



GORE[®] MICROWAVE/RF ASSEMBLIES

General Purpose Test and
Interconnect Applications



Together, improving life

Maximum flexibility, excellent electrical stability

For test applications that require consistent and highly repeatable measurements, GORE® Microwave/RF Assemblies for general purpose test applications provide reliable electrical performance with proven phase and amplitude stability. The smaller diameter and highly flexible, yet durable construction simplify the routing process while ensuring long-lasting electrical performance after installation, particularly in board-to-board and inside-the-box applications. GORE® Microwave/RF Assemblies provide electrical and mechanical integrity for long service life in a lightweight cable assembly.

Greater Flexibility

GORE® Microwave/RF Assemblies are extremely flexible and withstand the rigors of handling and installation. Unlike traditionally designed flexible cables that are more stiff and difficult to handle, Gore's assemblies have a small bend radius that makes routing easy even in tight spaces. Their smaller size and flexibility enable these cables to maintain signal integrity for a longer service life.

Precise and Repeatable Measurements

GORE® Microwave/RF Assemblies offer excellent electrical performance in applications from DC through 70 GHz. The assemblies' proven phase and amplitude stability ensures accurate and repeatable measurements. Gore tests each assembly after manufacturing to ensure that its insertion loss and VSWR meet performance criteria.

The construction of GORE® Microwave/RF Assemblies enables consistent electrical performance (Figure 1). Gore's expanded polytetrafluoroethylene (ePTFE) insulation has a dielectric constant of 1.4, which translates to low relative loss, high velocity of propagation (85 percent speed of light), low capacitive loading, and high cut-off frequencies. Protected by the inner braid and jacket, the outer conductor delivers

a minimum of 100 dB/ft of shielding effectiveness through 18 GHz. A specific assembly's shielding effectiveness is determined by the choice of connector.

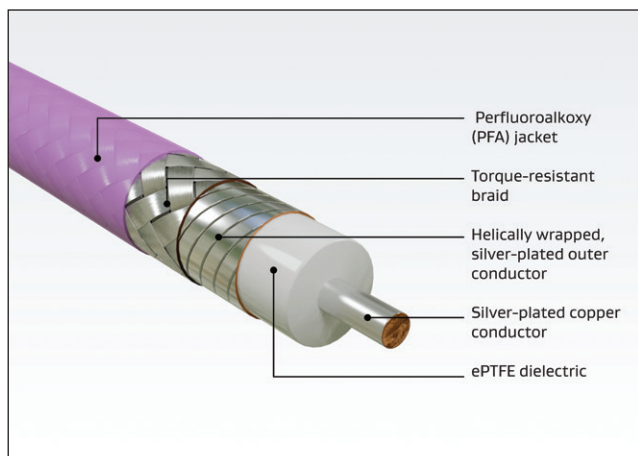
Gore provides a variety of standard connectors designed specifically for GORE® Microwave/RF Assemblies. These connectors are engineered to complement the performance of each cable, minimizing loss and reflection for optimized signal transmission.



Benefits of GORE® Microwave/RF Assemblies

- Reliable signal integrity over longer distances with low loss up to 70 GHz
- Reliable, repeatable electrical performance with consistent phase and amplitude stability
- Easy installation with flexible construction and small bend radius
- Decreased weight with smaller diameter for higher density applications
- Design flexibility with a variety of interconnect options

Figure 1: The Anatomy of GORE® Microwave/RF Assemblies for General Purpose Applications



Typical Applications

- Board-to-board
- Inside-the-box
- ATE systems (automated test equipment)
- Load boards
- Environmental test chambers
- Thermal vacuum chambers
- Telecommunication systems
- Optical modules
- Evaluation boards
- Antenna arrays
- Test bench systems
- Module-to-module interconnect
- Backplane interconnects
- Clock distribution
- 5G test and interconnection

Phase Matching

Upon request, phase or time delay matching can be specified for GORE® Microwave/RF Assemblies with frequencies of DC through 70 GHz. According to the performance requirements of the application, cable assemblies can be specified to meet absolute or relative matching values:

- **Absolute match:** One or more assemblies having a specific time delay or phase length target value $\pm$ some tolerance value. This type of specification allows replacement or addition of individual cables in a matched set.

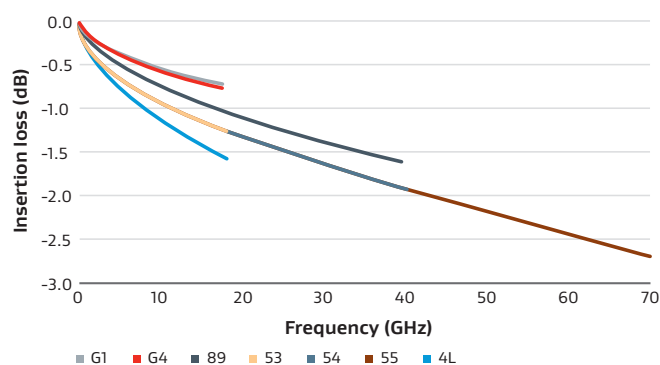
- **Relative match:** Two or more assemblies whose time delay or phase length fall within a specified match window. Relative matching ensures consistent matching within a set of cables, but an assembly from one set may not necessarily be matched with cable assemblies in another set.

Gore can provide absolute and relative time delay matching to sub-picosecond tolerances.

High-Density Interconnects

Gore offers several extremely small interconnects that deliver consistent electrical performance with maximum flexibility (Table 1). These assemblies enable you to achieve high density for applications such as printed circuit boards and load boards. The combination of low loss, small diameter and minimum bend radius facilitate easier routing and durable installation, making them an ideal replacement for semi-rigid assemblies (Figure 2). A variety of push-on connectors are available (Table 2). For cable/connector combinations specifically designed for load board applications, contact a Gore representative at electronics.usa@wlgore.com.

Figure 2: Typical Insertion Loss (dB) for High-Density Interconnects¹



¹The electrical specifications in this table are based on a 0.3 m (12 in) assembly length and maximum frequency with straight connectors.

Table 1: High-Density Interconnect Specifications¹**Electrical Properties**

Gore Cable Type	4L	53	G1	G4	54	89	55
Maximum Frequency (GHz)	18	18	18	18	40	40	70
Typical VSWR	1.33:1	1.32:1	1.30:1	1.30:1	1.33:1	1.40:1	1.40:1
Typical Insertion Loss (dB)	1.58	1.26	0.73	0.75	1.93	1.60	2.69
Impedance (Nominal) (Ohms)	50						
Attenuation at Maximum Frequency [dB/m (dB/ft)]	5.04 (1.54)	3.69 (1.13)	2.33 (0.71)	2.08 (0.63)	5.45 (1.66)	4.46 (1.36)	7.34 (2.24)
Dielectric Constant (Nominal)	1.4						
Velocity of Propagation (Nominal) (%)	85						
Shielding Effectiveness (dB through 18 GHz)	>100						
Time Delay (Nominal) [ns/m (ns/ft)]	4 (1.22)						

Mechanical/Environment Properties

Gore Cable Type	4L	53	G1	G4	54	89	55
Center Conductor	Solid	Solid	Stranded	Solid	Solid	Solid	Solid
Overall Diameter [mm (in)]	1.2 (0.047)	1.8 (0.070)	3.0 (0.120)	3.0 (0.120)	1.8 (0.070)	2.2 (0.085)	1.8 (0.070)
Nominal Weight [g/m (g/ft)]	6.6 (2)	13.1 (4)	26.2 (8)	26.2 (8)	13.1 (4)	16.4 (5)	13.1 (4)
Minimum Bend Radius [mm (in)]	6.4 (0.25)	10.2 (0.4)	12.7 (0.5)	12.7 (0.5)	10.2 (0.4)	12.7 (0.5)	10.2 (0.4)
Temperature Range (°C)	-55 to 125						

¹The electrical specifications in this table are based on a 0.3 m (12 in) assembly length and maximum frequency with straight connectors.

Table 2: Connector Options for High-Density Interconnects

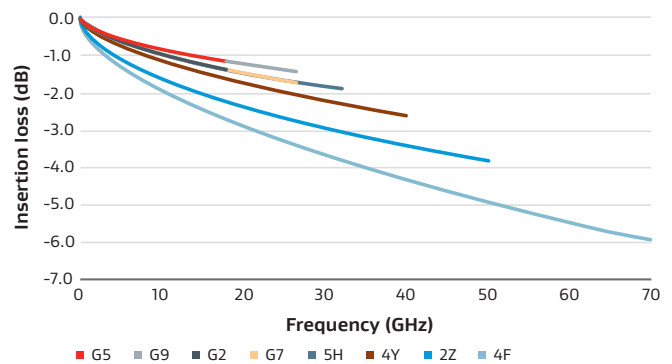
Connector Type	Max. Freq. (GHz) ²	Gore Cable Type						
		4L	53	G1	G4	54	89	55
		18	18	18	18	40	40	70
SMA Male	18	S01	S01	R01	R01	S01	S01	
SMA Box Right-Angle Male	18			R71	R71		S71	
SMA Female	18	S02	S02		R02		S02	
SMA Bulkhead Female	18			R42	R42		R42	
SMP Bulkhead Full Detent Male	26.5						ZT4	
SMP Bulkhead Smooth Bore Male	26.5	ZKT	ZKT				ZKT	
SMP Bulkhead Ultra Smooth Bore Male	26.5	ZUJ	ZUJ				ZUJ	
SMP Float Mount Modified Full Detent Male	26.5		ZQF		ZQF		ZQF	
SMP Female	26.5	ZEM	ZT8	ZEM	ZEM	ZT8	ZT8	
SMP Box Right-Angle Female	26.5	ZF6	ZF6	ZF6	ZF6		ZF6	
SMPM Full Detent Male	40					ZU2		
SMPM Smooth Bore Male	40		ZUK				ZUK	
SMPM Female	65	ZST	ZST			ZST	ZST	ZST
SMPM Box Right-Angle Female	65	ZVY	ZVY			ZVY	ZVY	ZVY
SMPM Bulkhead Female	40	ZW7	ZW7				ZW7	
TNCA Male	18			C01	C01			
2.92 mm Male	40					OCX	OCQ	
2.92 mm Female	40	OC2	OC2			OC2		
2.4 mm Male	50					OCY		OCY
1.85 mm Male	70					OCZ		OCZ

² The maximum operating frequency of a test assembly is determined as the lowest frequency of either the connectors or the cable.

Multi-Purpose Assemblies

These multi-purpose GORE® Microwave/RF Assemblies deliver a combination of excellent electrical and mechanical performance that ensures reliable measurement accuracy after repeated use (Table 3). The flexibility and consistent phase and amplitude stability enable these assemblies to maintain low loss and withstand the motion common in applications such as bench test systems (Figure 3). They also maintain phase and amplitude stability over temperature. These assemblies are available with a variety of connectors (Table 4).

Figure 3: Typical Insertion Loss (dB) for Multi-Purpose Assemblies³



³The electrical specifications in this table are based on a 0.9 m (36 in) assembly length and maximum frequency with straight connectors.

Table 3: Multi-Purpose Assembly specifications³

Electrical Properties

Gore Cable Type	G5	G2	G9	G7	5H	4Y	2Z	4F
Maximum Frequency (GHz)	18	18	26.5	26.5	32	40	50	70
Typical VSWR	1.19:1	1.19:1	1.17:1	1.17:1	1.30:1	1.30:1	1.26:1	1.30:1
Typical Insertion Loss (dB)	1.13	1.36	1.43	1.71	1.81	2.65	3.80	5.99
Impedance (Nominal) (Ohms)	50							
Attenuation at Maximum Frequency [dB/m (dB/ft)]	1.06 (0.32)	1.30 (0.40)	1.30 (0.40)	1.62 (0.50)	1.54 (0.47)	2.57 (0.78)	4.13 (1.26)	6.13 (1.87)
Typical Phase Stability (degree)	+/- 2.0	+/- 2.0	+/- 3.0	+/- 3.0	+/- 5.0	+/- 5.0	+/- 6.0	+/- 8.0
Typical Amplitude Stability (dB)	<+/- 0.05							
Dielectric Constant (Nominal)	1.4							
Velocity of Propagation (Nominal) (%)	85							
Shielding Effectiveness (dB through 18 GHz)	> 100							
Time Delay (Nominal) [ns/m (ns/ft)]	4 (1.22)							

Mechanical/Environment Properties

Gore Cable Type	G5	G2	G9	G7	5H	4Y	2Z	4F
Center Conductor	Solid	Stranded	Solid	Stranded	Solid	Solid	Solid	Solid
Overall Diameter [mm (in)]	4.8 (0.190)	4.8 (0.190)	4.8 (0.190)	4.8 (0.190)	4.3 (0.170)	3.8 (0.150)	3.6 (0.140)	3.0 (0.120)
Nominal Weight [g/m (g/ft)]	52.5 (16)	52.5 (16)	52.5 (16)	52.5 (16)	42 (13)	36.1 (11)	29.5 (9)	29.5 (9)
Minimum Bend Radius [mm (in)]	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	25.4 (1.0)	12.7 (0.5)
Temperature Range (°C)	-55 to 125							

³The electrical specifications in this table are based on a 0.9 m (36 in) assembly length and maximum frequency with straight connectors.

Table 4: Connector Options for Multi-Purpose Assemblies

		Gore Cable Type							
Connector Type	Max. Freq. (GHz) ⁴	G5	G2	G9	G7	5H	4Y	2Z	4F
		18	18	26.5	26.5	32	40	50	70
SMA Male	18	R01	R01				R01		
SMA Box Right-Angle Male	18	R71	R71				R71		
SMA Female	18	R02	R02						
SMA Bulkhead Female	18	R42	R42						
Precision N Male	18	Q01	Q01						
Precision N Box Right-Angle Male	18	Q71	Q71						
Precision N Female	18	Q02	Q02						
TNC Male	12.4	T01	T01						
TNCA Male	18	C01	C01						
TNCA Box Right-Angle Male	18	C71	C71						
Type N Male	18	N01	N01						
7 mm Hermaphroditic	18	K00	K00						
3.5 mm Male	26.5	D01	D01	D01	D01				
3.5 mm Female	26.5	D02	D02	D02	D02				
2.92 mm Male	40					ZMQ	OCQ		
2.92 mm Box Right-Angle Male	40					ZQA	ZQA		
2.92 mm Female	40						OCP	OBP	
2.4 mm Male	50						OCJ	OAJ	
2.4 mm Female	50						OCK	OAK	
1.85 mm Male	70								OBB
1.85 mm Female	70								OBA

⁴ The maximum operating frequency of a test assembly is determined as the lowest frequency of either the connectors or the cable.

High Power/Low Loss Assemblies

Traditionally, applications that need high power/low loss assemblies must compromise on flexibility and size. Several highly flexible GORE® Microwave/RF Assemblies deliver low loss and high power-handling capability in a smaller package (Table 5). Delivering reliable performance up to 18 GHz (Figure 4), these assemblies have smaller diameters, making them more flexible and easier to handle. These cables are available with a variety of connectors (Table 6).

Table 5: High Power/Low Loss Assembly Specifications⁵

Electrical Properties

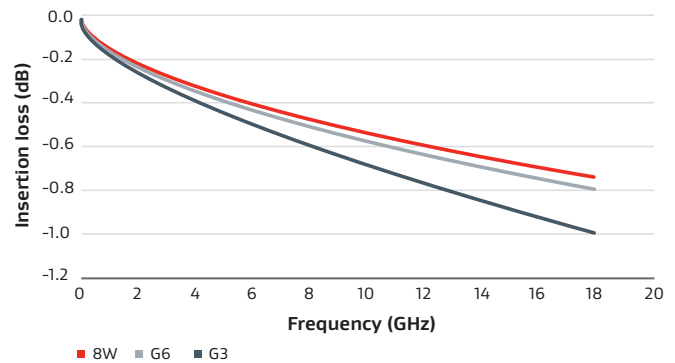
Gore Cable Type	G6	G3	8W
Maximum Frequency (GHz)	18	18	18
Typical VSWR	1.22:1	1.24:1	1.28:1
Typical Insertion Loss (dB)	0.80	1.00	0.75
Impedance (Nominal) (Ohms)	50		
Attenuation at Maximum Frequency [dB/m (dB/ft)]	0.68 (0.21)	0.84 (0.26)	0.63 (0.19)
Typical Phase Stability (degree)	+/- 8.0	+/- 6.0	+/- 15.0
Typical Amplitude Stability (dB)	<+/- 0.05		
Dielectric Constant (Nominal)	1.4		
Velocity of Propagation (Nominal) (%)	85		
Shielding Effectiveness (dB through 18 GHz)	> 100		
Time Delay (Nominal) [ns/m (ns/ft)]	4 (1.22)		

Mechanical/Environment Properties

Gore Cable Type	G6	G3	8W
Center Conductor	Solid	Stranded	Solid
Overall Diameter [mm (in)]	7.4 (0.290)	7.4 (0.290)	8.1 (0.320)
Nominal Weight [g/m (g/ft)]	124.6 (38)	118.1 (36)	144.3 (44)
Minimum Bend Radius [mm (in)]	38.1 (1.5)	38.1 (1.5)	50.8 (2.0)
Temperature Range (°C)	-55 to 125		

⁵ The electrical specifications in this table are based on a 0.9 m (36 in) assembly length and maximum frequency with straight connectors.

Figure 4: Typical Insertion Loss (dB) for High Power/Low Loss Assemblies⁵



⁵ The electrical specifications in this table are based on a 0.9 m (36 in) assembly length and maximum frequency with straight connectors.

Table 6: Connector Options for High Power/Low Loss Assemblies

Connector Type	Max. Freq. (GHz) ⁶	Gore Cable Type		
		G6	G3	8W
SMA Male	18	R01	R01	R01
SMA Male (Vented)	18	ZN1		ZN1
SMA Box Right-Angle Male	18	R71	R71	R71
SMA Box Right-Angle Male (Vented)	18	ZSK		
SMA Female	18	R02	R02	R02
SMA Bulkhead Female	18	R42	R42	R42
Precision N Male	18	Q01	Q01	Q01
TNC Male	12.4	T01	T01	T01
TNC Male (High Power, Vented)	5			ZLK
TNCA Male	18	C01	C01	C01
TNCA Box Right-Angle Male	18	C71		C71
TNCA Female	18	C02	C02	C02
Type N Male	18	N01	N01	N01

⁶ The maximum operating frequency of a test assembly is determined as the lowest frequency of either the connectors or the cable.

Thermal Vacuum Assemblies

GORE® Microwave/RF Assemblies are available for thermal vacuum (TVac) applications.

The cable and connector options listed in this data sheet are all available for TVac applications by configuring the part number with T/V at the end highlighted in table 8.

These assemblies will be manufactured using low outgassing materials having a TML of 1.0% or less and CVCM of 0.10% or less when tested per ASTM-595.



Thermal-vacuum chamber

Credit: NASA

Integrity of critical hardware

- Gore's focus on fitness for use
- Over 40 years of TVac applications experience

Successful test execution

- Repeatable and reliable products
- Broad range of thermal vacuum solutions proven over time

Ensure program schedule

- Access to Gore's global experience and regional support
- Gore's application engineering support will help you determine the right cable solutions
- Reduce risk of delays/test idle time for troubleshooting and addressing test anomalies

Save total cost

- Gore's portfolio offers best total value with performance over time
- Solutions to fit testing budget
- Reduce risk of cost creep due to troubleshooting and replacement of faulty/unstable test equipment

Torque Values

The recommended mating torque values for Gore connector types are provided in Table 7. They are intended for testing and measurement in the lab environment.

Table 7: Mating Torque Vales

Connector	Max. Freq. (GHz)	Recommended Mating Torque Value in-lbs (Nm)
Type N	12.4	9 - 15 (1.02 - 1.68)
TNC	12.4	10 - 12 (1.13 - 1.35)
TNCA	18	10 - 12 (1.13 - 1.35)
Precision N	18	10 - 12 (1.13 - 1.35)
7 mm	18	10 - 12 (1.13 - 1.35)
SMA	18	8 - 10 (0.90 - 1.13)
3.5 mm	26.5	8 - 10 (0.90 - 1.13)
2.92 mm	40	8 - 10 (0.90 - 1.13)
2.4 mm	50	8 - 10 (0.90 - 1.13)
1.85 mm	70	8 - 10 (0.90 - 1.13)

Ordering Information

GORE® Microwave/RF Assemblies are identified by a 12-character part number that designates the cable type, connector types, and assembly length (Table 8):

1 2	3 4 5	6 7 8	9 10 11 12 13
Cable Type	Connector A	Connector B	Assembly Length -T/V

Positions 1–2: The two-character identifier of the cable
Positions 3–5 and 6–8: Connector codes A and B in alphanumeric order

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

Position 13: Identifier included only for an assembly that has been prepared for thermal vacuum chamber use.

Example part number (positions 1–12): 4LS01S01010

Example part number (positions 1–13): 4LS01S010120-T/V

The **GORE® Microwave/RF Assembly Builder** is a step-by-step tool that allows you to configure and request a quote for a test assembly with different connector options, assembly lengths, and frequencies. For more information, visit www.gore.com/rfcablebuilder.

The **GORE® Microwave/RF Assembly Calculator** is an online tool that calculates and compares the insertion loss, VSWR, and other parameters for various cable types. For more information, visit tools.gore.com/gmcacalc.

Table 8: Part Configuration for Ordering

Ordering Identifier (Part Number Positions)						
Assembly Type	Frequency (GHz)	Center Conductor	Cable Type (Pos 1-2)	Connectors (Pos 3-5 and 6-8)	Lengths ⁷ (Pos 9-12)	Thermal Vacuum Identifier (Pos 13)
High-Density Interconnects (Table 1)	18	Solid	4L	See Table 2	012.0 12 in (0.30 m)	- T/V
	18	Solid	53			- T/V
	18	Stranded	G1			- T/V
	18	Solid	G4			- T/V
	40	Solid	54			- T/V
	40	Solid	89			- T/V
Multi-Purpose Assemblies (Table 3)	70	Solid	55	See Table 4	024.0 24 in (0.61 m)	- T/V
	18	Solid	G5		036.0 36 in (0.91 m)	- T/V
	18	Stranded	G2			- T/V
	26.5	Solid	G9			- T/V
	26.5	Stranded	G7		048.0 48 in (1.22 m)	- T/V
	32	Solid	5H			- T/V
	40	Solid	4Y		060.0 60 in (1.52 m)	- T/V
	50	Solid	2Z			- T/V
High Power/Low Loss Assemblies (Table 5)	70	Solid	4F	See Table 6		- T/V
	18	Solid	G6			- T/V
	18	Stranded	G3			- T/V
	18	Solid	8W			- T/V

⁷ Additional lengths available upon request

Gore Sets the Industry Benchmark for Microwave/RF Cable and Cable Assemblies Manufacturing

With more than 40 years of design expertise, Gore manufactures microwave/RF cable assemblies that provide enhanced durability while delivering consistent phase and amplitude stability with flexure and over temperature. We offer the industry a broad portfolio of cable assemblies for test and measurement, spaceflight, aerospace and defense applications. The portfolio includes cable diameters ranging from 0.047 to 0.420 inches at frequencies from DC to 110 GHz in low-loss cable constructions. Gore also designs and manufactures a selection of connector options to optimize the performance of the cable assemblies. With a proven track record and reputation, Gore's microwave/RF cable assemblies are the preferred solutions by key global OEMs for test systems.

For more information, visit gore.com/test.

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