

Ultra low-loss SHF cable assemblies

AS 9100 CERTIFIED



GENERAL
INTERCONNECT
RANGE

OUTDOOR
RANGE

AIR FRAME
RANGE

LIGHT WEIGHT
RANGE

ISO 9001 APPROVED





RADIALL, one of the world's leading manufacturers of coaxial connectors, has also been designing and manufacturing high performance coaxial cables and cable-assemblies for more than 15 years. RADIALL offers a broad range of high performance RF and microwave transmission lines (from DC to 40GHz) for military, space, telecom and automotive applications.

The RADIALL range is compliant with the most demanding requirements, particularly in terms of attenuation and RF shielding. In addition, the dual specialization (connector and cable) allows RADIALL to quickly develop customized solutions whenever they are necessary.

Lastly, through the L.C.E laboratory (independent and accredited laboratory), RADIALL masters important test and measurement capabilities which provide a high level of autonomy resulting in rapid and flexible customer support.

General Interconnect Range

This range, developed in late 80's, is the base of the RADIALL Ultra-Low Loss (ULL) range. It is 100% designed and manufactured by RADIALL at Chateau-Renault in FRANCE.

This special SHF construction, based on high precision wrapping technology, allows this range to present the best level of attenuation and screening effectiveness on the market, for a given diameter.

This cable range will be selected mainly for **indoor** and **non-severe outdoor applications** (non-permanent exposure to UV and water immersion) where ultra-low loss and/or high screening effectiveness is required.

This range is also advised for on-board applications which do not require hermetically sealed solutions and ship-board applications where cable-assemblies are installed in protected areas.

High Phase Stability

In some particular applications, cable-assemblies that are operating in stringent environments may require high phase stability as a major criterion.

This requirement can be chosen as an option and will be fulfilled in compliance with a customer specification for specific grade of SHF5M and SHF8M cables.

Custom Solutions

The following pages introduce only standard cable-assemblies. As cable and connector manufacturer, RADIALL will also be pleased to design and manufacture tailor-made solutions in accordance with customer specifications.

General interconnect SHF cable-assemblies

APPLICATIONS



Test and measurement

Low loss systems connections

Test bench
EMC Lab



Electronic warfare

Non-hermetically sealed solutions

On-board systems for intelligence



Combat aircraft

Non-hermetically sealed solutions

On-board radar and counter-measure
Missile

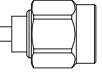
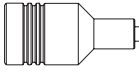


Ground surveillance system

Cable assemblies in protected areas

Phase array radar
Active antenna radar





• **Ultra-low loss cables (solid inner conductor)**

	0 to 1 GHz (VHF/UHF) (dB/m / dB/ft)	1 to 2 GHz (band L) (dB/m / dB/ft)	2 to 4 GHz (band S) (dB/m / dB/ft)	4 to 8 GHz (band C) (dB/m / dB/ft)	8 to 12.4 GHz (band X) (dB/m / dB/ft)	12.4 to 18 GHz (band Ku) (dB/m / dB/ft)	18 to 26.5 GHz (band K) (dB/m / dB/ft)	26.5 to 40 GHz (band Ka) (dB/m / dB/ft)
SHF2,4M	0.62 / 0.19	0.89 / 0.27	1.28 / 0.39	1.86 / 0.56	2.36 / 0.72	2.91 / 0.88	3.62 / 1.10	4.59 / 1.39
SHF3M	0.39 / 0.12	0.56 / 0.17	0.81 / 0.25	1.19 / 0.36	1.53 / 0.46	1.91 / 0.58	2.41 / 0.73	3.11 / 0.94
SHF4,2M	0.36 / 0.11	0.51 / 0.15	0.73 / 0.22	1.05 / 0.32	1.32 / 0.40	1.61 / 0.49		
SHF5M	0.23 / 0.07	0.32 / 0.10	0.46 / 0.14	0.66 / 0.20	0.84 / 0.25	1.02 / 0.31	1.27 / 0.38	
SHF8M	0.15 / 0.05	0.21 / 0.06	0.30 / 0.09	0.44 / 0.13	0.55 / 0.17	0.68 / 0.21		

• **Ultra-low loss and high flexibility cables (stranded inner conductor)**

	0 to 1 GHz (VHF/UHF) (dB/m / dB/ft)	1 to 2 GHz (band L) (dB/m / dB/ft)	2 to 4 GHz (band S) (dB/m / dB/ft)	4 to 8 GHz (band C) (dB/m / dB/ft)	8 to 12.4 GHz (band X) (dB/m / dB/ft)	12.4 to 18 GHz (band Ku) (dB/m / dB/ft)	18 to 26.5 GHz (band K) (dB/m / dB/ft)	26.5 to 40 GHz (band Ka) (dB/m / dB/ft)
SHF3	0.51 / 0.15	0.72 / 0.22	1.04 / 0.32	1.51 / 0.46	1.91 / 0.58	2.35 / 0.71	2.91 / 0.88	3.70 / 1.12
SHF5	0.26 / 0.08	0.37 / 0.11	0.54 / 0.16	0.79 / 0.24	1.00 / 0.30	1.24 / 0.38	1.55 / 0.47	
SHF8	0.18 / 0.05	0.26 / 0.08	0.38 / 0.12	0.56 / 0.17	0.72 / 0.22	0.90 / 0.27		
SHF13	0.09 / 0.03	0.14 / 0.04	0.20 / 0.06	0.30 / 0.09	0.33 / 0.10 (max 9,5 GHz)			

• **Armoured cables**

	0 to 1 GHz (VHF/UHF) (dB/m / dB/ft)	1 to 2 GHz (band L) (dB/m / dB/ft)	2 to 4 GHz (band S) (dB/m / dB/ft)	4 to 8 GHz (band C) (dB/m / dB/ft)	8 to 12.4 GHz (band X) (dB/m / dB/ft)	12.4 to 18 GHz (band Ku) (dB/m / dB/ft)	18 to 26.5 GHz (band K) (dB/m / dB/ft)	26.5 to 40 GHz (band Ka) (dB/m / dB/ft)
SHF5A	0.30 / 0.09	0.43 / 0.13	0.63 / 0.19	0.92 / 0.28	1.17 / 0.35	1.45 / 0.44	1.82 / 0.55	
SHF5MR	0.23 / 0.07	0.32 / 0.10	0.46 / 0.14	0.66 / 0.20	0.84 / 0.25	1.02 / 0.31	1.27 / 0.38	
SHF8MSE	0.15 / 0.05	0.21 / 0.06	0.30 / 0.09	0.44 / 0.13	0.55 / 0.17	0.68 / 0.21		
SHF8MR	0.15 / 0.05	0.21 / 0.06	0.30 / 0.09	0.44 / 0.13	0.55 / 0.17	0.68 / 0.21		



• **Ultra-low loss cables (solid inner conductor)**

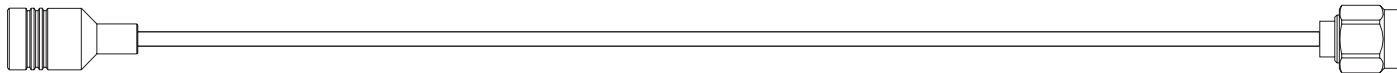
	SMP	SSMA	MCX / SMB	SMA	SMA 2.9	BMA	BNC	TNC	N	PC7	mQ	7/16	DSX	NSX	MPX	EPX	Mil C 38999 - BMA contact
SHF2,4M	✓	✓	✓	✓		✓			✓				✓	✓	✓	✓	✓
SHF3M				✓	✓	✓		✓	✓								✓
SHF4,2M				✓		✓		✓	✓				✓	✓		✓	✓
SHF5M				✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
SHF8M				✓			✓	✓	✓	✓		✓					

• **Ultra-low loss and high flexibility cables (stranded inner conductor)**

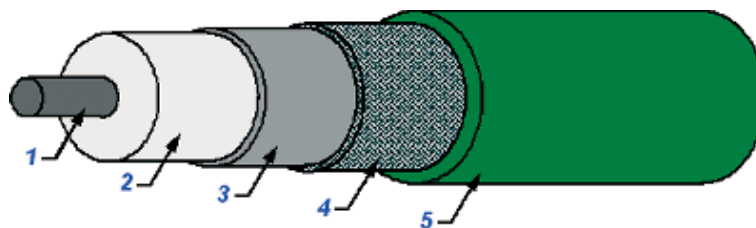
	SMP	SSMA	MCX / SMB	SMA	SMA 2.9	BMA	BNC	TNC	N	PC7	mQ	7/16	DSX	NSX	MPX	EPX	Mil C 38999 - BMA contact
SHF3				✓	✓	✓		✓	✓								✓
SHF5				✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
SHF8				✓			✓	✓	✓	✓		✓					
SHF13								✓	✓								

• **Armoured cables**

	SMP	SSMA	MCX / SMB	SMA	SMA 2.9	BMA	BNC	TNC	N	PC7	mQ	7/16	DSX	NSX	MPX	EPX	Mil C 38999 - BMA contact
SHF5A				✓				✓	✓		✓						
SHF5MR				✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
SHF8MSE								✓	✓								
SHF8MR				✓			✓	✓	✓	✓		✓					



Cable Construction



- 1 - inner conductor :** Solid (SHFXM) or stranded (SHFX) Silver-plated (2 μ m) copper wire
- 2 - dielectric :** Low density PTFE (PolyTetraFluoroEthylene) tape
- 3 - inner shield :** Silver-plated (2 μ m) copper tape
- 4 - outer shield :** Silver-plated (2 μ m) copper braid (> 90 % covering)
- 5 - outer jacket :** Extruded FEP (Fluorinated Ethylene Propylene) or PFA (PerFluoro Alkoxy)

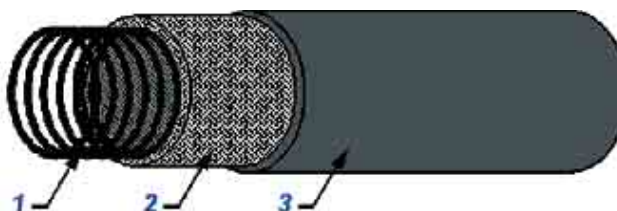
Optional Protective Jackets

In the case of harsh environmental conditions, like for example **antenna feeders** in battlefields or quite simply for **test bench cable-assemblies** submitted to many manipulations, RADIALL advises the use of specific protective jackets.

For optimal and secured watertightness, RADIALL has developed new specific compound chambers allowing the cable protective jacket to be glued to the connector once the chamber is filled with glue. In addition, the new compound chamber technology brings high mechanical protection for a secured cable/connector link.

For compact sizes and reduced weights, each cable size has its own adapted compound chamber.

Manufactured by RADIALL, these jackets bring exceptional crush resistance and tensile strength while keeping a very good flexibility.



- 1 - stainless steel spring :** crush resistance and flexibility
- 2 - stainless steel braid :** tensile strength
- 3 - black Polyurethane jacket :** UV, abrasion and chemical resistance, waterproofing



Optional protective jackets (flg)

	Projack 5	Projack 8
Cable type	SHF4.2M SHF5M SHF5	SHF8M SHF8
Maximum diameter (mm / inch)	11 / 0.433	15 / 0.590
Bending radius (mm / inch)	Equal to cable bend radius	Equal to cable bend radius
Temperature range (°C)	-55 / +100°C	-55 / +100°C
Maximum weight (g/m)	190	340
Crush resistance (N/100mm)	2500	2500
Tensile strength (N)	900	900

Remark : in this kind of construction, RADIALL advises the use of a “cable-puller” for easy and secured handling (see below)

Connectors Specification

Connector design : RADIALL connectors meet or exceed the requirements of MIL-C-39012. They are designed to provide optimal electrical, mechanical and environmental performances.

Connector materials : Stainless steel 303 & 316L and nickel-plated brass for body, coupling nut and compound chamber
Gold-plated nickel clad brass for center contact.
PTFE (PolyTetraFluoroEthylene) dielectric.

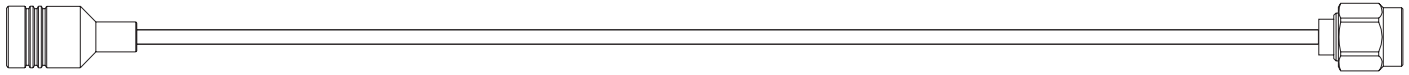
Optional Cable-Puller



This stainless steel cable-grip allows easy holding and routing of the assembly and avoids any damage between the connector interface and the cable attachment during the installation.



This support accessory can also feature a stainless steel snap-fastener for speedy anchoring and reliable attachment and detachment of any insulated cable.



Cable Specification

• SHF(X)M - Ultra-low loss cables (solid inner conductor)

	SHF2.4M	SHF3M	SHF4.2M	SHF5M	SHF8M	
Maximum operating frequency	40	40	30	26.5	18	
Velocity of propagation (%)	77	76	74	85	85	
Typical attenuation formula (F in GHz)	dB/m	$0.6\sqrt{F} + 0.02\cdot F$	$0.365\sqrt{F} + 0.02\cdot F$	$0.3\sqrt{F} + 0.02\cdot F$	$0.22\sqrt{F} + 0.005\cdot F$	$0.14\sqrt{F} + 0.005\cdot F$
	dB/100 ft	$19.8\sqrt{F} + 0.66\cdot F$	$12\sqrt{F} + 0.66\cdot F$	$9.9\sqrt{F} + 0.66\cdot F$	$7.26\sqrt{F} + 0.165\cdot F$	$4.62\sqrt{F} + 0.165\cdot F$
Capacitance(pf/m / pf/ft)	87 / 26.4	88 / 26.7	91 / 27.6	79 / 23.9	79 / 23.9	
Corona extinction voltage (kV)	-	-	> 1.5	> 2.3	> 3.3	
Nominal Phase (°/m/GHz)	1560	1590	1620	1400	1400	
Phase stability (with t°C)	< 3	< 3	< 3	< 1	< 1	
Maximum diameter (mm / inch)	2.45 / 0.096	3.50 / 0.138	4.20 / 0.165	5.20 / 0.200	7.60 / 0.299	
Maximum weight (g/m)	14	35	45	60	130	
Bending radius (mm / inch)	10 / 0.394	12.50 / 0.492	25 / 0.984	25 / 0.984	40 / 1.574	
Crush resistance(N/100mm)	> 400	> 400	> 600	> 200	> 200	

** Phase variation with t°C are given for temperature range : -55 / + 100°C

• SHF(X) Ultra-low loss and high flexibility cables (stranded inner conductor)

	SHF3	SHF5	SHF8	SHF13	
Maximum operating frequency (GHz)	40	26.5	18	9.5	
Velocity of propagation (%)	78	78	78	85	
Typical attenuation formula (with F in GHz)	dB/m	$0.49\sqrt{F} + 0.015\cdot F$	$0.25\sqrt{F} + 0.01\cdot F$	$0.17\sqrt{F} + 0.01\cdot F$	$0.087\sqrt{F} + 0.007\cdot F$
	dB/100 ft	$16.2\sqrt{F} + 0.5\cdot F$	$8.25\sqrt{F} + 0.33\cdot F$	$5.61\sqrt{F} + 0.33\cdot F$	$2.87\sqrt{F} + 0.23\cdot F$
Capacitance(pf/m / pf/ft)	85 / 25.75	85 / 25.75	85 / 25.75	78 / 23.65	
Corona extinction voltage (kV)	> 1.6	> 2.5	> 3.5	> 10	
Nominal Phase (°/m/GHz)	1520	1520	1520	1400	
Maximum diameter (mm / inch)	3.50 / 0.138	5.25 / 0.207	7.80 / 0.307	13.8 / 0.543	
Maximum weight (g/m)	29	72	140	280	
Bending radius (mm / inch)	12.5 / 0.492	25 / 0.984	40 / 1.574	60 / 2.362	
Crush resistance(N/100mm)	>400	> 400	> 400	> 600	

• Armoured cables

	SHF5MR	SHF5A	SHF8MR	SHF8MSE	
Maximum operating frequency (GHz)	26.5	26.5	18	18	
Velocity of propagation (%)	85	78	85	85	
Typical attenuation formula (with F in GHz)	dB/m	$0.22\sqrt{F} + 0.005\cdot F$	$0.287\sqrt{F} + 0.013\cdot F$	$0.14\sqrt{F} + 0.005\cdot F$	$0.14\sqrt{F} + 0.005\cdot F$
	dB/100 ft	$7.26\sqrt{F} + 0.165\cdot F$	$9.5\sqrt{F} + 0.43\cdot F$	$4.62\sqrt{F} + 0.165\cdot F$	$4.62\sqrt{F} + 0.165\cdot F$
Capacitance(pf/m / pf/ft)	79 / 23.94	85 / 25.75	79 / 23.94	78 / 23.64	
Corona extinction voltage (kV)	> 2.3	> 2	> 3.3	> 3.3	
Nominal Phase (°/m/GHz)	1400	1520	1400	1400	
Maximum diameter (mm / inch)	5.85 / 0.230	6.70 / 0.264	8.50 / 0.335	9.80 / 0.386	
Maximum weight (g/m)	73	115	155	205	
Bending radius (mm / inch)	25 / 0.984	45 / 1.77	40 / 1.57	100 / 3.94	
Crush resistance(N/100mm)	> 700	> 800	>1000	> 1000	

$$\text{Cable-assembly insertion loss} = \underbrace{\text{cable loss} * \text{length}}_{\text{cable loss}} + \underbrace{0.0447\sqrt{F} + 0.04}_{\text{connectors loss}}$$

Testing

Our cable assemblies are 100% Insertion Loss and VSWR tested over the test frequency range according to the RADIALL detailed specification. Many other tests are possible upon request.



Electrical

Impedance	50 ± 1 Ω
High amplitude stability under flexures	better than 0.005dB/GHz during and after repeated bending on dynamic bending radius
High phase stability under flexures	better than 0.4° / GHz during and after repeated bending on dynamic bending radius * <i>* Consult us for SHF13 phase stability with flexures</i>
High phase stability with temperature **	See detailed cable specification.
Insertion loss variation with temperature	< 0.2% / °C
Screening effectiveness	better than 90dB up to 18 GHz (for screwed connectors)
Phase matching	by set, with master or per absolute phase, available with a typical phase matching of ± 0.4°/GHz
VSWR and Power handling	depends on cable-assembly configuration <i>Please consult us</i>

** *Optimal phase stability with temperature is proposed for cables using a solid inner conductor.*

Mechanical

Reduced cable size and weight <i>(thanks to low density PTFE)</i>	see detailed cable specification
High flexibility	in accordance with MIL C 87104
Vibration resistance	in accordance with MIL T 81490
Shock	in accordance with MIL T 81490
High crush resistance <i>(for armoured cables)</i>	see detailed RADIALL specification

Environmental

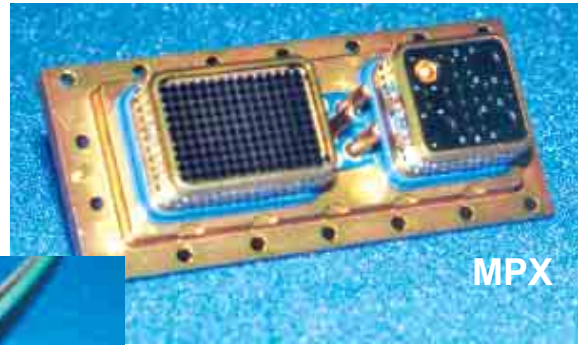
Large temperature range <i>(cable-assemblies)</i>	-55 / +150°C (except SHF8MSE = -50 / +105°C)
Fire resistant and self extinguishing	in accordance with MIL C 87104
Chemical resistance	in accordance with MIL C 87104 and MIL T 81490
Humidity resistance	in accordance with MIL C 87104 and MIL T 81490
Moisture resistance	in accordance with RTCADO 160 D
Salt fog	in accordance with MIL STD 810

General interconnect SHF cable-assemblies

RADIAL SHF HARNESS SOLUTIONS



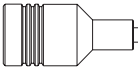
The combination of design and manufacturing of RF and microwave cables as well as multipin connectors allows Radiall to also be a specialist of harnesses for multicontact connections.



series	relevant standard	market & application	equipment design	key feature	temperature range	Radiall catalog
DSX	ARINC 404 MIL C81659B	civil & military aeronautics	rack & panel connections	spray water resistant	-65 / +125°C	D7 C00 CE
NSX	ARINC 600	civil aeronautics	rack & panel connections	rain water resistant	-65 / +125°C	D7 B00 CE
MPX	MIL DTL83527 EN 3682	military aeronautics	rack & panel connections	altitude and immersion	-55 / +155°C	D7 D00 CE
EPX	proprietary interface per BPSC179	civil & military aeronautics	rack & panel, disconnect panel and Cable-to-cable connections	altitude and immersion	-65 / +175°C	D7 2010 CE
MIL 38999	MIL C38999 Series I, II, III, IV BMA contact	civil & military aeronautics	disconnect panel and Cable-to-cable connections	see series detailed specification	see series detailed specification	----

General interconnect SHF cable-assemblies

CENTRAL TEST LABORATORY : Part of Radiall's Testing Capabilities



Since 1989, RADIALL has centralised the main part of its measurement capabilities in VOIRON (France)

In this Independent Testing Laboratory, engineers and technicians have run high-quality systems in compliance with ISO/ICE 17025



The accredited LCE test laboratory offers environmental, mechanical, electrical and optical testing services.

LCE provides:

- IEC, CECC, MIL, (QPL), ESA/SCC, Bellcore and customers' own qualification tests
- Evaluation, Homologation or Qualification of your product
- Calibration of wide range of equipment (Electrical, Optical, Dimensional...).

Various Standards (COFRAC) are available.

- Development of specific new measurement methodologies with real-time acquisition measurement facilities
- CAD design, modal analysis and manufacturing of vibration specific devices.
- Investigation and analysis of materials.

The accredited LCE test laboratory has over 12 years of experience in testing :

- RF & microwave passive components and antennas
- Electrical and coaxial connectors
- Aerospace/military components and devices
- Automotive and commercial products
- Fiber optic connectors, optical components, cable-assemblies and optoelectronic devices
- ...

Ultra low-loss SHF cable assemblies

AS 9100 CERTIFIED



ISO 9001 APPROVED





RADIALL, one of the world's leading manufacturers of coaxial connectors, has also been designing and manufacturing high performance coaxial cables and cable-assemblies for more than 15 years. RADIALL offers a broad range of high performance RF and microwave transmission lines (from DC to 40 GHz) for military, space, telecom and automotive applications.

The RADIALL range is compliant with the most demanding requirements, particularly in terms of attenuation and RF shielding. In addition, the dual specialization (connector and cable) allows RADIALL to quickly develop customized solutions whenever they are necessary.

Lastly, through the L.C.E. laboratory (independent and accredited laboratory), RADIALL masters important test and measurement capabilities which provide a high level of autonomy resulting in rapid and flexible customer support.

Outdoor (OD) Range

Based on the RADIALL "General Interconnect Range", this product family has been specially developed to suit most environmental conditions linked to outdoor applications.

Based on high precision wrapping technology (like the General Interconnect Range), this special SHF construction unites optimal electrical performances and **high resistance to harsh environmental conditions**.

This cable range will be selected for all **outdoor applications** requiring, for example, permanent **exposure to UV**, repetitive and/or **long time water immersion** and **high abrasion resistance**.

This range is 100% designed and manufactured by RADIALL at Chateau-Renault in FRANCE.

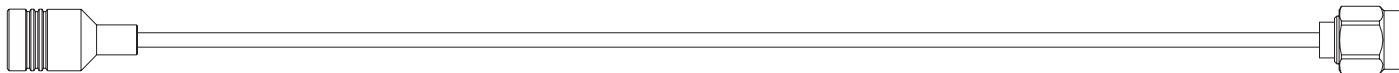
High Phase Stability

In some particular applications, cable-assemblies that are operating in stringent environments may require high phase stability as a major criterion.

This requirement can be chosen as an option and will be fulfilled in compliance with customer specification.

Custom Solutions

The following pages introduce only standard cable-assemblies. As cable and connector manufacturer, Radiall will also be pleased to design and manufacture tailor-made solutions in accordance with customer specifications



Applications

Ship-board

Antenna feeder
Cable assemblies for radar equipment



Ground surveillance system

Phase array radar
Active antenna radar



Finder Guide

CABLE / FREQUENCY / LOSS *(indicative average values) (dB/m)*

- **Ultra-low loss cables (solid inner conductor)**

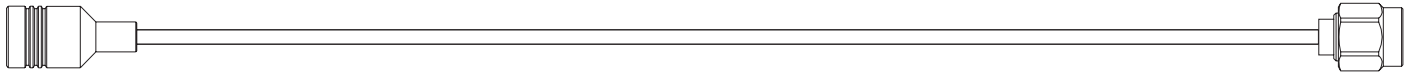
	0 to 1 GHz (VHF/UHF) <i>(dB/m / dB/ft)</i>	1 to 2 GHz (band L) <i>(dB/m / dB/ft)</i>	2 to 4 GHz (band S) <i>(dB/m / dB/ft)</i>	4 to 8 GHz (band C) <i>(dB/m / dB/ft)</i>	8 to 12,4 GHz (band X) <i>(dB/m / dB/ft)</i>	12,4 to 18 GHz (band Ku) <i>(dB/m / dB/ft)</i>	18 to 26,5 GHz (band K) <i>(dB/m / dB/ft)</i>
SHF5MOD	0.23 / 0.07	0.32 / 0.10	0.46 / 0.14	0.66 / 0.20	0.84 / 0.25	1.02 / 0.31	1.27 / 0.38
SHF8MOD	0.15 / 0.05	0.21 / 0.06	0.30 / 0.09	0.44 / 0.13	0.55 / 0.17	0.68 / 0.21	

- **Ultra-low loss and high flexibility cables (stranded inner conductor)**

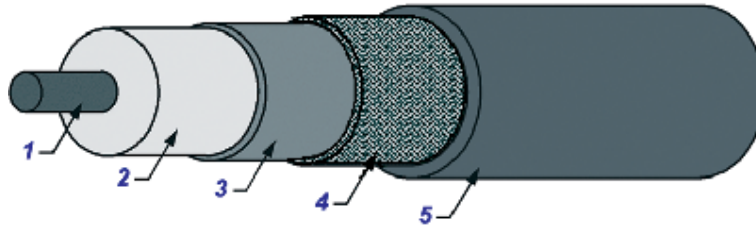
	0 to 1 GHz (VHF/UHF) <i>(dB/m / dB/ft)</i>	1 to 2 GHz (band L) <i>(dB/m / dB/ft)</i>	2 to 4 GHz (band S) <i>(dB/m / dB/ft)</i>	4 to 8 GHz (band C) <i>(dB/m / dB/ft)</i>	8 to 12,4 GHz (band X) <i>(dB/m / dB/ft)</i>	12,4 to 18 GHz (band Ku) <i>(dB/m / dB/ft)</i>	18 to 26,5 GHz (band K) <i>(dB/m / dB/ft)</i>
SHF5OD	0.26 / 0.08	0.37 / 0.11	0.54 / 0.16	0.79 / 0.24	1.00 / 0.30	1.24 / 0.38	1.55 / 0.47
SHF8OD	0.18 / 0.05	0.26 / 0.08	0.38 / 0.12	0.56 / 0.17	0.72 / 0.22	0.90 / 0.27	

CABLE / INTERFACE

All cables are compatible with **SMA, N and TNC**



Cable Construction



- 1 - inner conductor**
- 2 - dielectric**
- 3 - inner shield**
- 4 - outer shield**
- 5 - outer jacket**

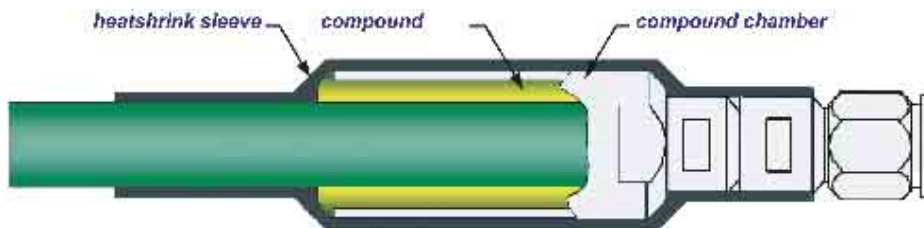
Solid (SHFXMOD) or stranded (SHFXOD) Silver plated (2µm) copper wire
Low density PTFE (PolyTetraFluoroEthylene) tape
Silver plated (2µm) copper tape
Silver plated (2µm) copper braid (> 90 % covering)
Polyurethane jacket (high resistance grade - UL94 V0)

Assembly Construction

For optimal and secured watertightness, RADIALL has developed new specific compound chambers (see drawing) allowing the cable jacket to be glued to the connector once the chamber is filled with glue.

In addition, the new compound chamber technology brings high mechanical protection for a secured cable-connector link.

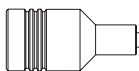
For compact sizes and reduced weights, each cable size has its own adapted compound chamber.



Connectors Specification

Connector design : RADIALL connectors meet or exceed the requirements of MIL-C-39012. They are designed to provide optimal electrical, mechanical and environmental performances.

Connector materials : Stainless steel 316L, nickel plated (4µm) brass, black chromium plated brass for body, coupling nut and compound chamber.
Gold plated nickel clad brass for center contact.
PTFE (PolyTetraFluoroEthylene) dielectric.



Cable Specification

- SHF(X)MOD - Ultra-low loss cables (solid inner conductor)

		SHF5MOD	SHF8MOD
Maximum operating frequency (GHz)		26.5	18
Velocity of propagation (%)		85	85
Typical Attenuation formula (with F in Ghz)	dB/m	$0.22*\sqrt{F} + 0.005*F$	$0.14*\sqrt{F} + 0.005*F$
	dB/100ft	$7.26*\sqrt{F} + 0.165*F$	$4.62*\sqrt{F} + 0.165*F$
Capacitance(pf/m / pf/ft)		79 / 23.9	79 / 23.9
Corona extinction voltage (kV)		> 2.3	> 3.3
Nominal Phase (°/m/GHz)		1400	1400
Phase stability with t°C (°/m/GHz)**		< 1	< 1
Maximum diameter (mm / inch)		5.90 / 0.232	8.60 / 0.338
Maximum weight (g/m)		68	135
Bending radius (mm / inch)		25 / 0.984	40 / 1.574
Crush resistance (N/100mm)		> 400	> 200

** Phase variation with t°C are given for temperature range : -55 /+ 100°C

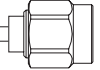
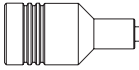
- SHF(X)OD - Ultra-low loss and high flexibility cables (stranded inner conductor)

		SHF5OD	SHF8OD
Maximum operating frequency (GHz)		26.5	18
Velocity of propagation (%)		78	78
Typical Attenuation formula (with F in GHz)	dB/m	$0.25*\sqrt{F} + 0.01*F$	$0.17*\sqrt{F} + 0.01*F$
	dB/100ft	$8.25*\sqrt{F} + 0.33*F$	$5.61*\sqrt{F} + 0.33*F$
Capacitance(pf/m / pf/ft)		85 / 25.7	85 / 25.7
Corona extinction voltage (kV)		> 2.5	> 3.5
Nominal Phase (°/m/GHz)		1520	1520
Maximum diameter (mm / inch)		6.25 / 0.246	8.90 / 0.350
Maximum weight (g/m)		78	155
Bending radius (mm/inch)		25 / 0.984	40 / 1.574
Crush resistance (N/100mm)		> 400	> 400

$$\text{Cable-assembly insertion loss} = \underbrace{\text{cable loss} * \text{length}}_{\text{cable loss}} + \underbrace{0.0447*\sqrt{F} + 0.04}_{\text{connectors loss}}$$

Testing

Our cable-assemblies are 100% Insertion Loss and VSWR tested over the test frequency range according to the RADIALL detailed specification. Many other tests are possible upon request.



Electrical

Impedance	50 ± 1 Ω
High amplitude stability under flexures	better than 0.005dB / GHz during and after repeated bending on dynamic bending radius
High phase stability under flexures	better than 0.4° / GHz during and after repeated bending on dynamic bending radius
High phase stability with temperature *	See detailed cable specification.
Insertion loss variation with temperature	<0.2% / °C
Screening effectiveness	better than 90dB up to 18 GHz
Phase matching	by set, with master or per absolute phase available with a typical phase matching of ± 0.4°/GHz
VSWR and Power handling	depends on cable-assembly configuration <i>Please consult us</i>

* Optimal phase stability with temperature is proposed for cables using a solid inner conductor.

Mechanical

Reduced cable size and weight <i>(thanks to low density PTFE)</i>	See detailed cable specification
High flexibility	in accordance with MIL C 87104
Vibration resistance	in accordance with MIL T 81490
Shock	in accordance with MIL T 81490
Crush resistance	See detailed RADIALL specification

Environmental

Temperature range	- 55 / + 100°C (cable-assemblies)
Hermeticity (helium)	in accordance with IEC 68-17
Watertightness	in accordance with EN 60529 - IP67
Radiation resistance	>100 Mrads (5 times better than FEP jacket)
Fire resistant and self extinguishing	in accordance with FAR 25
Fluid resistance	in accordance with MIL STD 1344 (except skydrol)
Humidity resistance	in accordance with MIL C 87104, MIL T 81490 and RTCADO 160 D
Moisture resistance	in accordance with RTCADO 160 D
Salt fog	in accordance with MIL C 87104 and MIL T 81490
Toxicity index (of the PUR jacket)	<1.4 in accordance with NES 713 (MIL C17 requires 5 max.)

Outdoor (OD) SHF cable-assemblies

CENTRAL TEST LABORATORY : *Part of Radiall's Testing Capabilities*



Since 1989, RADIALL has centralised the main part of its measurement capabilities in VOIRON (France)

In this Independent Testing Laboratory, engineers and technicians have run high-quality systems in compliance with ISO/ICE 17025



The accredited LCE test laboratory offers environmental, mechanical, electrical and optical testing services.

LCE provides:

- IEC, CECC, MIL, (QPL), ESA/SCC, Bellcore and customers' own qualification tests
- Evaluation, Homologation or Qualification of your product
- Calibration of wide range of equipment (Electrical, Optical, Dimensional...).

Various Standards (COFRAC) are available.

- Development of specific new measurement methodologies with real-time acquisition measurement facilities
- CAD design, modal analysis and manufacturing of vibration specific devices.
- Investigation and analysis of materials.

The accredited LCE test laboratory has over 12 years of experience in testing :

- RF & microwave passive components and antennas
- Electrical and coaxial connectors
- Aerospace/military components and devices
- Automotive and commercial products
- Fiber optic connectors, optical components, cable-assemblies and optoelectronic devices
- ...

Ultra low-loss SHF cable assemblies

AS 9100 CERTIFIED



GENERAL
INTERCONNECT
RANGE

OUTDOOR
RANGE

AIR FRAME
RANGE

LIGHT WEIGHT
RANGE

ISO 9001 APPROVED





RADIALL, one of the world's leading manufacturers of coaxial connectors, has also been designing and manufacturing high performance coaxial cables and cable-assemblies for more than 15 years. RADIALL offers a broad range of high performance RF and microwave transmission lines (from DC to 40GHz) for military, space, telecom and automotive applications.

The RADIALL range is compliant with the most demanding requirements, particularly in terms of attenuation and RF shielding. In addition, the dual specialization (connector and cable) allows RADIALL to quickly develop customized solutions whenever they are necessary.

Lastly, through the L.C.E laboratory (independent and accredited laboratory), RADIALL masters important test and measurement capabilities which provide a high level of autonomy resulting in rapid and flexible customer support.

Airframe (AF) Range

Based on the RADIALL "General Interconnect Range", this product family has been specially developed to suit most **on-board applications** requiring **hermetically sealed cable-assemblies**

Based on high precision wrapping technology (like the General Interconnect Range), this special SHF construction unites optimal electrical performances, **light weight** (use of flat braid) and high resistance to harsh environmental conditions.

As a result, this product range exhibits extremely **long life in very severe environments**.

This cable range will be selected for all on-board applications for which cable-assemblies are located in non-pressurized and non-protected areas.

This range is 100% designed and manufactured by RADIALL at Chateau-Renault in FRANCE.

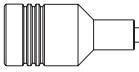
High Phase Stability

In some particular applications, cable-assemblies that are operating in stringent environments may require high phase stability as a major criterion.

This requirement can be chosen as an option and will be fulfilled in compliance with customer specification.

Custom Solutions

The following pages introduce only standard cable-assemblies. As cable and connector manufacturer, Radiall will also be pleased to design and manufacture tailor-made solutions in accordance with customer specifications.



Applications

Electronic warfare

On-board systems for intelligence



Unmanned Aerial vehicle

Drones



Combat aircraft

On-board radar and counter-measure



Finder Guide

CABLE / FREQUENCY / LOSS

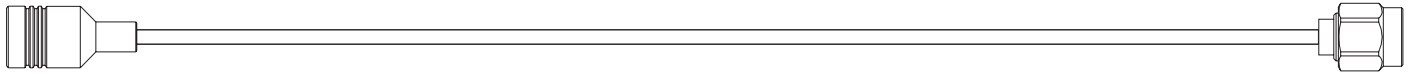
(Indicative typical values) (dB/m)

• Ultra-low loss cables (solid inner conductor)

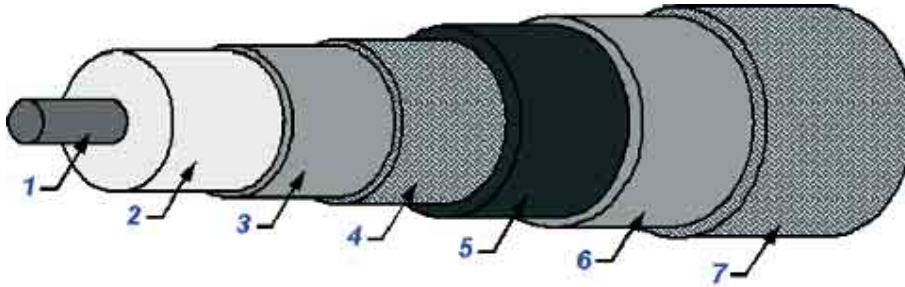
	0 to 1 GHz (VHF/UHF) (dB/m / dB/ft)	1 to 2 GHz (band L) (dB/m / dB/ft)	2 to 4 GHz (band S) (dB/m / dB/ft)	4 to 8 GHz (band C) (dB/m / dB/ft)	8 to 12,4 GHz (band X) (dB/m / dB/ft)	12,4 to 18 GHz (band Ku) (dB/m / dB/ft)	18 to 26,5 GHz (band K) (dB/m / dB/ft)
SHF5MAF	0.23 / 0.07	0.32 / 0.10	0.46 / 0.14	0.66 / 0.20	0.84 / 0.25	1.02 / 0.31	1.27 / 0.38
SHF8MAF	0.15 / 0.05	0.21 / 0.06	0.30 / 0.09	0.44 / 0.13	0.55 / 0.17	0.68 / 0.21	

CABLE / INTERFACE

All cables are compatible with **SMA, N and TNC**



Cable Construction



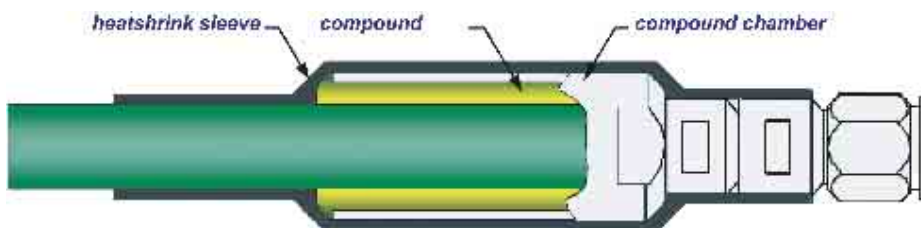
- | | |
|-----------------------------|--|
| 1 - inner conductor | <i>Solid Silver-plated (2μm) copper wire</i> |
| 2 - dielectric | <i>Low density PTFE (PolyTetraFluoroEthylene) tape</i> |
| 3 - inner shield | <i>Silver-plated (2μm) copper tape</i> |
| 4 - outer shield | <i>Silver-plated (2μm) copper flat braid (> 90 % covering)</i> |
| 5 - outer jacket | <i>Polyurethane jacket (high resistance grade - UL94 V0)</i> |
| 6 - interlayer | <i>Bonded Kapton tape</i> |
| 7 - protective braid | <i>PEEK braid (high abrasion and tensile strength resistance - UL94 V0)</i> |

Assembly Construction

For optimal and secured hermetically-sealed solution, RADIALL has developed new specific compound chambers (see drawing) allowing the cable jacket and the PEEK braid to be glued to the connector once the chamber is filled with glue.

In addition, the new compound chamber technology brings high mechanical protection for a secured cable/connector link.

For compact sizes and reduced weights, each cable size has its own adapted compound chamber.





Connectors Specification

- Connector design :** RADIALL connectors meet or exceed the requirements of MIL-C-39012. They are designed to provide optimal electrical, mechanical and environmental performances.
- Connector materials :** Stainless steel 316L for body, coupling nut and compound chamber
Gold plated nickel clad brass for center contact.
PTFE (PolyTetraFluoroEthylene) dielectric.
- Lock wire holes :** All connector series present 3 lock wire holes to ensure right addressing and secure the link.

Cable Specification

• SHF(X)MAF - Ultra-low loss cables (solid inner conductor)

		SHF5MAF	SHF8MAF
Maximum operating frequency (GHz)		26.5	18
Velocity of propagation (%)		85	85
Typical Attenuation formula (with F in GHz)	dB/m	$0.22*\sqrt{F} + 0.005*F$	$0.14*\sqrt{F} + 0.005*F$
	dB/100ft	$7.26*\sqrt{F} + 0.165*F$	$4.62*\sqrt{F} + 0.165*F$
Capacitance(pf/m / pf/ft)		79 / 23.9	79 / 23.9
Corona extinction voltage (kV)		> 2.3	> 3.3
Nominal Phase (°/m/GHz)		1400	1400
Phase stability with t°C (°/m/GHz)**		< 1	< 1
Maximum diameter (mm / inch)		7.40 / 0.291	9.90 / 0.390
Maximum weight (g/m)		74	130
Bending radius (mm / inch)		25 / 0.984	40 / 1.574
Crush resistance (N/100mm)		400	400
Cable-assembly insertion loss = $\underbrace{\text{cable loss} * \text{length}}_{\text{cable loss}} + \underbrace{0.0447*\sqrt{F} + 0.04}_{\text{connectors loss}}$			

**Phase variation with t°C are given for temperature range : -55/+ 100°C

Testing

Our cable assemblies are 100% Insertion Loss and VSWR tested over the test frequency range according to the RADIALL detailed specification. Many other tests are possible upon request.



Electrical

Impedance	50 ± 1 Ω
High amplitude stability under flexures	better than 0.005dB / GHz during and after repeated bending on dynamic bending radius
High phase stability under flexures	better than 0.4° / GHz during and after repeated bending on dynamic bending radius
High phase stability with temperature *	See detailed cable specification.
Insertion loss variation with Temperature	<0.2% / °C
Screening effectiveness	better than 90dB up to 18 GHz
Phase matching	by set, with master or per absolute phase available with a typical phase matching of ± 0.4°/GHz
VSWR and Power handling	depends on cable-assembly configuration <i>Please consult us</i>

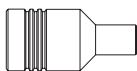
* Optimal phase stability with temperature is proposed for cables using a solid inner conductor.

Mechanical

Reduced cable size and weight <i>(thanks to low density PTFE and flat braid technology)</i>	See detailed cable specification
Vibration resistance	in accordance with MIL T 81490
Shock	in accordance with MIL T 81490
Crush resistance	See detailed cable specification

Environmental

Temperature range	- 55 / + 100°C (cable-assemblies)
Hermeticity (helium)	in accordance with IEC 68-17
Watertightness	in accordance with EN 60529 - IP67
Radiation resistance	>100 Mrads (5 times better than FEP jacket)
Fire resistant and self extinguishing	in accordance with FAR 25
Fluid resistance	in accordance with MIL STD 1344 (except skydrol)
Humidity resistance	in accordance with MIL C 87104, MIL T 81490 and RTCADO 160 D
Fungus resistance	in accordance with RTCADO 160 D
Salt fog	in accordance with MIL C 87104 and MIL T 81490



Since 1989, RADIALL has centralised the main part of its measurement capabilities in VOIRON (France)

In this Independent Testing Laboratory, engineers and technicians have run high-quality systems in compliance with ISO/ICE 17025



The accredited LCE test laboratory offers environmental, mechanical, electrical and optical testing services.

LCE provides:

- IEC, CECC, MIL, (QPL), ESA/SCC, Bellcore and customers' own qualification tests
- Evaluation, Homologation or Qualification of your product
- Calibration of wide range of equipment (Electrical, Optical, Dimensional...).

Various Standards (COFRAC) are available.

- Development of specific new measurement methodologies with real-time acquisition measurement facilities
- CAD design, modal analysis and manufacturing of vibration specific devices.
- Investigation and analysis of materials.

The accredited LCE test laboratory has over 12 years of experience in testing :

- RF & microwave passive components and antennas
- Electrical and coaxial connectors
- Aerospace/military components and devices
- Automotive and commercial products
- Fiber optic connectors, optical components, cable-assemblies and optoelectronic devices
- ...

Ultra low-loss SHF cable assemblies

AS 9100 CERTIFIED



**GENERAL
INTERCONNECT
RANGE**

**OUTDOOR
RANGE**

**AIR FRAME
RANGE**

**LIGHT WEIGHT
RANGE**

ISO 9001 APPROVED





RADIALL, one of the world's leading manufacturers of coaxial connectors, has also been designing and manufacturing high performance coaxial cables and cable-assemblies for more than 15 years. RADIALL offers a broad range of high performance RF and microwave transmission lines (from DC to 40GHz) for military, space, telecom and automotive applications.

The RADIALL range is compliant with the most demanding requirements, particularly in terms of attenuation and RF shielding. In addition, the dual specialization (connector and cable) allows RADIALL to quickly develop customized solutions whenever they are necessary.

Lastly, through the L.C.E. laboratory (independent and accredited laboratory), RADIALL masters important test and measurement capabilities which provide a high level of autonomy resulting in rapid and flexible customer support.

Lightweight (LW) Range

Based on the RADIALL "General Interconnect Range", this product family has been specially developed to suit most **on-board applications** for which the weight is a major issue.

Based on high precision wrapping technology (like the General Interconnect Range) these special cables use a flat wire braid instead of the standard round wire technology. This allows the braid weight to be halved and the jacket weight to be significantly reduced. For example, the SHF(X)MLW range allows a **15 to 20% weight saving** compared to the equivalent General Interconnect solutions.

All the electrical characteristics of the General Interconnect are maintained. Thus, this special SHF construction unites optimal electrical performances, **low weight and reduced size**.

This range is advised for on-board applications which do not require hermetically-sealed solutions as well as "high density" applications requiring reduced size.

The used flat wire braid does not slide over the other inter-layers like the standard round wire does, consequently, these LW cables will preferably be used in static applications.

This range is 100% designed and manufactured by RADIALL at Chateau-Renault in FRANCE.

High Phase Stability

In some particular applications, cable-assemblies that are operating in stringent environments may require high phase stability as a major criterion.

This requirement can be chosen as an option and will be fulfilled in compliance with customer specification.

Custom Solutions

The following pages introduce only standard cable-assemblies. As cable and connector manufacturer, Radiall will also be pleased to design and manufacture tailor-made solutions in accordance with customer specifications



Applications

Electronic warfare

On-board systems for intelligence



Unmanned Aerial vehicle

Drones



Finder Guide

CABLE / FREQUENCY / LOSS
(indicative typical values) (dB/m)

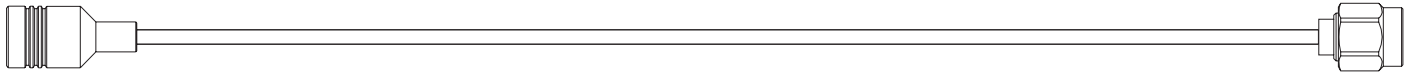
• Ultra-low loss cables (solid inner conductor)

	0 to 1 GHz (VHF/UHF) <i>(dB/m / dB/ft)</i>	1 to 2 GHz (band L) <i>(dB/m / dB/ft)</i>	2 to 4 GHz (band S) <i>(dB/m / dB/ft)</i>	4 to 8 GHz (band C) <i>(dB/m / dB/ft)</i>	8 to 12,4 GHz (band X) <i>(dB/m / dB/ft)</i>	12,4 to 18 GHz (band Ku) <i>(dB/m / dB/ft)</i>	18 to 26,5 GHz (band K) <i>(dB/m / dB/ft)</i>	26,5 to 40 GHz (band K) <i>(dB/m / dB/ft)</i>
SHF3MLW	0.39 / 0.12	0.56 / 0.17	0.81 / 0.25	1.19 / 0.36	1.53 / 0.46	1.91 / 0.58	2.41 / 0.73	3.11 / 0.94
SHF5MLW	0.23 / 0.07	0.32 / 0.10	0.46 / 0.14	0.66 / 0.20	0.84 / 0.25	1.02 / 0.31	1.27 / 0.38	
SHF8MLW	0.15 / 0.05	0.21 / 0.06	0.30 / 0.09	0.44 / 0.13	0.55 / 0.17	0.68 / 0.21		

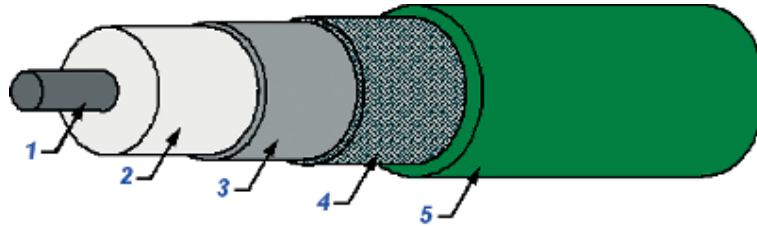
CABLE / INTERFACE

• Ultra-low loss cables (solid inner conductor)

	SMA	SMA 2.9	BMA	TNC	N
SHF3MLW	✓	✓	✓	✓	✓
SHF5MLW	✓		✓	✓	✓
SHF8MLW	✓			✓	✓



Cable Construction

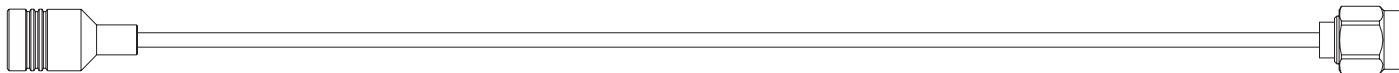


- | | |
|----------------------------|---|
| 1 - inner conductor | <i>Solid silver-plated (2μm) copper wire</i> |
| 2 - dielectric | <i>Low density PTFE (Polytetrafluoroethylene) tape</i> |
| 3 - inner shield | <i>Silver-plated (2μm) copper tape</i> |
| 4 - outer shield | <i>Silver-plated (2μm) copper flat braid (> 90 % covering)</i> |
| 5 - outer jacket | <i>Extruded FEP (Fluorinated Ethylene Propylene)</i> |

Connectors Specification

Connector design : RADIALL connectors meet or exceed the requirements of MIL-C-39012. They are designed to provide optimal electrical, mechanical and environmental performances.

Connector materials : Stainless steel 303 & 316L and nickel-plated brass for body and coupling nut
Gold plated nickel clad brass for center contact.
PTFE (PolyTetraFluoroEthylene) dielectric.



Cable Specification

- **SHF(X)MLW Ultra-low loss cables (solid inner conductor)**

		SHF3MLW	SHF5MLW	SHF8MLW
Maximum operating frequency (GHz)		40	26.5	18
Velocity of propagation (%)		76	85	85
Typical Attenuation formula (with F in Ghz)	DB/m	$0.365*\sqrt{F} + 0.02*F$	$0.22*\sqrt{F} + 0.005*F$	$0.14*\sqrt{F} + 0.005*F$
	dB/100ft	$12*\sqrt{F} + 0.66*F$	$7.26*\sqrt{F} + 0.165*F$	$4.62*\sqrt{F} + 0.165*F$
Capacitance(pf/m / pf/ft)		88 / 26.7	79 / 23.9	79 / 23.9
Corona extinction voltage (kV)		-	> 2.3	> 3.3
Nominal Phase (°/m/GHz)		1590	1400	1400
Phase stability with t°C (°/m/GHz)**		< 3	< 1	< 1
Maximum diameter (mm / inch)		3.35 / 0.132	4.90 / 0.193	7.30 / 0.287
Maximum weight (g/m)		30	49	105
Bending radius (mm / inch)		12.50 / 0.492	25 / 0.984	40 / 1.574
Crush resistance (N/100mm)		> 400	>200	>200
<p style="text-align: center;">Cable-assembly insertion loss = $\underbrace{\text{cable loss} * \text{length}}_{\text{cable loss}} + \underbrace{0.0447*\sqrt{F} + 0.04}_{\text{connectors loss}}$</p>				

**Phase variation with t°C are given for temperature range : -55/+ 100°C

Testing

Our cable assemblies are 100% Insertion Loss and VSWR tested over the test frequency range according to the RADIALL detailed specification. Many other tests are possible upon request.



Electrical

Impedance	50 ± 1 Ω
High amplitude stability under flexures	better than 0.005dB/GHz during and after repeated bending on dynamic bending radius
High phase stability under flexures	better than 0.4° / GHz during and after repeated bending on dynamic bending radius
High phase stability with temperature *	See detailed cable specification.
Insertion loss variation with temperature	< 0.2% / °C
Screening effectiveness	better than 90dB up to 18 GHz (for screwed connectors)
Phase matching	by set, with master or per absolute phase available with a typical phase matching of +/- 0.4°/GHz
VSWR and Power handling	depends on cable-assembly configuration <i>Please consult us</i>

* *Optimal phase stability with temperature is proposed for cables using a solid inner conductor.*

Mechanical

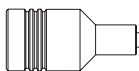
Reduced cable size and weight <i>(thanks to low density PTFE and flat braid)</i>	See detailed cable specification
Vibration resistance	in accordance with MIL T 81490
Shock	in accordance with MIL T 81490
Crush resistance	See detailed RADIALL specification

Environmental

Large temperature range :	- 55 / + 150°C (cable-assemblies)
Fire resistant and self extinguishing	in accordance with MIL C 87104
Chemical resistance	in accordance with MIL C 87104 and MIL T 81490
Humidity resistance	in accordance with MIL C 87104 and MIL T 81490
Fungus resistance	in accordance with RTCADO 160 D
Salt fog	in accordance with MIL STD 810

Lightweight (LW) SHF cable-assemblies

CENTRAL TEST LABORATORY : *Part of Radiall's Testing Capabilities*



Since 1989, RADIALL has centralised the main part of its measurement capabilities in VOIRON (France)

In this Independent Testing Laboratory, engineers and technicians have run high-quality systems in compliance with ISO/ICE 17025



The accredited LCE test laboratory offers environmental, mechanical, electrical and optical testing services.

LCE provides:

- IEC, CECC, MIL, (QPL), ESA/SCC, Bellcore and customers' own qualification tests
- Evaluation, Homologation or Qualification of your product
- Calibration of wide range of equipment (Electrical, Optical, Dimensional...).

Various Standards (COFRAC) are available.

- Development of specific new measurement methodologies with real-time acquisition measurement facilities
- CAD design, modal analysis and manufacturing of vibration specific devices.
- Investigation and analysis of materials.

The accredited LCE test laboratory has over 12 years of experience in testing :

- RF & microwave passive components and antennas
- Electrical and coaxial connectors
- Aerospace/military components and devices
- Automotive and commercial products
- Fiber optic connectors, optical components, cable-assemblies and optoelectronic devices
- ...