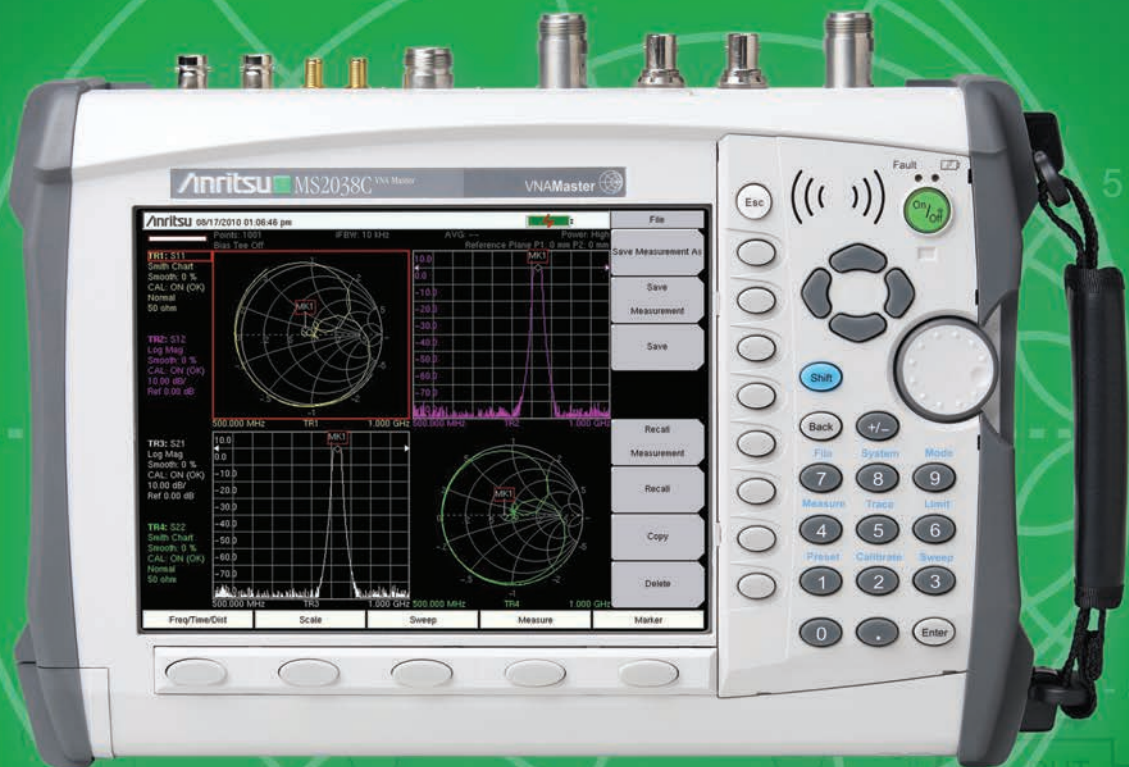


# VNA Master™

## Handheld Vector Network Analyzer + Spectrum Analyzer

MS2026C	MS2027C	MS2028C	Vector Network Analyzer
5 kHz to 6 GHz	5 kHz to 15 GHz	5 kHz to 20 GHz	
MS2036C	MS2037C	MS2038C	Vector Network Analyzer Spectrum Analyzer
5 kHz to 6 GHz 9 kHz to 9 GHz	5 kHz to 15 GHz 9 kHz to 15 GHz	5 kHz to 20 GHz 9 kHz to 20 GHz	

The Ultimate Handheld Vector Network + Spectrum Analyzer



### High Performance Handheld S-Parameters

# VNA Master™ MS202xC/3xC Features

## Overview

### Introduction

In any field, the title “Grand Master” suggests the ultimate level of skill, experience, accomplishment and recognition. The VNA Master™ MS202xC/3xC series truly embodies this distinction among Vector Network Analyzers, offering unmatched performance in a handheld solution for 2-port, 2-path measurements, anytime, anywhere.

The VNA Master specifically addresses complex cable, waveguide and antenna measurement needs in the field with accurate, vector corrected 2-port magnitude, phase, and Time or Distance Domain measurements. The MS203xC models also offer a high-performance spectrum analyzer with ultra-low noise floor. Based on Anritsu’s industry-leading handheld platform, the VNA Master offers unmatched measurement breadth, depth, and precision; reducing the number of different tools needed to analyze modern communication systems on land, sea, air and in space.



Global Communications



National Defense

### Vector Analyzer Key Features

- True 2-Path 2-Port fully-reversing VNA; measures and displays all S-parameters with a single connection.
- 5 kHz to 6/15/20 GHz; the industry’s first 20 GHz handheld VNA
- Ultra-fast 350  $\mu$ sec/data point sweep speed, ideal for filter tuning with ultimate flexibility in the number of points from 2 to 4001
- 12-term error correction algorithm
- Vector Voltmeter option, ideal for cable phase matching
- Time Domain option for precise Time or Distance Domain diagnostics, includes Gated Time Domain, LP Processing, and Phasor Impulse mode

### + Spectrum Analyzer Key Features

- 9 kHz to 9/15/20 GHz
- Detectors: Peak, Negative, Sample, Quasi-peak, and True RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Built-in pre-selector for eliminating spurious in displays
- Interference Analyzer Option: Spectrogram, Signal Strength, RSSI
- AM/FM/PM Modulation Analyzer Option: Carrier Power, Center Frequency, Occupied Bandwidth, Audio Waveform & Spectrum, Deviation, SINAD, THD

### Handheld VNA Master platform Key Features

- High-resolution, intuitive Graphical User Interface (GUI)
- Portable < 4.8 kg (10.5 lbs) and battery-powered – replaces bulky benchtop VNAs – no need for instrument carts or AC generators when working in the field!
- 8.4” daylight-viewable display offers hands-free operation while viewing measurement results
- USB and optional Ethernet connectivity supports remote programming/control and data storage
- Available display selections of normal, high contrast, night vision, black & white, and invert colors
- Military-grade ESD protection
- Optional Secure Data Handling offers increased security features including Frequency Blanking capabilities

### Standards Compliance

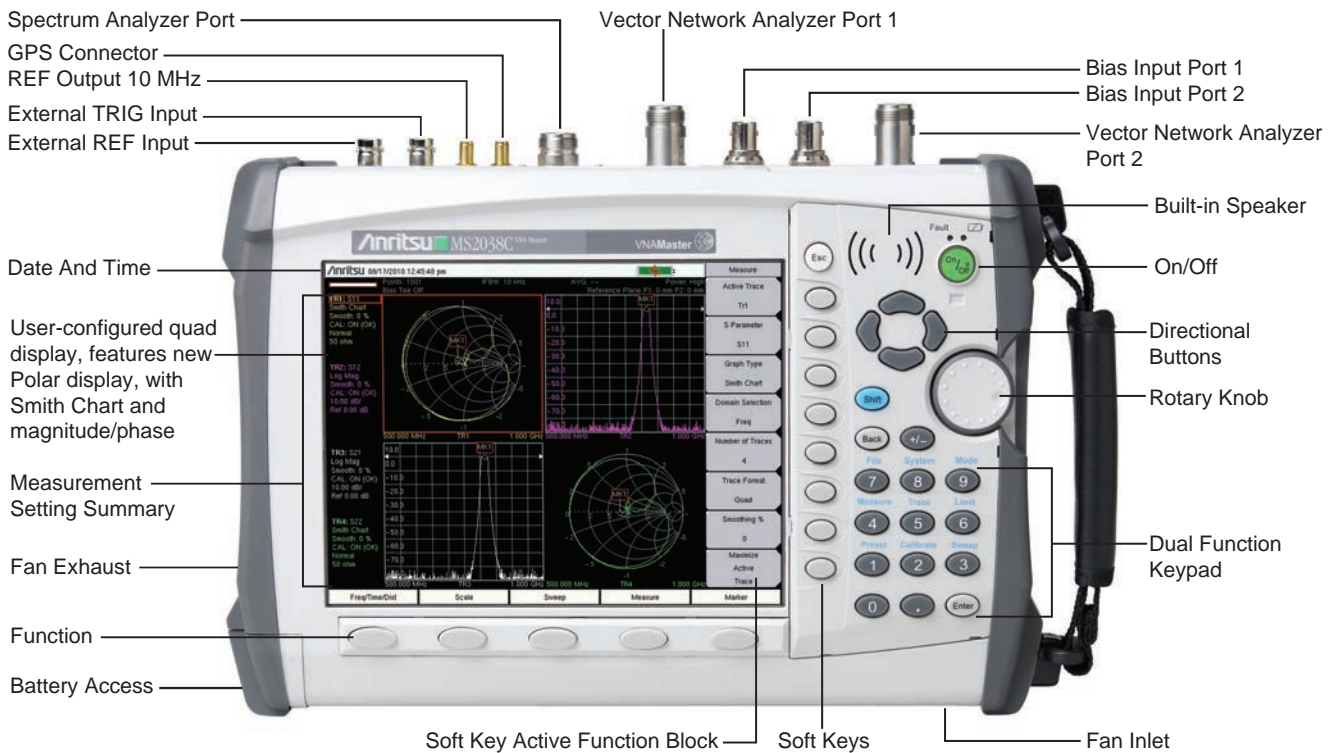
- MIL-PRF-28800F Class 2
- MIL-PRF-28800F Section 4.5.6.3 and MIL-STD-810F Method 511.4 (for Explosive Atmosphere)

# VNA Master™ MS202xC/3xC Features

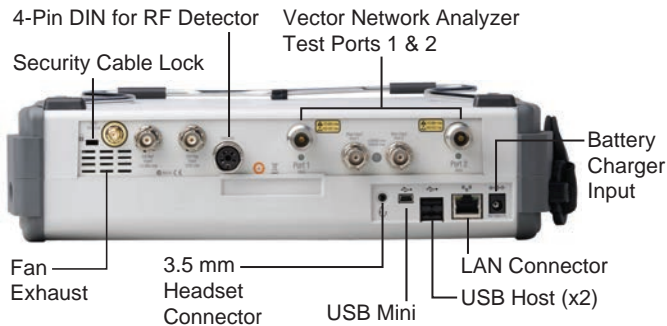
## Overview (continued)

The dynamic range, speed, accuracy and compact form factor of the VNA Master are ideal for demanding field use situations including aerospace & defense, SATCOM, commercial wireless backhaul, and research applications.

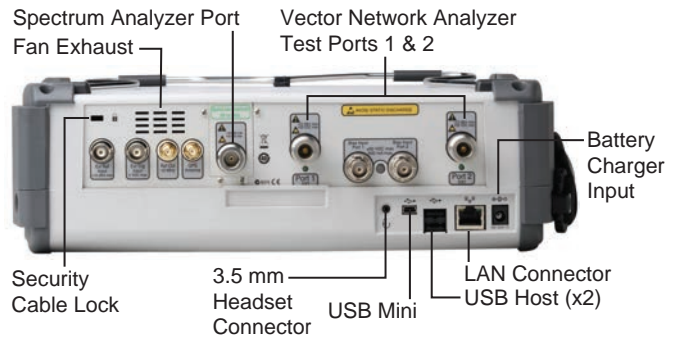
VNA Master Models Fully Reversing 2-Port	Vector Network Analyzer	Vector Network Analyzer with Spectrum Analyzer
MS2026C	5 kHz to 6 GHz	
MS2027C	5 kHz to 15 GHz	
MS2028C	5 kHz to 20 GHz	
MS2036C	5 kHz to 6 GHz	9 kHz to 9 GHz
MS2037C	5 kHz to 15 GHz	9 kHz to 15 GHz
MS2038C	5 kHz to 20 GHz	9 kHz to 20 GHz



### MS202xC VNA MASTER



### MS203xC VNA MASTER + SPECTRUM ANALYZER



Handheld size: 211 mm x 315 mm x 78 mm (8.3 in x 12.4 in x 3.1 in) (MS202xC)  
 211 mm x 315 mm x 97 mm (8.3 in x 12.4 in x 3.8 in) (MS203xC)

Light weight: 4.5 kg (9.9 lbs) (MS202xC), 4.8 kg (10.5 lbs) (MS203xC)



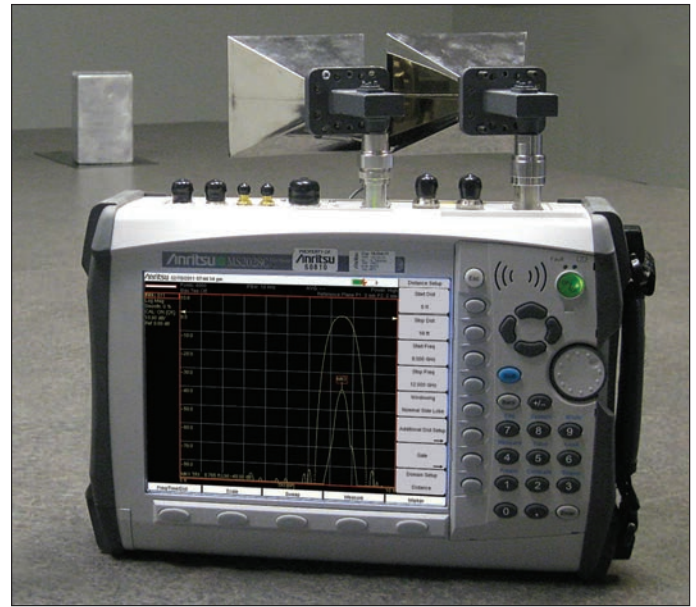
# VNA Master™ MS202xC/3xC Features

## Overview (continued)

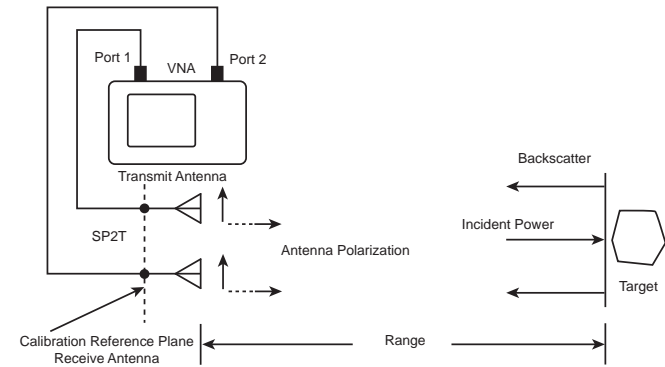
### Application Spotlight: Measurement of Radar Cross Section (RCS) using the VNA Master MS202xC

Radar cross section (RCS) is the measure of an object's ability to reflect radar signals in the direction of the radar receiver. The VNA Master makes it easy to do RCS tests on the flight line or in the field.

A typical aircraft RCS measurement configuration using a VNA is shown here. The transmit antenna (connected to port 1 of the VNA) and receive antenna (connected to port 2 of the VNA) are positioned in the same plane as shown. The measurement target consists of the aircraft either mounted on a low reflection pedestal or a standalone on a flight line.

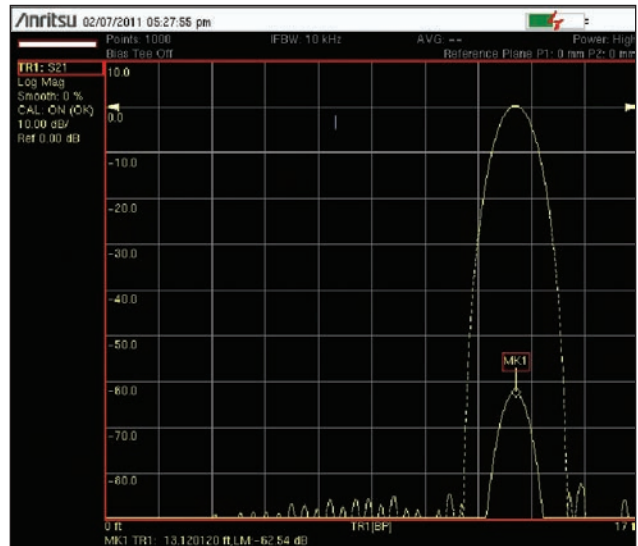


MS2028C with waveguide antenna



Block diagram for VNA measurement of RCS.

The target in this case is a known calibration standard which is positioned in the target area. The calibration standard reflection is identified and a range gate is placed on the calibration standard to remove all other reflections as shown here. The amplitude  $S_{21(tstd)}$  of the calibration standard reflection is measured. The  $S_{21}$  measurement in dB corresponds to the known RCS (in square meters).



Target reflection from a 6" Diameter Calibration Sphere (RCS = 0.018 m<sup>2</sup>).

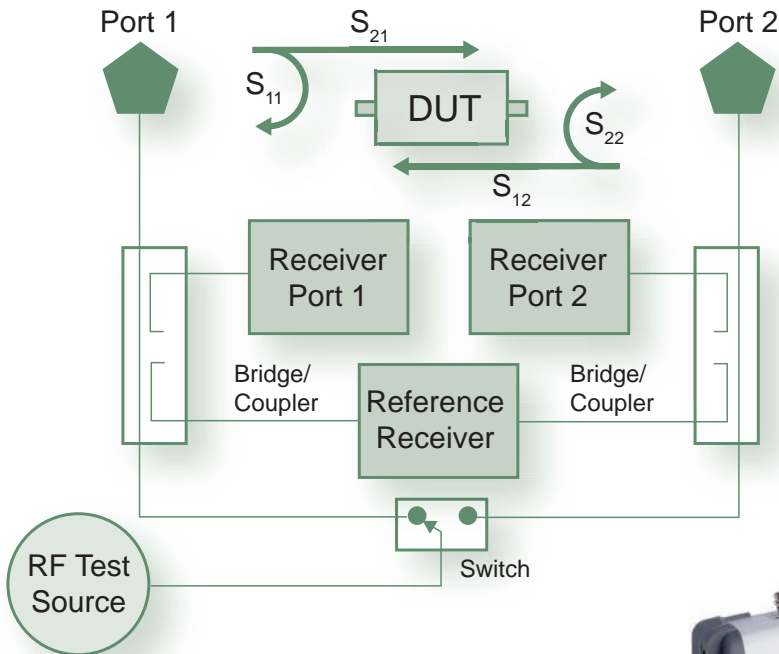
# VNA Master™ MS202xC/3xC Features

## Overview (continued)

### MS202xC/3xC Highlights: Vector Network Analyzer

- The ultimate accuracy of a fully-reversing 2-port architecture
- Measures all four S-parameters with a single connection:  $S_{11}$ ,  $S_{21}$ ,  $S_{12}$ , and  $S_{22}$
- Guaranteed 100 dB dynamic range to 3 GHz, 90 dB to 6 GHz, and 85 dB to 20 GHz for stop band filter rejection measurements
- World's fastest handheld display updates of 350  $\mu$ sec/data point for real-time filter tuning
- Polar and Smith Chart displays for added readout versatility
- Overlay screen formats for user-configured up-to-4 trace display
- Selectable IF Bandwidths of 10 Hz to 100 kHz – one calibration satisfies both fast sweeps and best dynamic range
- Arbitrary selection of 2 to 4001 data points for more overall resolution instead of save/recall multiple calibrations
- Improved frequency resolution of 1 Hz to 375 MHz, 10 Hz to 6 GHz, and 100 Hz to 20 GHz
- Available options for Vector Voltmeter, Integrated Bias Tee, Differential S-parameters (for balanced lines, SERDES channels, SATA, etc.), and Distance Domain analysis

The VNA Master has a 2-port, 2-path architecture that automatically measures four S-parameters with a single connection. There are three receivers, so the forward sweep from Port 1 simultaneously yields  $S_{11}$  and  $S_{21}$ , and the reverse sweep from Port 2 simultaneously yields  $S_{22}$  and  $S_{12}$ . The four S-parameters for a two-port DUT require only two sweeps, both forward and reverse transmission. With just one connection, the VNA Master provides both precision measurements and hands-free operation.



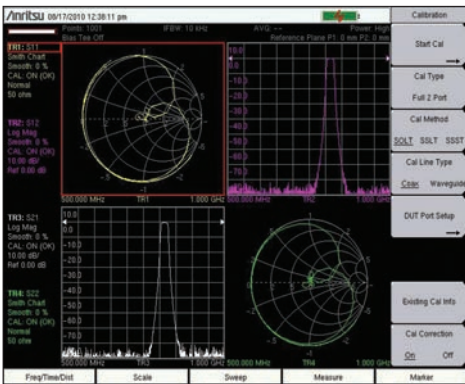
The functional block diagram of the VNA Master is shown in this illustration. The DUT is connected between Port 1 and Port 2 as shown. The switch alternates the source between forward and reverse transmission sweeps so all four S-parameters are measured in a single connection. With three receivers, the MS202xC/3xC only needs two sweeps to measure all 4 S-parameters so real-time display updates in excess of 350  $\mu$ sec/point are available for tuning filters and isolating faults in the field.



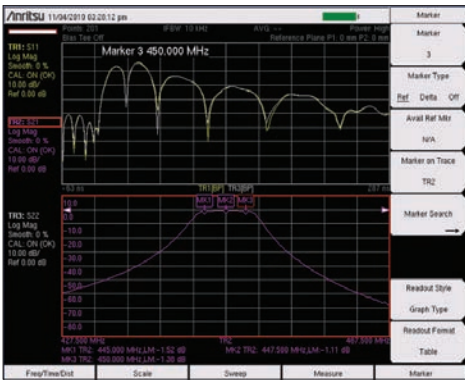
# VNA Master™ MS202xC/3xC Features



## 2 Port Vector Network Analyzer



The VNA Master's unique quadrature display provides simultaneous display of all S-parameters and allows you to mix frequency, time, and distance domain displays as needed.



The VNA Master MS202xC/3xC is the only handheld which offers Time Domain analysis for field alignment of cavity filters and combiners.

### 2 Port Vector Network Analyzer

VNA Master features a 2-port Vector Network Analyzer to be able to test and verify the performance of feedline, filtering, and antenna components. This includes:

- Connectors
- Cables/Jumpers
- Antenna Isolators
- Multicouplers/Diplexers/Duplexers
- Tower Mounted Amplifiers
- Waveguides/Couplers/Feedhorns

2-port Transmission Measurements can help identify poor filter adjustment, antenna isolation, and degraded tower mounted amplifiers. The goal of these measurements is to maximize the system coverage and capacity with problem-free base stations.

### Antenna System Failure Mechanisms

Maintenance is an on going requirement as antenna system performance can degrade at any point in time due to:

- Loose connectors
- Debris in waveguides
- Improperly weatherized connectors
- Pinched cables
- Poor grounding
- Corroded connectors
- Lightning strikes
- Strong winds misaligning antennas
- Water intrusion into cables and waveguides
- Bullet holes, nails, or rodent damage to the cable

### Making Measurements Easier

The VNA Master provides features for making measurements easier to perform and for analyzing test results such as:

- Fast sweep speed, measurement point selection, and flexible display formats make it easy to view and adjust base station RF system performance
- High RF Immunity mode for testing in harsh RF environments
- Trace Overlay compares reference traces to see changes over time
- Limit Lines and Alarming for providing reference standards
- High and Low Power output selection to test tower-top components without climbing the tower
- Internal Bias-Tee to power up TMAs for testing when off-line
- GPS tagging of data to verify location of tests
- User-selectable menu scheme offers choice of either full VNA capability or simplified cable and antenna user interface.

### Measurements

- VNA Measurements
  - Log Mag
  - SWR
  - Phase
  - Smith Chart
  - Group Delay
  - Linear Polar
  - Log Polar
  - Log Mag/2 (1 port cable loss)
  - Real
  - Imaginary
  - Real Impedance
  - Imaginary Impedance
- Windowing Functions in Distance Domain
  - Rectangular
  - Normal Side Lobe
  - Low Side Lobe
  - Minimum Side Lobe
- Domains
  - Frequency
  - Time
  - Distance
  - Frequency gated by time (FGT)
  - Frequency gated by distance (FGD)
- Low Pass Response
  - Impulse
  - Step
- Gate
  - Gate On/Off/Display
  - Start, Stop, Center, Span (Distance or Time)
  - Notch On/Off
  - Gate Shape Min/Nominal/Wide/Max

### Calibration

- User-variable Data Points from 2 to 4001
- Full 2-port ( $S_{11}$ ,  $S_{21}$ ,  $S_{12}$ ,  $S_{22}$ )
- Full  $S_{11}$  or  $S_{22}$  (Open, Short, Load)
- Full  $S_{11}$  &  $S_{22}$
- Reflection Response  $S_{11}$  or  $S_{22}$
- Reflection Response  $S_{11}$  &  $S_{22}$
- Transmission Response  $S_{21}$  or  $S_{12}$
- Transmission Response  $S_{21}$  &  $S_{12}$
- 1P2P  $S_{11}$  &  $S_{21}$  (Forward Path)
- 1P2P  $S_{22}$  &  $S_{12}$  (Reverse Path)

### Sweep Functions

- IFBW
- Run/Hold, Single/Continuous/External
- RF Immunity (High/Low)
- Averaging/Smoothing
- Port Power (High/Low)

### Trace Functions

- Save/Recall, Copy to Display Memory
- No Trace Math, Trace  $\pm$  Memory
- Trace Overlay

### Marker Functions

- 1-8 Markers each with a Delta Marker
- Marker to Peak/Valley
- Marker to/Peak Valley between Markers
- Marker Table

### Limit Line Functions

- Limit Lines
  - Single Limit
  - Multi-segment (41)
  - Limit Alarm
- Limit Line Edit
  - Frequency, Amplitude
  - Add/Delete Point
  - Next Point Left/Right
  - Move Limit

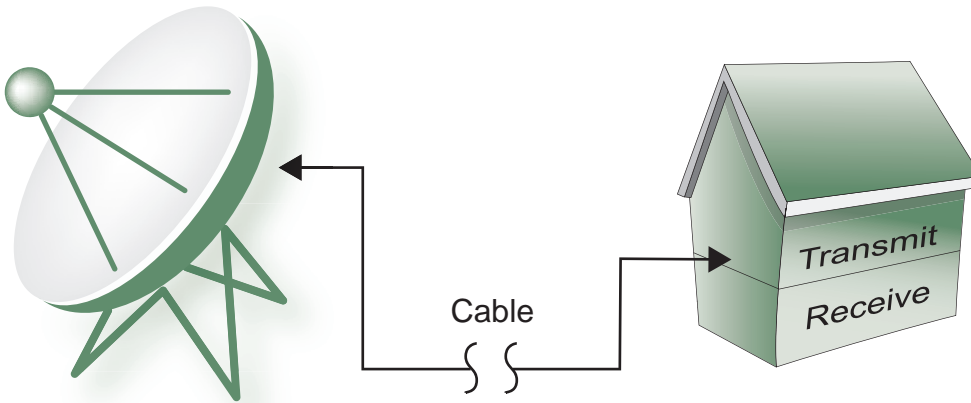
# VNA Master™ MS202xC/3xC Features

## Overview

### MS203xC Highlights: VNA + Spectrum Analyzer

- Two-port vector network analysis to 6/15/20 GHz that supports both coaxial and waveguide connector types
- True 2-port, 12-term error correction calibrations — outstanding calibration stability
- Fully reversing architecture with three receivers support fast measurements of 350  $\mu$ sec/point
- Broadband Spectrum Analysis (9 kHz to 9/15/20 GHz - MS203xC models only)
- Optional Vector Voltmeter (VVM) mode
- Available Options for Time and Distance Domain Analysis, Internal Bias Tee, Balanced/Differential Analysis, and Secure Data Storage
- Options for remote sensors and higher accuracy
- Optional Interference Analysis
- Optional Channel Scanner
- Optional AM/FM/PM Modulation Analyzer

The VNA Master™ MS202xC/3xC series is a compact handheld multi-function instrument that offers a portable yet powerful vector network analyzer, allowing you to do S-parameter analysis in the field — anytime, anywhere. The MS203xC models also offer a high-performance spectrum analyzer with industry-leading ultra-low noise floor. Based on Anritsu's 8th generation handheld platform, the VNA Master offers unmatched measurement breadth, depth, and precision; reducing the number of different tools needed to analyze modern communication systems in the field, on a tower, on a flightline, or in a vehicle.



The RF and Microwave Spectrum is crowded with many wireless systems that provide critical services. In this illustration, a simplified block diagram of a typical wireless system is shown, which consists of antenna, cable, and transmit/receive capabilities.

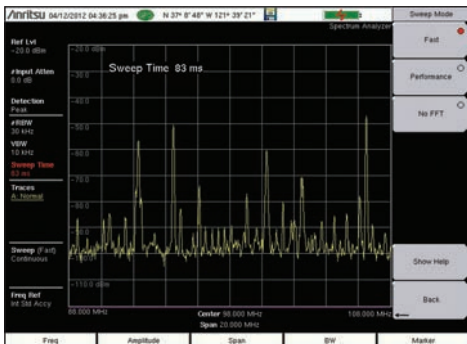




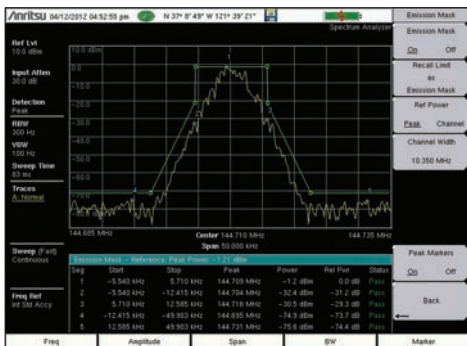
# VNA Master™ MS202xC/3xC Features



## MS203xC Highlights: VNA + Spectrum Analyzer



The spectrum analyzer mode in the VNA Master MS203xC offers fast sweep speeds for interference hunting intermittent signals.



The Spectrum Analyzer mode in the VNA Master MS203xC offers automated measurements including occupied bandwidth, adjacent channel power, and emission mask, as shown above. The mask can be quickly created using the standard limit line editor. The emission mask measurement function automatically moves the trace to match the peak of a modulated signal to conform to common mask standards.

### Simple but Powerful

The goal of Spectrum Analyzer measurements is to accurately monitor, measure, and analyze RF signals and their environments. It finds rogue signals, measures carriers and distortion, and verifies base stations' signal performance. It validates carrier frequency and identifies desired and undesired signals.

The VNA Master MS203xC models feature the most powerful handheld spectrum analyzer in their class with unmatched performance in:

- Sensitivity
- Dynamic Range
- Phase Noise
- Frequency Accuracy
- Sweep Speed

The VNA Master offers full control over bandwidth and sweep settings, or can be set to automatically optimize for best possible trade-off between accuracy and speed.

### GPS-Enhanced Frequency Accuracy

With GPS Option 31 the spectrum analyzer frequency accuracy (for MS203xC models) is improved to < 25 ppb (parts per billion) while the GPS is locked. After 3 minutes of GPS lock, the GPS antenna can be removed and the MS203xC will maintain 50 ppb frequency accuracy for up to 72 hours.

### Rx Noise Floor Testing

The VNA Master can measure the receive noise floor on a base station's uplink channel using the channel power measurement. An elevated noise floor indicates interference that can lead to call blocking, denial of service, call drops, low data rates, and lowered system capacity.

### Measurements

- One Button Measurements
  - Field Strength - in dBm/m<sup>2</sup> or dBm/V/m
  - Occupied Bandwidth - 1% to 99% of power
  - Emission Mask
  - Channel Power - in specified bandwidth
  - ACPR - adjacent channel power ratio
  - AM/FM/SSB Demodulation - audio out only
  - C/I - carrier-to-interference ratio

### Sweep Functions

- Sweep
  - Single/Continuous, Manual Trigger, Reset, Minimum Sweep Time
- Detection
  - Peak, True RMS, Negative, Sample, Quasi-peak
- Triggers
  - Free Run, External, Video, Change Position, Manual

### Trace Functions

- Traces
  - 1-3 Traces (A, B, C), View/Blank, Write/Hold
- Trace A Operations
  - Normal, Max Hold, Min Hold, Average, Number of Averages, (always the live trace)
- Trace B Operations
  - A → B, B ← C, Max Hold, Min Hold
- Trace C Operations
  - A → C, B ← C, Max Hold, Min Hold, A - B → C, B - A → C, Relative Reference (dB), Scale

### Marker Functions

- Markers
  - 1-6 Markers each with a Delta Marker, or Marker 1 Reference with 6 Delta Markers
- Marker Types
  - Fixed, Tracking, Noise, Frequency Counter
- Marker Auto-Position
  - Peak Search, Sequential Peak (Right/Left), Peak Threshold %, To Channel, To Center, To Reference Level, Delta Marker to Span
- Marker Table
  - 1-6 markers' frequency & amplitude plus delta markers' frequency offset & amplitude

### Limit Line Functions

- Limit Lines
  - Upper/Lower, Limit Alarm, Default Limit
- Limit Line Edit
  - Frequency, Amplitude, Add/Delete Point, Add Vertical, Next Point Left/Right
- Limit Line Move
  - To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
- Limit Line Envelope
  - Create, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope
- Limit Line Advanced
  - Absolute/Relative, Mirror, Save/Recall



# VNA Master™ MS202xC/3xC Features



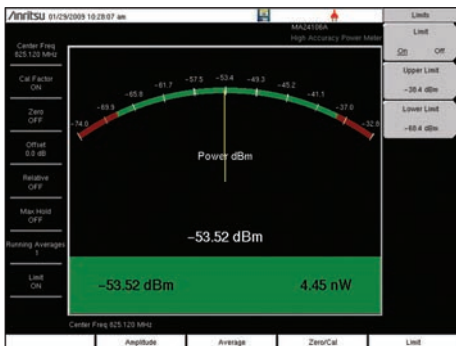
## Power Meter

## High Accuracy Power Meter (Option 19)



### Power Meter Built-in

Power is displayed in an analog type display and, supports both Watts and dBm. RMS averaging can be set to low, medium, or high.



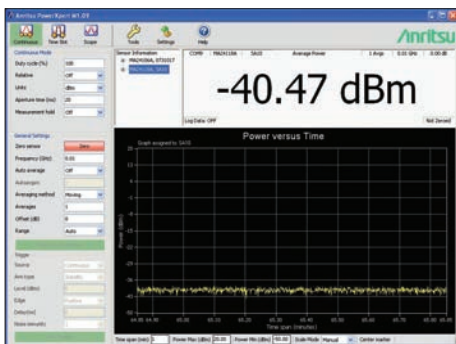
### High Accuracy Power Meter

Requires external power sensor with convenient connection via a USB A/mini-B cable. Use upper/lower limit activation during pass/fail measurements.



### USB Power Sensor

Anritsu offers a family of Power Sensors for your power measurement requirements. They are compact enough to fit in your shirt pocket.



### PC Power Meter

These power sensors can be used with a PC running Microsoft Windows® via USB. A front panel display makes the PC appear like a traditional power meter.

### Power Meters

The VNA Master offers a standard built-in Power Meter utilizing the Spectrum Analyzer and an optional High Accuracy Power Meter when used with optional external power sensors.

Properly setting the transmitter output power of a base station is critical to the overall operation of a wireless network. For example; 1.5 dB change in power levels indicates a 15% change in coverage area. Too much power means overlapping coverage that translates into cell-to-cell self interference. Too little power, or too little coverage, creates island cells with non-overlapping cell sites and reduced in-building coverage. High or low values will cause dead zones/dropped calls, lower data rates/reduced capacity near cell edges, and cell loading imbalances/blocked calls.

### High Accuracy Power Meter (Option 19)

To address the most accurate power measurement requirements, select the high accuracy measurement option and a choice of sensors with:

- Frequency ranges: 10 MHz to 26 GHz<sup>1</sup>
- Power ranges: -40 dBm to +51.76 dBm<sup>1</sup>
- Measurement uncertainties: ± 0.18 dB

<sup>1</sup>Depending on choice of sensor

These sensors enable users to make accurate measurements for CW and digitally modulated signals for VNA and cellular wireless networks.

The power sensor easily connects to the VNA Master via a USB A/Mini-B cable. An additional benefit of using the USB connection is that a separate DC supply (or battery) is not needed because the necessary power is supplied by the VNA Master's USB host port.

### PC Power Meter

Anritsu power sensors can be used stand-alone with a PC running Microsoft Windows® via USB. They come with the PowerXpert™ application, an advanced data analysis and control software. The application has abundant features, such as data logging, power vs. time graph, large numerical display, and many more features, that enable quick and accurate measurements.

### Remote Power Monitoring via LAN

A USB-to-LAN hub converter enables remote power monitoring via the Internet, if desired.

### Power Sensors

#### PSN50

- High Accuracy RF Power Sensor
  - 50 MHz to 6 GHz
  - Type N(m), 50 Ω
  - -30 dBm to +20 dBm (.001 mW to 100 mW)
  - True-RMS

#### MA24105A

- Inline Peak Power Sensor
  - 350 MHz to 4 GHz
  - +3 dBm to +51.76 dBm (2 mW to 150 W)
  - True-RMS

#### MA24106A

- RF USB Power Sensor
  - 50 MHz to 6 GHz
  - -40 dBm to +23 dBm (0.1 μW to 200 mW)
  - True-RMS

#### MA24108A

- Microwave USB Power Sensor
  - 10 MHz to 8 GHz
  - -40 dBm to +20 dBm (0.1 μW to 100 mW)
  - True-RMS
  - Slot Power
  - Burst Average Power

#### MA24118A

- Microwave USB Power Sensor
  - 10 MHz to 18 GHz
  - -40 dBm to +20 dBm (0.1 μW to 100 mW)
  - True-RMS
  - Slot Power
  - Burst Average Power

#### MA24126A

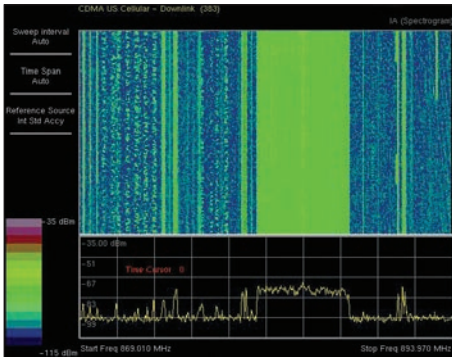
- Microwave USB Power Sensor
  - 10 MHz to 26 GHz
  - -40 dBm to +20 dBm (0.1 μW to 100 mW)
  - True-RMS
  - Slot Power
  - Burst Average Power

# VNA Master™ MS202xC/3xC Features



## Interference Analyzer (Option 25)

## Channel Scanner (Option 27)



With Option 25, spectrogram measurements identifies intermittent interference.

### Interference Analyzer (Option 0025) (Models MS203xC only)

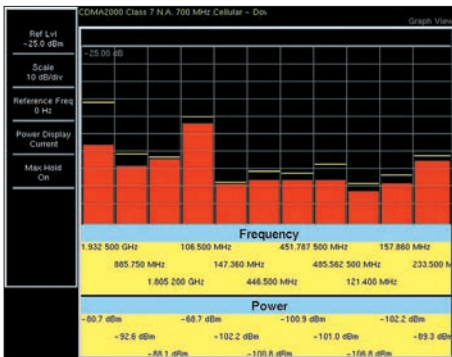
With its built-in low-noise preamplifier, the MS203xC models with interference analyzer option provides the ability to identify and locate interfering signals down to the noise floor, allowing technicians to better address the quality issues that affect user service.

#### 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 MS203xC can record spectrum data to internal memory for up to 72 hours.

### Interference Analyzer Measurements

- Spectrogram
- Signal Strength Meter
- Received Signal Strength Indicator (RSSI)
- Signal ID (up to 12 signals)
  - FM
  - GSM/GPRS/EDGE
  - W-CDMA/HSPA+
  - CDMA/EV-DO
  - Wi-Fi
- Spectrum
  - Field Strength - in dBm/m<sup>2</sup> or dBmV/m
  - Occupied Bandwidth - 1% to 99% of power
  - Channel Power - in specified bandwidth
  - ACPR - adjacent channel power ratio
  - AM/FM/SSB audio monitor
  - C/I - carrier-to-interference ratio



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

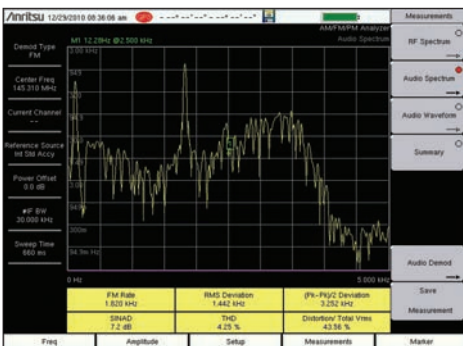
### Channel Scanner (Option 0027) (Models MS203xC only)

The channel scanner option measures the power of multiple transmitted signals and is very useful for measuring channel power in up to 20 channels at the same time. Display data in graph or table format. In the custom setup menu each channel can be custom built with different frequency, bandwidth, or channels for convenient simultaneous analysis of a variety of different signal standards.

### Channel Scanner

- Scan
  - 20 channels at once, by frequency or channel
  - Noncontiguous channels
  - Different channel bandwidths in one scan
- Display
  - Current plus Max hold display
  - Graph View
  - Table View
- Script Master™
  - Up to 1200 Channels
  - Auto-repeat sets of 20 channels and total
  - Auto-save with GPS tagging

## AM/FM/PM Modulation Measurements (Option 509)



The AM/FM/PM Option 509 displays the demodulated audio spectrum vs. frequency with AM (%), Deviation (kHz) or Deviation (rad) for AM/FM/PM, respectively.

### AM/FM/PM Modulation Analyzer (Option 0509) (Models MS203xC only)

Integrated modulation analysis of AM, FM, or PM provides tools to ensure optimum analog system performance. The RF Spectrum View displays the RF spectrum with carrier power (power in dB vs. frequency) along with center frequency, and occupied BW. Audio Spectrum shows the demodulated audio spectrum along with the modulation rate, RMS deviation, Pk-Pk deviation (FM/PM) or depth (AM), SINAD, Total Harmonic Distortion (THD), and Total Distortion. The user can easily monitor modulation performance with an oscilloscope display of the demodulated audio spectrum vs. time in units of AM Depth (%), Deviation (kHz), or Deviation (rad). A summary table shows a tabular list of all the RF and Demod measurement results. Audio performance of AM, USB, LSB, and FM systems can be monitored via the built-in demodulator.

### Measurements

- Carrier Power
- Center Frequency
- Occupied Bandwidth
- FM/PM Deviation
- AM Depth
- Modulation Rate
- SINAD
- THD
- Total Distortion

### Displays

- RF Spectrum
- Audio Waveform
- Audio Spectrum

### Audio Demodulation

- AM/USB/LSB/FM
- Squelch
- Volume



## Distance Domain Analysis (Option 501)

### Wire Cable Bundle Diagnostics for Aircraft and Shipboard

This innovative new Distance-to-Fault technique finds damaged aircraft wire bundles at bulkheads or other points of vulnerability. It uses the Time Domain option and Frequency Domain Reflectometry with special fixtures to launch high frequency sweep signals into the wiring harnesses. Find out more by downloading Anritsu's Application Note 11410-00565, "Troubleshoot Wire Cable Assemblies with Frequency-Domain-Reflectometry."

### Distance Domain (Option 501)

Distance-to-Fault Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the VNA Master sweeps a user-specified band of full power operational frequencies (instead of fast narrow pulses from TDR-type approaches) to more precisely identify discontinuities. The VNA Master converts S-parameters from frequency domain into distance (or time) domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar time domain analysis is available on transmission ( $S_{21}$ ) measurements.

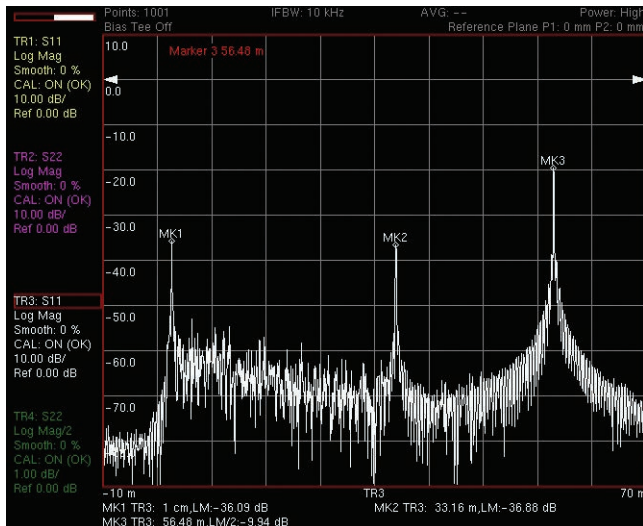
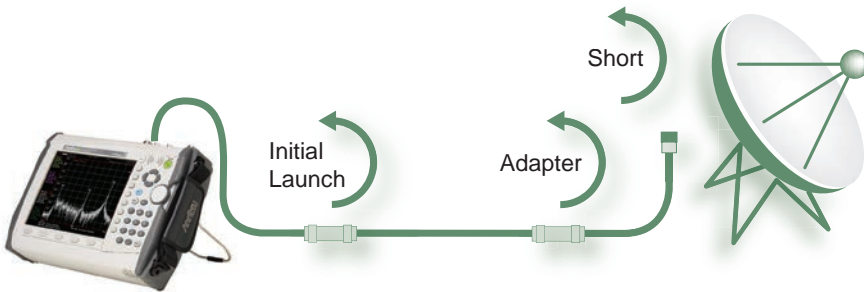
Option 501 Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and so minimize or prevent downtime of the system.

### Measurements

- DTF Return Loss
- DTF Insertion Loss

### Setup Parameters

- Start Distance
- Stop Distance
- Start Frequency (FDR)
- Stop Frequency (FDR)
- Windowing: Rectangular, Nominal Side Lobe, Low Side Lobe, Minimum Side Lobe
- Propagation Velocity
- Cable Loss
- Units: meters or feet
- Distance Info display



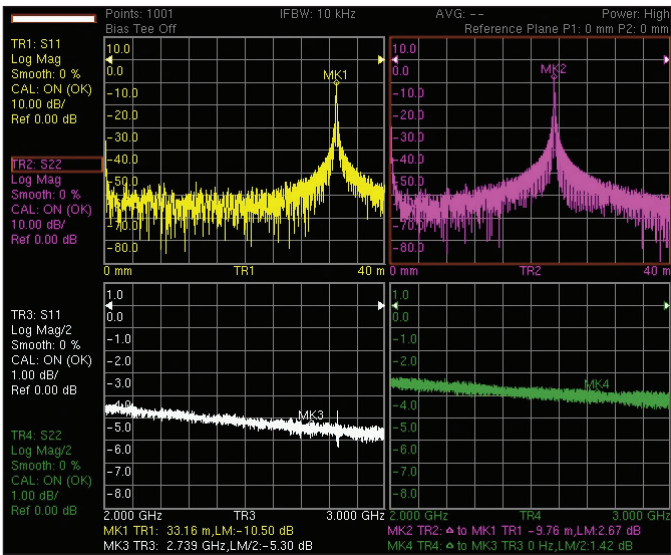
### Distance-to-Fault Analysis

This illustration shows a typical cable measurement scenario with an adapter between the near and far end of the cable. With a short on the far end, the VNA Master can convert frequency domain results into corresponding distance-domain readout. Moving left to right, we can see the initial launch (MK1), the intermediate adapter (MK2), and the short at the far end of the cable (MK3). It is easy to interpret the discontinuities as normal or faults by simply looking at the location and amplitude of the peaks. Since the short shows as -20 dB, this means that the one-way cable loss must be 10 dB.





## Time Domain (Option 2)



Optional time domain analysis offers trace selections for the horizontal axis in frequency, distance, or time scales. This screen simultaneously shows distance-to-fault and cable loss (Log Mag|S<sub>11</sub> / 2) for S<sub>11</sub> and S<sub>22</sub>.

## Power Monitor (Option 5)

### Time Domain Analysis (Option 0002)

The VNA Master can display the S-parameter measurements in the time or distance domain using this popular analysis mode. The broadband frequency coverage coupled with 4001 data points means you can measure discontinuities both near and far with clarity unprecedented in a hand held tool. With this option, you can simultaneously view S-parameters in frequency, time, and distance domain to quickly identify faults in the field. Further enhance the Distance-to-Fault (DTF) results by compensating for loss and relative propagation velocity (for cables) or cutoff frequency and dispersion (for waveguides).

Side lobes are inherent by-products of time domain analysis. They can distort DTF results, especially when simultaneously measuring both small and large discontinuities in close proximity to each other. To more easily interpret DTF results, the VNA Master offers the following windowing selections to help optimize results (in increasing side lobe reduction order): rectangular, nominal, low, and minimum side lobe. These windowing selections trade-off side lobe level with resolution by smoothing out sharp transitions caused by the selected start and stop frequencies. LP Processing and Gated Time Domain functions have been added to offer more user choice on display clarity.

Option 0002 includes the Distance-to-Fault Option 0501. This provides both the normal DTF diagnostics as well as providing more extensive data such as time separation of internal reflections of components.

### Power Monitor (Option 0005) (Models MS202xC only)

Transmitter measurements in the field are possible when using this VNA Master software mode with a separately purchased Anritsu 560 series detector. A variety of detectors are available. The popular 560-7N50B covers 10 MHz to 20 GHz with a measurement range of -50 dBm to +20 dBm with better than 0.5 dB flatness to 18 GHz. After zeroing the detector to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts.



The easy-to-view Power Monitor option offers convenient transmitter measurements in the field.

# VNA Master™ MS202xC/3xC Features

## Secure Data Operation (Option 7)

## K(f) Test Port Connectors (Option 11)



For secure environments, VNA Master will only use external USB memory as an external drive for storage when configured with Option 0007. Internal memory is disabled for data storage.

### Secure Data Operation (Option 0007)

For highly secure data handling requirements, this software option prevents the storing of measurement setup or data information onto any internal file storage location. Instead, setup and measurement information is stored ONLY to the external USB memory location. A simple factory preset prepares the VNA Master for transportation while the USB memory remains behind in the secure environment. Once configured for secure data operation, the VNA Master cannot be switched between secure and non-secure operation by the user.

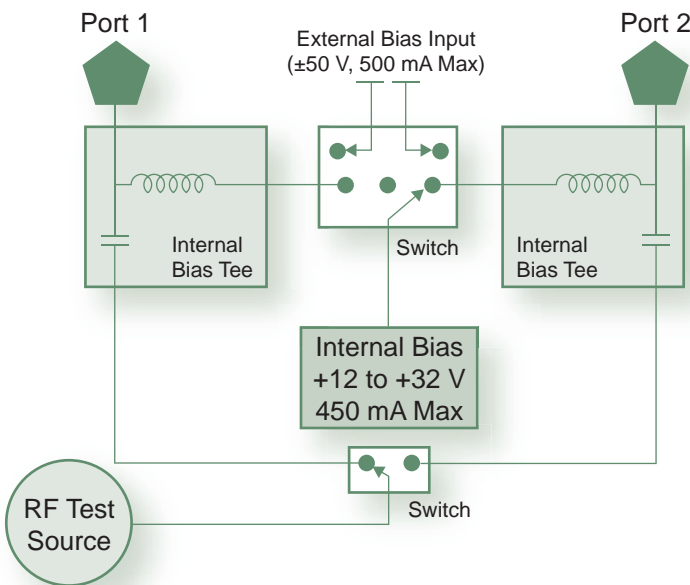
### Bias Tee (Option 0010)

For tower mounted amplifier tests, the MS202xC/3xC series (when configured with the optional internal bias tees) can supply both DC and RF test signals on the center conductor of the cable during measurements. In addition, the VNA Master can supply internal voltage control from +12V to +32V in 0.1V steps up to 450 mA. To extend battery life, an external power supply can substitute for the internal supply by using the external bias inputs instead. Both test ports can be configured to supply voltage via this integrated bias tees option.

### K(f) Test Port Connectors (Option 0011)



Optional K(f) test port connectors are available for precision measurements to 20 GHz.



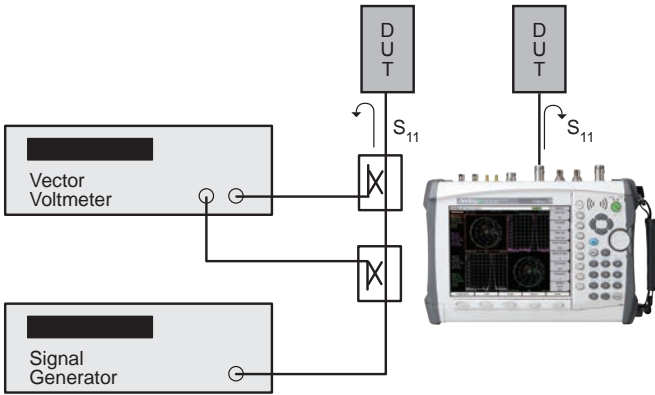
The VNA Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in the simplified block diagram. Connectivity is also provided for external supply (instead of internal) to preserve battery consumption.

# VNA Master™ MS202xC/3xC Features

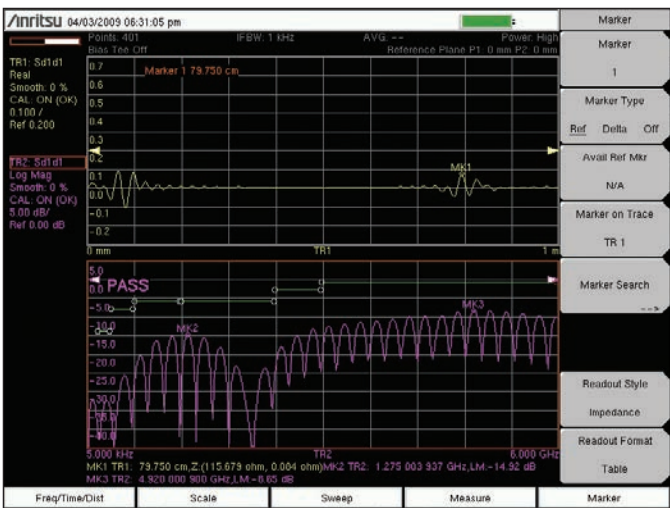


## Vector Voltmeter (Option 15)

## GPS Receiver (Option 31)



Compared to the Vector Voltmeter setup, this side-by-side illustration shows how VNA Master is a completely self-contained turnkey solution with integrated source, receivers, and couplers for phase matching cables.



This display shows a full 6 GHz sweep of a balanced pair of coax lines. If you add the Time Domain option 0002, you can get DTF diagnostics too. Use a full 2-port calibration to conduct one-port differential measurements of  $S_{d1d1}$ . Similar to other S-parameters, you can view  $S_{d1d1}$  in the frequency, time, or distance domain for signal integrity measurements anytime, anywhere.

## Vector Voltmeter (Option 0015)

A phased array system relies on phase matched cables for required performance. For this class of application, the VNA Master offers this special software mode to simplify phase matching cables at a single frequency.

The similarity between the popular vector voltmeter method (using bench instruments) and the VNA Master's Vector Voltmeter application will ensure minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements. The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts. For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables.

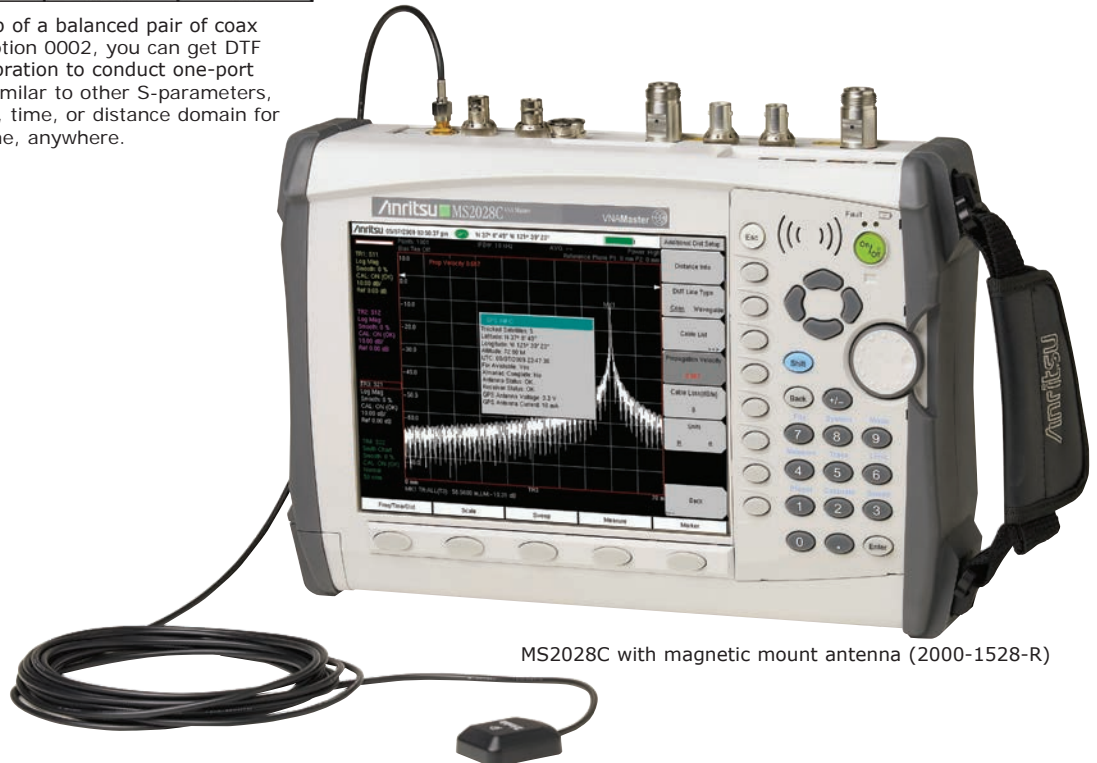
The MS202xC/3xC VVM solution is superior because the signal source is included internally, precluding the need for an external signal generator.

## Balanced/Differential S-Parameters, 1-port (Option 0077)

Verifying the performance and identifying discontinuities in differential cables is now possible with the VNA Master. After a full two-port calibration, connect your differential cable directly to the two test ports and reveal the  $S_{d1d1}$  performance, which is essentially differential return loss. With optional time domain, you can convert frequency sweeps to distance. This capability is especially valuable for applications in high data rate cables where balanced data formats are used to isolate noise and interference.

## GPS Receiver (Option 0031)

Built-in GPS provides location information (latitude, longitude, altitude) and Universal Time (UT) information for storage along with trace data so you can later verify that measurements were taken at the right location. The GPS option requires a separately ordered magnetic mount antenna (2000-1528-R) with a 15 foot (~ 5m) cable to mount outside on a metallic surface.



MS2028C with magnetic mount antenna (2000-1528-R)



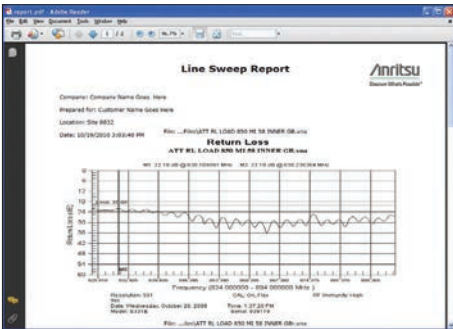
# VNA Master™ MS202xC/3xC Features

## Line Sweep Tools and Master Software Tools (for your PC)



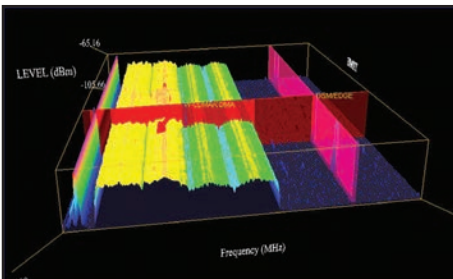
### Trace Validation

Marker and Limit Line presets allow quick checks of traces for limit violations.



### Report Generation

Create reports with company logo, GPS tagging information, calibration status, and serial number of the instrument for complete reporting.



### 3D Spectrogram

For in-depth analysis with 3-axis rotation viewing, threshold, reference level, and marker control. Turn on Signal ID to see the types of signals.

## Line Sweep Tools™

Line Sweep Tools increases productivity for people who deal with dozens of Cable and Antenna traces, or Passive Inter-Modulation (PIM) traces, every day.

### User Interface

Line Sweep Tools has a user interface that will be familiar to users of Anritsu's Hand Held Software Tools. This will lead to a short learning curve.

### Marker and Limit Line Presets

Presets make applying markers and a limit line to similar traces, as well as validating traces, a quick task.

### Renaming Grid

A renaming grid makes changing file names, trace titles, and trace subtitles from field values to those required for a report much quicker than manual typing and is less prone to error.

### Report Generator

The report generator will generate a professional looking PDF of all open traces with additional information such as contractor logos and contact information.

## Line Sweep Features

### Presets

7 sets of 6 markers and 1 limit line  
Next trace capability

### File Types

Input: HHST DAT, MNA and VNA Measurements:  
Return Loss (VSWR), Cable Loss, DTF-RL,  
DTF-VSWR, PIM  
Output: LS DAT, MNA, VNA, CSV, PNG, BMP, JPG, PDF

### Report Generator

Logo, title, company name, customer name,  
location, date and time, filename, PDF, HTML,  
all open traces

### Tools

Cable Editor  
Distance to Fault  
Measurement calculator  
Signal Standard Editor  
Renaming Grid

### Interfaces

Serial, Ethernet, USB

### Capture Plots to

Screen, Database, DAT files, JPEG, Instrument

## Master Software Tools™

Master Software Tools (MST) is a powerful PC software post-processing tool designed to enhance the productivity of technicians in data analysis and testing automation.

### Folder Spectrogram

Folder Spectrogram – creates a composite file of up to 15,000 multiple traces for quick review, also create:

- Peak Power, Total Power, and Peak Frequency plotted over time
- Histogram – filter data and plot number of occurrences over time
- Minimum, Maximum, and Average Power plotted over frequency
- Movie playback – playback data in the familiar frequency domain view
- 3D Spectrogram – for in-depth analysis with 3-axis rotation viewing control

## Master Software Tools Features

### Database Management

Full Trace Retrieval  
Trace Catalog  
Group Edit  
Trace Editor

### Data Analysis

Trace Math and Smoothing  
Data Converter  
Measurement Calculator

### Mapping (GPS Required)

Spectrum Analyzer Mode  
Mobile WiMAX OTA Option  
TS-SCDMA OTA Option  
LTE, both FDD and TDD Options

### Folder Spectrogram

Folder Spectrogram – 2D View  
Video Folder Spectrogram – 2D View  
Folder Spectrogram – 3D View

### List/Parameter Editors

Traces  
Antennas, Cables, Signal Standards  
Product Updates  
Firmware Upload  
Pass/Fail  
VSG Pattern Converter  
Languages  
Mobile WiMAX  
Display

# VNA Master MS202xC/3xC Ordering Information

## Ordering Information – Options

MS2026C <sup>1</sup>	MS2027C <sup>1</sup>	MS2028C <sup>1</sup>	MS2036C <sup>1</sup>	MS2037C <sup>1</sup>	MS2038C <sup>1</sup>	
VNA Master, 2-port, VNA 5 kHz to 6 GHz	VNA Master, 2-port, VNA 5 kHz to 15 GHz	VNA Master, 2-port, VNA 5 kHz to 20 GHz	VNA Master + Spectrum Analyzer, S/A 9 kHz to 9 GHz	VNA Master + Spectrum Analyzer, S/A 9 kHz to 15 GHz	VNA Master + Spectrum Analyzer, S/A 9 kHz to 20 GHz	
Options						Description
MS2026C-0002	MS2027C-0002	MS2028C-0002	MS2036C-0002	MS2037C-0002	MS2038C-0002	Time Domain (includes DTF capability)
MS2026C-0005	MS2027C-0005	MS2028C-0005	-	-	-	Power Monitor (requires external detector)
MS2026C-0007	MS2027C-0007	MS2028C-0007	MS2036C-0007	MS2037C-0007	MS2038C-0007	Secure Data Operation
MS2026C-0010	MS2027C-0010	MS2028C-0010	MS2036C-0010	MS2037C-0010	MS2038C-0010	Built-in Bias-Tee
-	-	MS2028C-0011	-	-	MS2038C-0011	K(f) Test Port Connectors
MS2026C-0015	MS2027C-0015	MS2028C-0015	MS2036C-0015	MS2037C-0015	MS2038C-0015	Vector Voltmeter
MS2026C-0019	MS2027C-0019	MS2028C-0019	MS2036C-0019	MS2037C-0019	MS2038C-0019	High Accuracy Power Meter (requires external USB sensor)
-	-	-	MS2036C-0025	MS2037C-0025	MS2038C-0025	Interference Analysis, 9 kHz to 9/15/20 GHz <sup>2</sup>
-	-	-	MS2036C-0027	MS2037C-0027	MS2038C-0027	Channel Scanner, 9 kHz to 9/15/20 GHz <sup>2</sup>
MS2026C-0031	MS2027C-0031	MS2028C-0031	MS2036C-0031	MS2037C-0031	MS2038C-0031	GPS Receiver (requires GPS antenna, 2000-1528-R or 2000-1652-R)
MS2026C-0077	MS2027C-0077	MS2028C-0077	MS2036C-0077	MS2037C-0077	MS2038C-0077	Balanced/Differential S-Parameters, 1-port
MS2026C-0098	MS2027C-0098	MS2028C-0098	MS2036C-0098	MS2037C-0098	MS2038C-0098	Standard Calibration (ANSI Z540-1-1994)
MS2026C-0099	MS2027C-0099	MS2028C-0099	MS2036C-0099	MS2037C-0099	MS2038C-0099	Premium Calibration (ANSI Z540-1-1994, plus test data)
MS2026C-0501	MS2027C-0501	MS2028C-0501	MS2036C-0501	MS2037C-0501	MS2038C-0501	Distance Domain (included in Option 0002)
-	-	-	MS2036C-0509	MS2037C-0509	MS2038C-0509	AM/FM/PM Analyzer

Notes: 1) Includes standard one-year warranty and Certificate of Calibration and Conformance.

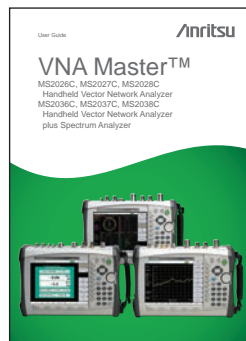
2) Requires external antenna (Series 2000-xxxx Antenna, or 61532 Antenna Kit), Recommend Option 0031 GPS.

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



Part Number	Description
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, True-RMS
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, True-RMS
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, True-RMS
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, True-RMS
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, True-RMS

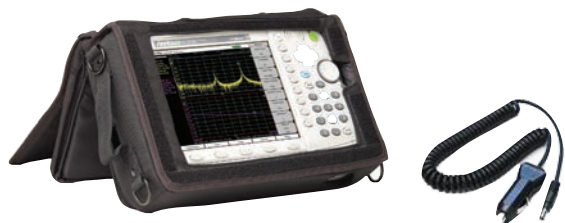
## Manuals (soft copy included on Handheld Document Disc and at [www.anritsu.com](http://www.anritsu.com))



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00305	VNA Master User Guide (Hard copy included)
10580-00289	Vector Network Analyzer Measurement Guide
10580-00231	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00244	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, CW Signal Generator, AM/FM/PM Analyzer, Interference Mapping, Coverage Mapping
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00306	VNA Master Programming Manual
10580-00307	VNA Master Maintenance Manual

# VNA Master MS202xC/3xC Ordering Information

## Standard Accessories (included with instrument)



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00305	VNA Master User Guide
2000-1685-R	Soft Carrying Case for MS202xC models
2000-1686-R	Soft Carrying Case for MS203xC models
2300-498	Master Software Tools (MST) CD Disc
633-75	Rechargeable Li-Ion Battery (Li-Ion, 7.5 Ah)
40-187-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter 12 V DC Adapter
3-2000-1498	USB A-type to Mini USB B-type cable, 3.05 m (10 ft)
2000-1371-R	Ethernet cable, 2.13 m (7 ft)
11410-00548	VNA Master Technical Data Sheet One Year Warranty (Including battery, firmware, and software) Certificate of Calibration and Conformance

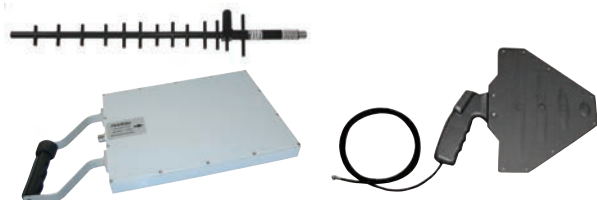
## Optional Accessories

### Ancillary Equipment



Part Number	Description
2000-1528-R	GPS Antenna – Magnet Mount (active 3-5 V) with SMA connector and 4.6 m (15 ft) cable
2000-1652-R	GPS Antenna – Magnet mount (active 3-5 V) with SMA connector and 0.3 m (1 ft) cable
2000-1653	Protective Screen Cover (Package of 2)
2000-1689	EMI Near Field Probe Kit
2300-517	Phase Noise Measurement Software
66864	Rack Mount Kit, Master Platform

### Directional Antennas



Part Number	Description
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 21000 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic

### Portable Antennas



Part Number	Description
2000-1200-R	806 MHz to 866 MHz, SMA(m), 50 $\Omega$
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 $\Omega$
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50 $\Omega$ (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 $\Omega$ (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50 $\Omega$ (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 $\Omega$
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50 $\Omega$ (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 $\Omega$
2000-1616	20 MHz to 21000 MHz, N(f) 50 $\Omega$
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)
2000-1487	Telescopic Whip Antenna



# VNA Master MS202xC/3xC Ordering Information

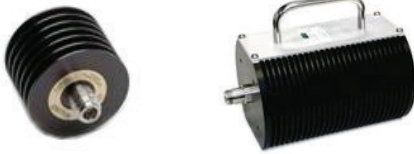
## Optional Accessories

### Bandpass Filters



Part Number	Description
1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50 Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50 Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50 Ω
1030-105-R	890 MHz to 915 MHz, N(m) to N(f), 50 Ω
1030-106-R	1710 MHz to 1790 MHz, N(m) to N(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz, N(m) to N(f), 50 Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω

### Attenuators



Part Number	Description
3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 50 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

### Phase-Stable Test Port Cables, Armored w/ Reinforced Grip (recommended for cable & antenna line sweep applications)



Part Number	Description
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω

### Phase-Stable Test Port Cables, Armored (recommended for use with tightly spaced connectors and other general purpose applications)



Part Number	Description
15NNF50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-1.5C	1.5 m, DC to 6 GHz, N(m) to N(m), 50 Ω
15NDF50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15ND50-1.5C	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15NNF50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15NN50-3.0C	3.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω

# VNA Master MS202xB/3xB Ordering Information

## Optional Accessories (continued)

### Adapters



Part Number	Description
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
510-90-R	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50 Ω
510-91-R	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50 Ω
510-92-R	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω
510-93-R	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω
510-96-R	7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50 Ω
510-97-R	7/16 DIN(f) to 7/16 DIN(f), DC to 7.5 GHz, 50 Ω
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50 Ω, with Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

### Precision Adapters



Part Number	Description
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
34NFN50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω
34NK50	Precision Adapter, DC to 18 GHz, N(m) to K(m), 50 Ω
34NKF50	Precision Adapter, DC to 18 GHz, N(m) to K(f), 50 Ω

### Connector Components



Part Number	Description
OSLN50	Precision Integrated Open/Short/Load N(m), DC to 18 GHz, 50 Ω
OSLNF50	Precision Integrated Open/Short/Load N(f), DC to 18 GHz, 50 Ω
22N50	Precision N(m) Short/Open, 18 GHz
22NF50	Precision N(f) Short/Open, 18 GHz
28N50-2	Precision Termination, DC to 18 GHz, 50 Ω, N(m)
28NF50-2	Precision Termination, DC to 18 GHz, 50 Ω, N(f)
OSLN50-1	Precision N(m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50-1	Precision N(f) Open/Short/Load, 42 dB, 6 GHz
SM/PL-1	Precision N(m) Load, 42 dB, 6 GHz
SM/PLNF-1	Precision N(f) Load, 42 dB, 6 GHz
1091-53-R	Precision TNC(m) Open, 18 GHz, 50 Ω
1091-54-R	Precision TNC(m) Short, 18 GHz, 50 Ω
1015-55-R	Precision TNC(m) Load, 18 GHz, 50 Ω
1091-55-R	Precision TNC(f) Open, 18 GHz, 50 Ω
1091-56-R	Precision TNC(f) Short, 18 GHz, 50 Ω
1015-54-R	Precision TNC(f) Load, 18 GHz, 50 Ω
2000-1618-R	Precision Open/Short/Load, 7/16(m), 6.0 GHz
2000-1619-R	Precision Open/Short/Load, 7/16(f), 6.0 GHz

### Backpack and Transit Case



Part Number	Description
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

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