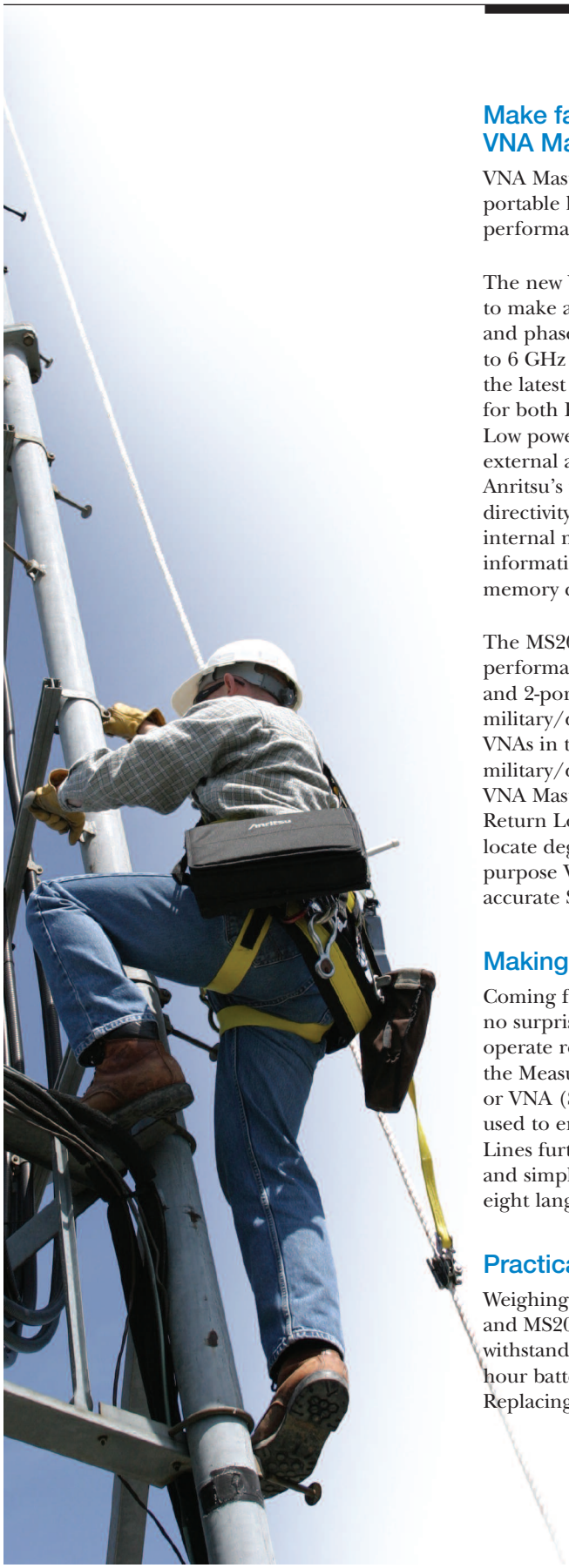
Anritsu

VNA Master™

MS2024A/MS2026A

Handheld Vector Network Analysis from 2 MHz to 6 GHz

Powerful, Portable and Ready to Perform



Make fast and accurate measurements anywhere with VNA Master MS2024A/MS2026A

VNA Master MS2024A and MS2026A are the most advanced ultra portable handheld VNAs on the market featuring unparalleled performance at modest prices.

The new VNA Master is a handheld Vector Network Analyzer designed to make accurate vector corrected 1-port and 1-path 2-port magnitude and phase measurements from 2 MHz to 4 GHz (MS2024A) and 2 MHz to 6 GHz (MS2026A). The MS2024A and MS2026A take advantage of the latest DSP processors technology enabling very fast measurements for both Return Loss and Distance-To-Fault measurements. High and Low power settings for 2-port measurements eliminate the need for external attenuators when performing direct gain measurements. Using Anritsu's precision components, better than 42 dB of corrected directivity can be obtained over the entire frequency range. The internal memory can store more than 1000 traces and setups and information can easily be transferred to a computer using either a memory card, an Ethernet connection, or the USB connection.

The MS2024A and MS2026A's wide frequency range and overall performance find applications in multiple markets. Providing 1-port and 2-port coverage down to 2 MHz fills a requirement for military/defense applications and eliminates the need for bench top VNAs in the field for S11 and S21 measurements. Both the military/defense and commercial wireless markets will appreciate the VNA Master's portable Frequency Domain Reflectometry (FDR) based Return Loss and DTF measurements to verify system performance and locate degradations and faults in cable and antenna systems. General purpose VNA customers looking for an economical solution to make accurate S11 and S21 measurements need to look no more.

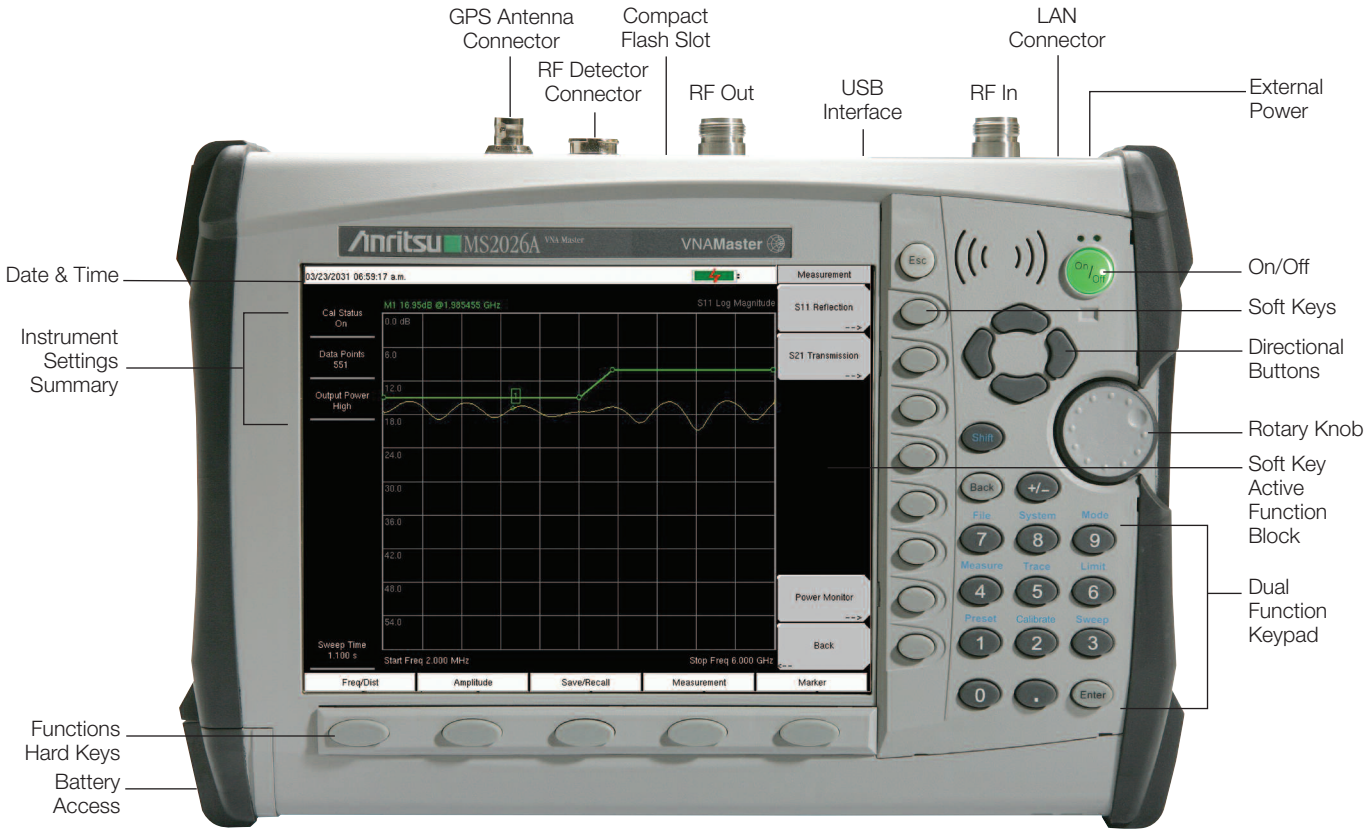
Making It Easy

Coming from the industry leader in cable and antenna analysis, it's no surprise that the MS2024A and MS2026A are incredibly easy to operate requiring little or no training. Depending on the application the Measurement menu can be changed to provide Field (Return Loss) or VNA (S11 Log Magnitude) menus. A full range of markers can be used to enable easier interpretation of the measurement data. Limit Lines further simplify procedures, allowing the user to create quick and simple pass/fail tests. The VNA Master comes packed with menus in eight languages (expandable to ten).

Practical and Ready to Roll

Weighing less than 6.4 pounds including the battery, the MS2024A and MS2026A are light enough to take anywhere. Better still, they easily withstand the rough and tumble of day-to-day punishment. The three-hour battery life allows plenty of time to complete most testing. Replacing the battery takes no time at all, and no tools.

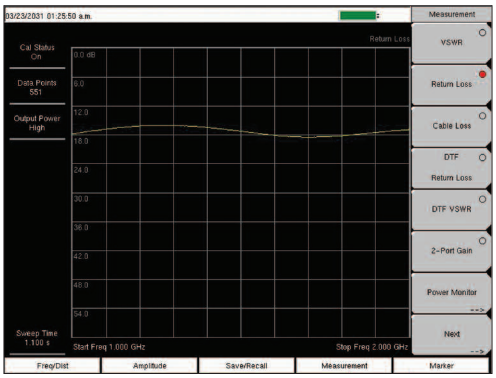
VNA Master is the most advanced 2 MHz to 6 GHz Handheld Vector Network Analyzer on the market



Many Features	Many More Benefits
VNA Menu	S11/S21 Log Magnitude, S11/S21 Phase, S11 Smith Chart, S11 VSWR, Fault Location
Field Menu	Return Loss, VSWR, Cable Loss, DTF RL/VSWR, 2-Port Gain, 1-Port Phase, 2-Port Phase, Smith Chart
Selectable output power for 2-port measurements	No need for external attenuators when measuring gain of active devices.
Powerful Processors	Save time while performing frequency sweeps and DTF measurements.
RF Immunity	Reject unwanted signals in RF rich environments.
Built-in Variable Bias Tee	Deliver +12V to +24V in 3V steps to the center pin of the RF In port. No need for external supply to bias active devices.
Lightweight (<6.4 lbs., including battery)	Instrument is light enough to carry anywhere
Field Replaceable three-hour battery	Maintain high productivity on a single battery; and replace the battery, without tools in seconds.
Multiple Markers	Display up to six markers on screen, each with delta marker capability, to get the exact reading.
Signal Standard/Cable Standard Editor	Add signal and cable standards that are not part of the standard lists.
Eight Built-in Languages	English, Spanish, Italian, French, German, Japanese, Korean, Chinese, and two customized languages.
Memory Storage and Data Transfer	Store more than 1000 traces in memory. Transfer data to a PC using Ethernet, USB, or Memory Card.

Convenient VNA Measurements Anywhere, Anytime

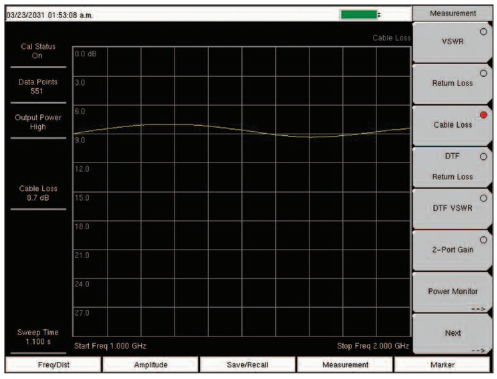
VNA Master performs a variety of RF measurements aimed at simplifying the task for the technician and engineer. A single key selection on the bottom hard keys brings up all the RF measurements you need, whether you are performing flightline test, cable and antenna maintenance, or S-parameters in the lab.



Return Loss

S11 Log Magnitude/Return Loss/VSWR

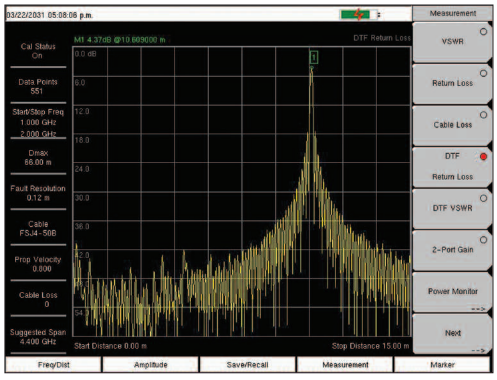
VNA Master's S11 measurements can be used in the lab or in manufacturing to measure the match of attenuators, antennas, cables, filters, amplifiers, or any other passive and active components. In the field, Return Loss is used to characterize cable and antenna systems to ensure conformance to system specific requirements. MS2024A and MS2026A display reflection measurements both in dB and linearly in the form of VSWR. Using Master Software Tools, rho or reflection coefficient is another linear display option.



Cable Loss

Cable Loss

Cable Loss measures the energy lost in the cable or transmission line. It is a field measurement usually performed with a short or open at the end of the cable. Since the absorbed RF energy is frequency dependent, VNA Master also displays the average cable loss over the given frequency range.



Distance-To-Fault

Distance-To-Fault (DTF)

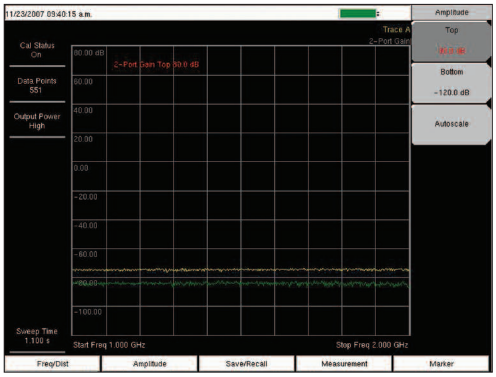
VNA Master's Distance-To-Fault (DTF) measurement is used in the field to precisely locate faults within cable and feedline systems by displaying magnitude discontinuities in dB or VSWR over distance in meters or feet. The DTF display is obtained by performing a sweep in the frequency domain and then by using the inverse Fast Fourier Transform, the data is converted to the time domain. Different windowing (frequency filters) types give the user the flexibility to trade off sidelobes for pulse width.

Frequency Domain Reflectometry (FDR)

TDR (Time Domain Reflectometry) is based on a DC pulse, providing no energy for the RF bands making it impractical to locate degradations and faults at RF frequencies. VNA Master's DTF measurement is based on a swept RF signal and is ideal for detecting faults and degradations in the RF bands. FDR (Frequency Domain Reflectometry) can be used to characterize systems using frequency selective devices (filters, duplexers, lightning arrestors, antennas, combiners), thus providing an early alert to devastating system failures. Plus, FDR can track down costly, time consuming problems due to corrosion, slight pin gaps and damaged RF components. By breaking away from the traditional fix-after-failure maintenance process, FDR techniques find small, hard-to-identify problems before they become big problems by testing the system at the operating frequency.

2-Port Magnitude and Phase Measurements from 2 MHz to 6 GHz

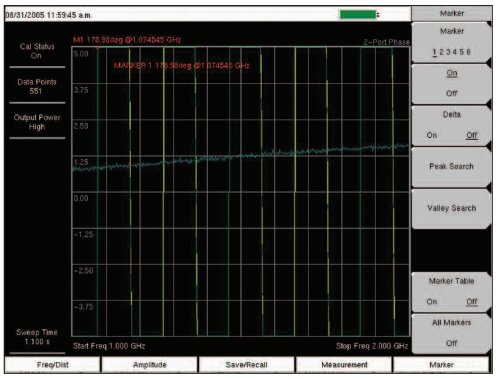
VNA Master is the first handheld VNA to display 1-port and 2-port phase information. All the VNA measurements can be accessed easily by pressing the Measurement key.



S21 Log Magnitude / 2-Port Gain

S21 Log Magnitude/2-Port Gain

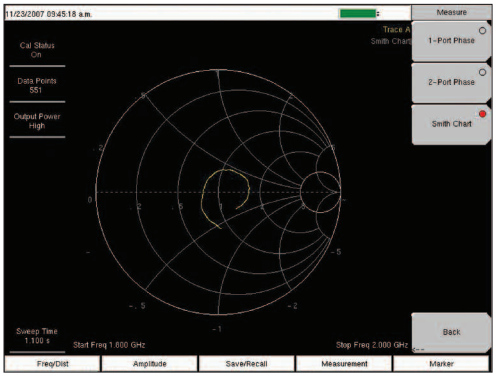
VNA Master's 2-Port measurements feature different output power levels: "High" (0 dBm) and "Low" (–35 dBm). "Low" power levels are used to measure the gain of an amplifier to ensure that the amplifier does not saturate. For cell site or field testing, VNA Master's 2-Port measurements are ideal for antenna-to-antenna isolation or gain measurements. The integrated optional +12 to +24V bias tee eliminates the need for external supplies when biasing an amplifier. Use VNA Master's "High" power setting to measure the insertion loss of passive devices such as cables, filters, and attenuators.



S11 and S21 Phase

S11 and S21 Phase

The MS2024A and MS2026A provide accurate 1-port and 2-port phase measurements for phase matching cables. Using the trace math menu, relative phase measurements can be made for phase matching applications from 2 MHz to 6 GHz.



S11 Smith Chart

S11 Smith Chart

VNA Masters can display matching results in the impedance Smith Chart display. In addition to being a useful tool for transforming between reflection coefficient and normalized impedance, the Smith Chart is used frequently in manufacturing for antenna tuning. Difference in wavelengths or electrical lengths can easily be obtained using the Smith Chart.

Vector Correction

Accuracy, repeatability, and overall quality of the 1-port and 2-port measurements are improved with vector error correction. VNA Master's 1-port measurements remove all the systematic errors associated with the reflection measurement including directivity, source match, and reflection tracking. When using Anritsu's precision components, residual directivity of 42 dB or better can be realized over the entire frequency range. VNA Master's vector corrected 1-path 2-port measurements remove transmission response errors and transmission source match errors in addition to the reflection errors.

VNA Master is a Multiple Purpose Instrument

The 2 MHz to 6 GHz frequency coverage, overall performance, and wide variety of display options available with this lightweight handheld VNA open up opportunities for a wide range of applications in the military/defense, general purpose VNA, and commercial wireless markets.

MS2024A and MS2026A are the first handheld VNAs that provide 1-port and 2-port magnitude and phase measurements in the HF band providing military/defense customers an opportunity to replace the 50 lbs. benchtop VNA for the much more practical 6.4 lbs. handheld battery operated VNA for cable and antenna testing, cable fault/degradation detection using DTF, phase matching, amplifier gain and isolation measurements.

For commercial site verification, the MS2024A and MS2026A's DTF, Return Loss, and 2-port Gain measurements are ideal for more complex cell sites using Tower Mounted Amplifiers.

As a general purpose VNA, the MS2024A and MS2026A are an affordable alternative for university labs and manufacturing lines in need of S-parameter solutions from 2 MHz to 6 GHz. USB and Ethernet ports provide connectivity for data transfer.

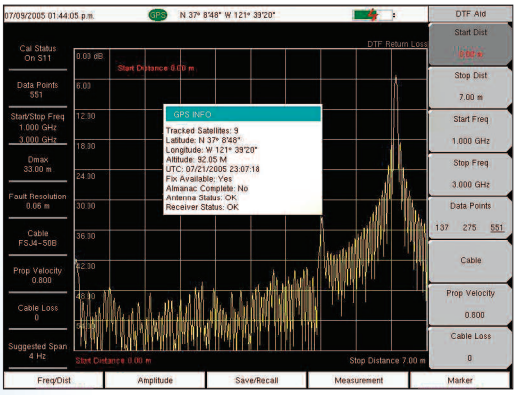
Extend the Functionality with Valuable Options

Power Monitor (Option 5)

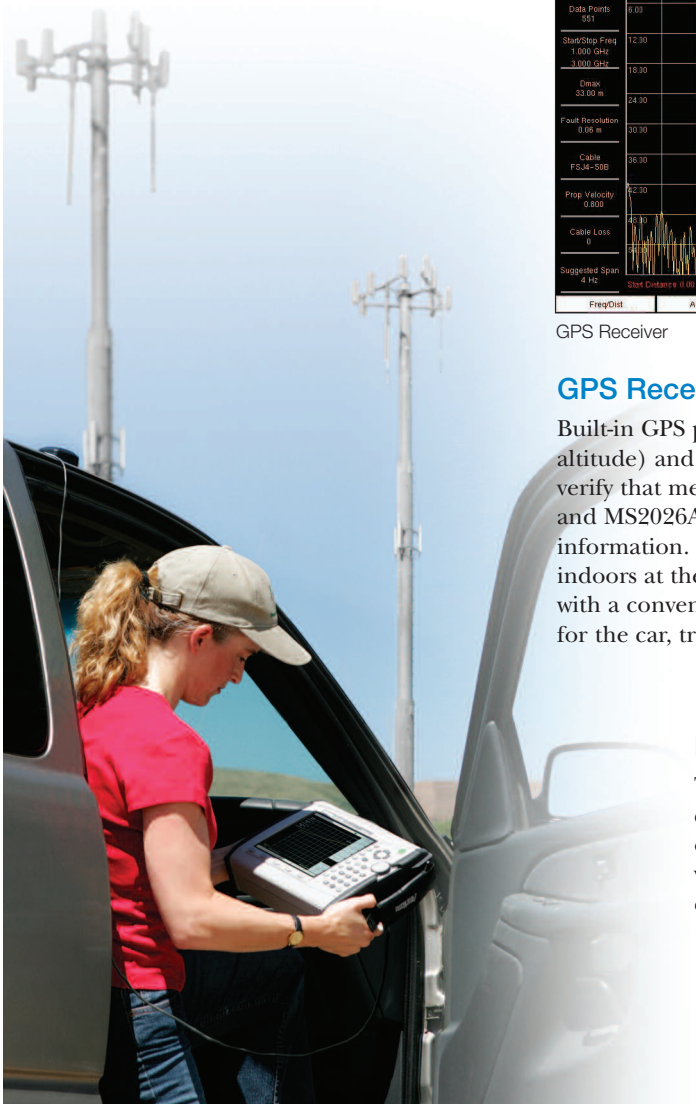
With the Anritsu 560 and 5400 series detectors, technicians can accurately measure broadband power up to 50 GHz. These high-precision detectors significantly help minimize mismatch uncertainty with detector flatness better than 0.5 dB up to 18 GHz.

The Power Monitor also features:

- Measurement range (-50 to +16 dBm)
- Display range (-80 to +80 dBm)
- Display formats: absolute power (dBm or Watts) and relative power (dB or %).
- Built-in auto averaging automatically reduces noise effects while Zeroing allows optimum measurement accuracy at low power levels.



GPS Receiver

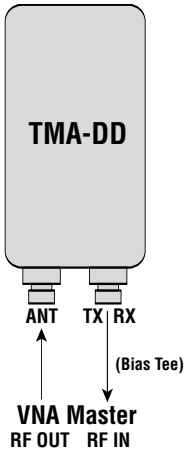


GPS Receiver (Option 31)

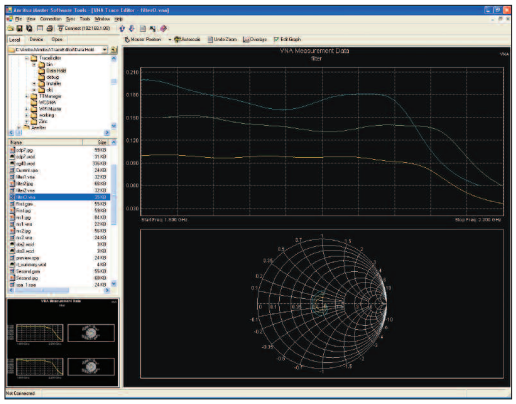
Built-in GPS provides precise location (latitude, longitude, and altitude) and Universal Time (UT) information to help the user verify that measurements are taken at the right location. The MS2024A and MS2026A then stamp each trace and store the GPS location information. This stored data can be used to stamp traces taken indoors at the same cell site location. The GPS option also comes with a convenient magnet-mount antenna with a 15-foot (5m) cable for the car, truck or any other useful surface.

Bias Tee (Option 10)

The integrated, variable Bias Tee is designed to supply bias to the TMA or other active devices, delivering a variable +12 to +24V in 3V steps to the center conductor of the RF In port.



Robust and Dynamic Software for Added Proficiency

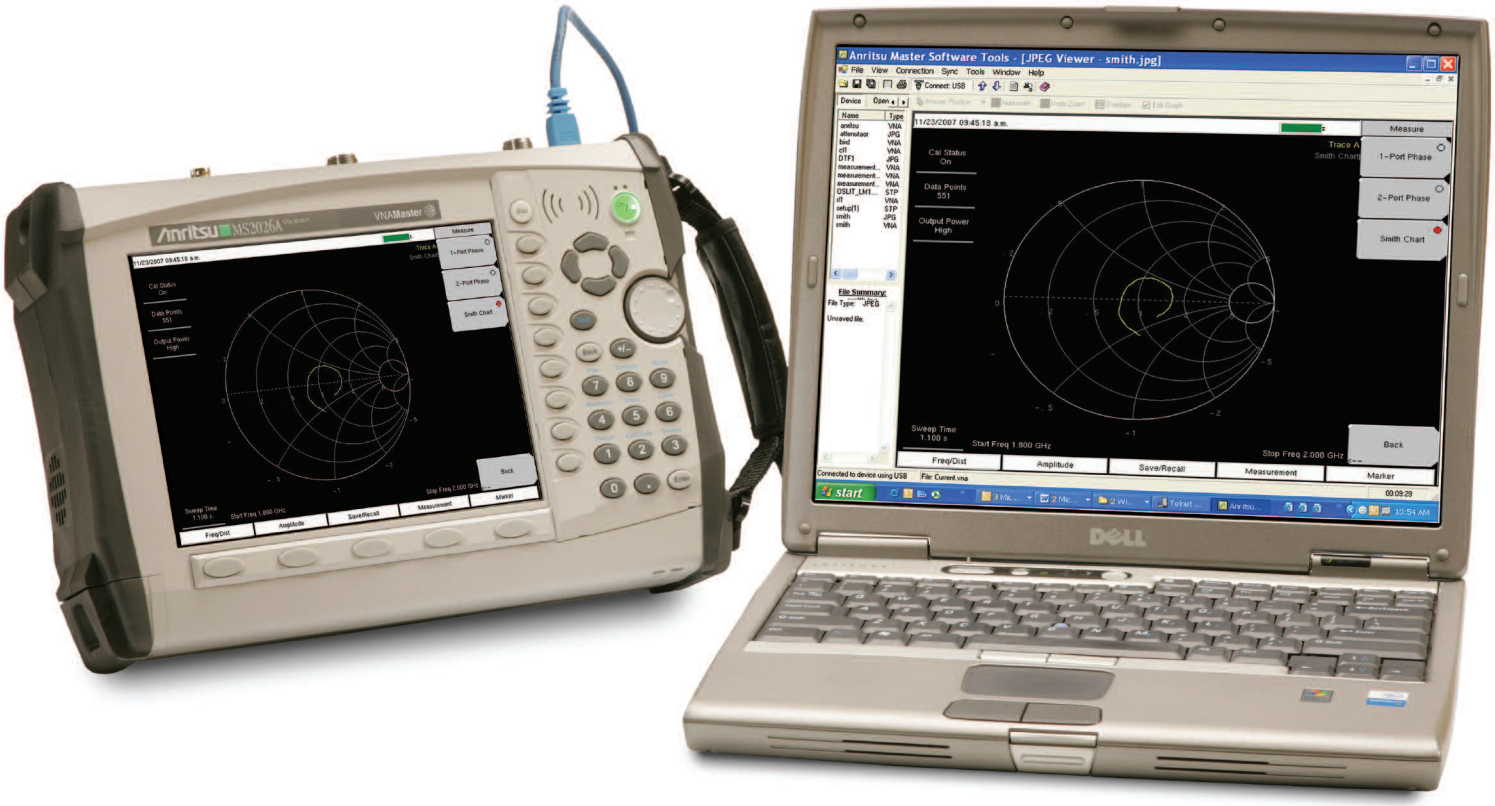


Master Software Tools

Master Software Tools

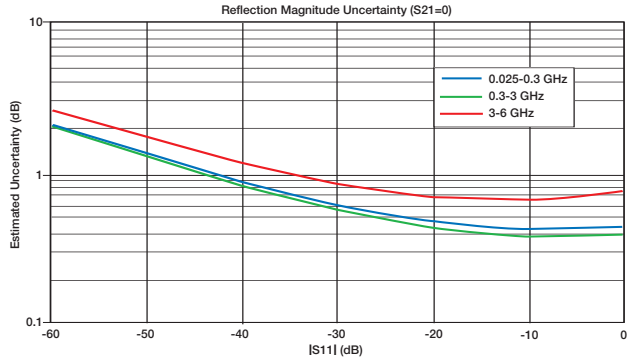
Every MS2024A and MS2026A comes with Master Software Tools, a comprehensive data management and analysis software that provides a simple and easy method for managing, archiving, analyzing, printing and reporting system performance and trends. With Master Software Tools (Windows® 2000/XP compatible) the MS2024A and MS2026A can:

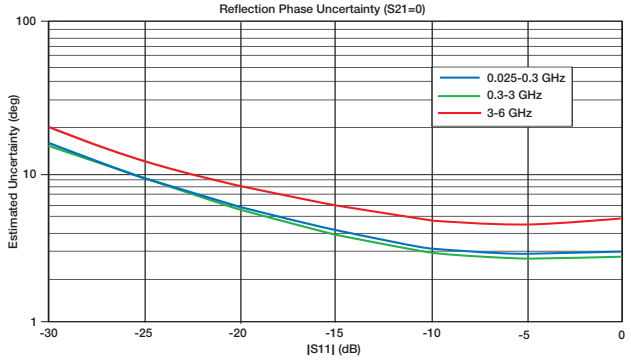
- Establish connection to a PC using Ethernet or USB
- Obtain VSWR, Cable Loss, DTF, Phase, or Smith Chart plots from one Return Loss measurement
- Add/Modify Limit Lines and Markers
- Simplify the task of comparing traces with intelligent drag and drop
- Handle long file names for easy, descriptive data labeling
- Display power level, calibration status, GPS information, and Bias Tee information along with a trace in one professional report
- Upload new cable and signal standards
- Upload traces into the unit for field comparison against historical data
- Store an unlimited number of traces to a PC to help analyze and monitor historical performance
- Add custom languages using the Language Editor

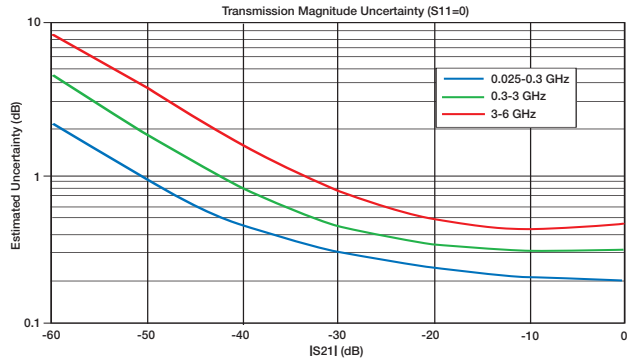


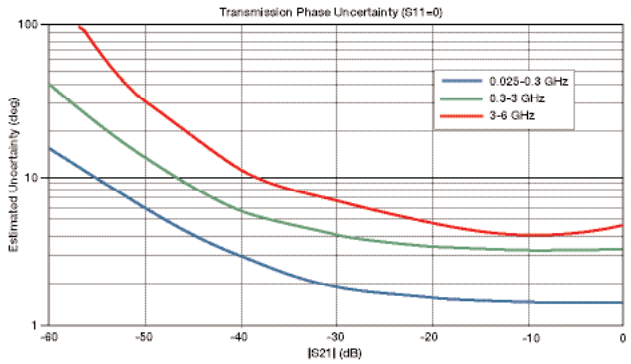
Performance Detail

Uncertainty Curves









The uncertainty graphs above provide measurement uncertainty at 23°C after vector correction for the standard N connector type. Errors are worse-case contributions of residual directivity, source match, frequency response, network analyzer dynamic range, and connector repeatability. For the 1-path 2-port measurements, transmission tracking, crosstalk and physical load match termination was added. OSLN50-1 calibration components were used.

Power Monitor–Detectors

Model	Frequency Range	Impedance	Return Loss	Input Connector	Frequency Response
5400–71N50	0.001 to 3 GHz	50Ω	26 dB	N(m)	±0.2 dB, <1 GHz ±0.3 dB, <3 GHz
5400–71N75	0.001 to 3 GHz	75Ω	26 dB, <2 GHz 20 dB, <3 GHz	N(m)	±0.2 dB, <1 GHz ±0.5 dB, <3 GHz
560–7A50	0.01 to 18 GHz	50Ω	15 dB, <0.04 GHz 17 dB, <18 GHz 22 dB, <8 GHz	GPC–7	±0.5 dB, <18 GHz
560–7N50B	0.01 to 20 GHz	50Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	N(m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz
560–7S50B	0.01 to 20 GHz	50Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	WSMA(m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz
560–7S50–2	0.01 to 26.5 GHz	50Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <26.5 GHz	WSMA(m)	±0.5 dB, <18 GHz ±1.25 dB, <26.5 GHz
560–7K50	0.01 to 40 GHz	50Ω	12 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 15 dB, <26.5 GHz 14 dB, <32 GHz 13 dB, <40 GHz	K(m)	±0.5 dB, <18 GHz ±1.25 dB, <26.5 GHz ±2.2 dB, <32 GHz ±2.5 dB, <40 GHz
560–7VA50	0.01 to 50 GHz	50Ω	12 dB, <0.04 GHz 19 dB, <20 GHz 15 dB, <40 GHz 10 dB, <50 GHz	V(m)	±0.8 dB, <20 GHz ±2.5 dB, <40 GHz ±3.0 dB, <50 GHz

Specifications

VNA Master™ MS2024A and MS2026A are the most ultra-portable VNAs on the market providing high performance 1-port and 1-path 2-port VNA measurements from 2 MHz to 4 GHz (MS2024A) and 2 MHz to 6 GHz (MS2026A). VNA Master's light weight (6.4 lbs.) and three hour battery life provide you with the flexibility needed to make VNA measurements anywhere.

Frequency

Frequency Range:	2 to 4000 MHz (MS2024A) 2 to 6000 MHz (MS2026A)
Frequency Accuracy:	25 ppm
Frequency Resolution[1]:	10 kHz
Data Points:	Low, Medium, High (137/275/551)
Interference Immunity[2]:	
On-Channel:	+17 dBm
On-Frequency:	+10 dBm (RF Out), +30 dBc RF In
1-Port Power:	High: 0 dBm (typical)
2-Port Power:	High: 0 dBm (typical) Low: –35 dBm (typical)
Residual Directivity[3]:	42 dB (2 MHz to 6 GHz)
1-Port Accuracy[3]:	= <0.8 + |20 log(1 ±$10^{-EΔ/20}$)| dB, typical EΔ = Directivity – Measured Return Loss
System Dynamic Range:	80 dB, 2 MHz to 3 GHz 70 dB, >3 GHz to 5.5 GHz 65 dB, >5.5 GHz to 6 GHz

Return Loss

Range: 0 to 60 dB
Resolution: 0.01 dB

VSWR

Range: 1 to 65
Resolution: 0.01

Cable Loss

Range: 0 to 30 dB
Resolution: 0.01 dB

1-Port Phase

Range: –180° to +180°
Resolution: 0.01°

Smith Chart

Resolution: 0.01

2-Port Gain

Range: –120 to 100 dB
Resolution: 0.01 dB

2-Port Phase

Range: –180° to +180°
Resolution: 0.01°

Dynamic Range

80 dB, 2 MHz to 3 GHz
70 dB, 3 GHz to 5.5 GHz
65 dB, 5.5 GHz to 6 GHz

Distance-to-Fault (DTF)

Fault Resolution (meters):	(1.5 x 10^8 x vp)/ΔF vp is the propagation constant and ΔF is F2–F1 in Hz
Horizontal Range (meters):	0 to (data points–1) x Fault Resolution to a maximum of 1500m (4921 ft.) where datapoints = 137/275/551
Vertical Range (Return Loss):	0 to 60 dB
Vertical Range (VSWR):	1 to 65

RF Power Monitor (Option 5)

Display Range:	–80 to +80 dBm (10 pW to 100 kW)
Measurement Range:	–50 to +16 dBm (10 nW to 40 mW)
Offset Range:	0 to +60 dB
Resolution:	0.1 dB or 0.1 W
Accuracy:	±1 dB

GPS Receiver (Option 31)

GPS Location Indicator, Latitude, Longitude and Altitude, and UTC

Bias Tee (Option 10)

Voltage/Current:	+12V, 250 or 500 mA steady state +15V, 250 or 500 mA steady state +18V, 350 mA steady state +21V, 300 mA steady state +24V, 250 mA steady state

General Specifications

Languages Built-in English, Spanish, Italian, French, German, Japanese, Korean, and Chinese. Can also customize two additional languages using Master Software Tools.

Memory Internal memory provides for the storage and recall of more than 1000 traces and setups. The contents of the internal memory can be copied to and from a removable Compact Flash card.

Markers six markers (delta marker, peak search, valley search) and Marker Table.

Traces View Trace, Memory, Trace – Memory, Trace + Memory, Trace and Memory

Limit Lines Upper and Lower Limit. Each upper and lower limit can be made up of one to forty segments.

Display Bright daylight-viewable color TFT LCD, Full SVGA, 8.4 in.

Interface Connectors
Type N female RF Out Port and RF In Port (50Ω)
5-pin Mini-B USB 2.0 for data transfer to a PC
RJ45 Connector for Ethernet 10/100 Base-T
2.5 mm 3-wire cellular headset connector

Remote Programmability Commands Not Available

Power Supply External DC Input, +12V, 5A max

ESD Damage Level 10 kV

Maximum Input (Damage Level) Test Port, Type N: +22 dBm
RF Detector: +20 dBm

Impedance 50 Ω

Dimensions 12 x 8 x 3 in. (305 x 203 x 76 mm)

Weight <6.4 lbs (2.9 kg)

Environment MIL–PRF–2800F Class 2

Operating: –10°C to 55°C, humidity 85% or less
Storage: –51°C to 71°C
Altitude: 4600 meters, operating and non-operating

Safety Conforms to EN 61010–1 for Class 1 portable equipment

Electromagnetic Compatibility Meets European Community requirements for CE marking.

[1] If display resolution (Span/(DataPoints–1)) is less than 150 kHz, then frequency resolution only applies to measurements with RF Immunity set to Normal.

[2] On Channel Interference Immunity is specified at >1.0 MHz of the carrier frequency. On-Frequency Interference Immunity is specified to within ±10 kHz of the carrier frequency.

[3] All accuracy and directivity specifications apply only when using Anritsu precision components.

[4] For data transfer only, remote programmability commands not available.

Ordering Information

Site Master Base Model

MS2024A	2-Port VNA Master 2 MHz to 4 GHz
MS2026A	2-Port VNA Master 2 MHz to 6 GHz

Options

MS2020/5	Power Monitor (requires external detector)
MS2020/10	Built-in Variable Bias Tee
MS2020/31	GPS (includes GPS antenna 2000–1410)

Standard Accessories (One year warranty)

10580–00122	User's Guide
61382	Soft Carrying Case
2000-1358	Compact Flash Card (64 MB)
64343	Tilt Bail
2300–498	Master Software Tools CD ROM
633–44	Rechargeable Li-Ion Battery
40–168	AC-DC Adapter
806–141	Automotive cigarette lighter 12 V DC Adapter
2000–1360	USB A–to mini B cable, 6 feet (1.83m)
2000–1371	Ethernet cable, 7 feet (2.13 m)

Optional Accessories

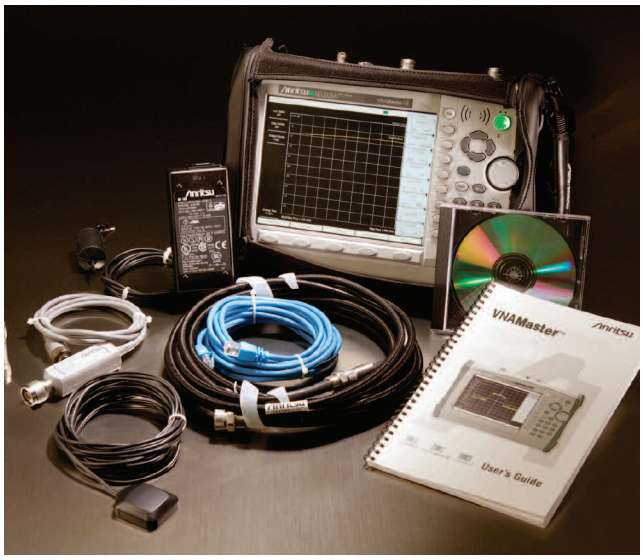
OSLN50–1	Precision N(m) Open/Short/Load, 42 dB, 6 GHz
OSLNF50–1	Precision N(f) Open/Short/Load, 42 dB, 6 GHz
22N50	Precision N(m) Short/Open, 18 GHz
22NF50	Precision N(f) Short/Open, 18 GHz
SM/PL–1	Precision N(m) Load, 42 dB, 6.0 GHz
SM/PLNF–1	Precision N(f) Load, 42 dB, 6.0 GHz
2000–767	Precision Open/Short/Load, 7/16(m), 4.0 GHz
2000–768	Precision Open/Short/Load, 7/16(f), 4.0 GHz
1N50C	Limiter, N(m) to N(f), 50Ω, 0.01 to 50 GHz
42N50–20	Attenuator, 20 dB, 5W, DC to 18 GHz, N(m)–N(f)
42N50A–30	Attenuator, 30 dB, 50W, DC to 18 GHz, N(m)–N(f)
2000–1410	Magnet Mount GPS Antenna with 15 ft (4.6m) cable
760–235	Hard Transit Case
10580–00122	User's Guide
61382	Soft Carrying Case
2000-1358	Compact Flash Card (64 MB)
2000-1374	Dual Battery Charger
64343	Tilt Bail
2300–498	Master Software Tools CD ROM
633–44	Rechargeable Li-Ion Battery
40–168	AC-DC Adapter
806–62	Automotive cigarette lighter 12 VDC Adapter
2000–1360	USB A to mini B cable, 6 feet (1.83m)
2000–1371	Ethernet cable, 7 feet (2.13 m)

Precision Adaptors

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

Adaptors

1091–26	N(m)–SMA(m), DC to 18 GHz, 50Ω
1091–27	N(m)–SMA(m), DC to 18 GHz, 50Ω
1091–80	N(f)–SMA(m), DC to 18 GHz, 50Ω
1091–81	N(f)–SMA(f), DC to 18 GHz, 50Ω
1091–172	N(m)–BNC(f), DC to 1.3 GHz, 50Ω
510–90	7/16 DIN(f)–N(m), DC to 7.5 GHz, 50Ω
510–91	7/16 DIN(f)–N(f), DC to 7.5 GHz, 50Ω



510–92	7/16 DIN(m)–N(m), DC to 7.5 GHz, 50Ω
510–93	7/16 DIN(m)–N(f), DC to 7.5 GHz, 50Ω
510–96	7/16 DIN(m)–N(m), DC to 7.5 GHz, 50Ω
510–97	7/16 DIN(f)–N(f), DC to 7.5 GHz, 50Ω
510–102	N(m)–N(m), 90° right angle, DC to 11 GHz, 50Ω

Detector Extender Cable

800–109	7.6m (25 ft.)
800–110	15.2m (50 ft.)
800–111	30.5m (100 ft.)
800–112	61.0m (200 ft.)

Band Pass Filter

1030–109	836.5 MHz Ctr Freq, 25.8 MHz BW, N(m) to SMA(f), 50Ω
1030–110	897.5 MHz Ctr Freq, 35 MHz BW, N(m) to SMA(f), 50Ω
1030–111	1.88 GHz Ctr Freq, 63.1 MHz BW, N(m) to SMA(f), 50Ω
1030–112	2.442 GHz Ctr Freq, 85.1 MHz BW, N(m) to SMA(f), 50Ω

Test Port Cable Armored

15NN50A	1.5 meters, N(m)–N(m), 6 GHz, 50Ω
15NN50–3.0C	3.0 meters, N(m)–N(m), 6 GHz, 50Ω
15NN50–5.0C	5.0 meters, N(m)–N(m), 6 GHz, 50Ω
15NN50–1.5C	1.5 meters, N(m)–N(f), 6 GHz, 50Ω
15NN50–3.0C	3.0 meters, N(m)–N(f), 6 GHz, 50Ω
15NN50–5.0C	5.0 meters, N(m)–N(m), 6 GHz, 50Ω
15ND50–1.5C	1.5 meters, N(m)–7/16 DIN(m), 6 GHz, 50Ω
15NDF50–1.5C	1.5 meters, N(m)–7/16 DIN(f), 6 GHz, 50Ω

Literature

10580–00122	MS2024A/MS2026A User's Guide
10580–00123	MS2024A/MS2026A Programming Manual
11410–00369	MS2024A/2026A Brochure
11410-00372	MS2024A/MS2026A Technical Datasheet
11410–00274	Tower Mounted Amplifiers Application Note
11410–00214	Reflection Measurement Application Note

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