Product Brochure

envision : ensure

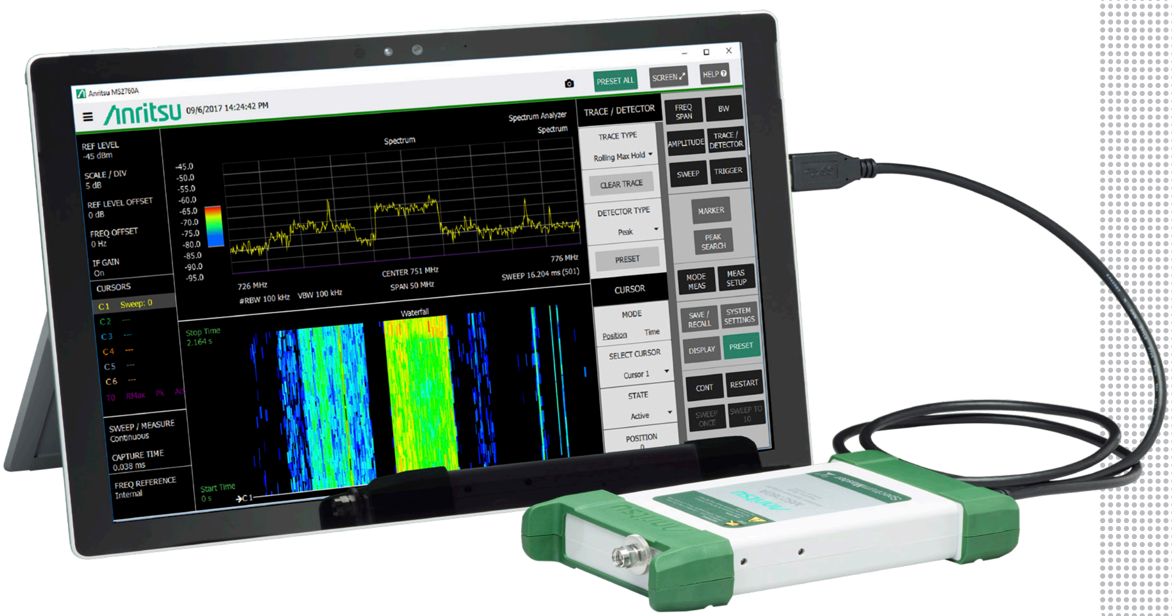
Spectrum Master™

Ultraportable Spectrum Analyzer

MS2760A

9 kHz to 32 GHz, 44 GHz, 50 GHz, 70 GHz, 90 GHz, 110 GHz

The world's smallest, fully featured spectrum analyzer to 110 GHz



Introduction

By utilizing Anritsu's patented nonlinear transmission line (NLTL) technology, the Spectrum Master MS2760A shatters the cost, size, and performance barriers associated with traditional benchtop spectrum analyzers. The Spectrum Master MS2760A is truly pocket-sized yet big on performance, with industry-leading dynamic range, sweep speed, and amplitude accuracy. Its ultraportable size enables direct connect to almost any DUT, eliminating the need for expensive cables at the test port that add loss and uncertainty. The Spectrum Master MS2760A series is the world's first handheld millimeter-wave (mmWave) spectrum analyzers to provide continuous coverage from 9 kHz up to 110 GHz. With five different frequency models
(32, 44, 50, 70, and 110 GHz), these solutions are positioned to analyze the latest 5G fixed wireless access radios, as well as other fast-growing mmWave applications, including 802.11ad (WiGig), E-band microwave wireless communications, satellite communications, electronic warfare, and automotive radar. The Spectrum Master MS2760A models are USB 3.0 powered and controlled from a Windows-based PC, laptop, or tablet, making it uniquely flexible for use in the lab, on the manufacturing floor, or in the field.

Spectrum Master MS2760A Highlights

- Up to six traces, three trace detectors, 12 markers
- Spectrogram display monitoring spectrum changes over time
- Zero span for amplitude vs. time
- Measure: channel power, adjacent channel power, occupied bandwidth
- Dynamic Range: > 103 dB from 6.15 GHz up to 110 GHz
- DANL: as low as –127 dBm
- Resolution Bandwidth (RBW): 1 Hz to 3 MHz
- Phase Noise: –110 dBc/Hz @ 1GHz
- External 10 MHz frequency reference
- External trigger

Size and Performance Driven by Anritsu's Patented NLTL Technology

The Spectrum Master MS2760A utilizes Anritsu's patented nonlinear transmission line (NLTL) technology (or shockline) to deliver direct input spectrum analysis measurements from 9 kHz to 110 GHz. NLTL is comprised of a high-impedance transmission line loaded with varactor diodes. When driven by a local oscillator, this NLTL creates a train of narrow pulses with very sharp edges. Compared to traditional methods of harmonic generation, the NLTL harmonic content remains strong up to 110 GHz. These pulses are used to sample mmWave signals and downconvert to a lower frequency signal. This signal is then digitized and FFT analysis techniques are applied to create spectrum measurements.

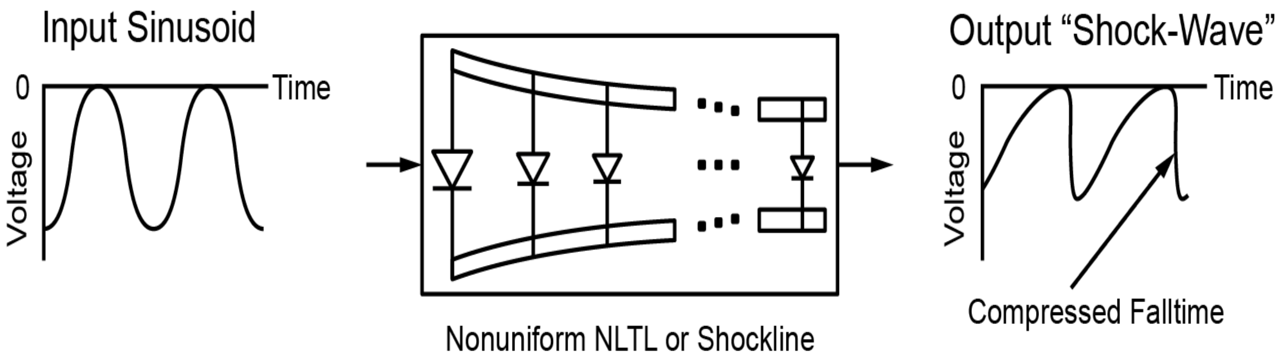


Figure 1. The falling edge of an electrical wave undergoes compression as the wave propagates along the nonlinear transmission line. This effect is analogous to that of a water wave before breaking on the shore.

Benefits

By using the NLTL receiver to sample signals, the Spectrum Master MS2760A delivers never before seen performance in an instrument just bigger than a smartphone. Some of the direct benefits include:

- **Unparalleled value per GHz –** this affordable solution can unlock the door to mmWave measurements that were previously unachievable. Traditionally, mmWave test equipment has been very expensive. Labs are often left sharing a limited number of instruments, which slows down development and limits testing. With the Spectrum Master MS2760A, more engineers and technicians can have tools in their hands to drive products to market faster.
- **Greater dynamic range –** The NLTL receiver provides > 103 dB of dynamic range, enabling measurements of deeper spectral masks and the ability to see both strong and weak signals in the same plot.
- **Measurements closer to your device –** At mmWave frequencies, propagation loss through cables or over-the-air is much higher than at lower frequencies. The direct RF sampling technique of the Spectrum Master MS2760A requires fewer components in the analyzer RF frontend, leading to its smaller size. This allows you to take measurements right at the output of your device, improving your power budget and limiting the need for expensive, low-loss mmWave cables.

In addition to the clear benefits of a small instrument size and weight, the use of NLTL technology has excellent stability — which means longer intervals between calibrations and improved measurement accuracy. The direct RF sampling technique requires fewer components in the analyzer RF front-end, leading to its smaller size. The direct RF sampling techniques also delivers excellent linearity at higher frequencies and low phase noise for precise device characterization.

The new world of technology is pushing products to higher frequencies. Projects that seemed out of reach due to the prohibitive cost of mmWave test and measurement instruments are now possible with the Spectrum Master MS2760A.

Typical Applications

802.11ad Testing

802.11ad wireless links at 60 GHz have entered commercial production. Testing at these frequencies has previously required the use of external mixers with all the associated errors and loss of dynamic range. The direct RF input of the Spectrum Master MS2760A at 60 GHz, coupled with the ability to get the test port very close to the test device, results in a greatly simplified test station.

The wide dynamic range allows full test of the IEEE 802.11ad spectral mask without the need for external amplifiers that add cost and complexity to the test system. Thanks to Anritsu's NLTL receiver, the Spectrum Master MS2760A is specified with over 100 dB of CW dynamic range across the entire frequency band, which means that, even with wider signals like 802.11ad, the analyzer has enough range to show the signal channels.

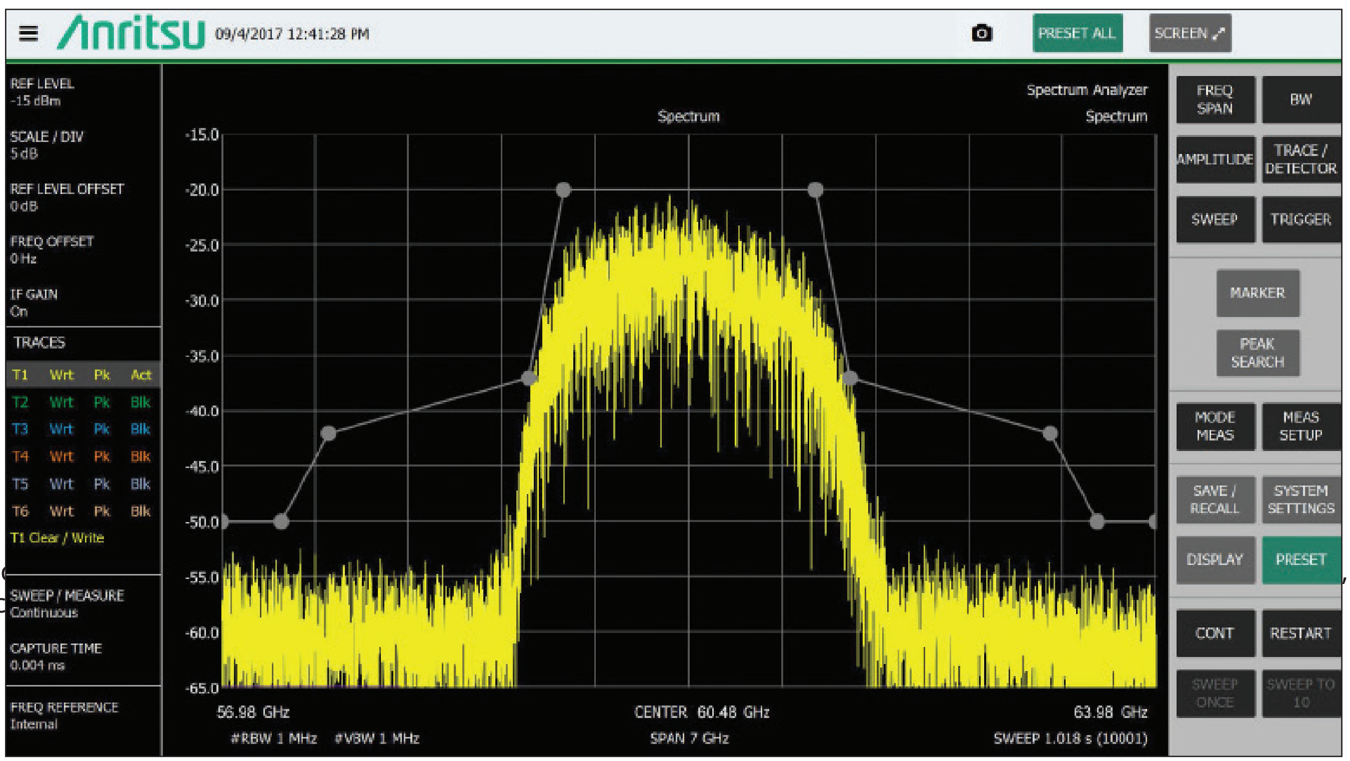


Figure 2. The Spectrum Master MS2760A provides enough dynamic range to easily measure the IEEE 802.11ad spectral mask.

Automotive FMCW Radar

Radar modules have quickly become a standard component in modern automobiles, beginning with adaptive cruise control at 70 GHz and evolving into applications including blind spot monitoring and collision avoidance, typically at 24 GHz. The push for autonomous vehicles is driving radar technologies into mmWave frequencies, where wide bandwidth FMCW chirps can provide improved resolution to help vehicle control systems differentiate between small/big or moving/still objects and react to them. With its advanced sweep controls, the Spectrum Master MS2760A can quickly capture the envelope of many automotive radar FMCW chirps, providing important signal information like start and stop frequencies and distortion.

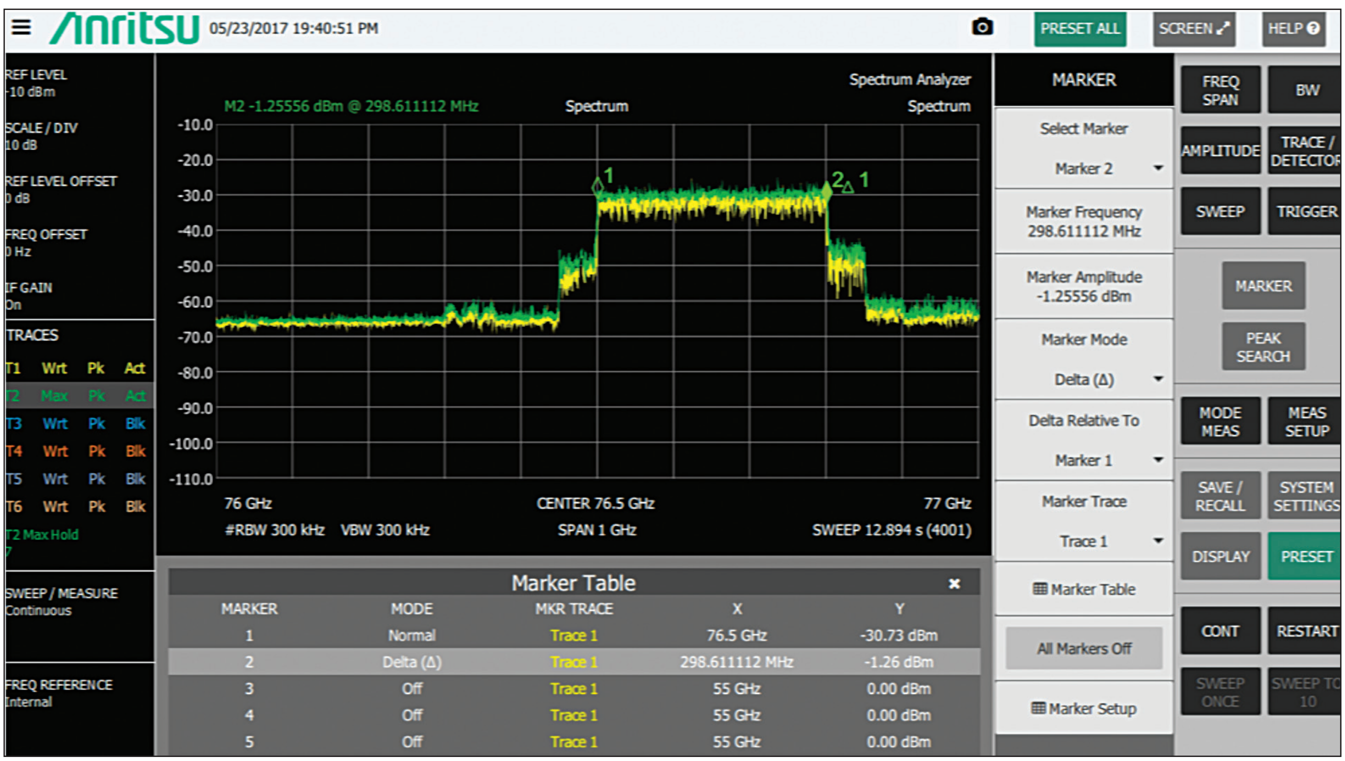


Figure 3. The Spectrum Master MS2760A captures the envelope of automotive radar FMCW chirps.

Innovative Millimeter-Wave Coverage Mapping Solution

Anritsu's Spectrum Master MS2760A ultraportable spectrum analyzer combined with the TRX NEON® MA8100A Signal Mapper is the ideal solution for anyone conducting coverage testing of RF and microwave communications systems, including 5G systems operating at the higher (mmWave) frequency bands as well as for testing of indoor DAS systems.

This solution is capable of supporting both indoor and outdoor coverage mapping needs. While outdoors and in sight of GPS satellites, the system will use GPS data to continuously track the user while making measurements of signal up to 70 GHz. Where GPS is not available, the system employs a tracking unit that supports collection and processing of sensor data that delivers 3D location information. This unique 3D tracking capability provides users with exceptional indoor coverage mapping capabilities that include:

Figure 4. Millimeter-wave indoor coverage mapping solution.

- Eliminating the need to manually perform "check-ins" at each test point by automatically calculating indoor location.
- Providing vastly more data than is possible with manual processes by recording data with every step. • Removing typical data recording errors caused by "guesstimating" locations in large buildings through automatic indoor location and path estimation.
- Delivering actionable data in areas not easily analyzed, such as stairways and elevators, by recording and referencing measurements in 3D.
- Enabling quick analysis of signal coverage and faster problem resolution by delivering the industry's only geo-referenced 3D visualization.
- Provides color-graded measurement results in 2D and 3D views. Measurement values can be seen by clicking on each point. A .csv file of all measurements is also provided.

Data collection is simple and efficient using Anritsu's integrated Spectrum Master MS2760A and TRX NEON MA8100A solution. Collection time is greatly reduced and data is much more accurate as compared to using nonintegrated solutions, where signal information is collected only in 2D at check-in locations or it is interpolated using the limited number of check-ins that have been performed. As a result, data from other systems is often sparse, inaccurate, and time intensive to collect.

Complimentary Spectrum Measurements for mmWave VectorStar™ VNA on wafer probing

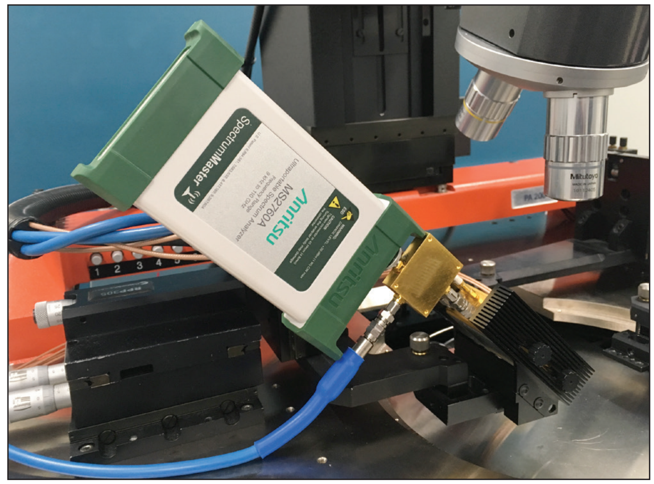


Figure 5. Spectrum Master MS2760A spectrum analyzer enables the test ports

Characterizing on-wafer devices and sub-systems presents a unique set of challenges. For devices such as transistors, a common need is to create accurate models used in circuit simulations. Accurate device modeling requires extreme broadband frequency VNA measurements well beyond the fundamental operating frequencies. During the design phase of an amplifier or MMIC, characteristics such as power saturation, linearity, IMD, harmonics, gain, and match need to be measured. At mmWave frequencies, a number of factors will contribute to the overall success of measurement accuracy and achievement of design goals. Often, multiple parameters must be included in the overall analysis. From a test equipment perspective, features such as the ability to include multiple parameters in a system setup with minimal re-configuration, ease of installation on a probe station, and acquiring multiple parameters with as few touch-downs on the wafer as possible become quite important. The ability to combine accurate, on-wafer S-parameter and spectrum analysis measurements with a single touch-down up to 110 GHz is now possible utilizing the VectorStar ME7838A broadband system and the Spectrum Master MS2760A spectrum analyzer. The small size of the Anritsu NLTL mmWave module and Spectrum Master MS2760A spectrum analyzer enables the test ports to be located close to the probe tip for minimum losses and maximum dynamic range. An Anritsu 10 to 110 GHz 1mm coupler is used to monitor the spectrum while the through-path of the coupler provides the S-parameter measurements down to 70 kHz. Achieving these measurements on a single touch-down means that both parameters can be monitored at the same time, thereby greatly improving the overall design success of the device under test (DUT) while, at the same time, reducing the time-to-test and thus time-to-market.

Aerial Spectrum Analysis with Drone

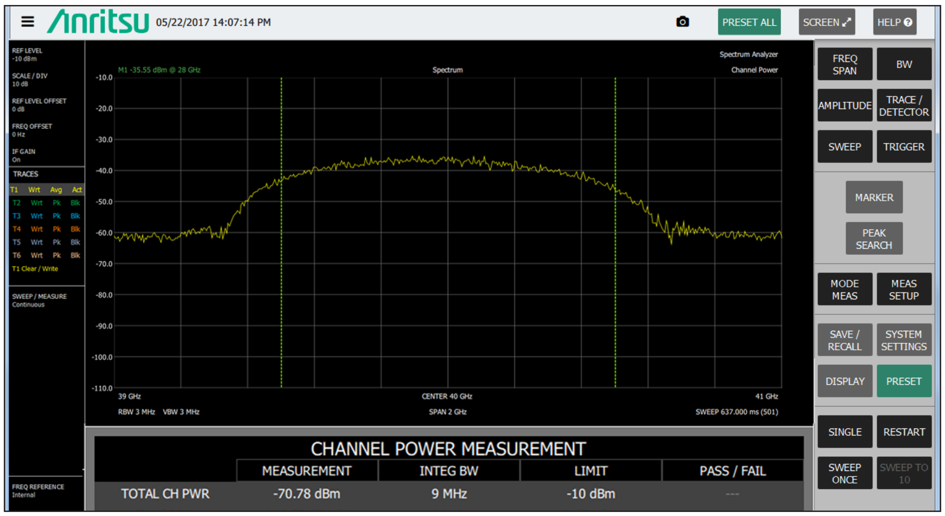
The compact size and weight of the Spectrum Master MS2760A make it ideal for aerial-based spectrum analysis. At only 255 g (9.0 oz) and 155 mm x 84 mm x 27 mm (6.1 in x 3.3 in x 1.1 in) the Spectrum Master MS2760A easily mounts under a commercial drone. Coupled with a small form factor Intel® compute stick to run the application, it is now possible to make coverage mapping measurements and search for interfering signals over a wide area in 3D.

Watch our video at: *www.anritsu.com/en-US/test-measurement/video-gallery/anritsu-signal-hunters-episode-1* to see how to assemble a typical flight package and find interfering signals quickly over a wide area.

Spectrum Master Features

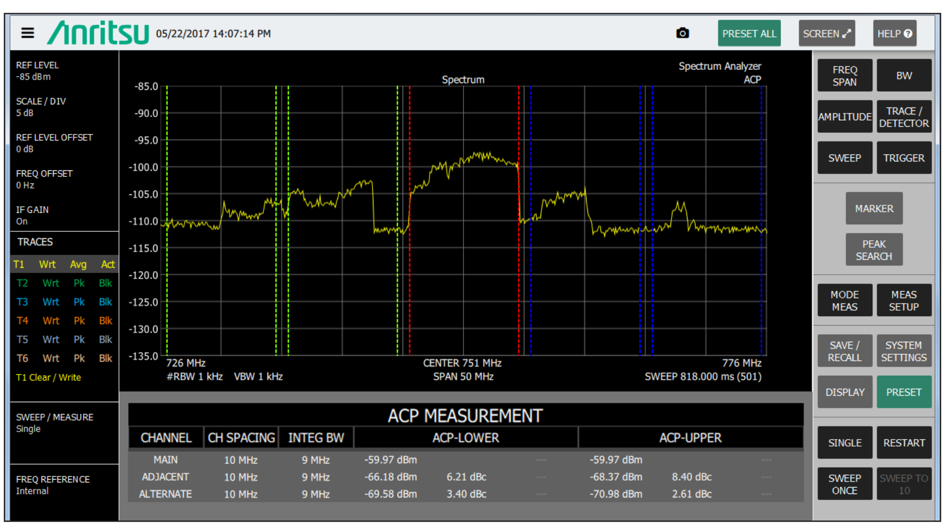
Channel Power

Channel power measurement is one of most common measurements for a radio transmitter. This test measures the output power, or channel power, of a transmitter over a defined frequency range. Out-of-specification power measurements indicate system faults, typically in the power amplifiers or in filter circuits. Channel power measurements are required to validate transmitter performance, comply with government regulations, or to keep overall system interference at a minimum.



Adjacent Channel Power (ACPR)

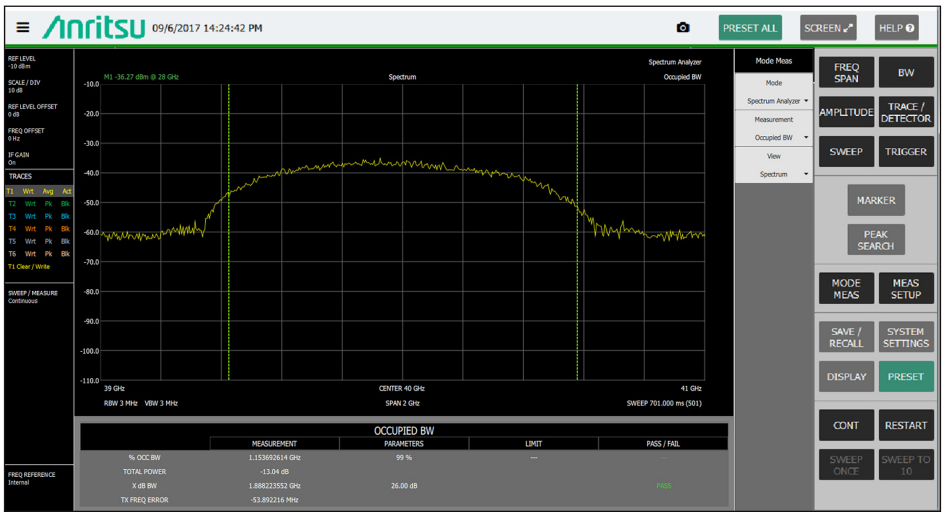
A common transmitter measurement is that of adjacent channel leakage power. This is the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel, and is used to replace the traditional two-tone intermodulation distortion (IMD) test for system nonlinear behavior. The result of an ACPR measurement is expressed as a power ratio between the main and adjacent or alternate channels. In order to calculate the upper and lower adjacent channel values, the Spectrum Master MS2760A 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 MS2760A, all these values are automatically set to the normal values for that standard.



Occupied Bandwidth

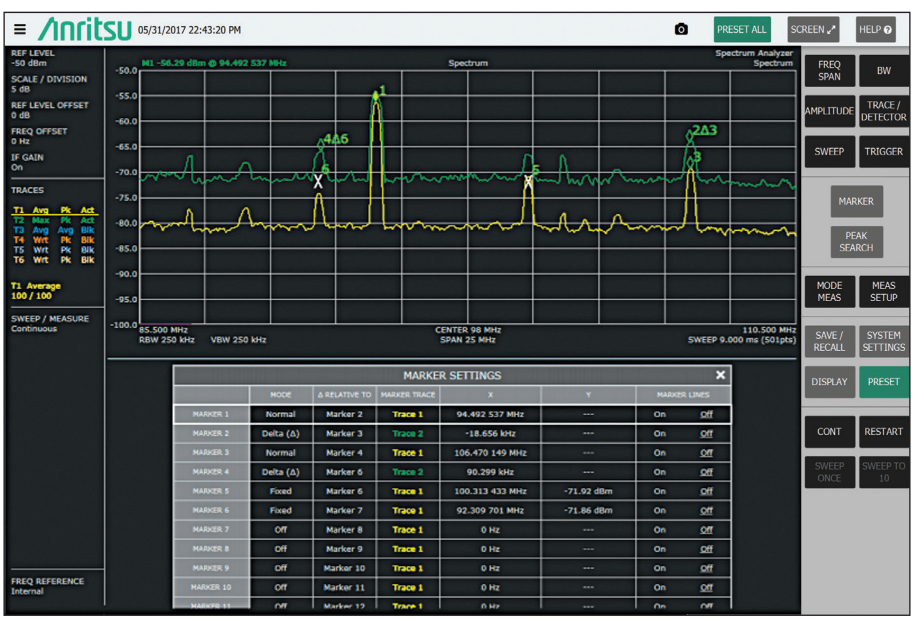
Occupied bandwidth (OBW) is a common measurement performed on radio transmitters. This measurement calculates the bandwidth containing the total integrated power occupied in a given signal bandwidth. There are two different methods of calculation, depending upon the technique used to modulate the carrier:

- % Integrated Power Method: The occupied frequency bandwidth is calculated as the bandwidth containing the specified percentage of the transmitted power.
- dB Tx Frequency Error Method: The occupied frequency bandwidth is defined as the bandwidth between the upper and lower frequency points at which the signal level is a desired number of dB below the peak carrier level.



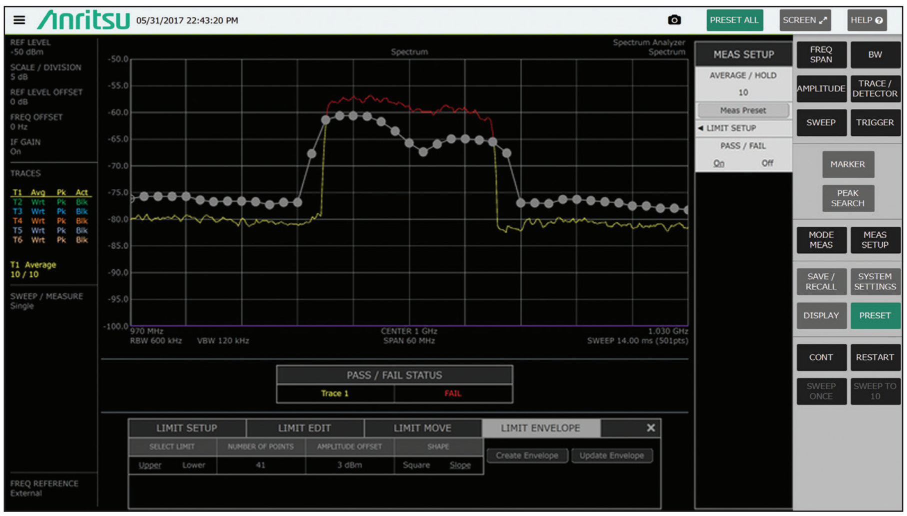
Comprehensive Marker Table

For better data analysis, the comprehensive marker table provides information on marker number, mode, function, trace #, and X and Y values, and is capable of displaying up to twelve regular and twelve delta markers as needed. A marker's component can be easily changed by selecting the marker, clicking on the desired component, and selecting the new value from a list or entering a numerical value.



Limit Line With Pass/Fail

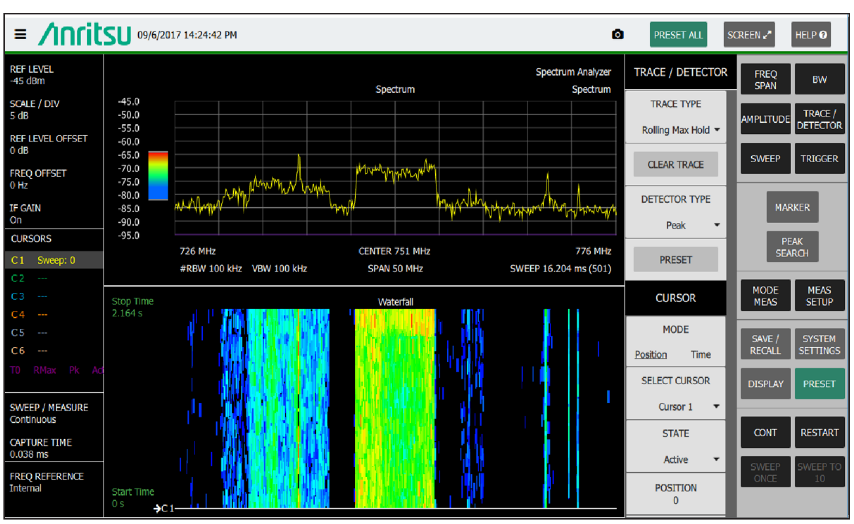
Two types of limit lines can be specified: lower limit lines and upper limit lines. Limit lines can be used for visual reference only or for pass/fail criteria using the limit alarm. Limit alarm failures are reported whenever a signal is above the upper limit line or below the lower limit line. By using "save on event", a signal that causes a limit alarm can be automatically saved. Each limit line can consist of a single segment or as many as 40 segments. These limit segments are retained regardless of the current frequency span of the instrument, which allows the configuring of specific limit envelopes at various frequencies of interest without having to re-configure them each time the frequency is changed. Limit envelope characteristics allow users to make adjustments to amplitude and frequency of each inflection point, and make it easy to add or delete inflection points to achieve a desired limit results.



Spectrogram

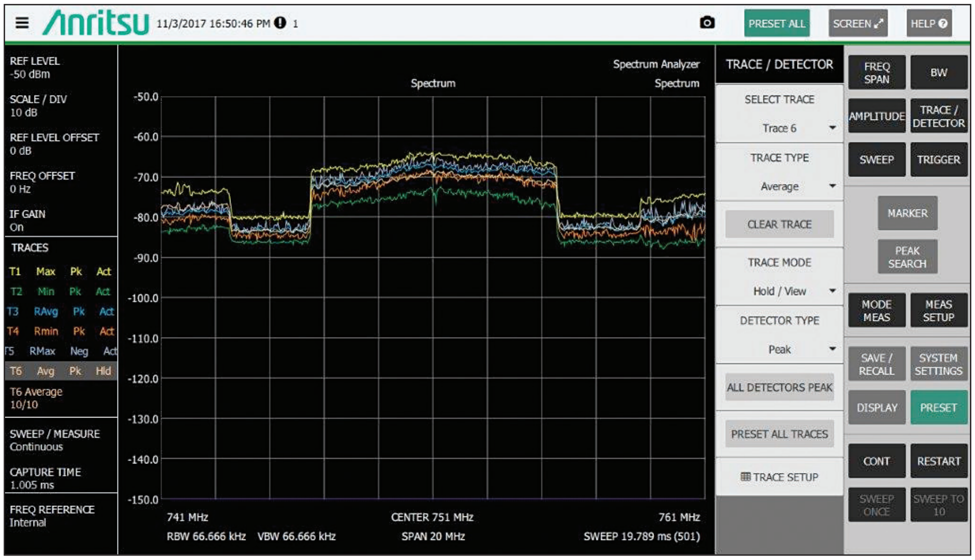
A spectrogram is a multi-dimensional representation of frequency, time, and power that is useful for identifying intermittent interference. Color is used to represent power levels.

Every trace captured in the spectrogram has a time and position index. The Spectrum Master MS2760A software allows you to set the position of the spectrogram cursor based on either the time or position index. When position is selected, you can change the position of the time cursor by adjusting the spectrogram position value in the TRACE / DETECTOR menu. If time is selected, you can set the position of the time cursor based on the amount of time that has passed since the selected trace and the current time.



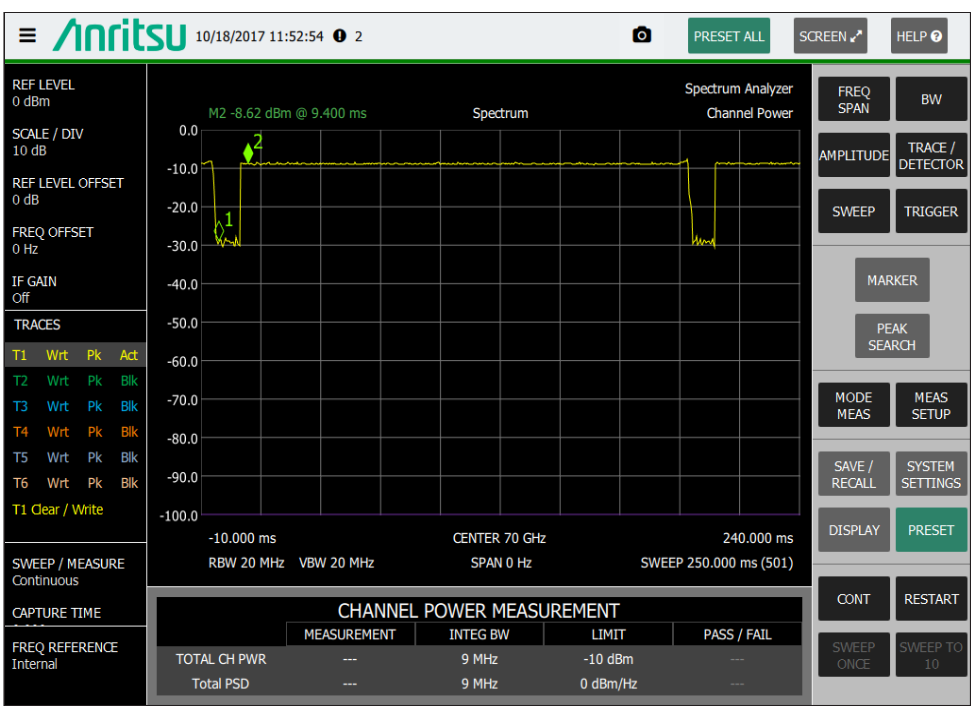
Multi-Trace Display

Multi-trace display allows up to 6 traces to be shown on the screen with different trace types (average, max hold, min hold, rolling average, rolling max hold, and rolling min hold) and detector types (peak, RMS/average, and negative) for additional data analysis.



Zero Span Capability

Signal amplitude is displayed as a function of time. With zero span capability, the carrier power of a transmitter can be easily measured. For example, in the graph below, zero span is used to measure a pulsed emission. Automotive FMCW radar and traditional pulse radar are the key applications. Engineers can also use zero span mode to measure the channel power of digitally modulated signals.



Ordering Information

Models and Options

Model Number	Description
MS2760A-0032	Ultraportable Spectrum Master, Frequency Range 9 kHz to 32 GHz
MS2760A-0044	Ultraportable Spectrum Master, Frequency Range 9 kHz to 44 GHz
MS2760A-0050	Ultraportable Spectrum Master, Frequency Range 9 kHz to 50 GHz
MS2760A-0070	Ultraportable Spectrum Master, Frequency Range 9 kHz to 70 GHz
MS2760A-0090	Ultraportable Spectrum Master, Frequency Range 9 kHz to 90 GHz
MS2760A-0110	Ultraportable Spectrum Master, Frequency Range 9 kHz to 110 GHz

Option Number	
MS2760A-0032-0098 MS2760A-0044-0098 MS2760A-0050-0098 MS2760A-0070-0098 MS2760A-0090-0098 MS2760A-0110-0098	Standard Calibration (ISO/IEC 17025 and ANSI/NCSL Z540-1)
MS2760A-0032-0099 MS2760A-0044-0099 MS2760A-0050-0099 MS2760A-0070-0099 MS2760A-0090-0099 MS2760A-0110-0099	Premium Calibration (ISO/IEC 17025 and ANSI/NCSL Z540-1 plus test data)

Standard Accessories (Included with instrument)

Part Number	Description
2300-1859-R	USB 3.0 Type C to Type A Cable
2300-1605-R	BNC(m) to MCX(m) Cable (qty 2)
Certificate of Calibration and Conformance	

Manuals (available at *www.anritsu.com*)

Part Number	Description
10580-00427	User Guide

Optional Accessories

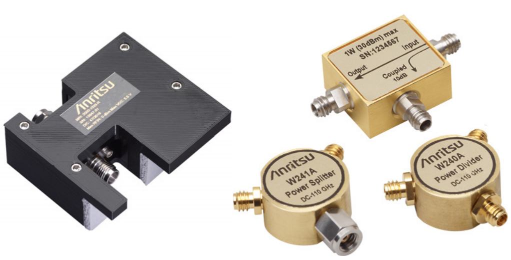
Coaxial Adapters

Part Number	Description
2000-1880-R	DC to 18 GHz, N(m) to V(f), 50 Ω
2000-1881-R	DC to 18 GHz, N(f) to V(f), 50 Ω
K222B	DC to 40 GHz, K(f) to K(f), 50 Ω
34VFK50	DC to 40 GHz, V(f) to K(m), 50 Ω
34VFKF50	DC to 40 GHz, V(f) to K(f), 50 Ω
34VV50	DC to 65 GHz, V(m) to V(m), 50 Ω
34VVF50	DC to 65 GHz, V(f) to V(m), 50 Ω
34VFVF50	DC to 65 GHz, V(f) to V(f), 50 Ω
34WV50	Precision Adapter, DC to 65 GHz, W1(m) to V(m), 50 Ω
34WVF50	Precision Adapter, DC to 65 GHz, W1(m) to V(f), 50 Ω
34WFV50	Precision Adapter, DC to 65 GHz, W1(f) to V(m), 50 Ω
34WFVF50	Precision Adapter, DC to 65 GHz, W1(f) to V(f), 50 Ω
33WW50	W1(m) to W1(m)
33WWF50	W1(m) to W1(f)
33WFWF50	W1(f) to W1(f)

Precision Fixed Attenuators

Part Number	Description
41KB-3	DC to 26.5 GHz, 2W, 3 dB, K(m) to K(f)
41KB-6	DC to 26.5 GHz, 2W, 6 dB, K(m) to K(f)
41KB-10	DC to 26.5 GHz, 2W, 10 dB, K(m) to K(f)
41KB-20	DC to 26.5 GHz, 2W, 20 dB, K(m) to K(f)
41KC-3	DC to 40 GHz, 2W, 3 dB, K(m) to K(f)
41KC-6	DC to 40 GHz, 2W, 6 dB, K(m) to K(f)
41KC-10	DC to 40 GHz, 2W, 10 dB, K(m) to K(f)
41KC-20	DC to 40 GHz, 2W, 20 dB, K(m) to K(f)
41V-3	DC to 60 GHz, 2W, 3 dB, V(m) to V(f)
41V-6	DC to 60 GHz, 2W, 6 dB, V(m) to V(f)
41V-10	DC to 60 GHz, 2W, 10 dB, V(m) to V(f)
41V-20	DC to 60 GHz, 2W, 20 dB, V(m) to V(f)
41W-3	DC to 110 GHz, 0.2W 3 dB, W1(m) – W1(f)
41W-6	DC to 110 GHz, 0.2W, 6 dB, W1(m) – W1(f)
41W-10	DC to 110 GHz, 0.2W, 10 dB, (m) – W1(f)

Miscellaneous Components



Part Number	Description
W240A	Precision Power Divider, DC to 110 GHz, W1(f) input, W1(f) outputs, 3 resistor, 50 Ω
W241A	Precision Power Splitter, DC to 110 GHz, W1(m) input, W1(f) outputs, 2 resistor, 50 Ω
MN25110A	Precision Directional Coupler, 20 GHz to 110 GHz, W1(f) input, W1(f) output, W1(f) coupled port, 50 Ω
2000-1929-E	Low Noise Amplifier, 18 GHz to 42 GHz, 28 dB Gain, V(m)-V(f)
2000-1930-R	Low Noise Amplifier, 18 GHz to 42 GHz, 28 dB Gain, K(m)-K(f)

Precision Waveguide Coaxial Adapters (right angle)

Part Number	Description
35WR42KF	18 GHz to 26.5 GHz, WR42 to K(f)
35WR28KF	26.5 GHz to 40 GHz, WR28 to K(f)
35WR22VF	33 GHz to 50 GHz, WR22 to V(f)
35WR19VF	40 GHz to 60 GHz, WR19 to V(f)
35WR15VF	50 GHz to 65 GHz, WR15 to V(f)
35WR10WF	75 GHz to 110 GHz, WR10 to W1(f)
SC7442 60	GHz to 90 GHz, WR12 to W1(f)

Optional Accessories (continued)

Waveguide to Coaxial End Launch Adapters (straight through)

Part Number	Description
2000-1889-R	17.6 GHz to 26.7 GHz, WR42 to K(f)
2000-1890-R	26.4 GHz to 40.1 GHz, WR28 to K(f)
1091-460-R	17.6 GHz to 26.7 GHz, WR42 to V(f)
1091-459-R	26.4 GHz to 40.1 GHz, WR28 to V(f)
1091-458-R	33.0 GHz to 50.1 GHz, WR22 to V(f)
1091-457-R	39.3 GHz to 59.7 GHz, WR19 to V(f)
1091-456-R	49.9 GHz to 67.0 GHz, WR15 to V(f)
1091-402-R	49.9 GHz to 75.8 GHz, WR15 to W1(f)
1091-401-R	60.5 GHz to 92.0 GHz, WR12 to W1(f)
1091-400-R	73.8 GHz to 110 GHz, WR10 to W1(f)

Directional Horn Antennas

Part Number	Description
2000-1867-R	17.6 GHz to 26.7 GHz, WR42, 25 dBi gain
2000-1868-R	26.4 GHz to 40.1 GHz, WR28, 25 dBi gain
2000-1869-R	33.0 GHz to 50.1 GHz, WR22, 25 dB gain
2000-1870-R	39.3 GHz to 59.7 GHz, WR19, 25 dBi gain
2000-1871-R	49.9 GHz to 75.8 GHz, WR15, 25 dBi gain
2000-1872-R	60.0 GHz to 90.0 GHz, WR12, 25 dBi gain
2000-1873-R	75.0 GHz to 110.0 GHz, WR10, 25 dBi gain

Test Port Cables (Armored, Semi-rigid)

Part Number	Description
3670K50-1	DC to 40 GHz, K(f) to K(m), 30.5 cm (1 ft)
3670K50-2	DC to 40 GHz, K(f) to K(m), 61.0 cm (2 ft)
3670V50A-1	DC to 70 GHz, V(f) to V(m), 30.5 cm (1 ft)
3670V50A-2	DC to 70 GHz, V(f) to V(m), 61.0 cm (2 ft)
3671W1-50-1	DC to 110 GHz, Flexible, W1(f) to W1(m), 10 cm
3671W1-50-2	DC to 145 GHz, Flexible, W1(f) to W1(m), 13 cm
3671W1-50-3	DC to 145 GHz, Flexible, W1(f) to W1(m), 16 cm

USB Cable Extender

Model Number	Description
2000-1888-R	USB 3.0 Powered Cable Extender, 10 m, (32 ft) (up to two can be used in series for a total length of 20 m)

Anritsu envision : ensure

Specifications are subject to change without notice.

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