

Anritsu

ME7808B

Broadband and Millimeter Wave VNA

40 MHz to 110 GHz (expandable to 325 GHz)



Measurement Solutions from 40 MHz

The ME7808B Broadband Vector Network Analyzer (VNA) is a high performance measurement solution that covers 40 MHz to 110 GHz in a single fast sweep. Built on the advanced technology of the Anritsu Lightning 65 GHz VNA, the ME7808B is ideal for making accurate S-parameter measurements of components and devices to 110 GHz. The flexible system architecture of the ME7808B makes it easy to adapt to multiple measurement applications.

An alternate configuration is the ME7808B Millimeter Wave VNA, a high performance measurement solution that covers specific millimeter wave bands from 50 GHz to 325 GHz. Any of the two-port Lightning VNA models can be used as the foundation for the Millimeter Wave VNA.

Key Features and Benefits

- Continuous Broadband Frequency Coverage from 40 MHz to 110 GHz or Banded Millimeter Wave Operation (up to 325 GHz)*
- Highly Reliable and Stable Lightning Platform
- Supports On-Wafer Device Characterization, Broadband Coaxial and Waveguide Measurements
- Fine Resolution in Time Domain
- Offers Total Flexibility and Upgradeability
- FREE, Easy-to-Use Lightning Navigator Software Facilitates Calibration and Measurement
- Outstanding Technical Support

* with VNA2 Frequency Extension Modules from OML, Inc.

Applications

- Broadband Characterization
- Parameter Extraction
- Device Modeling
- Millimeter Wave Measurements

System Configurations

The ME7808B Broadband VNA consists of:

- Lightning 37397C 65 GHz VNA
- Two Millimeter Wave Modules (3742A Series)
 - Extended W Band (WR-10), 65 to 110 GHz
- Broadband Test Set
- Two 20 GHz Ultra-Low Phase Noise Frequency Sources
- Two Multiplexing Couplers
- Equipment Console with Table

The ME7808B Millimeter Wave VNA consists of:

- Any Lightning 37200C or 37300C series VNA
- Two Millimeter Wave Modules (3740A or 3741A Series)
 - V Band (WR-15), 50 to 75 GHz
 - E Band (WR-12), 60 to 90 GHz
 - Extended E Band (WR-12), 56 to 94 GHz
 - W Band (WR-10), 75 to 110 GHz
 - Extended W Band (WR-10), 65 to 110 GHz
 - Higher frequency bands (up to 325 GHz)*
- Broadband Test Set
- Two 20 GHz Ultra-Low Phase Noise Frequency Sources
- Equipment Console with Table

* with VNA2 Frequency Extension Modules from OML, Inc.

to 325 GHz

Vector Network Analyzer

The Lightning high performance VNA (with Rear Panel IF Inputs) is the foundation of the ME7808B Broadband and Millimeter Wave VNAs. The Rear Panel IF inputs provide a path back into the VNA for the downconverted IF signals from the Millimeter Wave (mmW) modules. The Lightning VNA also controls the two synthesizers that are used for the LO and RF drive to the mmW modules. In addition to S-parameter measurements, the VNA also supports time domain and swept power gain compression measurements. The internal test port attenuators, bias tees, and wide ALC range provide flexibility for active device measurements. Multiple storage formats and ample hard disk space make it convenient to save test results and measurement set-ups.

Broadband Test Set and Millimeter-Wave Modules

The broadband test set drives the two external mmW modules that enable frequency coverage up to 110 GHz and beyond. The test set performs band switching between the VNA source and the mmW module source. In addition, the test set routes the IF outputs from the mmW modules back to the VNA. The mmW modules use the latest in component technology for optimum output power and dynamic range. A 20 dB variable attenuator is built into each 3742A Transmission/Reflection module that provides output power control and leveling of the broadband sweep using Anritsu's ML2437A Power Meter and SC6230 65 GHz power sensor.

The banded Millimeter Wave VNA offers two versions of millimeter wave modules to meet your exact measurement needs. The 3740A Transmission/Reflection modules have simultaneous transmission and reflection capability (just like the 3742A modules), while the 3741A Transmission-only modules are used with the 3740A modules when only forward transmission and reflection measurements are required. A pair of 3740A modules allows measurement of all four S-parameters of a two-port device. A 3740A combined with a 3741A allows measurement of one-path/two-port S-parameters (S_{11} and S_{21}). A single 3740A series module can be used for reflection-only measurements (S_{11}).

The Anritsu mmW modules are compact, low-profile, and lightweight which facilitates mounting on the micropositioners associated with semi-automatic or manual probe stations.

Ultra-Low Phase Noise Frequency Sources

The ME7808B Broadband and Millimeter Wave VNAs use two 20 GHz synthesized sources with ultra low phase noise (Option 3). They provide the LO and RF drive to the mmW modules which translates to the lowest measurement trace noise available in a millimeter wave VNA. These synthesizers are members of the MG3690A family of Anritsu synthesizers and offer a full range of capabilities. The two synthesizers may be upgraded at any time to add features such as expanded modulation or higher frequency coverage for use in other general purpose applications (i.e., intermodulation distortion, harmonic, and mixer measurements).

Single Pair of Coaxial Test Ports For Broadband Sweep

The ME7808B Broadband VNA combines the 40 MHz to 65 GHz output from the VNA and the 65 GHz to 110 GHz output from the mmW modules using a unique multiplexing coupler design. The effective system test ports for the broadband configuration are therefore two W1 coax connectors. The Anritsu W1 Connector™ is compliant with the IEEE standard 1.0 mm connector. This design provides a DC path that permits bias injection from the VNA front panel bias inputs directly to the W1 coax test ports.

Up to Three Systems in One

Using the approach of coupling the 65 GHz VNA output with that from the mmW modules, the ME7808B Broadband VNA can be operated in any of the following configurations:

- 1) as a broadband VNA (40 MHz to 110 GHz) with W1 Connector™ coaxial interface
- 2) as a stand-alone 65 GHz VNA with V Connector® coaxial interface
- 3) as a millimeter wave VNA (65 GHz to 110 GHz) with a WR-10 waveguide connector interface. Additional discrete mmW bands are easily supported by substituting other available mmW modules into the system.

The ME7808B Millimeter Wave VNA permits switching between the stand-alone coaxial and the millimeter wave modes, thus offering two systems in one.

Reconfiguration of the system is fast and simple using an internal software menu.

When operating either the stand-alone VNA or mmW systems independently, higher output power and increased dynamic range are achievable. Wafer probe tips can be connected to any of the three interfaces to make on-wafer measurements.



Test port flexibility provided with Anritsu's innovative multiplexing coupler

Accurate W1 Coaxial Calibration

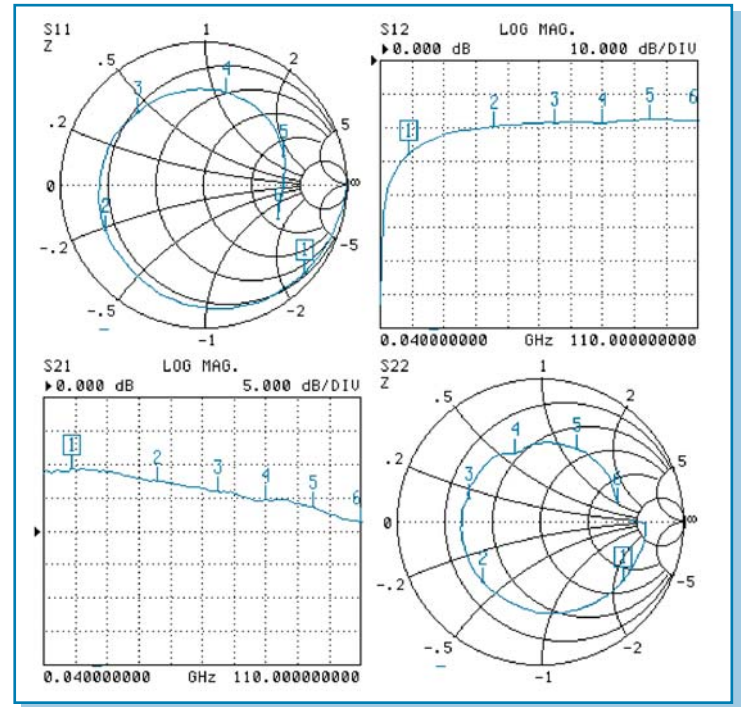
The 3656 W1 Calibration/Verification Kit consists of precision components that are used to calibrate the ME7808B Broadband VNA from 40 MHz to 110 GHz at its W1 coax test ports. The kit supports OSLT calibrations with opens, shorts and loads from 40 MHz to 65 GHz, and Triple Offset Short calibrations from 65 to 110 GHz. The two, banded calibrations are then concatenated in the VNA, resulting in a continuous, broadband calibration. Two innovative adapters with interchangeable, male or female ends, are provided to facilitate calibrations for measuring non-insertable devices. The kit also includes verification devices for confirming system accuracy of the VNA.



3656 W1 Calibration/Verification Kit

On-Wafer Calibration Methods

Device characterization and parameter extraction are most commonly performed on a wafer probe system, requiring specific on-wafer calibration methods. The Anritsu VNAs provide an easy interface for entering the parameters for OSLT, LRL, and LRM calibrations. Other external calibration techniques, optimized for wafer probing applications, are also supported for users of Suss MicroTec and Cascade Microtech probe systems.



On-wafer broadband measurement of an InP HEMT using the ME7808B

Compatibility with Probe Stations

Anritsu's VNAs are fully compatible with Suss MicroTec wafer probe stations and GGB Industries Picoprobe® tips. Contact your local sales representative to schedule a factory demonstration of on-wafer measurements with the ME7808B, the Suss MicroTec PA200 semi-automatic probe system, SussCal Calibration Software, GGB Industries 110 GHz probes and -calibration substrates. Cascade Microtech's probe stations and WinCal™ Calibration Software also support Anritsu VNAs. For parameter extraction and device modeling, an instrument driver for the ME7808B is available in Agilent EEsof's IC-CAP 2002.

Complete on-wafer measurement solution: ME7808B integrated with SussMicrotec PA200 probe system



ME7808B Broadband VNA System Specifications

Dynamic Range

System dynamic range is defined as the ratio of the typical power at Port 1 and the system noise floor. The noise floor measurement is made using 512 averages in a 10 Hz IF bandwidth, including isolation calibration.

W1 Coax

Frequency (GHz)	Max Signal into Port 2 (dBm)	Port 1 Power, Typical (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
0.04	+30	+2	-86	88	116
2	+30	+7	-105	112	135
20	+30	-1	-98	97	128
40	+30	-6	-88	82	118
50	+30	-9	-80	71	110
<65	+30	-12	-67	55	97
>65	+16	-14	-77	63	93
75	+14	-10	-88	78	102
85	+13	-11	-91	80	104
100	+12	-9	-88	79	100
110	+12	-11	-85	74	97

V Coax

Frequency (GHz)	Max Signal into Port 2 (dBm)	Port 1 Power, Typical (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
0.04	+30	+2	-86	88	116
2	+30	+8	-106	114	136
20	+30	+3	-102	105	132
40	+30	+1	-95	96	125
50	+30	-1	-88	87	118
65	+30	-2	-77	75	107

Extended W Band (WR-10) Waveguide (3742A-EW Modules)

Frequency (GHz)	Max Signal into Port 2 (dBm)	Port 1 Power, Typical (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
65	+8	-6	-85	79	93
75	+8	-4	-94	90	102
85	+8	-6	-96	90	104
100	+8	-5	-92	87	100
110	+8	-7	-89	82	97

Measurement Time for 101 Data Points

Measurement time is based on a single 40 MHz to 110 GHz sweep with 10 kHz IF bandwidth (no averages) after full 12-term calibration. Sweep time includes retrace and band switch times.

Frequency Span: 40 MHz to 110 GHz
Time: 1.5 s

Test Port Characteristics

W1 Coax

The specifications in the table below apply when the proper W1 Test Port Adapters are connected to the mux coupler test ports and calibrated with the 3656 W1 calibration kit at $23 \pm 3^\circ\text{C}$ using the two-band, concatenated OSLT and Triple Offset Short calibration methods to achieve 12-term error correction (90 min. warm-up time is recommended).

Frequency (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
0.04	31	34	31	± 0.05	± 0.03	105
2	31	34	31	± 0.05	± 0.05	115
20	31	34	31	± 0.06	± 0.07	110
40	29	34	29	± 0.06	± 0.08	100
50	29	34	29	± 0.08	± 0.1	90
<65	29	34	29	± 0.1	± 0.12	80
>65	32	33	32	± 0.08	± 0.1	100
75	32	33	32	± 0.08	± 0.1	100
85	32	33	32	± 0.08	± 0.1	100
100	32	33	32	± 0.08	± 0.1	100
110	32	33	32	± 0.08	± 0.1	100

V Coax

The specifications in the table below apply when the proper V Connector Test Port Adapters are connected, with or without phase equal insertables, to the test set ports and calibrated with the 3654B V calibration kit at $23 \pm 3^\circ\text{C}$ using the OSLT calibration method with a sliding load to achieve 12-term error correction (90 min. warm-up time is recommended).

Frequency (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
0.04	40	36	40	± 0.050	± 0.030	105
2	40	36	40	± 0.050	± 0.050	115
20	40	36	40	± 0.060	± 0.070	110
40	36	32	36	± 0.060	± 0.080	100
50	34	30	34	± 0.080	± 0.100	90
65	34	28	34	± 0.100	± 0.120	80

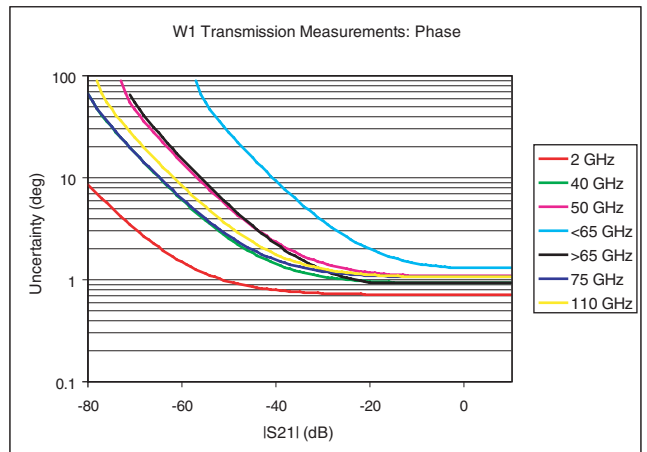
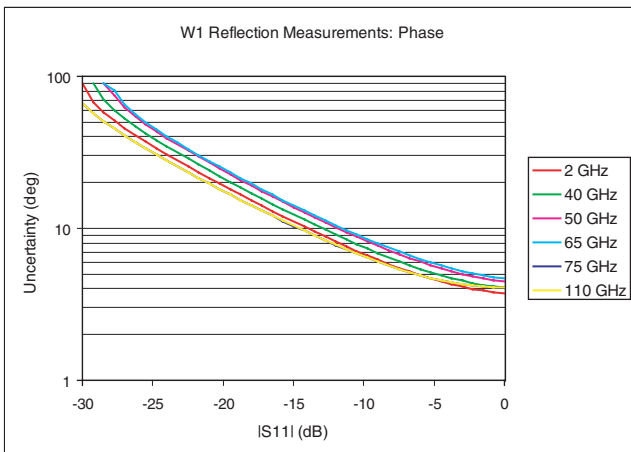
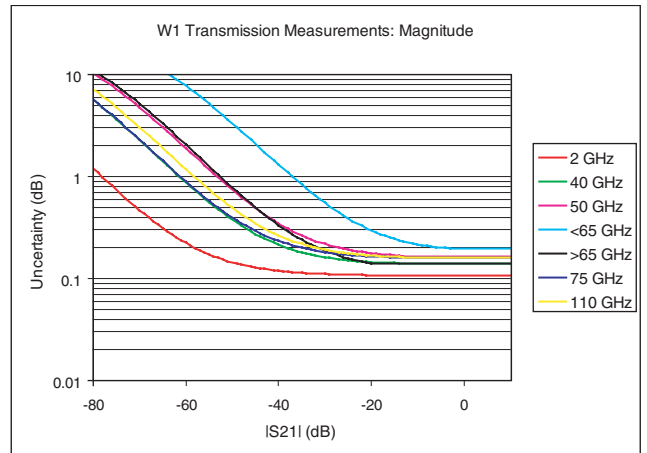
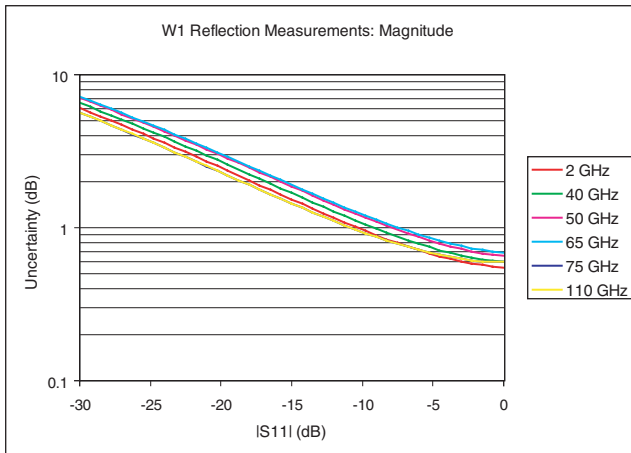
Extended W Band (WR-10) Waveguide (3742A-EW Modules)

The specifications in the table below apply when the proper high precision waveguide adapters are connected to the module ports and calibrated with the 3655W-1 WR-10 calibration kit at $23 \pm 3^\circ\text{C}$ using the offset short calibration method with a sliding load to achieve 12-term error correction (90 min. warm-up time is recommended).

Frequency (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
65 to 75	37	30	37	± 0.080	± 0.100	100
75 to 110	40	30	40	± 0.080	± 0.100	100

Measurement Uncertainty Curves for W1 Coax

For the ME7808B Broadband VNA with 3742A series millimeter wave modules (EW Band) using concatenated OSLT and triple offset short calibration methods.



ME7808B Millimeter Wave VNA System Specifications

Dynamic Range

System dynamic range is defined as the ratio of the typical power at Port 1 and the system noise floor. The noise floor measurement is made using 512 averages in a 100 Hz IF bandwidth, including isolation calibration.

V Band (WR-15) Waveguide (3740A-V or 3741A-V Modules)

Frequency Range (GHz)	Max Signal into Port 2 (dBm)	Port 1 Power, Typical (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
50 to 75	+8	+7	-90	97	98

E Band (WR-12) Waveguide (3740A-E or 3741A-E Modules)

Frequency Range (GHz)	Max Signal into Port 2 (dBm)	Port 1 Power, Typical (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
60 to 90	+8	+6	-90	96	98

Extended E Band (WR-12) Waveguide (3740A-EE or 3741A-EE Modules)

Frequency Range (GHz)	Max Signal into Port 2 (dBm)	Port 1 Power, Typical (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
56 to 60	+8	+5	-85	90	93
60 to 85	+8	+6	-90	96	98
85 to 94	+8	+4	-76	80	84

W Band (WR-10) Waveguide (3740A-W or 3741A-W Modules)

Frequency Range (GHz)	Max Signal into Port 2 (dBm)	Port 1 Power, Typical (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
75 to 100	+6	+5	-90	95	96
100 to 110	+6	+2	-90	92	96

Extended W Band (WR-10) Waveguide (3740A-EW or 3741A-EW Modules)

Frequency Range (GHz)	Max Signal into Port 2 (dBm)	Port 1 Power, Typical (dBm)	Noise Floor (dBm)	System Dynamic Range (dB)	Receiver Dynamic Range (dB)
65 to 75	+6	-5	-90	85	96
75 to 100	+6	+5	-89	94	95
100 to 110	+6	+2	-87	89	93

Test Port Characteristics

The specifications apply when the proper high precision waveguide adapters are connected to the module ports and calibrated with the appropriate waveguide calibration kit at $23 \pm 3^\circ\text{C}$ using the offset short calibration method with a sliding load or LRL calibration method to achieve 12-term error correction (90 minutes warm-up time is recommended).

V Band (WR-15) Waveguide (3740A-V or 3741A-V Modules)

Calibration Method	Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
Offset Short	50 to 75	>46	>37	>46	± 0.030	± 0.060	>90
LRL	50 to 75	>46	>46	>46	± 0.002	± 0.002	>90

E Band (WR-12) Waveguide (3740A-E or 3741A-E Modules)

Calibration Method	Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
Offset Short	60 to 90	>46	>36	>46	± 0.040	± 0.060	>90
LRL	60 to 90	>46	>46	>46	± 0.002	± 0.002	>90

Extended E Band (WR-12) Waveguide (3740A-EE or 3741A-EE Modules)

Calibration Method	Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
Offset Short	56 to 94	>44	>33	>44	± 0.080	± 0.100	>80
LRL	56 to 94	>44	>43	>44	± 0.006	± 0.006	>80

W Band (WR-10) Waveguide (3740A-W or 3741A-W Modules)

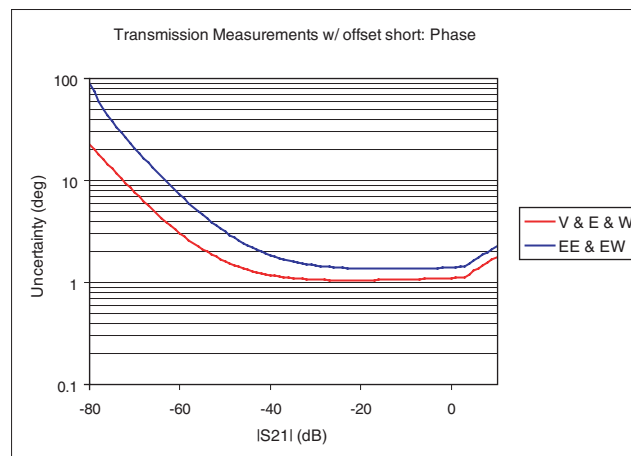
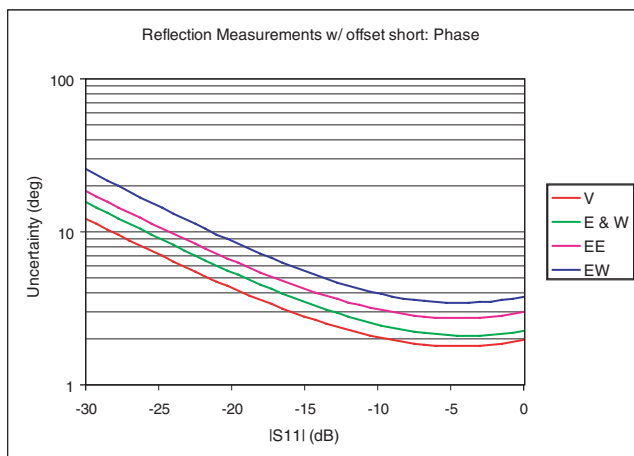
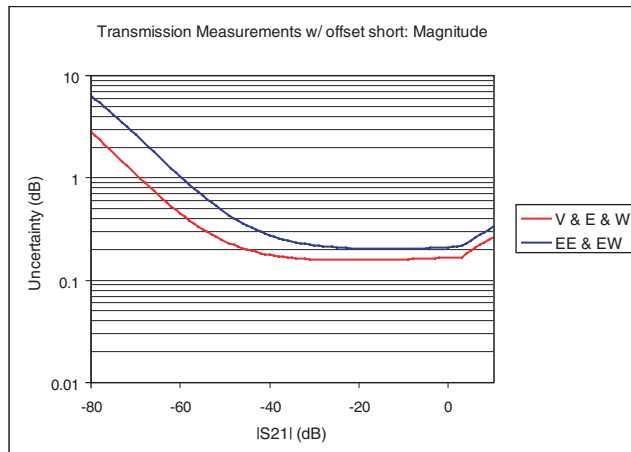
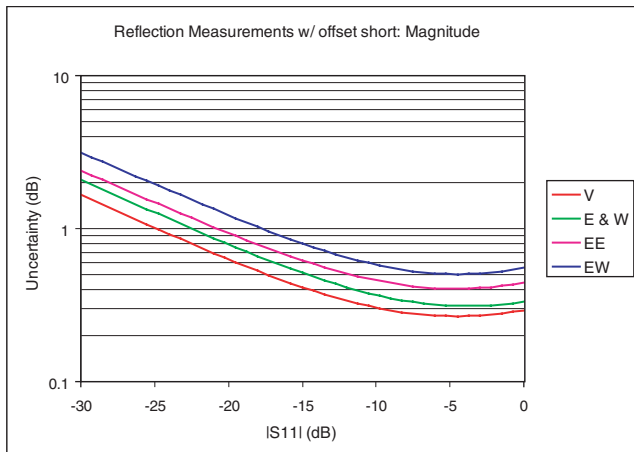
Calibration Method	Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
Offset Short	75 to 110	>46	>36	>46	± 0.040	± 0.070	>90
LRL	75 to 110	>46	>46	>46	± 0.002	± 0.002	>90

Extended W Band (WR-10) Waveguide (3740A-EW or 3741A-EW Modules)

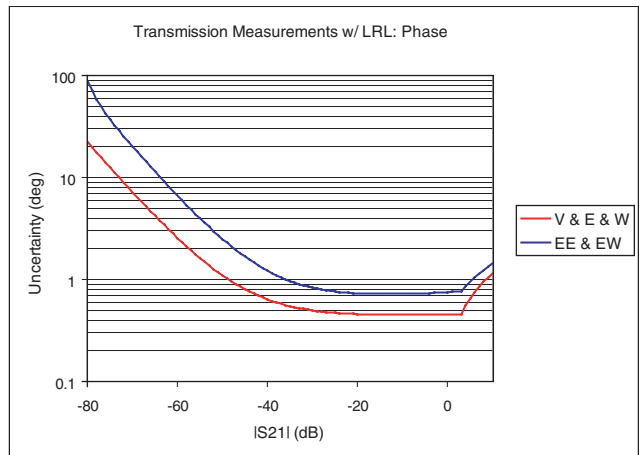
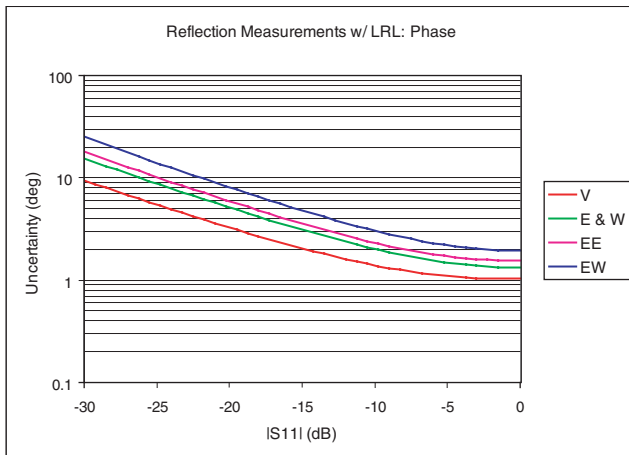
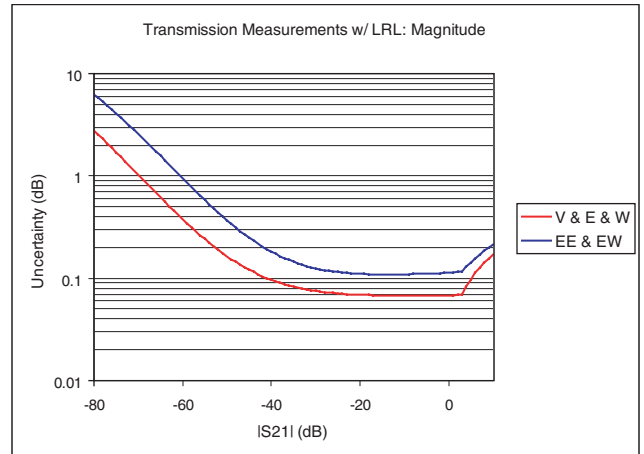
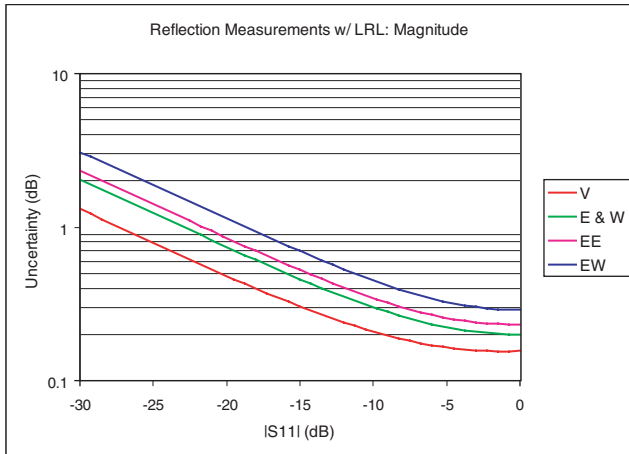
Calibration Method	Frequency Range (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
Offset Short	65 to 110	>40	>30	>40	± 0.080	± 0.100	>80
LRL	65 to 110	>40	>40	>40	± 0.006	± 0.006	>80

Measurement Uncertainty Curves for Waveguide

For the ME7808B Millimeter Wave VNA with 3740A and 3741A series millimeter wave modules (V, E, EE, W, and EW bands) using offset short calibration method with a sliding load.



For the ME7808B Millimeter Wave VNA with 3740A and 3741A series millimeter wave modules (V, E, EE, W, and EW bands) using LRL calibration method.



Ordering Information

System Configurations:

ME7808B, Broadband VNA, Single Sweep Coverage from 40 MHz to 110 GHz (with W1 Coax Test Ports)

Consisting of the following:

- 37397C VNA, 40 MHz to 65 GHz (with options 1A and 2A)
- 3738A Broadband Test Set
- MG3692A Synthesized Source, 2 to 20 GHz (with options 1B, 3, 15A)
- MG3692A Synthesized Source, 2 to 20 GHz (with options 1B, 3)
- 3742A-EW Millimeter Wave Modules (two are required)
- 57215, Multiplexing Coupler (left)
- 57216, Multiplexing Coupler (right)
- 806-101, V Female to V Male Interconnect Cables (two are required)
- 3700C3 Console

ME7808B, Millimeter Wave VNA, Discrete Band Coverage to 325 GHz (with Waveguide Test Ports)

Consisting of the following:

- Any 372xxC or 373xxC VNA (with options 1A and 2A)
- 3738A Broadband Test Set
- MG3692A Synthesized Source, 2 to 20 GHz (with options 1B, 3, 15A)
- MG3692A Synthesized Source, 2 to 20 GHz (with options 1B, 3)
- Any 3740A-x or 3741A-x Millimeter Wave Modules (two are required)*
- 3700C3 Console

Millimeter-Wave Modules*

3740A-V	Transmission/Reflection Module, 50 to 75 GHz
3740A-E	Transmission/Reflection Module, 60 to 90 GHz
3740A-EE	Transmission/Reflection Module, 56 to 94 GHz
3740A-W	Transmission/Reflection Module, 75 to 110 GHz
3740A-EW	Transmission/Reflection Module, 65 to 110 GHz
3741A-V	Transmission Module, 50 to 75 GHz
3741A-E	Transmission Module, 60 to 90 GHz
3741A-EE	Transmission Module, 56 to 94 GHz
3741A-W	Transmission Module, 75 to 110 GHz
3741A-EW	Transmission Module, 65 to 110 GHz

* Higher frequency bands to 325 GHz are supported with VNA2 Frequency Extension Modules from OML, Inc. (www.oml-mmw.com).

Calibration Kits

3656	W1 Calibration/Verification Kit
3655W	WR-10 Waveguide Calibration Kit
3655W-1	WR-10 Waveguide Calibration Kit with Sliding Terminations
3654B	V Connector Calibration Kit with Sliding Terminations
3652	K Connector Calibration Kit
3652-1	K Connector Calibration Kit with Sliding Terminations

Test Port Cables

3671W1-50-1,	W1 Female to W1 Male High Performance Cable, 3.9 inches (1 each)
3671W1-50-2,	W1 Female to W1 Male High Performance Cable, 5.1 inches (1 each)
3671W1-50-3,	W1 Female to W1 Male High Performance Cable, 6.3 inches (1 each)
3671V50-3,	V Female to V Male High Performance Cable, 25 inches (2 each)
3671K50-1,	K Female to K Male High Performance Cable, 25 inches (2 each)

Adapters

Coaxial

SC6299	W1 Male to V Male Adapter
SC6355	W1 Male to V Female Adapter
SC6357	W1 Female to V Male Adapter
SC6356	W1 Female to V Female Adapter
33WW50	W1 Male to W1 Male Adapter
33WWF50	W1 Male to W1 Female Adapter
33WFWF50	W1 Female to W1 Female Adapter

Waveguide to Coaxial

SC6216	WR-10 to W1 Male Adapter
SC6198	WR-10 to W1 Female Adapter

Power Meter and Sensor

ML2437A	Power Meter, Single Input
SC6230	MA2425B Thermal Sensor Characterized to 65 GHz

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