Technical Data Sheet

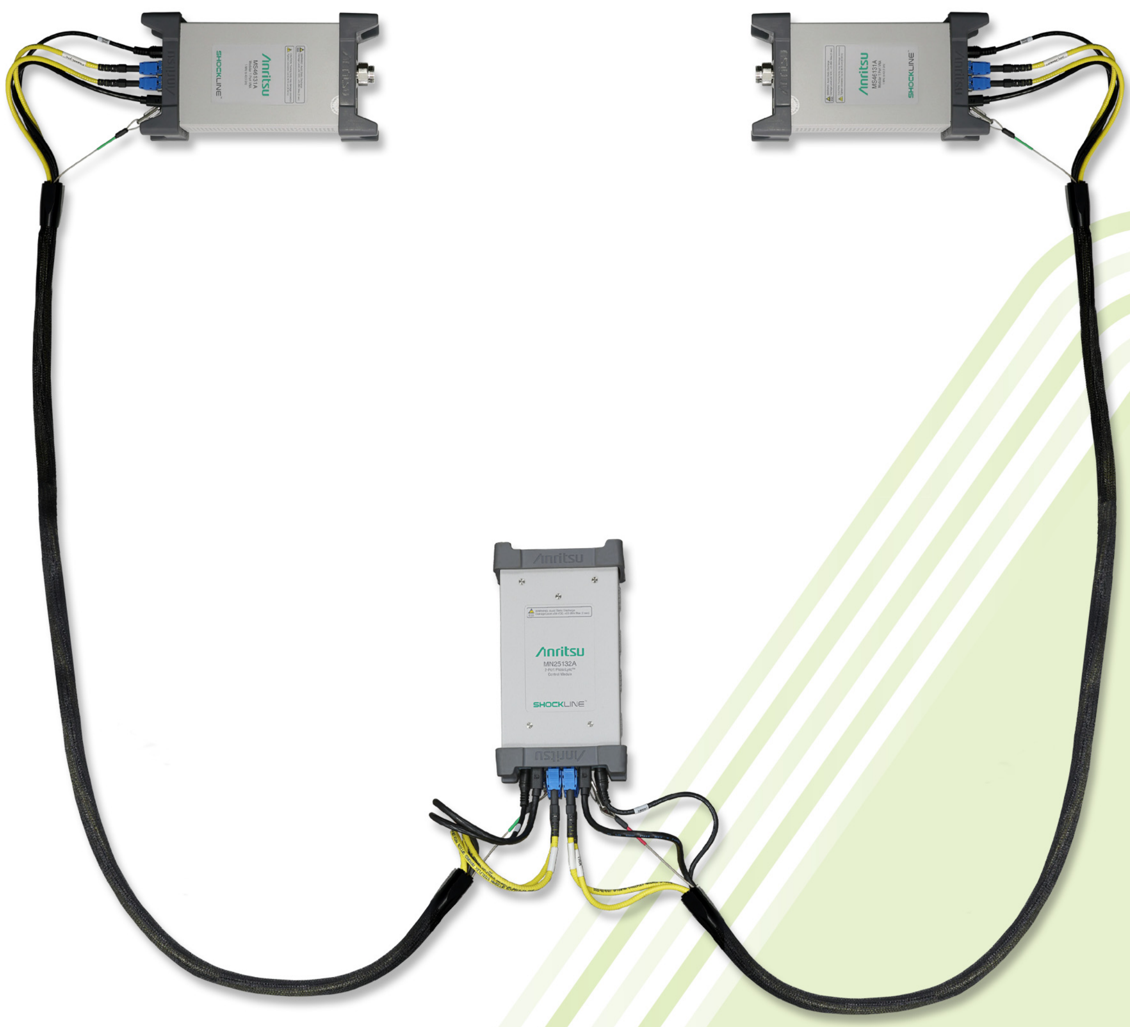
Anritsu Advancing beyond

ShockLine™ Modular 2-port PhaseLync™ VNA

ME7869A

ME7869A-010 1 MHz to 8 GHz
ME7869A-020 1 MHz to 20 GHz
ME7869A-043 1 MHz to 43.5 GHz

20 Meter, 50 Meter, 100 Meter Options



Introduction

The ME7869A is part of the ShockLine™ family of Vector Network Analyzers from Anritsu. It is a modular 2-port VNA consisting of two ShockLine MS46131A 1-port VNAs synchronized with PhaseLync™ technology. The ShockLine ME7869A 2-port VNA is available in three frequency ranges: 1 MHz to 8/20/43.5 GHz, and is capable of S-parameter and time domain measurements.

The two ShockLine MS46131A VNAs determine the instrument performance of the ME7869A, as they become the test ports and provide the source and measurement capabilities for the 2-port VNA. The MS46131A is based on patented ShockLine VNA on-chip technology, which simplifies the internal VNA architecture at high frequencies, reduces instrument cost and size, and enhances accuracy and measurement repeatability.

The patented PhaseLync technology enables the multiple MS46131As to phase synchronize, enabling the ME7869A VNA to measure complex S-parameters on passive RF and Microwave devices. The MS46131A-025/050/100 PhaseLync options support synchronization to distances of up to 100 meters, enabling the ME7869A to simplify applications where vector transmission measurements over distance is required by bringing the VNA port to the DUT.

The ME7869A VNA uses USB communication to control both MS46131A VNAs from an external PC. ShockLine software runs the ME7869A as well as the rest of the ShockLine family of VNAs, providing a powerful graphical user interface for debugging and manual testing of devices. The software also provides a common command syntax that is compatible across the entire ShockLine VNA lineup for comprehensive remote control programming.

This document provides detailed specifications for the ME7869A series Vector Network Analyzers and related options.

Models and Operating Frequencies

An ME7869A VNA comprises:

VNA (2):

- MS46131A
- MS36131A- 010/020/043 (Select one Frequency option: 10/20/43)

2-port PhaseLync Control Module MN25132A

Length Option:
(Order separately, two required, enabled on both VNAs):

- MS46131A-025 For lengths ? 20 m
- MS46131A-050 For lengths ? 50 m
- MS46131A-100 For lengths ? 100 m

PhaseLync cables (2):
(Order separately. Total cable length must be equal to or less than the length option distance.)

- 2000-2123-R: 2 m
- 2000-2124-R: 5 m
- 2000-2125-R: 10 m
- 2000-2126-R: 25 m
- 2000-2127-R: 50 m
- 2000-2128-R: 75 m

Optional Capabilities

Time Domain Measurements, MS46131A-002	Displays all S-parameters and overlays with Frequency Domain, Low-pass Mode with added harmonics frequency list flexibility, Band-pass Mode, Phasor Impulse Mode, Windowing, Gating (pass-band or reject-band), and Frequency with Time Gate. Option must be enabled on both MS46131As in the ME7869A configuration for time domain to be enabled for the 2-port VNA.

Table of Contents

Definitions

	All specifications and characteristics apply under the following conditions, unless otherwise stated.
	ME7869A 2-port VNAs consist of: • Two MS46131A, Base model, revision 2 • MN25132A, Control Module • Two PhaseLync cables
Warm-Up Time	After 60 minutes of warm-up time, where the instrument is left in the ON state.
Temperature Range	Over the 25 °C ± 5 °C temperature range.
Error-Corrected Specifications	Specifications are valid over 23 °C ± 3 °C, with < 1 °C variation from calibration temperature. Error-corrected specifications are warranted and include guard-bands, unless otherwise stated.
Frequency Bands in Tables	When a frequency is listed in two rows of the same table, the specification for the common frequency is taken from the lower frequency band.
User Cables	Specifications do not include effects of any user cables attached to the instrument.
Discrete Spurious Responses	Specifications may exclude discrete spurious responses.
Internal Reference Signal	All specifications apply with the internal 10 MHz frequency reference.
Interpolation Mode	All specifications are with Interpolation Mode Off.
Typical Performance	Typical performance indicates the measured performance of an average unit. It does not include guard-bands and is not covered by the product warranty. Typical specifications are shown in parenthesis, such as (-102 dB), or noted as Typical.
Characteristic Performance	Characteristic performance indicates a performance designed-in and verified during the design phase. It is not covered by the product warranty.
Transmission Performance	All transmission specifications are tested with a 2-meter PhaseLync cable. These specifications may be interpreted as typical values for longer PhaseLync cable lengths.
Recommended Calibration Cycle	12 months (Residual specifications also require calibration kit calibration cycle adherence.)
Instrument Grounding	For optimum performance and ESD protection, the AC power cord to the external power supply should be plugged into a AC socket with a ground. If this is not possible, the ground receptacles on the MS46131As and MN25132A can be used to ground the chassis.
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com
Patents	The instrument may be protected by one or more of the following patents: 6894581, 7088111, 7545151, 7683633, 7924024, 8417189, 8718586, 9967085, 9964585, 9860054, 9733289, 9366707, 10778592, 9366707, 9733289, 9860054, 9964585, 9967085, 10003453, and 10116432, depending upon the model and option configuration of the instrument.

System Dynamic Range

System dynamic range is calculated as the difference between High source power and the noise floor (RMS) at the specified reference plane at 10 Hz IF bandwidth. High isolation mode is used.

Frequency Range	All Configurations (dB)
1 MHz to 5 GHz	97 (110 typical)
> 5 GHz to 8.5 GHz	97[a,b] (105 typical)
> 8.5 GHz to 20 GHz	98 (110 typical)
> 20 GHz to 40 GHz	102 (110 typical)
> 40 GHz to 43.5 GHz	99 (110 typical)

a. Dynamic range may degrade in the > 5 GHz to 7 GHz range to 90 dB (105 dB typical).
b. Dynamic range may be degraded on -020 and -043 Options -020 and -043 due to receiver residuals: 91 dB (97 dB typical)..

High Level Noise — 1-Port MS46131A-010

Measured at 100 Hz IF bandwidth and at High power level, RMS.

Frequency	Magnitude (dB)	Phase (deg)
1 MHz to 8 GHz	0.009 (0.003 typical)	0.12 (0.03 typical)

High Level Noise — 1-Port MS46131A-020/043

Measured at 100 Hz IF bandwidth and at High power level, RMS.

Frequency	Magnitude (dB)	Phase (deg)
1 MHz to 6 GHz	0.009 (0.003 typical)	0.12 (0.03 typical)
> 6 GHz to 8 GHz	0.022 (0.01 typical)	0.15 (0.08 typical)
> 8 GHz to 40 GHz	0.006 (0.001 typical)	0.1 (0.02 typical)
> 40 GHz to 43.5 GHz	0.009 (0.002 typical)	0.12 (0.03 typical)

High Level Noise — 2-Port

Measured at 100 Hz IF bandwidth and at High power level, RMS exclusive of drift. High Isolation Mode off.

Frequency	Magnitude (dB)	Phase (deg)
1 MHz to 4GHz	0.007 (0.0015 typical)	0.21 (0.02 typical)
> 4 GHz to 8 GHz	0.011 (0.003 typical)	0.51 (0.08 typical)
> 8 GHz to 20 GHz	0.006 (0.0015 typical)	0.51 (0.08 typical)[a]
> 20 GHz to 43.5 GHz	0.011 (0.0025 typical)	0.59 (0.25 typical)[b]

a. Phase noise degraded to 0.6 deg (0.41 typical) for MS46131A-100.
b. Phase noise degraded to 1.6 deg (0.56 typical) for MS46131A-100.

Receiver Compression Levels

Port power level beyond which the response may be compressed more than 0.1 dB. Performance is typical.

Frequency Range	All Configurations (dBm)
1 MHz to 43.5 GHz	+ 5

Output Power Settings

Performance is typical.

Power Setting	All Configurations
High (default)	0 dBm ±2dB
Low	– 20 dBm ±2dB
Off	-50 dBm

Measurement Stability — 1-Port

Performance is typical.

Frequency	Magnitude (dB/°C)	Phase (deg/°C)
1 MHz to 43.5 GHz	0.02	0.3

Measurement Stability — 2-Port

Ratioed transmission measurement at default power with an electrically short thru in place over the normal specified temperature range and a 20 m PhaseLync interconnect (values approximately scale with length of the interconnect). Measured with both modules and interconnect in the same environment. Adequate airflow around the ME7869A VNA modules is recommended to ensure optimal performance. Larger values may be obtained with a temperature differential between modules. Performance is typical. For PhaseLync configurations of 50 meters or more, operating in the frequency range above 20 GHz to 43.5 GHz, the phase stability specification is approximately 2 degrees per °C

Frequency	Magnitude (dB/°C)	Phase (deg/°C)
1 MHz to 8 GHz	0.015	0.4
> 8 GHz to 20 GHz	0.015	0.5
> 20 GHz to 43.5 GHz	0.02	1.25

Frequency Resolution, Accuracy, and Stability

Resolution	Accuracy	Stability	Aging
1 Hz	± 1.0 ppm (at time of calibration)	± 1.0 ppm from -10 °C to +55 °C, typical	± 1.0 ppm/year, typical

Uncorrected (Raw) Port Characteristics

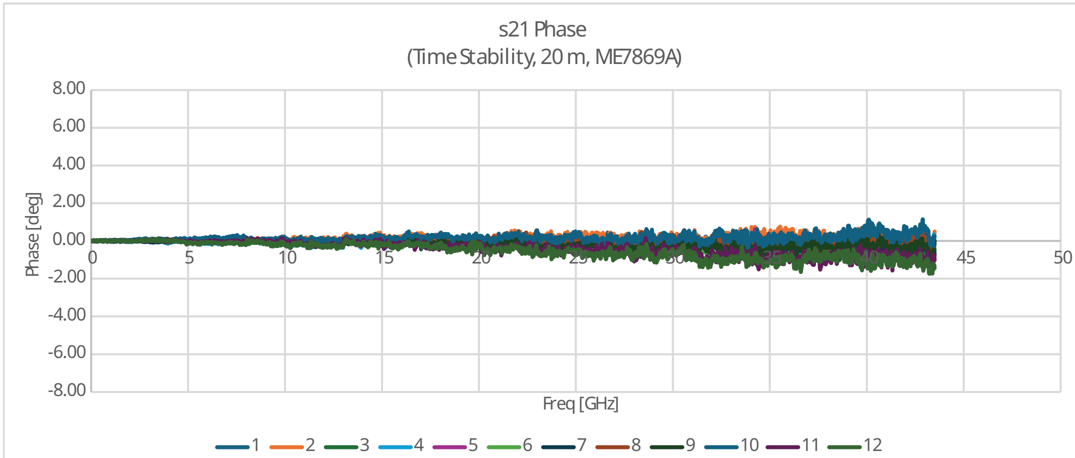
User correction off. System Correction On. All specifications are typical.

Frequency Range	Directivity (dB)	Port Match (dB)[a]
50 kHz to 1 GHz	> 21	> 17
> 1 GHz to 4 GHz	> 21	> 17
> 4 GHz to 8.5 GHz	> 15	> 15
> 8.5 GHz to 43.5 GHz	> 15	> 15

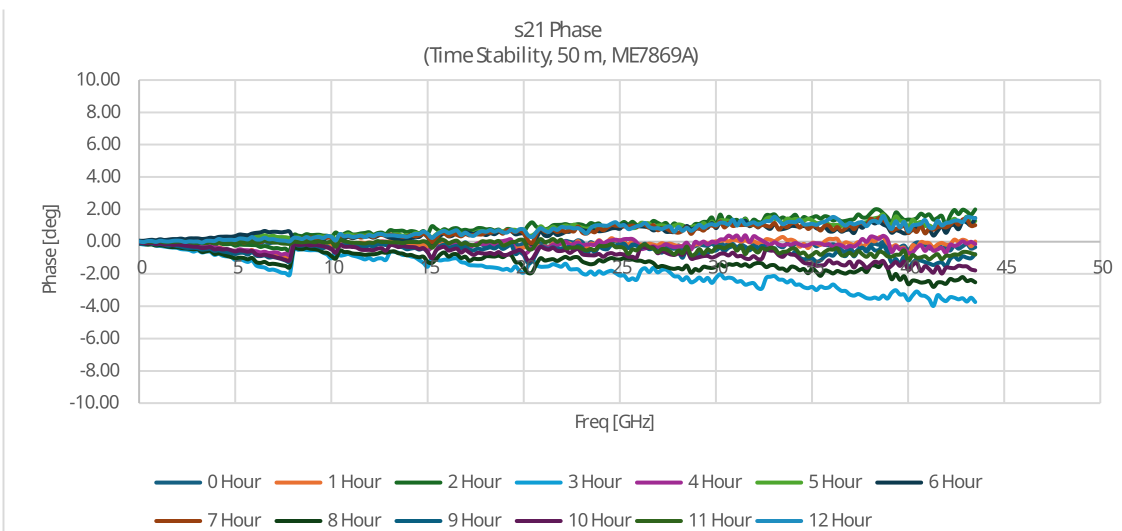
a. Port Match is defined as the worst of source and load match.

Phase Stability Plots

The phase stability plot below is captured from a 20-meter ME7869A PhaseLync system in a temperature-controlled chamber, with data recorded hourly over a 12-hour period.



The phase stability plot below is captured from a 50-meter ME7869A PhaseLync system placed on a bench in an uncontrolled temperature environment, with data recorded hourly over a 12-hour period.



MS46131A-010 VNA System Performance with Manual Cal Kits

Error-Corrected Specifications

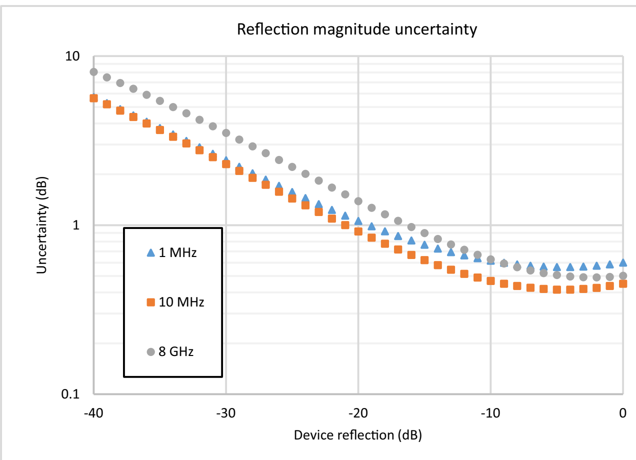
With calibration using TOSLN50A-8 or TOSLNF50A-8 N type connector calibration kits.

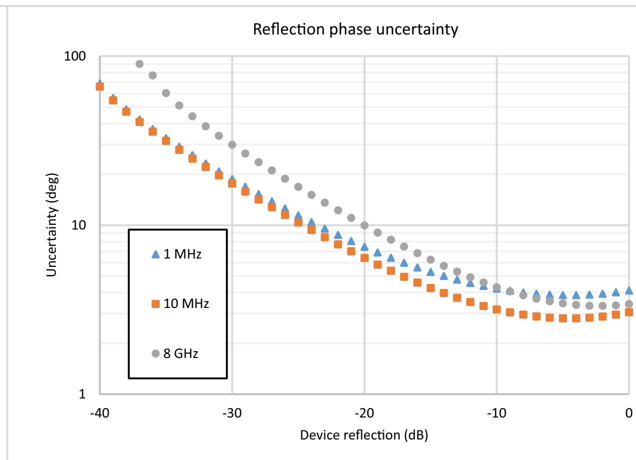
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to 6 GHz	? 42	? 33	? 41	± 0.15	±0.06
> 6 GHz to 8 GHz	? 37	? 33	? 36	± 0.15	±0.06

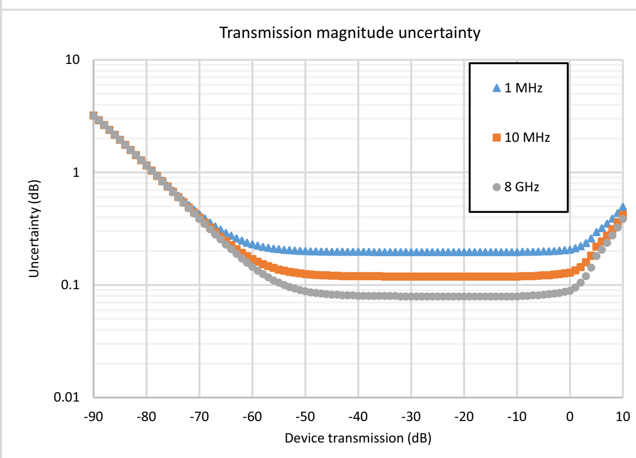
a. Characteristic performance.

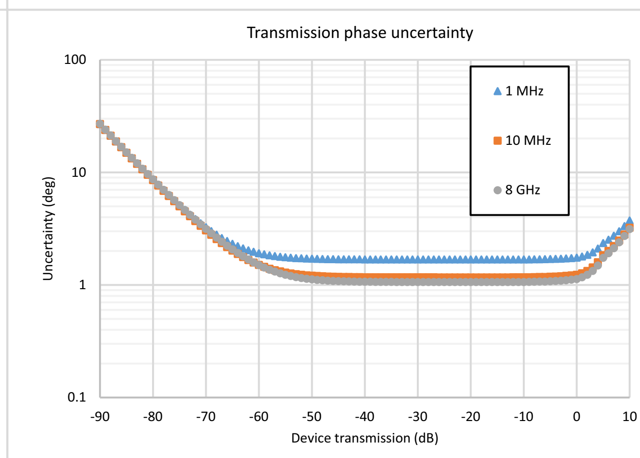
Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that $S_{21} = S_{12} = 0$. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.









MS46131A-020 VNA System Performance with Manual Cal Kits

Error-Corrected Specifications

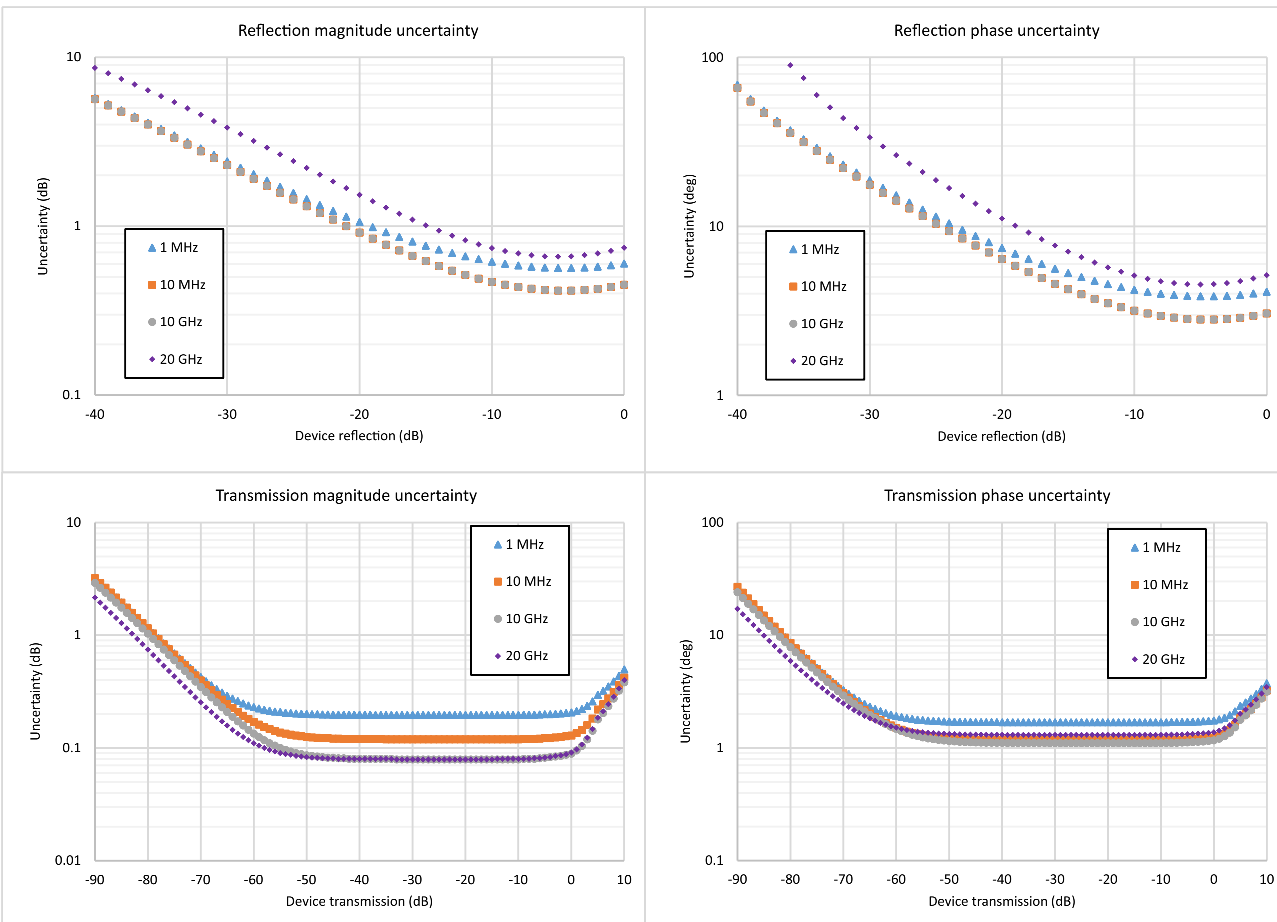
With calibration using the TOSLK50A-20 or TOSLKF50A-20 K type connector calibration kits.

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to 10 GHz	? 42	? 33	? 41	± 0.15	±0.06
> 10 GHz to 20 GHz	? 36	? 26	? 35	± 0.15	±0.06

a. Characteristic performance.

Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that $S_{21} = S_{12} = 0$. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.



MS46131A-043 VNA System Performance with Manual Cal Kits

Error-Corrected Specifications

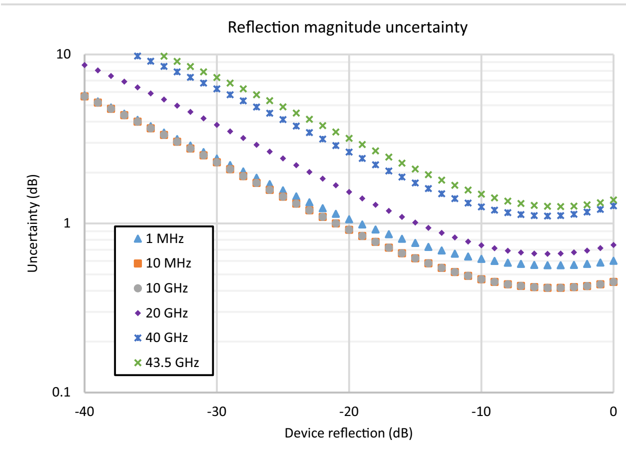
With calibration using TOSLK50A-43.5 or TOSLKF50A-43.5 K type connector calibration kits with generic calibration coefficients.

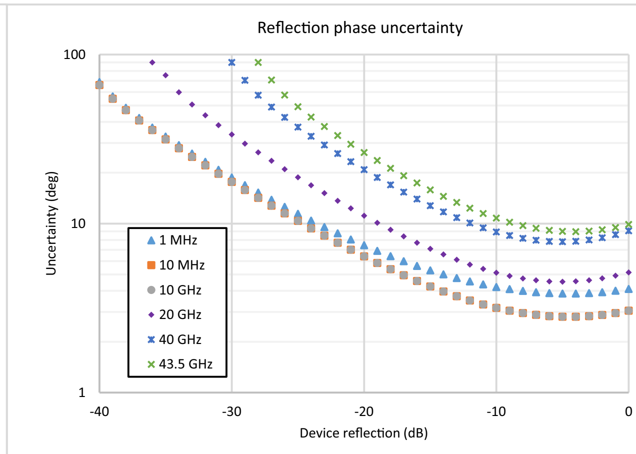
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to 10 GHz	? 42	? 33	? 41	± 0.15	±0.06
> 10 GHz to 20 GHz	? 36	? 26	? 35	± 0.15	±0.06
> 20 GHz to 30 GHz	? 32	? 22	? 31	± 0.15	±0.06
> 30 GHz to 40 GHz	? 30	? 20	? 29	± 0.15	±0.06
> 40 GHz to 43.5 GHz	? 28	? 20	? 27	± 0.2	±0.16

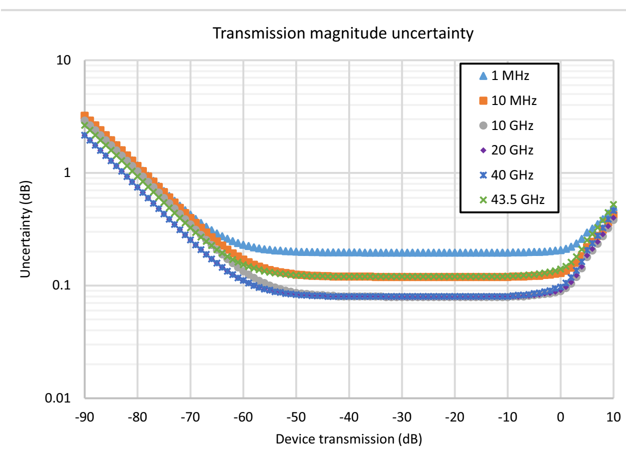
a. Characteristic performance.

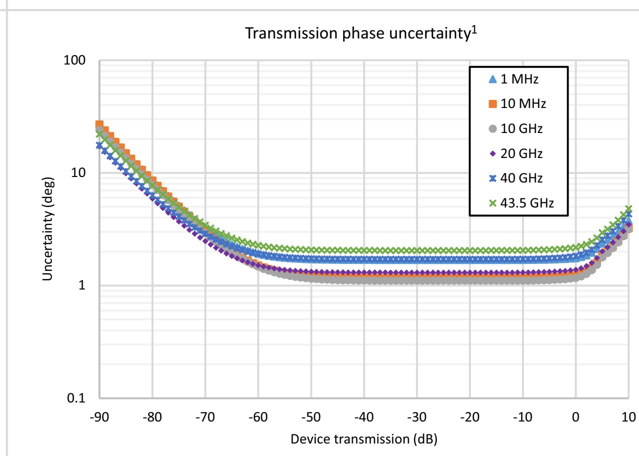
Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that $S_{21} = S_{12} = 0$. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.









1 For the transmission phase on 100 m systems, the uncertainty for device transmission between -65 dB and +5 dB is 2.5 degrees at 40 GHz and 3 degrees at 43.5 GHz.

MS46131A-043 VNA System Performance with Manual Cal Kits

Error-Corrected Specifications

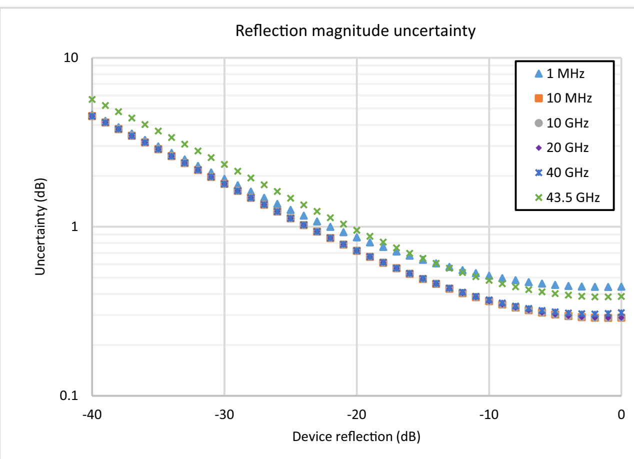
With calibration using TOSLK50A-43.5 or TOSLKF50A-43.5 K type connector calibration kits with .s1p definitions.

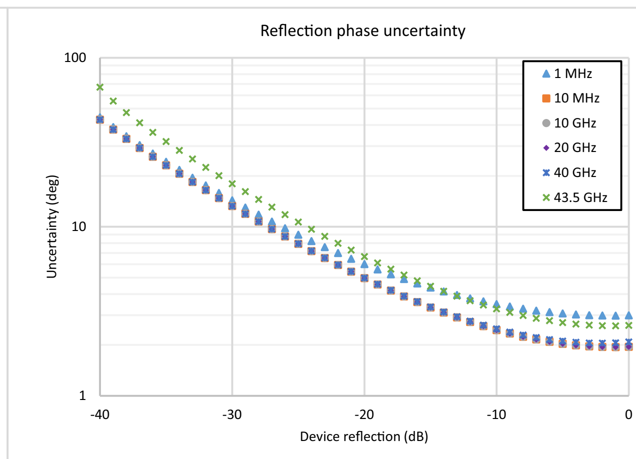
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to 50 MHz	? 45	? 45	? 44	± 0.15	±0.06
> 0.05 GHz to 10 GHz	? 45	? 45	? 44	± 0.15	±0.06
> 10 GHz to 20 GHz	? 45	? 45	? 44	± 0.15	±0.06
> 20 GHz to 30 GHz	? 45	? 44	? 44	± 0.15	±0.06
> 30 GHz to 40 GHz	? 45	? 42	? 44	± 0.15	±0.06
> 40 GHz to 43.5 GHz	? 42	? 41	? 41	± 0.2	±0.16

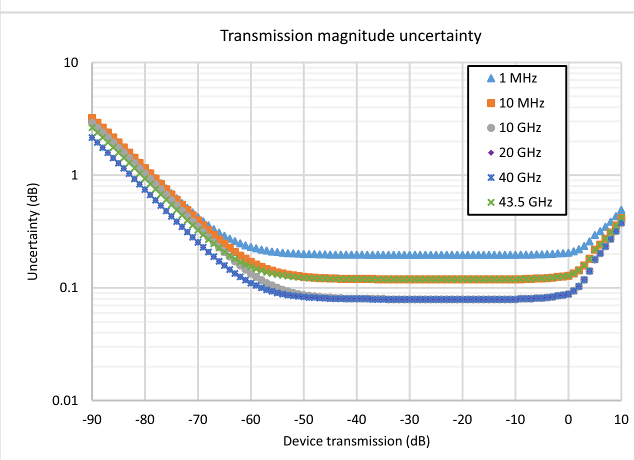
a. Characteristic performance.

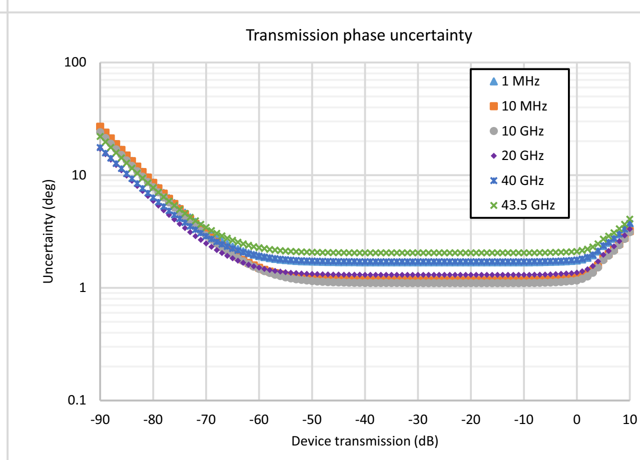
Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that $S_{21} = S_{12} = 0$. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.









MS46131A-010 VNA System Performance with SmartCal™

Error-Corrected Specifications

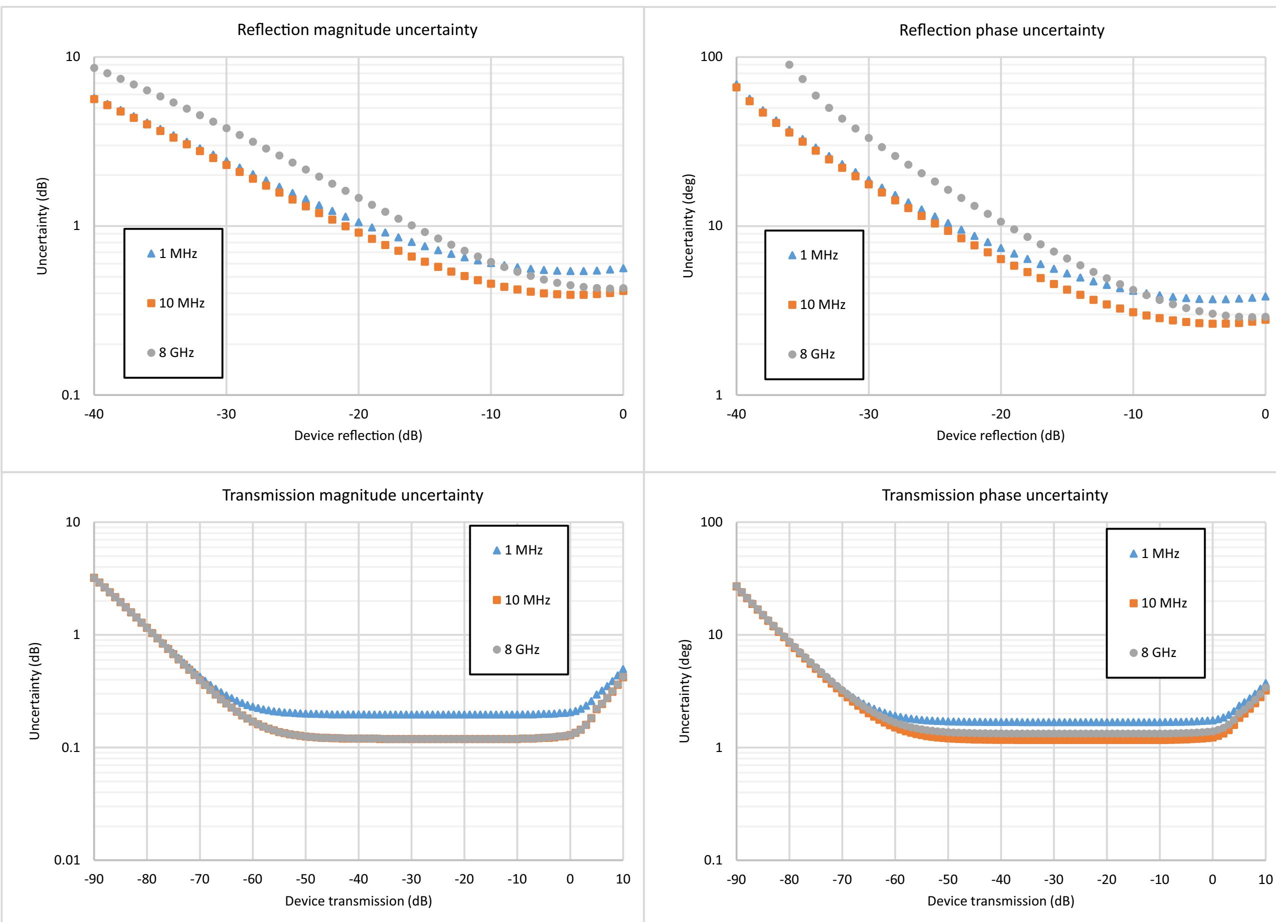
With calibration using the 2-port MN25208A SmartCal™ automatic calibration kit with connector options MN25208A-001, -002, -003

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to 1 GHz	? 42	? 35	? 41	± 0.15	±0.06
> 1 GHz to 5 GHz	? 42	? 35	? 41	± 0.08	±0.08
> 5GHz to 8 GHz	? 36	? 35	? 36	± 0.1	±0.08

a. Characteristic performance.

Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that S_{21} = S_{12} = 0. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.



MS46131A-010 VNA System Performance with SmartCal™

Error-Corrected Specifications

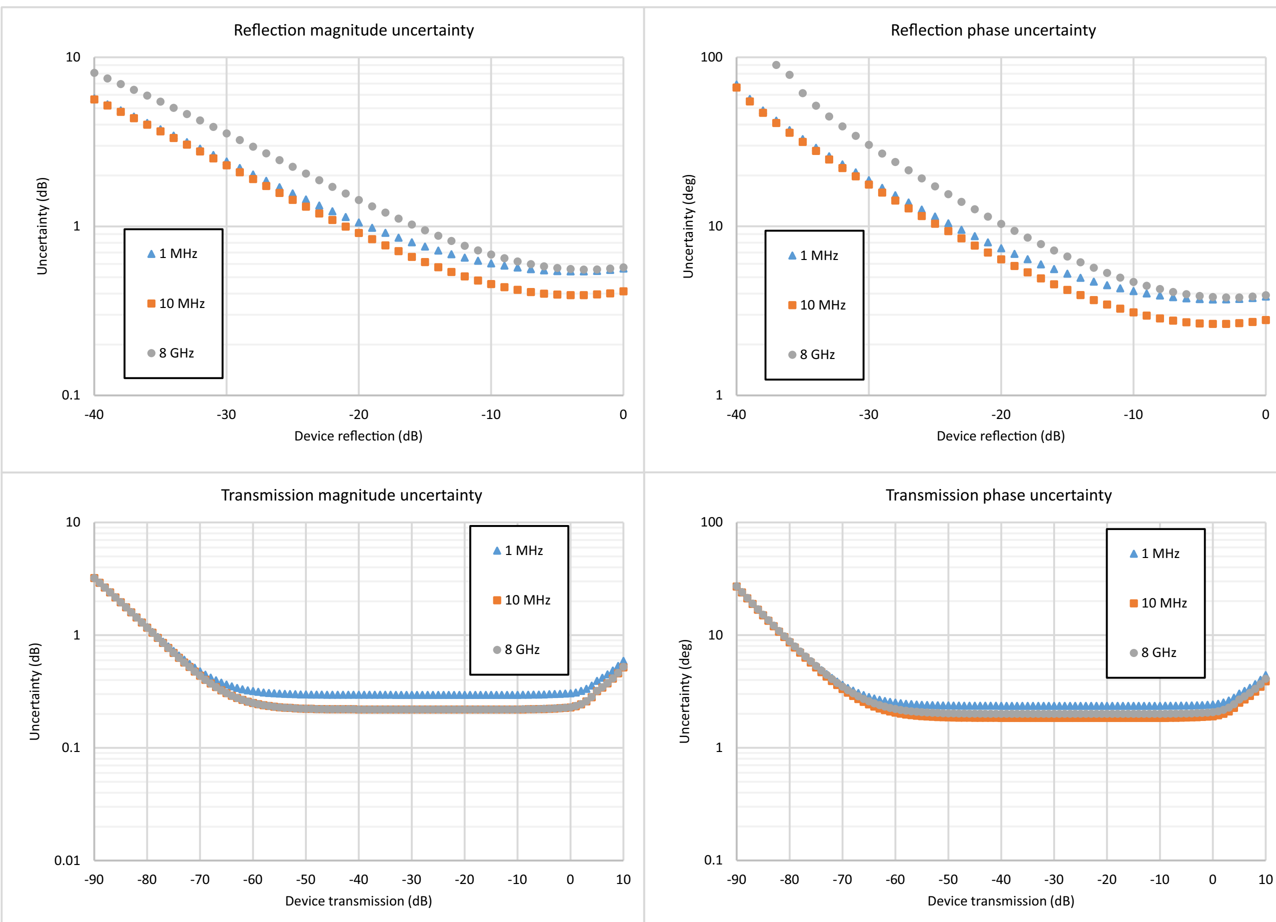
With calibration using the 4-port MN25408A SmartCal™ automatic calibration kit with connector options MN25408A-001, -002, -003

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to 1 GHz	? 42	? 35	? 41	± 0.15	±0.2
> 1 GHz to 5 GHz	? 37	? 35	? 36	± 0.08	±0.2
> 5 GHz to 8 GHz	? 37	? 32	? 36	± 0.2	±0.2

a. Characteristic performance.

Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that $S_{21} = S_{12} = 0$. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.



MS46131A-010, MS46131A-020 VNA System Performance with SmartCal™

Error-Corrected Specifications

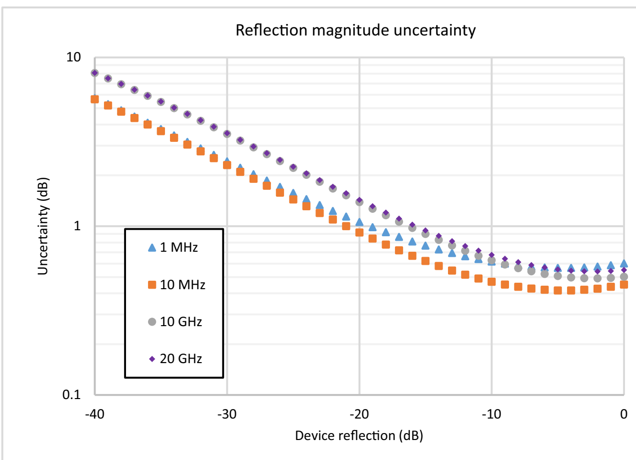
With calibration using the 2-port MN25218A SmartCal™ automatic calibration kit.

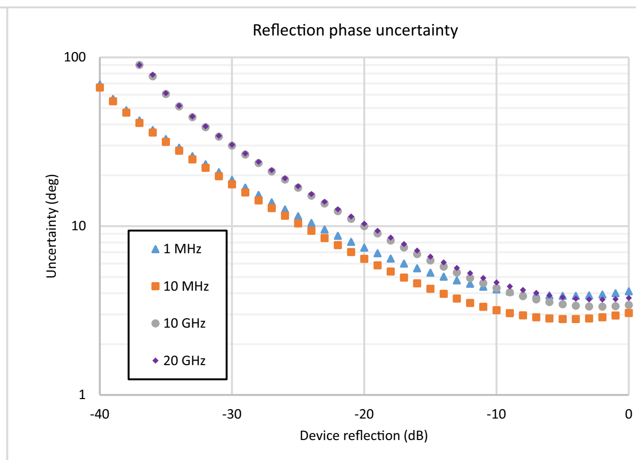
Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to 1 GHz	? 42	? 33	? 41	± 0.15	±0.1
> 1 GHz to 10 GHz	? 37	? 33	? 41	± 0.15	±0.1
> 10 GHz to 18 GHz	? 37	? 33	? 35	± 0.15	±0.1
> 18 GHz to 20 GHz	? 37	? 33	? 35	± 0.20	±0.15

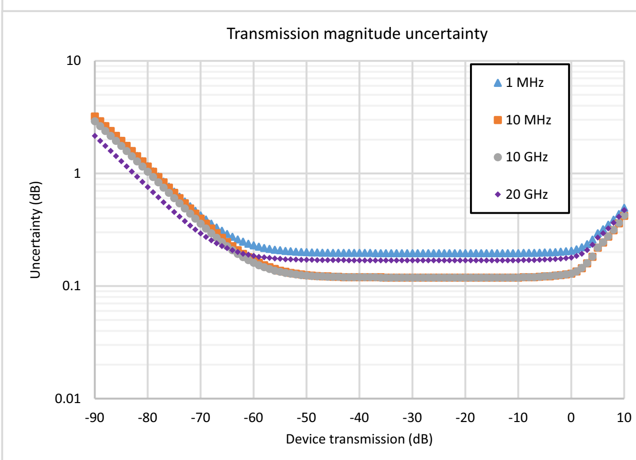
a. Characteristic performance.

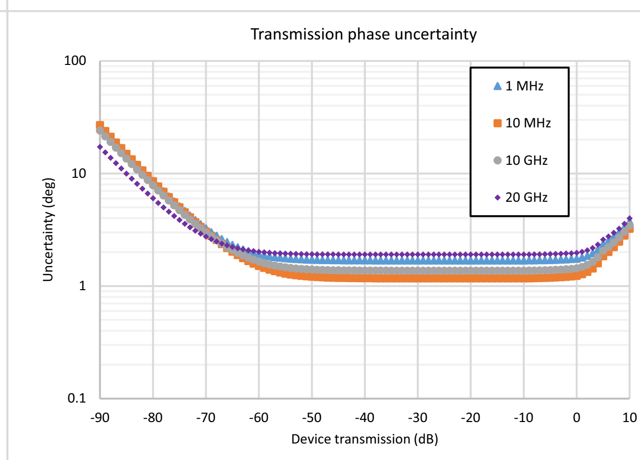
Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that $S_{21} = S_{12} = 0$. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.









MS46131A-010, MS46131A-020 VNA System Performance with SmartCal

Error-Corrected Specifications

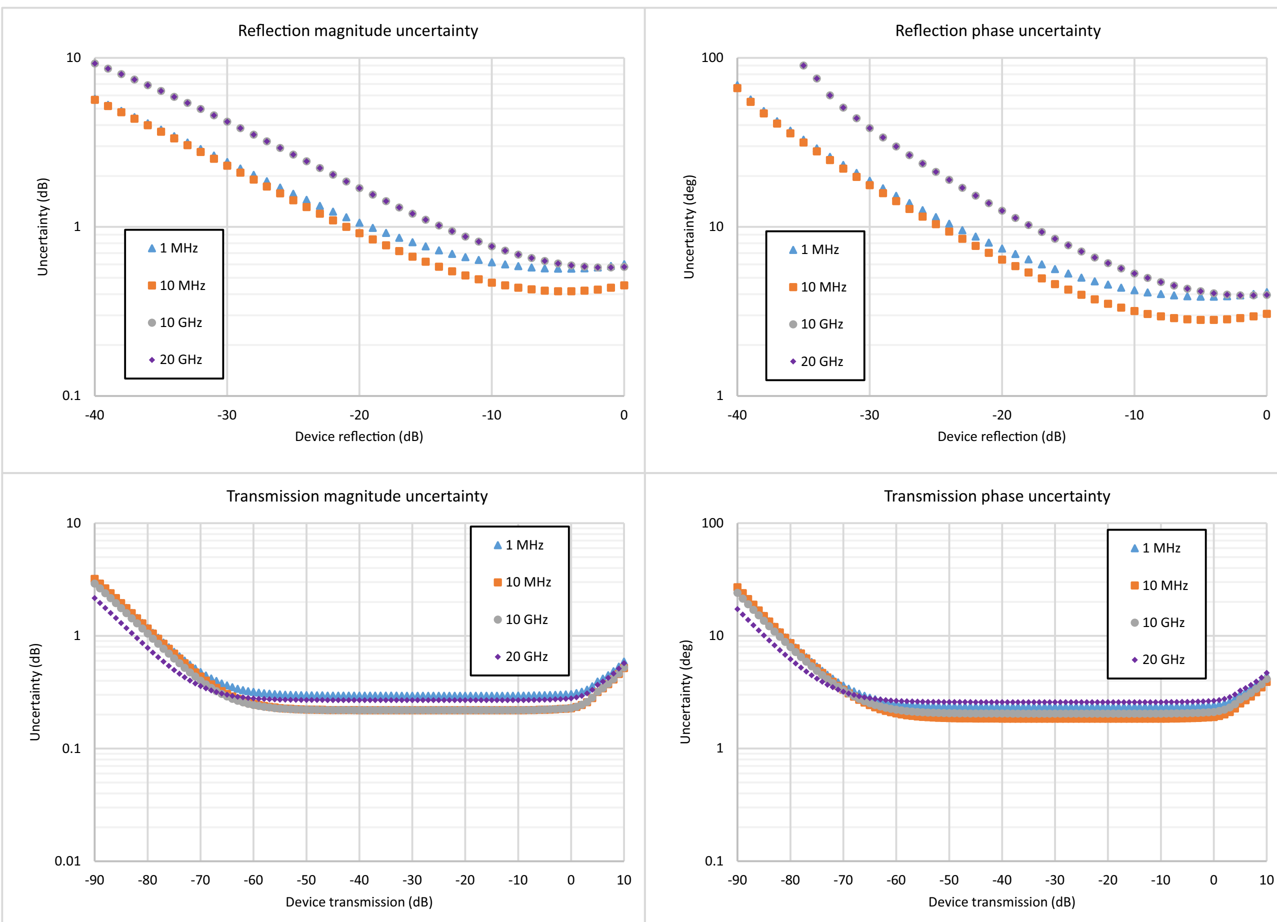
With calibration using the 4-port MN25418A SmartCal™ automatic calibration kit.

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to 10 MHz	? 40	? 31	? 41	± 0.15	±0.20
> 10 MHz to 6 GHz	? 40	? 31	? 41	± 0.15	±0.15
> 6 GHz to 18 GHz	? 35	? 31	? 36	± 0.20	±0.20
> 18 GHz to 20 GHz	? 35	? 31	? 33	± 0.20	±0.25

a. Characteristic performance.

Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that S_{21} = S_{12} = 0. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.



MS46131A-043 VNA System Performance with Precision AutoCal™

Error-Corrected Specifications

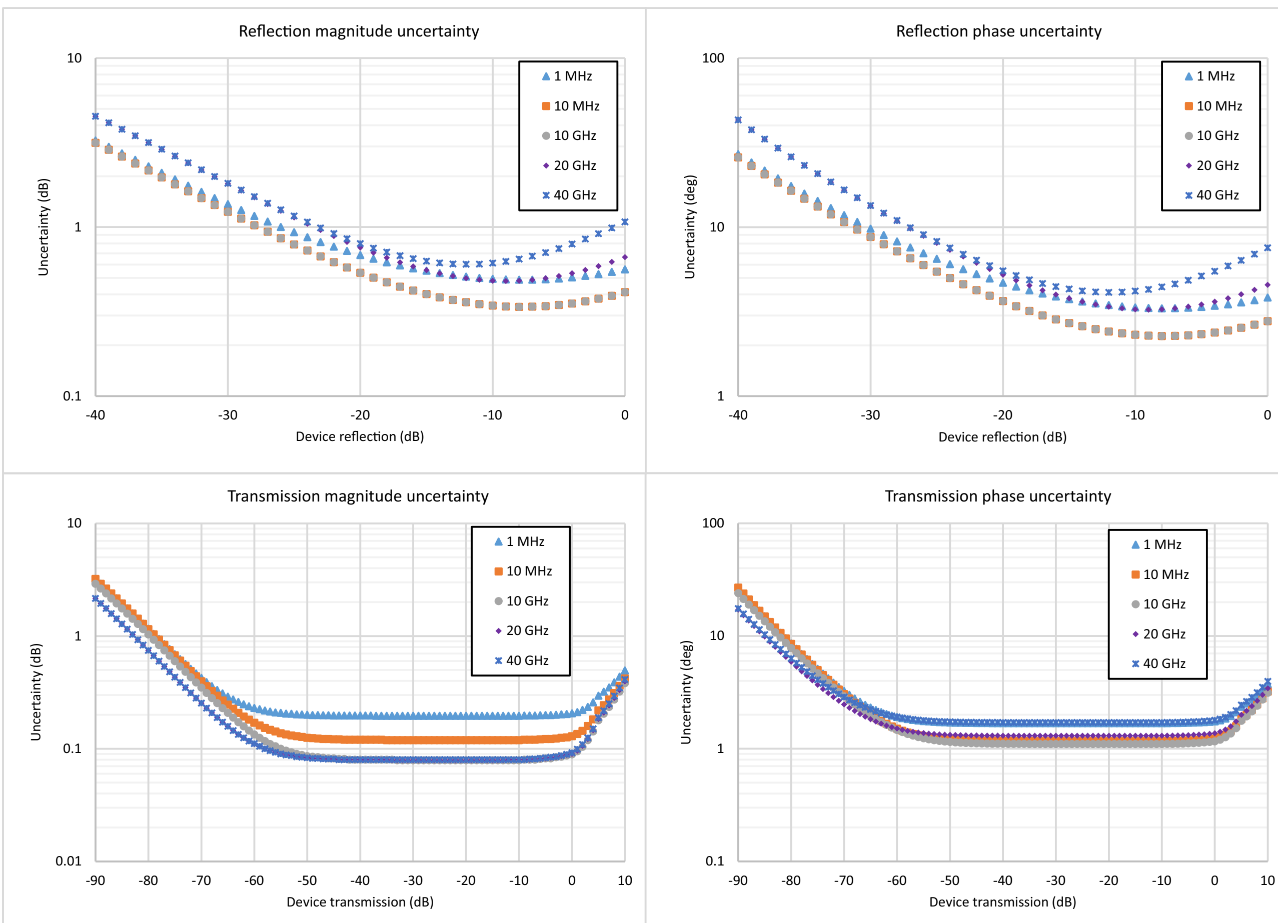
With calibration using the 36585K automatic calibration kit with type K connectors.

Frequency Range	Directivity (dB)	Source Match (dB)	Load Match [a] (dB)	Reflection Tracking [a] (dB)	Transmission Tracking [a] (dB)
1 MHz to < 10 GHz	? 50	? 49	? 42	± 0.15	±0.06
10 GHz to < 20 GHz	? 45	? 49	? 36	± 0.15	±0.06
20 GHz to < 30 GHz	? 45	? 45	? 36	± 0.10	±0.06
30 GHz to 40 GHz	? 45	? 45	? 30	± 0.10	±0.06

a. Characteristic performance.

Measurement Uncertainties

The graphs give measurement uncertainties after the above error-corrected calibration. The errors are a worst-case contribution of residual directivity, load and source match, frequency response and isolation, network analyzer dynamic accuracy, and connector repeatability. 10 Hz IF Bandwidth is used. For transmission uncertainties, it is assumed that S11 = S22 = 0. A nominal amount of time drift is included in the computation as is consistent with the use of phase compensation mode. Without phase compensation, uncertainties hold, but for a shorter amount of time/temperature change after calibration. For reflection uncertainties, it is assumed that S_{21} = S_{12} = 0. All calibrations and measurements were performed at default port power. For other conditions, please use our free Exact Uncertainty Calculator software, available for download from the Anritsu web site at www.anritsu.com.



Measurement Throughput

Measurement Speed	180 µs/point (1-port calibrated data, typical) 250 µs/point (2-port calibrated data, phase compensation ON, IF Gain ranging OFF, typical) Per point single sweep time, including placing measurement data into memory. Average of narrow, mid, and wide frequency span sweeps. Measured with 300 kHz IFBW, 1601 points. Timing dependent on external computer configuration. Measurements taken with an Intel® Core™ i5-6300U processor running Windows 10 with 4 GB of RAM and 60 GB of free hard disk space.

Standard Capabilities

Operating Frequencies Applies to all PhaseLync cable lengths.	
ME7869A-010	1 MHz to 8 GHz
ME7869A-020	1 MHz to 20 GHz
ME7869A-043	1 MHz to 43.5 GHz
Measurement Parameters	
2-Port Measurements	S11, S21, S22, S12, and any user-defined combination of a1, a2, b1, b2, 1 Maximum Efficiency Analysis, Mixed-mode SDD, SDC, SCD, SCC
Domains	Frequency Domain, Time (Distance) Domain (Option 002)
Sweeps	
Frequency Sweep Types	Linear, Log, CW, or Segmented
Display Graphs	
Single Rectilinear Graph Types	Log Magnitude, Phase, Group Delay, Linear Magnitude, Real, Imaginary, SWR, Impedance
Dual Rectilinear Graph Types	Log Mag and Phase, Linear Mag and Phase, Real and Imaginary
Circular Graph Types	Smith Chart (Impedance), Polar
Measurements Data Points	
Maximum Data Points	2 to 16,001 points
Limit Lines	
Limit Lines	Single or segmented. 2 limit lines per trace. 50 segments per trace.
Single Limit Readouts	Uses interpolation to determine the intersection frequency.
Test Limits	Both single and segmented limits can be used for PASS/FAIL testing.
Ripple Limit Lines	
Limit Lines	Single or segmented. 2 limit lines per trace. 50 segments per trace.
Ripple Value	Absolute Value or Margin
Test Limits	Both single and segmented limits can be used for PASS/FAIL testing.
Averaging	
Point-by-Point	Point-by-point (default), maximum number of averages = 200
Sweep-by-Sweep	Sweep-by-sweep, maximum number of averages = 4096
IF Bandwidth	
	10, 20, 50, 70, 100, 200, 300, 500, 700 Hz 1, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 200, 300 kHz
Reference Plane	
Line Length or Time Delay	The reference planes of a calibration or other normalization can be changed by entering a line length or time delay.
Dielectric Constants	Dielectric constants may be entered for different media so the length entry can be physically meaningful.
Dispersion Modeling	Dispersion modeling is used in the cases of microstrip and waveguide to take into account frequency dependent phase velocities.
Attenuation	Attenuation (with frequency slope) and constant phase offsets can be entered to better describe any reference plane distortions. The frequency dependence exponent is changeable.
Auto Modes	Automatic reference plane finding tools are available for phase alone or phase + magnitude. These routines do a fitting process on phase or phase and magnitude to estimate the reference plane location and enter correcting values.
De-embedding	For more complete reference plane manipulation, the full de-embedding system can also be used.
Measurement Frequency Range	
Frequency Range Change	Frequency range of the measurement can be narrowed within the calibration range without recalibration.
CW Mode	CW mode permits single frequency measurements also without recalibration.
Interpolation Not Activated	If interpolation is not activated, the subset frequency range is forced to use calibration frequency points.
Interpolation Activated	If interpolation is activated, any frequency range that is a subset of the calibration frequency range can be used, but there may be some added interpolation error.
Group Delay	
Group Delay Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point.
Aperture	The aperture can be changed without recalibration.
Minimum Aperture	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

Standard Capabilities (continued)

Channels, Display, and Traces	
Channels and Traces	16 channels, each with up to 16 traces
Display Colors	Unlimited colors for data traces, memory, text, markers, graticules, and limit lines
Trace Memory and Math	Up to 20 trace memories per channel can be used to store trace measurement data for later display or subtraction, addition, multiplication or division with current measurement data. The trace data can be saved and recalled.
Inter-trace Math	Any two traces within a channel can be combined (via addition, subtraction, multiplication, or division) and displayed on another trace. An equation editor mode is also available that allows the combination of trace data, trace memory and S-parameter data in more complex equations. Over 30 built-in functions are available. Simple editing tools and the ability to save/recall equations are also provided.
Scale Resolution	
	Minimum per division, varies with graph type.
Log Magnitude	0.001 dB
Linear Magnitude	10 µU
Phase	0.01°
Group Delay	0.1 ps
Time	0.0001 ps
Distance	0.1 µm
SWR	10 µU
Power	0.01 dB
Markers	
Markers	12 markers + 1 reference marker
Marker Coupling	Coupled or decoupled
Marker Overlay	Display markers on active trace only or on all traces when multiple trace responses are present on the same trace
Marker Data	Data displayed in graph area or in table form
Reference Marker	Additional marker per trace for reference
Marker Statistics	Mean, maximum, minimum, standard deviation
	Per trace or over a marker region
Marker Search and Tracking	Search and/or track for minimum, maximum, peak, or target value. Multiple marker search ranges per trace are available.
Other	
Filter Parameters	Display bandwidth (user-selectable loss value), corner and center frequencies, loss, Q, and shape factors.
S-Parameter Conversion	Z Reflection Impedance Z Transmission Impedance Y Reflection Admittance Y Transmission Admittance 1/S

Calibration and Correction Capabilities

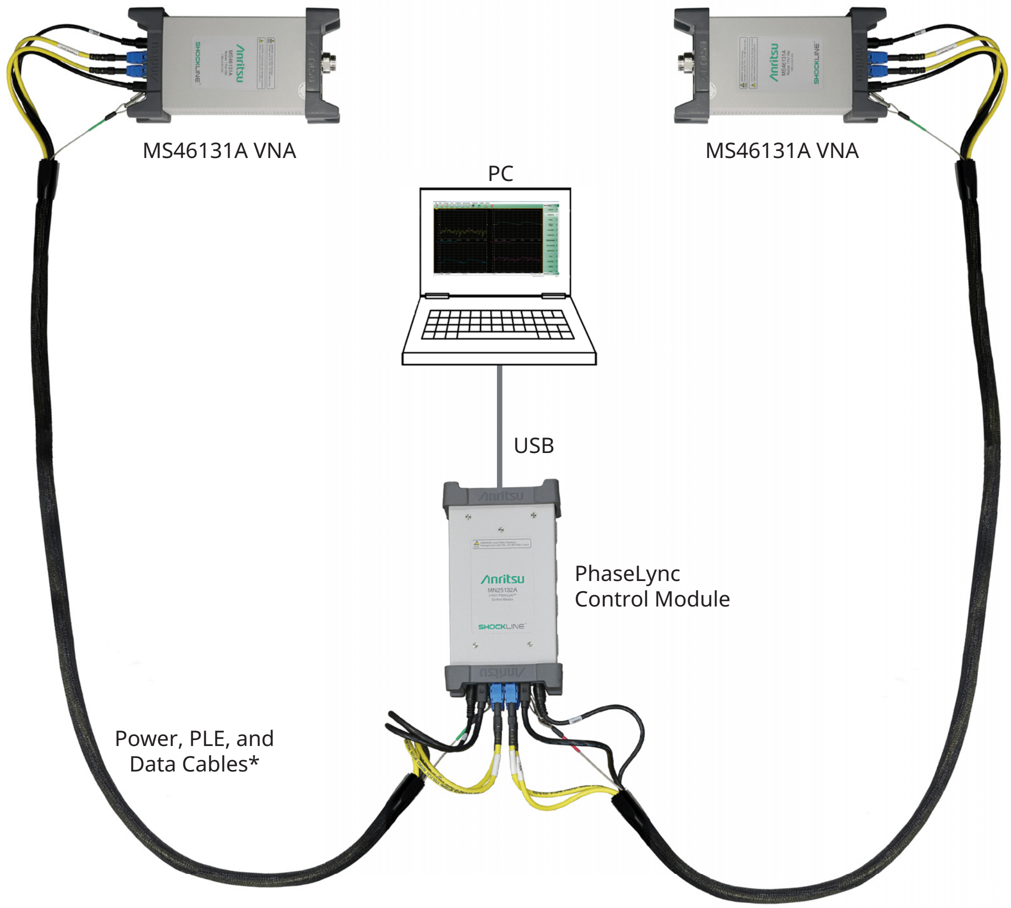
Calibration Methods	
	Short-Open-Load-Through (SOLT) Offset-Short-Offset-Short-Load-Through (SSLT) Triple-Offset-Short-Through (SSST) Short-Open-Load-Reciprocal (SOLR) Line-Reflect-Line (LRL) / Line-Reflect-Match (LRM) Thru-Reflect-Line (TRL) / Thru-Reflect-Match (TRM) SmartCal™ AutoCal™ Thru Update available Secondary match correction available for improved low insertion loss measurements
Correction Models	
	1-Port (S11, S22, or both) 2-Port (Forward, Reverse, or both directions) Transmission Frequency Response (Forward, Reverse, or both directions) Reflection Frequency Response (S11, S22, or both)
Coefficients for Calibration Standards	
	Use the Anritsu calibration kit USB memory device to load kit coefficients and characterization files. Enter coefficients into user-defined locations. Use complex load models.
Interpolation	Allows interpolation between calibration frequency points.
Adapter Removal Calibration	Characterizes and "removes" an adapter that is used during calibration that will not be used for subsequent device measurements; for accurate measurement of non-insertable devices.
Dispersion Compensation	Selectable as Coaxial, other non-dispersive (e.g., for coplanar waveguide), Waveguide, or Microstrip
Embedding/De-embedding	The ME7869A is equipped with an Embedding/De-embedding system.
De-embedding	De-embedding is generally used for removal of test fixture contributions, modeled networks, and other networks described by S-parameters (s2p files) from measurements.
Embedding	Similarly, the Embedding function can be used to simulate matching circuits for optimizing amplifier designs or simply adding effects of a known structure to a measurement.
Multiple Networks	Multiple networks can be embedded/de-embedded and changing the port and network orientations is handled easily.
Extraction Utility	An extraction utility is part of this package that allows easier computation of de-embedding files based on additional calibration steps and measurements.
Impedance Conversion	Allows entry of different reference impedances (complex values) for different ports

Remote Operability

ShockLine supports several remote operability options.

Communication Type	Data Format	Performance	Description
Drivers	IVI-C drivers are available for download from the Anritsu website. The IVI-C package supports National Instruments LabVIEW and LabWindows, C#, .NET, MATLAB, and Python programming environments.		
Triggering	Start Trigger	Software and Digital Edge	
	Input Range	+3.3 V logic level (+5 V tolerant)	
	Minimum Trigger Width	50 ns	
	Trigger Delay	6 µs, typical	

Standard System Connections



* various combinations support 20, 50, and 100 meter lengths

ME7869A Systems

≤ 20 Meter ME7869A-010: 1 MHz to 8 GHz ME7869A-020: 1 MHz to 20 GHz ME7869A-043: 1 MHz to 43.5 GHz	Solution must include: • Two MS46131A Modular 1-Port VNAs: - Each VNA must have one frequency option 010 / 020 / 043 - Each VNA must have one length option 025 / 050 /100 • One MN25132A Control Module • Two 2000-212x-R Cables totaling 20 m or less • Windows PC is user supplied
≤ 50 Meter ME7869A-010: 1 MHz to 8 GHz ME7869A-020: 1 MHz to 20 GHz ME7869A-043: 1 MHz to 43.5 GHz	Solution must include: • Two MS46131A Modular 1-Port VNAs: - Each VNA must have one frequency option 010 / 020 / 043 - Each VNA must have one length option 050 or 100 • One MN25132A Control Module • Two 2000-212x-R Cables totaling 50 m or less • Windows PC is user supplied
≤ 100 Meter ME7869A-010: 1 MHz to 8 GHz ME7869A-020: 1 MHz to 20 GHz ME7869A-043: 1 MHz to 43.5 GHz	Solution must include: • Two MS46131A Modular 1-Port VNAs: - Each VNA must have one frequency option 010 / 020 / 043 - Each VNA must have length option 100 • One MN25132A Control Module • Two 2000-212x-R Cables totaling 100 m or less • Windows PC is user supplied

Note: If the two VNA's do not have the same options for length (MS46131A-25 / 50 / 100), the system will work for the lower length option only. The MS46131A-100 option will work to any available length. However, for option MS46131A-050 the system is limited to distances of 50 m or less; similarly for MS46131A-025, the system is limited to distances ? 20 m.

Test Port	ME7869A-010	N(f)
	ME7869A-020	Ruggedized K(m)
	ME7869A-043	Ruggedized Extended-K™(m)
	Damage Input Levels	+23 dBm maximum, ±50 VDC maximum
10 MHz In		Signal presence is auto-sensing (better than 10 ppm frequency accuracy is recommended).
	Connector Type	SMA(f)
	Signal	+0 dBm, typical; 50 Ω, nominal
External Trigger Input/Output		External trigger input should be applied to the Base MS46131A in the ME7869A. External trigger output may be accessed on the Satellite MS46131A.
	Connector Type	SMA(f)
	Voltage Input	0 to 3.3 V input (5 V tolerant)
	Impedance	High impedance (> 100 kΩ)
	Pulse Width	50 ns minimum input pulse width
	Trigger Delay	6 µs typical
	Voltage Output	0 to 3.3 V (HCMOS logic)
	Drive Current	12 mA maximum
	Pulse Width	1 µs, typical
Power Consumption		24 W

Recommended External PC Configuration

CPU	Intel® Core™ i5-6300U Processor
RAM	4 GB
Disk	120 GB
DirectX	Version 9 with Windows Display Driver Model (WDDM) installed
	ShockLine software is compatible with Windows® 7,8, 8.1, or 10; 32 or 64 bit operating systems
USB	One USB 2.0 (or higher) type A port per MS46131A used
	To increase the number of USB ports available, an externally powered USB hub may also be used.

Regulatory Compliance

European Union	EMC 2014/30/EU, EN 61326:2013, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/11 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010 RoHS Directive 2011/65/EU & Amendment 2015/863
United Kingdom	EMC SI 2016/1091; BS EN 55011 & BS EN 61000-4-2/3/4/5/6/8/11 Consumer Protection (Safety) SI 2016/1101; BS EN 61010-1:2010 Environmental Protection SI 2012/3032; 2011/65/EU & 2015/863
Canada	ICES-1(A)/NMB-1(A)
Australia and New Zealand	RCM AS/NZS 4417:2012
South Korea	R-R-A2J-1011

Environmental

	MIL-PRF-28800F Class 2
Operating Temperature Range	-10 °C to 55 °C
Storage Temperature Range	–51 °C to 71 °C
Maximum Relative Humidity	95 % RH at 30 °C, non-condensing
Altitude	4600 meters, operating and non-operating

Warranty

MS46131A and Built-In Options	1 year from the date of shipment (standard warranty)
MN25132A	Typically 1 year from the date of shipment
PhaseLync cables	Typically 1 year from the date of shipment
Calibration Kits	Typically 1 year from the date of shipment
Test Port Cables	Typically 1 year from the date of shipment
Warranty Options	Additional warranty available

Ordering Information

ME7869A 2-Port VNA	
ME7869A-010	MS46131A: Qty 2 MS46131A-010 freq option: Qty 2 MN25132A Control module: Qty 1
ME7869A-020	MS46131A: Qty 2 MS46131A-020 freq option: Qty 2 MN25132A Control module: Qty 1
ME7869A-043	MS46131A: Qty 2 MS46131A-043 freq option: Qty 2 MN25132A Control module: Qty 1
Order length option separately (at least 1 and enabled on both VNAs)	MS46131A-025: 20 m MS46131A-050: 50 m MS46131A-100: 100 m
Choose the length of the PhaseLync cables (2)	2000-2123-R: 2 m 2000-2124-R: 5 m 2000-2125-R: 10 m 2000-2126-R: 25 m 2000-2127-R: 50 m 2000-2128-R: 75 m
VNA Options	
Main Options	MS46131A-002, Time Domain with Time Gating (required on both MS46131A VNAs for option to be enabled in the ME7869A) ME7869A-010, 10 GHz Frequency Option ME7869A-020, 20 GHz Frequency Option ME7869A-043, 43 GHz Frequency Option
Calibration Options	VNA performance is determined by the verified performance of the two MS46131As in the configuration. Calibration options offered for the MS46131A only. ME7869A-097, Accredited Calibration to ISO17025 and ANSI/NCSL Z540-1, includes calibration certificate, test report, and uncertainty data. ME7869A-098, Standard Calibration, ISO 17025 compliant, without data ME7869A-099, Premium Calibration, ISO 17025 compliant, with data
Precision Automatic Calibrator Modules	
MN25208A	2-port USB SmartCal Module, 300 kHz to 8.5 GHz (available with connector Options -001 N(f), -002 K(f), -003 3.5 mm(f))
MN25408A	4-port USB SmartCal Module, 300 kHz to 8.5 GHz (available with connector Options -001 N(f), -002 K(f), -003 3.5 mm(f))
MN25218A[1]	2-port USB SmartCal Module, 300 kHz to 20 GHz (available with connector Option -002 K(f))
MN25418A	4-port USB SmartCal Module, 300 kHz to 20 GHz (available with connector Option -002 K(f))
36585K-2M	K Connector Precision AutoCal Module, 70 kHz to 40 GHz, K(m) to K(m)
36585K-2F	K Connector Precision AutoCal Module, 70 kHz to 40 GHz, K(f) to K(f)
36585K-2MF	K Connector Precision AutoCal Module, 70 kHz to 40 GHz, K(m) to K(f)
2000-1809-R	Serial to USB Adapter (required for use with 36585 AutoCal module if control PC does not have a serial port)

1. Applies to Rev 2 SmartCal Modules. MN25218A with serial numbers < 1817999 operate from 1 MHz to 20 GHz.

Mechanical Calibration Kits

3650A	SMA/3.5 mm Calibration Kit, Without Sliding Loads, DC to 26.5 GHz, 50 Ω
3652A	K Connector Calibration Kit, Without Sliding Loads, DC to 40 GHz, 50 Ω
3653A	N Connector Calibration Kit, Without Sliding Loads, DC to 18 GHz, 50 Ω
OSLN50A-8	Precision N Male Open/Short/Load Mechanical Calibration Tee, DC to 8 GHz, 50 Ω
OSLNF50A-8	Precision N Female Open/Short/Load Mechanical Calibration Tee, DC to 8 GHz, 50 Ω
TOSLN50A-8	Precision N Male Through/Open/Short/Load Mechanical Calibration Tee, DC to 8 GHz, 50 Ω
TOSLNF50A-8	Precision N Female Through/Open/Short/Load Mechanical Calibration Tee, DC to 8 GHz, 50 Ω
OSLN50A-18	Precision N Male Open/Short/Load Mechanical Calibration Tee, DC to 18 GHz, 50 Ω
OSLNF50A-18	Precision N Female Open/Short/Load Mechanical Calibration Tee, DC to 18 GHz, 50 Ω
TOSLN50A-18	Precision N Male Through/Open/Short/Load Mechanical Calibration Tee, DC to 18 GHz, 50 Ω
TOSLNF50A-18	Precision N Female Through/Open/Short/Load Mechanical Calibration Tee, DC to 18 GHz, 50 Ω
TOSLK50A-20	Precision K Male Through/Open/Short/Load Mechanical Calibration Tee, DC to 20 GHz, 50 Ω
TOSLKF50A-20	Precision K Female Through/Open/Short/Load Mechanical Calibration Tee, DC to 20 GHz, 50 Ω
TOSLK50A-40	Precision K Male Through/Open/Short/Load Mechanical Calibration Tee, DC to 40 GHz, 50 Ω
TOSLKF50A-40	Precision K Female Through/Open/Short/Load Mechanical Calibration Tee, DC to 40 GHz, 50 Ω
TOSLK50A-43.5	Precision K Male Through/Open/Short/Load Mechanical Calibration Tee, DC to 43.5 GHz, 50 Ω Includes .s1p files for data-based calibration support
TOSLKF50A-43.5	Precision K Female Through/Open/Short/Load Mechanical Calibration Tee, DC to 43.5 GHz, 50 Ω Includes .s1p files for data-based calibration support

Verification Kits

3663-3	N Connector Verification Kit
3668-4	K Connector Verification Kit

Adapters

1091-26-R	Adapter, SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	Adapter, SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	Adapter, SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	Adapter, SMA(f) to N(f), DC to 18 GHz, 50 Ω
71693-R	Ruggedized adapter, K(f) to N(f), DC to 18 GHz, 50 Ω
33KK50C	Calibration Grade Adapter, DC to 43.5 GHz, K(m) to K(m), 50 Ω
33KKF50C	Calibration Grade Adapter, DC to 43.5 GHz, K(m) to K(f), 50 Ω
33KFKF50C	Calibration Grade Adapter, DC to 43.5 GHz, K(f) to K(f), 50 Ω
34NK50	Precision Adapter, N(m) to K(m), DC to 18 GHz, 50 Ω
34NKF50	Precision Adapter, N(m) to K(f), DC to 18 GHz, 50 Ω
34NFK50	Precision Adapter, N(f) to K(m), DC to 18 GHz, 50 Ω
34NFKF50	Precision Adapter, N(f) to K(f), DC to 18 GHz, 50 Ω
34VFK50A	Precision Adapter, DC to 43.5 GHz, V(f) - K(m), 50 Ω
34VFKF50A	Precision Adapter, DC to 43.5 GHz, V(f) - K(f), 50 Ω
34VK50A	Precision Adapter, DC to 43.5 GHz, V(m) - K(m), 50 Ω
34VKF50A	Precision Adapter, DC to 43.5 GHz, V(m) - K(f), 50 Ω
K220B	Precision Adapter, DC to 40 GHz, K(m) to K(m), 50 Ω
K222B	Precision Adapter, DC to 40 GHz, K(f) to K(f), 50 Ω
K224B	Precision Adapter, DC to 40 GHz, K(m) to K(f), 50 Ω

Test Port Cables, Flexible, Ruggedized, Phase Stable

15 Series Cable Example

15NNF50-1.0B	Test Port Cable, Flexible, Phase Stable, N(f) to N(m), 1.0 m
15NNF50-1.5B	Test Port Cable, Flexible, Phase Stable, N(f) to N(m), 1.5 m
15NN50-1.0B	Test Port Cable, Flexible, Phase Stable, N(m) to N(m), 1.0 m
15LL50-1.0A	Test Port Extension Cable, Armored, Phase Stable, DC to 26.5 GHz, 3.5 mm(m) to 3.5 mm(m), 1.0 m, 50 Ω
15LLF50-1.0A	Test Port Extension Cable, Armored, Phase Stable, DC to 26.5 GHz, 3.5 mm(m) to 3.5 mm(f), 1.0 m, 50 Ω
15KK50-1.0A	Test Port Extension Cable, Armored, Phase Stable, DC to 26.5 GHz, K(m) to K(m), 1.0 m, 50 Ω
15KKF50-1.0A	Test Port Extension Cable, Armored, Phase Stable, DC to 26.5 GHz, K(m) to K(f), 1.0 m, 50 Ω

Phase-Stable 18 GHz and 43.5 GHz Semi-Rigid Cables (Armored)

3670 Series Cable Example

3670N50-1	0.3 m (12”), DC to 18 GHz, N(f) to N(m), 50 Ω
3670NN50-1	0.3 m (12”), DC to 18 GHz, N(m) to N(m), 50 Ω
3670N50-2	0.6 m (24”), DC to 18 GHz, N(f) to N(m), 50 Ω
3670NN50-2	0.6 m (24”), DC to 18 GHz, N(m) to N(m), 50 Ω
3670K50A-1	0.3 m (12”), DC to 43.5 GHz, K(f) to K(m), 50 Ω
3670K50A-2	0.6 m (24”), DC to 43.5 GHz, K(f) to K(m), 50 Ω

Phase-Stable 20 GHz, 40 GHz, and 43.5 GHz Test Port Cables (Flexible)

3671 Series Cable Example

806-304-R Cable Example

806-423-R Cable Example

3671KFS50-60	60 cm (23.6 in), DC to 20 GHz, K(f) to 3.5 mm(m), 50 Ω
3671KFSF50-60	60 cm (23.6 in), DC to 20 GHz, K(f) to 3.5 mm(f), 50 Ω
3671KFKF50-60	60 cm (23.6 in), DC to 40 GHz, K(f) to K(f), 50 Ω
3671KFK50-100	100 cm (39.4 in), DC to 40 GHz, K(f) to K(m), 50 Ω
806-304-R	36 in (91.5 cm), DC to 40 GHz, K(m) - K(f), 50 Ω
806-423-R	60 cm (23.6 in), DC to 43.5 GHz, K(f) - K(f), 50 Ω
806-424-R	60 cm (23.6 in), DC to 43.5 GHz, K(m) - K(f), 50 Ω
806-425-R	100 cm (39.4 in), DC to 43.5 GHz, K(f) - K(f), 50 Ω
806-426-R	100 cm (39.4 in), DC to 43.5 GHz, K(m) - K(f), 50 Ω

Transit Case

760-299-R	Transit Case (for ME7869A VNA system)

Tools

01-201	Torque End Wrench, 5/16 in, 0.9 N·m (8 lbf·in) (for tightening male devices, for SMA, 3.5 mm, 2.4 mm, K, and V connectors)
01-203	Torque End Wrench, 13/16 in, 0.9 N.m (8 lbf.in) (for tightening ruggedized SMA, 2.4 mm, K and V test port connectors)
01-204	End Wrench, 5/16 in, Universal, Circular, Open-ended (for SMA, 3.5 mm, 2.4 mm, K, and V connectors)
More Information	Refer to our Precision RF & Microwave Components Catalog for descriptions of adapters and other components.

Documentation

User Documentation	Soft copies of the manuals as Adobe Acrobat PDF files are available for download from the instrument model web page at www.anritsu.com. For more information and product support, please contact www.anritsu.com/contact-us.
10100-00067	ShockLine Product Information, Compliance, and Safety
10410-00780	MS46131A Series VNA Operation Manual
10410-00337	MS46121A/B, MS46122A/B, MS46131A, and MS46322A/B Series VNA User Interface Reference Manual
10410-00336	MS46122A/B, MS46131A, and MS46322A/B Series VNA Measurement Guide
10410-00746	ShockLine Programming Manual

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List Revision Date: 20250812

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