Product Brochure

Anritsu

Spectrum Master™

MS2721B MS2723B MS2724B

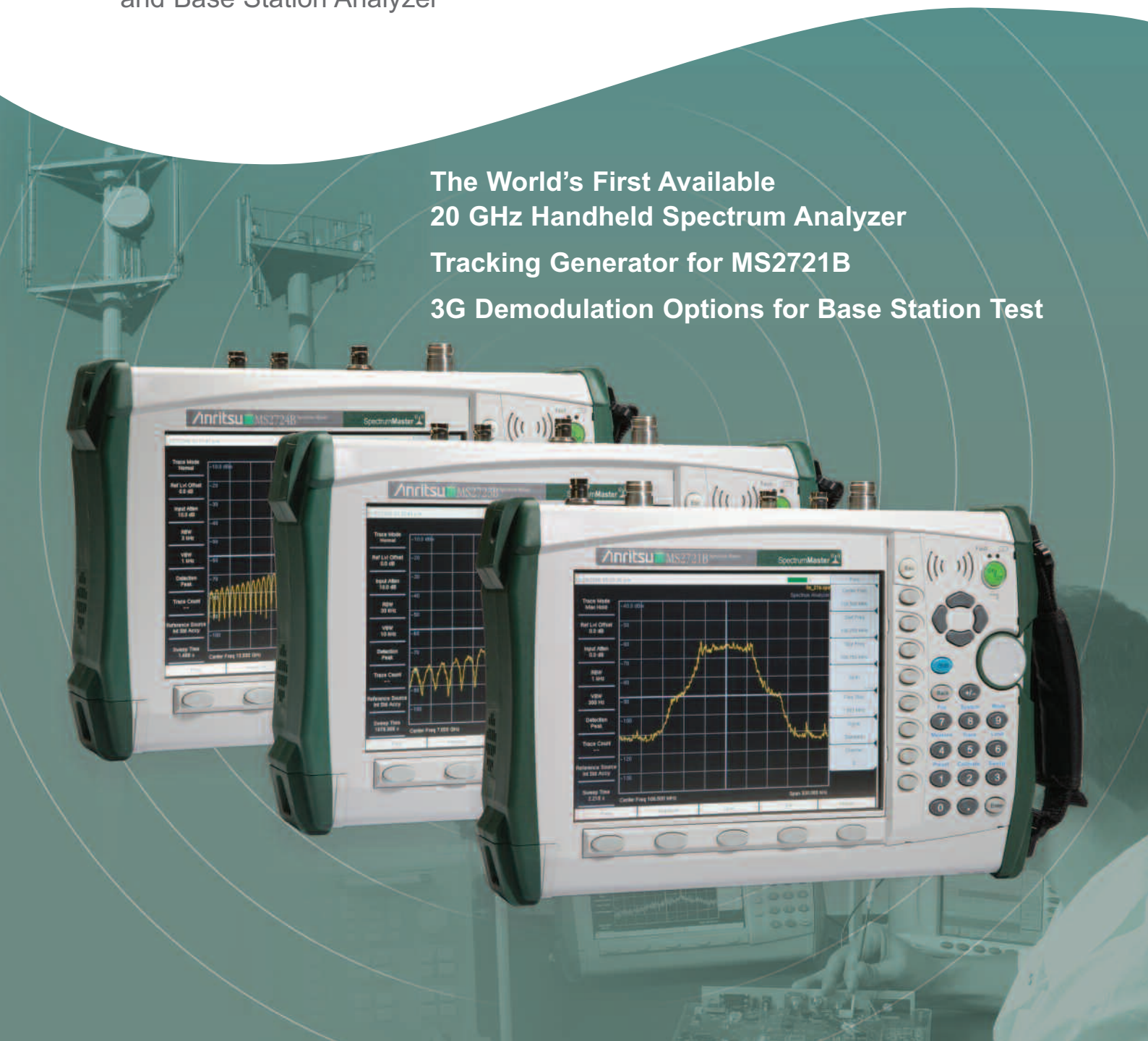
9 kHz to 7.1 GHz 9 kHz to 13 GHz 9 kHz to 20 GHz

A High Performance Handheld Spectrum Analyzer
and Base Station Analyzer

The World's First Available
20 GHz Handheld Spectrum Analyzer

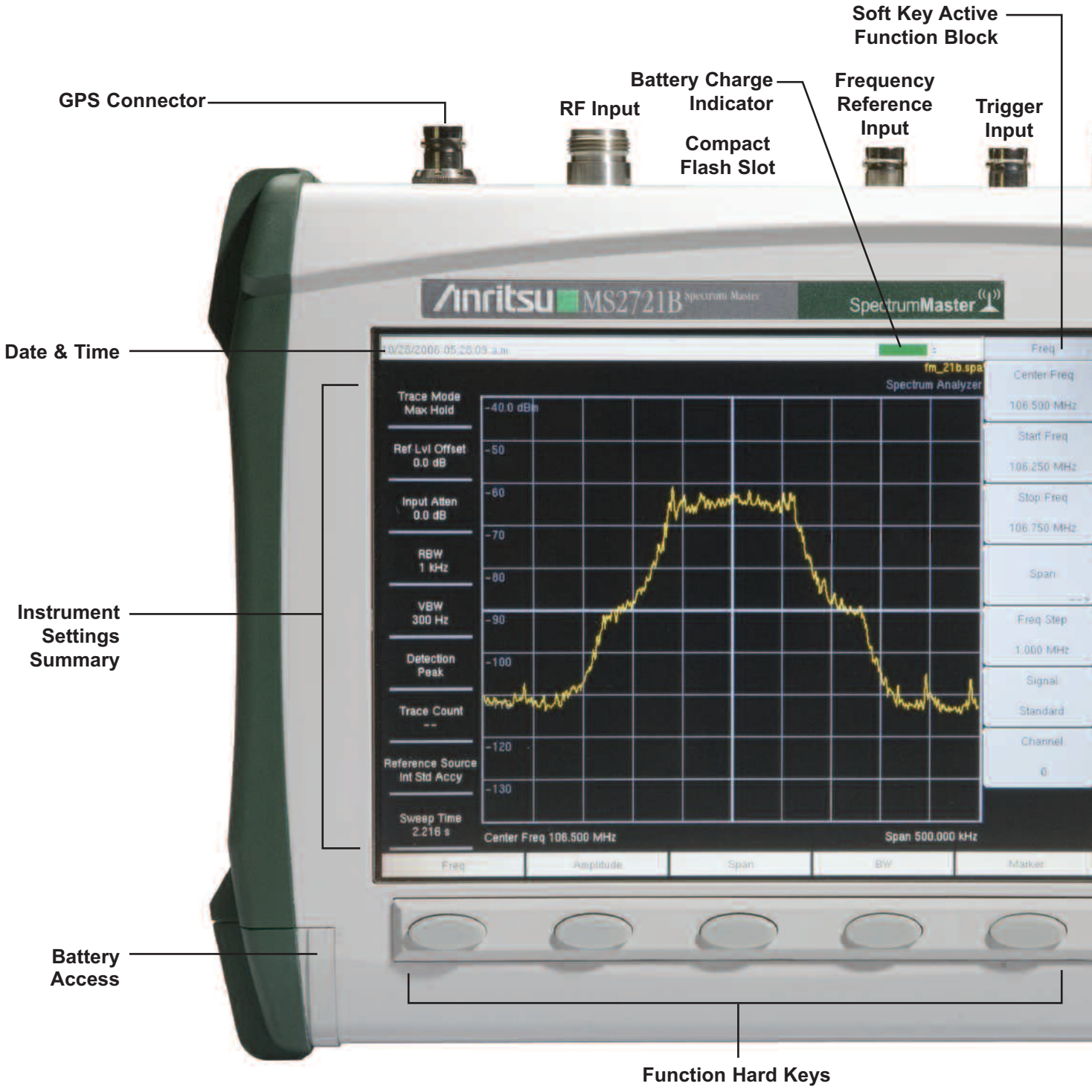
Tracking Generator for MS2721B

3G Demodulation Options for Base Station Test



The World's First 20 GHz Handheld Spectrum Analyzer

The Anritsu MS2721B, MS2723B and MS2724B are the most advanced ultra-portable spectrum analyzers on the market, featuring unparalleled performance and size at a modest price.

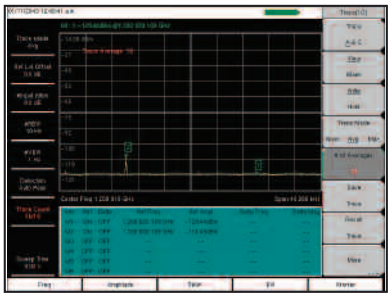


≤–153 dBm Displayed Average Noise Level Typical @ 1 GHz

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.

Field Use

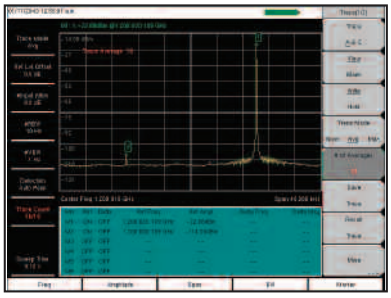


Measuring a Small Signal

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.



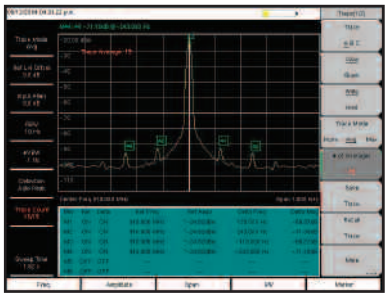
Wide Dynamic Range — Measuring a small signal in the presence of a very large signal

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 synthesized 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.

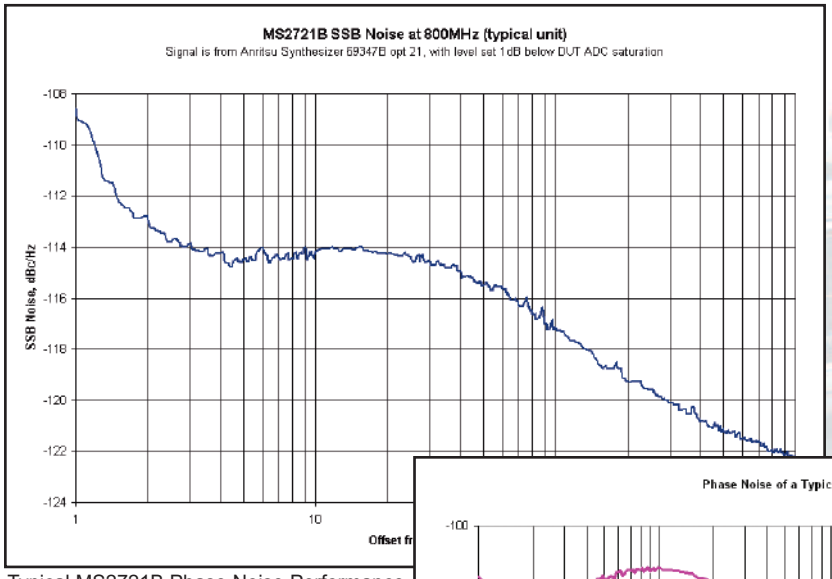
For maximum flexibility, sweep triggering can be set to free run, or to do a single sweep. In zero span, the sweep can be set to trigger when a signal meets or exceeds a certain power level or it can be externally triggered.

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

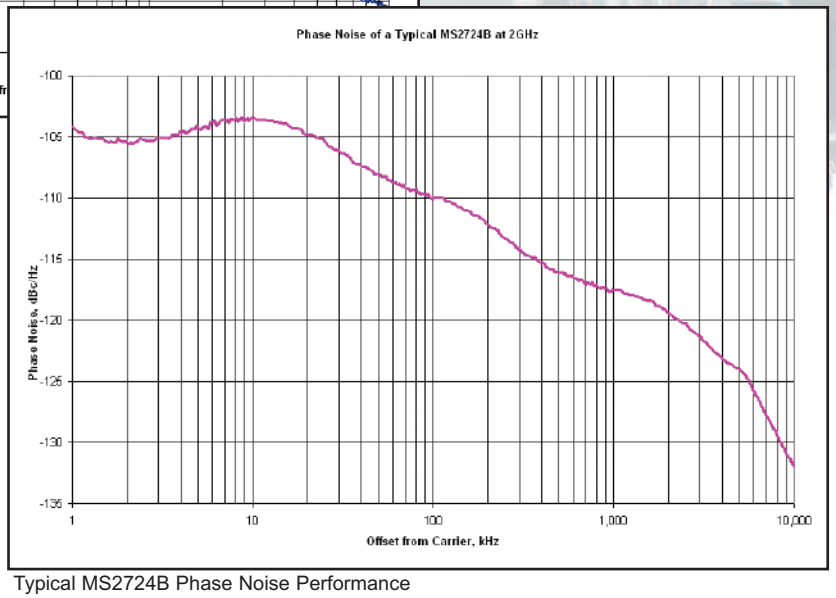
Using battery-powered equipment to measure powerline related sidebands on a signal source removes any question as to the source of the sidebands.

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.

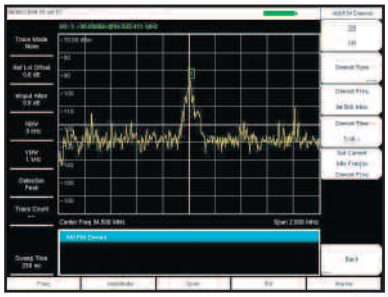


Typical MS2721B Phase Noise Performance



Typical MS2724B Phase Noise Performance

Features



AM, FM and SSB Demodulation

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

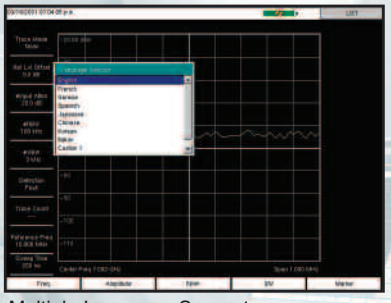
A built-in demodulator for AM, narrowband FM, wideband FM and single sideband (selectable USB and LSB) allows a technician to easily identify interfering signals. The demodulated audio can be heard either through the built-in speaker or through a standard cellphone headset. A demodulation marker is provided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



Multiple Language Support

Fast Sweep Speed

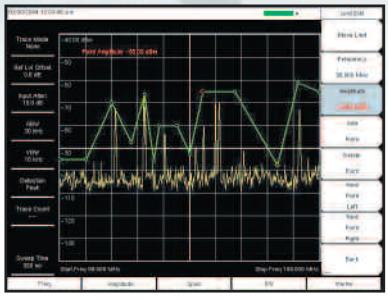
The Spectrum Master automatically sets the fastest sweep consistent with accurate measurements, and sweep speed in zero span can be set from 10 microseconds up to 600 seconds. This is faster and more flexible than any portable spectrum analyzer on the market today, simplifying the capture of intermittent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



Segmented Limit Lines

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/meter^2 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

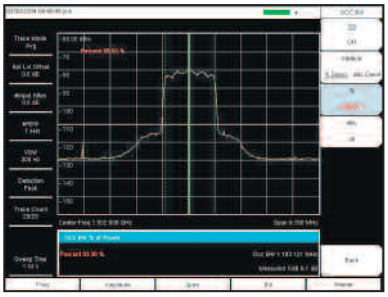
The Spectrum Master family has dedicated routines for one-button measurements of field strength, channel power, occupied bandwidth, Adjacent Channel Power Ratio (ACPR) and C/I. These are increasingly critical measurements for today's wireless communication systems. The simple interface for these complex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

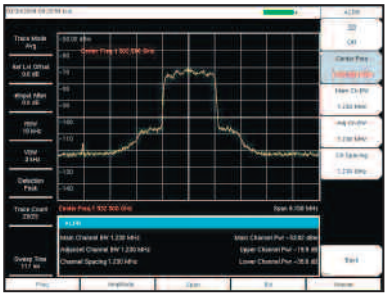
As more 802.11 access points are installed, there is an increasing level of interference in the 2.4 GHz and 5.8 GHz bands occupied by this service and other devices such as cordless telephones. This measurement capability makes it simple for an access point installer to determine if the level of interference 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.



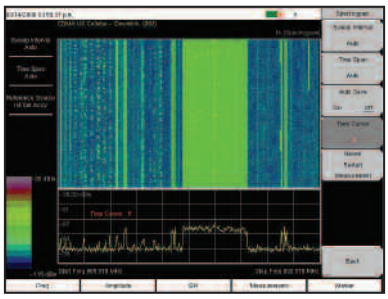
Adjacent Channel Power Ratio

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



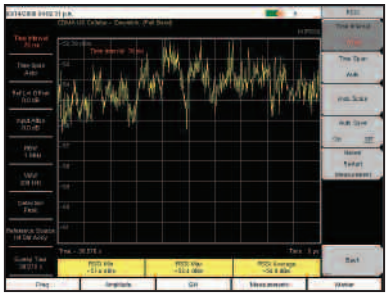
With Option 25, spectrogram measurements identify intermittent interference.

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

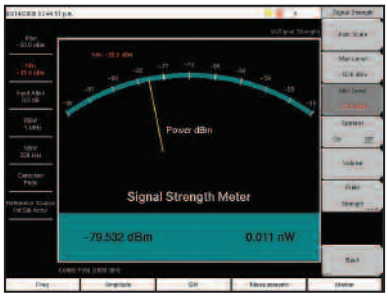
The Spectrogram display is a three dimensional display of frequency, power, and time of the spectrum. It is applicable for identifying intermittent interference and tracking signal levels over time. The Spectrum Master can save data for up to 72 hours.



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.



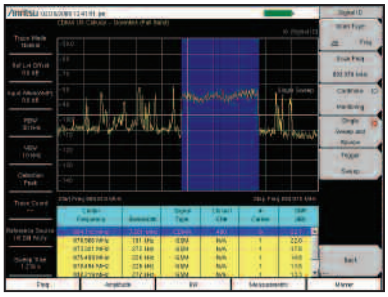
The Signal Strength Meter can be used to locate an interfering signal.

Signal Strength Meter

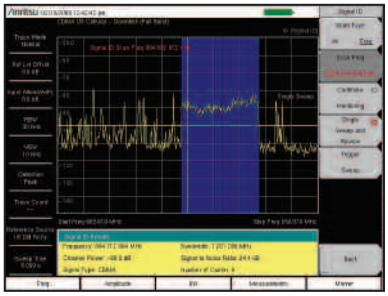
The Signal Strength meter locates an interfering signal by measuring the strength of the interfering signal. Power is displayed in Watts, dBm and in the graphical analog meter display. The strength of the signal is also indicated by an audible beep.

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.

Signal ID

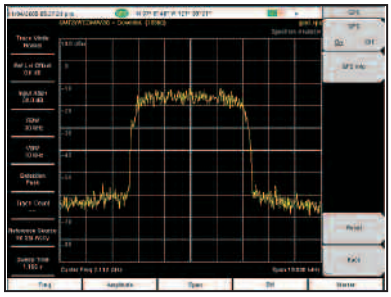
The Signal ID feature in the interference Analyzer can help to quickly identify the type of the interfering signal. This measurement can be configured to identify all signals in the selected band or just monitor one single interfering frequency. The results displayed include the Center Frequency, Bandwidth 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.

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

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.

Enhance Frequency Accuracy with Built-in GPS

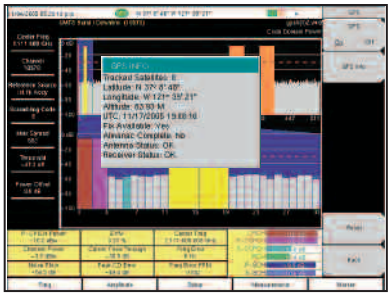


With GPS Option 31, the location information (longitude, latitude) is shown at the top of the screen.

GPS (Option 31)

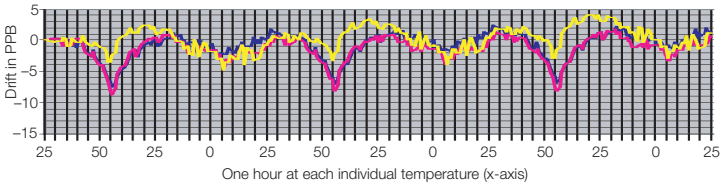
GPS information allows confirmation of the correct measurement location. The GPS option provides exact location information (longitude, latitude) which is saved with each measurement in addition to date and time. Included with the GPS option is a magnet mount antenna with a 5m (15 feet) cable allowing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

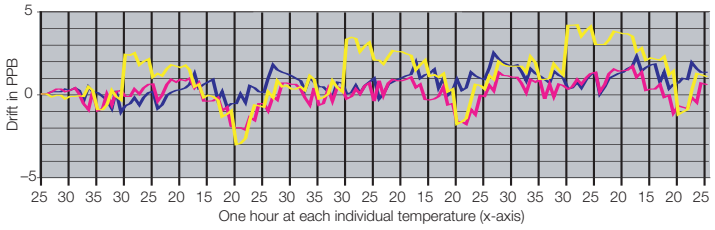


With GPS Option 31, enhance the frequency reference oscillator accuracy to make accurate frequency error measurements.

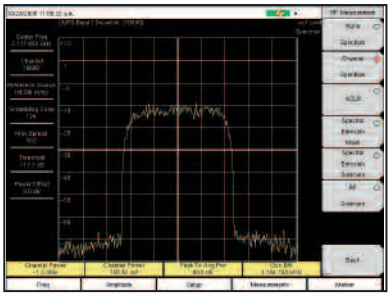
Typical frequency accuracy of the Spectrum Master for 72 hours following the GPS antenna disconnect over full specified temperature range.



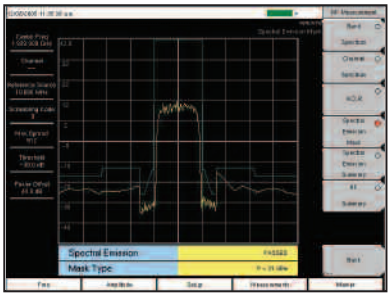
Typical frequency accuracy of the Spectrum Master for 24 hours following the GPS antenna disconnect over temperature range 15° C to 35° C.



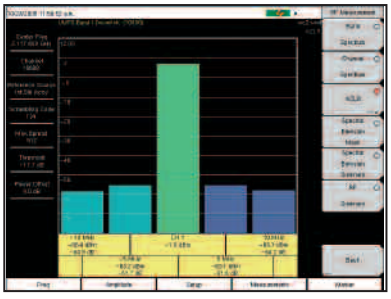
MS2724B Spectrum Master



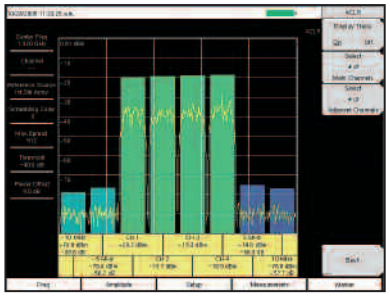
The RF Spectrum screen shows selected signals along with key parameters, such as channel power and occupied bandwidth.



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.

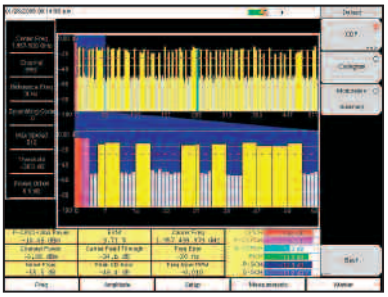
ACLR

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



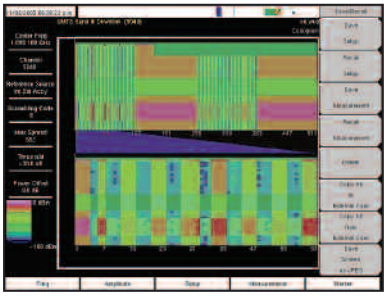
The Code Domain Power (CDP) screen shows 256 or 512 OVSF codes with flexible zoom capabilities.

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.

Code Domain Power

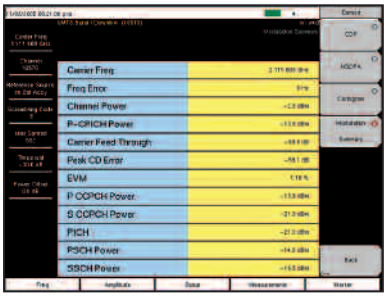
The Code Domain Power (CDP) screen displays 256 or 512 OVSF codes with zoom capability, common pilot power (P-CPICH), channel power, error vector magnitude (EVM), carrier frequency, carrier feed through, frequency error (in Hz and ppm), Peak CD error, and noise floor. Option 45 can zoom to 32, 64, or 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.



The Codogram screen shows how code levels are changing over time to simplify fault analysis.

Codogram

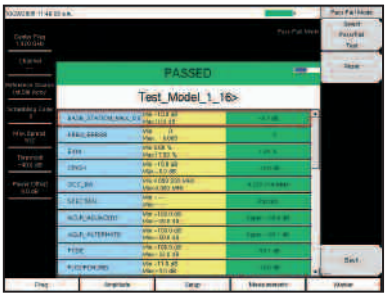
The Codogram screen displays how code levels are changing over time, making it easier to monitor traffic, faults and hand-off activity. Showing 256 or 512 OVSF codes with zoom codes, the Spectrum Master can zoom to 32, 64 or 128 codes, or the user can directly zoom to particular OVSF codes of interest.



The Modulation Summary screen shows critical transmitter performance parameters in table format.

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.



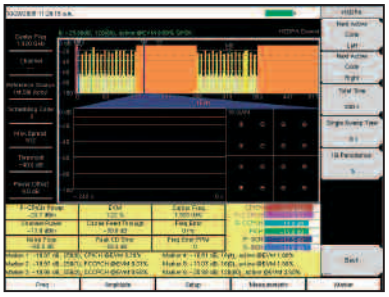
The Spectrum Master offers a clear Pass/Fail display for quick evaluation of a Node B base station.

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.

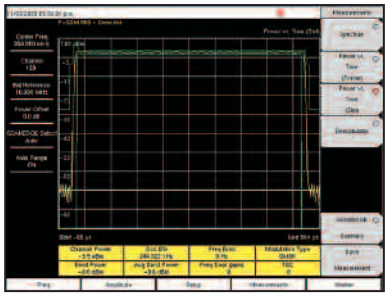
W-CDMA/HSDPA Demodulator (Option 65)

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.

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.

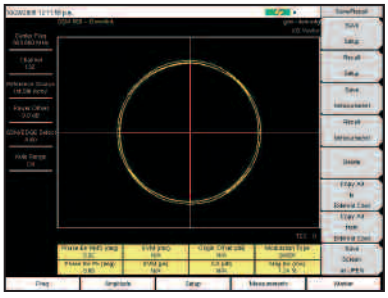
Demodulate GSM, GPRS and EDGE Signals



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)

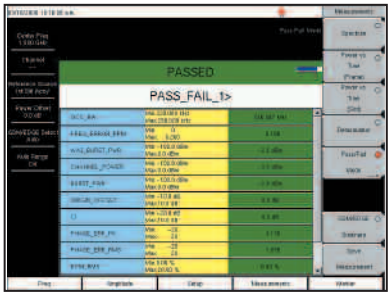
GSM/GPRS/EDGE RF measurements provide views of single-channel spectrum, multichannel spectrum, power versus time (frame), power versus time (slot) with mask per 3GPP TS 05.05 specification and summary screens.

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.

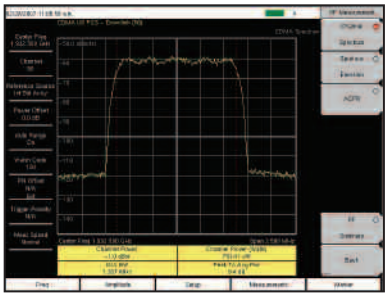
Pass/Fail Mode

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.



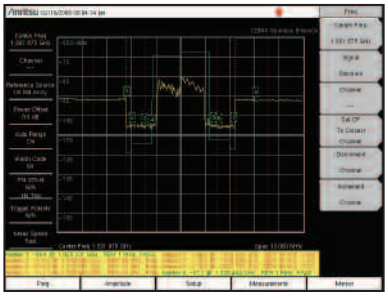
CDMA Channel Spectrum measurement display

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.

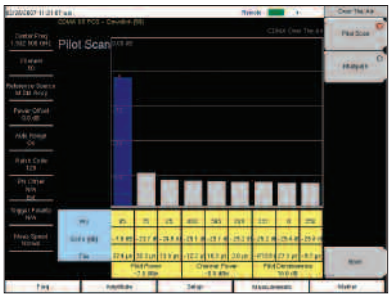
CDP Table

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.

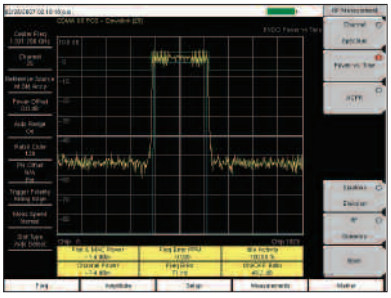
Optimize EVDO Network Performance

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.

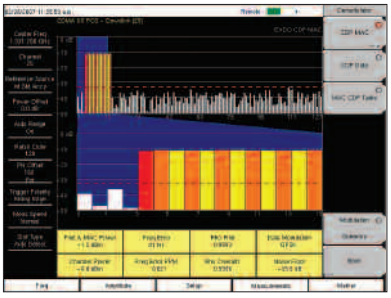
Spurious Emission

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.

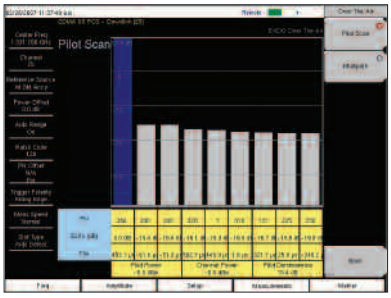
MAC CDP Table

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.



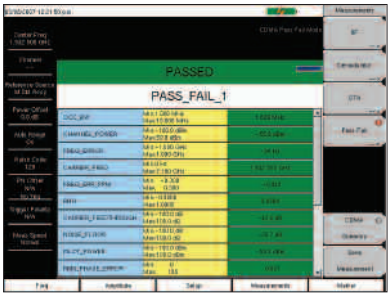
EVDO Over the Air measurement display

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.



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.

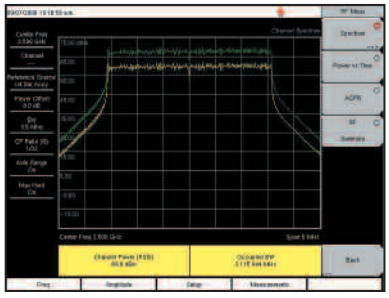
Fixed WiMAX Measurements Made Simple

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 businesses 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)

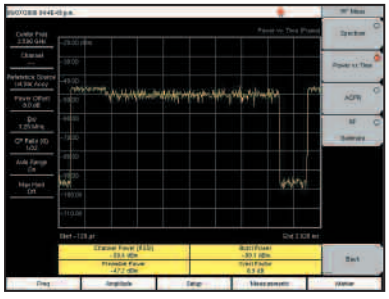
RF measurements are used to measure the transmitted signal strength and signal shape of the selected BTS transmitter. For the technician's convenience, the RF measurement option can display Channel Spectrum, Power vs. Time, ACPR and RF Summary screens.



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

Spectrum

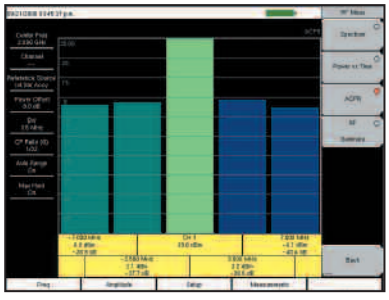
In the Spectrum screen, technicians can view and examine the selected signal's channel power (in dBm) and occupied bandwidth.



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.

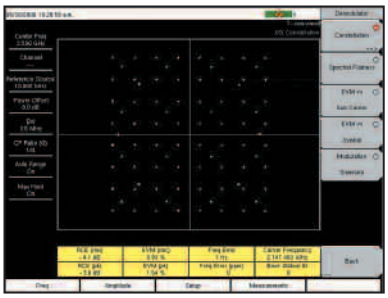
ACPR

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)

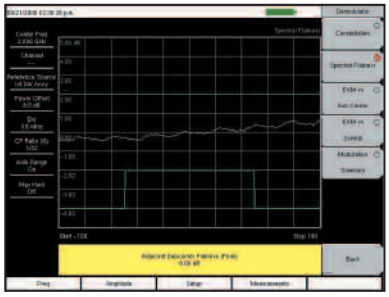
With Option 47, the Spectrum Master can demodulate Fixed WiMAX OFDM signals and displays detailed measurements for evaluating transmitter modulation performance using Constellation, Spectral Flatness, EVM vs. Sub carrier, and EVM vs. Symbol.



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.

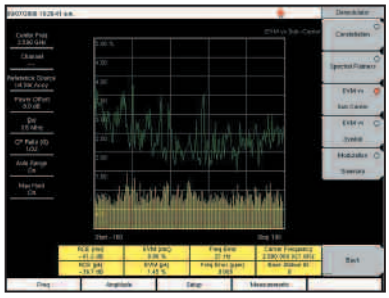


Spectral Flatness is displayed with the mask as specified in 802.16-2004.

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.

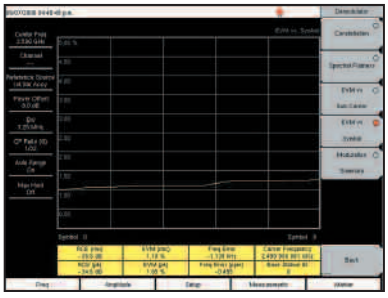
Demodulate Fixed WiMAX Signals with Ease



EVM vs. Sub Carrier displays pilot and data subcarrier.

EVM vs. Sub Carrier

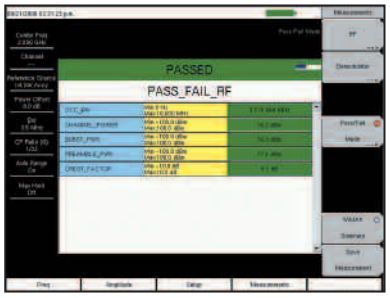
The EVM vs. Sub Carrier screen displays the EVM (rms) values vs. OFDM sub carriers. The pilot and data sub carriers are displayed and color-coded.



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.

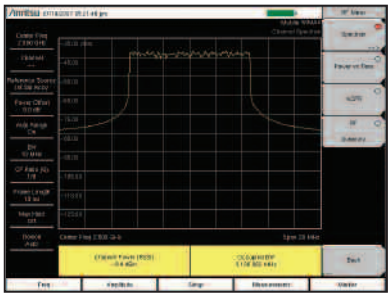
Pass/Fail Mode

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.



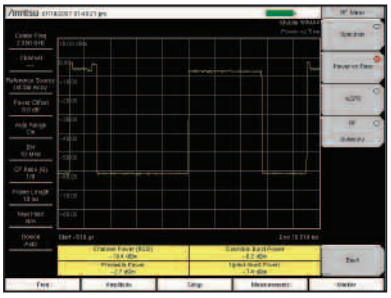
The RF Spectrum screen shows the signal spectrum along with key parameters, such as channel power and occupied bandwidth.

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

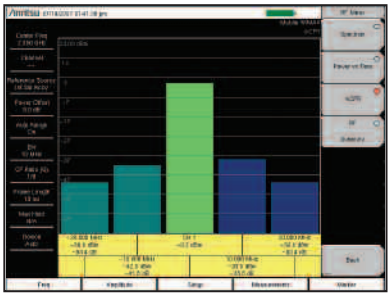
In the Spectrum screen, technicians can view and examine the selected signal's channel power (in dBm) and occupied bandwidth.



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

Power vs. Time

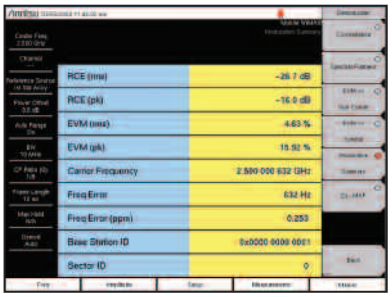
The Power vs. Time screen shows the time domain view of a Mobile WiMAX OFDMA signal in either 5 ms or 10 ms frames. The different power vs. time components of a Mobile WiMAX signal are measured and displayed as channel power, preamble power, downlink burst power and uplink burst power in dBm.



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.

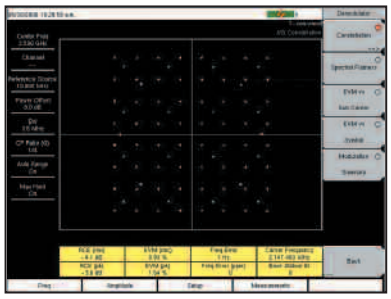
WiMAX Summary

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)

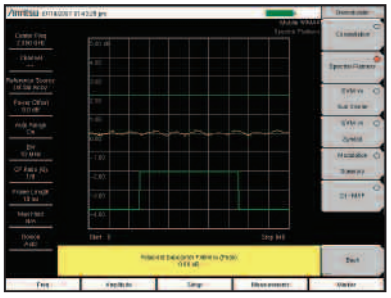
Option 67 can demodulate Mobile WiMAX OFDMA signals and displays detailed measurements for evaluating transmitter modulation performance using Constellation, Spectral Flatness, EVM vs. Sub carrier, and EVM vs. Symbol and it can automatically decode the DL MAP. For faster go no-go testing, a technician 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

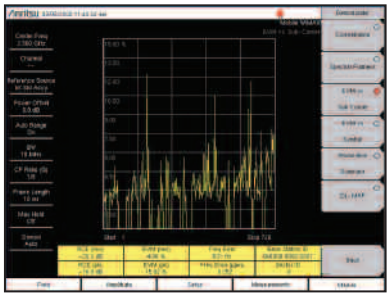
The Constellation view shows the constellation of the demodulated data symbols over one frame. The data bursts can have QPSK, 16 QAM or 64 QAM modulations. Each modulation format is color coded for easy identification. The screen also displays RCE (rms) in dB, RCE (pk) in dB, EVM (rms) in %, EVM (pk) 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.

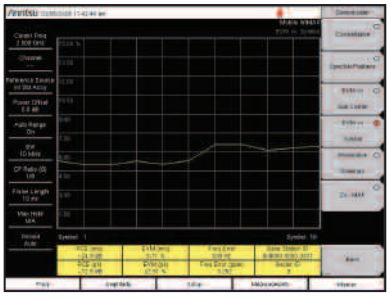


The EVM vs. Sub Carrier displays the EVM of individual subcarriers.

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.

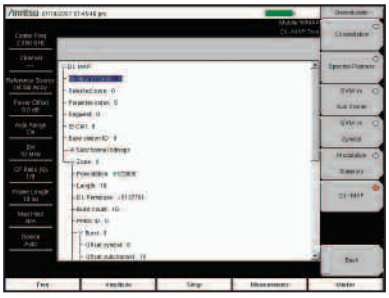
Demodulate Mobile WiMAX Signals with Ease



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.

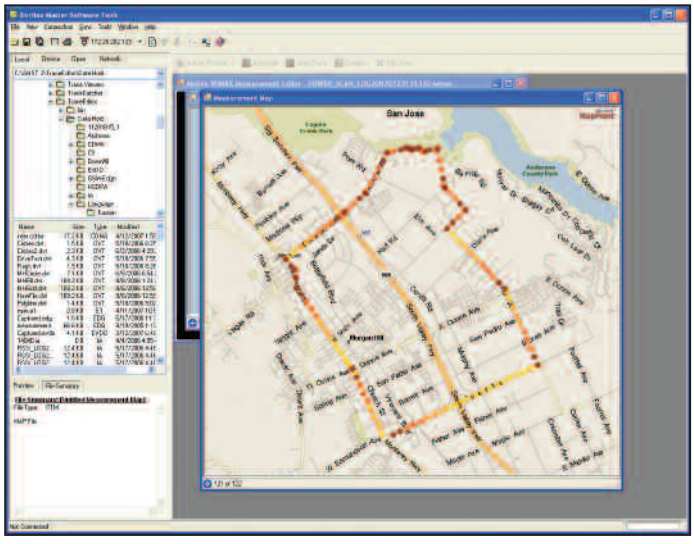
DL MAP

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

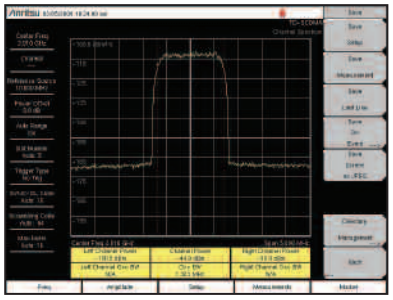
The channel power monitor view captures Mobile WiMAX channel power continuously or for a specified time, the user can also select the time interval to capture measurements and can set the instrument to automatically save the data, if the optional GPS receiver is turned on the captured data will also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

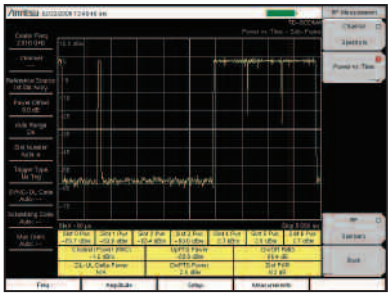
TD-SCDMA RF Measurements (Option 60)

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

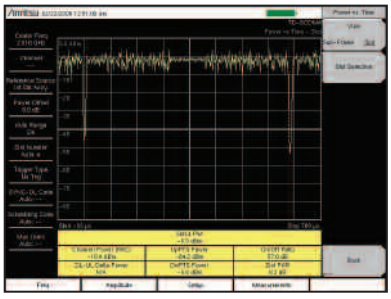
The Channel Spectrum screen displays the signals of a selected channel as well as channel power (in dBm or watts), occupied bandwidth. In addition, the left and right channel powers and occupied bandwidths are also displayed.



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

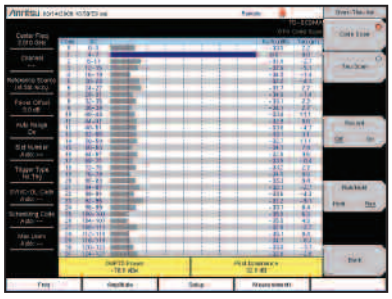
TD-SCDMA Demodulator (Option 61)

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.

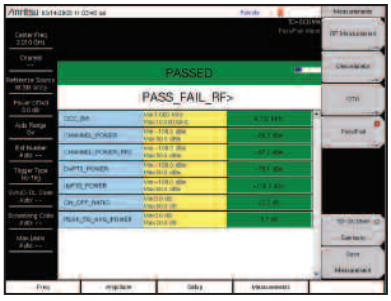


Over the Air Code Scan displays all 32 codes and its Ec/Io and Tau.

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.



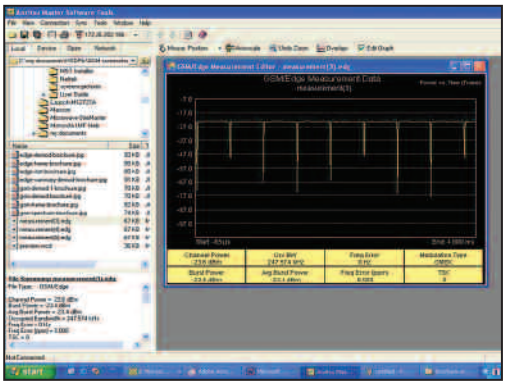
Automated Pass/Fail Testing for TD-SDMA.

Pass/Fail Mode

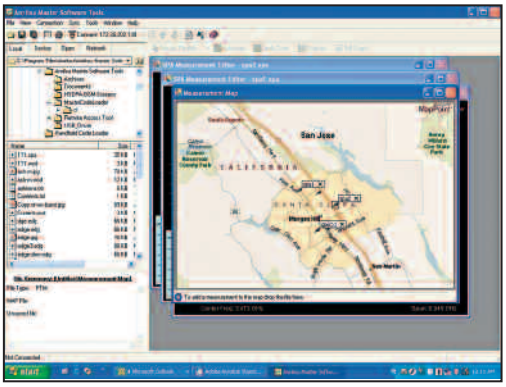
The Spectrum Master can perform automated Pass/Fail testing for TD-SCDMA signals. The test results are displayed in table format with clear PASS or FAIL indications that include min/max thresholds and actual measured results. Using Master Software Tools, custom tests can be easily created and uploaded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

Master Software Tools™
Augment the Power of Spectrum Master

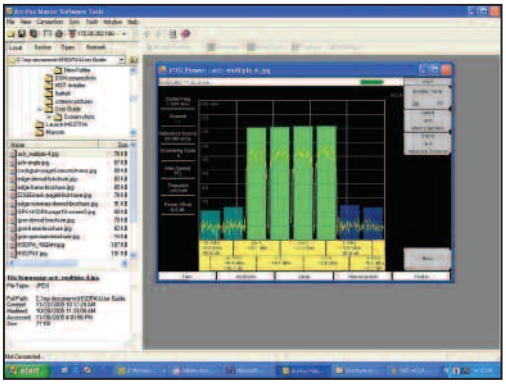
To further increase the convenience, each Spectrum Master comes with Master Software Tools—comprehensive data management and analysis software that provides simple and easy methods to manage, archive, analyze, print and report system performance. For the most current version of Anritsu Master Software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

Product Brochure

Anritsu

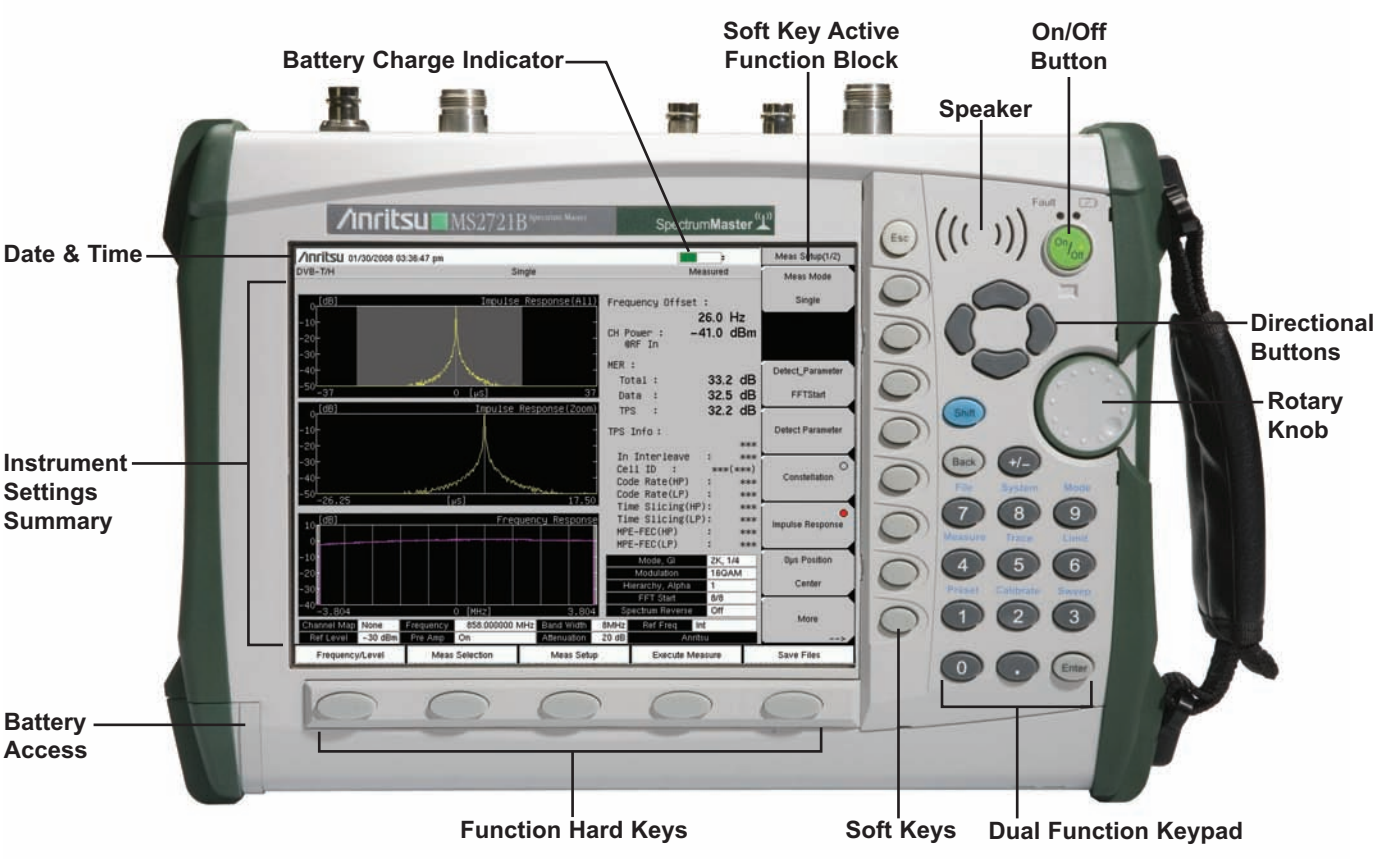
DVB-T/H Options

MS2721B Spectrum Master and MT8222A BTS Master

Option 064 DVB-T/H – Measurements 30 MHz to 990 MHz
Option 078 DVB-T/H – SFN Field Measurements
Option 057 DVB-T/H – BER Unit

The DVB-T/H Options for the MS2721B and MT8222A

The DVB-T/H options for the MS2721B and MT8222A feature high-performance in a compact, battery-operated unit. These options are very useful for area surveys and field maintenance of digital broadcasting equipment.



High-Performance Handheld Spectrum Analyzer

This high-performance spectrum analyzer covers the frequency band from 9 kHz to 7.1 GHz.

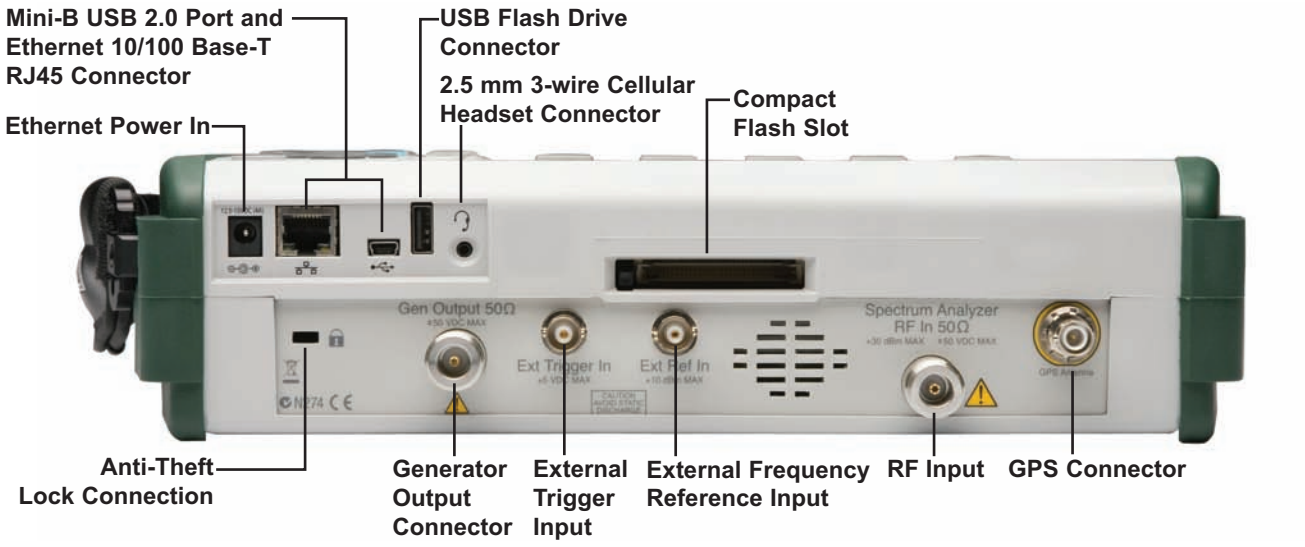
Option 64 – DVB-T/H Analysis Option

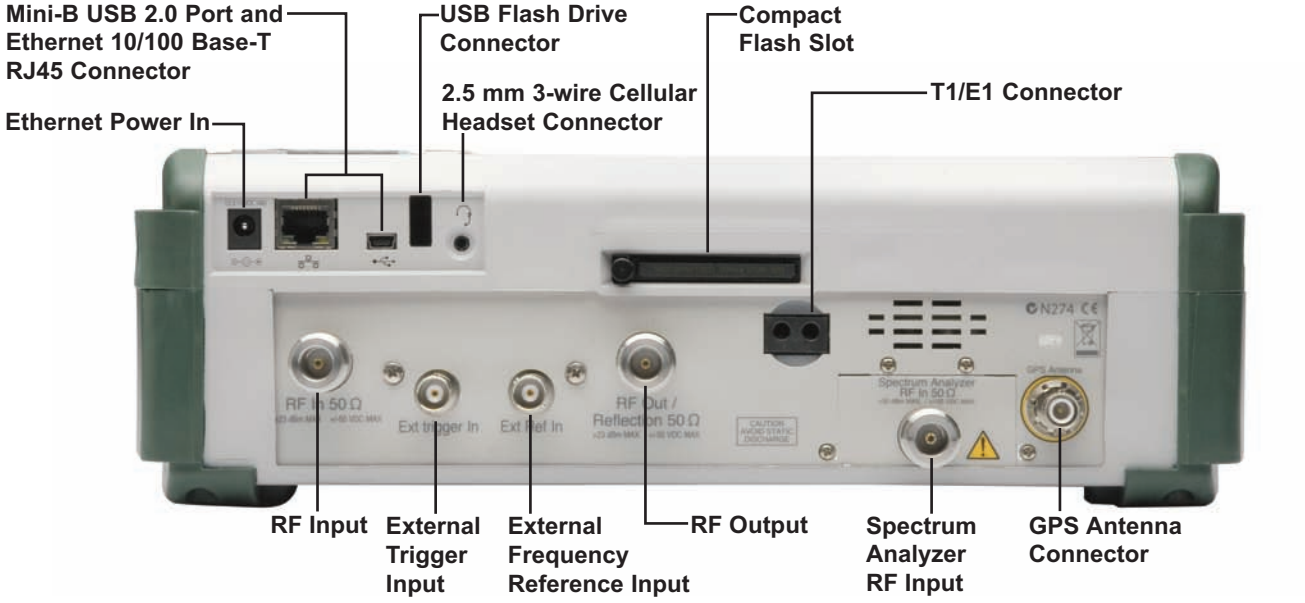
DVB-T/H Terrestrial Digital Broadcasting Measurements

DVB-T/H field strength, modulation analysis MER, constellation, frequency offset, impulse response, and frequency response measurements are supported, making this analyzer the ideal solution for area surveys and maintenance of DVB-T/H equipment.

Usability

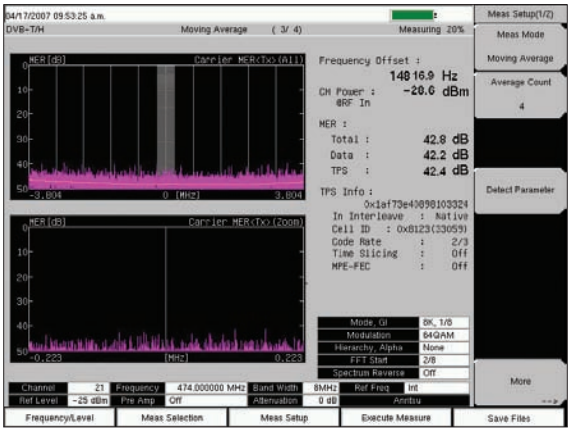
The design of the DVB-T/H analysis option minimizes the number of steps required to measure DVB-T/H signals, so that even novices can analyze signals easily and quickly.





High-Performance Handheld Spectrum Analyzer Functions

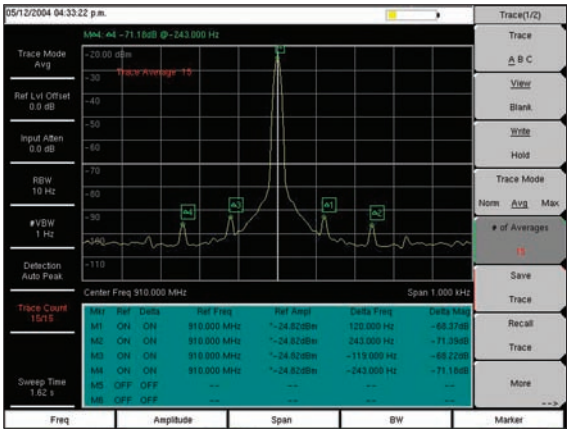
Option 64 DVB-T/H Analysis firmware covers 30 MHz to 990 MHz.



Measuring small signal in presence of very large signal

Field Measurements

The MS2721B and MT8222A shorten field measurement time while covering a wide dynamic range. User can save measurement results to internal memory, Compact Flash or USB Flash drive.



Power-line related sidebands on synthesized signal generator

R&D Measurements

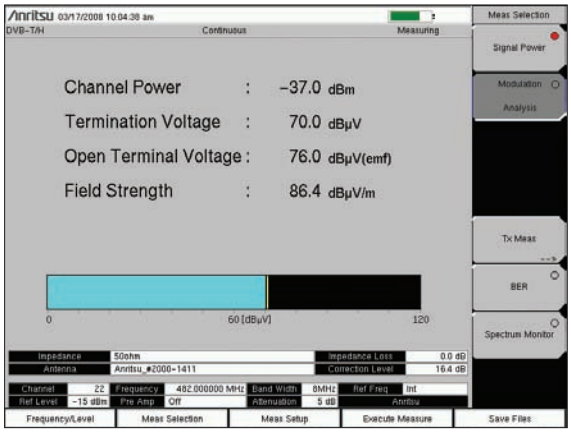
This analyzer has a full range of versatile functions, including RBW, VBW, and span. It can be used as a high-performance spectrum analyzer for R&D, manufacturing and field measurements. For example, the power-line sideband noise of a signal source can be measured.

Other Features

- Automatically sweep as fast as possible, consistent with accurate measurements: 10 µs to 600 seconds.
- Maximum safe input level +43 dBm (20 W) (Maximum measurable signal +30 dBm, Zero Span)
- Limit Lines
- Remote operation using Ethernet with Master Software Tools

Option 64 DVB-T/H Measurement Functions

Option 64 analyzes terrestrial digital broadcast (DVB-T) and mobile terminal (DVB-H) signals. This is very useful for area surveys, and installation and maintenance of terrestrial digital broadcasting equipment.



Signal Power Measurement

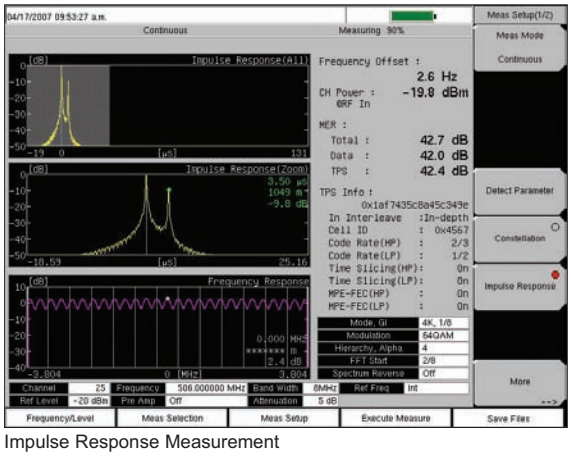
Option Measurements

- Terminal voltage, channel power, and field strength Impulse response
- MER, constellation, and frequency offset
- Detection of Mode, GI, and TPS parameters

Signal Power Measurement

This function measures terminal voltage, channel power, and field strength (dBµV/m) accurately.

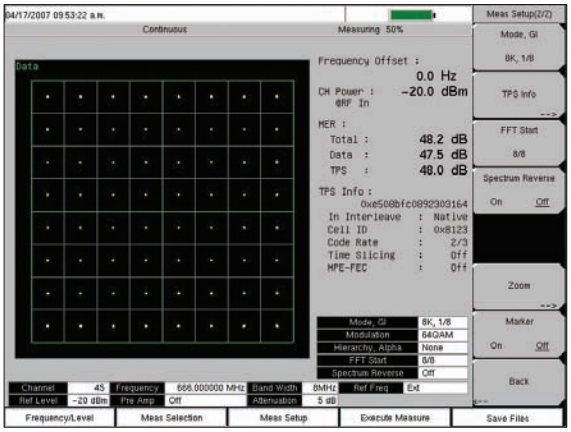
The results are displayed as numeric values and bar graphs. It is useful for adjusting antenna angles and when doing area surveys.



Impulse Response Measurement

Impulse Response Measurement

This function measures the difference in time and frequency of multi-path signals. By measuring the channel frequency response, the multi-path effect or frequency selective fading can be observed, which is useful for adjusting the timing of SFN repeaters.



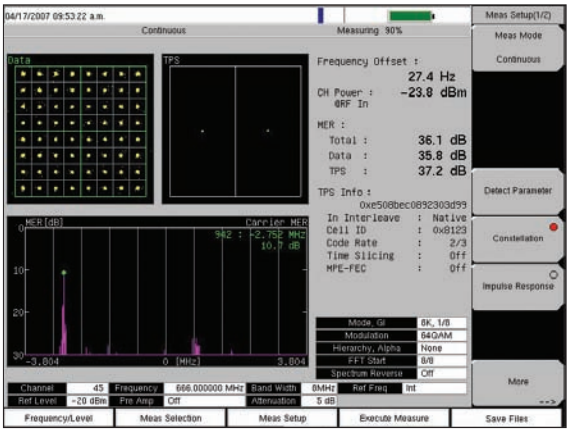
MER/Constellation Measurement

MER/Constellation Measurement

The MER measurement function quantifies the modulation signal quality of digital broadcasting signals directly. It is essential for managing signal margin and the fixed deterioration of equipment with time, as well as for maintaining stable broadcast services.

The constellation function is very useful for analyzing the condition of the received signal by monitoring the modulation symbol movement.

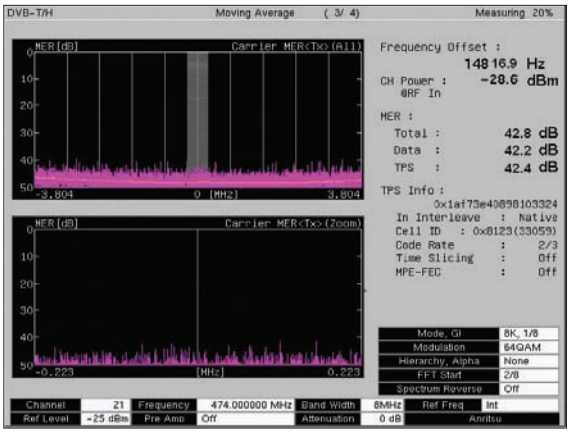
In addition, this function measures the center frequency accurately by using a proprietary advanced signalprocessing technique.



Merits of Measuring MER

Merits of Measuring MER

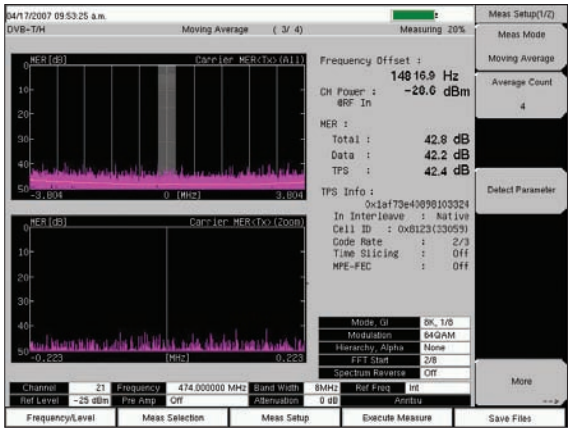
- MER indicates the signal deterioration even when BER measurement does not detect errors (error-free range), making it possible maintain margin quality.
- MER is unrelated to modulation parameters, so one MER results are easily compared with other MER results.



Carrier MER Graph

In-Band Interference Measurement

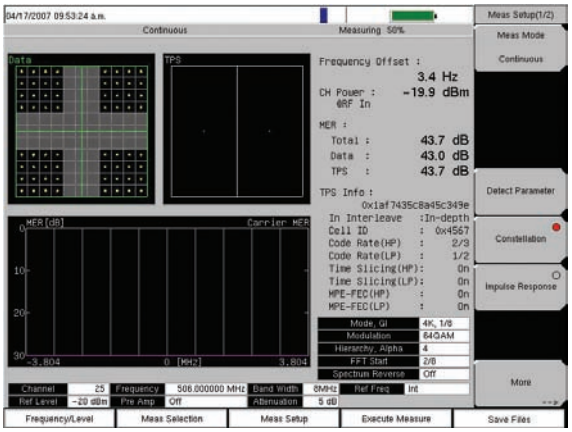
This function identifies the frequency of interference or spurious signals hiding in the bandwidth of the DVB-T/H signal, using the Carrier vs MER function.



Carrier vs MER

Tx Meas Mode: Carrier vs MER

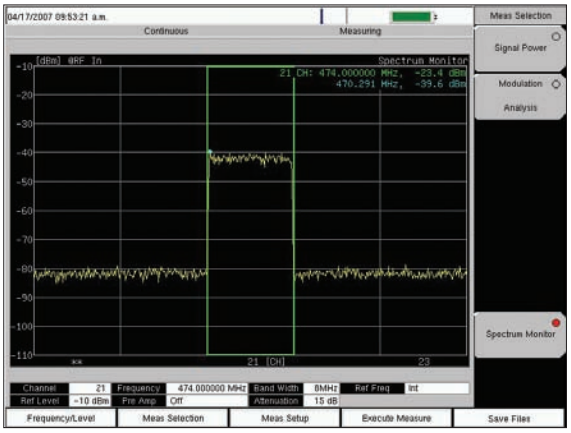
This function is very useful for transmitter installation or maintenance because it offers a very wide dynamic range (50 dB) for high-performance transmitters on the vertical scale and very precise checks of each carrier by zooming all carriers on the horizontal scale.



Constellation Display

Troubleshooting

Option 64 uses Anritsu's proprietary analysis technology for monitoring problems, such as AM or PM. Impairments are visible on the constellation display.



Spectrum Monitor (Span = 5 Channels)

Spectrum Monitor

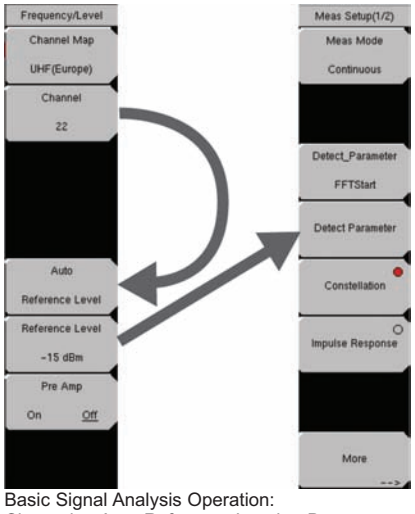
This function displays the frequency response around the desired channel. The variable span supports display of up to 51 channels simultaneously, so broadcast service signals can be checked at a glance.

Ease of Use

Field measurements are restricted by time, place, and the user's level of skill. Option 64 makes operation easy, so even novices can make measurements just by setting the required channel number.

The Auto Reference Level and Detect Parameter buttons set the reference level and transmission parameters automatically.

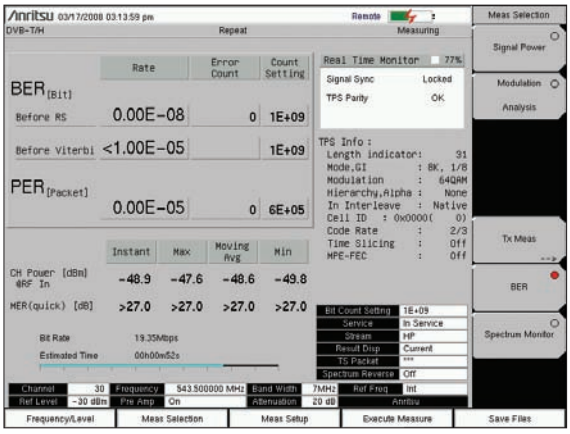
Option 64 makes operation easy



Basic Signal Analysis Operation:
Channel to Auto Reference Level to Detector Parameter

Option 57 BER

The Option 57 BER option adds BER measurement to the Option 64 DVB-T/H Measurements.



BER Measurement

BER Measurement

This function measures the BER of actual broadcast signals. Measurement of BER is a useful index for evaluating the quality of a broadcast signal. The BER and PER can be measured simultaneously along with channel power and MER.

DVB-ASI

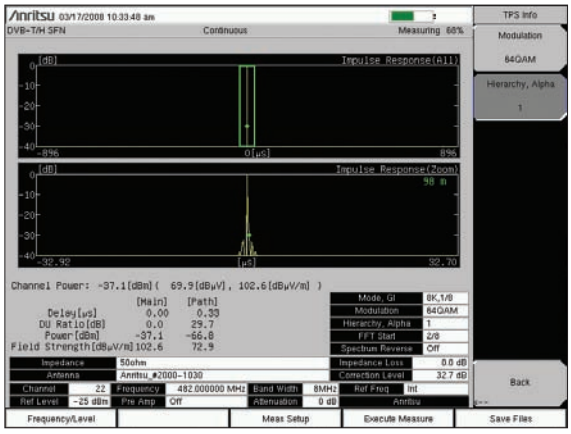
This function provides an MPEG-TS output from the DVB-ASI connector during demodulation (BER measurement).

Functions

- BER (Bit Error Ratio) Measurement
- PER (Packet Error Ratio) Measurement
- DVB-ASI Output

Option 78 DVB-T/H SFN Field Measurement

Option 78 DVB-T/H Single Frequency Network (SFN) Field Measurement accurately calculates the field strength of each incoming signal in single frequency network (SFN) environments.



SFN Measurement

SFN Measurement

Measurement of field strength of each base station or broadcast station in an SFN environment becomes more difficult as the number of broadcast locations increases because the signals appear to be mixed up. This option simplifies field strength measurements of incoming signals without needing to stop broadcasts coming from non-target stations.

Long-Term Delay

Previously, impulse response was measured as the difference in the delay time exceeding the measurement range from the actual delay time. Using this software, the measurement range is expanded to six times (±1 OFDM Symbol) the previous range for more accurate measurement of delay time.

Functions

- Field Strength Measurements in SFN Environments
- Level, Delay and DU Ratio of Each Incoming Signal
- Time Delay between Signals (Time length: ±1 OFDM Symbol length)

Ordering Information

Please specify the model/order number, name and quantity when ordering.

Options

MS2721B-064	DVB-T/H Analysis Option (requires Option 9)
MS2721B-078	DVB-T/H SFN Option (requires Option 9)
MS2721B-057	BER Measurement (requires Option 64)
MT8222A-064	DVB-T/H Analysis Option*
MT8222A-078	DVB-T/H SFN Option*

*The BER measurement option is not available for the MT8222A

Option 64 DVB-T/H Analyzer Specifications*

The following table lists the standard specifications when Option 64 is installed on Anritsu's MS2721B or MT8222A.

Common	Channel Map	UHF(Australia), UHF(Europe), None
	Channel	When channel map is UHF (Australia), the numerical value 28 to 69 (setting resolution: 1 channel) can be set to channel. This time, the central frequency is set to 529.5 + (channel –28) x 7 MHz Channel When channel map is UHF (Europe), the numerical value 21 to 69 (setting resolution: 1 channel) can be set to channel. This time, the central frequency is set to 474 + (channel –21) x 8 MHz
	Frequency	When channel map is None, frequency range is 30 to 990 MHz (setting resolution: 1 Hz).
	Bandwidth	7 MHz, 8 MHz
	Pre Amp	On, Off
	Reference Level	–25 to +20 dBm/5 dB step (Pre Amp = Off) –50 to –10 dBm/10 dB step (Pre Amp = On)
Signal Power	Meas Mode	Single, Continuous, Average, Moving average, Max. hold
	Average Count	1 to 100
	Correction table for Field Strength	Level correction data table for measuring the Field Strength can be stored within the measurement instrument.
	Impedance	50, 75 Ohm (External impedance converter corresponds with the case of 75 Ohm)
Modulation Analysis	Meas Mode	Single, Continuous, Average, Moving average
	Average Count	1 to 100
	Screen Select	Constellation, Impulse response
	Mode	2K, 4K, 8K
	GI	1/4, 1/8, 1/16, 1/32
	Modulation	QPSK, 16QAM, 64QAM
	Hierarchy	None, α =1, α =2, α =4
	FFT Start Position	0/8, 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8, 8/8, 0/8 Fixed, 1/8 Fixed, 2/8 Fixed, 3/8 Fixed, 4/8 Fixed, 5/8 Fixed, 6/8 Fixed, 7/8 Fixed, 8/8 Fixed
	Spectrum Reverse	On, Off
	Detect Parameters	Automatic detection for Mode, GI, Modulation, and Hierarchy parameter
Spectrum Monitor	Meas Mode	Single, Continuous
	Span	1, 3, 5, 11, 31, 51 Channel
Carrier MER <Tx>	Meas Mode	Single, Continuous, Average, Moving average
	Average Count	1 to 100
	Mode	2K, 4K, 8K
	GI	1/4, 1/8, 1/16, 1/32
	Modulation	QPSK, 16QAM, 64QAM
	Hierarchy	None, α =1, α =2, α =4
	FFT Start Position	0/8, 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8, 8/8, 0/8 Fixed, 1/8 Fixed, 2/8 Fixed, 3/8 Fixed, 4/8 Fixed, 5/8 Fixed, 6/8 Fixed, 7/8 Fixed, 8/8 Fixed
	Spectrum Reverse	On, Off
	Detect Parameters	Automatic detection for Mode, GI, Modulation, and Hierarchy parameter
Option 57 BER Unit Available on the MS2721B only	Meas Mode	Single: The set number of bits is measured at once. Repeat: Measurement of the set number of bits is repeated
	Bit Count Setting	xE+yy x: 1 to 9, setting resolution 1 yy: 6 to 12, setting resolution 1 and 1E+6 to 1E+12
	Service	In Service: BER measurement is possible to arbitrary contents. It is possible to measure the measurement point of Before Viterbi and Before RS, simultaneously. Out of Service: BER measurement is possible to PRBS (PRBS 23). It is possible to measure the measurement point of Before Viterbi, Before RS and After RS.
	Stream	HP, LP
	BER Meas Point	Before Viterbi, Before RS and After RS can be choosen, when Service is selected "Out of Service".
	Result Disp	Current: Measured value is always updated. Last: Measured value is updated after measurement of the set number of bits is completed.
	TS Packet	The following can be chosen, when "BER Meas Point" is selected Before RS or After RS. 1 + [187] + 16, 4 + [184] + 16 (Only Out of Service)
	Spectrum Reverse	On, Off

* For performance specifications, each value is assumed to be obtained from measurement after 10-minute preheating under constant ambient temperature conditions.

Option 64 DVB-T/H Analyzer Specifications (continued)

Common	Reference Frequency		Internal, External (10 MHz)	
Signal Power	DVB-T/H Signal, 1 Channel Input			
	Channel Power	Measures channel power		
		Display Resolution	0.1 dB	
		Accuracy	Channel Map: UHF(Europe), Channel: 21 to 69, Bandwidth: 8 MHz Averaging Count: 10, Target VSWR <1.5, 50 Ohm termination Preamplifier: Off ±2.0 dB (–10 to 20 dBm, typical) ±2.0 dB (–60 to –10 dBm) Preamplifier: On ±2.0 dB (–84 to –20 dBm)	
		DANL (Display Average Noise Level)	Channel Map: UHF(Europe), Channel: 21 to 69, Bandwidth: 8 MHz Averaging Count: 50, RF input 50 Ohm termination, 20 to 30 °C Preamplifier: Off, Reference Level: –25 dBm ≤–69 dBm Preamplifier: On, Reference Level: –50 dBm ≤–93 dBm	
		1 dB Compression Level	Channel Map: UHF(Europe), Channel: 21 to 69, CW, 20 to 30 °C Preamplifier: Off, Reference Level: –25 dBm ≥–15 dBm Preamplifier: On, Reference Level: –50 dBm ≥–43 dBm	
		Unit	dBm	
	Termination Voltage, Open Terminal Voltage, Field Strength	Display Item	Termination Voltage [dBµV], Open Terminal Voltage [dBµV (emf)], Field Strength [dBµV/m]	
		Graph	Termination Voltage [dBµV] is displayed as bar chart	
Modulation Analysis	DVB-T/H Signal, 1 Channel Input			
	Common	Frequency Lock Range	±90 kHz	
		Frequency Offset	Measures central frequency offset of modulation signal	
			Unit	Hz
			Display Resolution	0.1 Hz
			Accuracy	–20 dBm, MER >40 dB, Preamplifier: off, Average Count 10, Channel Map: UHF (Europe), Channel: 21 to 69, Bandwidth: 8 MHz, Mode: 8K GI: 1/8, Modulation: 64QAM, Hierarchy: None ± (Measurement frequency x Reference frequency accuracy) ±0.3 Hz
		Channel Power	Measures channel power (@RF In)	
			Display Resolution	0.1 dB
		MER	Measures MER (Modulation Error Ratio)	
			Display Item	Total, Data, TPS
			Display Resolution	0.1 dB
			Residual MER	MER: Total, Channel Map :UHF (Europe), Channel: 21 to 69 Bandwidth: 8 MHz, Mode: 8K, GI:1/8, Modulation: 64 QAM, Hierarchy: None, Average count: 10, Typical Preamplifier: Off, Reference Level: –20 dBm input ≥42 dB Preamplifier: On, Reference Level: –50 dBm input ≥37 dB
			Interference	MER: Total, Channel Map: UHF(Europe), Channel: 21 to 69, Bandwidth: 8 MHz, Mode: 8K, GI:1/8, Modulation: 64 QAM, Hierarchy: None, Average Count: ten, Reference Level: –25 dBm, ±2ch interfering wave, 0 dBm typical for required wave ≥30 dB (Preamplifier: Off, –35 dBm)

Option 64 DVB-T/H Analyzer Specifications (continued)

Modulation Analysis	Constellation	TPS	TPS information (68 bits) displayed in hexadecimal		
			Inner Interleave	Native, In-depth	
			Cell ID	Cell ID (16 bits) displayed in hexadecimal and decimal	
			Code Rate	1/2, 2/3, 3/4, 5/6, 7/8 HP and LP displayed in hierarchical mode	
			Time Slicing	On, Off HP and LP displayed in hierarchical mode	
			MPE-FEC	On, Off HP and LP displayed in hierarchical mode	
		Constellation	Display Item	Data, TPS	
		Carrier MER Graph	For field measurement		
			Horizontal Axis	Frequency Displays central frequency as 0 MHz.	
				Display Range	When Bandwidth is 7 MHz: –3.328 to 3.328 MHz When Bandwidth is 8 MHz: –3.804 to 3.804 MHz
				Valid Range	Bandwidth: 7 MHz When Mode is 2K: –3.234 to 3.234 MHz When Mode is 4K: –3.281 to 3.281 MHz When Mode is 8K: –3.305 to 3.305 MHz Bandwidth: 8 MHz When Mode is 2K: –3.696 to 3.696 MHz When Mode is 4K: –3.750 to 3.750 MHz When Mode is 8K: –3.777 to 3.777
				Display Resolution	Bandwidth: 7 MHz When Mode is 2K: 3.906 kHz When Mode is 4K: 1.953 kHz When Mode is 8K: 0.977 kHz Bandwidth: 8 MHz When Mode is 2K: 4.464 kHz When Mode is 4K: 2.232 kHz When Mode is 8K: 1.116 kHz
			Vertical Axis	MER	
				Display Range	0 to 30 dB
				Display Resolution	0.1 dB
			Marker	Carrier number, Offset frequency and MER displayed	
	Impulse Response	Impulse Response Graph	Horizontal Axis	Delayed time Displays the maximal level signal as 0 ms	
				Display Range	All graph: –1/24 of the valid symbol length to 7/24 of the valid symbol length Zoom graph: 50.00 µs (Band Width: 7 MHz) or 43.75 µs (Band Width: 8 MHz) width at the optional position within the all graph
				Valid Range	0 µs to guard interval
				Display Resolution	0.13 µs (Bandwidth: 7 MHz) 0.11 µs (Bandwidth: 8 MHz
				0 µs positon	Shifting the 0 ms position changes the 0 ms position on All graph. Displayed range when the 0 ms position is selected: Left: –(1/24 of the valid symbol length) to 7/24 of the valid symbol length Center: –(4/24 of the valid symbol length) to 4/24 of the valid symbol length Right: –(7/24 of the valid symbol length) to 1/24 of the valid symbol length
			Vertical Axis	Level	
				Display Range	5, 10, 25, 50 dB
			Marker	On, Off When marker is on, Delay, Distance and relative Level are displayed Delta marker On, Off When delta marker is on, the current marker position becomes a reference position. Delay time, presumed distance and relative level are displayed.	

Option 64 DVB-T/H Analyzer Specifications (continued)

Modulation Analysis	Impulse Response	Marker	On, Off When marker is on, Delay, Distance and relative Level are displayed Delta marker On, Off When delta marker is on, the current marker position becomes a reference position. Delay time, presumed distance and relative level are displayed.		
		Frequency Response Graph	Horizontal Axis	Displays the central frequency as 0 MHz	
				Display Range	When Bandwidth is 7 MHz: –3.328 to 3.328 MHz When Bandwidth is 8 MHz: –3.804 to 3.804 MHz
				Valid Range	Bandwidth: 7 MHz When Mode is 2K: –3.234 to 3.234 MHz When Mode is 4K: –3.281 to 3.281 MHz When Mode is 8K: –3.305 to 3.305 MHz Bandwidth: 8 MHz When Mode is 2K: –3.696 to 3.696 MHz When Mode is 4K: –3.750 to 3.750 MHz When Mode is 8K: –3.777 to 3.777 MHz
				Display Resolution	Bandwidth: 7 MHz When Mode is 2K: 3.906 kHz When Mode is 4K: 1.953 kHz When Mode is 8K: 0.977 kHz Bandwidth: 8 MHz When Mode is 2K: 4.464 kHz When Mode is 4K: 2.232 kHz When Mode is 8K: 1.116 kHz
			Vertical Axis	Display Range	5, 10, 25, 50 dB
				Marker	On, Off When marker is on, the offset frequency and the relative level are displayed
Spectrum Monitor	Spectrum Graph		Horizontal axis	Channel or Frequency	
				Display width	1, 3, 5, 11, 31, 51 Channel
			Vertical Axis	Display Range	100 dB of the range between –150 to 20 dB (Preamplifier: On, Reference level: Over –50 dBm, Preamplifier: Off, Reference level: 20 dBm)
	Channel Power		Measures the channel power (@RF In)		
			Display Resolution	0.1 dB	
Carrier MER<Tx>	DVB-T/H Signal, 1 Channel Input for Stable Signal Like Transmitter				
	Common	Frequency Offset	Measures the central frequency offset of the modulation signal		
			Unit	Hz	
			Display Resolution	0.1 Hz	
		Channel Power	Measures the channel power (@RF In)		
			Display Resolution	0.1 dB	
		MER	Measures MER (Modulation Error Ratio)		
			Display Item	Total, Data, TPS	
			Display Resolution	0.1 dB	
		TPS	TPS information (68 bits) is displayed in hexadecimal		
			Inner Interleave	Native, In-depth	
			Cell ID	Cell ID (16 bits) is displayed in hexadecimal and decimal	
			Code Rate	1/2, 2/3, 3/4, 5/6, 7/8 HP and LP are displayed in hierarchical mode	
			Time Slicing	On, Off HP and LP are displayed in hierarchical mode	
			MPE-FEC	On, Off HP and LP are displayed in hierarchical mode	
		Carrier MER Graph	For Transmitter measurement		
			Horizontal Axis	Frequency Displays the central frequency as 0 MHz	
				Display Range	When Bandwidth is 7 MHz: –3.328 to 3.328 MHz When Bandwidth is 8 MHz: –3.804 to 3.804 MHz
				Valid Range	When Bandwidth is 7 MHz: –3.328 to 3.328 MHz When Bandwidth is 8 MHz: –3.804 to 3.804 MHz
				Display Resolution	Bandwidth: 7 MHz When Mode is 2K: 3.906 kHz When Mode is 4K: 1.953 kHz When Mode is 8K: 0.977 kHz Bandwidth: 8 MHz When Mode is 2K: 4.464 kHz When Mode is 4K: 2.232 kHz When Mode is 8K: 1.116 kHz
			Vertical Axis	MER	
				Display Range	0 to 50 dB
				Display Resolution	0.1 dB
			Marker	Carrier number, Offset frequency and MER are displayed	

Option 64 DVB-T/H Analyzer Specifications (continued)

Option 57 BER Unit Available on the MS2721B only	These specifications become effective when the Option 64 is installed in the MS2721B. At the time of this unit mounting, a temperature of the function of this unit of operation is restricted to 0 °C to 40 °C		
	Indication	Real Time Monitor	Signal Sync: Locked, Unlocked TPS Parity: OK, NG PRBS Sync (PRBS23): Locked, Unlocked (only Out of Service)
		TPS Info	Length indicator: 23,31,33 Mode: 2K, 4K, 8K GI: 1/4, 1/8, 1/16, 1/32 Modulation: QPSK, 16QAM, 64QAM Hierarchy: None, α = 1, α = 2, α = 4 Inner Interleave: Native, In-depth Cell ID: 0 x 0~0 x FFFF (Hexadecimal, Decimal) Code Rate: 1/2, 2/3, 3/4, 5/6, 7/8 (HP, LP) Time Slicing: On, Off (HP, LP) MPE-FEC: On, Off (HP, LP) It is possible to display of a detailed information for TPS warning.
		Estimate Time	hh: mm: ss hh: hour, mm: minute, ss: second
	BER measurement	Display format	Rate: x.xx E-yy x.xx: Mantissa, display resolution 0.01 yy: Exponent, display resolution 1 Error Count: It displays in the following cases. In Service: Before RS Out of Service: Before RS, After RS
	PER measurement	It is performed when In service, and After RS in the case of Out of Service are set.	
		Display format	Rate: x.xx E-yy x.xx: Mantissa, display resolution 0.01 yy: Exponent, display resolution 1 Error Count: It displays number of error packets.
	MER (Quick)	Display Items	Instant, Maximum, Moving average, Minimum
		Unit	dB
		Display Resolution	0.1 dB
		Display Range	< 27 dB
	CH Power (@RF In)	Display Items	Instant, Maximum, Moving average, Minimum
		Unit	dB
		Display Resolution	0.1 dB
	Connector	BNC-J, 75 Ω	
	Output level	800 mVp-p (typical)	
Reference Frequency		Frequency	10 MHz
		Level	–10 to +10 dBm
Save the Measurement Results			JPEG file on the measurement screen and the CSV file of the numerical data (Except for graph data) can be stored within the internal memory. The file of the measurement results within the memory can be copied to the external memory.
Save Recall of the Setting Information			Saves the panel setting information into the internal memory. Recalls the panel set information which is saved, to reflect to the panel setting.
Display Language			English or Japanese is selectable.

Option 78 DVB-T/H Single Frequency Network (SFN) Measurement Specifications

The following table lists the standard specifications when Option 78 is installed on Anritsu's MS2721B or MT8222A.

Electric Characteristic	For performance specifications, each value is assumed to be obtained from measurement after 10-minute preheating under constant ambient temperature conditions.		
Total	Frequency Range	30 to 990 MHz (setting resolution: 1Hz)	
	Channel Map	UHF (Australia), UHF (Europe) None (Optional frequency setup	
	Channel Range	When channel map is UHF (Australia), a numerical value from 28 to 69 (setting resolution: 1 channel) can be set to channel. This time, the central frequency is set to 529.5 + (channel –28) x 7 MHz When channel map is UHF (Europe), a numerical value from 21 to 69 (setting resolution: 1 channel) can be set to channel. This time, the central frequency is set to 474 + (channel –21) x 8 MHz	
	Band Width	7, 8 MHz	
	Mode	2K, 4K, 8K Manual setup or automatic detection setup	
	Guard Interval	1/4, 1/8, 1/16, 1/32 Manual setup or automatic detection setup	
	Modulation System	QPSK, 16QAM, 64QAM Manual setup or automatic detection setup	
	Hierarchy	None, α = 1, α = 2, α = 4	
	Spectrum Reverse	On, Off	
	FFT Start Position	Can specify the position to hew out data used for modulation analysis. Pick up the data for the valid symbol length, from where guard interval of n/8 x guard interval length is included, beginning at a valid symbol start. n: 0 to 8	
	Maximum Input Level	+20 dBm (Preamplifier: Off) –10 dBm (Preamplifier: On	
	Reference Level Setting Range	+20 to –25 dBm, 5 dB steps (Preamplifier: Off) –10 to –50 dBm, 10 dB steps (Preamplifier: On)	
	Impedance	50, 75 Ω (External impedance converter deals wh it 75 Ω)	
	Correction Table for Field Strength Measurement	Can store the level correction data table for field strength measurement	
	Measurement Mode	Single, Continuous	
Channel Power/Terminal Voltage	DVB-T/H Signal, 1 Channel Input		
	Level	Input Level Range	+20 dBm to noise floor (Preamplifier: Off) –20 dBm to noise floor (Preamplifier: On)
		Measurement Resolution	0.1 dB
		Measurement Resolution	Channel Map: UHF(Europe), Channel: 21 to 69, Bandwidth: 8 MHz, Target's VSWR: 1.5 or less, 50 Ω Preamplifier: Off ±2.0 dB (+20 to –10 dBm, typical) ±2.0 dB (–10 to –60 dBm) Preamplifier: On ±2.0 dB (–20 to –84 dBm)
		Display Average Noise Level	Channel Map: UHF (Europe), Channel: 21 to 69, Bandwidth: 8 MHz, RF input 50 W termination, 20 °C to 30 °C Preamplifier: Off, Reference level: –25 dBm ≤–69 dBm Preamplifier: On, Reference level: –50 dBm ≤–93 dBm
		1 dB Compression Level	Channel Map: UHF(Europe), Channel: 21 to 69, CW, 20 °C to 30 °C Preamplifier: Off, Reference level: –25 dBm ≥–15 dBm Preamplifier: On, Reference level: –50 dBm ≥–43 dBm
		Units	dBm, dBmV, dBmV/m

Option 78 DVB-T/H Single Frequency Network (SFN) Measurement Specifications (continued)

Impulse Response	DVB-T/H Signal, 1 Channel Input			
	Frequency Lock Range			±90 kHz
	Level	Input Level Range		+20 dBm to noise floor +10 dB (Preamplifier: Off) –20 dBm to noise floor +10 dB (Preamplifier: On)
	Impulse Response Graph	Display Range		All graph: –896 ms to +896 ms (Bandwidth: 8 MHz) –1024 ms to +1024 ms (Bandwidth: 7 MHz) Zoom graph: Optional 66 ms width of All graph (Bandwidth: 8 MHz) Optional 75 ms width of All graph (Bandwidth: 7 MHz)
		Resolution		0.11 ms (Bandwidth: 8 MHz) 0.13 ms (Bandwidth: 7 MHz)
		Vertical Axis (Level)	Display Range	5, 10, 20, 40 dB
			Display Resolution	0.1 dB
		Marker		Can read delay time, relative level (DU ratio), power and field strength (unit: dBmV/m) by using marker function
		Marker Mode		Normal: Reads 1-point marker Zone: Zoom graph: Reads the maximum value within the 1/10 width marker. (Bandwidth: 8 MHz) Zoom graph: Reads the maximum value within the 1/10 width marker. (Bandwidth: 7MHz)
Impulse Response: Path-level Estimation	Selects the object path with marker, 8K Mode, Guard Interval: 1/8, Channel Map: UHF (Europe), Channel: 21 to 69, Bandwidth: 8 MHz, Target's VSWR of 1.5 or less, 50 Ω			
	2 wave model	Main Wave Estimated Level Accuracy*1		Preamplifier: Off ±2.5 dB (Terminal power: –10 to –55 dBm, typical) Preamplifier: On ±2.5 dB (Terminal power: –20 to –79 dBm, typical)
		Delay Wave Estimated Level Accuracy*2		Preamplifier: Off ±2.5 dB (Terminal power: –10 to –55 dBm, typical) Preamplifier: On ±2.5 dB (Terminal power: –20 to –79 dBm, typical)
		DU Ratio Accuracy*2		Preamplifier: Off ±1.0 dB (Terminal power: –10 to –55 dBm, typical) Preamplifier: On ±1.0 dB (Terminal power: –20 to –79 dBm, typical)
	*1: Time difference between main wave and delay wave is 5 to 850 ms, DU ratio is 3 dB or more *2: Time difference between main wave and delay wave is 5 to 850 ms, DU ratio is 3 to 20 dB			
	3 wave model	Main Wave Estimated Level Accuracy*3, *5		Preamplifier: Off ±2.5 dB (Terminal power: –10 to –55 dBm, typical) Preamplifier: On ±2.5 dB (Terminal power: –20 to –79 dBm, typical)
		Delay Wave Estimated Level Accuracy*4, *5		Preamplifier: Off ±2.5 dB (Terminal power: –10 to –55 dBm, typical) Preamplifier: On ±2.5 dB (Terminal power: –20 to –79 dBm, typical)
		DU Ratio Accuracy*4, *5		Preamplifier: Off ±1.0 dB (Terminal power: –10 to –55 dBm, typical) Preamplifier: On ±1.0 dB (Terminal power: –20 to –79 dBm, typical)
	*3: When time difference between main wave and delay wave is 5 to 420 ms, and DU ratio is 6 dB or more *4: When time difference between main wave and delay wave is 5 to 420 ms, and DU ratio is 6 dB *5: When main wave is set to 0 ms * Delay time (absolute value) of one delay wave is different from that of the other by 2 ms or more * When difference of delay time among delay waves is different from delay time (absolute value) by 2 ms or more			

Option 78 DVB-T/H Single Frequency Network (SFN) Measurement Specifications (continued)

Impulse Response: Interference	UHF (Europe), Channel: 21 to 69, Bandwidth:8 MHz, 8K Mode, Guard Interval: 1/8, 21 to 69 channel, 64QAM, Reference Level: –25 dBm, ±2 channels for desired signal, CW interfering wave of 0 dBm			
	Main Wave Presumed Level Accuracy*6		Preamplifier: Off ±2.5 dB (Terminal power: –35 dBm, typical)	
	*6: When time difference between main wave and delay wave is 5 to 850 ms and DU ratio is 3 dB or more at 2-wave model			
Impulse Response: Sidelobe Compress Function of Main Wave	Automatically compresses the occurrence of the sidelobe centered on the main wave.			
In-band Spectrum	Displays the measurement signal spectrum, focusing on the setup frequency.			
	Level	Input Level Range		+20 dBm to noise floor (Preamplifier: Off) –20 dBm to noise floor (Preamplifier: On)
	In-band Spectrum Graph	Horizontal Axis Frequency)		Displays the central frequency as 0 MHz.
		Display Range		±3.804 MHz (Bandwidth: 8 MHz) ±3.328 MHz (Bandwidth: 7 MHz)
		Valid Range		±3.804 MHz (Bandwidth: 8 MHz) ±3.328 MHz (Bandwidth: 7 MHz)
		Display Resolution		Bandwidth: 8MHz: 1.116 kHz Bandwidth: 7MHz: 0.977 kHz
		Vertical Axis		Displays, with linear value root-mean-square of the spectrum within the display range as 0 dB standard.
		Vertical Axis (Level)	Display Range	5, 10, 25, 50 dB
			Display Resolution	0.1 dB
		Marker		Delta Marker Off: Reads 1-point marker frequency and relative level from vertical axis 0 dB. Delta Marker On: Reads relative level, presumed distance and frequency difference, based on the position just after turning the delta marker on.
Others	External Reference Signal	Frequency		10 MHz
		Level		–10 to +10 dBm
	Measurement Result Save			Saves the JPEG file on the measurements screen and the text file of the numerical value within the internal memory. Can copy the measurements file within the internal memory to the external memory.
	Save and Recall of the Panel Setup Information			Saves the panel setup information into the internal memory Recalls the saved panel setup information to reflect to the panel setup.
	Screen Display Language			English, Japanese