RF Cable Assembly Selection Guide

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Choosing RF cable assemblies during the design process means balancing electrical performance, connector fit, mechanical routing and EMI requirements, often on a tight schedule. This engineering guide provides a practical decision-making path, technical guidance and quick-reference information to help designers select, specify and validate the best RF cable-and-connector assemblies for the application.

KEY DESIGN CONSIDERATIONS

Matching frequency and impedance

Ensuring reliable mating, frequency rating and durability

Meeting mechanical and routing demands such as bend radius, strain relief and phase/length matching

Reducing EMI risk by incorporating shielding/ grounding without degrading RF performance

1 SELECT THE CABLE TYPE

- Frequency range
- Characteristic impedance (50 or 75 Ohms)
- Flexibility and routing space (overall diameter, or OD)
- Environmental (temperature and chemical) requirements

Quick-Reference Cable Family Selection Guide

Micro-Coaxial Cable				
Cable Type	OD	Frequencies (GHz)	Impedance (Ohms)	Common Connectors
0.81mm	0.81mm (.032")	Up to 9	50	MHF, MHF1 LK, MCX, MMCX, SMA, TNC, Type N
1.13, 1.32mm	1.13, 1.32mm (.044, .05")	Up to 9	50	MHF, MHF1 LK, MCX, MMCX, SMA, SMB, TNC, Type N
1.37mm	1.37mm (.053")	Up to 12	50	MHF, MHF1 LK, MHF4L LK, MCX, MMCX, SMA, SMB, TNC, Type N

***Applications**: Compact and flexible when board space and tight bends matter—use for internal device routing and antennas.*

Temp-Flex Flexible Cable				
Cable Type	OD	Frequencies (GHz)	Impedance (Ohms)	Common Connectors
.047" Cable	1.42mm (.056")	Up to 50	50	2.4mm, 2.92mm, MCX, MMCX, SMA, SMP, SMPM, SMPS, TNC, Type N
.141" Cable	1.24mm (.049")	Up to 18		
.086" Cable	2.57mm (.10")	Up to 50 GHz		

***Applications**: Optimized for high frequency and phase stability—use for mmWave and high-performance test leads.*

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RG Family Cable				
Cable Type	OD	Frequencies (GHz)	Impedance (Ohms)	Common Connectors
RG178	1.75mm (.069")	Up to 3	50	BNC, MHF, MHF1 LK, MCX, MMCX, MPRF, SMA, SMB, TNC, Type N
RG178 DS	1.75mm (.069")	Up to 3	50	BNC, MCX, MMCX, SMA, SMB, TNC, Type N
RG316	2.49mm (.098")	Up to 3	50	BNC, FAKRA, MCX, MMCX, MPRF, SMA, SMB, SMP, TNC, Type N
RG316 DS	2.90mm (.114")	Up to 3	50	BNC, MCX, MMCX, SMA, SMB, TNC, Type N
RG174	2.80mm (.110")	Up to 3	50	BNC, FAKRA, MCX, MMCX, MPRF, SMA, SMB, SMP, TNC, Type N
RG141	4.15mm (.163")	Up to 6	50	BNC, DIN 7/16, MCX, MMCX, SMA, TNC, Type N
RG142	2.95mm (.195")	Up to 8	50	BNC, DIN 7/16, SMA, SMB, TNC, Type N
RG55	3.68mm (.145")	Up to 3	50	BNC, DIN 7/16, SMA, SMB, TNC, Type N
RG58	4.95mm (.195")	Up to 1	50	BNC, DIN 7/16, FAKRA, MCX, SMA, SMB, TNC, Type N
RG179	2.54mm (.100")	Up to 3	75	BNC, MCX, Mini-BNC, SMB, Type F
RG179 DS	2.90mm (.114")	Up to 3	75	
RG59	6.15mm (.242")	Up to 1	75	

***Applications**: Versatile and robust, with double-shielded (DS) options—useful for a wide range of applications, including ~1 GHz legacy and low-frequency systems.*

Semi-Rigid/Precision Cable				
Cable Type	OD	Frequencies (GHz)	Impedance (Ohms)	Common Connectors
RG402	3.58mm (.141")	Up to 20	50	2.2-5, BNC, MCX, MMCX, SMA, SMB, SMP, SMPM, TNC, Type N
RG405	2.16mm (.085")	Up to 40		

***Applications**: High precision—use for controlled-impedance runs and high repeatability.*

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MLX and Large-Diameter Coaxial Cable				
Cable Type	OD	Frequencies (GHz)	Impedance (Ohms)	Common Connectors
MLX100	2.80mm (.110")	Up to 8	50	2.2-5, 4.3-10, BMA, BNC, DIN 7/16, FAKRA, SMA, SMB, TNC, Type F, Type N
MLX195	4.95mm (.195")			
MLX200	5.08mm (.200")			
MLX240	6.10mm (.240")			
MLX400	10.16mm (.400")			
MLX500	12.70mm (.500")			
MLX600	15.24mm (.600")			

***Applications**: High power and low loss—use for longer-distance runs.*

2 SELECT THE CONNECTOR AND TERMINATION METHOD

- Frequency range
- Mechanical durability (mating cycles)
- Mating footprint (board/bulkhead)
- Ingress protection/sealing requirements
- Assembly process (crimp, solder, press, overmold)

QUICK-REFERENCE CONNECTOR SELECTION RECOMMENDATIONS

Frequencies of 40 GHz and above →	Use precision RF interfaces such as SMP, SMPS, 2.92, 2.4, 1.85 or 1.0mm matched to cable capability (Temp-Flex or semi-rigid)
Frequencies of 3 GHz and below →	SMA, TNC, BNC, SMB, MCX and MMCX are the most common connectors, depending on space and mating form
50 versus 75 Ohms →	Choose a connector family and part rated to support the desired impedance (e.g., 75-Ohm BNC or Type F for video/legacy applications)
Board/PCB transitions →	Use right-angle or low-profile board connectors such as MHF for very compact boards or MMCX/MCX for slightly larger footprints
Durability →	Choose threaded connectors (e.g., SMA, Type N) for high-assurance mating or snap/press-on types (e.g., MCX, MMCX) for compact designs

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RF Connector Portfolio					
Image	Size Class	Connector Type	Typical Frequencies	Attachment Style	Typical PCB Footprint*
	Ultra-Microminiature	MCRF	Up to 6 GHz	Snap-on	3.10 by 3.10mm
		SSMCX	Up to 6 GHz	Snap-on	2.55 by 2.55mm
	Microminiature	MMCX	Up to 6 GHz	Snap-on	3.45 by 3.45mm
		MCX	Up to 6 GHz	Snap-on	5.08 by 5.08mm
		SMPM	Up up to 65 GHz	Push-on, snap-on	4.00 by 4.00mm
	Subminiature	SMP	Up to 40 GHz	Push-on, snap-on	6.00 by 6.00mm
		SMP-MAX	Up to 6 GHz	Push-on, snap-on	5.88 by 5.88mm
		DIN 1.0/2.3	Up to 10 GHz	Threaded	5.00 by 5.00mm
		SMA	Up to 26.5 GHz	Threaded	6.35 by 6.35mm
		SMB	Up to 4 GHz	Snap-on	6.35 by 6.35mm
		BMA	Up to 4 GHz	Push-on	
		FAKRA	Up to 4 GHz	Threaded	7.50 by 8.40mm
		Type F	Up to 4 GHz	Threaded	9.50 by 9.50mm
	Precision	1.0mm	Up to 110 GHz	Threaded	4.57 by 9.90mm
		1.85mm	Up to 67 GHz	Threaded	5.66 by 10.00mm
		2.4mm	Up to 50 GHz	Threaded	5.66 by 10.00mm
		2.92mm	Up to 40 GHz	Threaded	5.66 by 10.00mm
	Miniature	BNC	Up to 4 GHz	Bayonet	11.30 by 11.30mm
		TNC	Up to 11 GHz	Threaded	12.00 by 12.00mm
		2.2-5	Up to 6 GHz	Threaded	17.40 by 17.40mm
	Medium	Type N	Up to 11 GHz	Threaded	24.13 by 24.13mm
		4.3-10	Up to 12 GHz	Threaded	25.40 by 25.40mm
	Large	DIN 7/16	Up to 8.3 GHz	Threaded	32.00 by 32.00mm

**Vertical-launch PCB jack*

3 MECHANICAL AND INTEGRATION CHECKLIST

✓ **Minimum Bend Radius**
Preserve the intended cable geometry; best practice is to avoid bends tighter than 6 to 10X the cable diameter for flexible coaxial cable. Verify bend radius and dynamic flex life for the specific material with the supplier.

✓ **Routing Space and Clearance**
Account for connector bodies and nut clearance; allow for mating/un-mating access and torque clearance on threaded connectors.

✓ **Straight Relief and Cable Clamps**
Secure assemblies near the connectors to avoid cyclic stress at terminations.

✓ **Phase and Length Matching**
For phased arrays and multi-path systems, specify length-matching tolerances (e.g., ±X ps or ±Y mm) and procure phase-matched sets. Phase error scales with frequency, so assemblies must be validated at the operating band.

✓ **Thermal and Chemical Exposure**
Check the jacket material (FEP, PFA, PTFE, etc.) for compatibility with the operating environment.

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4 SHIELDING AND EMI/EMC BEST PRACTICES

Choose shield construction for system EMI needs
- Single braid/tape, double shield or quad/foil for especially noisy environments
- Example: Double-shielded RG178 DS improves EMI resistance versus standard RG178

Maintain a continuous shield path to the connector body
- Avoid chopped or discontinuous shield wraps near transitions

Ground at the enclosure
- Terminate the shield to the chassis at a single point or use a controlled multi-point scheme per the system ground plan
- Use grounding straps or board-edge grounding features

Manage the PCB transition
- Use via fences, ground pour and controlled-impedance traces
- Avoid leaving the shield floating at the breakout

5 SPECIFYING AND VALIDATING RF PERFORMANCE

Key electrical information to include in an assembly specification:
- Characteristic impedance (50 or 75 Ohms)
- Frequency range, with VSWR and target insertion loss/return loss at specific frequencies
- Maximum assembly length and insertion-loss budget
- Phase/length-matching requirement (if applicable)
- Mating cycle requirements and mechanical durability
- Environmental conditions (temperature, sealing, vibration)

WHY MOLEX?

- Molex is a one-stop shop for cables, connectors, terminations and assembly solutions
- Responsive technical support for design-in and rapid prototyping for validation is available to streamline the design process
- Custom assembly options, including overmolding, shielding upgrades, phase matching and environmental sealing, are offered to help solve design challenges

Use the RF Cable Assembly Builder at www.molex.com to build a custom cable assembly, complete with a concept drawing and 3D model.

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