



# 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 67 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.

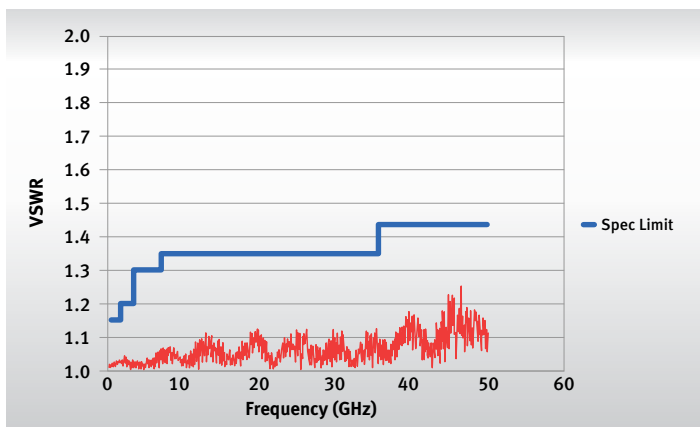
### TYPICAL APPLICATIONS

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

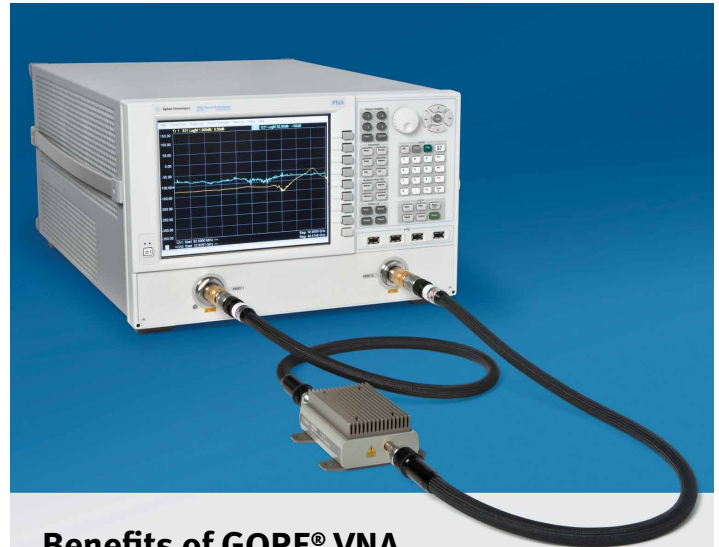
### GUARANTEED STABILITY FOR PRECISE AND REPEATABLE MEASUREMENTS

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

FIGURE 1: TYPICAL VSWR PERFORMANCE<sup>1</sup>



<sup>1</sup> 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 67 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

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.



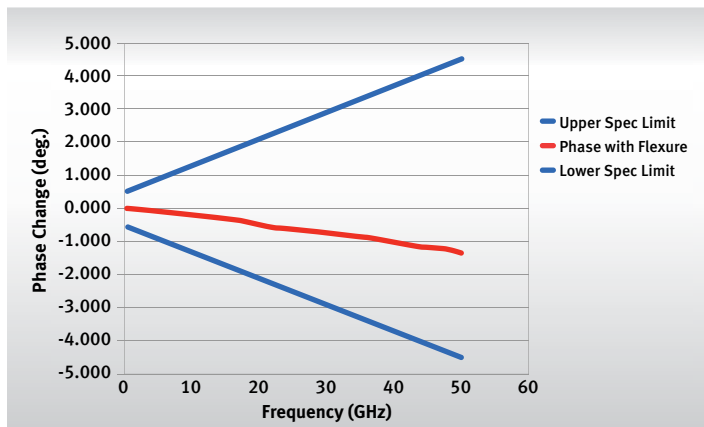
# GORE VNA Microwave/RF

## TEST ASSEMBLIES

**TABLE 1: PRODUCT SPECIFICATIONS**

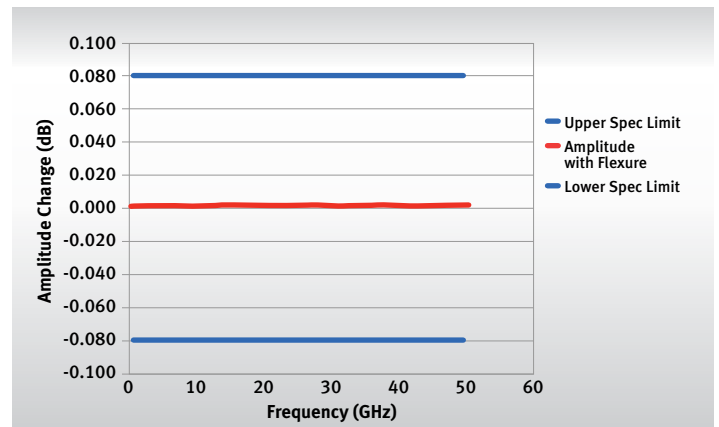
| Gore Cable Type       |   | FB  |        |        | FD     |        |        | FE     |        |        | FF     |        |        |
|-----------------------|---|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| ELECTRICAL PROPERTIES | Length (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     | 67     | 67     | 67     |
|                       | 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 | 1.40:1 | 1.40:1 | 1.40:1 |
|                       | 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   | 5.07   | 7.04   | 8.56   |
|                       | Maximum Insertion Loss (dB)                 | 1.56  | 2.17   | 2.64   | 3.46   | 4.82   | 5.87   | 3.62   | 5.16   | 6.34   | 5.83   | 8.01   | 9.68   |
|                       | 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    | 4.0    | 5.0    | 7.0    |
|                       | Maximum Phase Stability (degree)            | 3.9   | 7.4    | 10.0   | 3.7    | 7.3    | 7.3    | 4.5    | 9.0    | 9.0    | 8.5    | 10.5   | 10.5   |
|                       | 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<sup>1</sup>**



<sup>1</sup> 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<sup>1</sup>**



<sup>1</sup> 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