GORE-FLIGHT™

MICROWAVE ASSEMBLIES

6 Series

Lightweight solution with lowest insertion loss before and after installation

Airframe cable assemblies are exposed to extreme conditions that can compromise their performance — beginning with the challenges of installation and continuing through the rigorous flight conditions that combine rapid temperature and pressure changes with potential contamination from fuels, oils, and fluids. Maintaining signal integrity in these challenging environments is essential to ensuring the reliability of the sophisticated electronic systems in the aircraft. At the same time, the assemblies must be lightweight and durable to improve fuel efficiency and reduce operating costs.

GORE-FLIGHT™ Microwave Assemblies, 6 Series are lightweight cable solutions that deliver the lowest insertion loss before and after installation, ensuring reliable performance for the life of the system (Table 1). The robust construction of these assemblies reduces total costs by withstanding the challenges of installation, reducing costly production delays, field service frequency, and the need for purchasing replacement assemblies. Also, the 6 Series are lighter weight, which improves fuel efficiency and increases payload.

The 6 Series has been qualified to the most stringent specifications for airframe assemblies. Gore controls the entire manufacturing process from purchasing raw materials and creating and applying the proprietary dielectric material, through testing and shipping the final cable assembly. This unsurpassed vertical integration allows Gore the complete control necessary to achieve tight specifications consistently. This process includes testing 100 percent of the assemblies for vapor leakage, dielectric withstanding voltage, VSWR, insertion loss, impedance, and velocity of propagation — ensuring that every assembly will deliver the highest-quality performance required for today's civil and military aircraft.

Typical Applications

- Airborne electronic surveillance/counter measures
- Radar warning (electronic defense) systems
- Missile approach warning systems
- Radar interconnects
- Electronic/signal intelligence
- Navigation/communication systems

Benefits of GORE-FLIGHT™ Microwave Assemblies, 6 Series

- Outstanding signal integrity with lowest insertion loss before and after installation
- Lower installation costs due to fewer failures and reduced aircraft production delays
- Improved fuel efficiency and increased payload with lightweight assembly
- Longer system life and reduced downtime due to mechanically robust construction
- Less RF interference among electronic systems due to superior shielding effectiveness
- Proven compliance with MIL-T-81490 requirements[a]

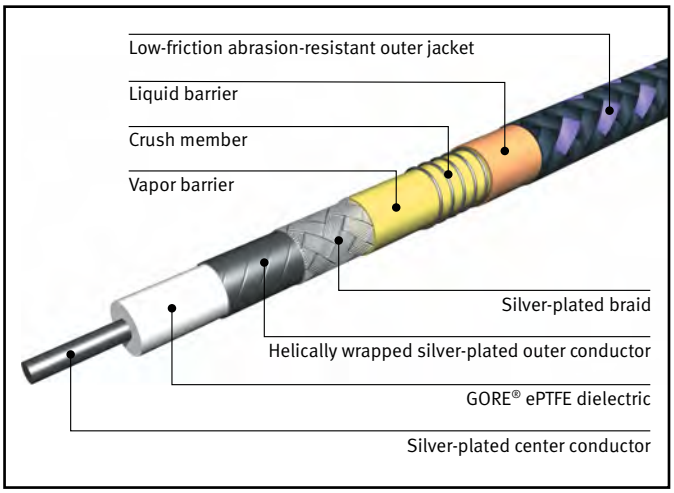
[a] See Table 2 for specific compliance data

Rugged Construction for Longer Service Life

GORE-FLIGHT™ Microwave Assemblies, 6 Series are engineered with a rugged construction that withstands the challenging environments they encounter throughout an aircraft's service life (Figure 1). The engineered fluoropolymers used in this construction help reduce abrasion caused by routing during installation, and they help maintain stable performance by resisting the effects of vibration during flight (Figure 2).

With a concentrated load resistance that exceeds MilSpec requirements, the 6 Series cable assemblies prevent the internal core from being compromised and protect against uncontrolled changes in impedance and dielectric constant. At the same time, this rugged construction is 17 percent lighter than alternative airframe assemblies, improving fuel efficiency and increasing payload.

Figure 1: Cable Construction

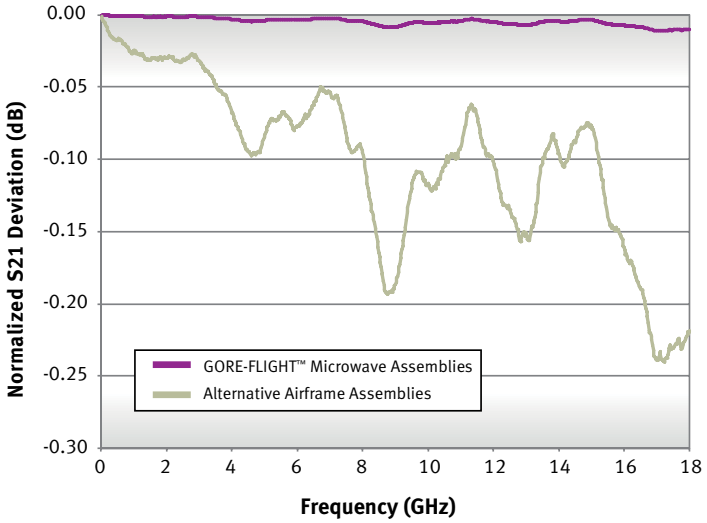


Outstanding EMI Shielding

The MIL-T-81490 standard requires a minimum shielding effectiveness of 90 dB. As the power and frequency requirements increase in today's applications, radiating cable assemblies can interfere with mission-critical systems. These systems can also be susceptible to interference due to inadequate shielding effectiveness.

With proven EMI shielding performance, GORE-FLIGHT™ Microwave Assemblies, 6 Series improves signal integrity by reducing RF interference among multiple electronic systems (Figure 3).

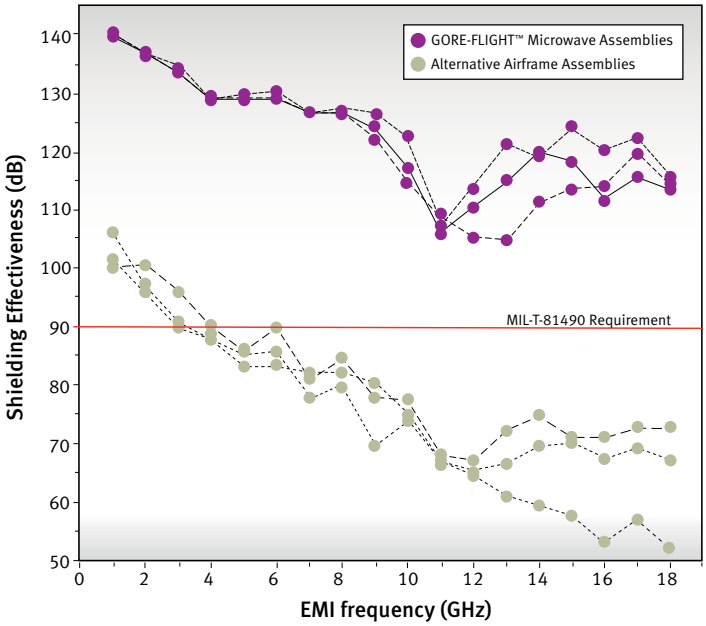
Figure 2: Shake Stability[b,c]



[b] Shake stability is a routine test conducted by Gore and is a good indication of the overall performance and stability of an assembly. The test is conducted by normalizing the assembly's insertion loss and then forcefully shaking the assembly against a hard surface. Gore's cable assemblies typically achieve less than 0.02 dB of change through 18 GHz.

[c] Data in this graph reflects 6E Series test results. Results for 65 Series are similar.

Figure 3: Shielding Effectiveness[c]



[c] Data in this graph reflects 6E Series test results. Results for 65 Series are similar.

Table 1: 6 Series Product Specifications

	Property	Value	
		Cable Type 6E	Cable Type 65
Electrical Properties	Maximum Frequency (GHz)	18	18
	Typical VSWR through 18 GHz (straight connector)	1.25:1	1.25:1
	Guaranteed VSWR through 18 GHz (straight connector)	1.40:1	1.40:1
	Typical Insertion Loss at 18 GHz (dB/ft)	0.198	0.342
	Guaranteed Insertion Loss at 18 GHz (dB/ft)	0.208	0.384
	Impedance (ohms)	50 ± 1	50 ± 1
	Dielectric Constant (nominal)	1.35	1.35
	Velocity of Propagation (nominal) (%)	86	86
	Time Delay (nominal) [ns/cm (ns/in)]	0.0387 (0.0984)	0.0387 (0.0984)
	Shielding Effectiveness through 18 GHz (dB)	90	90
Mech/Env Properties	Overall Diameter [mm (in)]	8.9 (0.35)	6.1 (0.24)
	Nominal Weight [g/m (lb/ft)]	125 (0.084)	60 (0.040)
	Minimum Bend Radius [mm (in)]	48.3 (1.9)	25.4 (1.0)
	Temperature Range (°C)	-55 to 125	-55 to 125
	Concentrated Load per MIL-T-81490 paragraph 4.7.18 (lb)	› 150	› 150

GORE-FLIGHT™ Microwave Assemblies — The most cost-effective solution for critical applications

Proven Performance Through Testing

Gore has designed a simulator to evaluate the stress of installation on microwave airframe assemblies (Figure 4). The simulator has several features that replicate minimum bend radius conditions, routing guides that induce torque, and an abrasive edge to simulate routing across sharp edges or through access holes in the airframe structure (Figure 5).

The simulator enables Gore to evaluate the electrical performance of various cable assemblies after installation. Testing electrical characteristics such as insertion loss and VSWR before and after routing through the simulator verifies whether an assembly can withstand the rigorous challenges of installation — resulting in lower total costs and longer service life.

To evaluate the insertion loss of GORE-FLIGHT™ Microwave Assemblies, 6 Series, Gore ran a 10-foot assembly through the simulator for three cycles. The results of this simulation demonstrate the importance of testing insertion loss after installation (Table 2).

Table 2: GORE-FLIGHT™ Microwave Assemblies, 6 Series Insertion Loss

Property	Nominal Value	
	Cable Type 6E	Cable Type 65
Typical Insertion Loss at 18 GHz (dB/ft)	0.198	0.342
Installed Insertion Loss at 18 GHz (dB/ft)	0.219	0.354

With GORE-FLIGHT™ Microwave Assemblies, a fit-and-forget philosophy is now a reality — providing the most cost-effective solution that ensures mission-critical system performance for military and civil applications.

For more information about the installation simulator, visit gore.com/simulator.

Figure 4: Installation Simulator

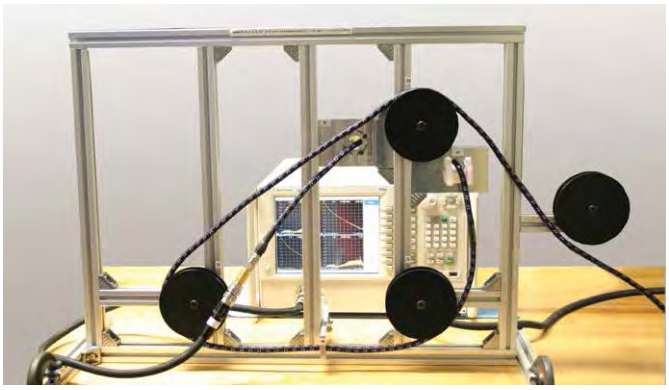


Figure 5: Abrasive Edge

Excellent Signal Integrity for Improved Reliability

GORE-FLIGHT™ Microwave Assemblies, 6 Series improve system performance by withstanding the challenges of installation, maintenance activities, and flight conditions. When compared to alternative airframe assemblies (Figure 6), the 6 Series maintains the lowest insertion loss before and after installation (Figure 7) — providing stable and accurate system performance.

Likewise, the VSWR of alternative airframe assemblies is less reliable due to impedance changes from cable damage (Figure 8), while the VSWR for the 6 Series is well controlled (Figure 9). With this level of performance, the 6 Series maintains consistent impedance of 50 ± 1 ohms, eliminating insertion loss stack-up issues when routing through airframe bulkheads.

Figure 6: Alternative Airframe Assembly Insertion Loss[c]

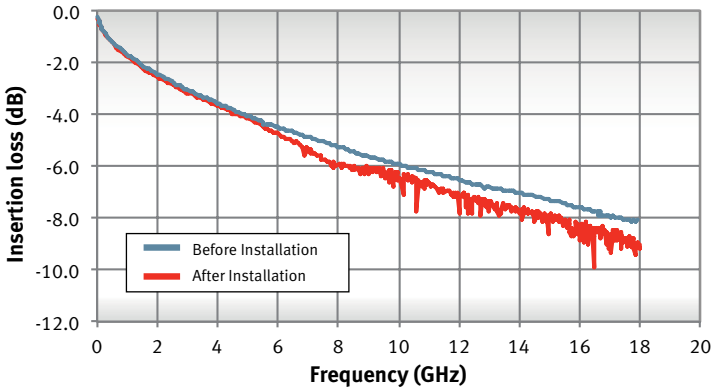


Figure 8: Alternative Airframe Assembly VSWR[c]

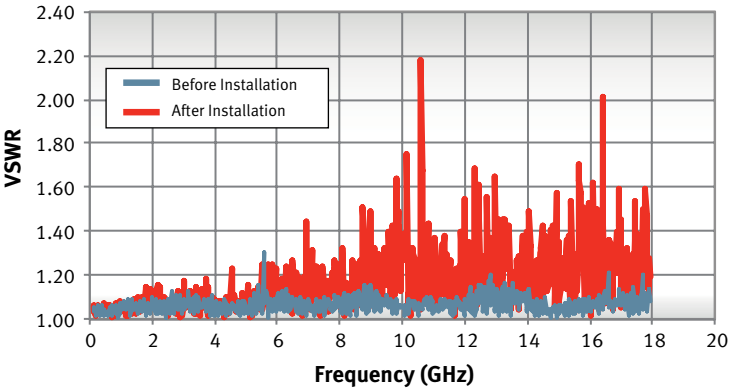


Figure 7: GORE-FLIGHT™ Microwave Assemblies, 6 Series Insertion Loss[c]

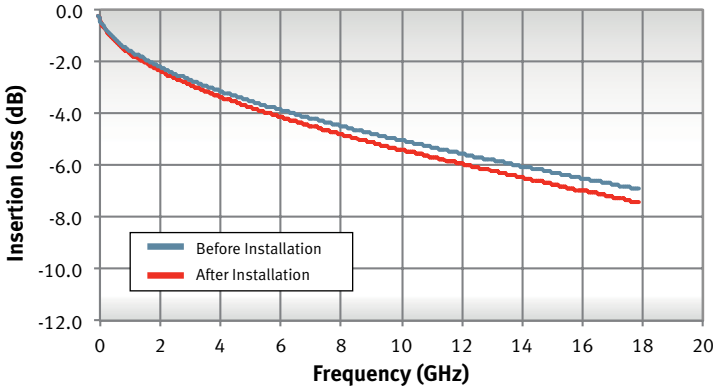
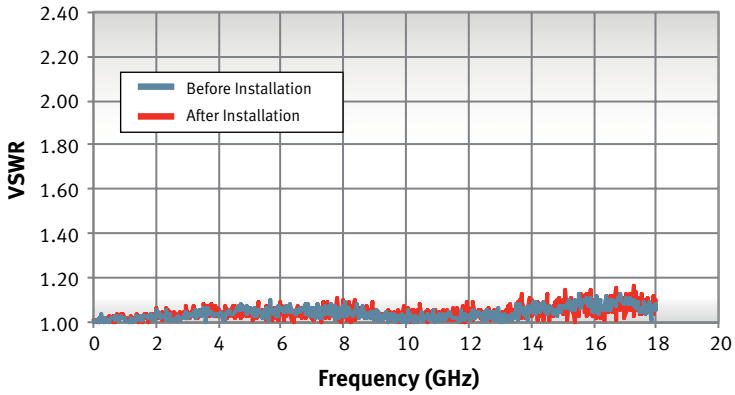


Figure 9: GORE-FLIGHT™ Microwave Assemblies, 6 Series VSWR[c]



[c] Data in this graph reflects 6E Series test results. Results for 65 Series are similar.

Connector Options

Connectors available for GORE-FLIGHT™ Microwave Assemblies are specifically engineered to optimize performance of the assembly (Table 3). Gore also offers an interface that allows the use of replaceable connectors (Table 4).

Table 3: Direct Mount Connector Options[d]

Connector Type	Maximum Frequency (GHz)	Connector Code			
		Cable Type 6E		Cable Type 65	
		Standard[e]	Lock-Wire[f]	Standard[e]	Lock-Wire[f]
TNCA Straight Male	18	C01	C0L	C01	C0L
TNCA Bulkhead Female	18	C42		C42	
SMA Straight Male	18	R01	R0L	R01	R0L
SMA Straight Female	18	R02		R02	
SMA Bulkhead Female	18			R42	
SMA Box Right Angle Male	18			R71	R7L
Size 8 – Male Contact	18			ZR3	
M8 Multiport Straight Male	18			ZXE	

[d] If your connector option is not listed, please contact a Gore representative.
[e] Coupling nuts do not have provision for wire locking.
[f] Coupling nuts are supplied with lock-wire holes.

Torque Values

The recommended mating and installation torque values for Gore connector options are provided in Table 5.

Table 5: Mating/Installation Torque Values

Connector	Installation Torque in-lbs (Nm)
TNCA[l] TNCA Bulkhead Mount Panel Nut	23 ± 3 (2.59 ± 0.33) 35 ± 5 (3.95 ± 0.56)
SMA	12 – 15 (1.35 – 1.69)
Type N[l] Type N Bulkhead Mount Panel Nut	23 ± 3 (2.59 ± 0.33) 35 ± 5 (3.95 ± 0.56)
TK	19 – 21 (2.15 – 2.37)
HN HN Bulkhead Mount Panel Nut	15 ± 3 (1.69 ± 0.33) 35 ± 5 (3.95 ± 0.56)
Replaceable Adapter	45 ± 5 (5.08 ± 0.56)
Size 8 – Pin Contact (socket Microwave Interface)	Not applicable

[l] Based on MIL-T-81490

Table 4: Replaceable Adapter Connector Options[g]

Connector Type	Connector Code			
	Maximum Frequency (GHz)	Standard[i]	Lock-Wire[j]	Self-Lock[k]
TNCA Straight Male[h]	18	801	80L	80S
TNCA Straight Female[h]	18	802		
TNCA Bulkhead Female	18	842		
TNCA Flange-Mount Female[h]	18	852		
TNCA 45° Male[h]	18	8P1	8PL	8PS
TNCA 90° Male[h]	18	8V1	8VL	8VS
SMA Straight Male	18	701	70L	70S
SMA 45° Male	18	7P1	7PL	
SMA 90° Male	18	7V1	7VL	
Type N Straight Male	18	901	90L	
Type N Bulkhead Female	18	962		
Type N 45° Male	18	9P1	9PL	
Type N 90° Male	18	9V1	9VL	
TK Straight Male	18	ZVM		
TK 45° Male	18	ZVN		
HN Straight Male	4	ZJS		
HN 90° Male	4	ZNM		
HN Bulkhead Female	4	ZNL		
Multiport M8 Straight Male	18	ZTC		
Multiport M8 45° Male	18	Z1A		
Multiport M8 45° Male Extended	18	Z1B		
Multiport M8 Straight Female	18	ZTD		
Multiport M8 90° Female	18	Z1C		
Multiport M8 90° Female Extended	18	Z1D		

[g] If your connector option is not listed, please contact a Gore representative.
[h] Available in polorized versions.
[i] Coupling nuts do not have provision for wire locking.
[j] Coupling nuts are supplied with lock-wire holes.
[k] Coupling nuts include a self-locking mechanism, eliminating the need for wire locking.

Ordering Information

GORE-FLIGHT™ Microwave Assemblies are identified by a 12-character part number. This number designates the cable type, connector types, and assembly length:

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

Positions 1–2: Enter **6E** or **65** to identify the specific assembly type of GORE-FLIGHT™ Microwave Assemblies, 6 Series.

Positions 3–5 and 6–8: See Table 3 for the list of connectors available for each cable type. When reading the label, Connector A is on the left-hand side. Additionally, Gore offers an interface that can be used with replaceable connectors (see Table 4).

Positions 9–12: The length of the assembly is 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 24.0-inch assembly is specified as 0240 in the last four digits of the part number.

To review your application needs and request a quote for an assembly, contact a Gore representative or visit our online cable builder at **www.gore.com/rfcablebuilder**. To calculate insertion loss, VSWR, and other parameters, visit our online microwave/RF assembly calculator at **http://tools.gore.com/gmcacalc.**

Qualification Summary

Engineered to meet the stringent specification requirements of civil and military aircraft, these assemblies have undergone substantial qualification testing to ensure that they meet the specifications of the most current standard (Table 6).

Table 6: GORE-FLIGHT™ Microwave Assemblies, 6 Series Qualifications

Examination or Test	Applicable Standards	Status
Design and Construction	MIL-T-81490 paragraph 4.7.1	Compliant
Markings	MIL-T-81490 paragraph 4.7.1	Compliant
Workmanship	MIL-T-81490 paragraph 4.7.1	Compliant
RF Insertion Loss	MIL-T-81490 paragraph 4.7.3	Compliant
Voltage Standing Wave Ratio (VSWR)	MIL-T-81490 paragraph 4.7.4	Compliant
Impedance	MIL-T-81490 paragraph 4.7.5	Compliant
Seal - Vapor Leakage	MIL-STD-202 method 112E, paragraph 5, test condition C, procedure IV	Compliant
Velocity of Propagation	MIL-T-81490 paragraph 4.7.7	Compliant
EMI Shielding Effectiveness	EIA-364-66, mode stirred test	Compliant
Thermal Shock	MIL-STD-810 method 503.5, procedure I-C MIL-STD-202 method 107, test condition A-1 and B-1	Compliant
Power Handling Capability	MIL-T-81490 paragraph 4.7.13, procedure I	Compliant
Flexure	MIL-T-81490 paragraph 4.7.15, procedure I	Compliant
Torque	MIL-T-81490 paragraph 4.7.16, torque requirement of 50 in/lbs replaced by ±90° angular displacement	Compliant
Tensile Load	MIL-T-81490 paragraph 4.7.17	Compliant

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Table 6: GORE-FLIGHT™ Microwave Assemblies, 6 Series Qualifications, Continued

Examination or Test	Applicable Standards	Status
Concentrated Load	MIL-T-81490 paragraph 4.7.18, 100 ±2 lbs force	Compliant Achieved ≥ 150 lbs
Abrasion	MIL-T-81490 paragraph 4.7.19, procedure II	Compliant
Sand and Dust	MIL-STD-810 method 510, procedure I	Compliant
Dielectric Withstanding Voltage	MIL-STD-202 method 301	Compliant
Explosive Atmosphere	MIL-STD-810 method 511, procedure I	Compliant
Temperature, Humidity, Altitude, Vibration	MIL-STD-810 method 520, procedure III with vibration as per MIL-STD-810 method 514, procedure I	Compliant
Humidity	MIL-STD-810 method 520, procedure III	Compliant
Vibration	MIL-STD-810 method 514, procedure I	Compliant
Salt Fog	MIL-STD-810 method 509	Compliant
Chemical Resistance	MIL-STD-810 method 504	Compliant
Icing/Freezing Rain	MIL-STD-810 method 521	Compliant
Fungus Resistance	MIL-STD-810 method 508	Compliant
Mechanical Shock	MIL-STD-810 method 516, procedure I, V	Compliant
Drip	MIL-STD-810 method 506, procedure III	Compliant
Rain & Blowing Rain	MIL-STD-810 method 506, procedure I	Compliant
Corona Extinction Voltage	MIL-DTL-17 paragraph 3.7.5	Compliant
Flammability	FAR25.853 appendix F part I (b)(7) ABD0031 paragraph 7.1.6 MIL-STD-202 method 111	Compliant
Toxicity	ABD0031 paragraph 7.4	Compliant
Smoke Density	ABD0031 paragraph 7.3.5 (AITM 2.0008 B) FAR25.853 Appendix F part V	Compliant
Impact Shock Cable Type 6E Cable Type 65	MIL-T-81490 paragraph 4.7.14 with 1.5 lb with 1.0 lb	Compliant

NOTICE – USE RESTRICTIONS APPLY
Not for use in food, drug, cosmetic or medical device manufacturing, processing, or packaging operations