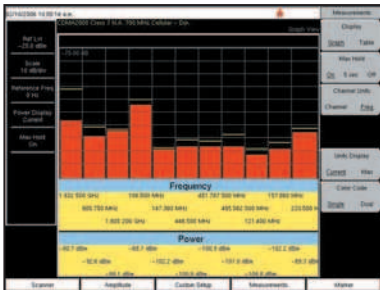
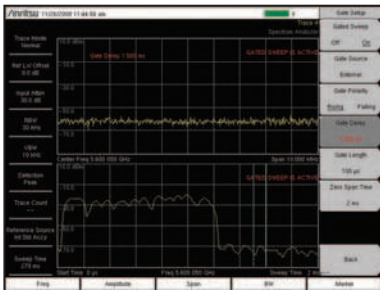# Extend the Functionality with Valuable Options
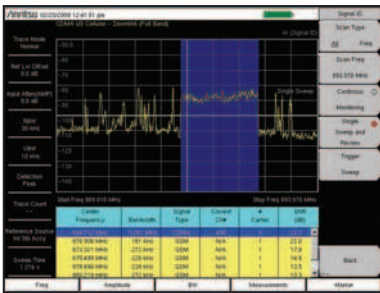
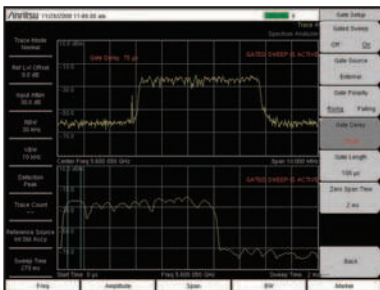Signal ID feature showing scanned results of the whole band.
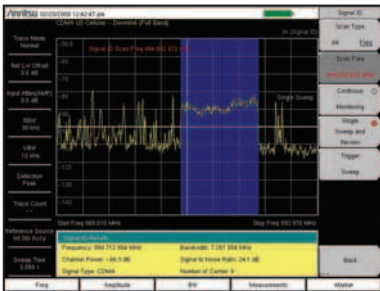
Signal ID feature showing scanned results of a particular frequency.

With Option 27, channel scanner measures power of multiple transmitters.

With Option 90, display setup showing off time of a WiMAX signal.

With Option 90, gated sweep display setup. WiMAX header

Signal ID

The Signal ID feature in the interference Analyzer can help to quickly identify the type of the interfering signal. This measurement can be configured to identify all signals in the selected band or just monitor one single interfering frequency. The results displayed include the Center Frequency, Bandwidth of the signal, the type of the signal (CDMA, GSM and WCDMA); its closest channel number, the number of carriers, its Signal to Noise ratio and the Channel Power of the signal. The spectrum of the signal is colored to ease review of the scanned signals.

Channel Scanner (Option 27)

The channel scanner option measures the power of multiple transmitted signals and is very useful for measuring channel power in AMPS, iDEN, GSM, TDMA, CDMA, W-CDMA, and HSDPA networks. Up to 20 channels can be scanned at the same time. You can select to display the frequencies or the scanned data, to be displayed by frequencies or the channel number. Display data in graph or table format. In the custom setup menu each channel can be custom built with different frequency, bandwidth, or channels from different signal standards.

Gated Sweep (Option 90)

This option will be of interest to those who want the capability to view pulsed or burst signals only when they are on, or conversely look at the spectrum only when the signals are off. The signals may be such things as radar signals, WiMAX signals, TD-SCDMA, and GSM signals.

Gated sweep uses the external trigger input to begin sweeping when the trigger signal goes to the user-selected TTL high or TTL low. After the trigger event has occurred, the instrument will sweep for the time specified by the Gate Length parameter and then wait for further trigger events before continuing the sweep. This repeats until enough trigger conditions occur to finish the full sweep. The user can also enter a gate delay value to have sweeping start at the end of the delay. This allows the user to compensate for cases where the trigger signal occurs before the RF event they want to measure.

Enhance Frequency Accuracy with Built-in GPS
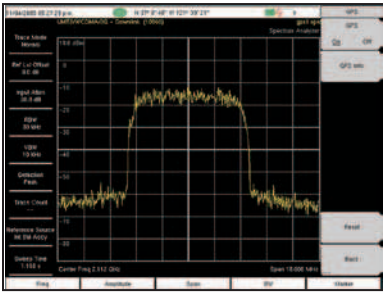
With GPS Option 31, the location information (longitude, latitude) is shown at the top of the screen.
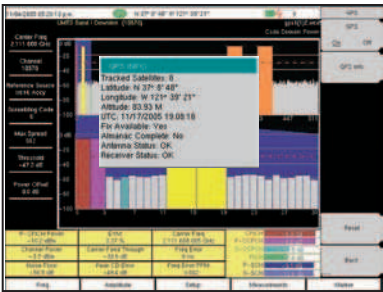
With GPS Option 31, enhance the frequency reference oscillator accuracy to make accurate frequency error measurements.

GPS (Option 31)

GPS information allows confirmation of the correct measurement location. The GPS option provides exact location information (longitude, latitude) which is saved with each measurement in addition to date and time. Included with the GPS option is a magnet mount antenna with a 5m (15 feet) cable allowing use on a car roof or other useful surface.

The GPS Option also enhances the frequency accuracy of the Spectrum Master's internal OCXO oscillator. Within three minutes of GPS satellite acquisition, the built-in GPS receiver provides a frequency accuracy to better than 25 ppb (parts per billion). After the GPS antenna is disconnected, the instrument will remain in High-Accuracy mode for three days, preserving frequency accuracy to better than 50 ppb.

Typical frequency accuracy of the Spectrum Master for 72 hours following the GPS antenna disconnect over full specified temperature range.
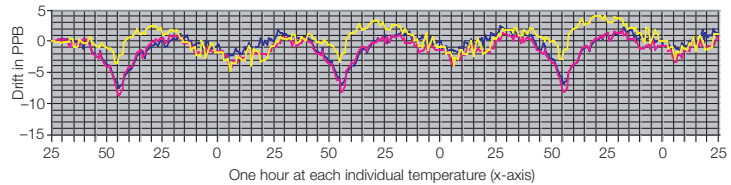
Typical frequency accuracy of the Spectrum Master for 24 hours following the GPS antenna disconnect over temperature range 15° C to 35° C.
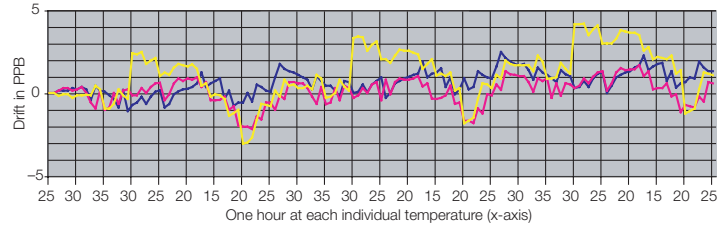
MS2724B Spectrum Master

Node B Transmitter Performance Testing Made Simple
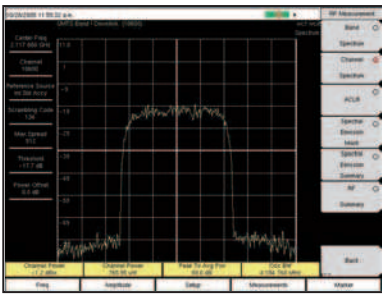
The RF Spectrum screen shows selected signals along with key parameters, such as channel power and occupied bandwidth.
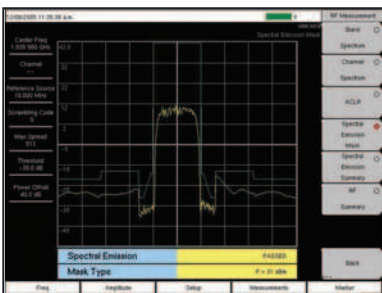
The Spectral Emission Mask screen presents a received signal framed by the 3GPP spectral mask.
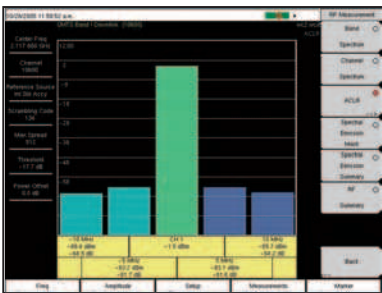
The ACLR screen shows the power levels for the main channel as well as two adjacent channels.
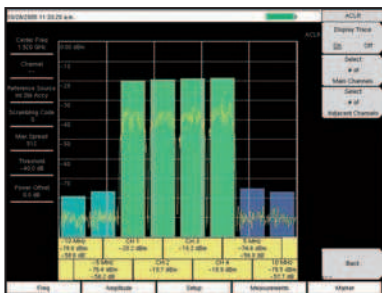
Multi-channel ACLR with four main channels and two adjacent channels on both sides.

With four measurement options — W-CDMA/HSDPA RF Meas, W-CDMA Demod, W-CDMA/HSDPA Demod (covering all W-CDMA Demod measurements) and W-CDMA/HSDPA Over The Air (OTA) measurements — technicians and RF engineers can connect the Spectrum Master to any Node B for accurate RF and demodulator measurements. A physical connection is not required for the instrument to receive and demodulate W-CDMA and HSDPA OTA signals. With a Spectrum Master, a technician no longer needs to take a Node B site off line. For details see the Option Comparison Table on page 29.

W-CDMA/HSDPA RF Measurements (Option 44)

RF measurements are used to measure the transmitted signal strength and signal shape of the selected Node B transmitter. For the technician's convenience, the RF measurement option includes Band Spectrum, Channel Spectrum, Spectral Emission Mask, ACLR and RF Summary screens.

Band Spectrum

Select the applicable signal standard downlink spectrum, place a cursor on the desired channel, and the unit automatically selects that channel to make W-CDMA/HSDPA measurements.

Channel Spectrum

The Channel Spectrum screen displays the signals of a selected channel as well as channel power (in dBm and watts), occupied bandwidth and peak to average power. Operators can select a channel by using the band channel or by choosing a signal standard and channel.

Spectral Emission Mask

The Spectral Emission Mask measurement applies the mask depending upon the transmitter output as defined in the 3GPP specification (TS 125.141). The mask varies depending upon the input signal. The Spectrum Master will indicate if the signal "PASSED" or "FAILED" according to the specified limits. For ease of analysis, the spectral emission mask is also displayed in a tabular format with different frequency ranges and a PASS or FAIL indication for each range.

ACLR

The Spectrum Master's ACLR screen shows measurements of main channel power as well as the power levels of the adjacent channels set at –10 MHz, –5 MHz, +5 MHz and +10 MHz according to the 3GPP standard (TS 125.141). The Spectrum Master can also make multichannel ACLR measurements with as many as four main channels and four adjacent channels. See the example with four main channels and two adjacent channels on both sides.

RF Summary

The RF Summary screen displays the transmitter performance parameters in a table format so technicians can quickly check details at a glance.

Connect Directly or Over the Air
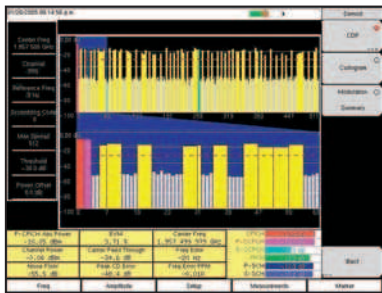
The Code Domain Power (CDP) screen shows 256 or 512 OVSF codes with flexible zoom capabilities.
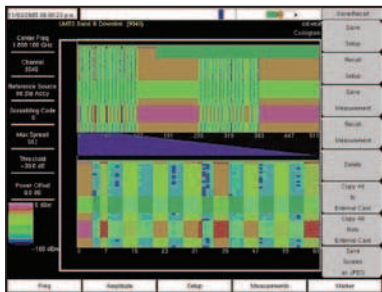
The Codogram screen shows how code levels are changing over time to simplify fault analysis.
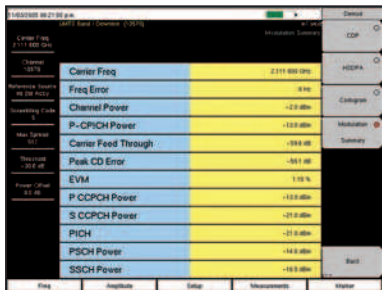
The Modulation Summary screen shows critical transmitter performance parameters in table format.

The Spectrum Master offers a clear Pass/Fail display for quick evaluation of a Node B base station.

W-CDMA Demodulator (Option 45)

The Spectrum Master with Option 45 demodulates W-CDMA signals and displays detailed measurements for evaluating transmitter modulation performance using Code Domain Power (CDP), Codogram, Modulation Summary and Pass/Fail screens. All the capability of Option 45 is included in Option 65.

Code Domain Power

The Code Domain Power (CDP) screen displays 256 or 512 OVSF codes with zoom capability, common pilot power (P-CPICH), channel power, error vector magnitude (EVM), carrier frequency, carrier feed through, frequency error (in Hz and ppm), Peak CD error, and noise floor. Option 45 can zoom to 32, 64, or 128 codes and the user can input the zoom code to zoom in on the OVSF codes. The demodulator also displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH power in a dedicated control channel view.

Codogram

The Codogram screen displays how code levels are changing over time, making it easier to monitor traffic, faults and hand-off activity. Showing 256 or 512 OVSF codes with zoom codes, the Spectrum Master can zoom to 32, 64 or 128 codes, or the user can directly zoom to particular OVSF codes of interest.

Modulation Summary

The Modulation Summary screen displays critical transmitter performance measurements in table format for easy viewing, showing carrier frequency, frequency error, channel power, primary common pilot channel (P-CPICH) absolute power, secondary common pilot channel (S-CCPCH) power and paging indicator channel (PICH) as well as physical shared channel (PSCH) absolute power.

Pass/Fail Mode

The Spectrum Master stores the five test models covering all eleven test scenarios specified in the 3GPP specification (TS 125.141) for testing base station performance and recalls these models for quick easy measurements. After an operator selects a test model, the Spectrum Master displays test results in table format with clear PASS or FAIL indications that include min/max thresholds and actual measured results.

Using Master Software Tools, additional custom tests can be easily created and uploaded into the Spectrum Master. All critical parameters can be selected for pass/fail testing including each individual code's power level, the spreading factor and symbol EVM.

Demodulate and Display HSDPA Signals with Ease
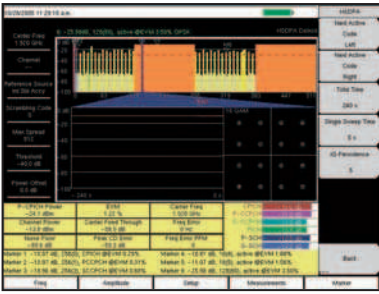
With Option 65, the Spectrum Master demodulates HSDPA and W-CDMA signals and displays selected code constellation. The selected code power versus time is also displayed.
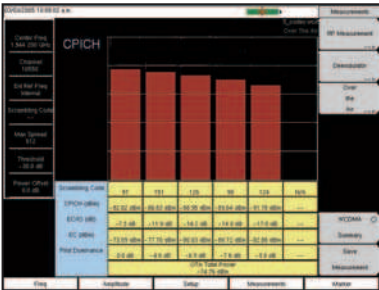
With Option 35, the Spectrum Master shows six scrambling codes and CPICH data in a combination bar graph/table view.

W-CDMA/HSDPA Demodulator (Option 65)

High Speed Downlink Packet Access (HSDPA) uses up to fifteen dedicated physical channels to provide high downlink data rates. The Spectrum Master with Option 65 allows demodulating HSDPA signals and displaying CDP, selected code power variation over time, and the constellation for the selected code, in addition to all the standard W-CDMA demodulator measurements that are included in Option 45.

W-CDMA/HSDPA Over The Air (OTA) (Option 35)

OTA displays six scrambling codes in a bar graph format. For each scrambling code, CPICH in dBm, Ec/Io in dB, Ec in dBm, and pilot dominance in dB are displayed in table format. The user will also see OTA total power in dBm.

Demodulate GSM, GPRS and EDGE Signals
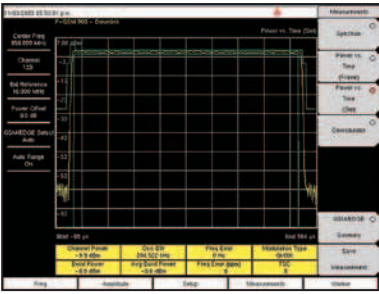
Option 40 displays the first detected timeslot mask as specified in 3GPP TS 05.05.

GSM/GPRS/EDGE Measurements

For flexibility, the Spectrum Master features two GSM/GPRS/EDGE measurement modes: RF Meas and Demod. Technicians and RF engineers can connect the unit to any GSM/GPRS/EDGE base station for accurate RF and demodulator measurements. When a physical connection is not required, the unit can receive and demodulate GSM/GPRS/EDGE signals over the air.

Option 41 demodulates and displays GSM/GPRS/EDGE signals, including vector diagrams.

GSM/GPRS/EDGE RF Measurements (Option 40)

GSM/GPRS/EDGE RF measurements provide views of single-channel spectrum, multichannel spectrum, power versus time (frame), power versus time (slot) with mask per 3GPP TS 05.05 specification and summary screens.

The spectrum view displays channel spectrum and multichannel spectrum. The channel spectrum screen includes channel power, burst power, average burst power, frequency error, modulation type and Training Sequence Code (TSC). The multichannel spectrum allows the user to show as many as ten channels with measurements displayed for the selected channel.

Option 41 provides a quick, table view of critical test parameters, including channel power, occupied bandwidth, phase error and EVM.

GSM/GPRS/EDGE Demodulator (Option 41)

Option 41 demodulates GSM/GPRS/EDGE signals and displays the results of detailed measurements to analyze transmitter modulation performance. Results are shown for phase error (rms), phase error peak, EVM (rms), EVM (peak), origin offset, C/I, modulation type and magnitude error (rms) and a vector diagram of the signal.
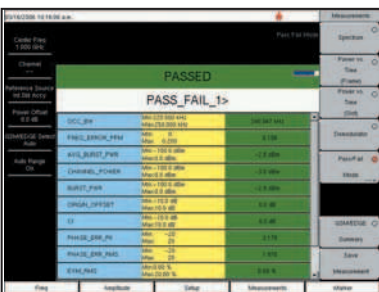
Using Master Software Tools, custom GSM/GPRS/EDGE Pass/Fail test sets can be created and uploaded to the Spectrum Master.

Pass/Fail Mode

Using Master Software Tools, custom GSM/GPRS/EDGE Pass/Fail test sets can be easily created and uploaded into the Spectrum Master. The test results are displayed in table format with clear pass or fail indicators that include min/max thresholds and actual measured results.

Connect Directly or Over the Air to Make CDMA/ EVDO Measurements

CDMA RF Measurements (Option 42)

RF Measurements are used to measure the transmitted signal power, shape, power in adjacent channels and spurious emissions. The following sets of measurements help the technician evaluate the RF characteristics of a CDMA base station.
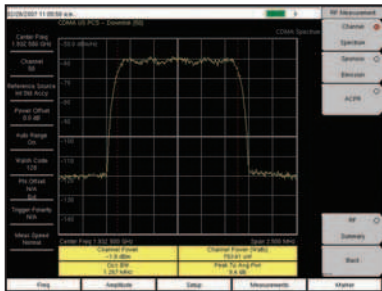
CDMA Channel Spectrum measurement display

Channel Spectrum

The Channel Spectrum measurement displays the spectrum of the specified channel in addition to numerical values for Channel Power, Occupied BW and Peak to Average Ratio.

ACPR

The ACPR measurement displays the main channel and the power of two adjacent channels on each side of a bar graph. The user can configure up to five main channels.
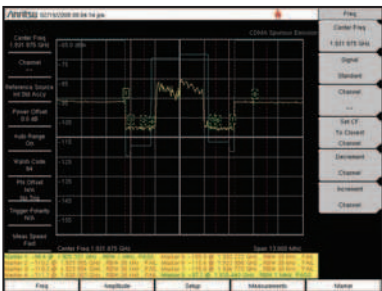
CDMA Spurious Emissions measurement display

Spurious Emission

This measurement displays the spectrum of the input signal at specific offsets (based upon the Signal Standard). Markers are automatically tuned to measure the input power at these offsets and to determine a PASS or FAIL according to limits that are set by the signal standard. A blue mask is also calculated and shown on the spectrum to visually check for pass fail conditions.

Evaluate the Quality of the Modulation from the CDMA Base Station

cdmaOne and CDMA2000 1xRTT Demodulator (Option 43)

Demodulator measurements are used to measure the code domain power in both graphical and tabular forms.
The following sets of measurements help the technician evaluate the quality of the modulation from the CDMA base station.
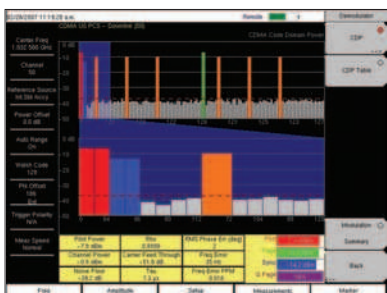
CDMA Code Domain Power measurement display

CDP

The Code Domain Power measurement displays the power of the various demodulated codes (display is automatically bit reversed if Walsh Codes are set to 128). Rho, Frequency Error, Average Noise Floor and Tau are numerical values that are calculated and displayed. A zoom view of 16, 32 or 64 codes is also seen. Markers can be turned on to display the code power and code type.

CDP Table

This measurement displays all the active codes in a color coded tabular format..

Evaluate the Quality of the Modulation from the CDMA Base Station

cdmaOne and CDMA2000 1xRTT Over The Air (Option 33)

Over The Air Measurement provides a cost effective way to identify base station performance problems before they become catastrophic without taking the base station off the air. Traditionally, technicians had to bring down the sector or site to test the base station performance. Now technicians can sit in a vehicle and make these measurements. For accurate measurements over the air, a GPS antenna should be used to provide a timing reference.
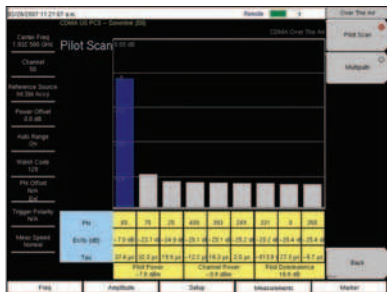
CDMA Over the Air measurement display

Pilot Scan

The strongest nine received PNs are displayed as bar graphs, and the PN numbers are displayed at the bottom of the bar graphs. For each PN, a table displays PN number, Ec/Io, and Tau. Also shown are Pilot Power, Channel Power, and Pilot Dominance.

MultiPath

The strongest six paths are displayed. For each path, a table below the bar graph displays Ec/Io and Tau. Also shown are Channel Power and Multipath Power.

Optimize EVDO Network Performance

EVDO

With the 3G evolution of CDMA technology, 1xEV-DO provides data rates up to 2.4 Mbps, providing greater system capacity and lower costs, making wireless broadband possible. The CDMA2000 1xEV-DO (EVDO) system is backward compatible and is spectrally identical to the cdmaOne and CDMA2000 systems.

EVDO RF Measurements (Option 62)

RF Measurements are used to measure the transmitted signal power, shape, power in adjacent channels and spurious emissions. The following sets of measurements help the technician evaluate the RF characteristics of an EVDO base station.
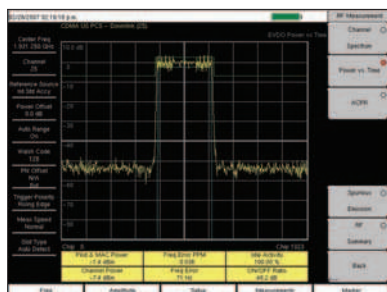

EVDO Power vs. Time measurement display

Channel Spectrum

The Channel Spectrum measurement displays the spectrum of the specified channel in addition to numerical values for Channel Power, Occupied BW and Peak to Average Ratio.

Power vs Time

This measurement displays the time domain view of an EVDO half-slot and helps determine the % of idle activity which gives a measure of how many users are connected to the base station.

ACPR

The ACPR measurement displays the main channel and the power of two adjacent channels on each side of a bar graph. The user can configure up to five main channels.

### Spurious Emission

This measurement displays the spectrum of the input signal at specific offsets (based upon the Signal Standard). Markers are automatically tuned to measure the input power at these offsets and to determine a PASS or FAIL according to limits that are set by the signal standard. A blue mask is also calculated and shown on the spectrum to visually check for pass fail conditions.

Evaluate the Quality of the Modulation from the CDMA Base Station

EVDO Demodulator (Option 63)

Demodulator measurements are used to measure the code domain power in both graphical and tabular forms. The following sets of measurements help the technician evaluate the quality of the modulation from the EVDO base station.

EVDO CDP MAC measurement display

CDP MAC

This measurement displays the power of the various demodulated codes in the MAC Channel. Pilot and MAC Power, Rho, Frequency Error, and Average Noise Floor are numerical values that are calculated and displayed. A zoom view of 16, 32 or 64 codes is also seen. Markers can be turned on to display the code power and code type.

CDP Data

This measurement displays the power of the 16 I and 16 Q sub-channels of the Data channel separately.

MAC CDP Table

This measurement displays all the active codes in the MAC channel in a color coded tabular format.

Cost Effective Way to Identify Base Station Performance Problems

EVDO Over The Air (Option 34)

Over The Air Measurement provides a cost effective way to identify base station performance problems before they become catastrophic without taking the base station off the air. Traditionally, technicians had to bring down the sector or site to test the base station performance. Now technicians can sit in a vehicle and make these measurements. For accurate measurements over the air, a GPS antenna should be used to provide a timing reference.

EVDO Over the Air measurement display

Multipath Power.

Pilot Scan

The strongest nine received PNs are displayed as bar graphs, and the PN numbers are displayed at the bottom of the bar graphs. For each PN, a table displays PN number, Ec/Io, and Tau. Also shown are Pilot Power, Channel Power, and Pilot Dominance.

MultiPath

The strongest six paths are displayed. For each path, a table below the bar graph displays Ec/Io and Tau. Also shown are Channel Power and

EVDO Pass Fail Mode measurement display

Pass/Fail Mode

The Spectrum Master can perform automated Pass/Fail testing for both CDMA and EVDO. The test results are displayed in table format with clear PASS or FAIL indications that include min/max thresholds and actual measured results. Using Master Software Tools, custom tests can be easily created and uploaded into the unit. All critical parameters can be selected for Pass/Fail testing.

Fixed WiMAX Measurements Made Simple

The Fixed WiMAX 802.16-2004 specification refers to an air interface standard for Broadband Wireless Access systems. It enables multiple services in a wireless metropolitan area network, such as wireless backhaul for telecommunications, E1/T1 replacement for small and medium b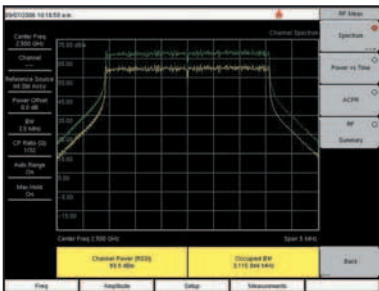usinesses and residential wireless cable/DSL for broadband internet at home. Also, WiMAX provides fixed, nomadic, portable and mobile wireless broadband connectivity without the need for a direct line-of-sight connectivity between a base station and a subscriber.

Fixed WiMAX provides two measurement options: Fixed WiMAX RF Meas and Fixed WiMAX Demod. So for accurate RF and demodulator measurements, technicians and RF engineers can connect the Spectrum Master to any Fixed WiMAX Base Station.

Fixed WiMAX RF Measurements (Option 46)

RF measurements are used to measure the transmitted signal strength and signal shape of the selected BTS transmitter. For the technician's convenience, the RF measurement option can display Channel Spectrum, Power vs. Time, ACPR and RF Summary screens.

The RF Spectrum screen shows the signal spectrum along with key parameters, such as channel power and occupied bandwidth.

Spectrum

In the Spectrum screen, technicians can view and examine the selected signal's channel power (in dBm) and occupied bandwidth.

Power vs. Time screen displays the burst power and preamble power of the signal.
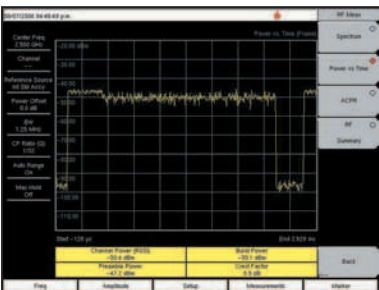
Power vs. Time

The Power vs. Time screen shows the time domain view of a Fixed WiMAX OFDM signal. The Preamble power is always 3 dB higher than the data power. The channel power, preamble power, burst power of data bursts in dBm and the Crest Factor are displayed as numerical values.

The ACPR screen shows the power levels for the main channel and two adjacent channels.

ACPR

ACPR is the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel. Technicians can easily inspect measurements of main channel power as well as the power levels of the two adjacent channels on each side.

Demodulate Fixed WiMAX Signals with Ease

Fixed WiMAX Demodulator (Option 47)

With Option 47, the Spectrum Master can demodulate Fixed WiMAX OFDM signals and displays detailed measurements for evaluating transmitter modulation performance using Constellation, Spectral Flatness, EVM vs. Sub carrier, and EVM vs. Symbol.
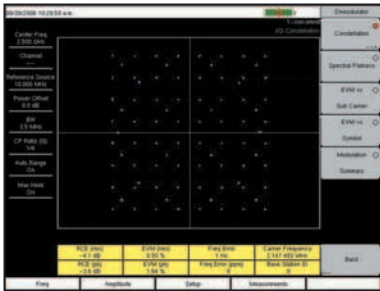
Option 47 displays the constellation of the demodulator signal.

Constellation

The Constellation view shows the constellation of the demodulated data symbols over 1 frame. The data bursts can have BPSK, QPSK, 16 QAM or 64 QAM modulations. All the modulations are color coded. The screen also displays RCE (rms) in dB, RCE (pk) in dB, EVM (rms) in %, EVM (pk) in %, Freq Error in Hz, Freq Error in ppm, Carrier Frequency in Hz and Base Station ID.
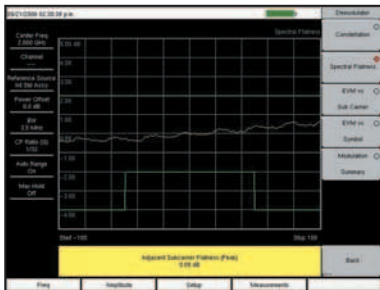
Spectral Flatness is displayed with the mask as specified in 802.16-2004.

Spectral Flatness

The Spectral Flatness view displays the data collected from the preamble before channel estimation is performed. The deviation of the spectral flatness from the average over all the carriers is shown in dB. A mask that conforms to the 802.16-2004 specification is displayed as green/red lines depending on the measurement value. The absolute delta of the power between adjacent sub carriers in dB is also displayed.

Demodulate Fixed WiMAX Signals with Ease

EVM vs. Sub Carrier displays pilot and data subcarrier.

EVM vs. Sub Carrier

The EVM vs. Sub Carrier screen displays the EVM (rms) values vs. OFDM sub carriers. The pilot and data sub carriers are displayed and color-coded.

The EVM vs. Symbol displays the EVM (rms) values vs. OFDM Symbols.

EVM vs. Symbol

The EVM vs. Symbol screen displays the EVM (rms) values vs. OFDM Symbols.

Using Master Software Tools create and download custom Fixed WiMAX Pass/Fail test sets.

Pass/Fail Mode

The Spectrum Master has the capability of creating test procedures with minimum and maximum limits for testing base station performance and recalls these tests for quick and easy measurements. After a test procedure, the unit can display test results in table format with clear PASS or FAIL indications that include min/max thresholds and actual measured results. Plus using Master Software Tools, additional custom tests can be easily created and uploaded into the unit.

Mobile WiMAX Measurements Enabled

The Mobile WiMAX 802.16-2005 specification refers to an air interface standard for Broadband Wireless Access systems. It enables multiple services in a high speed wireless network, such as wireless backhaul for telecommunications, E1/T1 replacement for small and medium businesses, wireless cable/DSL for broadband internet at home or on the move, video on demand and voice over IP services. Also, WiMAX provides, nomadic, portable and mobile wireless broadband connectivity without the need for a direct line-of-sight connectivity between a base station and a subscriber.

The Mobile WiMAX provides three measurement options: Mobile WiMAX RF Measurements, Mobile WiMAX Demodulator and Mobile WiMAX Over The Air (OTA) measurements. So for accurate RF and demodulator measurements, technicians and RF engineers can connect the Spectrum Master to any Mobile WiMAX Base Station.

The RF Spectrum screen shows the signal spectrum along with key parameters, such as channel power and occupied bandwidth.

Mobile WiMAX RF Measurements (Option 66)

RF measurements are used to measure the transmitted signal strength and signal shape of the selected BTS transmitter. For the technician's convenience, the RF measurement option can display Channel Spectrum, Power vs. Time, ACPR and RF Summary screens..

Spectrum

In the Spectrum screen, technicians can view and examine the selected signal's channel power (in dBm) and occupied bandwidth.

Power vs. Time screen displays the burst power and preamble power of the signal.

Power vs. Time

The Power vs. Time screen shows the time domain view of a Mobile WiMAX OFDMA signal in either 5 ms or 10 ms frames. The different power vs. time components of a Mobile WiMAX signal are measured and displayed as channel power, preamble power, downlink burst power and uplink burst power in dBm.

The ACPR screen shows the power levels for the main channel and two adjacent channels.

ACPR

ACPR is the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel. Technicians can easily inspect measurements of main channel power as well as the power levels of the two adjacent channels on each side.

The WiMAX Summary screen shows all key measured parameters of the Mobile WiMAX signal, there are three summary screens, Mobile WiMAX RF, Mobile WiMAX demod and a combined RF & demod Summary screen.

WiMAX Summary

Technicians can quickly view key measurement parameters in the various Summary screens. The WiMAX RF summary screen displays channel power, preamble power, DL burst power and UL burst power and occupied bandwidth. The WiMAX demod summary screen displays RCE (Relative Constellation Error) rms and peak, EVM (Error Vector Magnitude) rms and peak, carrier frequency, frequency error Hz and ppm, Base Station ID and sector ID. The WiMAX Summary is a compilation of both RF and demod measurements together.

Demodulate Mobile WiMAX Signals with Ease

Mobile WiMAX Demodulator (Option 67)
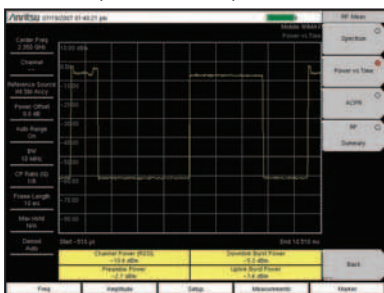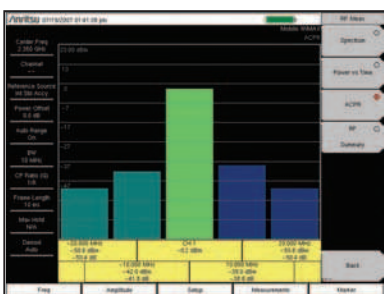
Option 67 can demodulate Mobile WiMAX OFDMA signals and displays detailed measurements for evaluating transmitter modulation performance using Constellation, Spectral Flatness, EVM vs. Sub carrier, and EVM vs. Symbol and it can automatically decode the DL MAP. For faster go no-go testing, a technician can specify to only demodulate the FCH (Frame Control Header).
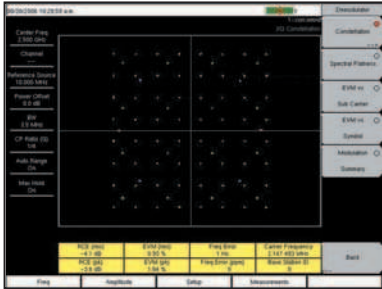
The constellation screen displays the different modulation formats of the demodulated signal using color codes, QPSK (purple), 16QAM (green), 64 QAM (yellow).

Constellation

The Constellation view shows the constellation of the demodulated data symbols over one frame. The data bursts can have QPSK, 16 QAM or 64 QAM modulations. Each modulation format is color coded for easy identification. The screen also displays RCE (rms) in dB, RCE (pk) in dB, EVM (rms) in %, EVM (pk) in %, Freq Error in Hz, Freq Error in ppm, Base Station ID in Hz and Sector ID.
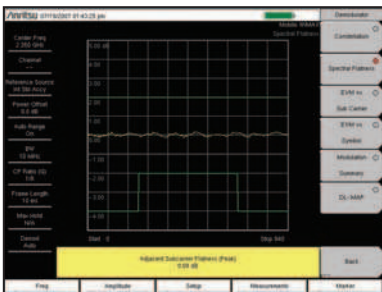
Spectral flatness uses the specified 802.16-2005 mask for pass fail analysis

Spectral Flatness

The Spectral Flatness view displays the data measured from the preamble before channel estimation is performed. The deviation of the spectral flatness from the average over all the carriers is shown in dB. A mask that conforms to the 802.16-2005 specification is displayed as green lines, the mask turns red when the measured value crosses the mask. The absolute delta of the power between adjacent sub carriers in dB is also displayed.

The EVM vs. Sub Carrier displays the EVM of individual subcarriers.

EVM vs. Sub Carrier

The EVM vs. Sub Carrier screen displays the EVM (rms) values vs. OFDMA sub carriers. The number of sub carriers will vary depending on the bandwidth of the signal.

Demodulate Mobile WiMAX Signals with Ease

The EVM vs. Symbol displays the EVM values of the OFDMA symbols.

EVM vs. Symbol

The EVM vs. Symbol screen displays the EVM (rms) values vs. OFDMA Symbols. The values displayed are a composite of all sub carriers.

DL MAP screen displays the DL MAP zone information in a decision tree format.

DL MAP

The Spectrum Master can automatically decode the DL MAP information from the Mobile WiMAX carrier, thereby simplifying the testing of the demodulated Mobile WiMAX signals. The DL MAP screen displays the decoded DL MAP zone information and all relevant data associated with each individual burst in a zone. If the instrument is set to manual demodulation the DL MAP parameters from the XML file specified is shown.

Make Over the Air Mobile WiMAX Measurements

Mobile WiMAX OTA (Over The Air) (Option 37)

Option 37 has basic drive test capability with it's channel monitor measurement that combines the channel power measurement made over time with the GPS location information (requires Option 31) of the instrument, this information can be saved to either internal or external memory for export to post processing software such as Mapinfo or MapPoint, which can display Mobile WiMAX power levels over a geographic area.

The Channel Power Monitor data can be plotted on a map.

Channel Power Monitor

The channel power monitor view captures Mobile WiMAX channel power continuously or for a specified time, the user can also select the time interval to capture measurements and can set the instrument to automatically save the data, if the optional GPS receiver is turned on the captured data will also have the longitude/latitude and time information tagged to each measurement.

RF TD-SCDMA Measurements Made Simple

TD-SCDMA Analyzer offers three different measurement modes – RF Measurements, Demodulator and Over the Air Measurements. These options help RF engineers and technicians to make accurate RF and Demodulation measurements by connecting the Spectrum Master to any Node B. A physical connection is not required for the Spectrum Master to receive and demodulate TD-SCDMA OTA signals. With the Spectrum Master, a technician no longer needs to take a Node B site off-line.

TD-SCDMA RF Measurements (Option 60)

RF measurements are used to measure the transmitted signal strength and signal shape of the selected Node B transmitter. The RF measurement option includes Channel Spectrum, Power vs. Time and RF Summary screens.
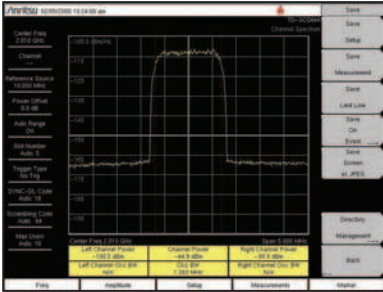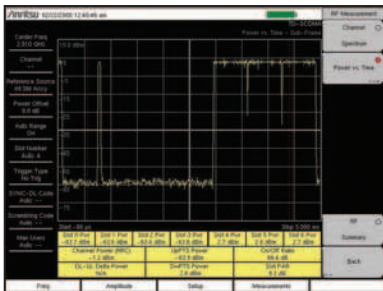

Channel Spectrum

The Channel Spectrum screen displays the signals of a selected channel as well as channel power (in dBm or watts), occupied bandwidth. In addition, the left and right channel powers and occupied bandwidths are also displayed.

Power vs. Time screen displaying a full frame of a TD-SCDMA signal.

Power vs. Time

The Power vs. Time screen displays the power over the frame of the signal. The display can also be configured to zoom in on a selected slot. In the frame view, individual slot powers are displayed along with Channel Power RRC, UpPTS Power, DwPTS Power, ON/OFF Ratio, Slot Peak to Average Ratio and Downlink – Uplink Delta Power.
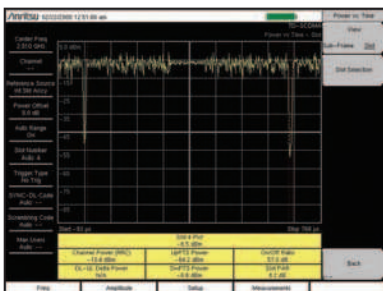
Power vs. Time screen displaying a selected slot in a Frame.

Demodulate TD-SCDMA Signals with Ease

TD-SCDMA Demodulator (Option 61)

Demodulation measurements are used to measure the modulation performance of the transmitted signal of the selected Node B transmitter. The Demodulator option includes Code Domain Power Data screen and Demod Summary screens.

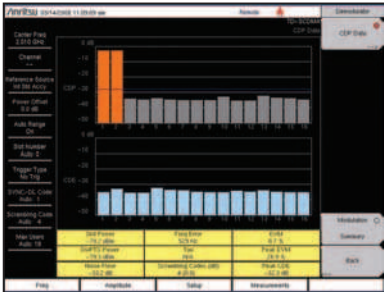Code Domain Power of the Data Codes is displayed as a bar graph along with the Code Domain Error.

Code Domain Power (CDP) Data

The CDP Data screen displays the power of the 16 codes of a demodulated TD-SCDMA Signal. The Code Domain Power and Code Domain Error of the codes are displayed as a bar graph. Other measurement results include Slot Power, Frequency Error in Hz, EVM and Peak EVM, DwPTS Power, Tau, Noise Floor, and Peak Code Domain Error.
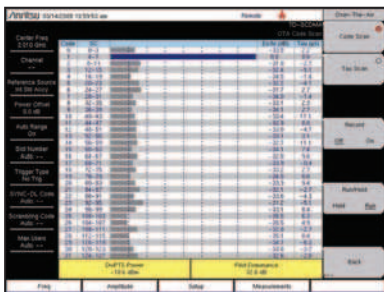
Over the Air Code Scan displays all 32 codes and its Ec/Io and Tau.

TD-SCDMA Over the Air (OTA) Measurements (Option 38)

Over the Air Measurements provide the user with an easy way to monitor all 32 SYNC-DL codes outside a base station. The Spectrum Master displays the codes in two convenient formats sorted by codes or by Tau, indicating distance from a base station. The Code scan view displays all 32 codes in a bar graph with their individual Ec/Io and Tau. The Code scan view also displays the DwPTS Power and the Pilot Dominance. The Tau scan displays the code power in the Y axis and the Tau in the X axis. In addition, a table below the graph displays six of the strongest codes sorted by power.

Over the Air Tau Scan.
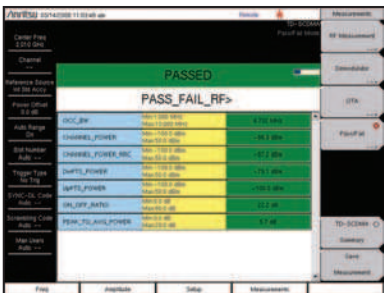
Automated Pass/Fail Testing for TD-SDMA.

Pass/Fail Mode

The Spectrum Master can perform automated Pass/Fail testing for TD-SCDMA signals. The test results are displayed in table format with clear PASS or FAIL indications that include min/max thresholds and actual measured results. Using Master Software Tools, custom tests can be easily created and uploaded into the Spectrum Master. All critical parameters can be selected for Pass/Fail testing.

Master Software Tools™
Augment the Power of Spectrum Master

To further increase the convenience, each Spectrum Master comes with Master Software Tools—comprehensive data management and analysis software that provides simple and easy methods to manage, archive, analyze, print and report system performance. For the most current version of Anritsu Master Software Tools, please visit www.us.anritsu.com.
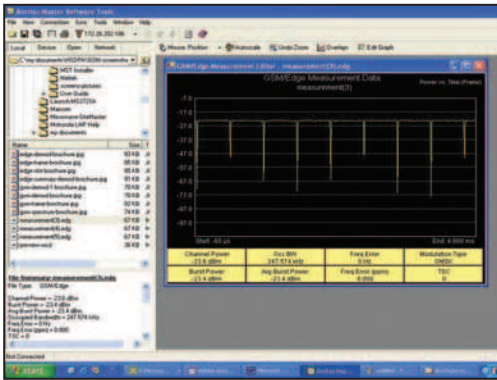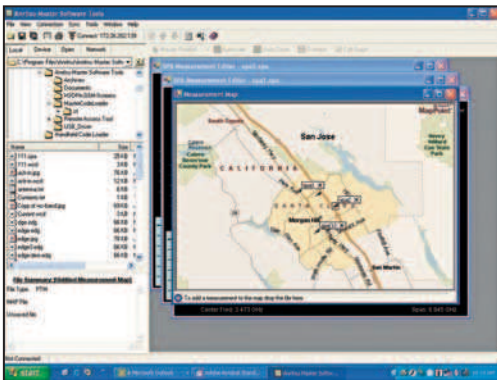

Windows-compatible Master Software Tools simplifies the process of formatting data and generating reports.

Master Software Tools integrated with MapPoint can display the geographic location of measurements with GPS data.
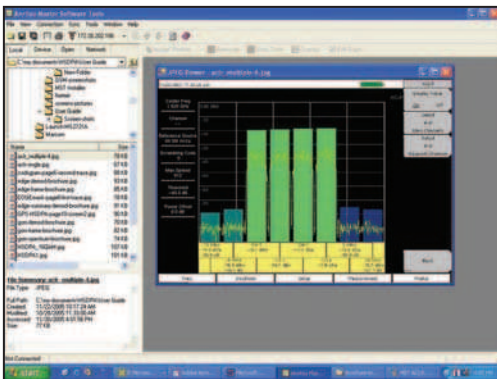
Use Master Software Tools to save details with the measurement and display for rapid analysis.

With Master Software Tools (Windows® 2000/XP/Vista compatible) the Spectrum Master can:

- Store an unlimited number of data traces to a PC easing the task of analyzing and monitoring historical performance
- Coordinate cell site locations using Microsoft MapPoint and GPS location mapping
- Automatically update the Spectrum Master with the latest firmware available from the Anritsu web site
- Create and upload new signal standards, Pass/Fail Mode custom lists and antenna factors to existing lists into the unit
- Modify existing languages or add two custom languages to the Spectrum Master
- Establish a connection to a PC using USB, Ethernet LAN, or Direct Ethernet
- Export plot data as text files for use in spreadsheets or graphic files (jpg format)
- View multiple Spectrum Analyzer measurements on the same screen using Trace Overlay
- Capture live traces from the instrument and view them on the PC
- Add or modify Limit Lines and Markers
- Handle long file names for easy, descriptive data labeling
- Create a spectrogram from a set of spectrum analyzer measurements
- Create a movie of a sequence of saved spectrum measurements
- Edit measurement labels

Easy Access to Connectors

MS2721B Connector Panel

MS2723B and MS2724B Connector Panel

Option Comparison Tables

GSM/GPRS/EDGE Measurements	GSM/GPRS/EDGE RF Measurements Option 40	GSM/GPRS/EDGE Demodulator Option 41
Channel Spectrum	✓	
Multi-Channel Spectrum	✓	
Channel Power	✓	
Burst Power	✓	
Frequency Error	✓	
Occupied Bandwidth	✓	
Training Sequence Code	✓	✓
Power Versus Time	✓	
IQ Vector Display		✓
Phase Error RMS		✓
Phase Error Peak		✓
EVM (RMS)		✓
EVM (Peak)		✓
Origin Offset		✓
C/I		✓
Modulation Type	✓	✓
Magnitude Error		✓
Pass/Fail Mode	✓	✓

W-CDMA/HSDPA Measurements	W-CDMA/HSDPA RF Measurements Option 44	W-CDMA Demodulator Option 45	W-CDMA/HSDPA Demodulator Option 65	W-CDMA/HSDPA Over The Air Option 35
Band Spectrum	✓			
Channel Spectrum	✓			
Carrier Frequency	✓	✓	✓	✓
Frequency Error	✓	✓	✓	
Channel Power	✓	✓	✓	✓
Occupied Bandwidth	✓			
Peak to Average Power	✓			
Noise Floor	✓			✓
ACLR	✓			
Spectral Emission Mask	✓			
P-CPICH Abs Power		✓	✓	
EVM		✓	✓	
Symbol EVM		✓	✓	
Carrier Feed Through		✓	✓	
Peak CD Error		✓	✓	
CPICH		✓	✓	✓
P-CCPCH Power		✓	✓	
S-CCPCH Power		✓	✓	
PICH		✓	✓	
P-SCH Power		✓	✓	
S-SCH Power		✓	✓	
W-CDMA, HSDPA Color-Coded Codes			✓	
Code Power vs Time Display			✓	
OVSF Code Constellation Display			✓	
Pass/Fail Mode	✓	✓	✓	
Six Scrambling Codes				✓
Ec/Io				✓
Ec				✓
Pilot Dominance				✓

Ordering Information

Models

MS2721B Handheld Spectrum Analyzer
9 kHz to 7.1 GHz

Options

MS2721B-009	IQ Demodulation Hardware
MS2721B-019	High Accuracy Power Meter (Power Sensor not included)
MS2721B-020	Tracking Generator
MS2721B-025	Interference Analysis
MS2721B-027	Channel Scanner
MS2721B-031	GPS (includes GPS antenna)
MS2721B-033	cdmaOne and CDMA2000 1xRTT OTA (requires Opt. 009, Opt. 031)
MS2721B-034	EVDO Over The Air (OTA) Measurements (requires Opt. 009, Opt. 031)
MS2721B-035	W-CDMA/HSDPA OTA (requires Opt. 009, Opt. 031)
MS2721B-037	Mobile WiMAX Over The Air (OTA) Measurements (requires Opt. 009)
MS2721B-038	TD-SCDMA Over the Air (OTA) Measurements (requires Opt. 009)
MS2721B-040	GSM/GPRS/EDGE RF Measurements (requires Opt. 009)
MS2721B-041	GSM/GPRS/EDGE Demodulation (requires Opt. 009)
MS2721B-042	CDMA RF Measurements (requires Opt. 009)
MS2721B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Opt. 009)
MS2721B-044	W-CDMA/HSDPA RF Measurements (requires Opt. 009)
MS2721B-045*	W-CDMA Demodulation (requires Opt. 009)
MS2721B-046	Fixed WiMAX RF Measurements (requires Opt. 009)
MS2721B-047	Fixed WiMAX Demodulation (requires Opt. 009)
MS2721B-060	TD-SCDMA RF Measurements (requires Opt. 009)
MS2721B-061	TD-SCDMA Demodulator (requires Opt. 009)
MS2721B-062	EVDO RF Measurements (requires Opt. 009)
MS2721B-063	EVDO Demodulator (requires Opt. 009)
MS2721B-064	DVB-T/H Measurements (requires Opt. 009)
MS2721B-065*	W-CDMA/HSDPA Demodulation (requires Opt. 009)
MS2721B-066	Mobile WiMAX RF Measurements (requires Opt. 009)
MS2721B-067	Mobile WiMAX Demodulator (requires Opt. 009)
MS2721B-090	Gated Sweep

MS2723B Handheld Spectrum Analyzer
9 kHz to 13 GHz

Options

MS2723B-009	IQ Demodulation Hardware
MS2723B-019	High Accuracy Power Meter (Power Sensor not included)
MS2723B-025	Interference Analysis
MS2723B-027	Channel Scanner
MS2723B-031	GPS (includes GPS antenna)
MS2723B-033	cdmaOne and CDMA2000 1xRTT OTA (requires Opt. 009, Opt. 031)
MS2723B-034	EVDO Over The Air (OTA) Measurements (requires Opt. 009, Opt. 031)
MS2723B-035	W-CDMA/HSDPA OTA (requires Opt. 009, Opt. 031)
MS2723B-037	Mobile WiMAX Over The Air (OTA) Measurements (requires Opt. 009)
MS2723B-038	TD-SCDMA Over the Air (OTA) Measurements
MS2723B-040	GSM/GPRS/EDGE RF Measurements (requires Opt. 009)
MS2723B-041	GSM/GPRS/EDGE Demodulation (requires Opt. 009)
MS2723B-042	CDMA RF Measurements (requires Opt. 009)
MS2723B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Opt. 009)
MS2723B-044	W-CDMA/HSDPA RF Measurements (requires Opt. 009)
MS2723B-045*	W-CDMA Demodulation (requires Opt. 009)
MS2723B-046	Fixed WiMAX RF Measurements (requires Opt. 009)
MS2723B-047	Fixed WiMAX Demodulation (requires Opt. 009)
MS2723B-060	TD-SCDMA RF Measurements (requires Opt. 009)
MS2723B-061	TD-SCDMA Demodulator (requires Opt. 009)
MS2723B-062	EVDO RF Measurements (requires Opt. 009)
MS2723B-063	EVDO Demodulator (requires Opt. 009)
MS2723B-065*	W-CDMA/HSDPA Demodulation (requires Opt. 009)
MS2723B-066	Mobile WiMAX RF Measurements (requires Opt. 009)
MS2723B-067	Mobile WiMAX Demodulator (requires Opt. 009)
MS2723B-089	IF Output
MS2723B-090	Gated Sweep

MS2724B Handheld Spectrum Analyzer
9 kHz to 20 GHz

Options

MS2724B-009	IQ Demodulation Hardware
MS2724B-019	High Accuracy Power Meter (Power Sensor not included)
MS2724B-025	Interference Analysis
MS2724B-027	Channel Scanner
MS2724B-031	GPS (includes GPS antenna)
MS2724B-033	cdmaOne and CDMA2000 1xRTT OTA (requires Opt. 009, Opt. 031)
MS2724B-034	EVDO Over The Air (OTA) Measurements (requires Opt. 009, Opt. 031)
MS2724B-035	W-CDMA/HSDPA OTA (requires Opt. 009, Opt. 031)
MS2724B-037	Mobile WiMAX Over The Air (OTA) Measurements (requires Opt. 009)
MS2724B-038	TD-SCDMA Over the Air (OTA) Measurements
MS2724B-040	GSM/GPRS/EDGE RF Measurements (requires Opt. 009)
MS2724B-041	GSM/GPRS/EDGE Demodulation (requires Opt. 009)
MS2724B-042	CDMA RF Measurements (requires Opt. 009)
MS2724B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Opt. 009)
MS2724B-044	W-CDMA/HSDPA RF Measurements (requires Opt. 009)
MS2724B-045*	W-CDMA Demodulation (requires Opt. 009)
MS2724B-046	Fixed WiMAX RF Measurements (requires Opt. 009)
MS2724B-047	Fixed WiMAX Demodulation (requires Opt. 009)
MS2724B-060	TD-SCDMA RF Measurements (requires Opt. 009)
MS2724B-061	TD-SCDMA Demodulator (requires Opt. 009)
MS2724B-062	EVDO RF Measurements (requires Opt. 009)
MS2724B-063	EVDO Demodulator (requires Opt. 009)
MS2724B-065*	W-CDMA/HSDPA Demodulation (requires Opt. 009)
MS2724B-066	Mobile WiMAX RF Measurements (requires Opt. 009)
MS2724B-067	Mobile WiMAX Demodulator (requires Opt. 009)
MS2724B-089	IF Output
MS2724B-090	Gated Sweep

* All the capability of Option 45 is included in Option 65. They cannot be ordered together.

Standard Accessories Include:

10580-00175	MS2721B/MS2723B/MS2724B User's Guide
65729	Soft Carrying Case
40-168-R	AC – DC Adapter
806-141	Automotive Cigarette Lighter/12 Volt DC Adapter
2300-498	CD ROM containing Master Software Tools
2000-1371	Ethernet Cable
3-806-152	Cross-over Ethernet Cable
633-44	Rechargeable battery, Li-Ion
1091-27	Type-N male to SMA female adapter
1091-172	Type-N male to BNC female adapter
64343	Tilt Bail Stand Accessory
2000-1520-R	2 GB USB Flash Drive
3-2000-1498	USB Type A to Mini-B Cable (10 ft)
	One Year Warranty

Optional Accessories:

PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24106A	USB Power Sensor, 50 MHz to 6 GHz
3-2000-1567	256 MB Compact Flash Memory Module
2000-1501-R	256 MB USB Flash Drive
2000-1520-R	2 GB USB Flash Drive
42N50A-30	30 dB, 50 watt, Bi-directional, DC to 18 GHz, N(m) to N(f) Attenuator
34NN50A	Precision Adapter, DC to 18 GHz, 50 Ω, N(m) to N(m)
34NFNF50C	Precision Adapter, DC to 18 GHz, 50 Ω, N(f) to N(f)
15NN50-1.5C	Test port cable armored, 1.5 meter, N(m) to N(m), 6 GHz
15NN50-3.0C	Test port cable armored, 3.0 meter, N(m) to N(m), 6 GHz
15NN50-5.0C	Test port cable armored, 5.0 meter, N(m) to N(m), 6 GHz
15NNF50-1.5B	Test port cable armored, 1.5 meter N(m) to N(f), 18 GHz
15NNF50-1.5C	Test port cable armored, 1.5 meter, N(m) to N(f), 6 GHz
15NNF50-3.0C	Test port cable armored, 3.0 meter, N(m) to N(f), 6 GHz
15NNF50-5.0C	Test port cable armored, 5.0 meter, N(m) to N(f), 6 GHz
15ND50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(m), 6.0 GHz
15NDF50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(f), 6.0 GHz

510-90	Adapter, 7/16 DIN (f) to N(m), DC to 7.5 GHz, 50 Ω
510-91	Adapter, 7/16 DIN (f) to N(f), DC to 7.5 GHz, 50 Ω
510-92	Adapter, 7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω
510-93	Adapter, 7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω
510-96	Adapter 7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50 Ω
510-97	Adapter 7/16 DIN(f) to 7/16 DIN(f), DC to 7.5 GHz, 50 Ω
1030-105-R	Band Pass Filters, 890-915 MHz, N(m) to N(f), 50 Ω
1030-106-R	Band Pass Filters, 1710-1790 MHz, N(m) to N(f), 50 Ω
1030-107-R	Band Pass Filters, 1910-1990 MHz, N(m) to N(f), 50 Ω
1030-109-R	Band Pass Filters, 824-849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	Band Pass Filters, 880-915 MHz, N(m) to SMA(f), 50 Ω
1030-111-R	Band Pass Filters, 1850-1910 MHz, N(m) to SMA(f), 50 Ω
1030-112-R	Band Pass Filters, 2400-2484 MHz, N(m) to SMA(f), 50 Ω
1030-114-R	Band Pass Filters, 806-869 MHz, N(m) to SMA(f), 50 Ω
65729	Spare soft carrying case
64343	Spare Tilt Bail Stand Accessory
40-168-R	Spare AC/DC adapter
806-141	Spare automotive cigarette lighter/12 Volt DC adapter
760-243-R	Transit case with wheels and retractable handle for Anritsu Handheld Master products

/Inritsu

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