GORE® VNA Microwave/RF

TEST ASSEMBLIES

Improved VNA performance with precise measurements

GORE® VNA Microwave/RF Test Assemblies set the industry standard for vector network analyzers (VNAs) through 70 GHz. Constant and/or highly repetitive movement of cables can compromise the measurement precision of high-performance VNAs. Leading manufacturers choose GORE® VNA Microwave/RF Test Assemblies because of the improved performance they see in their equipment.

These test assemblies are specifically engineered to provide the most precise VNA measurements under laboratory conditions. They deliver the highest accuracy and the greatest time interval between recalibrations. GORE® VNA Microwave/RF Test Assemblies have a rugged, lightweight construction that enables longer service life, reduced downtime, and lower operating costs over the life of the equipment.

Typical Applications

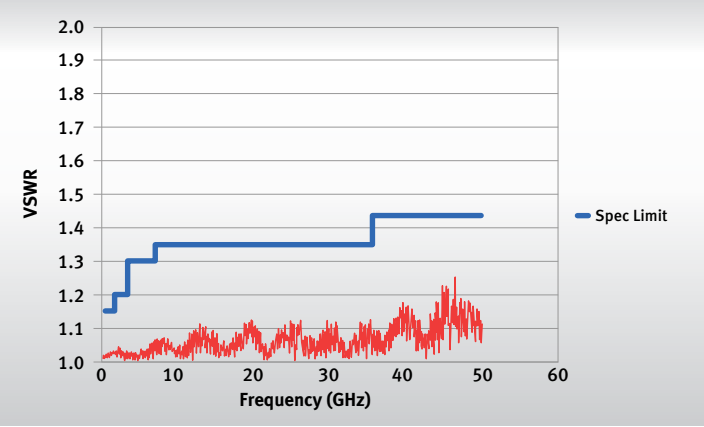
- Vector network analyzers
- Testing in lab environments
- Critical measurements

Guaranteed Stability for Precise and Repeatable Measurements

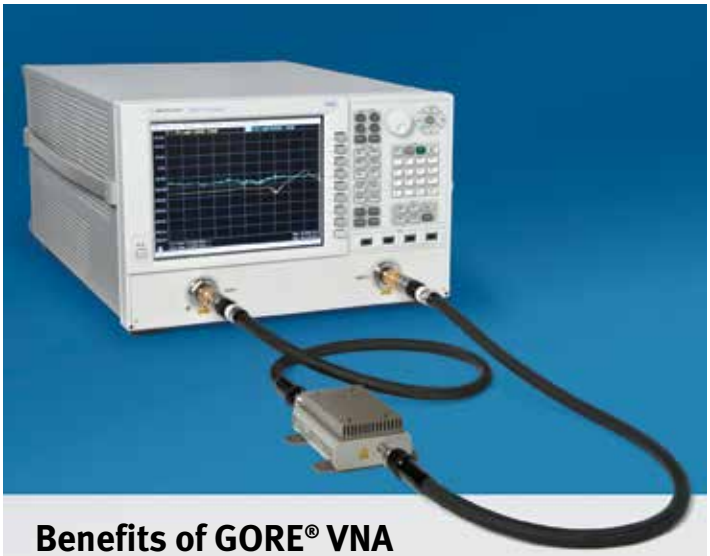
GORE® VNA Microwave/RF Test Assemblies maintain excellent insertion loss and VSWR (Figure 1). Unlike conventionally designed RF test assemblies, Gore's assemblies ensure accurate and repeatable measurements because of their excellent phase and amplitude stability with flexure (Figures 2 and 3). Additional testing is performed to guarantee this performance with flexure. See Table 1 for typical and guaranteed performance for each assembly.

Prior to shipment, all GORE® VNA Microwave/RF Test Assemblies are tested for return loss, insertion loss, phase stability, and loss stability up to their maximum operating frequency. Gore test methods simulate real-world environments to ensure that the assembly delivers precise and repeatable measurements in your application.

Figure 1: Typical VSWR Performance[1]



[1] Data is based on Gore's 50 GHz VNA assembly FE0BN0BM025.0.



Benefits of GORE® VNA Microwave/RF Test Assemblies

- Extremely precise measurements with stable electrical performance up to 70 GHz
- Outstanding phase and amplitude stability with flexure
- Excellent reliability with extremely rugged cable construction and NMD-style connectors that withstand repetitive mating, flexure, crushing, twisting, and bending
- Reduced downtime because of increased intervals between calibrations

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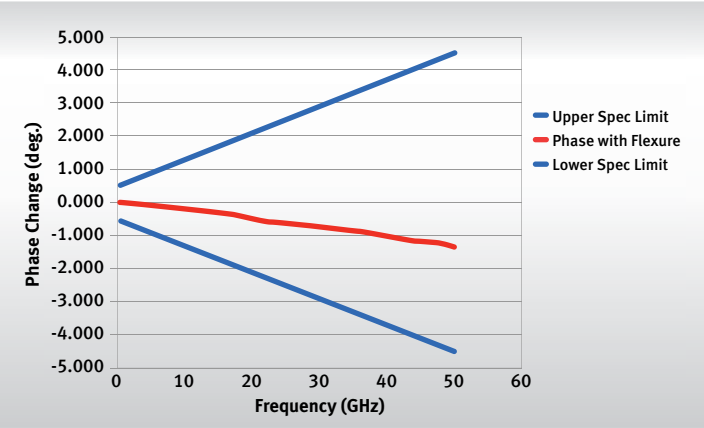
Table 1: Product Specifications

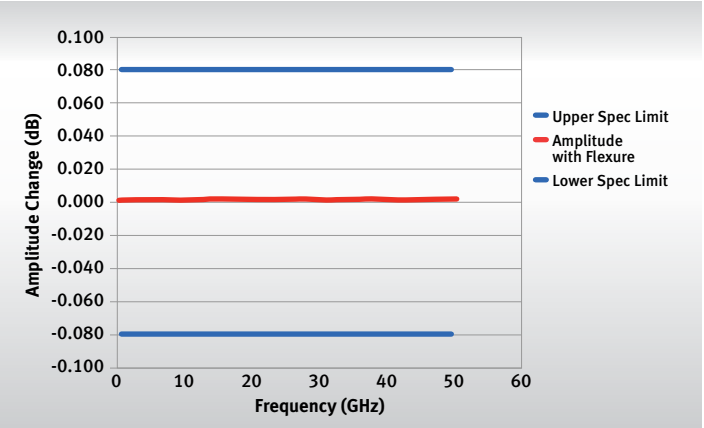
	Gore Cable Type	FB			FD			FE			FF		
Electrical Properties	**Length (in)**	**25**	**38**	**48**	**25**	**38**	**48**	**25**	**38**	**48**	**25**	**38**	**48**
	Maximum Frequency (GHz)	26.5	26.5	26.5	40	40	40	50	50	50	70	70	70
	Typical VSWR	1.20:1	1.20:1	1.20:1	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	1.25:1	1.35:1	1.35:1	1.35:1
	Maximum VSWR	1.29:1	1.29:1	1.29:1	1.35:1	1.35:1	1.35:1	1.43:1	1.43:1	1.43:1	1.50:1	1.50:1	1.50:1
	Typical Insertion Loss (dB)	1.26	1.80	2.21	2.64	3.85	4.78	2.62	4.00	5.05	5.15	7.17	8.73
	Maximum Insertion Loss (dB)	1.56	2.17	2.64	3.46	4.82	5.87	3.62	5.16	6.34	5.93	8.16	9.88
	Impedance (Nominal) (Ohms)	50											
	Typical Phase Stability (degree)	2.0	2.0	3.0	1.5	3.0	3.0	1.5	4.0	4.0	5.0	6.0	7.0
	Maximum Phase Stability (degree)	3.9	7.4	10.0	3.7	7.3	7.3	4.5	9.0	9.0	8.54	10.55	10.55
	Typical Amplitude Stability (dB)	0.01	0.02	0.03	0.02	0.02	0.03	0.01	0.03	0.03	0.02	0.02	0.04
	Maximum Amplitude Stability (dB)	0.08	0.15	0.25	0.08	0.15	0.25	0.08	0.15	0.25	0.10	0.15	0.25
	Dielectric Constant (Nominal)	1.4											
	Velocity of Propagation (Nominal) (%)	85											
	Shielding Effectiveness (dB through 18 GHz)	› 100											
	Time Delay (Nominal) ns/cm (ns/in)	0.04 (0.103)											
Mech./Env. Properties	Nominal Weight g/m (oz/ft)	295.3 (3.2)											
	Typical Flex Cycles	100,000			50,000			50,000			50,000		
	Minimum Bend Radius mm (in)	57.2 (2.25)											
	Temperature Range (°C)	Laboratory conditions; analyzer-specific (23 ± 5)											
	Crush Resistance kgf/cm (lbf/in)	143 (800)											

Figure 2: Typical Phase Stability with Flexure[1]



[1] Data is based on Gore's 50 GHz VNA assembly FE0BN0BM025.0. The assembly is terminated with a short circuit and tested on a calibrated system. A mandrel of 2.25-inch radius is placed midway down the assembly on either side. The assembly is bent 180 degrees around the mandrel, forming a "U" shape. The assembly is held in this position for one full sweep. Maximum deviation over the frequency range of analysis is noted. The assembly is then returned to its straight position, and the VNA is renormalized. The mandrel is placed on the opposite side of the assembly and the test is repeated.

Figure 3: Typical Amplitude Stability with Flexure[1]



[1] Data is based on Gore's 50 GHz VNA assembly FE0BN0BM025.0. The assembly is terminated with a short circuit and tested on a calibrated system. A mandrel of 2.25-inch radius is placed midway down the assembly on either side. The assembly is bent 180 degrees around the mandrel, forming a "U" shape. The assembly is held in this position for one full sweep. Maximum deviation over the frequency range of analysis is noted. The assembly is then returned to its straight position, and the VNA is renormalized. The mandrel is placed on the opposite side of the assembly and the test is repeated.

Durable and Rugged Construction

GORE® VNA Microwave/RF Test Assemblies offer outstanding electrical and mechanical performance for extremely precise and repeatable measurements (see Table 1 for product specifications).

Constructed with an abrasion-resistant polymer braid around a flexible armor casing, these assemblies are extremely durable (Figure 4). They withstand crush forces of more than 800 pounds force/inch and have an auto-limiting bend radius of 2.25 in (57.2 mm). Even with this armored and rugged construction, GORE® VNA Microwave/RF Test Assemblies maintain excellent flexibility, which increases the cable's life. For example, when you drape the assembly over your finger, it will assume a 180-degree arc near the restricted bend radius.

Features of these assemblies include:

- NMD-style ruggedized connectors
- Crush resistance greater than 800 lbf/in
- Over 50,000 flexures at minimum bend radius
- Torque resistance
- Virtually zero cable springback

Figure 4: Assembly Cross-Section

GORE® VNA Microwave/RF Test Assemblies include NMD-style ruggedized connectors for direct attachment to VNA test ports and allow the use of test port-compatible adapters for best durability and stability. The combination of the assembly's ruggedized construction and NMD-style connector ensures longer flex life with consistent performance and reduced frequency of recalibration. In addition, these NMD-style ruggedized connectors include:

- A large gripping area with knurled metal spacer for easier connection
- An anti-skid friction band that helps prevent accidental movement when testing on a smooth surface
- A strain-relief boot that protects the cable-to-connector termination from external forces that can compromise measurement repeatability and assembly longevity

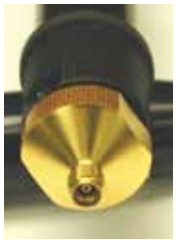
To verify the durability of GORE® VNA Microwave/RF Test Assemblies, Gore has performed flex testing of more than 100,000 cycles (200,000 bends). For each cycle, the assembly was flexed 90 degrees to its auto-limiting bend radius and then bent 180 degrees in the opposite direction. Then the same assembly was torqued 50,000 times (25,000 clockwise and 25,000 counter-clockwise). After these tests, the assemblies still met the same specifications as new assemblies.

Connector Options

NMD connectors available for GORE® VNA Microwave/RF Test Assemblies are specifically engineered to optimize performance of the assembly (see Tables 2 and 3 for connector options). These connectors mate with standard VNA systems, allowing mode-free broadband coaxial measurements from DC to maximum frequency of the assembly. They have an auxiliary, large thread and bearing surface for mating with conventional connectors of the same type and for attaching either male or female adapters.

Ruggedized Port Female

Ruggedized DUT Male



DUT Female

Precision N Male

Precision DUT Female

7mm Hermaphroditic

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Ordering Information

Ordering GORE® VNA Microwave RF/Test Assemblies requires selecting the cable type, connector types and assembly length, which are identified by a 12-character part number:

1 2	3 4 5	6 7 8	9 10 11 .12
Cable Type	Connector A	Connector B	Assembly Length

Positions 1–2: See Table 1 for the two-letter codes representing each cable type.

Positions 3–5: Connector that will attach to the VNA; see Table 2 for the list of connectors available for each cable type.

Positions 6–8: Connector that will attach to the device under test (DUT); see Table 3 for the list of connectors available for each cable type.

Positions 9–12: The length of the assembly expressed in inches to the nearest tenth, including zeroes to fill positions if the length is less than three digits. For example, the length of a 38-inch test assembly is specified as 038.0 in the last four digits of the part number. Cables are available in standard lengths of 25 in (0.64 m), 38 in (0.97 m) and 48 in (1.22 m).

Gore's Microwave/RF Assembly Builder is a step-by-step tool that allows you to configure and request a quote for a test assembly. For more information, visit **www.gore.com/rfcablebuilder**.

Table 2: Connector Options for End A (VNA)[1]

	Gore Connector Type	Maximum Frequency (GHz)	FB (26.5 GHz)	FD (40 GHz)	FE (50 GHz)	FF (70 GHz)
End A (VNA Connector)	Precision N Male	18	0AH	0AH	0AH	
	7 mm Hermaphroditic	18	0HD	0HD	0HD	
	3.5 mm Ruggedized Port Female	26.5	0HA			
	2.92 mm Ruggedized Port Female	40		0BS		
	2.4 mm Ruggedized Port Female	50			0BN	
	1.85 mm Ruggedized Port Female	67				0CN

[1] The maximum operating frequency of a test assembly is determined as the lowest frequency of either the connector or the cable.

Table 3: Connector Options for End B (DUT)[1]

	Gore Connector Type	Maximum Frequency (GHz)	FB (26.5 GHz)	FD (40 GHz)	FE (50 GHz)	FF (70 GHz)
End B (Device Under Test Connector)	Precision N Male	18	0AH	0AH	0AH	
	Precision N Female	18	0AL	0AL	0AL	
	7 mm Hermaphroditic	18	0HD	0HD	0HD	
	3.5 mm Ruggedized DUT Male	26.5	0HB	0HB	0HB	
	3.5 mm Female	26.5	0HC	0HC	0HC	
	2.92 mm Ruggedized DUT Male	40		0HR	0HR	
	2.92 mm Female	40		0HQ	0HQ	
	2.4 mm Ruggedized DUT Male	50			0BM	
	2.4 mm Female	50			0BL	
	1.85 mm Ruggedized DUT Male	67				0CM
	1.85 mm Female	67				0CL

[1] The maximum operating frequency of a test assembly is determined as the lowest frequency of either the connector or the cable.