

**Anritsu** Advancing beyond

# Spectrum Master™

Ultraportable Spectrum Analyzer

## MS2760A

9 kHz to 32, 44, 50, 70, 90, 110, 145, 170 GHz

## MS2762A

6 GHz to 32, 44, 50, 70, 90, 110, 145, 170 GHz



# Spectrum Master MS2760A

## Introduction

Utilizing Anritsu's patented nonlinear transmission line (NLTL) technology, the Spectrum Master™ MS2760A and MS2762A ultraportable spectrum analyzer products deliver the best-in-class price/performance ratio unmatched by traditional benchtop instruments. This enables you to more efficiently advance your technology development and reduce your time to market. The Spectrum Master™ MS276xA series are pocket-sized, yet big on performance with leading dynamic range, sweep speed, and amplitude accuracy. The ultraportable size of these instruments enables a direct connection to almost any DUT, eliminating the need for lossy, expensive cables.

The 145 GHz and 170 GHz models are the world's first handheld millimeter-wave spectrum analyzers to provide broadband, continuous coverage from 9 kHz to 170 GHz. These are the world's first and only broadband spectrum analyzers that break through the 110 GHz barrier and enable research and development in the entire D band spectrum. They are perfect for advanced millimeter-wave applications like radio astronomy, automotive radar, antenna beam pattern testing, and more. The Spectrum Master™ MS2760A and MS2762A are USB-powered and controlled from a Windows-based PC, laptop, or tablet, making them uniquely flexible for use in the lab, on the manufacturing floor, or even in the field.



The Spectrum Master MS2760A models provide full broadband coverage from 9 kHz to 170 GHz with excellent dynamic range and DANL performance.

The Spectrum Master MS2762A models provide even better dynamic range and DANL performance than the Spectrum Master MS2760A models, for the most demanding sensitivity requirements, with frequency coverage starting at 6 GHz and a top frequency range of 170 GHz.

### Spectrum Master MS2760A Highlights

- Frequency from 9 kHz up to 170 GHz
- DANL: as low as -134 dBm, 4 to 40 GHz
- Dynamic Range: > 103 dB at 70 GHz

### Spectrum Master MS2762A Highlights

- Frequency from 6 GHz up to 170 GHz
- DANL: as low as -142 dBm, 6 to 40 GHz
- Dynamic Range: > 108 dB at 70 GHz

### Spectrum Master MS2760A and MS2762A Highlights

- Measure: Channel Power, Adjacent Channel Power, Occupied Bandwidth
- Spectrum and Spectrogram Displays
- Zero span
- Resolution Bandwidth (RBW): 1 Hz to 3 MHz
- Up to Six Spectrum Traces and Spectrogram Cursors, Three Trace Detectors, 12 Markers
- External 10 MHz Frequency Reference
- External TTL Trigger Input

## 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 complicated setup, high amplitude errors, and loss of dynamic range. The direct RF input of the Spectrum Master MS276xA 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. The Spectrum Master MS276xA 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 dynamic range to perform spectrum emission mask testing. Direct connection to DUT Avoid high propagation loss and/or expensive precision cables at mmWave frequencies, which saves money and improves the accuracy and repeatability of measurements.

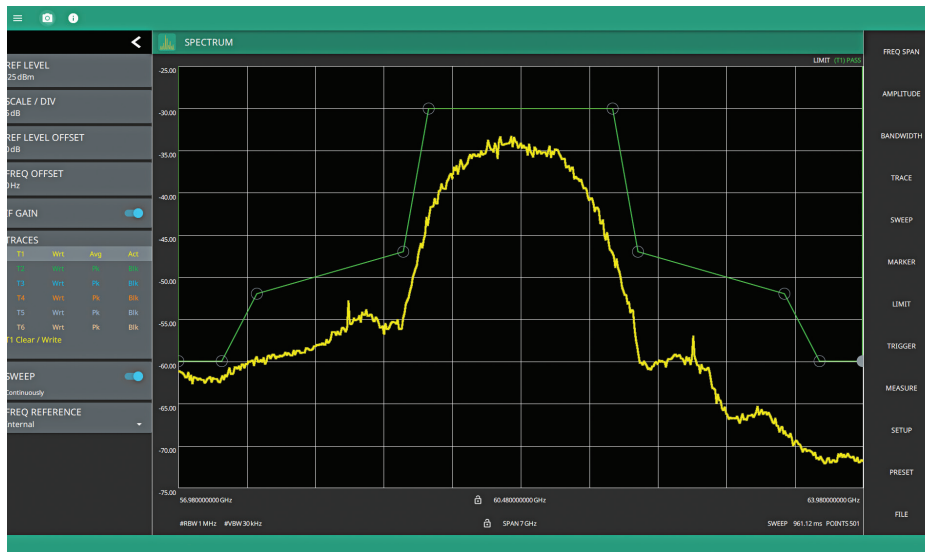


Figure 2. The Spectrum Master MS276xA Provides Enough Dynamic Range to Perform Spectrum Emission Mask Testing of an IEEE 802.11ad Signal Over-the-Air

## 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 spatial 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 MS276xA can quickly capture the envelope of many automotive radar FMCW chirps, providing important signal information like start and stop frequencies and distortion.

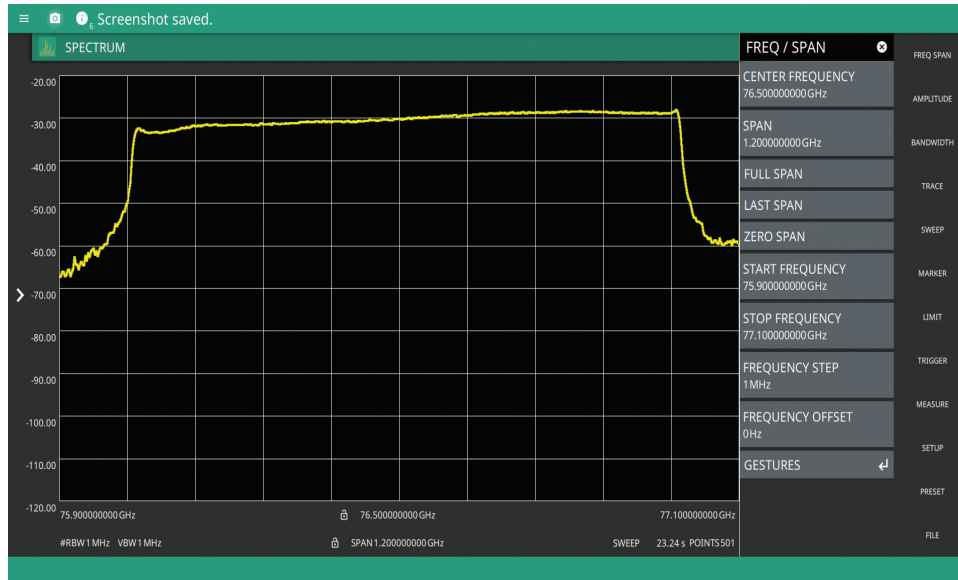


Figure 3. The Spectrum Master MS276xA Captures the Envelope of Automotive Radar FMCW Chirps from an Over-the-Air Measurement

### Innovative Millimeter-Wave Coverage Mapping Solution

Anritsu's Spectrum Master MS276xA ultraportable spectrum analyzer combined with the 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. 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:

- 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.



Figure 4. Millimeter-wave Indoor Coverage Mapping Solution

Data collection is simple and efficient using Anritsu's integrated Spectrum Master MS276xA 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

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. From a test equipment perspective, features such as the ability to measure multiple parameters in a system setup with minimal re-configuration, ease of installation on a probe station, and acquiring multiple parameters with the fewest touch-downs on the wafer is important at mmWave frequencies. The ability to combine accurate, on-wafer S-parameter up to 110 GHz and spectrum analysis measurements up to 170 GHz with a single touch-down up to is now possible utilizing the VectorStar ME7838A broadband system and the Spectrum Master MS276xA spectrum analyzer. The small size of the Spectrum Master MS276xA spectrum analyzer enables its RF test port to be connected close to the probe tip, minimizing insertion loss and maximizing dynamic range. An Anritsu 20 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.

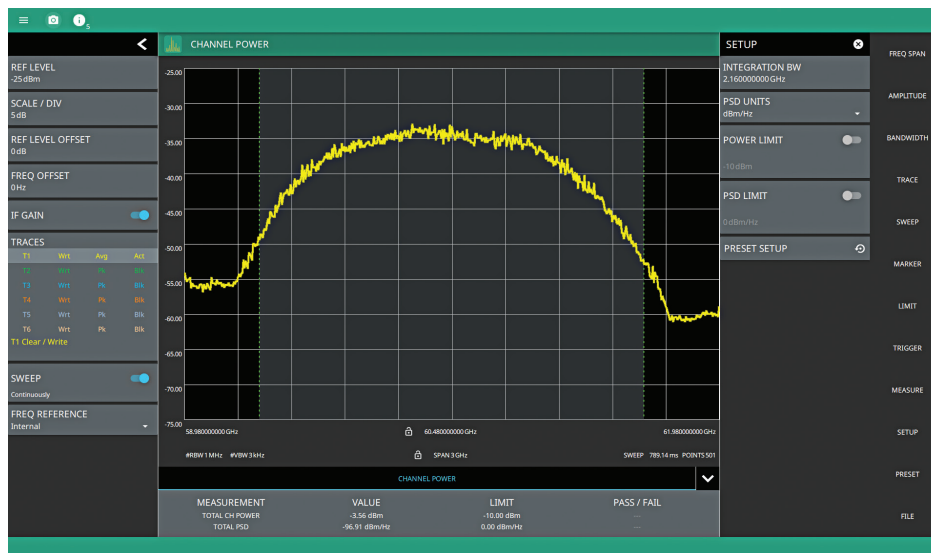


Figure 5. The Spectrum Master MS276xA is Connected Close to the Probe Tip on a Wafer Probe Station.

## Spectrum Master Features

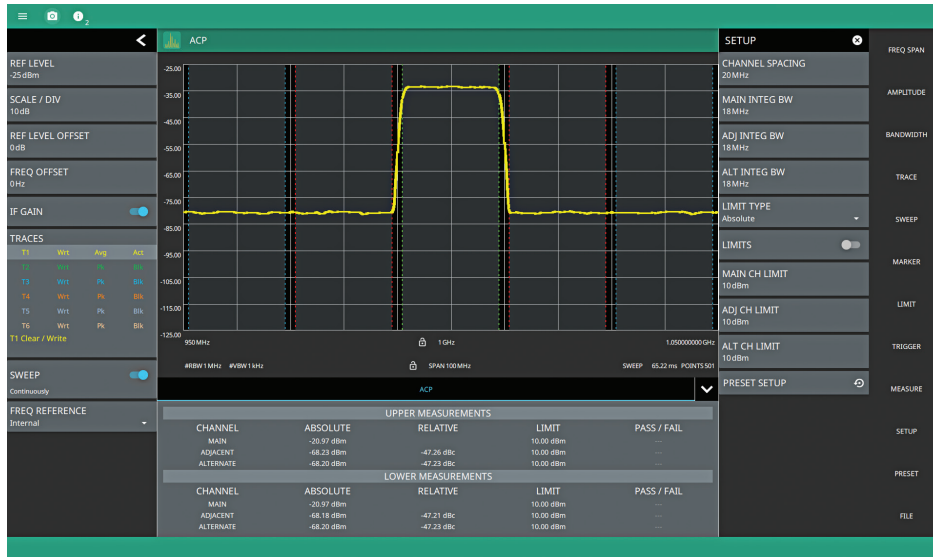
### Channel Power

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 bandwidth. 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 MS276xA allows the adjustment of five parameters to meet specific measurement needs: main channel center frequency, channel spacing, main, adjacent and alternate channel bandwidth.



## 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.

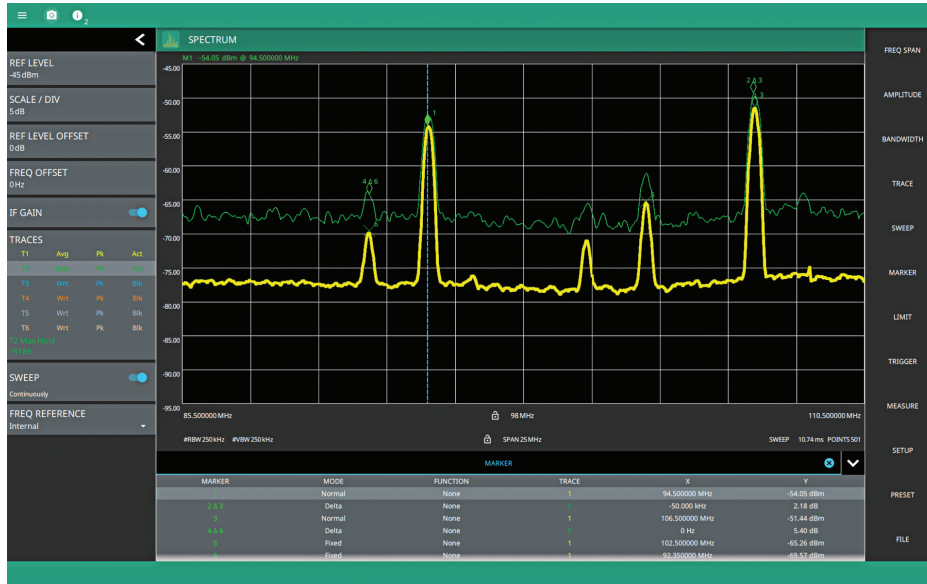


# Spectrum Master MS2760A

## 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 markers as needed.

Marker parameters can be easily changed by selecting the marker, clicking on the desired marker parameter, and selecting a 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 setting 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 or span 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 line shape.

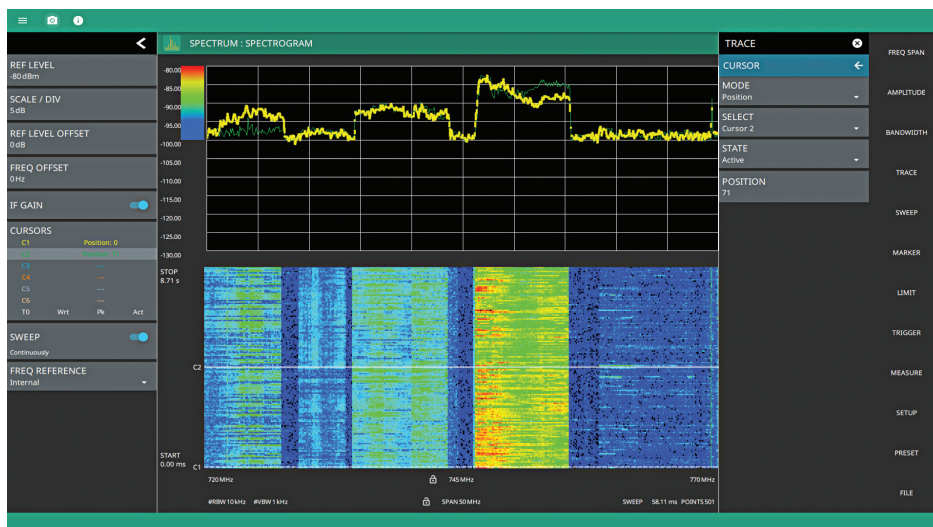


## Spectrogram

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.

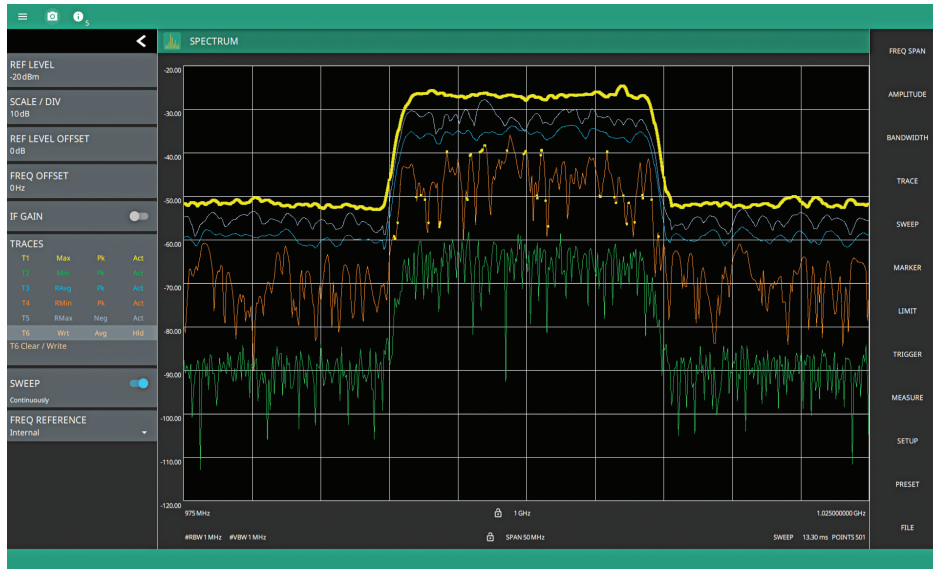
The Spectrum Master MS276xA spectrogram holds 142 consecutive traces and the spectrogram cursor function allows you to select which trace to display based on either a position of time index relative to the current sweep. Up to six cursors can be set to help you compare spectrum trace measurements taken at different points in time.

Depending on the cursor mode setting, you can set the cursor position by adjusting the position or time value in the CURSOR menu, under the TRACE menu. You can also set the position by clicking and dragging the cursor along the left edge of the spectrogram.



## Multi-trace Display

Multi-trace display allows up to six 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 the frame period of an automotive FMCW radar over the air transmission. Automotive FMCW radar and traditional pulse radar are the key applications. Using delta markers in Zero Span you can determine factors like frame repetition rate, pulse width, and so on.



## Ordering Information

### Models and Options

Model Number	Description
MS2760A-0032	Spectrum Master, ultraportable spectrum analyzer, 9 kHz to 32 GHz
MS2760A-0044	Spectrum Master, ultraportable spectrum analyzer, 9 kHz to 44 GHz
MS2760A-0050	Spectrum Master, ultraportable spectrum analyzer, 9 kHz to 50 GHz
MS2760A-0070	Spectrum Master, ultraportable spectrum analyzer, 9 kHz to 70 GHz
MS2760A-0090	Spectrum Master, ultraportable spectrum analyzer, 9 kHz to 90 GHz
MS2760A-0110	Spectrum Master, ultraportable spectrum analyzer, 9 kHz to 110 GHz
MS2760A-0145	Spectrum Master, ultraportable spectrum analyzer, 9 kHz to 145 GHz
MS2760A-0170	Spectrum Master, ultraportable spectrum analyzer, 9 kHz to 170 GHz
MS2762A-0032	Spectrum Master, ultraportable spectrum analyzer, 6 GHz to 32 GHz
MS2762A-0044	Spectrum Master, ultraportable spectrum analyzer, 6 GHz to 44 GHz
MS2762A-0050	Spectrum Master, ultraportable spectrum analyzer, 6 GHz to 50 GHz
MS2762A-0070	Spectrum Master, ultraportable spectrum analyzer, 6 GHz to 70 GHz
MS2762A-0090	Spectrum Master, ultraportable spectrum analyzer, 6 GHz to 90 GHz
MS2762A-0110	Spectrum Master, ultraportable spectrum analyzer, 6 GHz to 110 GHz
MS2762A-0145	Spectrum Master, ultraportable spectrum analyzer, 6 GHz to 145 GHz
MS2762A-0170	Spectrum Master, ultraportable spectrum analyzer, 6 GHz to 170 GHz
<b>Option Number</b>	
MS2760A-0032-0098	Standard Calibration (ISO/IEC 17025 and ANSI/NCSL Z540-1)
MS2760A-0044-0098	
MS2760A-0050-0098	
MS2760A-0070-0098	
MS2760A-0090-0098	
MS2760A-0110-0098	
MS2760A-0145-0098	
MS2760A-0170-0098	
MS2760A-0032-0099	Premium Calibration (ISO/IEC 17025 and ANSI/NCSL Z540-1 plus test data)
MS2760A-0044-0099	
MS2760A-0050-0099	
MS2760A-0070-0099	
MS2760A-0090-0099	
MS2760A-0110-0099	
MS2760A-0145-0099	
MS2760A-0170-0099	
MS2762A-0032-0098	Standard Calibration (ISO/IEC 17025 and ANSI/NCSL Z540-1)
MS2762A-0044-0098	
MS2762A-0050-0098	
MS2762A-0070-0098	
MS2762A-0090-0098	
MS2762A-0110-0098	
MS2762A-0145-0098	
MS2762A-0170-0098	
MS2762A-0032-0099	Premium Calibration (ISO/IEC 17025 and ANSI/NCSL Z540-1 plus test data)
MS2762A-0044-0099	
MS2762A-0050-0099	
MS2762A-0070-0099	
MS2762A-0090-0099	
MS2762A-0110-0099	
MS2762A-0145-0099	
MS2762A-0170-0099	

### Standard Accessories (included with instrument)

Part Number	Description
2300-1859-R	USB 3.0 Type C to Type A Cable, 1 m
2300-1605-R	BNC(m) to MCX(m) Cable (qty 2)
Certificate of Calibration and Conformance	

### Manuals (available at [www.anritsu.com](http://www.anritsu.com))

Part Number	Description
10580-00427	User Guide

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