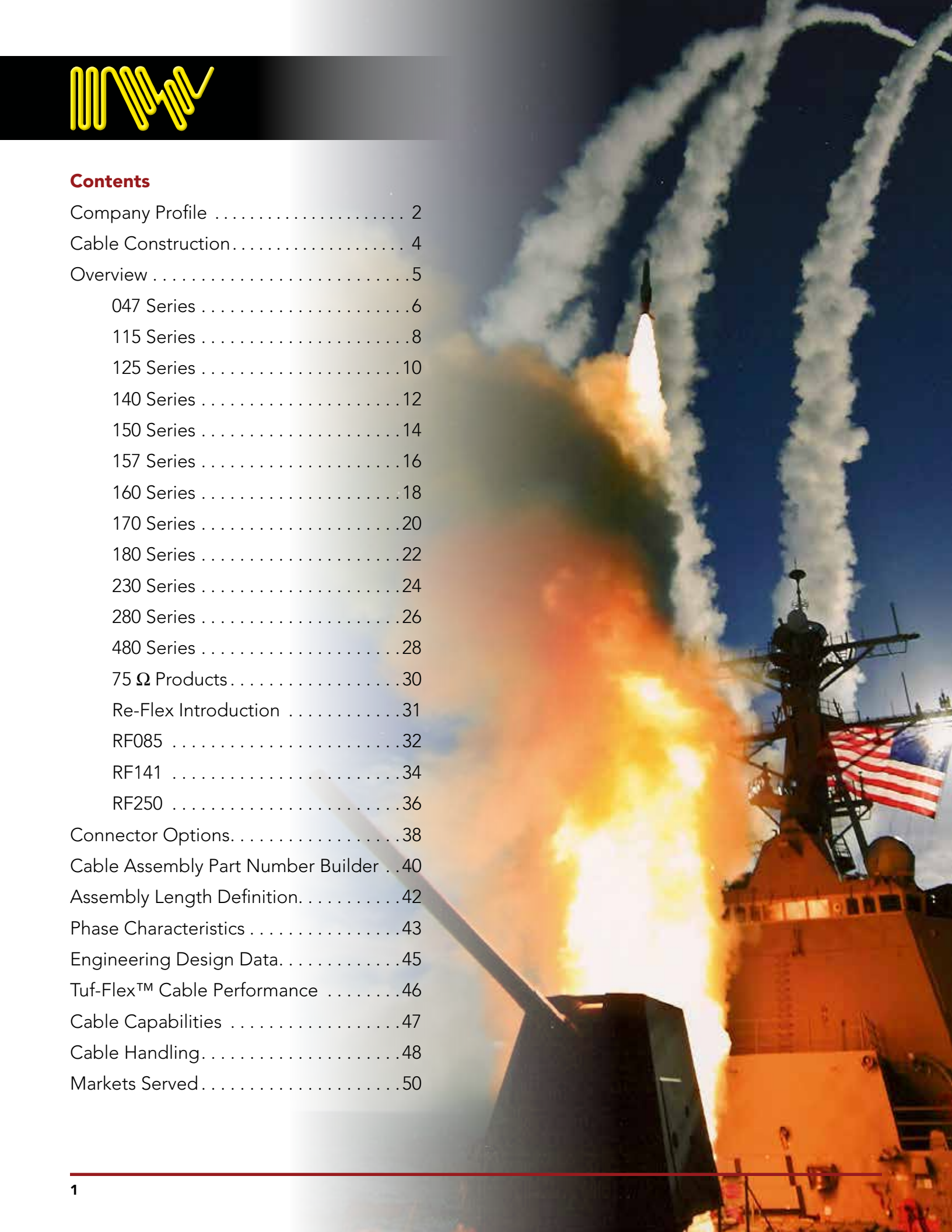
IW MICROWAVE PRODUCTS

DIVISION OF
INSULATED WIRE

Innovative
specialists in the
manufacture
of microwave
cable and cable
assemblies

Contents



Insulated Wire Today

Founded in 1970, IW developed a unique PTFE lamination process and applied it to manufacturing wire and cable. This process allowed IW to manufacture products of unprecedented reliability along with smaller diameters. Combining the new lamination process along with a patented shield design allowed IW to become one of the leaders in low loss microwave transmission lines, utilizing both solid and expanded PTFE dielectrics. In 1988, IW expanded its operations and created a Microwave Products Division.

Today, IW Bayport designs and manufactures a wide range of cables to support demanding customer application specific requirements for high performance cable assemblies operating at frequencies up to 67GHz, across a range of diameters from .050" to 0.500" diameter. IW also offers a broad selection of connectors in order to provide our customers the proper cable assembly for specific applications. IW operates in two facilities. Headquarters and cable manufacturing are located in Bayport, NY. The Microwave Products Division, responsible for the sales of all microwave assemblies, is located in Bethel, CT. Both are ISO 9001:2008 certified with AS9100.

IW serves a broad range of both military and commercial markets. These include telecommunications, data links, satellite systems,

airborne electronic warfare and counter measures, missile systems, UAV applications, avionics and instrumentation, fire control systems, medical electronics, and geophysical exploration.

All cable assemblies are built to customer specifications using the most advanced equipment and procedures including IPC-WHMA-A-620 trained technicians for soldering. All assemblies are tested for VSWR and insertion loss before leaving the factory. Phase matching, amplitude matching, and time delay measurements up to 67 GHz are available when required. We can provide either in-house or an external laboratory for environmental testing such as humidity, salt spray, vibration, thermal shock, flex testing, as well as other unique requirements. Engineering support is also available for optimal cable/ connector configuration in rack systems, black boxes, and other packaging areas where transmission line performance is critical to the overall system performance.

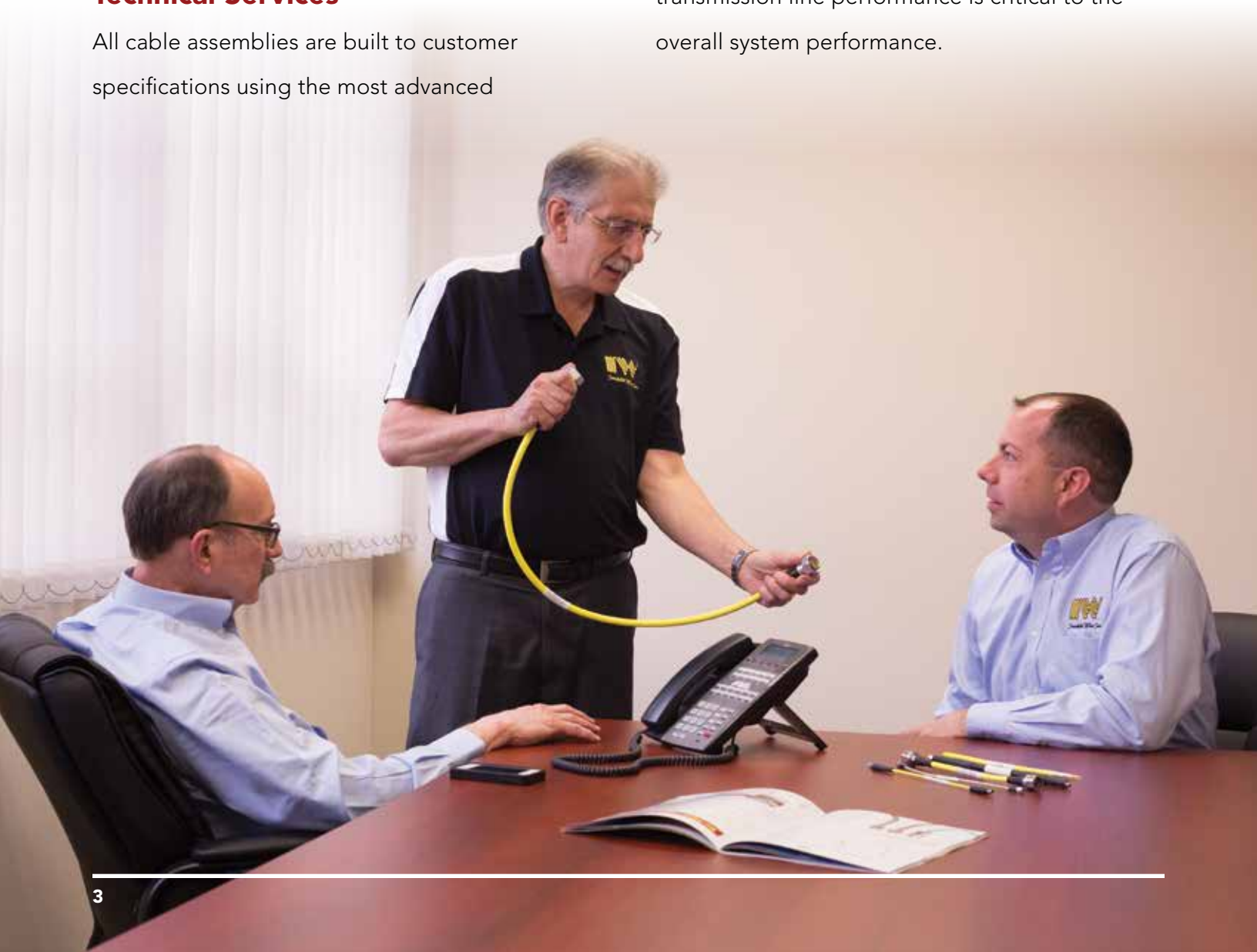
Markets Served

IW serves a broad range of both military and commercial markets. These include telecommunications, high-end audio, data links, satellite systems, airborne electronic warfare and counter measures, missile systems, UAV applications, avionics and instrumentation, fire control systems, high-end broadcast, medical electronics, and geophysical exploration.

Technical Services

All cable assemblies are built to customer specifications using the most advanced equipment and procedures including IPCWHMA-A-620 trained technicians for soldering.

All assemblies are tested for VSWR and insertion loss before leaving the factory. Phase matching, amplitude matching, and time delay measurements up to 67 GHz are available when required. We can provide either in-house or an external laboratory for environmental testing such as humidity, salt spray, vibration, thermal shock, flex testing, as well as other unique requirements. Engineering support is also available for optimal cable/ connector configuration in rack systems, black boxes, and other packaging areas where transmission line performance is critical to the overall system performance.

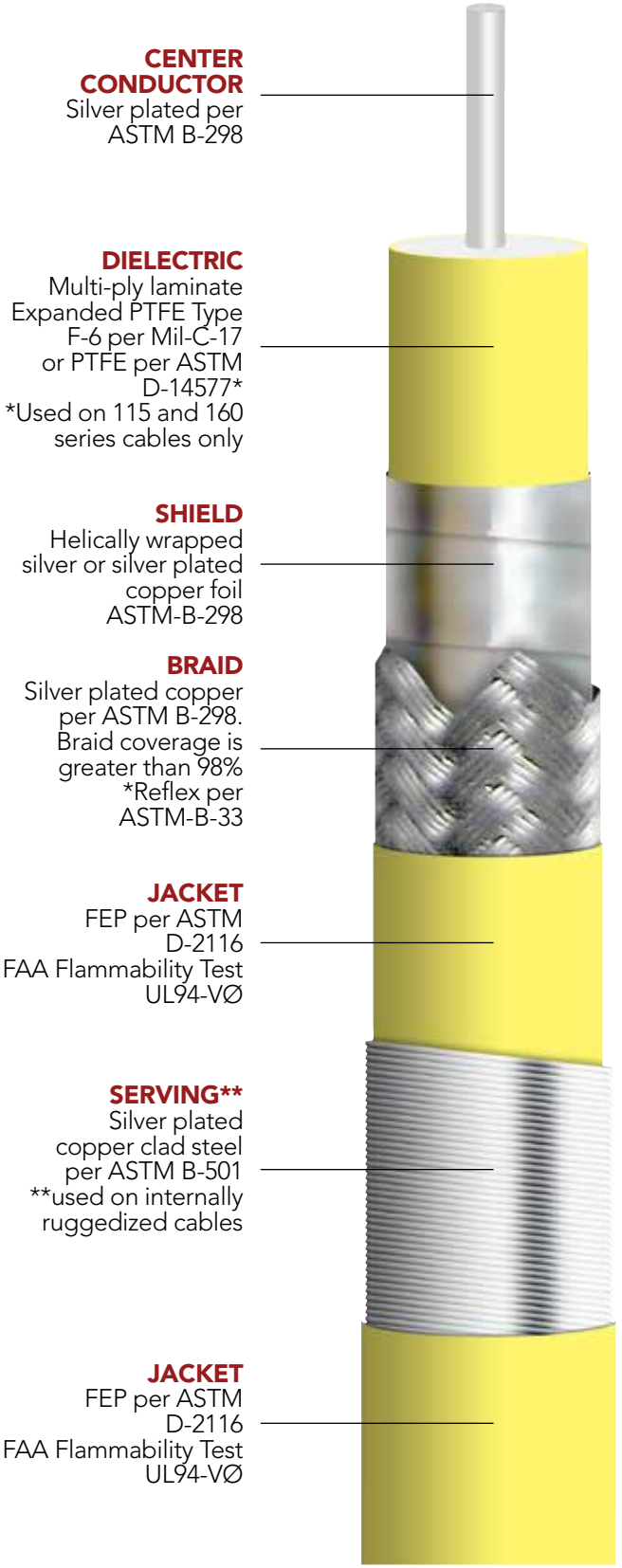


Cable Construction

IW is ready to work with you to provide the exact cable specifications you need for your extreme condition application. We can start at square one, from initial specifications and requirements analysis; through the design phase using CAD, working in sync with your systems and applications personnel; then through development, manufacturing and delivery; right up to hands on guidance for installation and maintenance.

The needs of each of our microwave customers are diverse and demanding and can change on a moment's notice. That's why we never rest on our laurels. We are constantly working to develop the next new innovative machine, or to design the newest process for delivering state of the art microwave cables and assemblies.

These scale drawings (approximately 50X actual size) illustrate IW's unique Multi-Ply Laminate insulation that eliminates the problems which occur with other forms of construction. **1. Extruded Insulation** requires a thicker insulating wall to compensate for the possibility of conductor eccentricity within the insulation. **2. Lap Wrap Tape Insulation** creates an irregular surface which precludes use with "O" ring seals at high pressures; contamination on the tape surface creates a low resistance path; and a corona site forms in the triangular voids created where the tape overlaps. **3. IW's Multi-Ply Laminate Insulation**, by contrast, delivers greater reliability with maximum space and weight savings.



Overview

IW-Microwave Products Division's extremely low loss Cable Assemblies are optimized for operation in their respective frequency bands from low MHz to 67 GHz. Upon request we have the ability to accommodate custom assembly configurations, and can extrude a broad range of jacketing materials. Our jacketing capabilities allow us to produce assemblies that have extra flexibility, extended flex life, low and high temperature ranges, and resistance to oils and corrosive materials. Our standard assemblies are extruded with FEP.

Here is a list of other materials that are available:

- FEP
- PFA
- ETFE
- ESTANE® 58244 (Low Smoke Zero Halogen)
- Silicone Rubber

Below is an overview of our standard product selection, but as you peruse our catalog you can see we can offer you and your company a vast amount of options.

Calculation of Cable Assembly Loss *Standard*

$$dB = \left(\frac{\text{Cable Attenuation in dB/100ft}}{1200} \times L\right) + \text{Connector Loss}$$

Where L is Length in Inches

Calculation of Cable Assembly Loss *Metric*

$$dB = \left(dB/m \times L(m)\right) + \text{Connector Loss}$$

Cable Construction

P/N	Cable Diameter (Inches)	Bend Radius (Inches)	Weight (lb/100 ft)	Capacitance (pF/ft)	Time Delay (nS/ft)	VP (%)	Cut Off Frequency (GHz)
0471	.057	1/16	.47	29	1.44	71	110
1151	.097	1/2	2.0	29	1.44	71	62
1251	.097	1/4	2.0	27	1.44	75	70
1401	.130	1/4	1.9	24	1.2	83	50
1403	.191	1/2	4.8	24	1.2	83	50
1501	.144	1/4	2.2	24	1.2	83	45
1503	.192	1/4	5.2	24	1.2	83	45
1571	.157	1/4	2.6	24	1.2	83	42
1573	.209	1/4	2.8	24	1.2	83	42
1601	.160	5/16	3.0	29	1.44	71	32
1603	.229	3/8	6.0	29	1.44	71	32
1701	.170	1/4	1.1	24	1.22	83	38.5
1703	.240	1/2	9.3	24	1.22	83	38.5
1801	.190	1/2	3.7	24	1.2	83	32
1803	.260	1/2	8.0	24	1.2	83	32
2301	.230	3/4	4.5	24	1.2	83	26.5
2303	.290	3/8	10.1	24	1.2	83	26.5
2801	.305	1	7.8	24	1.2	83	19.5
2803	.380	1	15.0	24	1.2	83	19.5
4806	.480	2.25	20	24	1.2	83	11.5
RF085	.085	1/8	.78	29	1.40	71	60
RF141	.144	1/8	2.5	29	1.40	71	32
RF250	.230	3/8	6.2	24	1.22	71	18

0471 Series Operating Up to 110 GHz

Center Conductor	Dielectric	Foil	Braid	Outer Jacket
Silver Plated Copper	PTFE	Silver Plated Copper	Silver Plated Copper	FEP (1.45mm 0.057")

	0471
Electrical Characteristics	
Impedance	50 +/– 2Ω
Cut Off Frequency (cable only, max)	115 GHz
Capacitance	29 pF/ft.
Velocity of Propagation	71%
Time Delay	1.4 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB
Power Handling	See Chart
Mechanical Characteristics:	
Weight	0.075 oz/ft (6.9g/m)
Minimum Bend Radius inches (mm)	0.0625" (1.6mm)
Environmental Characteristics:	
Operating Temperature Range [1]	-65°C to +165°C
RoHS (2002/95/EC)	Available on request

[1]+200°C available on request

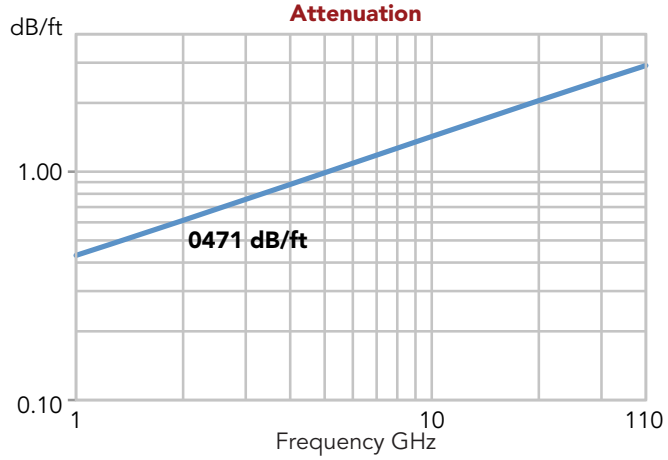
VSWR for assemblies with two straight connectors 1.35:1 to 18 GHz

0471 Series (Continued)

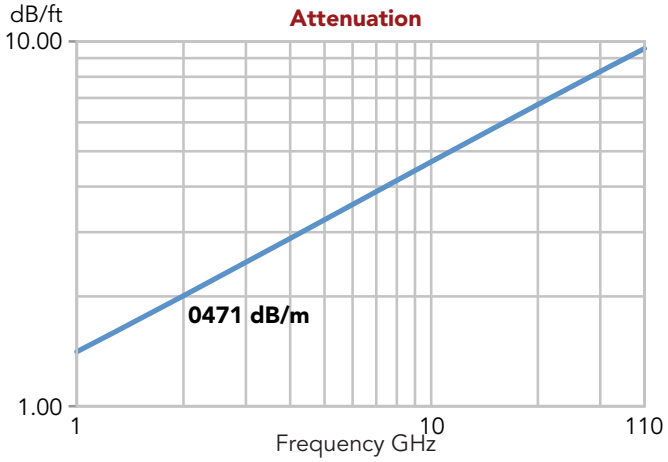
Attenuation (max)

		0471	
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.22	0.72	50.0
1	0.43	1.41	32.0
2	0.51	1.67	25.0
4	0.74	2.43	15.0
6	0.92	3.02	12.0
8	1.07	3.51	10.0
10	1.29	4.23	9.0
12	1.30	4.26	8.0
14	1.50	4.92	7.5
16	1.60	5.25	7.0
18	1.76	5.77	6.5
20	1.86	6.10	6.0
22	1.96	6.43	5.6
24	2.06	6.76	5.3
26	2.16	7.08	5.0
28	2.26	7.41	4.8
30	2.31	7.58	4.6
32	2.41	7.90	4.4
34	2.51	8.23	4.0
36	2.61	8.56	3.8
38	2.71	8.89	3.6
40	2.73	8.95	3.4
50	3.02	9.90	3.2
60	3.38	11.07	3.0
80	4.04	13.25	2.4
90	4.35	14.27	2.3
100	4.65	15.27	2.1
110	4.95	16.23	2.0

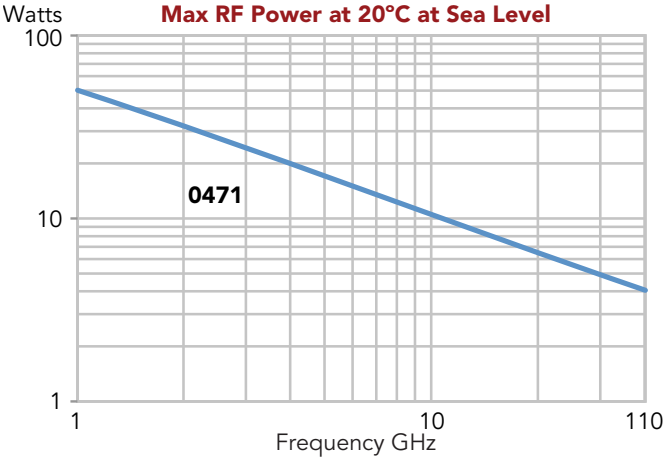
Attenuation



Attenuation



Max RF Power at 20°C at Sea Level



115 Series Operating Up to 62 GHz

Center Conductor	Dielectric	Foil	Braid	Outer Jacket
Silver Plated Copper 1151 Solid 1156 Stranded	PTFE	Silver Plated Copper	Silver Plated Copper	FEP (2.46mm 0.097")

	1151	1156
Electrical Characteristics		
Impedance	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	62 GHz	62 GHz
Capacitance	29 pF/ft.	29 pF/ft.
Velocity of Propagation	71%	71%
Time Delay	1.4 ns/ft.	1.4 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB
Power Handling	See Chart	See Chart
Mechanical Characteristics:		
Weight	.2 oz/ft (19g/m)	.2 oz/ft (19g/m)
Minimum Bend Radius inches (mm)	0.25" (6.5mm)	0.25" (6.5mm)
Environmental Characteristics:		
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Available on request	Available on request

[1]+200°C available on request

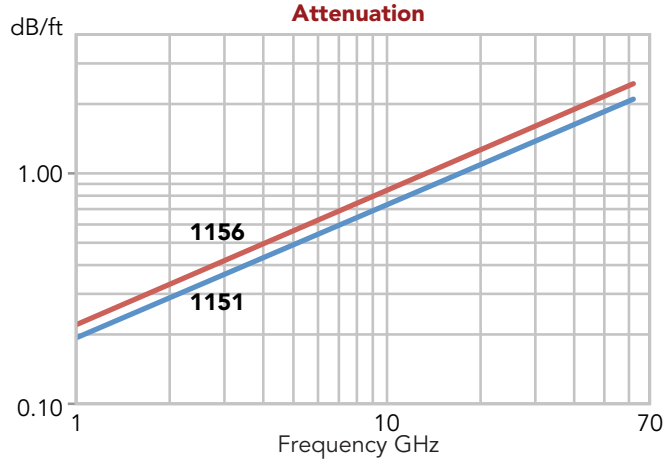
VSWR for assemblies with two straight connectors	1.35:1 to 18 GHz	1.35:1 to 18 GHz
VSWR for assemblies with one straight and one right angle connector	1.40:1 to 18 GHz	1.40:1 to 18 GHz
VSWR for assemblies with two right angle connectors	1.45:1 to 18 GHz	1.45:1 to 18 GHz

115 Series (Continued)

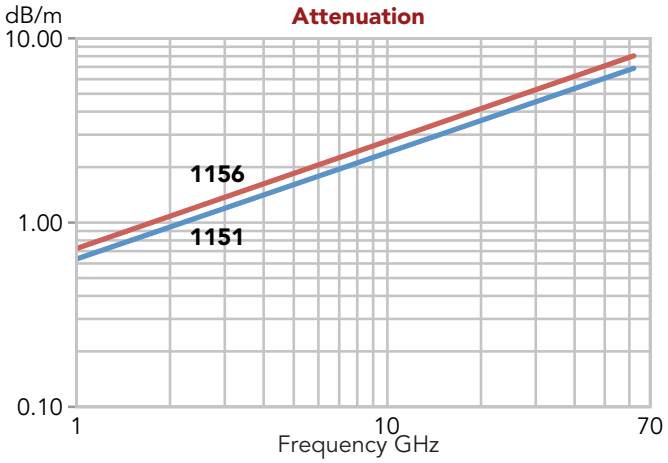
Attenuation (max)

	1151			1156		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.12	0.39	270	0.14	0.45	241
1	0.19	0.63	220	0.22	0.72	196
2	0.28	0.92	200	0.32	1.05	170
4	0.41	1.34	120	0.47	1.53	107
6	0.51	1.68	85	0.58	1.91	76
8	0.61	1.98	75	0.69	2.26	67
10	0.69	2.26	70	0.78	2.57	63
12	0.77	2.51	65	0.87	2.86	58
14	0.84	2.75	60	0.96	3.14	54
16	0.91	2.98	55	1.04	3.40	49
18	0.98	3.20	50	1.11	3.65	45
20	1.04	3.42	45	1.19	3.89	40
22	1.10	3.62	43	1.26	4.13	38
24	1.17	3.82	42	1.33	4.36	38
26	1.23	4.02	40	1.40	4.58	36
28	1.28	4.21	39	1.46	4.80	35
30	1.34	4.40	38	1.53	5.01	34
32	1.40	4.58	37	1.59	5.22	33
34	1.45	4.76	36	1.65	5.43	32
36	1.51	4.94	35	1.72	5.63	31
38	1.56	5.11	32	1.78	5.83	29
40	1.61	5.28	30	1.84	6.02	27
42	1.66	5.45	29	1.90	6.22	26
44	1.71	5.62	28	1.95	6.41	25
46	1.76	5.79	27	2.01	6.60	24
48	1.81	5.95	26	2.07	6.78	23
50	1.86	6.11	25	2.12	6.97	22
52	1.91	6.27	25	2.18	7.15	22
54	1.96	6.43	25	2.24	7.33	22
56	2.01	6.59	23	2.29	7.51	21
58	2.06	6.74	23	2.34	7.69	21
60	2.10	6.90	22	2.40	7.86	20
62	2.15	7.05	22	2.45	8.04	20

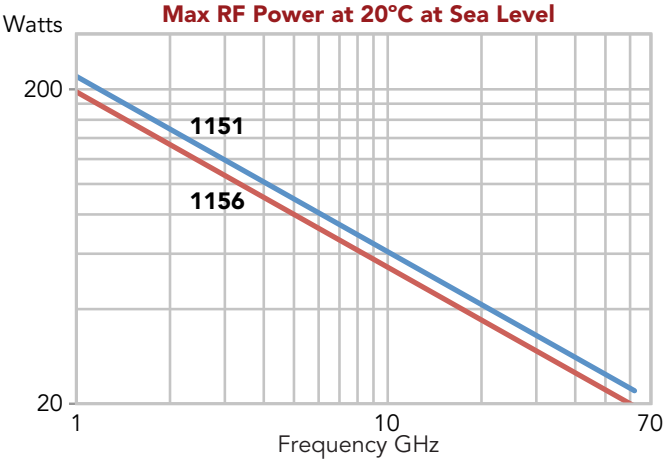
Attenuation



Attenuation



Max RF Power at 20°C at Sea Level



125 Series Operating Up to 70 GHz

Center Conductor	Dielectric	Foil	Braid	Outer Jacket
Silver Plated Copper	EPTFE	Silver Plated Copper	Silver Plated Copper	FEP (2.46mm 0.097")

	1251
Electrical Characteristics	
Impedance	50 +/– 2Ω
Cut Off Frequency (cable only, max)	70 GHz
Capacitance	27 pF/ft.
Velocity of Propagation	75%
Time Delay	1.35 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB
Power Handling	See Chart
Mechanical Characteristics:	
Weight	0.2 oz/ft (5.70g/m)
Minimum Bend Radius inches (mm)	.200" (5mm)
Environmental Characteristics:	
Operating Temperature Range [1]	-65°C to +165°C
RoHS (2002/95/EC)	Available on request

[1]+200°C available on request

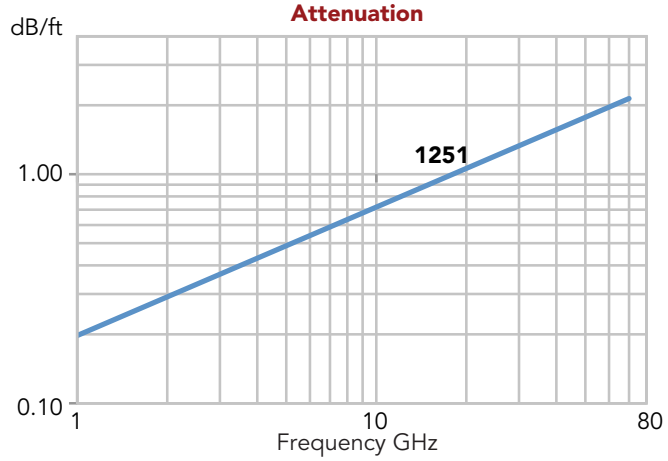
VSWR for assemblies with two straight connectors 1.35 : 1 to 40 GHz

125 Series (Continued)

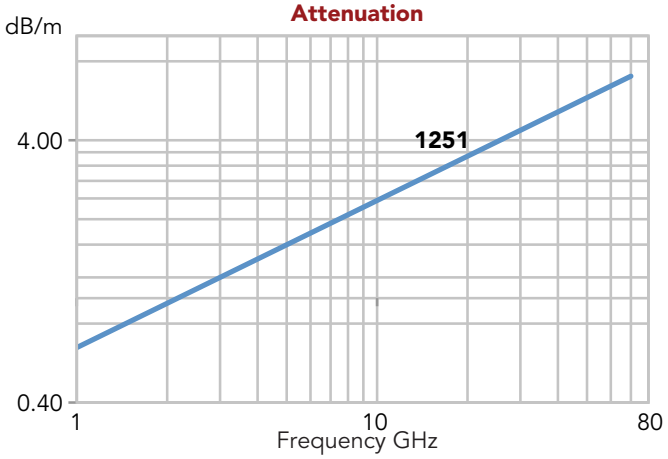
Attenuation (max)

			1251
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.12	0.41	270
1	0.20	0.65	220
2	0.28	0.93	200
4	0.41	1.35	120
6	0.51	1.69	85
8	0.60	1.98	75
10	0.68	2.24	70
12	0.76	2.49	65
14	0.83	2.71	60
16	0.89	2.93	55
18	0.96	3.14	50
20	1.02	3.34	45
22	1.08	3.53	43
24	1.14	3.72	42
26	1.19	3.90	40
28	1.25	4.08	39
30	1.30	4.26	38
32	1.35	4.43	37
34	1.40	4.59	36
36	1.45	4.76	35
38	1.50	4.92	32
40	1.55	5.08	30
42	1.59	5.23	29
44	1.64	5.38	28
46	1.69	5.53	27
48	1.73	5.68	26
50	1.78	5.83	25
52	1.82	5.98	25
54	1.87	6.12	25
56	1.91	6.26	23
58	1.95	6.36	23
60	2.00	6.52	22
62	2.04	6.65	22
64	2.08	6.78	22
65	2.10	6.84	21
68	2.12	6.95	20
70	2.14	7.02	19

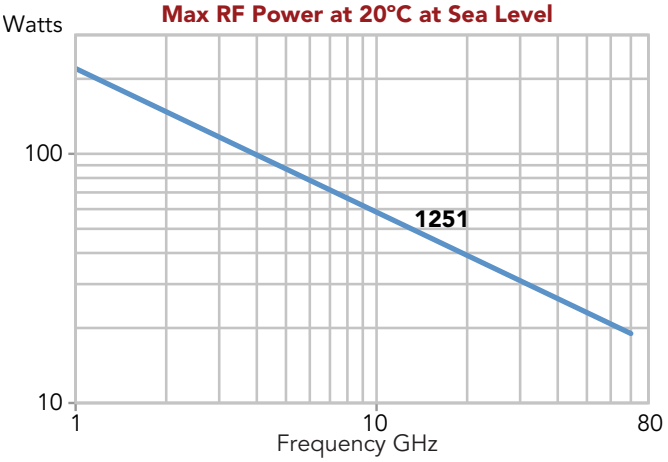
Attenuation



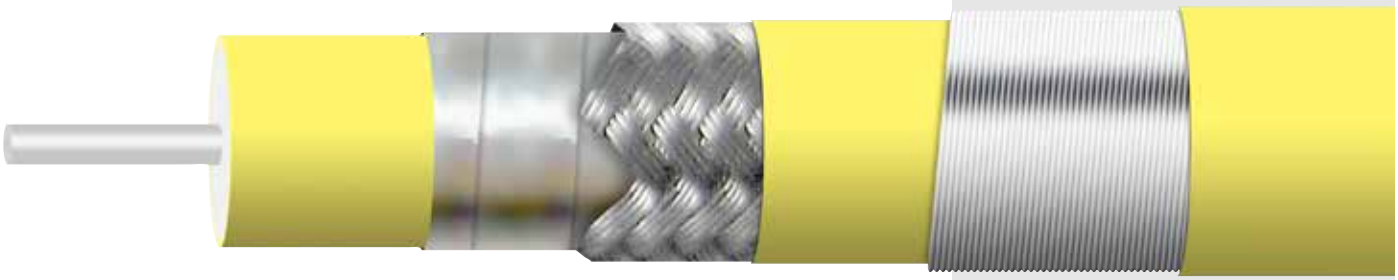
Attenuation



Max RF Power at 20°C at Sea Level



140 Series Operating Up to 50 GHz



Center Conductor	Dielectric	Foil	Braid	Outer Jacket	Serving	Outer Jacket
Silver Plated Copper 1401/1403 Solid 1406/1408 Stranded	EPTFE	Silver Plated Copper	Silver Plated Copper	FEP (3.30mm 0.130")	SCCS Armor	FEP (4.85mm 0.191")

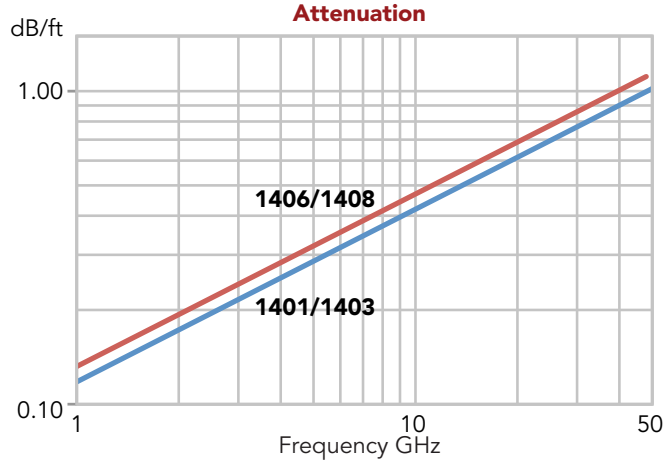
	1401	1406	1403	1408
Electrical Characteristics				
Impedance	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	52 GHz	48.5 GHz	52 GHz	48.5 GHz
Capacitance	24 pF/ft.	25 pF/ft.	24 pF/ft.	25 pF/ft.
Velocity of Propagation	83%	83%	83%	83%
Time Delay	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB	>90 dB	>90 dB
Power Handling	See Chart	See Chart	See Chart	See Chart
Mechanical Characteristics:				
Weight	.3 oz/ft (28g/m)	0.275 oz/ft (26g/m)	0.73 oz/ft (68g/m)	0.73 oz/ft (68g/m)
Minimum Bend Radius inches (mm)	0.25" (6.4mm)	0.25" (6.4mm)	0.25" (6.4mm)	0.25" (6.4mm)
Environmental Characteristics:				
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Available on request	Available on request	Available on request	Available on request
[1]+200°C available on request				
VSWR for assemblies with two straight 2.4 mm connectors	1.40 : 1 to 50 GHz	1.40 : 1 to 50 GHz	1.40 : 1 to 50 GHz	1.40 : 1 to 50 GHz

140 Series (Continued)

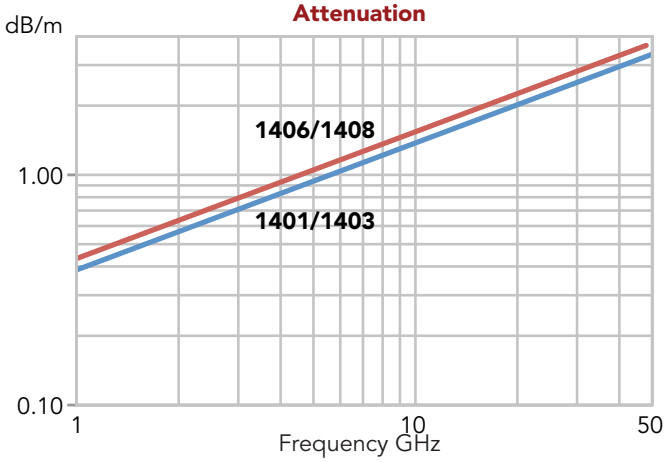
Attenuation (max)

	1401/1403			1406/1408		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.075	0.25	550	0.08	0.28	491
1	0.12	0.39	450	0.13	0.43	402
2	0.17	0.55	300	0.19	0.62	268
4	0.24	0.80	225	0.27	0.90	201
6	0.30	0.99	175	0.34	1.11	156
8	0.35	1.16	150	0.40	1.30	134
10	0.40	1.32	140	0.45	1.47	125
12	0.44	1.46	120	0.50	1.63	107
14	0.48	1.59	110	0.54	1.78	98
16	0.52	1.72	105	0.59	1.92	94
18	0.56	1.83	100	0.63	2.05	89
20	0.59	1.95	95	0.67	2.18	85
22	0.63	2.06	90	0.70	2.30	80
24	0.66	2.16	85	0.74	2.42	76
26	0.69	2.27	80	0.77	2.54	71
28	0.72	2.37	75	0.81	2.65	67
30	0.75	2.46	73	0.84	2.76	65
32	0.78	2.56	71	0.87	2.87	63
34	0.81	2.65	70	0.91	2.97	63
36	0.84	2.74	68	0.94	3.07	61
38	0.86	2.83	65	0.97	3.17	58
40	0.89	2.92	60	1.00	3.27	54
42	0.92	3.01	58	1.03	3.37	52
44	0.94	3.09	56	1.06	3.47	50
46	0.97	3.18	54	1.09	3.56	48
48	0.99	3.26	52	1.11	3.65	46
50	1.02	3.34	50	N/A	N/A	N/A

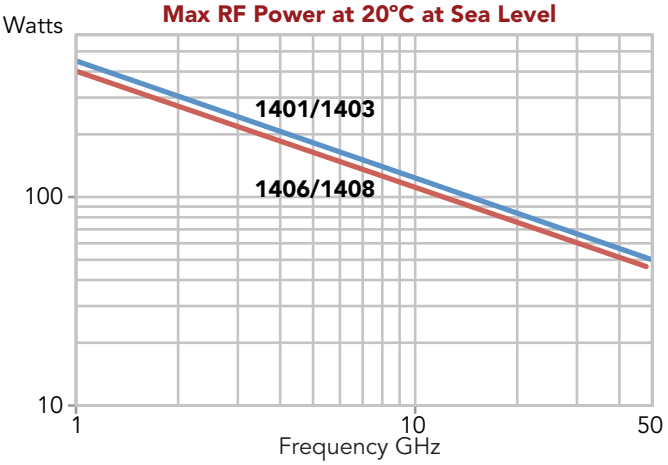
Attenuation



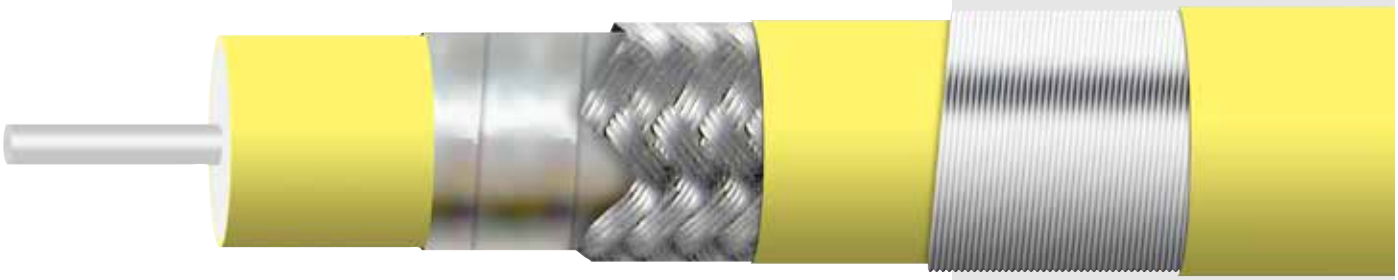
Attenuation



Max RF Power at 20°C at Sea Level



150 Series Operating Up to 40 GHz



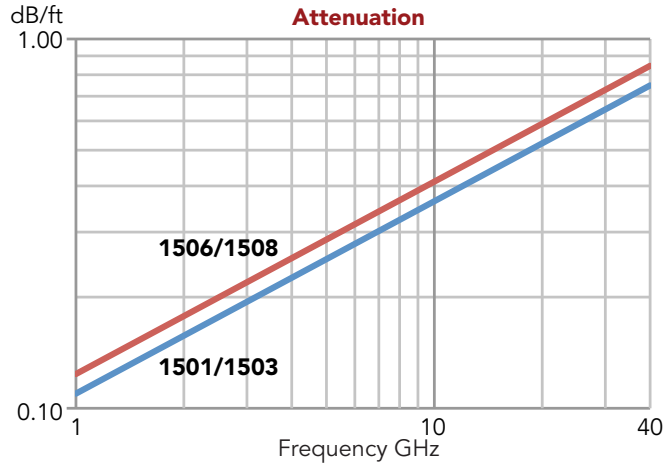
Center Conductor	Dielectric	Foil	Braid	Outer Jacket	Serving	Outer Jacket
Silver Plated Copper 1501/1503 Solid 1506/1508 Stranded	EPTFE	Silver Plated Copper	Silver Plated Copper	FEP (3.65mm 0.144")	SCCS Armor	FEP (4.87mm 0.192")

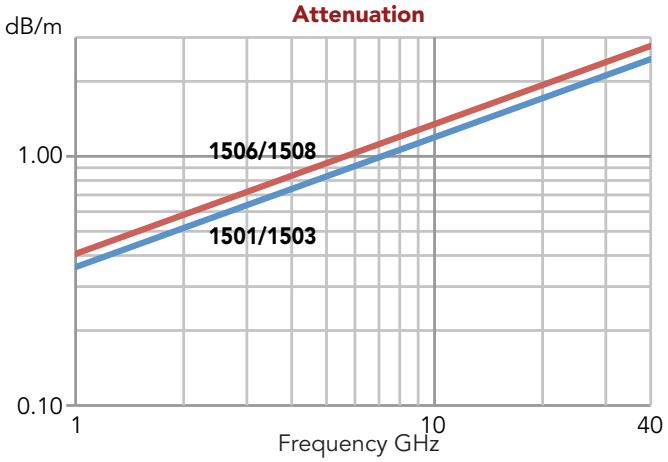
	1501	1506	1503	1508
Electrical Characteristics				
Impedance	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	45 GHz	42 GHz	45 GHz	42 GHz
Capacitance	24 pF/ft.	26 pF/ft.	24 pF/ft.	26 pF/ft.
Velocity of Propagation	83%	83%	83%	83%
Time Delay	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB	>90 dB	>90 dB
Power Handling	See Chart	See Chart	See Chart	See Chart
Mechanical Characteristics:				
Weight	.36 oz/ft (33g/m)	0.34 oz/ft (31g/m)	0.75 oz/ft (70g/m)	0.73 oz/ft (68g/m)
Minimum Bend Radius inches (mm)	0.5" (12.7mm)	0.5" (12.7mm)	0.5" (12.7mm)	0.5" (12.7mm)
Environmental Characteristics:				
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Available on request	Available on request	Available on request	Available on request
[1]+200°C available on request				
VSWR for assemblies with two straight 2.9 mm connectors	1.35 : 1 to 40 GHz	1.35 : 1 to 40 GHz	1.35 : 1 to 40 GHz	1.35 : 1 to 40 GHz

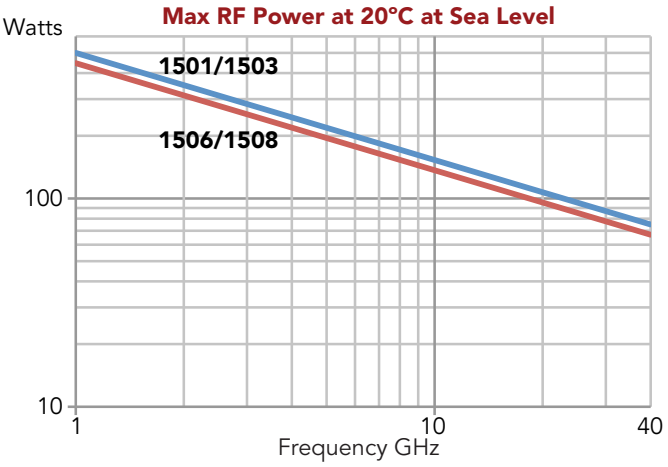
150 Series (Continued)

Attenuation (max)

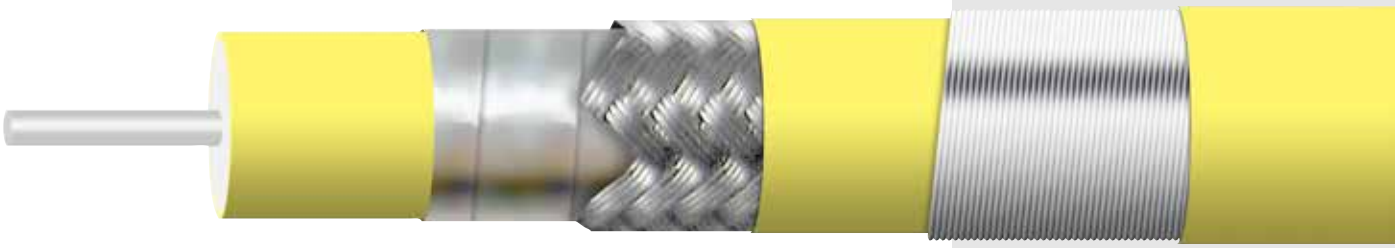
	1501/1503			1506/1508		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.07	0.23	600	0.08	0.26	536
1	0.11	0.36	500	0.12	0.41	446
2	0.16	0.51	370	0.18	0.58	330
4	0.22	0.73	260	0.25	0.82	232
6	0.27	0.90	210	0.31	1.01	188
8	0.32	1.04	180	0.36	1.18	161
10	0.36	1.17	160	0.40	1.32	143
12	0.39	1.29	150	0.44	1.45	134
14	0.43	1.40	140	0.48	1.58	125
16	0.46	1.50	125	0.52	1.69	112
18	0.49	1.60	120	0.55	1.80	107
20	0.51	1.69	115	0.58	1.91	103
22	0.54	1.78	110	0.61	2.01	98
24	0.57	1.86	105	0.64	2.10	94
26	0.59	1.94	100	0.67	2.20	89
28	0.62	2.02	99	0.70	2.29	88
30	0.64	2.10	97	0.72	2.37	87
32	0.66	2.17	95	0.75	2.46	85
34	0.69	2.25	90	0.77	2.54	80
36	0.71	2.32	85	0.80	2.62	76
38	0.73	2.39	80	0.82	2.70	71
40	0.75	2.46	75	0.85	2.78	67







157 Series Operating Up to 40 GHz



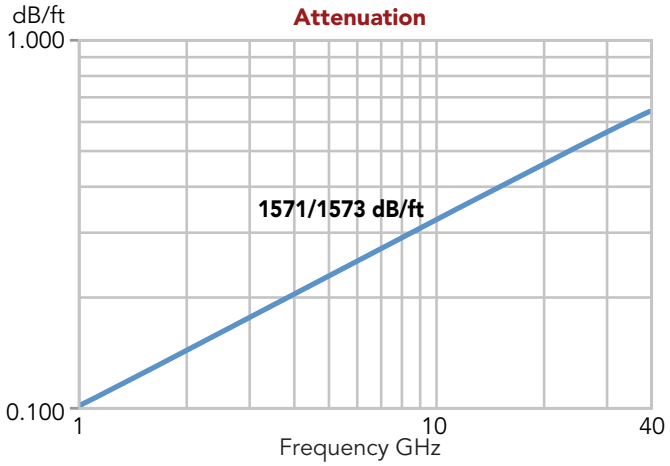
Center Conductor	Dielectric	Foil	Braid	Outer Jacket	Serving	Outer Jacket
Silver Plated Copper	EPTFE	Silver Plated Copper	Silver Plated Copper	FEP (3.98mm 0.157")	SCCS Armor	FEP (5.30mm 0.209")

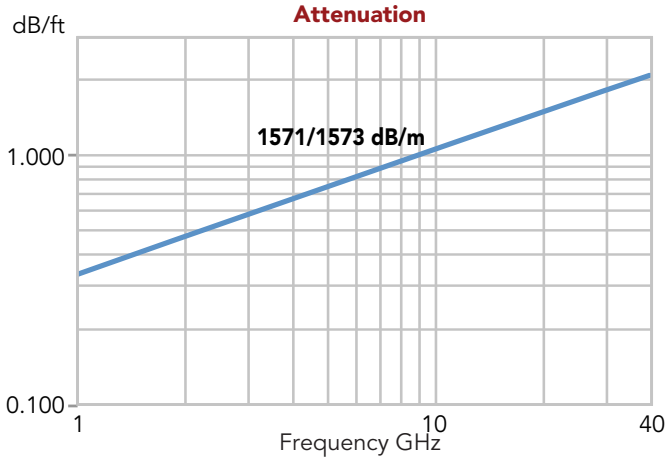
	1571	1573
Electrical Characteristics		
Impedance	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	42 GHz	42 GHz
Capacitance	24 pF/ft.	24 pF/ft.
Velocity of Propagation	83%	83%
Time Delay	1.22 ns/ft.	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB
Power Handling	See Chart	See Chart
Mechanical Characteristics:		
Weight	.42 oz/ft (38.5g/m)	.44 oz/ft (41g/m))
Minimum Bend Radius inches (mm)	0.5" (12.7mm)	0.5" (12.7mm)
Environmental Characteristics:		
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Yes	Yes
[1]+200°C available on request		
VSWR for assemblies with two straight connectors	1.35:1 to 18 GHz	1.35:1 to 18 GHz

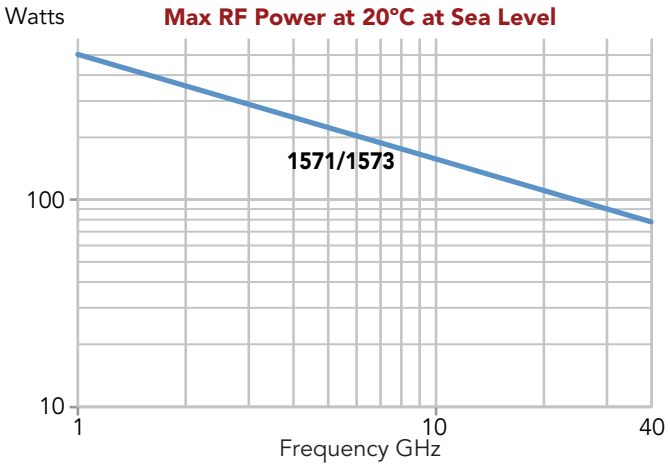
157 Series (Continued)

Attenuation (max)

	1571/1573		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.044	0.146	600
1	0.101	0.331	500
2	0.131	0.431	370
4	0.201	0.659	260
6	0.231	0.759	210
8	0.287	0.941	180
10	0.303	0.933	160
12	0.351	1.151	150
14	0.362	1.188	140
16	0.389	1.276	125
18	0.430	1.410	120
20	0.439	1.439	160
22	0.462	1.515	110
24	0.484	1.588	105
26	0.521	1.709	100
28	0.540	1.771	99
30	0.549	1.801	97
32	0.568	1.863	95
34	0.586	1.922	90
36	0.605	1.984	85
38	0.623	2.044	80
40	0.640	2.099	75







160 Series Operating Up to 32 GHz

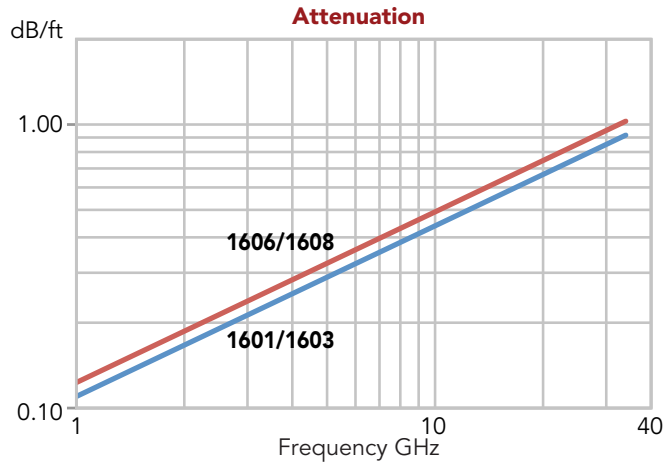
Center Conductor	Dielectric	Foil	Braid	Outer Jacket	Serving	Outer Jacket
Silver Plated Copper 1601/1603 Solid 1606/1608 Stranded	PTFE	Silver Plated Copper	Silver Plated Copper	FEP (4.8mm 0.160")	SCCS Armor	FEP (5.8mm 0.229")

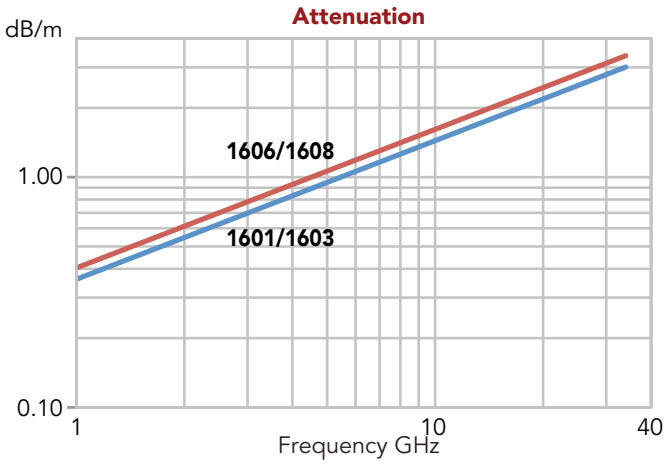
	1601	1606	1603	1608
Electrical Characteristics				
Impedance	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	34 GHz	34 GHz	34 GHz	34 GHz
Capacitance	29 pF/ft.	22 pF/ft.	29 pF/ft.	22 pF/ft.
Velocity of Propagation	71%	71%	71%	71%
Time Delay	1.4 ns/ft.	1.4 ns/ft.	1.4 ns/ft.	1.4 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB	>90 dB	>90 dB
Power Handling	See Chart	See Chart	See Chart	See Chart
Mechanical Characteristics:				
Weight	.48 oz/ft (44g/m)	0.5 oz/ft (13g/m)	0.98 oz/ft (92g/m)	0.98 oz/ft (92g/m)
Minimum Bend Radius inches (mm)	0.325" (8.3mm)	0.325" (8.3mm)	0.375" (9.5mm)	0.375" (9.5mm)
Environmental Characteristics:				
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Available on request	Available on request	Available on request	Available on request
[1]+200°C available on request				
VSWR for assemblies with two straight connectors	1.35:1 to 18 GHz	1.35:1 to 18 GHz	1.35:1 to 18 GHz	1.35:1 to 18 GHz
VSWR for assemblies with one straight and one right angle connector	1.40:1 to 18 GHz	1.40:1 to 18 GHz	1.40:1 to 18 GHz	1.40:1 to 18 GHz
VSWR for assemblies with two right angle connectors	1.45:1 to 18 GHz	1.45:1 to 18 GHz	1.45:1 to 18 GHz	1.45:1 to 18 GHz

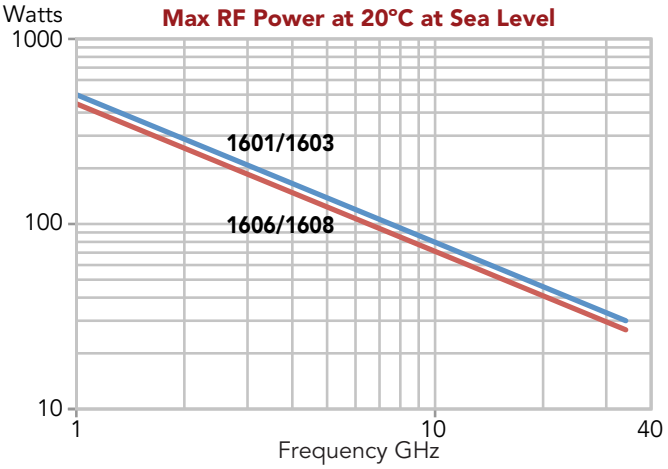
160 Series (Continued)

Attenuation (max)

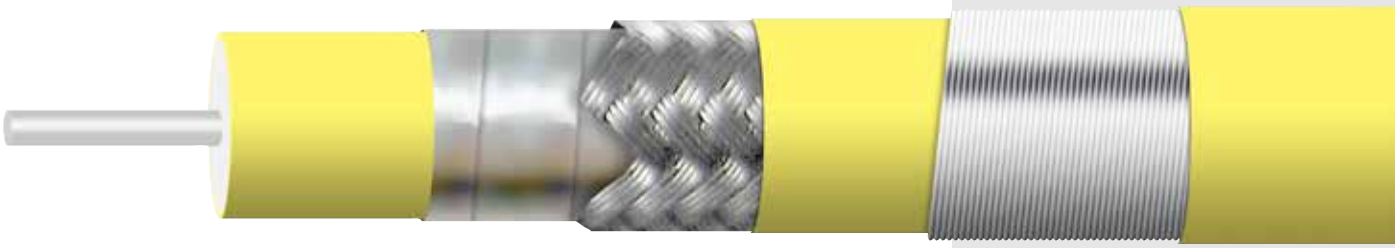
	1601/1603			1606/1608		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.07	0.22	700	0.08	0.25	625
1	0.11	0.36	500	0.12	0.40	446
2	0.16	0.53	350	0.18	0.59	313
4	0.24	0.78	240	0.27	0.88	214
6	0.30	0.99	190	0.34	1.11	170
8	0.36	1.18	160	0.40	1.32	143
10	0.41	1.36	150	0.46	1.52	134
12	0.46	1.52	140	0.52	1.70	125
14	0.51	1.68	130	0.57	1.88	116
16	0.56	1.83	120	0.62	2.04	107
18	0.60	1.97	110	0.67	2.21	98
20	0.64	2.11	100	0.72	2.36	89
22	0.68	2.25	90	0.77	2.52	80
24	0.73	2.38	80	0.81	2.66	71
26	0.77	2.51	70	0.86	2.81	63
28	0.80	2.64	60	0.90	2.95	54
30	0.84	2.76	50	0.94	3.09	45
32	0.88	2.89	40	0.99	3.23	36







170 Series Operating Up to 38.5 GHz



Center Conductor	Dielectric	Foil	Braid	Outer Jacket	Serving	Outer Jacket
Silver Plated Copper	EPTFE	Silver Plated Copper	Silver Plated Copper	FEP (4.3mm 0.170")	SCCS Armor	FEP (6.09mm 0.240")

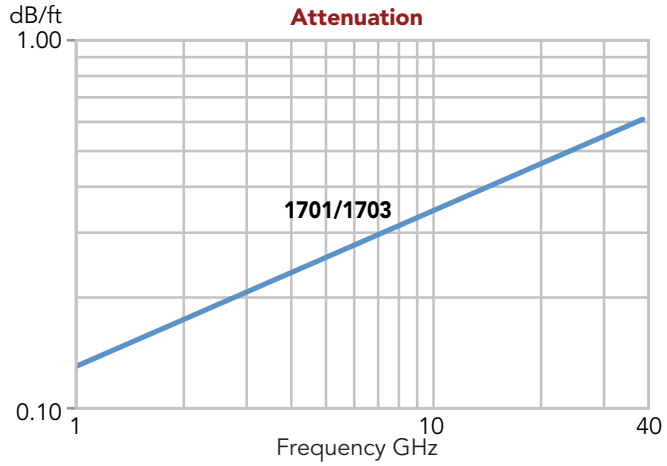
	1701	1703
Electrical Characteristics		
Impedance	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	38 GHz	38 GHz
Capacitance	24 pF/ft.	24 pF/ft.
Velocity of Propagation	83%	83%
Time Delay	1.22 ns/ft.	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB
Power Handling	See Chart	See Chart
Mechanical Characteristics:		
Weight	.44 oz/ft (41g/m)	1.50 oz/ft (111g/m)
Minimum Bend Radius inches (mm)	0.25" (6.5mm)	0.5" (13mm)
Environmental Characteristics:		
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Available on request	Available on request
[1]+200°C available on request		
VSWR for assemblies with two straight connectors	1.35:1 to 18 GHz	1.35:1 to 18 GHz

170 Series (Continued)

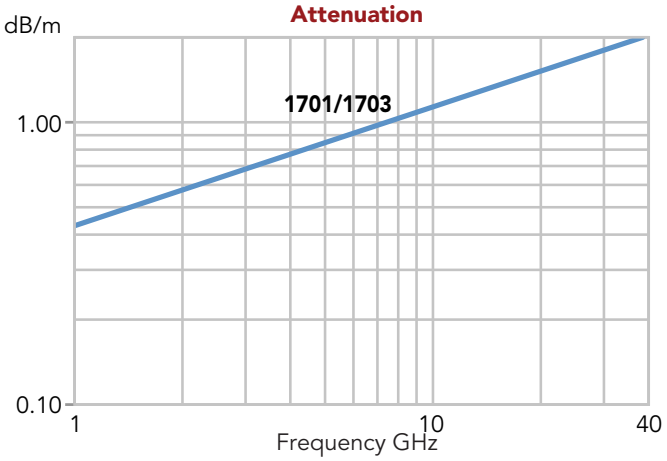
Attenuation (max)

	1701/1703		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.10	0.32	850
1	0.13	0.43	680
2	0.18	0.59	467
4	0.25	0.86	340
6	0.26	0.82	270
8	0.29	0.95	245
10	0.31	1.03	210
12	0.34	1.13	190
14	0.36	1.13	178
16	0.38	1.17	170
18	0.40	1.24	165
20	0.42	1.31	160
22	0.44	1.63	157
24	0.46	1.42	153
26	0.48	1.49	148
28	0.50	1.56	144
30	0.52	1.63	136
32	0.53	1.73	131
34	0.55	1.79	127
36	0.56	1.84	125
38	0.57	1.88	120
38.5	0.61	2.00	119

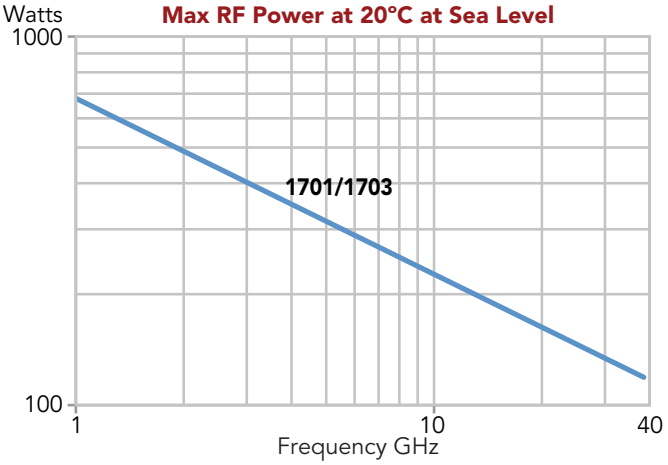
Attenuation



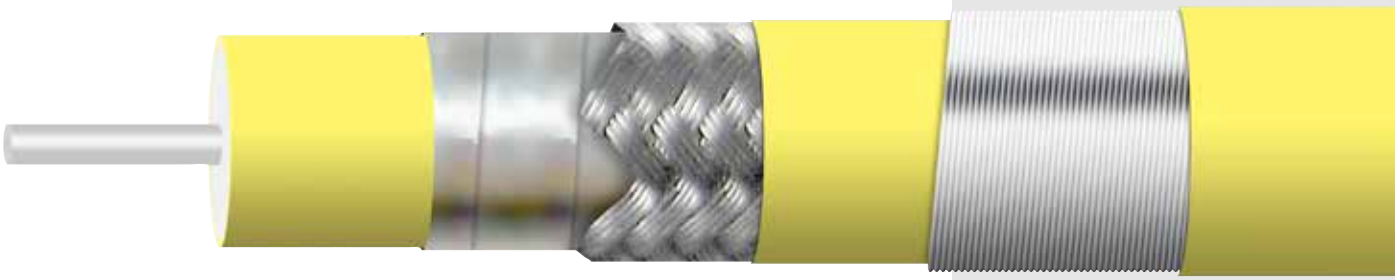
Attenuation



Max RF Power at 20°C at Sea Level



180 Series Operating Up to 32 GHz



Center Conductor	Dielectric	Foil	Braid	Outer Jacket	Serving	Outer Jacket
Silver Plated Copper 1801/1803 Solid 1806/1808 Stranded	EPTFE	Silver Plated Copper	Silver Plated Copper	FEP (4.8mm 0.190")	SCCS Armor	FEP (6.6mm 0.260")

	1801	1806	1803	1808
Electrical Characteristics				
Impedance	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	32 GHz	31 GHz	32 GHz	31 GHz
Capacitance	24 pF/ft.	25 pF/ft.	24 pF/ft.	25 pF/ft.
Velocity of Propagation	83%	83%	83%	83%
Time Delay	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB	>90 dB	>90 dB
Power Handling	See Chart	See Chart	See Chart	See Chart
Mechanical Characteristics:				
Weight	0.62 oz/ft (58g/m)	0.6 oz/ft (54g/m)	1.40 oz/ft (130g/m)	1.40 oz/ft (130g/m)
Minimum Bend Radius inches (mm)	0.5" (13mm)	0.5" (13mm)	0.5" (13mm)	0.5" (13mm)
Environmental Characteristics:				
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Available on request	Available on request	Available on request	Available on request

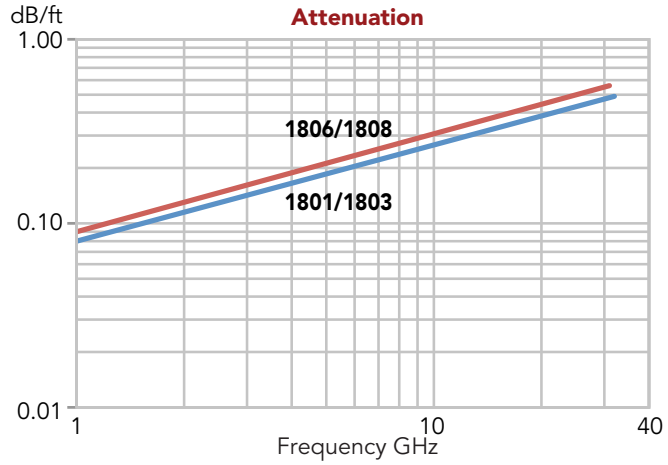
[1]+200°C available on request

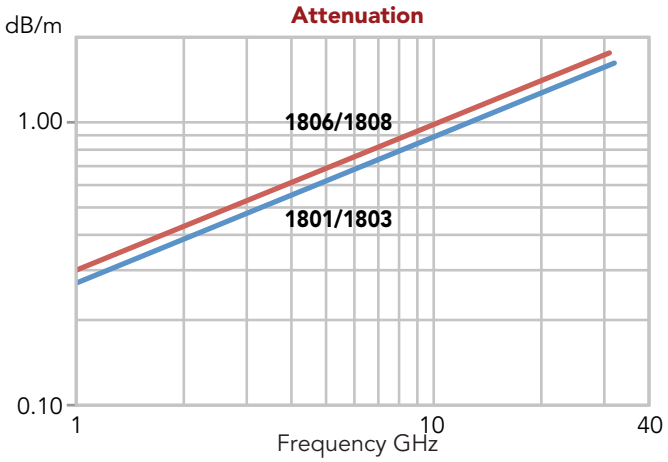
VSWR for assemblies with two straight connectors	1.35:1 to 18 GHz	1.35:1 to 18 GHz	1.35:1 to 18 GHz	1.35:1 to 18 GHz
VSWR for assemblies with one straight and one right angle connector	1.40:1 to 18 GHz	1.40:1 to 18 GHz	1.40:1 to 18 GHz	1.40:1 to 18 GHz
VSWR for assemblies with two right angle connectors	1.45:1 to 18 GHz	1.45:1 to 18 GHz	1.45:1 to 18 GHz	1.45:1 to 18 GHz
VSWR for assemblies with two straight 3.5mm connectors	1.35:1 to 26.5 GHz	1.35:1 to 26.5 GHz	1.35:1 to 26.5 GHz	1.35:1 to 26.5 GHz

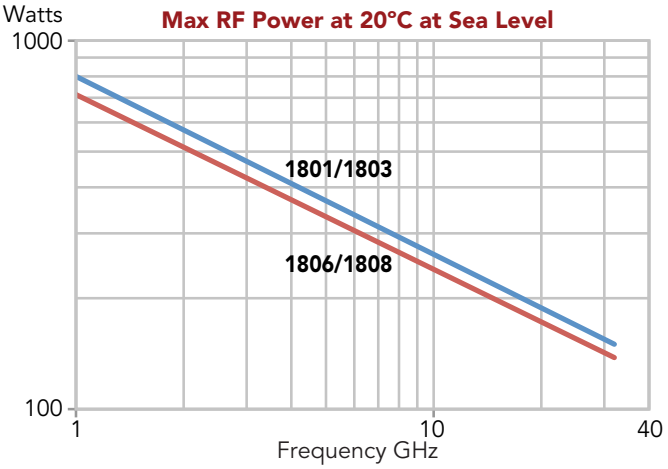
180 Series (Continued)

Attenuation (max)

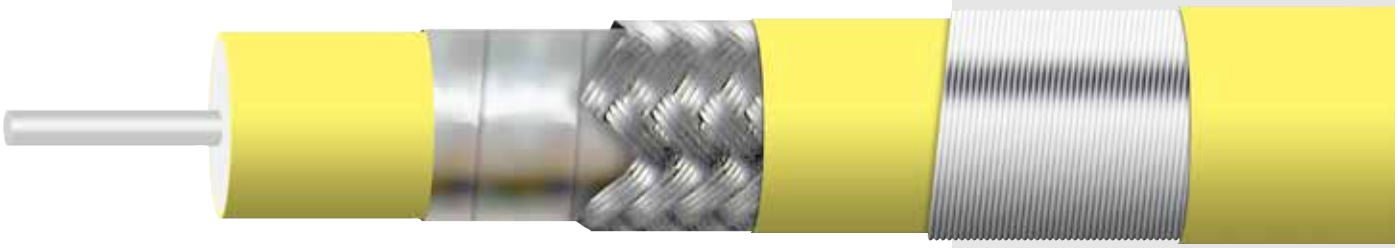
	1801/1803			1806/1808		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.05	0.17	1000	0.06	0.19	893
1	0.08	0.27	800	0.09	0.30	714
2	0.12	0.38	550	0.13	0.42	491
4	0.16	0.53	400	0.18	0.60	357
6	0.20	0.66	320	0.23	0.74	286
8	0.23	0.77	290	0.26	0.86	259
10	0.26	0.87	250	0.30	0.97	223
12	0.29	0.95	220	0.33	1.07	196
14	0.32	1.03	210	0.35	1.16	188
16	0.34	1.11	200	0.35	1.25	179
18	0.36	1.18	195	0.41	1.33	174
20	0.38	1.25	190	0.43	1.40	170
22	0.40	1.32	185	0.45	1.48	165
24	0.42	1.38	180	0.47	1.55	161
26	0.44	1.45	175	0.49	1.62	156
28	0.46	1.51	170	0.52	1.69	152
30	0.47	1.54	160	0.53	1.73	143
31	0.48	1.57	155	0.56	1.76	138
32	0.49	1.62	150	n/a	n/a	n/a







230 Series Operating Up to 26.5 GHz



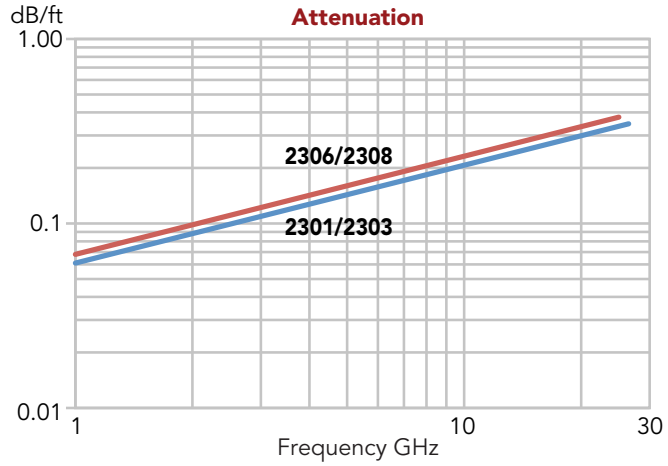
Center Conductor	Dielectric	Foil	Braid	Outer Jacket	Serving	Outer Jacket
Silver Plated Copper 2301/2303 Solid 2306/2308 Stranded	EPTFE	Silver Plated Copper	Silver Plated Copper	FEP (5.8mm 0.230")	SCCS Armor	FEP (7.4mm 0.290")

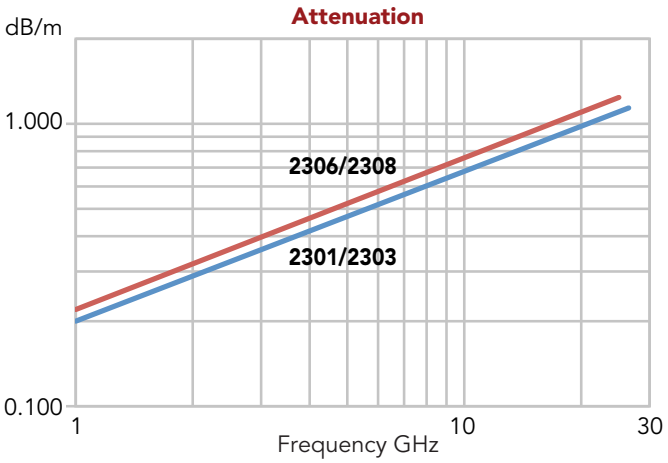
	2301	2306	2303	2308
Electrical Characteristics				
Impedance	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	26.7 GHz	25 GHz	26.7 GHz	25 GHz
Capacitance	24 pF/ft.	25 pF/ft.	24 pF/ft.	25 pF/ft.
Velocity of Propagation	83%	83%	83%	83%
Time Delay	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB	>90 dB	>90 dB
Power Handling	See Chart	See Chart	See Chart	See Chart
Mechanical Characteristics:				
Weight	0.77 oz/ft (72g/m)	0.77 oz/ft (72g/m)	1.6 oz/ft (148g/m)	1.6 oz/ft (148g/m)
Minimum Bend Radius inches (mm)	0.750" (19mm)	0.750" (19mm)	0.625" (16mm)	0.625" (16mm)
Environmental Characteristics:				
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Available on request	Available on request	Available on request	Available on request
[1]+200°C available on request				
VSWR for assemblies with two straight connectors	1.35:1 to 18 GHz	1.35:1 to 18 GHz	1.35:1 to 18 GHz	1.35:1 to 18 GHz
VSWR for assemblies with one straight and one right angle connector	1.40:1 to 18 GHz	1.40:1 to 18 GHz	1.40:1 to 18 GHz	1.40:1 to 18 GHz
VSWR for assemblies with two right angle connectors	1.45:1 to 18 GHz	1.45:1 to 18 GHz	1.45:1 to 18 GHz	1.45:1 to 18 GHz
VSWR for assemblies with two straight 3.5mm connectors	1.35:1 to 26.5 GHz	1.35:1 to 26.5 GHz	1.35:1 to 26.5 GHz	1.35:1 to 26.5 GHz

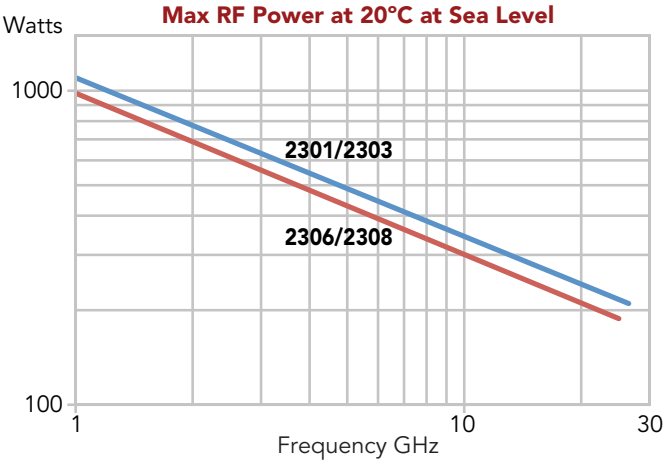
230 Series (Continued)

Attenuation (max)

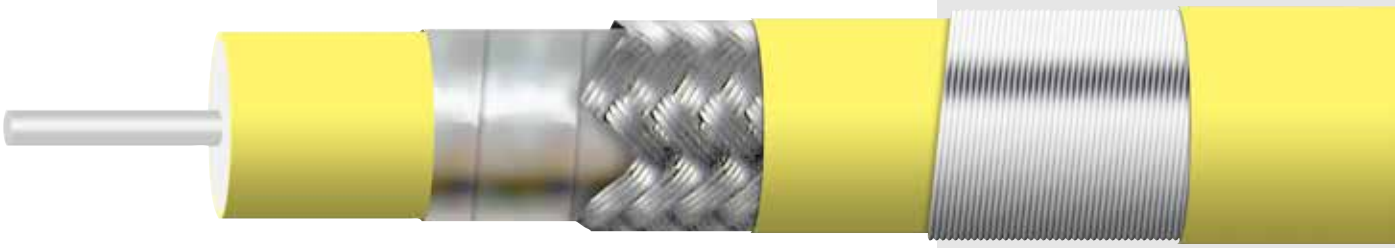
	2301/2303			2306/2308		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.038	0.125	1300	0.043	0.140	1161
1	0.061	0.200	1100	0.068	0.220	982
2	0.087	0.285	800	0.097	0.320	714
4	0.125	0.410	520	0.14	0.460	464
6	0.155	0.508	450	0.173	0.570	402
8	0.180	0.590	380	0.202	0.660	339
10	0.203	0.666	350	0.228	0.750	313
12	0.224	0.735	310	0.251	0.820	277
14	0.244	0.800	300	0.273	0.900	268
16	0.263	0.863	280	0.294	0.960	250
18	0.280	0.918	270	0.314	1.030	241
20	0.297	0.974	250	0.332	1.09	223
22	0.313	1.027	230	0.351	1.15	205
24	0.329	1.079	220	0.368	1.21	196
25	0.336	1.102	215	0.377	1.24	188
26.5	0.347	1.138	210	N/A	N/A	N/A







280 Series Operating Up to 18 GHz



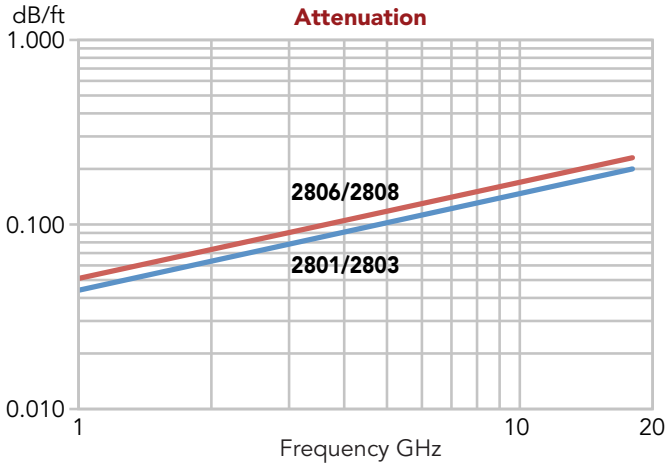
Center Conductor	Dielectric	Foil	Braid	Outer Jacket	Serving	Outer Jacket
Silver Plated Copper 2801/2803 Solid 2806/2808 Stranded	EPTFE	Silver Plated Copper	Silver Plated Copper	FEP (7.74mm 0.305"	SCCS Armor	FEP (9.65mm 0.380")

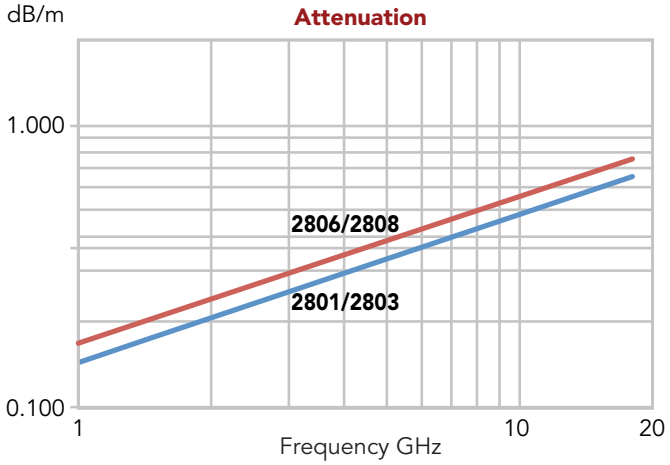
	2801	2806	2803	2808
Electrical Characteristics				
Impedance	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω	50 +/– 2Ω
Cut Off Frequency (cable only, max)	19.5 GHz	18 GHz	19.5 GHz	18 GHz
Capacitance	24 pF/ft.	24 pF/ft.	24 pF/ft.	24 pF/ft.
Velocity of Propagation	83%	83%	83%	83%
Time Delay	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB	>90 dB	>90 dB	>90 dB
Power Handling	See Chart	See Chart	See Chart	See Chart
Mechanical Characteristics:				
Weight	1.40 oz/ft (130g/m)	1.30 oz/ft (120g/m)	2.50 oz/ft (230g/m)	2.50 oz/ft (230g/m)
Minimum Bend Radius inches (mm)	1" (25.4mm)	1" (25.4mm)	1" (25.4mm)	1" (25.4mm)
Environmental Characteristics:				
Operating Temperature Range [1]	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C	-65°C to +165°C
RoHS (2002/95/EC)	Available on request	Available on request	Available on request	Available on request
[1]+200°C available on request				
VSWR for assemblies with two straight connectors	1.35:1 to 18 GHz	1.35:1 to 18 GHz	1.35:1 to 18 GHz	1.35:1 to 18 GHz
VSWR for assemblies with one straight and one right angle connector	1.40:1 to 18 GHz	1.40:1 to 18 GHz	1.40:1 to 18 GHz	1.40:1 to 18 GHz
VSWR for assemblies with two right angle connectors	1.45:1 to 18 GHz	1.45:1 to 18 GHz	1.45:1 to 18 GHz	1.45:1 to 18 GHz

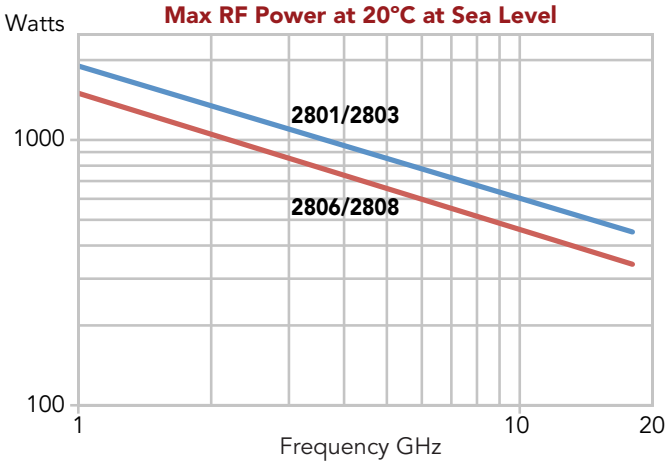
280 Series (Continued)

Attenuation (max)

	2801/2803			2806/2808		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.009	0.028	2500	0.011	0.034	2000
1	0.044	0.145	1900	0.057	0.171	1500
2	0.063	0.206	1350	0.081	0.244	1100
4	0.090	0.295	900	0.117	0.350	700
6	0.111	0.365	750	0.144	0.433	600
8	0.130	0.425	650	0.168	0.504	500
10	0.146	0.479	600	0.189	0.567	450
12	0.161	0.528	580	0.208	0.625	400
14	0.175	0.574	550	0.227	0.680	380
16	0.188	0.617	525	0.243	0.730	350
18	0.200	0.657	450	0.260	0.779	340







480 Series Operating Up to 11 GHz

Center Conductor
Silver Plated Copper (Stranded only)

Dielectric
EPTFE

Foil
Silver Plated Copper

Braid
Silver Plated Copper

Outer Jacket
FEP
(12.mm 0.480")

	4806
Electrical Characteristics	
Impedance	50 +/– 2Ω
Cut Off Frequency (cable only, max)	11.5 GHz
Capacitance	24 pF/ft.
Velocity of Propagation	83%
Time Delay	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB
Power Handling	See Chart
Mechanical Characteristics:	
Weight	2.9 oz/ft (267g/m)
Minimum Bend Radius inches (mm)	2.25" (57mm)
Environmental Characteristics:	
Operating Temperature Range [1]	-65°C to +165°C
RoHS (2002/95/EC)	Available on request

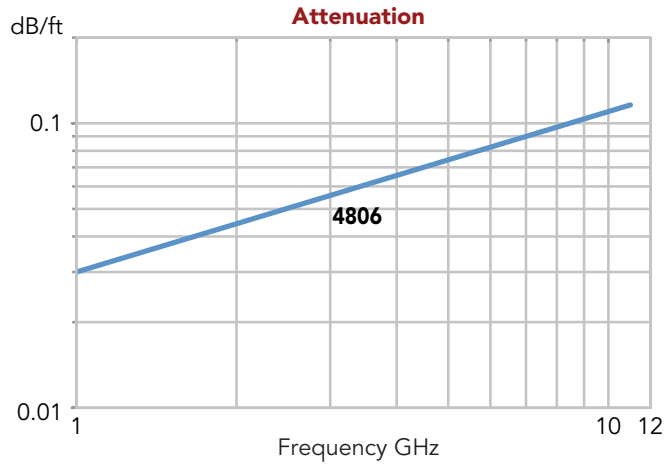
[1]+200°C available on request

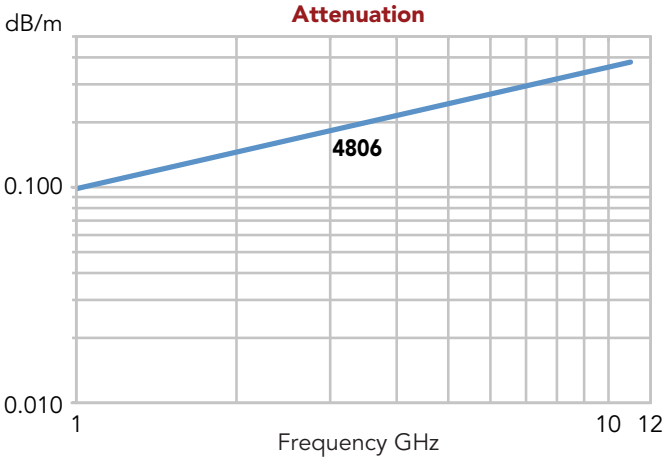
VSWR for assemblies with two straight connectors 1.35:1 to 11 GHz

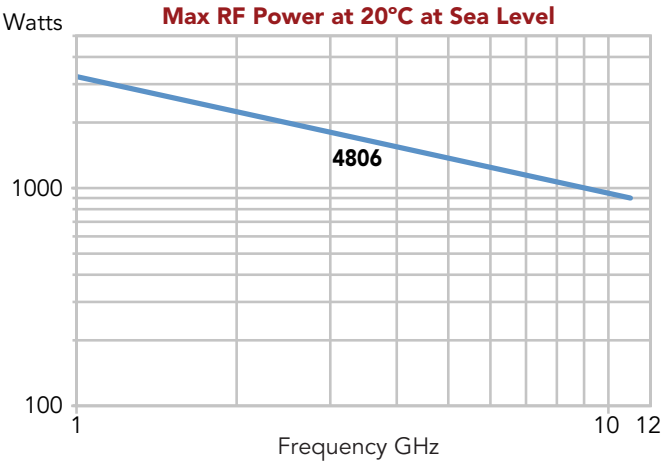
480 Series (Continued)

Attenuation (max)

	4806		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
.04	0.006	0.019	7500
1	0.030	0.098	3250
2	0.043	0.141	2260
4	0.064	0.210	1650
6	0.080	0.262	1300
8	0.095	0.312	1100
10	0.109	0.575	950
11	0.116	0.380	900







IW 75Ω Products

Insulated Wire now offers three line sizes of 75Ω cables utilizing the same technology and materials that give our 50Ω products industry leading performance.

1151/75: Small diameter cable providing lower loss than RG179 with an 0.085" line size. BNC and HD BNC connectors are available, performing up to 12 GHz; enhanced designs for 18 GHz applications will follow.

1801/75: Mid-size cable offering exceptional attenuation with Precision N and BNC connectors for applications where commodity cables cannot provide the performance required by increasing signal speeds; 1801/75 can support 12 GHz requirements, with 18 GHz connectors in development.

2801/75: Introduced to out-perform RG11 both electrically and mechanically. IW 280 series cable is a more flexible solution, intended to provide optimum attenuation performance to 18 GHz.

All three cables employ expanded PTFE™ dielectric materials with silver plated copper conductors and shielding to ensure lowest attenuation with maximum signal integrity from -55°C to +135°C.

Optional protection for Outside Broadcast applications include Low Smoke/Zero Halogen polyurethane jacketing to provide weather-proofing, and armoring options to prevent damage due to accidental damage.

Re-Flex™ Products

To provide improved electrical and mechanical performance over traditional hand-formable designs, Insulated Wire presents Re-Flex™.

Available in 0.085", 0.141" and 0.235" diameters (identified as RF085, RF141 and RF250), IW's RF cable series offers the advantages of the same lamination process used on our Low Loss products. Combined with the same double shield construction plus a solder-free tin/alloy plated outer braid, the Re-Flex™ design provides a re-formable cable that will not develop micro-fractures with repeated flexing, eliminating manufacturability issues associated with conformable style RG cables.

Both RF085 and RF141 are industry standard line sizes, consequently a wide range of connector types and styles can be used with these cables, including: SMA, TNC, N, GPO™, GPPO™, 2.92mm/K™, 2.4mm and 1.85mm/V™, with performance up to 60GHz. RF250 is commonly used for higher power applications with SMA, TNC, N, SC and HN connectors available.

Re-Flex™ assemblies can be employed wherever a semi-rigid or conformable cable type is currently used, and with FEP™ jacket available as a standard option, Re-Flex™ provides greater versatility.

Just ask our customers.

Re-Flex™ Cable - Key Performance Parameters

Cable Type	Maximum Frequency (cable only)	Attenuation (dB/ft., max)				Bend Radius (inch)	Replaces
		10 GHz	18 GHz	32 GHz	60 GHz		
RF085	62 GHz	0.60	0.91	1.28	2.01	0.125	RG405
RF141	34 GHz	0.41	0.60	0.88	-	0.250	RG402
RF250	19.5 GHz	0.29	0.44	-	-	0.375	RG401

Re-Flex™ Cable - Availability

Cable Type	AMS-DTL-23053 Jacket Available	FEP Jacket Available	Distribution Stock
RF085	Yes	Yes	SMA (m) to SMA (m) direct solder, 3" and up
RF141	Yes	Yes	SMA (m) to SMA (m) direct solder, 3" and up SMA (m) to SMA (m) shell style, 2" and up
RF250	Yes	Yes	-

RF085 Series Operating Up to 62 GHz

Center Conductor
Silver Plated
Copper

Dielectric
PTFE

Foil
Silver Plated
Copper

Braid
Tin Plated
Copper
(2.15mm 0.085")

	RF085
Electrical Characteristics	
Impedance	50 +/– 2Ω
Cut Off Frequency (cable only, max)	62 GHz
Capacitance	29 pF/ft.
Velocity of Propagation	71%
Time Delay	1.40 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB
Power Handling	See Chart
Mechanical Characteristics:	
Weight	.017 oz/ft (16g/m)
Minimum Bend Radius inches (mm)	.125" (3.175mm)
Environmental Characteristics:	
Operating Temperature Range [1]	-65°C to +165°C
RoHS (2002/95/EC)	Available on request

VSWR for assemblies with two straight connectors 1.35:1 to 18 GHz

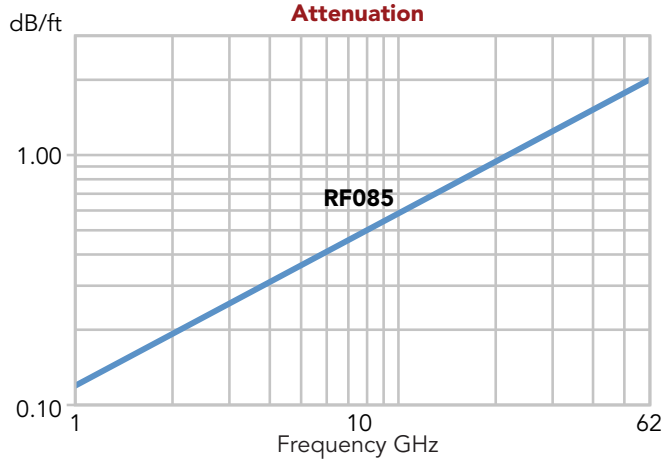
FEP Jacket available

RF085 Series (Continued)

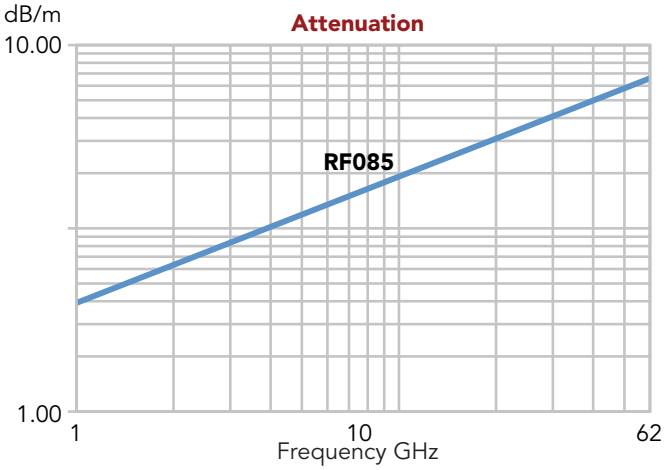
Insertion Loss

	RF085		
GHz	dB/ft.	dB/m	Power(W) @ 20°C @ Sea Level
0.04	0.12	0.39	270
1	0.19	0.63	220
2	0.28	0.92	200
4	0.41	1.34	120
6	0.51	1.68	85
8	0.61	1.98	75
10	0.69	2.26	70
12	0.77	2.51	65
14	0.84	2.75	60
16	0.91	2.98	55
18	0.98	3.20	50
20	1.04	3.42	45
22	1.10	3.62	43
24	1.17	3.82	42
26	1.23	4.02	40
28	1.28	4.21	39
30	1.34	4.40	39
32	1.40	4.58	37
34	1.45	4.76	36
36	1.51	4.94	35
38	1.56	5.11	32
40	1.61	5.28	30
42	1.66	5.45	29
44	1.71	5.62	28
46	1.76	5.79	27
48	1.81	5.95	26
50	1.86	6.11	25
52	1.91	6.27	25
54	1.96	6.43	25
56	2.01	6.59	23
58	2.06	6.74	23
60	2.10	6.90	22
62	2.15	7.05	22

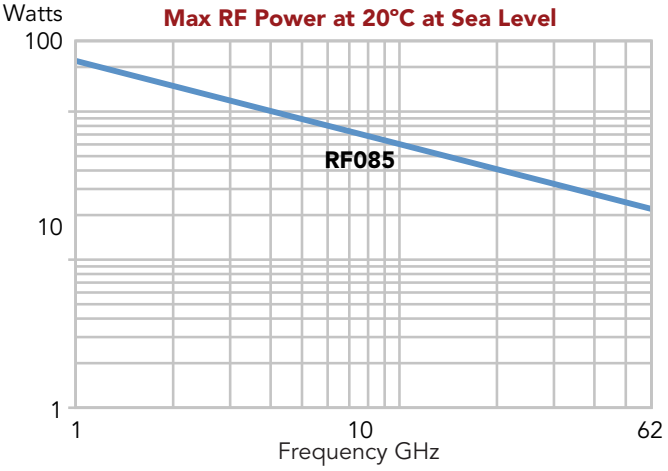
Attenuation



Attenuation



Max RF Power at 20°C at Sea Level



RF141 Series Operating Up to 34 GHz

Center Conductor
Silver Plated
Copper

Dielectric
PTFE

Foil
Silver Plated
Copper

Braid
Tin Plated
Copper
(3.58mm 0.141")

	RF141
Electrical Characteristics	
Impedance	50 +/– 2Ω
Cut Off Frequency (cable only, max)	34 GHz
Capacitance	29 pF/ft.
Velocity of Propagation	71%
Time Delay	1.40 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB
Power Handling	See Chart
Mechanical Characteristics:	
Weight	.402 oz/ft (37g/m)
Minimum Bend Radius inches (mm)	.250" (6.4mm)
Environmental Characteristics:	
Operating Temperature Range [1]	-65°C to +165°C
RoHS (2002/95/EC)	Available on request

VSWR for assemblies with two straight connectors 1.35:1 to 18 GHz

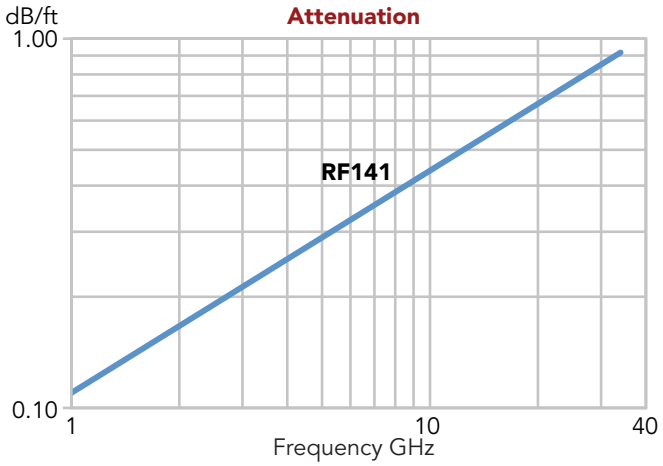
FEP Jacket available

RF141 Series (Continued)

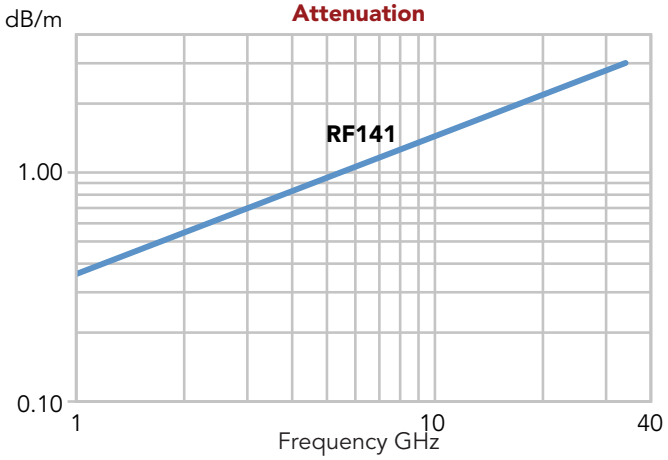
Insertion Loss

	RF141		
GHz	**dB/ft.**	**dB/m**	**Power(W) @ 20°C @ Sea Level**
0.04	0.07	0.22	700
1	0.11	0.36	500
2	0.16	0.53	350
4	0.24	0.78	240
6	0.30	0.99	190
8	0.36	1.18	160
10	0.41	1.36	150
12	0.46	1.52	140
14	0.51	1.68	130
16	0.56	1.83	120
18	0.60	1.97	110
20	0.64	2.11	100
22	0.68	2.25	90
24	0.73	2.38	80
26	0.77	2.51	70
28	0.80	2.64	60
30	0.84	2.76	50
32	0.88	2.89	40
34	0.92	3.01	30

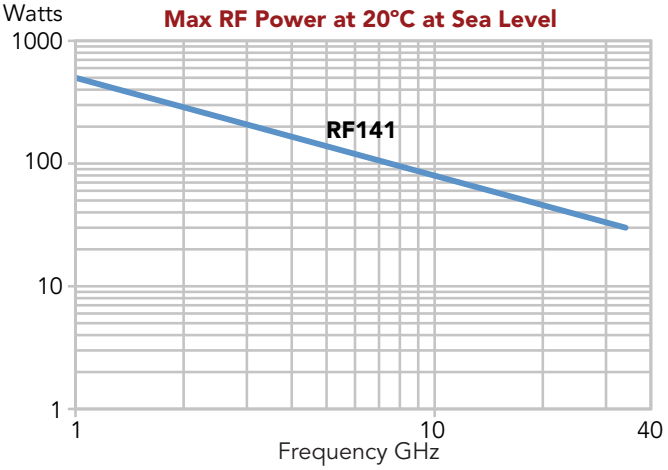
Attenuation



Attenuation



Max RF Power at 20°C at Sea Level



RF250 Series Operating Up to 18 GHz

Center Conductor
Silver Plated
Copper

Dielectric
PTFE

Foil
Silver Plated
Copper

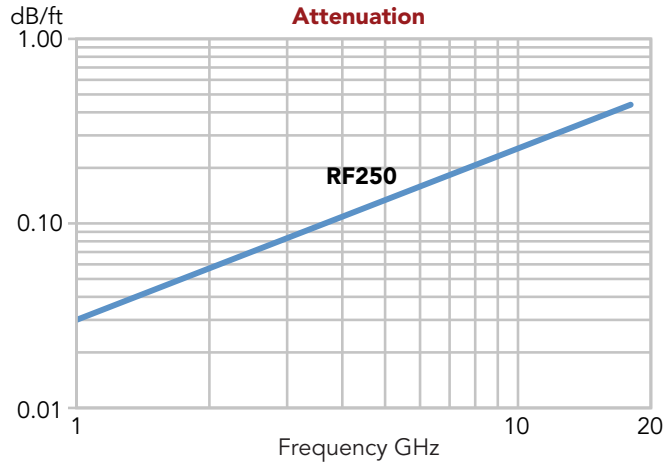
Braid
Tin Plated
Copper
(5.84mm 0.230")

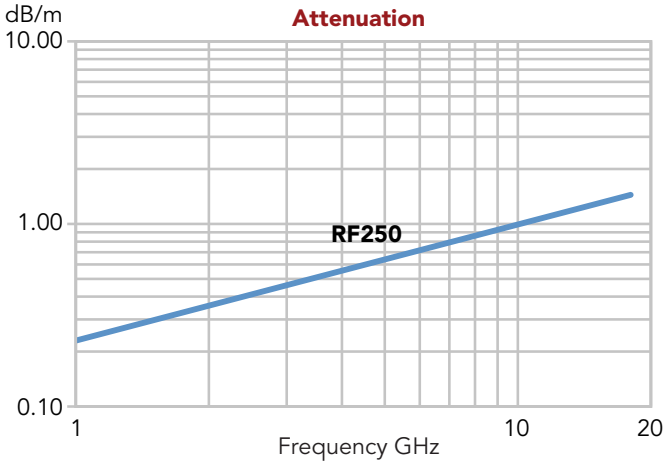
	RF250
Electrical Characteristics	
Impedance	50 +/– 2Ω
Cut Off Frequency (cable only, max)	18 GHz
Capacitance	24 pF/ft.
Velocity of Propagation	71%
Time Delay	1.22 ns/ft.
Shielding Effectiveness up to 18GHz	>90 dB
Power Handling	See Chart
Mechanical Characteristics:	
Weight	1.0 oz/ft (97g/m)
Minimum Bend Radius inches (mm)	.375" (9.5mm)
Environmental Characteristics:	
Operating Temperature Range [1]	-65°C to +165°C
RoHS (2002/95/EC)	Available on request
VSWR for assemblies with two straight connectors	1.35:1 to 18 GHz
FEP Jacket available	

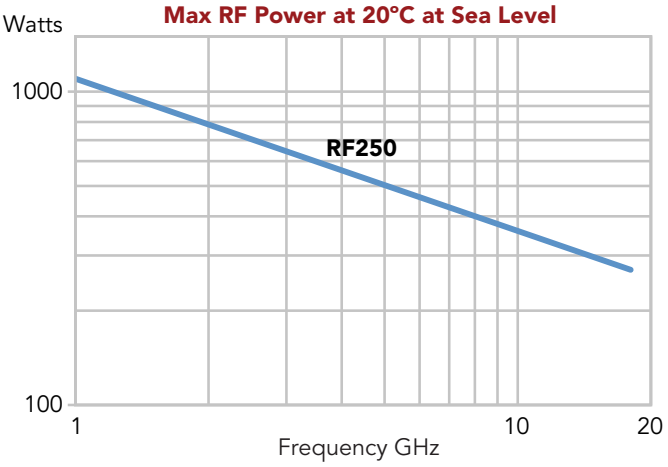
RF250 Series (Continued)

Insertion Loss

	RF250		
GHz	dB/ft.	dB/m	Power(W) @ 20°C @ Sea Level
0.04	0.03	0.10	1300
1	0.07	0.23	1100
2	0.11	0.36	800
4	0.17	0.56	520
6	0.22	0.72	450
8	0.26	0.85	380
10	0.29	0.95	350
12	0.34	1.12	310
14	0.37	1.21	300
16	0.41	1.34	280
18	0.44	1.44	270







Connector Options

This catalog lists the most common configurations for each cable type. If necessary, **IW** can modify existing designs or design a custom connector to meet your specific requirements. Our standard connectors meet the environmental specifications of MIL-PRF-39012. See table on page 34 for maximum operating frequency.

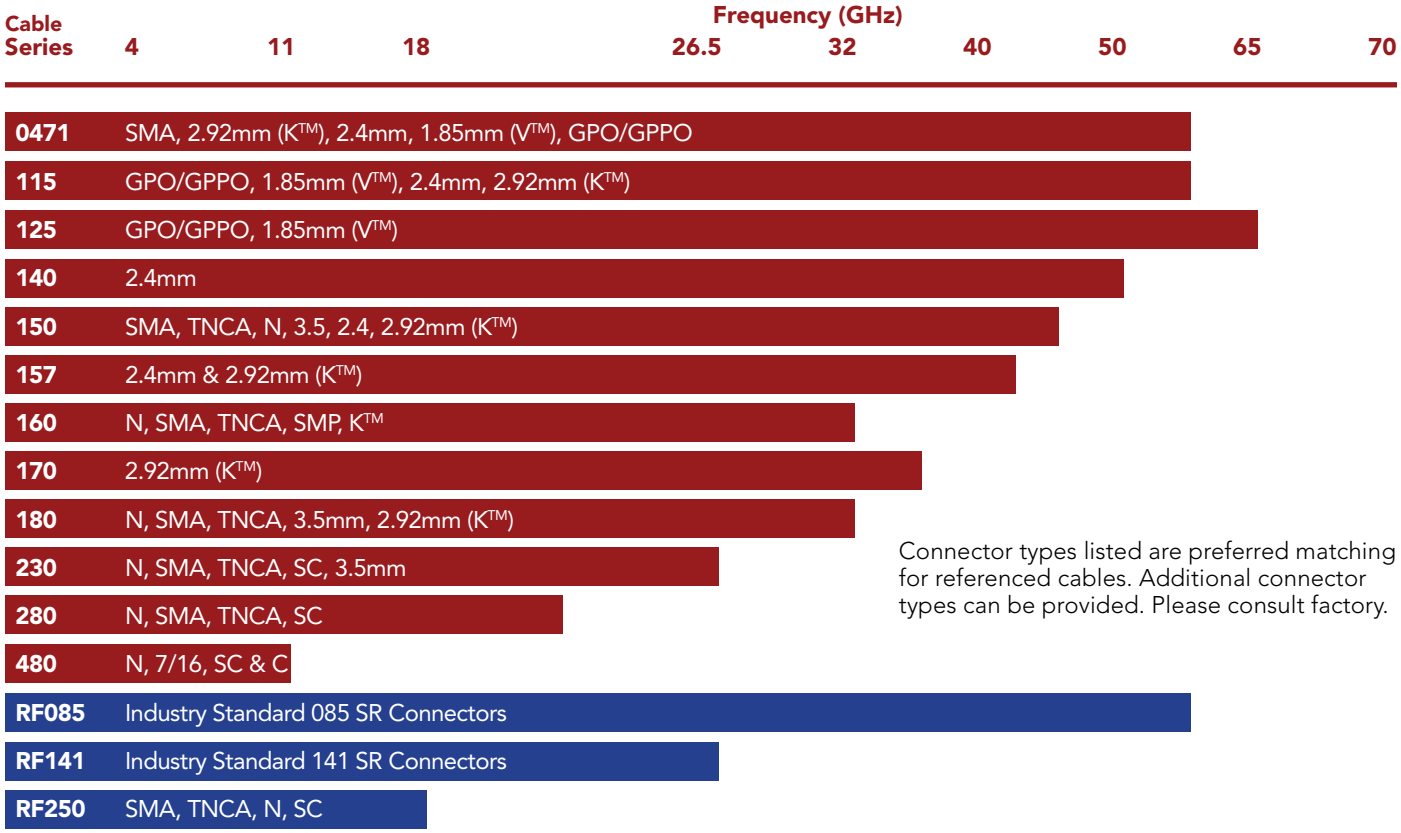
Materials & Finishes

Component	Material Specifications	Finish Specifications
Bodies	Stainless Steel per AMS-5640 UNS-S303000, Type 1	Passivation per SAE-AMS-2700
Coupling Nut	Stainless Steel per AMS-5640 UNS-S303000, Type 1	Passivation per SAE-AMS-2700
Contacts	Beryllium Copper per ASTM-B-196 Brass per ASTM-B-16	Gold Plated per ASTM-B-488 Gold Plated per ASTM-B-488
Solder Ferrule	Brass per ASTM-B-16	Gold Plated per ASTM-B-488
Dielectric	PTFE (polytetrafluoroethylene) per ASTM-D-1710 Kel-F ASTM-D-1430-03 ULTEM* (Grade 1000) *Trademark General Electric Corporation	
Gasket	Silicone Rubber per A-A-59588 Viton ASTM-D-1418	

Connector Options

continued

Choose Your Connector



Connector types listed are preferred matching for referenced cables. Additional connector types can be provided. Please consult factory.

Connector Insertion Loss (per connector) (F in GHz)

Cable Series	Connector Type	Maximum Cable Frequency (GHz)	Straight (dB)	Right Angle (dB)
0471	SMA, 2.92mm (K™), 2.4mm, 1.85mm (V™), GPO/GPPO	60	.012 x F	.017 x F
115	GPO/GPPO, 1.85mm (V™), 2.4mm, 2.92mm (K™)	60	.012 x F	.017 x F
125	GPO/GPPO, 1.85mm (V™)	67	.005 x F	N/A
140	2.4 mm	50	.01 x F	N/A
150	SMA, TNCA, N, 3.5, 2.4, 2.92mm (K™)	45	.01 x F	N/A
157	2.4mm & 2.92mm (K™)	40	.01 x F	N/A
160	N, SMA, TNCA, SMP, K™	22	.012 x F	.017 x F
170	2.92mm (K™)	18	.012 x F	.017 x F
180	N, SMA, TNCA 3.5 mm/2.92mm (K™)	18 26.5	.012 x F .01 x F	.017 x F N/A
230	N, SMA, TNCA, SC 3.5 mm	18 26.5	.012 x F .01 x F	.017 x F N/A
280	N, SMA, TNCA, SC	22	.012 x F	.017 x F
480	N, 7/16, SC & C	11	.012 x F	.017 x F
RF085	Industry Standard 085 SR Connectors	60	.012 x F	.017 x F
RF141	Industry Standard 141 SR Connectors	26.5	.01 x F	N/A
RF250	SMA, TNCA, N, SC	18	.012 x F	.017 x F

Cable Assembly Part Number Builder

Connector Codes

B	BNC
G	GPO
GG	GPPO
K	2.92 mm (K™)
MB	SMB
MC	SMC
N	N
O	OSP*/BMA
S	SMA
SC	SC
SS	SSMA
T	TNCA
V	1.85 mm (V™)
Z1	ZMA-90°
Z2	ZMA-120°
Z3	ZMA-130/130/100
Z4	ZMA-110/110/140
7	7 mm
3	3.5 mm
2	2.4 mm

* OSP is a trademark of MA/COM

Type Codes

J	Jack
P	Plug

Style Codes

B	Bulkhead mount
O	Obtuse angle (135˚)
P2	2 hole panel mount
P4	4 hole panel mount
R	Right angle
RW	Right angle w/ wire holes
RX	Extended right angle
S	Straight
SD	Straight Direct Solder
SH	Shell type
SW	Straight w/ wire holes

Optional Protection

(see page 34)

A	Stainless steel flexible armor
N	Black neoprene jacket
X	Nomex
LC	Low smoke, zero halogen polyurethane

† LC – LS/ZH jacket is available for 140-480 series cables, including 03/06/08; not recommended for Re Flex™. LC jacket can be combined with external armor code 'A' for maximum crush resistance in outdoor environments.

†† Neoprene, 'N' can be applied to all cable types.

Please consult the factory for custom/ application specific jacket requirements.

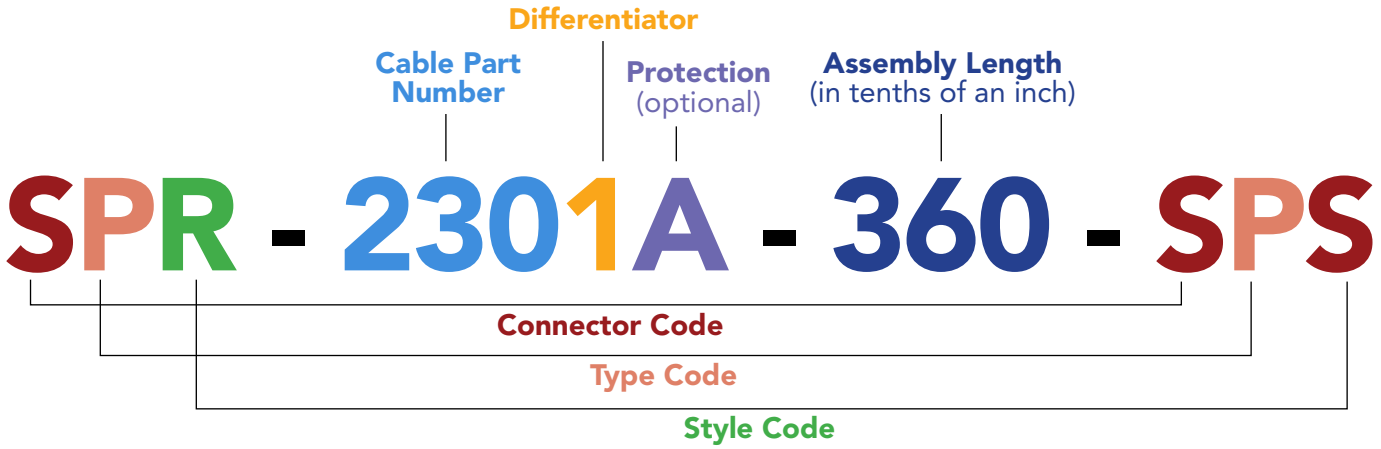
Differentiator Codes

1	Solid center conductor
3	Tuf-Flex™ solid center conductor
6	Stranded conductor
8	Tuf-Flex™ stranded center conductor

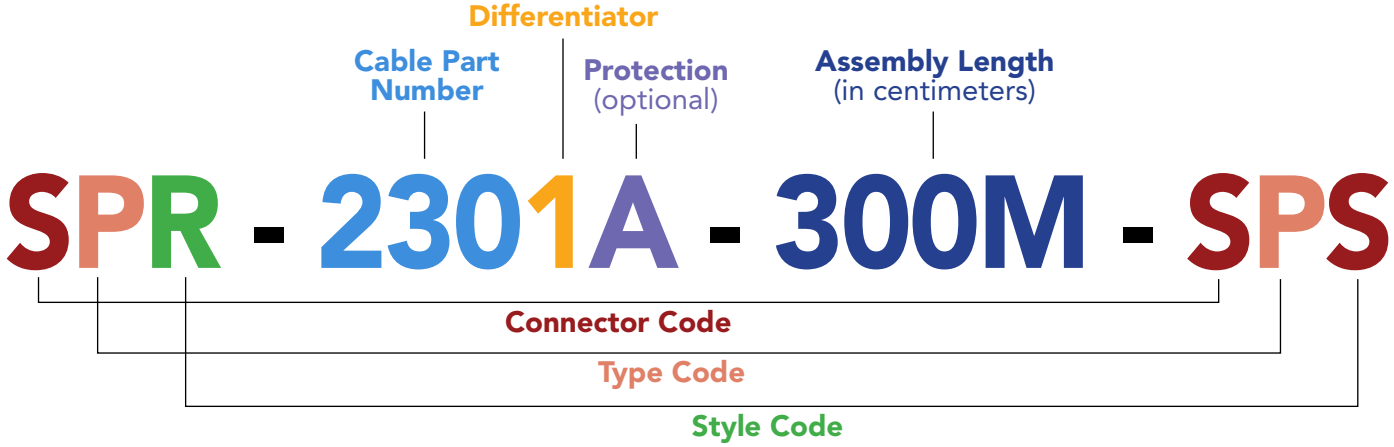
Cable Assembly Part Number Builder

With so many variables involved in creating custom wires for multiple purposes, IW has devised an Part Number (P/N) Coding System which we use to readily identify all our microwave cables. In the first example part number below, the cable assembly is an SMA right angle plug to a 2301 armored cable at 36" long to an SMA straight plug.

STANDARD PART NUMBER

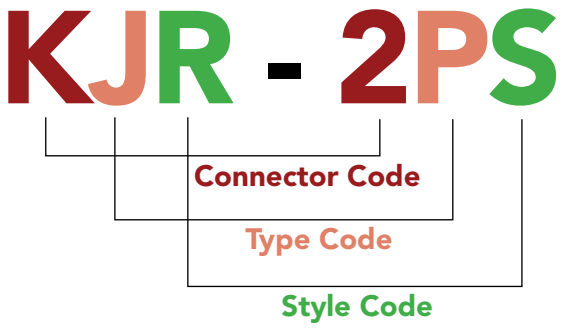


METRIC PART NUMBER



Note: Metric part number format is X.XX meters – 300M defines a 3m lengthassembly; a 10m assembly part number with the same connectors as shown above is SPR-2301A-1000M-SPS

ADAPTER PART NUMBER



Assembly Length Definition

The outlines below show typical cable assembly configurations and reference points to determine overall length.

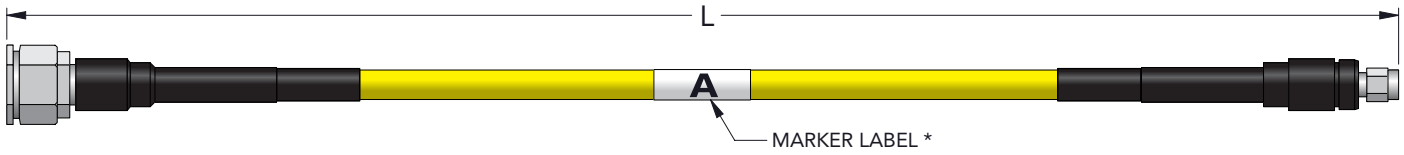


Fig. 1 – NPS-XXXX-XXX-SPS

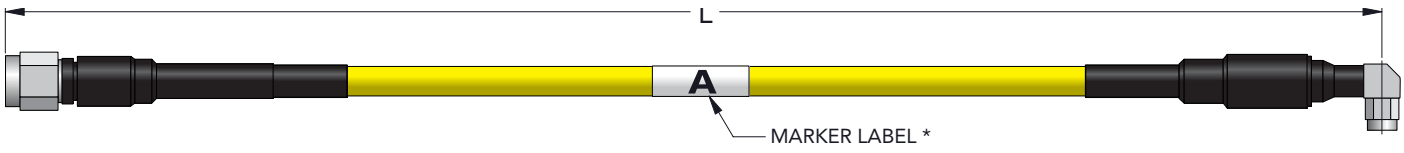


Fig. 2 – TPS-XXXX-XXX-SPRC

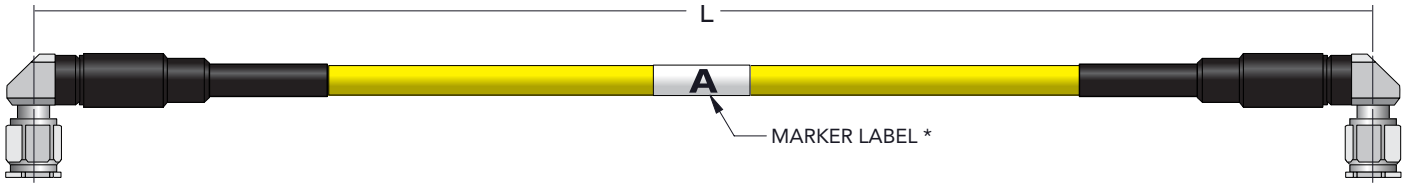


Fig. 3 – TPR-XXXX-XXX-TPR

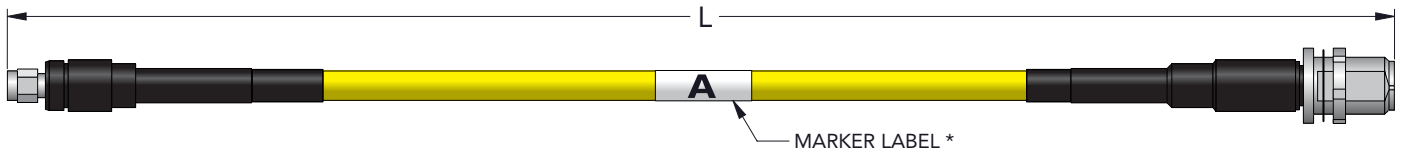
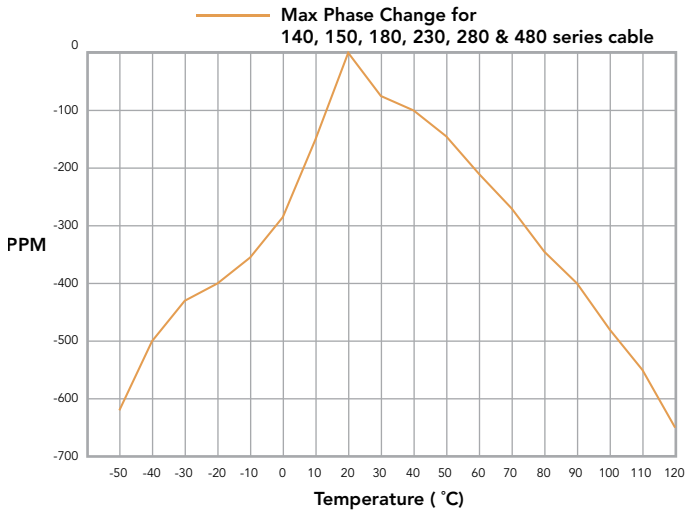
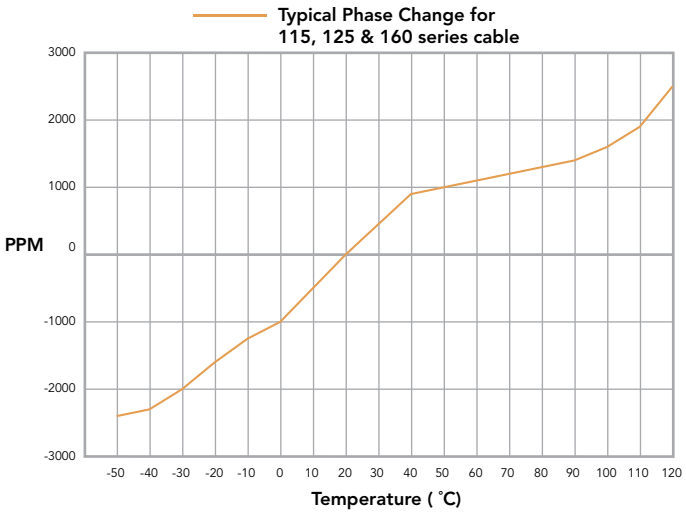


Fig. 4 – SPS-XXXX-XXX-NJB

* A center traceability marker label is fitted to all assemblies over 6" in length; two markers located close to the cable ends are fitted for asemblies greater than 10ft./120"/3m.

Phase Characteristics





Determination of Phase Change Over Temperature

The following example illustrates how to calculate the change in phase (and the tracking error) of cable assemblies over a specific temperature range. In this example, the cable is IW 2801, and the temperature range is -40˚C to +80˚C.

* determined by the charts above

** tracking error of two or more assemblies of the same type

1. Calculate electrical length
2. Calculate change in phase
3. Calculate tracking error

Frequency	=	10 GHz	f
Assembly length	=	72 in	L
Start temp	=	20˚C	T
Dielectric const	=	1.4	e
Change in PPM	=	-500*	PPM
PPM tracking error	=	±100*	PPM tracking
Electrical length	=	TBD	F
Change in phase	=	TBD	DF
Tracking error	=	TBD**	F tracking

Phase Change with Flexing

Phase change when flexing will be slightly different depending on the particular cable. Larger cables have more dielectric and greater internal forces, thus phase change will be greater for cables with larger diameters. When wrapped 360˚ around a 4 inch diameter mandrel, the phase change will be:

±0.30˚ • f - for cables 480, 280, 230 & 180

±0.20˚ • f - for cables 150 and 140

$$\Phi = \frac{L \cdot \sqrt{e} \cdot f \cdot 360}{11.808}$$

$$\Phi = \frac{72 \cdot \sqrt{1.4} \cdot 10 \cdot 360}{11.808} = 25,973^{\circ}$$

$$\Delta\Phi = \frac{\Phi \cdot PPM}{1,000,000}$$

$$\Delta\Phi = \frac{25973 \cdot (-500)}{1,000,000} = -12.93^{\circ}$$

$$\Phi_{tracking} = \frac{\Phi \cdot (PPM\ tracking)}{1,000,000}$$

$$\Phi_{tracking} = \frac{25973 \cdot (\pm 100)}{1,000,000} = \pm 2.6^{\circ}$$

Phase Match and Time Delay

For applications where phase or electrical length is a critical performance parameter, IW can provide matched assembly sets, tested to customer specifications, typically up to 40 GHz, with both Low Loss Phase Stable and Re-Flex™ cable types.

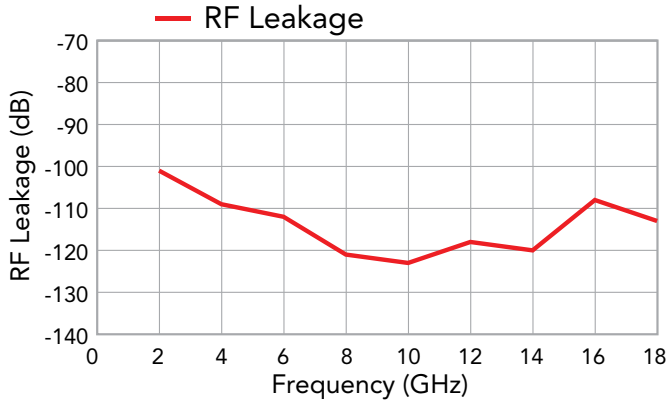
Relative phase matching is a common requirement achieved with multiple assembly sets. Typical phase matching tolerances are shown in Table 1 below.

Frequency (GHz)	Phase Match (degrees)
10	± 2
18	± 3.5
26.5	± 5
40	± 8

Tighter tolerances may be achievable; IW engineers review all matching requirements on a case by case basis. In addition, IW also provides time delay matched assemblies with tolerances in the order of 2pS being achievable with both Low Loss and Re-Flex™ cable types, and individual assemblies can also be supplied trimmed to a specific electrical length.

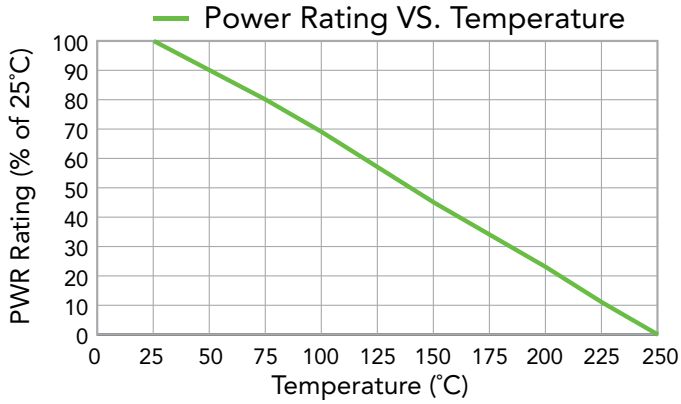
All matched assemblies are tested 100% for insertion loss and VSWR performance parameters in addition to phase.

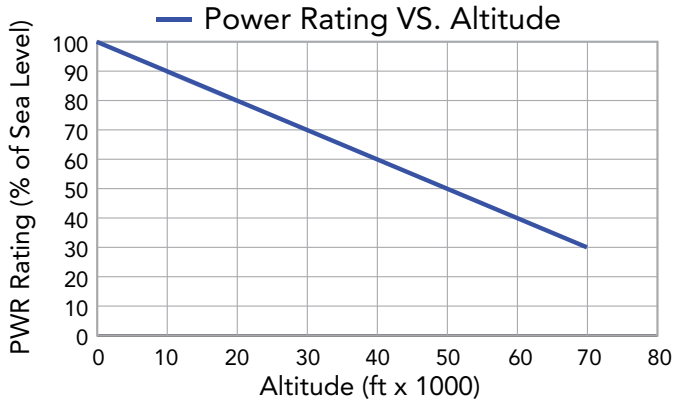
RF Leakage (IW 1801)



Measured values of IW 1801 cable using the test method specified in MIL-T-81490.

Power Rating





Insertion Loss vs. Temperature

$$dB_T = \alpha 20 \sqrt{.0038\ (T\text{-}20) + 1}$$

Use this equation to determine cable loss (dBT) at any temperature (T) in degrees Celcius. $\alpha 20$ is the cable loss at 20°C

Coaxial Transmission Line Equations

Impedance (Ω)

$$Z_o = \frac{138.059}{\sqrt{\varepsilon}} \cdot \log_{10}\left(\frac{D}{d}\right)$$

Cut Off Frequency (GHz)

$$f_{co} = \frac{7.52}{\sqrt{\varepsilon} \cdot (D + d)}$$

Velocity of Propogation (%)

$$V\rho = \frac{100}{\sqrt{\varepsilon}}$$

Outer Conductor Loss (dB)

$$A_c = \frac{2.745 \cdot 10^{-4}}{Zo} \sqrt{\rho f} \left(\frac{K_o l}{D}\right)$$

Inner Conductor Loss (dB)

$$A_c = \frac{2.745 \cdot 10^{-4}}{Zo} \sqrt{\rho f} \left(\frac{K_i l}{D}\right)$$

Dielectric Loss (dB)

$$A_d = (23.15 \cdot 10^{-10}) \cdot \sqrt{\varepsilon} \cdot f \cdot \tan\delta \cdot l$$

Reflection Loss (dB)

$$A_r = 10 \log_{10}\left[\frac{(VSWR + 1)^2}{4(VSWR)}\right]$$

Time Delay (ns/ft)

$$TD = 1.016 \sqrt{\varepsilon}$$

Capacitance (pf/ft)

$$C = \frac{1.016 \sqrt{\varepsilon}}{Z}$$

D = Inner diameter of outer conductor (inches)
d = Outer diameter of inner conductor (inches)
ε = Dielectric constant
ρ = Resistivity in Ohm-cm
f = Frequency in Hertz
l = Length in inches
Z_o = Characteristic impedance
K_o = Outer conductor stranding factor
K_i = Inner conductor stranding factor
$\tan\delta$ = Loss tangent of dielectric

Tuf-Flex™ Cable Performance

IW's range of Tuf-Flex™ cables was introduced to provide a high level of crush resistance for applications where an unarmored cable could be subject to damage, e.g. long assemblies used in a test chamber; down-mast, air frame, etc. where a cable needs to be secured in position and could be subject to high levels of vibration.

The following tables show the results of crush and bend tests performed on IW's Tuf-Flex™ internally ruggedized cable. The test samples were 2ft. overall length, using 1803 cable. Results show maximum VSWR and Insertion Loss, tested across a frequency range of 40 MHz to 18 GHz. The test sample was placed between two 1" diameter plates with the force applied to the top plate.

Tuf-Flex™ Cable Performance
Crush Resistance

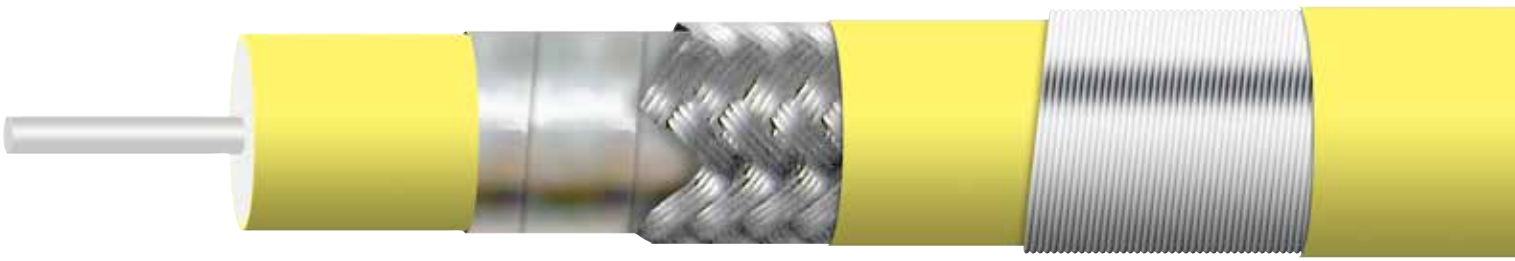
Force (lbs.)	1803 Cable	
	VSWR (max.)	Insertions Loss dB (max.)
0	1.32	1.1
80	1.32	1.1
160	1.32	1.1
200	1.32	1.1
250	1.35	1.1
300	1.43	1.2

The same cable was tested to measure performance with successively tighter bend radii.

Tuf-Flex™ Cable Performance
Bend Radius

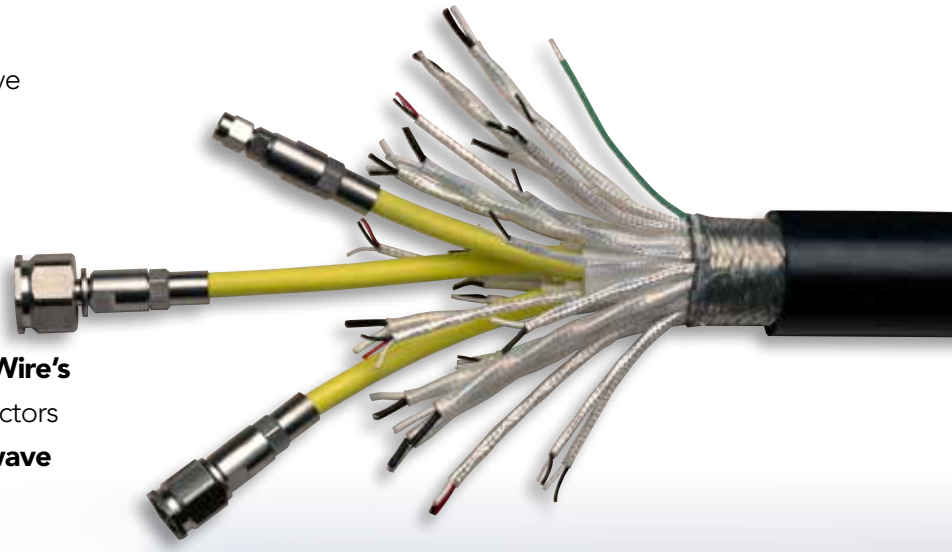
Bend Radius (inches)	1803 Cable	
	VSWR (max.)	Insertions Loss dB (max.)
Straight	1.25	1.1
1/4	1.25	1.1
1/8	1.32	1.1
Straight	1.25	1.1

The serving used to create the armor not only provides excellent crush resistance, but maintains the concentricity of the cable as it is flexed through a radius, enabling RF performance to be maintained.



Cable Capabilities

IW Microwave Products Division has the capability to supply composite RF & microwave assemblies for various applications including marine platforms such as submarines. One example is a multicable type assembly which includes twisted pair, twisted triple, 16AWG and custom coaxial cable.



The bulk cable is manufactured at **Insulated Wire's** Long Island, NY facility with the coaxial connectors and cable assemblies prepared at **IW Microwave Products Division** facility in Bethel, CT.

Mechanical Construction

IW's composite cables provide a myriad of options. Components can include individually shielded and jacketed signal transmission cables, power cables, microwave cables and fiber optic. Depending on the application, cables can be optimized to address issues such as hydrostatic pressure, tensile loads, concentrated compression points, etc. Overall shielding can be provided with ferrous or non-ferrous materials. High performance, non-metallic braids and strength members, such as Kevlar™ are also available.

The cable shown here was produced for a submarine application and contains multiple, individual signal cables and IW's Tuf-Flex™ microwave cables for use at frequencies up to 18 GHz. Water block fillers and binders are incorporated under a double braided Sn/Cu braid and polyurethane jacket. Cable withstands the anticipated environmental extremes in accordance with the method requirements of MIL-DTL-24643B par 4.8.8 and can withstand hydrostatic pressure up to 1050psi.

IW provides hands on service to install and troubleshoot cabling, like this complex wire created for the US Navy.

Cable Handling

The following contains a list of precautions and procedures that should be taken when handling or installing Insulated Wire cable assemblies. They should be used as guidelines and followed whenever possible. By doing this you can ensure a long assembly life which requires virtually no maintenance.

Handle cable with care:
IW cable assemblies are designed to operate at the highest electrical performance level. High performance cables such as these require special handling procedures to ensure optimum electrical performance. Many of these handling procedures are outlined in detail, however taking just a few basic preventative measures during handling can significantly extend the life of the assembly. You should always take care to prevent anything from being placed on an assembly. This could result in internal damage caused by compression. Also, prevent the cable from bending below it's minimum bend radius as this will cause the cable to kink, which results in internal damage and subsequent degradation in RF perfomance.

Limit bend radius whenever possible:
Although IW cable assemblies can accommodate a very small bend radius, it is recommended to use the widest possible radius to fit the application. This will help to keep mechanical stresses low through the bend and prolong the life of the assembly.

Avoid torquing down connector ends until both connectors are mated in position:
It is important to first hand tighten both connectors into position before any torque is applied. If a connector is torqued down before the assembly is routed into position, excessive torsion could be applied at the torqued connector's termination during the routing. These torsion forces could cause the dielectric to change its mechanical position at the connector termination. This could ultimately lead to an electrical failure.

Avoid twisting assembly to orient connectors:
When installing assemblies with right angle connectors, do not twist the cable or connectors to orient with the mating connectors. Twisting the assembly could result in mechanically changing the dielectric position at the termination and ultimately lead to an electrical failure. Assemblies should be purchased with a specific connector offset angle to match the proper mating connector. If an offset angle needs to be changed during assembly installation, proper adjustment procedures can be obtained by calling IW's Technical Support.

Avoid bending the assembly at the connector termination:
A cable assembly should never be bent at the back of the connector. Applying a bend prematurely at the end of an assembly and allowing the bend to encompass the connector could lead to the build up of excessive cable forces against the connector and through the bend area. The applied forces will cause the cable to kink. Electrical degradation and possible failure may result.

Avoid pulling an assembly through channeling by the connector end:
Never pull an assembly by its connector when routing it through a structure, channeling or building. Doing this could mechanically damage the connector termination. The assembly should always be pulled by the cable itself. Furthermore, the installation should be assisted by pushing the assembly through the channeling while the cable is pulled. Additionally, it is less stressful to the assembly if it is installed in phases (through individual sections) rather than a single run across the entire routing length.

Never allow an assembly to support its own weight when routed in a vertical installation:
Never allow an assembly to hang freely by its own weight. Clamp down the cable at equal intervals along its length. Cable hangers can be used when it is not possible to clamp down the assembly in a vertical installation provided the assembly has been reinforced for such an installation. Using multiple hangers whenever possible is also recommended to help evenly distribute the assembly's weight along the run.

Avoid the use of cable ties:
Most high performance cables use an air filled dielectric core. This makes the cable very soft. Therefore any compressive load applied to the cable has the potential of collapsing the dielectric core within the cable. Cable ties and tie wraps are not recommended for this reason. They offer virtually no load distribution and consequently focus very high compressive forces through the tied down area. A concentrated force such as this almost always deforms the cable and significantly degrades assembly performance. For best holding results with minimal clamping forces, IW recommends rubberized clamps. Be sure to select a clamp that will apply a minimum amount of compression force while still offering the desired holding strength. Selecting a clamp that it too small can do as much damage to an assembly as a cable tie.

Avoid subjecting the connector ends to cable axial loads:
Cable assembly life can be increased by clamping down the cable a few inches from the connector ends in applications where the cable will be moving (such as a moving antenna) or where a high vibration condition exists. Clamping the cable down at the cable ends reduces mechanical loads applied to the connector when the cable is moved.

Always wrap connectors in weather proofing when installing outside:
All cable connections that will be subjected to rain and snow should be wrapped in a weather proofing material. A self fusing silicone tape is recommend to create a weather tight seal over the connection. If weather precautions are not taken, water will eventually work its way into the connector assembly causing high insertion losses.

Always provide adequate drip loops:
Always allow for a drip loop in outside applications to prevent water from flowing down the cable and onto the connector. Over time the water could work its way into the connector assembly causing high insertion losses.

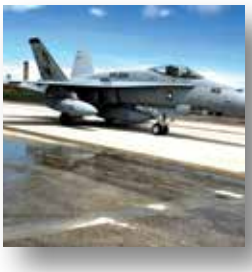
Take extra care on short assemblies:

- Always bend assemblies around mandrels whenever possible.
- The use of mandrels or wheels will help to evenly distribute bending loads applied to the cable. This is the preferred method for bending cables.
- Take caution when bending cables by hand.
- Sometimes bending a cable by hand is the only option. In this case the following method should be used:
- Start at bending point keeping hands close together.
- Bend the cable a little at a time working in an outward direction along the bend.
- Return to the center point of the bend and work in an outward direction making the bend a little tighter.
- Continue to return to the center of the bend, and working outward until the desired bend is reached.

Take caution bending cables under 12" in length.
An assembly that is 12" in length and smaller can be very rigid depending on the cable type. The cable becomes rigid because its inner and outer conductors are fully (mechanically) terminated to the cable connectors. The cable is terminated this way to yield maximum electrical performance. Unfortunately, it minimizes the bending characteristics of the assembly because the cable is too short to accommodate the total material volume displacement needed for a typical bend. Often, the minimum bend radius can not be achieved without damaging the assembly. Therefore, short cables should only be used in applications where slight jogging bends will be used. A longer assembly that uses a service loop should be considered as a replacement for a short cable in situation where a tight or sharp bend is needed.

Markets Served

- Aerospace
- Sub-Surface
- SatCom
- Missiles
- Ground Vehicles
- High End Audio
- Tactical Data Links
- IFF Systems
- CIWS
- UAVs
- Medical Electronics
- ECMs
- Geothermal Exploration
- Instrumentation
- High End Broadcast
- Telecommunications












INSULATED
WIRE
INCORPORATED

Bulk Cable & Wire Sales
Insulated Wire Inc.
960 Sylvan Avenue, Bayport, NY 11705
Tel: 631-472-4070 • Fax: 631 472 4071

Cable Assemblies
Insulated Wire
Microwave Products Division
2C Parklawn Drive, Bethel, CT 06801
Tel: 203-791-1999 • Fax: 203 748 5217

Visit our website for contact information on your local representative at:
www.iw-microwave.com/contact_us
Please don't hesitate to contact IW directly if you are unable to locate a representative in your area.

AS9100 & ISO 9001: 2008 Certified