Rosenberger

Rmor Cable Assemblies

For Test, Measurement and Calibration

Rmor For Test — Cable Assemblies for Test and Measurement

Rosenberger's Rmor cable assemblies for test and measurement are very low-loss, air-spaced Polytetrafluoroethylene (PTFE) cable assemblies suitable for use in demanding factory test applications, general laboratory measurement applications and anywhere measurement accuracy, consistency and measurement stability are a top priority. Rmor assemblies may often be used in place of much more expensive VNA cable assemblies.

Rmor cable assemblies for test are armored with a highly-flexible steel spiral construction ensuring high crush resistance and durability while affording very high flexibility. Rmor's steel spiral armor is wrapped with a durable blue polyurethane jacket. In addition to the low-loss nature of the cable assemblies and their highly durable armor, each assembly has been measured and characterized; that data that is included with each assembly that you purchase.

RF performance of Rmor assemblies is available in four main frequency bands of 18 Ghz, 26.5 Ghz, 40 Ghz and 50 Ghz with four lengths available —18", 24" ,36 " and 48". Connector types, mirroring the frequency ranges above, are Rosenberger's Precision SMA, 3.5mm, 2.92mm (K type) and 2.4mm. The Rmor cable assembly's connectors are all constructed using Rosenberger's well-known high quality standards. All connectors for the Rmor test family have stainless steel outer conductors, ensuring a long-lasting and durable assembly.

Many of these assemblies are available for immediate delivery and are off-the-shelf from our distributor saving valuable time and offering the convenience that is often lacking with other manufacturer's products.

- VNA Test
- Rugged & Durable
- Factory Test Applications
- Phase, VSWR & Insertion Loss Stable
- Long Life
- 18, 26.5,40 & 50 Ghz Assemblies
- Cost Effective

Please refer to the table below for the appropriate part numbers. Each assembly listed below features Rmor's flexible steel spiral construction and durable blue polyurethane jacket.

Rmor Cable Assembly Part Numbers

Table 1

Connector Style	18" Length	24" Length	36" Length	48" Length	Max Frequency
2.4mm M-M	L1D-00457-BB	L1D-00610-BB	L1D-00915-BB	L1D-01220-BB	50 Ghz
2.4mm M-F	L1D-00457-BC	L1D-00610-BC	L1D-00915-BC	L1D-01220-BC	50 Ghz
2.92mm M-M	L2D-00457-DD	L2D-00610-DD	L2D-00915-DD	L2D-01220-DD	40 Ghz
2.92mm M-F	L2D-00457-DE	L2D-00610-DE	L2D-00915-DE	L2D-01220-DE	40 Ghz
3.5mm M-M	L4D-00457-FF	L4D-00610-FF	L4D-00915-FF	L4D-01220-FF	26.5 Ghz
3.5mm M-F	L4D-00457-FG	L4D-00610-FG	L4D-00915-FG	L4D-01220-FG	26.5 Ghz
SMA M-M	L4D-00457-HH	L4D-00610-HH	L4D-00915-HH	L4D-01220-HH	18 Ghz
SMA M-F	L4D-00457-HJ	L4D-00610-HJ	L4D-00915-HJ	L4D-01220-HJ	18 Ghz
N(m)-N(m)	L4D-00457-NN	L4D-00610-NN	L4D-00915-NN	L4D-01220-NN	18 Ghz
N(m)-N(f)	L4D-00457-NP	L4D-00610-NP	L4D-00915-NP	L4D-01220-NP	18 Ghz

Rmor Application Guide

When selecting a high performance cable assembly for test, such as the Rosenberger R-Mor for Test, the first thing to consider is the test frequency range. The test frequency range will be one of the determining factors of the connector style you select along with cable style and your test equipment (VNA, Spectrum analyzer, amplifiers, etc.). The SMA and type N connectors are rated for 18 Ghz. The 3.5mm connector are rated to 26.5 Ghz and the 2.92mm connector are rated to 40 Ghz. Finally, the 2.4mm connector is rated to 50 Ghz. All of the connectors used in the R-Mor for Test cable assemblies are metrology grade and made from precision machined stainless steel.

Next, after frequency range is determined, how long of a cable assembly do you require? Do you require a relatively short cable assembly (18") or perhaps one that is 48"? Please refer to table 4 in this brochure for a comparison of insertion loss, connector type, cable style and frequency range. Generally, the larger diameter of cable, the lower the insertion loss, but the lower the top frequency of operation. Occasionally, a balance will have to be struck between cable size, connector type and assembly length. For instance, at 10 Ghz, one could easily use an L1-style cable with a 2.4mm connector at 18" in length (insertion loss ~1.05 dB, but if you switched to a 3.5mm L4 assembly, your assembly insertion loss would only be 0.61 dB at 10 Ghz. Please refer to Table 1 for the appropriate part number. Finally, please refer to the table below for a summary of connector compatibility, mating and frequency characteristics.

Table 2

Style	Max Frequency	Mateability / Compatiblity	Comments
SMA	18 Ghz	3.5mm, 2.92mm	—
3.5mm	26.5 Ghz	SMA, 2.92mm	When 3.5mm is mated with SMA, frequency response is limited by the SMA
2.92mm	40 Ghz	SMA, 3.5mm	When 2.92mm is mated with SMA, frequency response is limited by the SMA
2.4mm	50 Ghz	1.85mm	—

Applications Brief

Why use a high performance Rmor for Test Cable Assembly instead of a standard, solid PTFE interconnect or polyethylene foam style cable assembly?

Many test and measurement applications require a combination of low-loss (S11), Low VSWR/Return Loss (S12) and perhaps more importantly, measurement repeatability and consistency. Many low loss (and very low cost) poly foam style cables and many solid PTFE cables, while very good for basic signal routing applications simply can not be trusted in a test and measurement application when consistent measurements are required, whether it be at a factory test and measurement station, or the lab. One of the main reasons the traditional poly foam cable or solid PTFE cable tends to be less stable and consistent when used in a test application is that fact that the cable's electrical length changes as the cable is moved and flexed during a test session. During test calibration, the test cable's electrical length was calculated and calibrated out. Correspondingly, if the electrical length changes too much during test, erroneous readings will result.

Rosenberger's Rmor for test cable assemblies use a low-loss, air spaced PTFE dielectric rather than a solid PTFE, or poly foam, and have been designed and built with a stable electrical length as a prime consideration. This helps to ensure more repeatable and consistent measurements.

Rmor For Test Assemblies — Insertion & Return Loss Stability

Table 3

Cable Style	Frequency Ghz	1	10	18	26	40	50
L1	Insertion Loss Stability	< +/- 0.15 dB	< +/- 0.15 dB	+/- 0.15 dB	+/- 0.25 dB	+/- 0.75 dB	+/- 1.5 dB
	Phase Stability [1]	< +/- 4 Deg	< +/- 4 Deg	< +/- 4 Deg	< +/- 6 Deg	< +/- 8 Deg	< +/- 10 Deg
	Return Loss Stability	< / = 0.5 dB	< / = 0.5 dB	< / = 0.5 dB	< / = 1 dB	< / = 2.0 dB	< / = 3.0 dB
L2	Insertion Loss Stability	< +/- 0.15 dB	< +/- 0.05 dB	< +/- 0.05 dB	< +/- 0.20 dB	< +/- 0.5 dB	—
	Phase Stability [1]	< +/- 3 Deg	< +/- 3 Deg	< +/- 4 Deg	< +/- 6 Deg	< +/- 8 Deg	—
	Return Loss Stability	< / = 0.5 dB	< / = 0.5 dB	< / =1 dB	< / = 2.0 dB	< / = 3.0 dB	—
L4	Insertion Loss Stability	< +/- 0.05 dB	< +/- 0.05 dB	< +/- 0.2 dB	< +/- 0.5 dB	—	—
	Phase Stability [1]	< +/- 1 Deg	< +/- 3 Deg	< +/- 4 Deg	< +/- 6 Deg	—	—
	Return Loss Stability	< / = 0.5 dB	< / = 1 dB	< / =2.0 dB	< / = 3.0 dB	—	—

Notes: (1) All phase stability specifications are for phase stability when the cable is wrapped around a 5 Cm diameter mandrel. (2) All measurements at 25 ° C. Insertion Loss stability methods are Natural Curl, Method 1. Phase stability verses temperature, for all of the above cable styles, is 1500 PPM from 0°C to 60°C.

Rmor For Test Assemblies — Typical Total Assembly Insertion Loss

Table 4

		← Assembly Length in Inches →			
Assembly Style	Frequency Ghz	18"	24"	36"	48"
2.4mm – Type L1	10	1.05	1.30	1.79	2.28
m-m	18	1.44	1.48	2.16	2.84
m-f	26	1.75	1.79	2.62	3.50
	40	2.22	2.27	3.33	4.51
	50	2.52	2.58	3.79	5.26
2.92mm – Type L2	1	0.26	0.24	0.35	0.46
m-m	10	0.85	1.05	1.45	1.85
m-f	18	1.16	1.44	1.98	2.52
	26	1.42	1.75	2.43	3.11
	40	1.80	2.23	3.09	3.95
3.5mm – Type L4	1	0.15	0.22	0.30	0.38
m-m	5	0.41	0.50	0.68	0.86
m-f	10	0.61	0.75	1.03	1.31
	18	0.84	1.03	1.42	1.81
	26.5	1.05	1.30	1.80	2.30
SMA – Type L4	1	0.22	0.26	0.35	0.42
m-m	5	0.50	0.59	0.77	0.95
m-f	10	0.74	0.88	1.16	1.44
	18	1.01	1.20	1.59	1.98
N – Type L4	1	0.18	0.22	0.30	0.38
m-m	5	0.41	0.50	0.68	0.86
m-f	10	0.61	0.75	1.03	1.31
	18	0.84	1.03	1.42	1.81

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2.4mm M-F	L1D-00457-BC	L1D-00610-BC	L1D-00915-BC	L1D-01220-BC	50 Ghz
2.92mm M-M	L2D-00457-DD	L2D-00610-DD	L2D-00915-DD	L2D-01220-DD	40 Ghz
2.92mm M-F	L2D-00457-DE	L2D-00610-DE	L2D-00915-DE	L2D-01220-DE	40 Ghz
3.5mm M-M	L4D-00457-FF	L4D-00610-FF	L4D-00915-FF	L4D-01220-FF	26.5 Ghz
3.5mm M-F	L4D-00457-FG	L4D-00610-FG	L4D-00915-FG	L4D-01220-FG	26.5 Ghz
SMA M-M	L4D-00457-HH	L4D-00610-HH	L4D-00915-HH	L4D-01220-HH	18 Ghz
SMA M-F	L4D-00457-HJ	L4D-00610-HJ	L4D-00915-HJ	L4D-01220-HJ	18 Ghz
N(m)-N(m)	L4D-00457-NN	L4D-00610-NN	L4D-00915-NN	L4D-01220-NN	18 Ghz
N(m)-N(f)	L4D-00457-NP	L4D-00610-NP	L4D-00915-NP	L4D-01220-NP	18 Ghz

Rmor Application Guide

When selecting a high performance cable assembly for test, such as the Rosenberger R-Mor for Test, the first thing to consider is the test frequency range. The test frequency range will be one of the determining factors of the connector style you select along with cable style and your test equipment (VNA, Spectrum analyzer, amplifiers, etc.). The SMA and type N connectors are rated for 18 Ghz. The 3.5mm connector are rated to 26.5 Ghz and the 2.92mm connector are rated to 40 Ghz. Finally, the 2.4mm connector is rated to 50 Ghz. All of the connectors used in the R-Mor for Test cable assemblies are metrology grade and made from precision machined stainless steel.

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Table 2

Style	Max Frequency	Mateability / Compatiblity	Comments
SMA	18 Ghz	3.5mm, 2.92mm	—
3.5mm	26.5 Ghz	SMA, 2.92mm	When 3.5mm is mated with SMA, frequency response is limited by the SMA
2.92mm	40 Ghz	SMA, 3.5mm	When 2.92mm is mated with SMA, frequency response is limited by the SMA
2.4mm	50 Ghz	1.85mm	—

Applications Brief

Why use a high performance Rmor for Test Cable Assembly instead of a standard, solid PTFE interconnect or polyethylene foam style cable assembly?

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Rmor For Test Assemblies — Insertion & Return Loss Stability

Table 3

Cable Style	Frequency Ghz	1	10	18	26	40	50
L1	Insertion Loss Stability	< +/- 0.15 dB	< +/- 0.15 dB	+/- 0.15 dB	+/- 0.25 dB	+/- 0.75 dB	+/- 1.5 dB
	Phase Stability [1]	< +/- 4 Deg	< +/- 4 Deg	< +/- 4 Deg	< +/- 6 Deg	< +/- 8 Deg	< +/- 10 Deg
	Return Loss Stability	< / = 0.5 dB	< / = 0.5 dB	< / = 0.5 dB	< / = 1 dB	< / = 2.0 dB	< / = 3.0 dB
L2	Insertion Loss Stability	< +/- 0.15 dB	< +/- 0.05 dB	< +/- 0.05 dB	< +/- 0.20 dB	< +/- 0.5 dB	—
	Phase Stability [1]	< +/- 3 Deg	< +/- 3 Deg	< +/- 4 Deg	< +/- 6 Deg	< +/- 8 Deg	—
	Return Loss Stability	< / = 0.5 dB	< / = 0.5 dB	< / =1 dB	< / = 2.0 dB	< / = 3.0 dB	—
L4	Insertion Loss Stability	< +/- 0.05 dB	< +/- 0.05 dB	< +/- 0.2 dB	< +/- 0.5 dB	—	—
	Phase Stability [1]	< +/- 1 Deg	< +/- 3 Deg	< +/- 4 Deg	< +/- 6 Deg	—	—
	Return Loss Stability	< / = 0.5 dB	< / = 1 dB	< / =2.0 dB	< / = 3.0 dB	—	—

Notes: (1) All phase stability specifications are for phase stability when the cable is wrapped around a 5 Cm diameter mandrel. (2) All measurements at 25 ° C. Insertion Loss stability methods are Natural Curl, Method 1. Phase stability verses temperature, for all of the above cable styles, is 1500 PPM from 0°C to 60°C.

Rmor For Test Assemblies — Typical Total Assembly Insertion Loss

Table 4

		← Assembly Length in Inches →			
Assembly Style	Frequency Ghz	18"	24"	36"	48"
2.4mm – Type L1	10	1.05	1.30	1.79	2.28
m-m	18	1.44	1.48	2.16	2.84
m-f	26	1.75	1.79	2.62	3.50
	40	2.22	2.27	3.33	4.51
	50	2.52	2.58	3.79	5.26
2.92mm – Type L2	1	0.26	0.24	0.35	0.46
m-m	10	0.85	1.05	1.45	1.85
m-f	18	1.16	1.44	1.98	2.52
	26	1.42	1.75	2.43	3.11
	40	1.80	2.23	3.09	3.95
3.5mm – Type L4	1	0.15	0.22	0.30	0.38
m-m	5	0.41	0.50	0.68	0.86
m-f	10	0.61	0.75	1.03	1.31
	18	0.84	1.03	1.42	1.81
	26.5	1.05	1.30	1.80	2.30
SMA – Type L4	1	0.22	0.26	0.35	0.42
m-m	5	0.50	0.59	0.77	0.95
m-f	10	0.74	0.88	1.16	1.44
	18	1.01	1.20	1.59	1.98
N – Type L4	1	0.18	0.22	0.30	0.38
m-m	5	0.41	0.50	0.68	0.86
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2.4mm M-F	L1D-00457-BC	L1D-00610-BC	L1D-00915-BC	L1D-01220-BC	50 Ghz
2.92mm M-M	L2D-00457-DD	L2D-00610-DD	L2D-00915-DD	L2D-01220-DD	40 Ghz
2.92mm M-F	L2D-00457-DE	L2D-00610-DE	L2D-00915-DE	L2D-01220-DE	40 Ghz
3.5mm M-M	L4D-00457-FF	L4D-00610-FF	L4D-00915-FF	L4D-01220-FF	26.5 Ghz
3.5mm M-F	L4D-00457-FG	L4D-00610-FG	L4D-00915-FG	L4D-01220-FG	26.5 Ghz
SMA M-M	L4D-00457-HH	L4D-00610-HH	L4D-00915-HH	L4D-01220-HH	18 Ghz
SMA M-F	L4D-00457-HJ	L4D-00610-HJ	L4D-00915-HJ	L4D-01220-HJ	18 Ghz
N(m)-N(m)	L4D-00457-NN	L4D-00610-NN	L4D-00915-NN	L4D-01220-NN	18 Ghz
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	Return Loss Stability	< / = 0.5 dB	< / = 1 dB	< / =2.0 dB	< / = 3.0 dB	—	—

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m-f	26	1.75	1.79	2.62	3.50
	40	2.22	2.27	3.33	4.51
	50	2.52	2.58	3.79	5.26
2.92mm – Type L2	1	0.26	0.24	0.35	0.46
m-m	10	0.85	1.05	1.45	1.85
m-f	18	1.16	1.44	1.98	2.52
	26	1.42	1.75	2.43	3.11
	40	1.80	2.23	3.09	3.95
3.5mm – Type L4	1	0.15	0.22	0.30	0.38
m-m	5	0.41	0.50	0.68	0.86
m-f	10	0.61	0.75	1.03	1.31
	18	0.84	1.03	1.42	1.81
	26.5	1.05	1.30	1.80	2.30
SMA – Type L4	1	0.22	0.26	0.35	0.42
m-m	5	0.50	0.59	0.77	0.95
m-f	10	0.74	0.88	1.16	1.44
	18	1.01	1.20	1.59	1.98
N – Type L4	1	0.18	0.22	0.30	0.38
m-m	5	0.41	0.50	0.68	0.86
m-f	10	0.61	0.75	1.03	1.31
	18	0.84	1.03	1.42	1.81

Table 5

R-Mor Cable Assembly Electrical Characteristics	
Impedance	50 +/- 1 Ω
Operating Frequency	L1 Style: DC—50 Ghz
Velocity of Propagation (Vp)	77 %
Shielding Effectiveness @ 1 Ghz	> 100 dB
Power Rating, CW	
L1 Style	105 Watts @ 10 Ghz
L2 Style	200 Watts@ 5Ghz
L4 Style	600 Watts @ 2 Ghz
Dielectric Withstand Voltage	L1, L2 & L4 Styles: 500 Vrms
Return Loss Specification	
L1Style, 2.44mm connectors, 18", 24" and 36" Lengths	> 15 dB @ 50 Ghz, > 18 dB @ 40 Ghz, > 23 dB DC—39 Ghz
L2 Style, 2.92mm (K) connectors, 18", 24" and 36" lengths	> 17 dB @ 40 Ghz, > 19 dB @ 30 Ghz, > 22 dB @ 20 Ghz
L4 Style, RPC N style connector	> 21 dB @ 18 Ghz, > 23 dB @ 10 Ghz
L4 Style, RPC 3.5 mm connector	> 19 dB @ 26 Ghz, > 21 dB @ 18 Ghz
L4 Style, Precision SMA	> 18 dB @ 18 Ghz, > 21 dB @ 8 Ghz

Rmor Connector Information — General

All connectors used in Rosenberger's Rmor assemblies are Rosenberger precision connectors, suitable for Test, Measurement and Calibration. These connectors are made to exacting standards and are highly durable.

Table 6

General Cable Assembly Specification	
Materials	
Center Contact	BeCu, gold-plated
Outer Conductor	Stainless steel
Gaskets	Silicone
Dielectrics	PEEK, PS, PPE (Type N)
Armor Information	
Construction	Blue polyurethane plastic over stainless steel braid over stainless steel spiral
Crush Strength	> 80 N/mm (456 Lbs/per inch)
Armor Temperature Range	-50°C to +80°C
Abrasion Resistance	Excellent
UV Stable (outdoor)	Yes
Color	Medium blue
Flexibility	High
Cable Assembly Diameter (over armor)	L1 Style = .249"(6.33mm), L2 Style = .249"(6.33mm), L4 Style = .325" (8.25mm)
Flex Life Bending	> 10,000 (5cm Mandrel)
Minimum Bend Radius*	L1 Style = 0.200"(5.1mm), L2 Style = 0.25" (6.1mm), L4 Style = 0.38"(9.7mm) N
Operating Temperature	-50°C to +125°C (+80°C for armor)
Connector Torque Specifications	SMA: 7 – 9 inch pounds (.8 — 1 N M), 2.92mm & 3.5 mm 7— 9.7 inch pounds (.8 N M — 1.10 N M), Type N 8.8 - 9.7 inch pounds (.7 - 1.10 N M)

*Note: The above minimum bend radius refers to the internal cable only. Minimum bend radius of assembly with armor is 2.4" (6 cm).

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Rmor Cable Assemblies

For Test, Measurement and Calibration

Table 5

R-Mor Cable Assembly Electrical Characteristics	
Impedance	50 +/- 1 Ω
Operating Frequency	L1 Style: DC—50 Ghz
Velocity of Propagation (Vp)	77 %
Shielding Effectiveness @ 1 Ghz	> 100 dB
Power Rating, CW	
L1 Style	105 Watts @ 10 Ghz
L2 Style	200 Watts@ 5Ghz
L4 Style	600 Watts @ 2 Ghz
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Return Loss Specification	
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Rmor Connector Information — General

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