

# VNA Master™

## Handheld Vector Network Analyzer + Spectrum Analyzer

<b>MS2024B</b>	<b>MS2034B</b>	<b>MS2025B</b>	<b>MS2035B</b>	
500 kHz to 4 GHz	500 kHz to 4 GHz	500 kHz to 6 GHz	500 kHz to 6 GHz	Vector Network Analyzer
	100 kHz to 4 GHz		100 kHz to 6 GHz	+ Spectrum Analyzer

The Affordable, Handheld Vector Network + Spectrum Analyzer for Cable, Antenna and Signal Analysis Anytime, Anywhere

### Introduction

Anritsu introduces the MS202xB/3xB VNA Master + Spectrum Analyzer, the industry’s most affordable and compact handheld solution to address cable, antenna, component and signal analysis needs in the field. Models MS2024/25B VNA Masters bring the the error-correction power of S-parameter measurements to make more precise field diagnostics. With frequency coverage from 500 kHz to 4/6 GHz. in a truly handheld, battery-operated, rugged multi-function instrument, it also provides a field-friendly touch-screen user interface.

MS2034/35B models include a powerful spectrum analyzer which multiplies user convenience by combining both a VNA and a separate spectrum analyzer into a single measurement powerhouse for the harsh RF and physical environments of field test. Whether it is for spectrum monitoring, broadcast proofing, interference analysis, RF and microwave measurements, regulatory compliance, or 3G/4G, Land Mobile Radio, and wireless data network measurements, this VNA/Spectrum Analyzer combination is the ideal instrument to making fast and reliable measurements in the field.



## Performance and Functional Highlights

### VNA Master

- Broadband coverage of 500 kHz to 4/6 GHz
- 1-path, 2-port Vector Network Analyzer
- Intuitive Graphical User Interface (GUI) with convenient Touch Screen
- VNA-quality error correction for directivity and source match
- 2-port Transmission Measurements: High/Low Power
- Outstanding calibration stability, up to 16 hours
- User-defined overlays for viewing multiple S-Parameters
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- 100 dB Transmission Dynamic Range
- 850  $\mu$ s/data point sweep speed
- Greater than 3 hour battery life
- USB & (Optional) Ethernet for data transfer and instrument control
- Automate repetitive tasks via optional Ethernet & USB
- Field Upgradable Firmware
- Store more than 4000 traces and setups in memory
- Portable: 7.6 lbs (3.5 kg)
- Full Speed USB Memory support
- High resolution daylight viewable TFT color display
- "Glove Friendly" Resistive Touch-Screen Display
- Distance Domain Option, supports optical DTF module
- Internal Bias Tee Option
- Vector Voltmeter Option, ideal for cable phase matching
- High Accuracy Power Meter Option
- GPS Receiver Option
- Polar Format Impedance Display
- Complies with MIL-PRF-28800F Class 2 specification

### VNA Master + Spectrum Analyzer

All of the above VNA features, PLUS:

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Signal ID
- Dynamic Range: > 95 dB in 10 Hz RBW
- DANL: -162 dBm in 1 Hz RBW
- Phase Noise: -100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: <  $\pm$  50 ppb with GPS On
- Traces: Normal, Max Hold, Min Hold, Average, # of Averages
- Detectors: Peak, Negative, Sample, Quasi-peak, and true RMS
- Markers: 6, each with a Delta Marker, or 1 Reference with 6 Deltas
- Limit Lines: up to 41 segments with one-button envelope creation
- Trace Save-on-Event: crossing limit line or sweep complete
- Option to automatically optimize sweep-RBW-VBW tradeoff for best possible display
- AM/FM/SSB Audio-only Demodulation
- Optional AM/FM/PM Demodulation Analyzer
- Store 2000 traces internally
- Channel Scanner Option
- GPS tagging of stored traces
- Internal Preamplifier standard
- High Accuracy Power Meter Option
- Coverage Mapping Option

# VNA Master Functional Specifications

## Definitions

- All specifications and characteristics apply under the following conditions, unless otherwise stated:
- After 15 minutes of warm-up time in VNA mode, where the instrument is left in the ON state.
- Temperature range is  $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ .
- All specifications apply when using internal reference.
- All specifications subject to change without notice. Please visit [www.anritsu.com](http://www.anritsu.com) for most current data sheet.
- Typical performance is the measured performance of an average unit.
- Recommended calibration cycle is 12 months.

## Frequency

VNA Master Frequency Range: MS2024/34B 500 kHz to 4 GHz  
 MS2025/35B: 500 kHz to 6 GHz

Frequency Accuracy: 2.5 ppm

Frequency Resolution: 1 Hz

## Typical Test Port Power

VNA Master supports selection of either High (default) or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical power by bands is shown in the following table.

Frequency Range (GHz)	High Port Power (dBm)	Low Port Power (dBm)
500 kHz to $\leq$ 3 GHz	+3	-25 dBm
3 GHz to $\leq$ 6 GHz	0	-25 dBm

## Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power is shown in the following table.

Frequency Range (GHz)	Dynamic Range (dB)
2 MHz to $\leq$ 4 GHz	100
4 GHz to $\leq$ 6 GHz	90

## Typical Sweep Speed

The typical sweep speed for IF Bandwidth of 100 kHz, 1001 data points, and single display is shown in the following table. The two receiver architecture will simultaneously collect  $S_{21}$  and  $S_{11}$  in a single sweep.

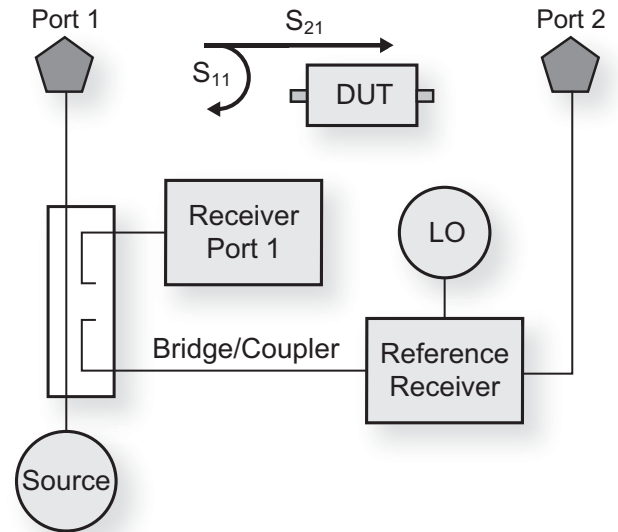
Frequency Range (GHz)	Typical Sweep Speed ( $\mu\text{s}/\text{point}$ )
500 kHz to 6 GHz	850

## Interference Immunity

On-Channel	+17 dBm @ $>$ 1.0 MHz from carrier frequency
On-Frequency	0 dBm within $\pm$ 10 kHz of the carrier frequency

## Block Diagram

As shown in the following block diagram, the VNA Master has a 2-port, 1-path architecture that automatically measures 2 S-parameters with error-correction precision inherent to VNA operation.



The above illustration is a simplified block diagram of VNA Master's 2-port, 1-path architecture. The magnitude AND phase information gained from Vector Network data enables the VNA Master to make significant error corrections and provide improved field measurements.

# High Port Power

OSLxx50 Calibration Components (N-Connector)  
 Corrected System Performance and Uncertainties:  
 MS202xB/3xB with 1-path, 2-port calibration including isolation  
 using either OSLN50-1 & OSLNF50-1 Calibration Kits



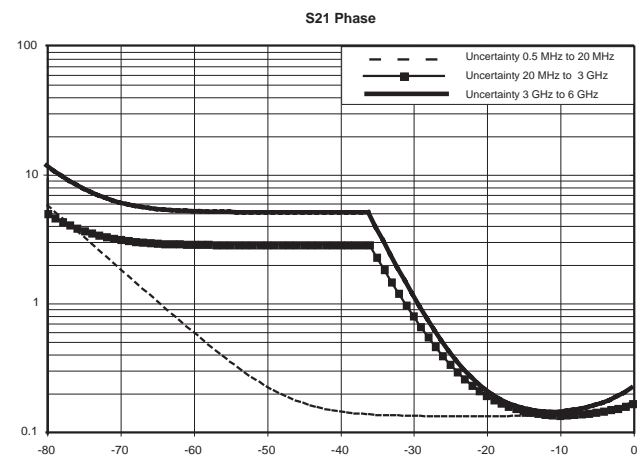
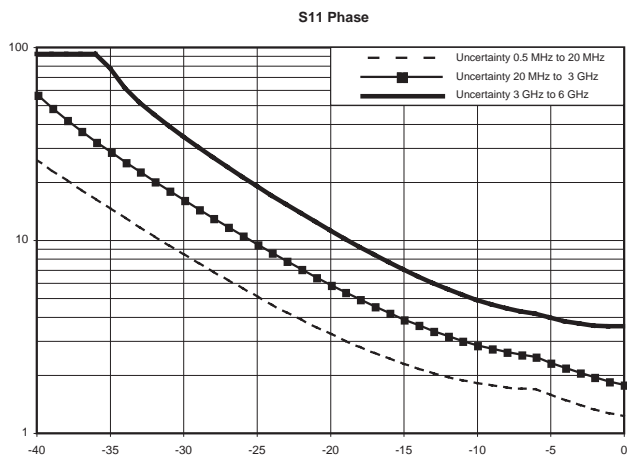
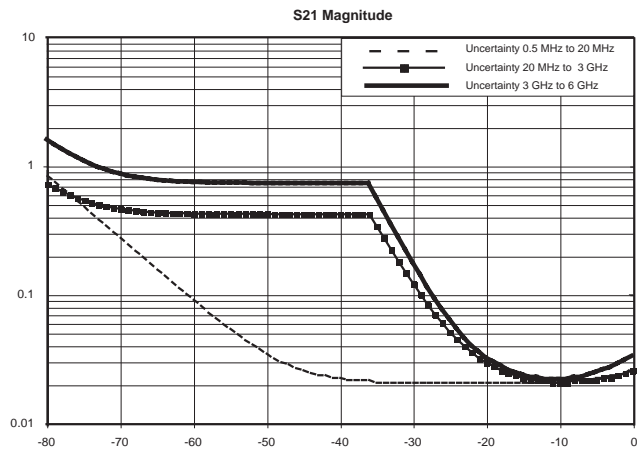
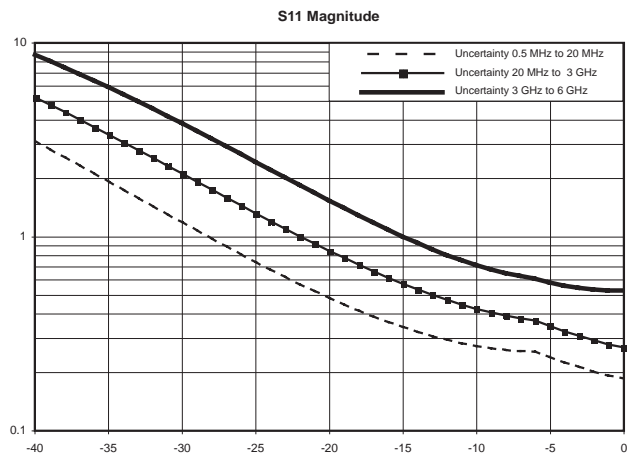
*Precision calibration standards come in a convenient configuration for field work.*

Frequency Range (GHz)	Directivity (dB)
≤ 6	> 42

Frequency Range (GHz)	Typical High Port Power (dBm)
≤ 3	+3
≤ 6	0

## Measurement Uncertainties

The following graphs provide measurement uncertainty at 23 °C ± 5 °C for the above indicated connector type and calibration. Errors are worst-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.



## Low Port Power

OSLxx50 Calibration Components (N-Connectors)  
 Corrected System Performance and Uncertainties:  
 MS202xB/3xB Model with 1-path, 2-port calibration  
 including isolation using either OSLN50-1 or OSLNF50-1  
 Calibration Kits.

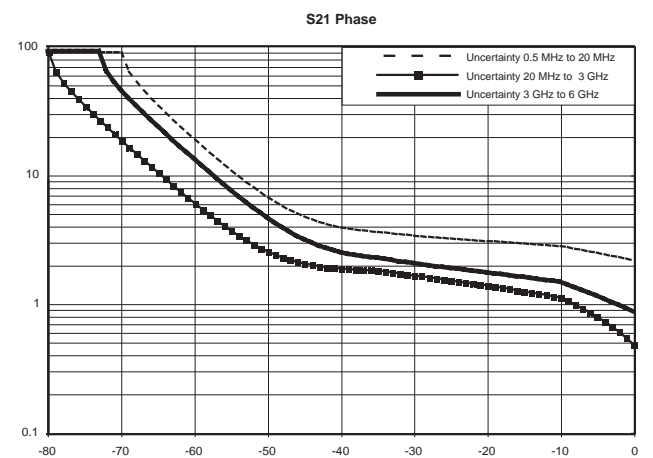
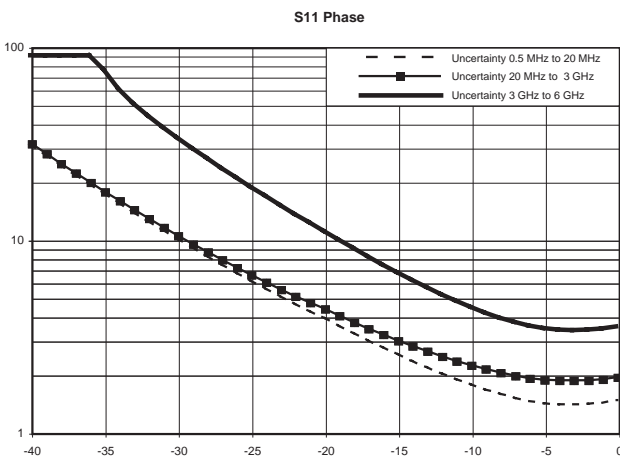
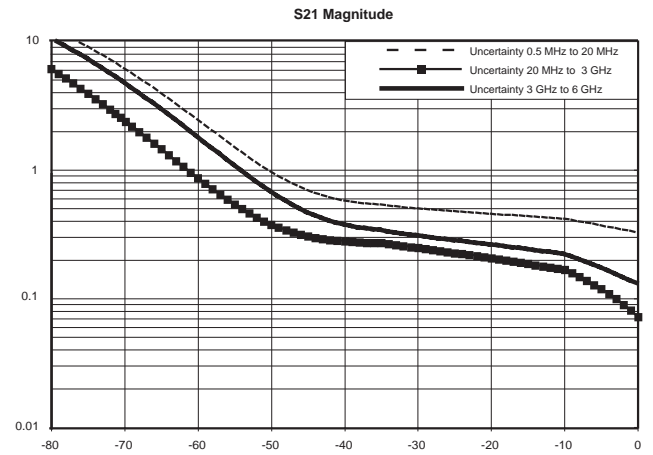
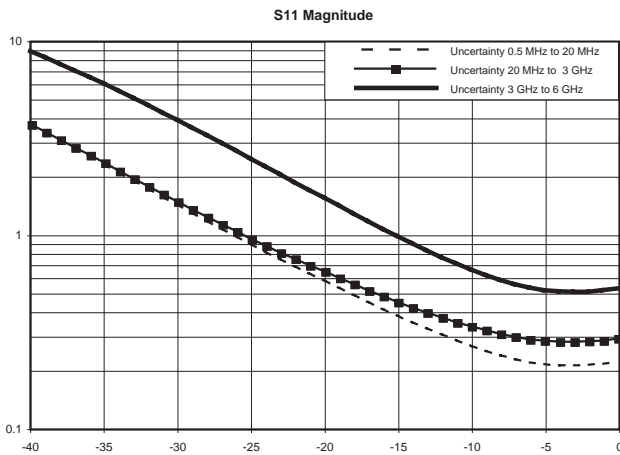


Frequency Range (GHz)	Directivity (dB)
≤ 6	> 42

Frequency Range (GHz)	Typical Low Port Power (dBm)
≤ 3	-25
≤ 6	-25

### Measurement Uncertainties

The following graphs provide measurement uncertainty at 23 °C ± 5 °C for the above indicated connector type and calibration. Errors are worst-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For two-port measurements, transmission tracking, crosstalk, and physical load match termination were added. Isolation calibration and an IF Bandwidth of 10 Hz is used.



## + Spectrum Analyzer Functional Specifications (Models MS2034/35B only)

Frequency				
Frequency Range:	MS2034B: 100 kHz to 4 GHz, (usable to 0 Hz) MS2035B: 100 kHz to 6 GHz, (usable to 0 Hz)			
Tuning Resolution	1 Hz			
Frequency Reference	Aging: $\pm 1.0$ ppm/year Accuracy: $\pm 1.5$ ppm ( $25\text{ }^{\circ}\text{C} \pm 25\text{ }^{\circ}\text{C}$ ) + aging $< \pm 50$ ppb with GPS on			
Frequency Span	MS2034B: 10 Hz to 4 GHz including zero span MS2035B: 10 Hz to 6 GHz including zero span			
Sweep Time	Minimum 100 ms, 10 $\mu$ s to 600 seconds in zero span			
Sweep Time Accuracy	$\pm 2\%$ in zero span			
Bandwidth				
Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence $\pm 10\%$ (1 MHz max in zero-span) (–3 dB bandwidth)			
Video Bandwidth (VBW)	1 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)			
RBW with Quasi-Peak Detection	200 Hz, 9 KHz, 120 kHz (–6 dB bandwidth)			
VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1			
Spectral Purity				
SSB Phase Noise @ 1 GHz	–100 dBc/Hz, –110 dBc/Hz typical @ 10 kHz offset –105 dBc/Hz, –112 dBc/Hz typical @ 100 kHz offset –115 dBc/Hz, –121 dBc/Hz typical @ 1 MHz offset			
Amplitude Ranges				
Dynamic Range	$> 95$ dB (2.4 GHz), 2/3 (TOI-DANL) in 10 Hz RBW			
Measurement Range	DANL to +26 dBm			
Maximum Continuous Input	+35 dBm			
Display Range	1 to 15 dB/div in 1 dB steps, ten divisions displayed			
Reference Level Range	–120 dBm to +30 dBm			
Attenuator Resolution	0 to 55 dB, 5.0 dB steps			
Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dB $\mu$ V Linear Scale Modes: nV, $\mu$ V, mV, V, kV, nW, $\mu$ W, mW, W, kW			
<b>Amplitude Accuracy</b> (single sine wave input $<$ Ref level, and $>$ DANL, auto attenuation)				
–10 $^{\circ}$ C to 50 $^{\circ}$ C after 30 minute warm-up	Typical: $\pm 0.5$ dB, 100 kHz to 6 GHz Maximum: $\pm 1.3$ dB, 100 kHz to 6 GHz			
Displayed Average Noise Level (DANL)	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
	Maximum	Typical	Maximum	Typical
(RBW Normalized to 1 Hz, 0 dB attenuation)				
10 MHz to 2.4 GHz	–141 dBm	–146 dBm	–157 dBm	–162 dBm
$> 2.4$ GHz to 4 GHz	–137 dBm	–141 dBm	–154 dBm	–159 dBm
$> 4$ GHz to 5 GHz	–134 dBm	–138 dBm	–150 dBm	–155 dBm
$> 5$ GHz to 6 GHz	–126 dBm	–131 dBm	–143 dBm	–150 dBm
(RBW = 10 Hz, 0 dB attenuation)				
10 MHz to 2.4 GHz	–131 dBm	–136 dBm	–147 dBm	–152 dBm
$> 2.4$ GHz to 4 GHz	–127 dBm	–131 dBm	–144 dBm	–149 dBm
$> 4$ GHz to 5 GHz	–124 dBm	–128 dBm	–140 dBm	–145 dBm
$> 5$ GHz to 6 GHz	–116 dBm	–121 dBm	–133 dBm	–140 dBm
Spurs				
Residual Spurious	$< -90$ dBm (RF input terminated, 0 dB input attenuation, $> 10$ MHz)			
Input-Related Spurious	$< -75$ dBc (0 dB attenuation, –30 dBm input, span $< 1.7$ GHz, carrier offset $> 4.5$ MHz)			
Exceptions, typical	$< -70$ dBc @ $< 2.5$ GHz, with 2072.5 MHz Input $< -68$ dBc @ F1-280 MHz with F1 Input $< -70$ dBc @ F1 + 190.5 MHz with F1 Input $< -52$ dBc @ 7349-2F2 MHz, with F2 Input, where F2 $< 2424.5$ MHz $< -55$ dBc @ $190.5 \pm F1/2$ MHz, F1 $< 1$ GHz			
Third-Order Intercept (TOI)				
800 MHz	+16 dBm			
2400 MHz	+20 dBm			
200-2200 MHz	+25 dBm, typical			
$> 2.2$ GHz to 5.0 GHz	+28 dBm, typical			
$> 5.0$ GHz to 6.0 GHz	+33 dBm, typical			
Second Harmonic Distortion				
50 MHz	–56 dBc			
$> 50$ MHz to 200 MHz	–60 dBc, typical			
$> 200$ MHz to 3000 MHz	–70 dBc, typical			
VSWR	2:1, typical			

## VNA Performance Capabilities

Measurement Parameters	$S_{11}$ , $S_{21}$
Number of Traces	Four: TR1, TR2, TR3, TR4
Trace Format	Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays.
Graph Types	Log Magnitude SWR Phase Real Imaginary Group Delay Smith Chart Log Mag / 2 (1-Port Cable Loss) Linear Polar Log Polar Real Impedance Imaginary Impedance
Domains	Frequency Domain, Distance Domain
Frequency	Start Frequency, Stop Frequency, Center Frequency, Span
Distance	Start Distance, Stop Distance
Frequency Sweep Type: Linear	Single Sweep, Continuous
Data Points	2 to 4001 (arbitrary setting); data points can be reduced without recalibration.
Limit Lines	Upper, Lower, 10 segmented Upper, 10 segmented Lower
Test Limits	Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm
Data Averaging	Sweep-by-sweep
Smoothing	0 to 20%
IF Bandwidth	10, 20, 50, 100, 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Hz)
Reference Plane	The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase, and constant impedance.
Auto Reference Plane Extension	Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance.
Frequency Range	Frequency range of the measurement can be narrowed within the calibration range without recalibration.
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range.
Group Delay Range	< 180° of phase change within the aperture
Trace Memory	A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled.
Trace Math	Complex trace math operations of subtraction, addition, multiplication, or division are provided.
Number of Markers	Eight, arbitrary assignments to any trace
Marker Types	Reference, Delta
Marker Readout Styles	Log Mag, Cable Loss (Log Mag / 2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, and Group Delay
Marker Search	Peak Search, Valley Search, Find Marker Value
Correction Models	Full $S_{11}$ , 1-Path, 2-Port ( $S_{11}$ & $S_{21}$ ), Response $S_{11}$ , Response $S_{21}$
Calibration Methods	Short-Open-Load-Through (SOLT)
Calibration Standards' Coefficients	Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined
Cal Correction Toggle	On/Off
Impedance Conversion	Support for 50 $\Omega$ and 75 $\Omega$ are provided.
Units	Meters, Feet
Bias Tee Settings	Internal, Off
Timebase Reference	Internal
File Storage Types	Measurement, Setup (with CAL), Setup (without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), JPEG
Ethernet Configuration	DHCP or Manual (Static); IP, Gateway, Subnet entries
Languages	English, French, German, Spanish, Chinese, Japanese, Korean, Italian, plus two User Defined

## + Spectrum Analyzer Performance Capabilities (Models MS2034/35B only)

<b>Measurements</b>	
Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m <sup>2</sup> or dBmV/m) Occupied Bandwidth (measures 99% to 1% power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask Coverage Mapping (requires option 0431)
<b>Setup Parameters</b>	
Frequency	Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event
Save-on-Event	Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Application Options	Bias-Tee (On/Off), Impedance (50 Ω, 75 Ω, Other)
<b>Sweep Functions</b>	
Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
Detection	Peak, RMS, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Change Position, Manual
<b>Trace Functions</b>	
Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
Trace A Operations	Normal, Max Hold, Min Hold, Average, # 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
<b>Marker Functions</b>	
Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off), All Markers Off
Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker Marker Auto-Position Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
Marker Table	1-6 markers frequency and amplitude plus delta markers frequency offset and amplitude
<b>Limit Line Functions</b>	
Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, 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 Envelope, Update Amplitude, Number of Points (41 max), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall

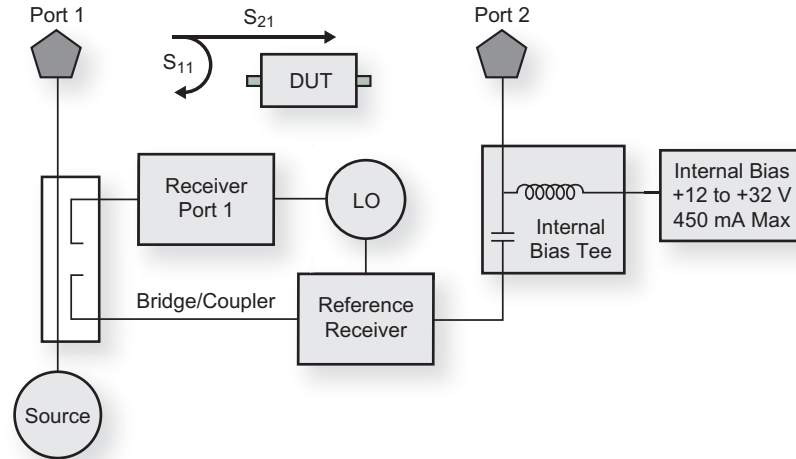


## Measurement Options Specifications

### Bias Tee (Option 0010)

For tower mounted amplifier tests, the MS202xB/3xB series with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements. For frequency sweeps in excess of 2 MHz, the VNA Master can supply internal voltage control from +12 to +32 V in 0.1 V steps up to 450 mA. Bias can be directed to VNA Port 2.

<b>Frequency Range</b>	2 MHz to 4 GHz (MS20x4B) 2 MHz to 6 GHz (MS20x5B)
<b>Internal Voltage/Current</b>	+12V to +32V at 450 ma. Steady state
<b>Internal Resolution</b>	0.1V
<b>Bias Tee Selections</b>	Internal, Off



The Compact VNA Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram. .

### Vector Voltmeter (Option 0015)

A phased array system relies on phase matched cables for nominal 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 and this software mode ensures 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 MS202x/3xB solution is superior because the signal source is included internally, precluding the need for an external signal generator

<b>CW Frequency Range</b>	500 kHz to 4/6 GHz
<b>Measurement Display</b>	CW, Table (Twelve Entries, Plus Reference)
<b>Measurement Types</b>	Return Loss, Insertion
<b>Measurement Format</b>	dB/VSWR/Impedance

## High Accuracy Power Meter (Option 0019) Requires external USB power sensor.

Conduct precise measurements of CW and digitally modulated transmitters in the field using this VNA Master software mode with a separately purchased Anritsu USB power sensor. After specifying the center frequency and zeroing the sensor to ensure accuracy at low power levels, the software offers intuitive operation for absolute and relative readouts in dBm or Watts.

Option 0019 supports the USB Power Sensors in the following table.

### USB Power Sensors (Ordered separately):

	PSN50	MA24104A	MA24106A	MA24108A	MA24118A	MA24126A
<b>Frequency Range:</b>	50 MHz to 6 GHz	600 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26.5 GHz
<b>Description</b>	High Accuracy RF Power Sensor	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor	Microwave USB Power Sensor
<b>Connector</b>	Type N, male, 50 Ω	Type N, female, Ω	Type N, male, 50 Ω	Type N, male, 50 Ω	Type N, male, 50 Ω	Type N, male, 50 Ω
<b>Dynamic Range:</b>	-30 dBm to +20 dBm (0.001 mW to 100 mW)	+3 dBm to +51.76 dBm (2 mW to 150 W)	-40 dBm to +23 dBm (0.1 μW to 200 mW)	-40 dBm to +20 dBm (0.1 μW to 100 mW)	-40 dBm to +20 dBm (0.1 μW to 100 mW)	-40 dBm to +20 dBm (0.1 μW to 100 mW)
<b>VBW</b>	100 Hz	100 Hz	100 Hz	50 kHz	50 kHz	50 kHz
<b>Measurand:</b>	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot power, Burst Average power	True-RMS, Slot power, Burst Average power
<b>Measurement Uncertainty</b>	± 0.16 dB <sup>1</sup>	± 0.17 dB <sup>2</sup>	± 0.16 dB <sup>1</sup>	± 0.18 dB <sup>3</sup>	± 0.18 dB <sup>3</sup>	± 0.18 dB <sup>3</sup>
<b>Datasheet for Additional Specifications</b>	11410-00414	11410-00483	11410-00424	11410-00504	11410-00504	11410-00504

#### Notes:

- 1) Total RSS measurement uncertainty (0 °C to 50 °C) for power measurements of a CW signal greater than -20 dBm with zero mismatch errors
- 2) Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
- 3) Expanded uncertainty with K=2 for power measurements of a CW signal greater than -20 dBm with zero mismatch errors

## Interference Analyzer (Option 0025) (Models 2034/35B only) (Recommend GPS)

<b>Measurements</b>	Spectrum Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I) Spectrogram (Collect data up to one week) Signal Strength (Gives visual and aural indication of signal strength) Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength Signal ID (up to 12 signals) Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers Signal-to-Nose Ratio (SNR) > 10 dB Interference Mapping
<b>Application Options</b>	Impedance (50 Ω, 75 Ω, Other)

## Channel Scanner (Option 0027) (Models MS2034/35B only)

<b>Number of Channels</b>	1 to 20 Channels (Power Levels)
<b>Measurements</b>	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
<b>Scanner</b>	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
<b>Amplitude</b>	Reference Level, Scale
<b>Custom Scan</b>	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
<b>Frequency Range</b>	500 kHz to 4 GHz (MS2034B) 500 kHz to 6 GHz (MS2035B)
<b>Frequency Accuracy</b>	± 10 Hz + Time base error
<b>Measurement Range</b>	-110 dBm to +26 dBm
<b>Application Options</b>	Bias-Tee (On/Off), Impedance (50 Ω, 75 Ω, Other)

## GPS (Option 0031) Requires external GPS antenna

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 magnet mount GPS antenna (2000-1528-R), which is configured with a 15 foot (~5 m) cable to mount outside on a metallic surface. Frequency accuracy is enhanced for the Spectrum Analyzer when Options 0025 Interference Analyzer and 0027 Channel Scanner are engaged.

<b>Setup</b>	On/Off, Antenna Voltage 3.3/5.0 V, GPS Info
<b>GPS Time/Location Indicator</b>	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
<b>High Frequency Accuracy</b>	Spectrum Analyzer, Interference Analyzer when GPS Antenna is connected < $\pm 50$ ppb with GPS On, 3 minutes after satellite lock in selected mode
<b>GPS Lock – after antenna is disconnected</b>	< $\pm 50$ ppb for 3 days, 0 °C to 50 °C ambient temperature
<b>Connector</b>	SMA, female

## Distance Domain (Option 0501)

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 Compact VNA Master exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify discontinuities. The Compact VNA Master converts S-parameters from frequency domain into distance 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 distance domain analysis is available on transmission measurements.

Option 0501 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.

Option 0501 Distance Domain also supports field measurements for optical fiber diagnostics. Anritsu Model ODTF-1 test module (see page 15) works directly with RF techniques and converts optical DTF signals to display on the VNA Master.

## Ethernet Connectivity (Option 0411)

By enabling the Compact VNA Master to communicate with PCs via Ethernet, you gain the ability to operate automated testing from your PC, or conversely, to upload data from field test to the PC.

## AM/FM/PM Demodulation Analyzer, (Option 0509) (Models MS2034/35B only)

The VNA Master + Spectrum Analyzer comes with AM/FM/SSB audio demodulation standard. By adding Option 0509, it then measures, analyzes and displays key modulation parameters of RF Spectrum, Audio Spectrum, Audio Waveform and FM Demod Summary. The RF Spectrum View displays the spectrum analyzer with carrier power, frequency, and occupied BW. Audio Spectrum shows the demodulated audio spectrum along with the Rate, RMS deviation, Pk-Pk/2 deviation, SINAD, Total Harmonic Distortion (THD), and Distortion/Total. Each demodulation also includes an Audio Waveform display that shows the time-domain demodulated waveform. There is a summary table that includes a summary of all the RF and Demod parameters.

## Coverage Mapping (Option 0431) (Requires GPS)

Measurements	Indoor Mapping		Outdoor Mapping	
	RSSI ACPR		RSSI ACPR	
Setup Parameters	Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment		
	Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection		
	Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span		
	BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/VBW		
	Measurement Setup	ACPR, RSSI		
	Point Distance / Time Setup	Repeat Type Time Distance		
	Save Points Map	Save KML, JPEG, Tab Delimited		
	Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid		

# VNA Master General Specifications (MS202xB/3xB)

<b>Maximum Input (Damage Level) into Vector Network Analyzer</b>	+23 dBm, $\pm$ 50 VDC
<b>Interfaces</b>	Type N female Spectrum Analyzer Port (MS203xB) Type N female Type BNC female Trigger In port Type BNC female External Reference In port Type SMA female GPS port supports +3.3 V or +5 V external antenna (Available with opt 0031) USB Interface, Type A (2 connectors) USB Interface, Type Mini-B RJ45 connector for Ethernet 10/100-Base T (Available with opt 0411 Ethernet) 2.5 mm 3-wire cellular headset connector

## Setup Parameters

<b>System</b>	Status (Temperature, Battery Info, S/N, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
<b>System Options</b>	Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
<b>File</b>	Save, Recall, Delete, Directory Management
<b>Save/Recall</b>	Setups, Measurements, Screen Shots Jpeg (save only)
<b>Delete</b>	Selected File, All Measurements, All Mode Files, All Content
<b>Directory Management</b>	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
<b>Internal Trace/Setup Memory</b>	2,000 traces, 2,000 Setups
<b>External Trace/Setup Memory</b>	Limited by size of USB Flash drive
<b>Mode Switching</b>	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

## Connectors

<b>VNA Port 1, VNA Port 2</b>	Type N, female, 50 $\Omega$
<b>RF Out Damage Level</b>	+23 dBm, $\pm$ 50 VDC
<b>RF In Damage Level</b>	+35 dBm peak, $\pm$ 50 VDC, Maximum Continuous Input ( $\geq$ 10 dB attenuation) (MS203xB)
<b>GPS</b>	SMA, female
<b>External Power</b>	5.5 mm barrel connector, 12.5 to 15 VDC, < 4.0 Amps
<b>USB Interface (2)</b>	Type A, Connect Flash Drive and Power Sensor
<b>USB Interface</b>	5-pin mini-B, Connect to PC for data transfer
<b>Headset Jack</b>	2.5 mm barrel connector
<b>External Reference In</b>	BNC, female, 50 $\Omega$ , Maximum Input $\pm$ 5 VDC 1 MHz, 5 MHz, 10 MHz, 13 MHz
<b>External Trigger/Clock Recovery</b>	BNC, female, 50 $\Omega$ , Maximum Input $\pm$ 50 VDC

## Display

<b>Type</b>	Resistive Touch Screen
<b>Size</b>	8.4 in, daylight viewable color LCD
<b>Resolution</b>	800 x 600

## Power

<b>Field replaceable Li-Ion Battery (633-44: 6600 mAh, 4.5 Amps)</b>	40 Watts on battery power only
<b>DC power from Universal 110/220V AC/DC Adapter</b>	55 Watts running off AC/DC adaptor while charging battery
<b>Life time charging cycles (Li-Ion Battery, 633-44)</b>	> 300 (80% of initial capacity)
<b>Battery Operation</b>	3.0 hours, typical

## Electromagnetic Compatibility

<b>European Union</b>	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
<b>Australia and New Zealand</b>	C-tick N274
<b>Interference</b>	EN 61326-1
<b>Emissions</b>	EN 55011
<b>Immunity</b>	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11

## Safety

<b>Safety Class</b>	EN 61010-1 Class 1
<b>Product Safety</b>	IEC 60950-1 when used with Company supplied Power Supply

## Environmental

<b>Operating Temperature</b>	-10 $^{\circ}$ C to 55 $^{\circ}$ C
<b>Maximum Humidity</b>	85%
<b>Shock</b>	MIL-PRF-28800F Class 2
<b>Storage</b>	-40 $^{\circ}$ C to 71 $^{\circ}$ C
<b>Altitude</b>	4600 meters, operating and non-operating

## Size and Weight

<b>Dimensions</b>	Height	199 mm (7.8 in)
	Width	273 mm (10.7 in)
	Depth	91 mm (3.6 in)
<b>Weight, Including Battery</b>	3.5 kg (7.6 lbs)	

## Ancillary Module extends Optical Fiber Testing to Distance-to-Fault

The ODTF-1 module is primarily intended for field use by technicians and engineers responsible for the deployment and maintenance of remote radio heads (RRH). The majority of next generation high speed data networks are being deployed with fiber between the main and remote unit creating a need for contractors to sweep both RF and fiber systems.

The ODTF-1 module is fully compatible with the MS202xB/3xB VNA Masters which are optionally equipped with the Distance Domain Option 0501. Field operation of the ODTF-1 module with the VNA Master requires the normal DTF (RF/microwave) mode along with simple modification of some of the setup parameters such as  $V_p$ , cable loss, and frequency.

VNA Master users need only to connect a short cable between the RF output of the VNA and the ODTF-1 module and perform a 1-port calibration at the end of the cable. Essentially the ODTF-1 module is simply a wavelength translator, RF test signals in, RF signals returning. The same physics that apply to the traditional DTF measurements apply to ODTF-1 meaning highly accurate measurements can be made with event resolution as good as 10 cm. The same trade-offs carry over as well so better event resolution translates to shorter maximum distance, and vice-versa. Max distance is specified at 1020 meters (3345 ft).

The battery life of the ODTF-1 module matches the battery life of the VNA Master. It can be charged with the same 40-168-R power supply so there is no need to maintain different power supplies.



Using a VNA Master equipped with Option 0501 Distance-to-Fault, this ODTF-1 optical module translates the RF test wavelengths to display fault locations in standard optical fibers

### Specifications

Wavelength	1550 nm typical
Frequency Range	1 GHz to 2 GHz
Fiber Type	Single Mode Fiber (SMF)
Event Resolution	10.2 cm (0.335 ft) maximum, or $150/(n \cdot \Delta F)$ , $\Delta F$ in MHz, n is IOR
Horizontal Range	1020 meter (3345 ft) maximum, or $(\#dp-1) \cdot \text{Event Resolution}$
Optical Dynamic Range	30 dB
Optical Output Power	3 dBm typical

### Input and Output Ports

RF Connector	N(m)
Max RF Input Power	+ 5 dBm
Optical Connector	FC/APC

### General Specifications

External DC Input	+15 VDC, 3A maximum
Electromagnetic Compatibility	Meets European Community requirements for CE marking
Temperature Operating	0 to 50 °C
Non-operating	0 to 70 °C recommended

### Dimensions

Size	15.7 x 5.37 x 18.6 cm (6.18 x 2.1 x 7.3 in.)
Weight	< 1 kg (2.2 lbs)

## Ordering Information

<b>MS2024B<sup>1</sup></b>	<b>MS2025B<sup>1</sup></b>	<b>MS2034B<sup>1</sup></b>	<b>MS2035B<sup>1</sup></b>
VNA Master™ 2-port, 1-path, VNA: 500 kHz to 4 GHz	VNA Master™ 2-port, 1-path, VNA: 500 kHz to 6 GHz	VNA Master™ + Spectrum Analyzer, S/A: 100 kHz to 4 GHz	VNA Master™ + Spectrum Analyzer, S/A: 100 kHz to 6 GHz

<b>Options</b>				<b>Description</b>
MS2024B-0010	MS2025B-0010	MS2034B-0010	MS2035B-0010	Built-in Bias-Tee, +12 to +24 V variable
MS2024B-0015	MS2025B-0015	MS2034B-0015	MS2035B-0015	Vector Voltmeter
MS2024B-0019	MS2025B-0019	MS2034B-0019	MS2035B-0019	High Accuracy Power Meter (requires external USB sensor)
-	-	MS2034B-0025	-	Interference Analysis, 100 kHz to 4 GHz <sup>2</sup>
-	-	-	MS2035B-0025	Interference Analysis, 100 kHz to 6 GHz <sup>2</sup>
-	-	MS2034B-0027	-	Channel Scanner, 100 kHz to 4 GHz <sup>2</sup>
-	-	-	MS2035B-0027	Channel Scanner, 100 kHz to 6 GHz <sup>2</sup>
MS2024B-0031	MS2025B-0031	MS2034B-0031	MS2035B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R)
MS2024B-0098	MS2025B-0098	MS2034B-0098	MS2035B-0098	Z-540 Calibration
MS2024B-0099	MS2025B-0099	MS2034B-0099	MS2035B-0099	Premium Calibration
MS2024B-0411	MS2025B-0411	MS2034B-0411	MS2035B-0411	Ethernet Connectivity
-	-	MS2034B-0431	MS2035B-0431	Coverage Mapping <sup>3</sup>
MS2024B-0501	MS2025B-0501	MS2034B-0501	MS2035B-0501	Distance Domain
-	-	MS2034B-0509	MS2035B-0509	AM/FM/PM Demodulation 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.
- 3) Requires Option 0031 GPS

### MS2024/5/34/5B Standard Accessories

10580-00220	VNA Master User's Guide
3-68736	Soft Carrying Case
2300-498	Master Software Tools CD ROM
633-44	Rechargeable Battery, Li-Ion, 6.6 Ah
40-168-R	AC-DC Adapter
806-141-R	Automotive Cigarette Lighter
3-2000-1498	USB A-type to Mini USB B-type cable, 3.05 m (10 ft.)
2000-1520-R	USB Flash Drive

### Optional Accessories

#### Ancillary Equipment

ODTF-1	Optical Time Domain Module
15NNF50-1.5C	Armored Test Port Cable, 1.5 meter, N(m) to N(f)
2300-517	Phase Noise Measurement Software
3-806-152	Ethernet Crossover Cable
2000-1371-R	Ethernet Cable (7 ft.)

#### High Accuracy Power Sensor

PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24104A	Inline High Power Sensor, 600 MHz to 4 GHz, True RMS
MA24106A	High Accuracy 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 26.5 GHz, True RMS

### N-Type Connector Components

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

### TNC Connector Components

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

### 7/16 Connector Components

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

*continued on next page...*

## Ordering Information *(continued)*

### Directional Antennas

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

2000-1200	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035	896 MHz to 941 MHz, SMA (m), 50 Ω (1/4 wave)
2000-1030	1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1474	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031	1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1475	1920 MHz to 1980 MHz and 2110-2170 MHz, SMA(m), 50 Ω
2000-1032	2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1361	2400 MHz to 2500, 5000 to 6000 MHz, SMA(m), 50 Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50 Ω
61532	Antenna Kit (Consists of: 2000-1030, 2000-1031, 2000-1032-R, 2000-1200, 2000-1035, 2000-1361, and carrying pouch)

### Bandpass Filters

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
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50 Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA (f), 50 Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA (f), 50 Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω

### Adapters

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	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
510-90	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50 Ω
510-91	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50 Ω
510-92	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω
510-93	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω
510-96	7/16 DIN(m) to 7/16 DIN (m), DC to 7.5 GHz, 50 Ω
510-97	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, w/ Reinforced Grip
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

### Precision Adapters

34NN50A Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
34NFNF50 Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω

### Attenuators

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)

### Backpack and Transit Case

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

### Manuals

10580-00215	ODTF-1 Optical Distance-to-Fault Module – Quick Start Guide
10580-00231	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00289	VNA Measurement Guide
10580-00301	VNA Master User's Guide
10580-00302	VNA Master Programming Manual
10580-00303	VNA Master Maintenance Manual

### Related Literature, Application Notes, Books

11410-00206	Time Domain for Vector Network Analyzers
11410-00214	Reflectometer Measurements – Revisited
11410-00270	What is Your Measurement Accuracy?
11410-00373	Distance-to-Fault
11410-00387	Primer on Vector Network Analysis
11410-00414	High Accuracy Power Meter, PSN50
11410-00424	USB Power Sensor MA24106A
11410-00483	Inline High Power Sensor MA24104A
11410-00504	Microwave USB Power Sensor MA241x8A
11410-00531	Practical Tips on Making “Vector Voltmeter (VVM)” Phase Measurements using VNA Master (Opt. 15)
11410-00545	VNA Master + Spectrum Analyzer Brochure
11410-00549	VNA Master + Spectrum Analyzer Technical Data Sheet
11410-00472	Measuring Interference
11410-00476	Essentials of Vector Network Analysis
11410-00565	Troubleshoot Wire Cable Assemblies with Frequency-Domain Reflectometry



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