

VNA MasterTM

Handheld Vector Network Analyzer + Spectrum Analyzer

MS2024B	MS2025B	
500 kHz to 4 GHz	500 kHz to 6 GHz	Vector Network Analyzer
MS2034B	MS2035B	
500 kHz to 4 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 proudly offers the MS202xB/MS203xB 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. All MS202xB/3xB VNA Master models offer benchtop accuracy and high performance S-parameter measurements in portable form. With frequency coverage from 500 kHz up to 4 or 6 GHz in a truly handheld, battery-operated, rugged, multi-function instrument, the VNA Master also provides a field-friendly touch screen user interface.

MS2034B/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, 3G/4G, Land Mobile Radio, or wireless data network measurements, this VNA/Spectrum Analyzer combination is the ideal instrument for making fast and reliable measurements in the field.



Size: Width - 273 mm (10.7 in), Height - 199 mm (7.8 in), Depth - 91 mm (3.6 in).
Weight: 3.5 kg (7.6 lb).

Performance and Functional Highlights (All Models)

Vector Network Analyzer

- 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 μ s/data point sweep speed
 - Greater than 3 hour battery life
 - USB and (Optional) Ethernet for data transfer and instrument control
 - Automate repetitive tasks via optional Ethernet and USB
 - User-selectable menu options: Chose either VNA or simplified Cable & Antenna analysis
 - Field upgradable firmware
 - Internal Flash Memory: 2 GB — Store more than 4000 traces and setups in memory
 - Portable: 3.5 kg (7.6 lb)
 - 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.
 - Certified for use in Explosive Atmosphere per MIL-PRF-28800F and MIL-STD-810G
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Performance and Functional Highlights (MS203xB Models)

Vector Network Analyzer + 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 3 minutes after GPS lock
- 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
- Trace Save-on-Event: crossing limit line or sweep complete
- Limit Lines: up to 41 segments with one-button envelope creation
- Option to automatically optimize sweep-RBW-VBW trade-off 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 Performance Specifications

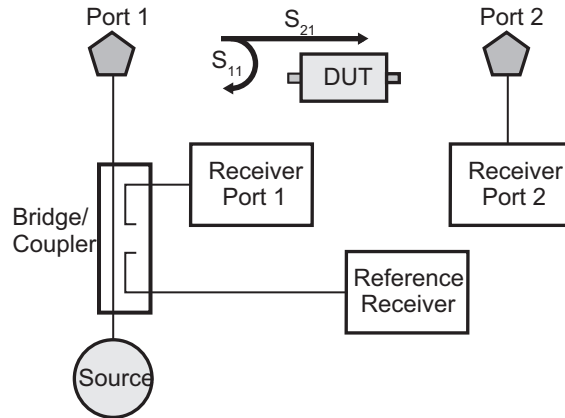
Definitions

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 °C ± 5 °C.
- All specifications apply when using internal reference.
- All specifications subject to change without notice. Please visit www.anritsu.com for most current data sheet.
- Typical performance is the measured performance of an average unit.
- Recommended calibration cycle is 12 months.

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 the VNA Master 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 to provide improved field measurements.

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

Test Port Power (Typical)

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:

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

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:

Frequency Range	
2 MHz to ≤ 4 GHz	100 dB
4 GHz to ≤ 6 GHz	90 dB

Sweep Speed (Typical)

Sweep speed in μs/point for IF Bandwidth of 100 kHz, 1001 data points, and single display. The two-receiver architecture will simultaneously collect S_{21} and S_{11} in a single sweep.

Frequency Range	
500 kHz to 6 GHz	850 μs/point

Noise Floor

Frequency	Noise Floor (typical)
500 kHz to 3 GHz	-97 dBm
3 GHz to 4 GHz	-100 dBm
4 GHz to 6 GHz	-90 dBm

**VNA Performance Specifications** (continued)**Temperature Stability** (S_{11} or S_{21} , Short, 23 °C ± 5 °C)

Frequency Range	Magnitude (typical)	Phase (typical)
500 kHz to 6 GHz	0.020 dB/°C	0.200 deg/°C

Reflection Tracking (S_{11})

Frequency	Tracking (typical)
500 kHz to 6 GHz	0.10 dB (High Power)

Transmission Tracking (S_{21})

Frequency	Tracking (typical)
500 kHz to 6 GHz	0.01 dB

Interference Immunity

On-Channel	+17 dBm at > 1.0 MHz from carrier frequency
On-Frequency	0 dBm within ± 10 kHz of the carrier frequency

Corrected System Performance and Uncertainties – High Port Power

Models with 1-path, 2-port calibration including isolation using OSLN50-1 or OSLNF50-1 Calibration Tees

Directivity

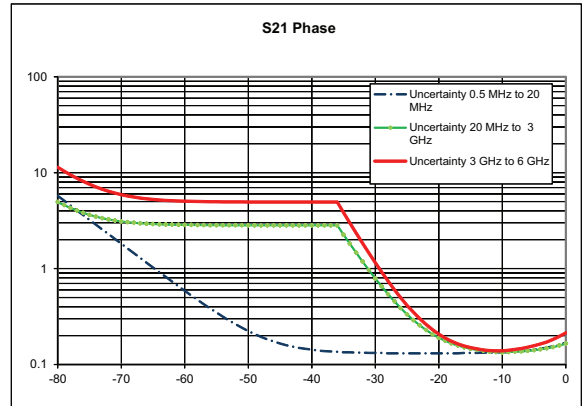
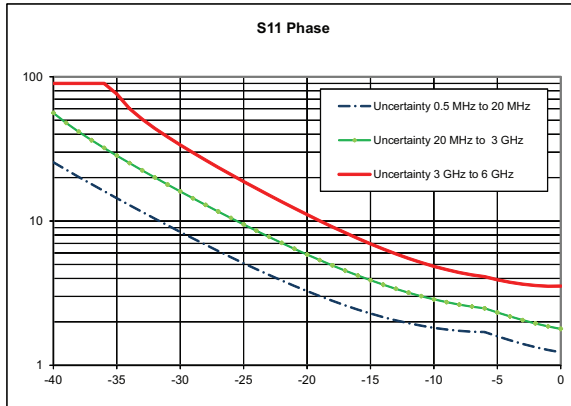
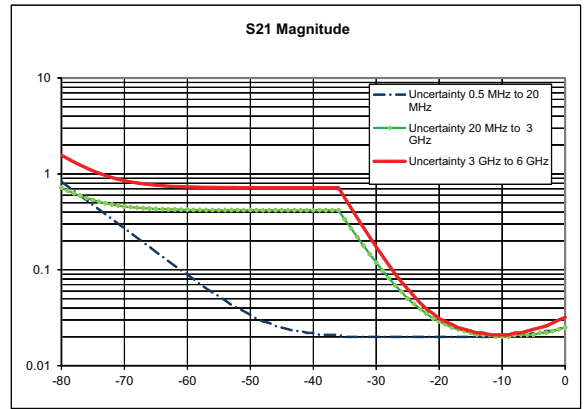
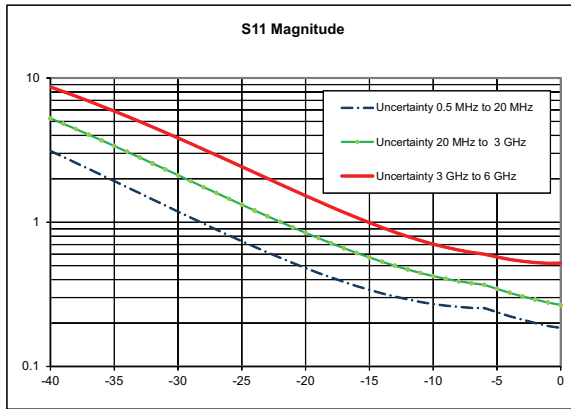
Frequency Range
 $\leq 6 \text{ GHz}$ $> 42 \text{ dB}$

High Port Power Typical

Frequency Range
 $\leq 3 \text{ GHz}$ $+3 \text{ dBm}$
 $\leq 6 \text{ GHz}$ 0 dBm

Measurement Uncertainties

The following graphs provide measurement uncertainty at $23 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$ 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 are used.



Calibration Tee

OSLN50 & OSLNF50

Corrected System Performance and Uncertainties – Low Port Power

Models with 1-path, 2-port calibration including isolation using either OSLN50-1 or OSLNF50-1 Calibration Tees

Directivity

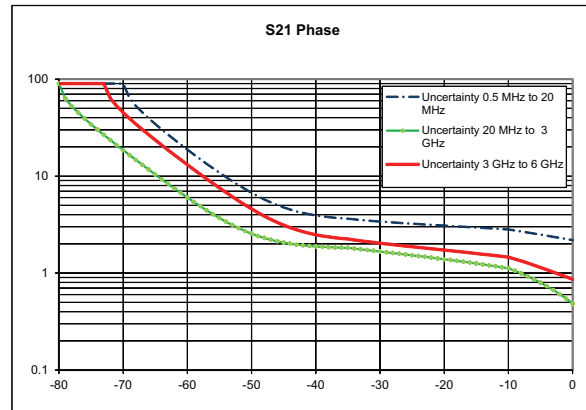
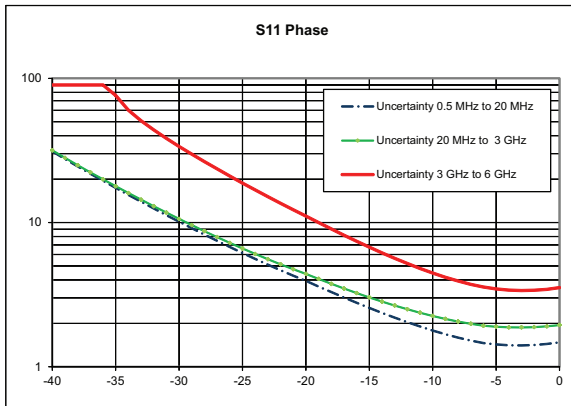
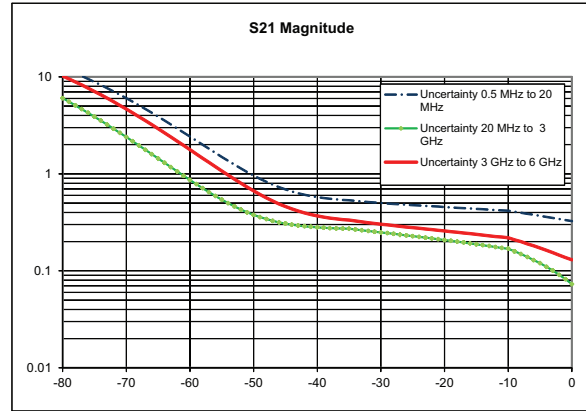
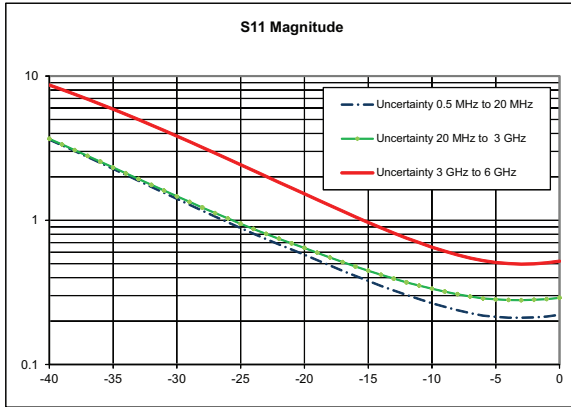
Frequency Range
 ≤ 6 GHz > 42 dB

Low Port Power (Typical)

Frequency Range
 ≤ 3 GHz -25 dBm
 ≤ 6 GHz -25 dBm

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 are used.



Calibration Tee

OSLN50 & OSLNF50



Spectrum Analyzer Performance Specifications (Models MS203xB 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	1.0 ppm/year
Accuracy	120 ppb (25 °C ± 25 °C) + aging < 50 ppb 3 minutes after GPS locked
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 μs to 600 seconds in zero span
Sweep Time Accuracy	± 2 % in zero span

Bandwidth

Resolution Bandwidth (RBW)	10 Hz to 3 MHz in 1–3 sequence ± 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
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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	+30 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, dBμV Linear Scale Modes: nV, μV, mV, V, kV, nW, μW, mW, W, kW
Amplitude Accuracy	(single sine wave input < Ref level, and > DANL, auto attenuation)
–10 °C to 50 °C after 30 minute warm-up	Typical: ± 0.5 dB, 100 kHz to 6 GHz Maximum: ± 1.3 dB, 100 kHz to 6 GHz

DANL

Displayed Average Noise Level (DANL) (RBW Normalized to 1 Hz, 0 dB attenuation)	Preamp Off (Reference level –20 dBm)		Preamp On (Reference level –50 dBm)	
	Maximum	Typical	Maximum	Typical
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


Spectrum Analyzer Performance Specifications (Models MS203xB only) (continued)

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	
Third-Order Intercept (TOI)	Preamp Off (-20 dBm tones 100 kHz apart, 0 dB and 10 dB attenuation)	
Frequency	0 dB attenuation	10 dB attenuation
800 MHz	+ 6 dBm	+16 dBm
2400 MHz	+10 dBm	+20 dBm
200 MHz to 2200 MHz	+15 dBm, typical	+25 dBm, typical
> 2.2 GHz to 5.0 GHz	+18 dBm, typical	+28 dBm, typical
> 5.0 GHz to 6.0 GHz	+23 dBm, typical	+33 dBm, typical
Second Harmonic Distortion	Preamp Off, 0 dB input attenuation, -30 dBm input	
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 Functional Specifications

Measurements

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} and 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 Ω and 75 Ω 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, Russian plus one User Defined



Spectrum Analyzer Functional Specifications (Models MS203xB only)

Measurements

Smart Measurements	Field Strength (uses antenna calibration tables to measure dBm/m ² 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, AM, Upper/Lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask Coverage Mapping (requires Option 431 and Option 31)
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Setup Parameters

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)

Sweep Functions

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

Trace Functions

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

Marker Functions

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

Limit Line Functions

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



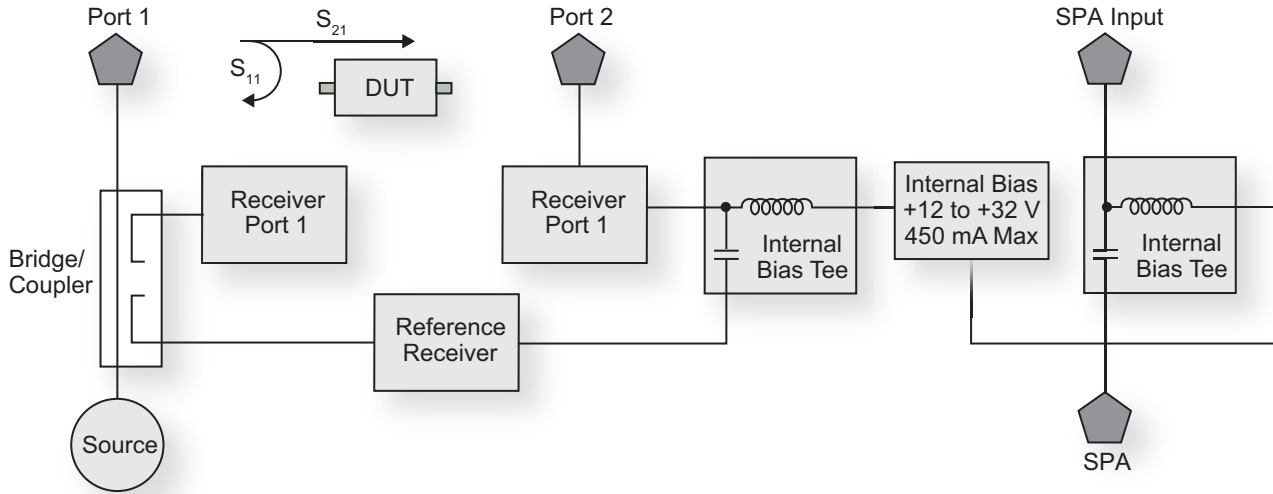
Bias Tee (Option 10)

Bias Tee Measurements

For tower mounted amplifier tests, the MS202xB/MS203xB 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.

Bias Tee Specifications

Frequency Range	
MS20x4B	2 MHz to 4 GHz
MS20x5B	2 MHz to 6 GHz
Internal Voltage/Current	+12 V to +32 V at 450 ma. Steady state
Internal Resolution	0.1 V
Bias Tee Selections	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 15)

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 Omnidirectional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables. The MS202xB/MS203xB solution is superior because the signal source is included internally, precluding the need for an external signal generator.

VVM Specifications

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

**High Accuracy Power Meter (Option 19)** (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.

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108A/18A/26A
Description	High Accuracy RF Power Sensor	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26.5 GHz
Connector	Type N(m), 50 Ω	Type N(f), 50 Ω	Type N(m), 50 Ω	Type N(m), 50 Ω (8/18 GHz)
Dynamic Range	-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 μ W to 200 mW)	-40 dBm to +20 dBm (0.1 μ W to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	± 0.16 dB ¹	± 0.17 dB ²	± 0.16 dB ¹	± 0.18 dB ³
Data sheet (for complete specifications)	11410-00414	11410-00621	11410-00424	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 25)** (Models MS203xB only) (Recommend GPS)**Measurements**

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
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	

Application Options

Impedance	50 Ω , 75 Ω , Other
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**Channel Scanner (Option 27)** (Models MS203xB only)**General**

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Frequency Range	150 kHz to 13 GHz
Frequency Accuracy	± 10 Hz + Time base error
Measurement Range	-110 dBm to +30 dBm
Application Options	Bias-Tee (On/Off), Impedance (50 Ω 75 Ω Other)

**GPS (Option 31)** 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 that 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 or 2000-1652-R), which is configured to mount outside on a metallic surface. Frequency accuracy is enhanced for the Spectrum Analyzer (on MS203xB models) when Options 25 Interference Analyzer and Option 27 Channel Scanner are engaged.

GPS Specifications

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

Ethernet Connectivity (Option 411)

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.

**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 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 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.

Coverage Mapping (Option 431) (Models MS203xB only. Requires GPS)**Measurements**

Indoor Mapping and Outdoor Mapping	RSSI and ACPR
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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

**AM/FM/PM Demodulation Analyzer (Option 509)** (Models MS203xB 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.



General Specifications

Maximum Input (Damage Level) into Vector Network Analyzer
Maximum Input +23 dBm, \pm 50 VDC

Setup Parameters

System	Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test GPS (see Option 31)
System Options	Name, Date and Time, Ethernet Configuration, Brightness, Volume, Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, User defined), Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Copy, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots JPEG (save only), Limit Lines
Copy	Setups, Measurements, Screen Shots JPEG
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Internal Trace/Setup Memory	2000 traces, 2000 setups
External Trace/Setup Memory	Limited by size of USB Flash drive
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

Connectors

VNA Port 1, VNA Port 2	Type N, female, 50 Ω
RF In Damage Level	+30 dBm peak, \pm 50 VDC, Maximum Continuous Input (\geq 10 dB attenuation) (Models MS203xB only)
GPS	SMA, female
External Power	5.5 mm barrel connector, 12.5 VDC to 15 VDC, < 4.0 Amps
USB Interface (2)	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset Jack	3.5 mm barrel connector
External Reference In	BNC, female, Maximum Input \pm 5 VDC 1 MHz, 5 MHz, 10 MHz, 13 MHz
External Trigger/Clock Recovery	BNC, female, Maximum Input \pm 5 VDC
Ethernet	RJ45 connector for Ethernet 10/100-BaseT (Available with Option 411 Ethernet)

Display

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

Power

Field replaceable Battery	Li-Ion, 633-75, 7500 mAh 40 W on battery power only
DC Power	Universal 110/220 V AC/DC Adapter 55 W running off AC/DC adaptor while charging battery
Life time charging cycles	> 300 (80 % of initial capacity)
Battery Operation	3.6 hours, typical
Battery Charging Limits	0 $^{\circ}$ C to +45 $^{\circ}$ C, Relative Humidity \leq 80 %

Electromagnetic Compatibility

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

Safety

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

Warranty

Duration	Standard three-year warranty
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General Specifications (continued)

Environmental (MS202xB/3xB)

MIL-PRF-28800F, Class 2

Temperature, operating (°C) (3.8.2.1 & 4.5.5.14)	Passed, -10 °C to 55 °C, Humidity 85 %
Temperature, not operating (°C) (3.8.2.2 & 4.5.5.1)	Passed, -40 °C to 71 °C
Relative humidity (3.8.2.3 & 4.5.5.1)	Passed
Altitude, not operating (3.8.3 & 4.5.5.2)	Passed, 4600 m (Qualified by similarity — tested on a similar product)
Altitude, operating (3.8.3 & 4.5.5.2)	Passed, 4600 m (Qualified by similarity — tested on a similar product)
Vibration limits (3.8.4.1 & 4.5.5.3.1)	Passed
Shock, functional (3.8.5.1 & 4.5.5.4.1)	Passed
Transit Drop (3.8.5.2 & 4.5.5.4.2)	Passed
Bench handling (3.8.5.3 & 4.5.5.4.3)	Passed
Shock, high impact (3.8.5.4 & 4.5.5.4.4)	Not Required (Not defined in standard; must be invoked and defined by purchase description)
Salt exposure structural parts (3.8.8.2 & 4.5.6.2.2)	Not Required (Not required for Class 2 equipment)

Explosive Atmosphere

MIL-PRF-28800F, Section 4.5.6.3	Passed
MIL-STD-810G, Method 511.5, Procedure 1	Passed

Size and Weight

Dimensions	Height: 199 mm (7.8 in) Width: 273 mm (10.7 in) Depth: 91 mm (3.6 in)
Weight, Including Battery	3.5 kg (7.6 lb)

Instrument Options

VNA Master™ Handheld Vector Network Analyzer + Spectrum Analyzer

Includes standard three-year warranty and Certificate of Calibration and Conformance.

MS2024B	MS2025B	MS2034B	MS2035B	
500 kHz to 4 GHz	500 kHz to 6 GHz	500 kHz to 4 GHz 100 kHz to 4 GHz	500 kHz to 6 GHz 100 kHz to 6 GHz	Vector Network Analyzer Spectrum Analyzer
Options	Options	Options	Options	
MS2024B-0010	MS2025B-0010	MS2034B-0010	MS2035B-0010	Built-in Bias-Tee, +12 V to +32 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	MS2035B-0025	Interference Analysis, 100 kHz to 4/6 GHz ^a
		MS2034B-0027	MS2035B-0027	Channel Scanner, 100 kHz to 4/6 GHz ^a
MS2024B-0031	MS2025B-0031	MS2034B-0031	MS2035B-0031	GPS Receiver (requires GPS antenna, 2000-1528-R or 2000-1652-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 ^b
MS2024B-0501	MS2025B-0501	MS2034B-0501	MS2035B-0501	Distance Domain
		MS2034B-0509	MS2035B-0509	AM/FM/PM Demodulation Analyzer

a.Requires external antenna (Series 2000-xxxx Antenna, or 61532 Antenna Kit), Recommend Option 31 GPS.

b.Requires Option 31 GPS.

Standard Accessories

2000-1654-R	Soft Carrying Case
10920-00060	Handheld Instruments Documentation Disc
2300-498	Master Software Tools Disc (Models MS203xB only)
2300-530	Anritsu Tool Box with Line Sweep Tools (LST) Disc
2000-1691-R	Stylus with Coiled Tether
633-75	Rechargeable Battery, Li-Ion, 7500 mAh
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter, 12 VDC, 60 Watts
3-2000-1498	USB A-type to Mini USB B-type cable, 3.05 m (10 ft)
	Certificate of Calibration and Conformance

Optional Accessories

Ancillary Equipment

2300-517	Phase Noise Measurement Software
2000-1371-R	Ethernet Cable (7 ft)
2000-1653	Protective Screen Cover (Package of 2)
2000-1652-R	GPS Antenna – Magnet mount (active 3–5 V) with SMA connector and 1 ft cable
2000-1528-R	GPS Antenna – Magnet Mount (active 3–5 V) with SMA connector and 4.6 m (15 ft) extension cable
2000-1689	EMI Near Field Probe Kit

High Accuracy Power Sensor

PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, True RMS
MA24106A	High Accuracy Power Sensor, 50 MHz to 6 GHz, True RMS
MA24108A	High Accuracy Power Sensor, 10 MHz to 8 GHz, True RMS
MA24118A	High Accuracy Power Sensor, 10 MHz to 18 GHz, True RMS
MA24126A	High Accuracy Power Sensor, 10 MHz to 26 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

Optional Accessories (continued)**Phase-Stable Test Port Cables, Armored**

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

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-R	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035-R	896 MHz to 941 MHz, SMA (m), 50 Ω (1/4 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 Ω (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 Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
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)
2000-1616	20 MHz to 21000 MHz, N(f), 50 Ω
2000-1487	Telescopic Whip Antenna

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-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

34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
34NFF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω

Optional Accessories (continued)**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

10580-00244	Spectrum Analyzer Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00289	VNA Measurement Guide
10580-00301	VNA Master User 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
11410-00504	Microwave USB Power Sensor MA241x8A
11410-00531	Practical Tips on Making “Vector Voltmeter (VVM)” Phase Measurements using VNA Master (Option 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
11410-00700	Evaluation of RF Network Testing
11410-00601	Effectively Testing 700 MHz Public Safety LTE Broadband and P25 Narrowband Networks
11410-00608	Finding Radio Frequency Interferers

Notes



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