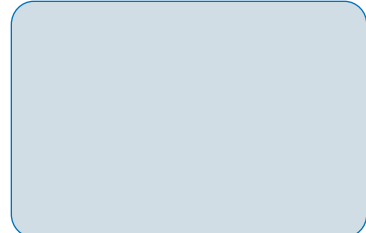
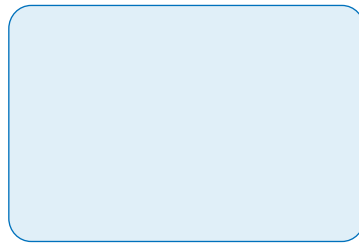
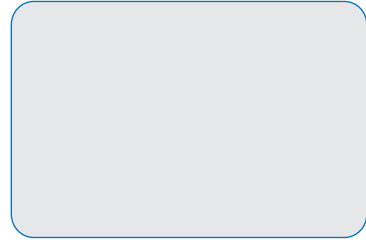


# Microwave Cable Products



# HeliFoil®



## Features & Benefits:

- Lowest Insertion Loss Available, DC-18GHz
- Ultra Stable Loss, Phase and VSWR with Flexing
- Excellent Phase Tracking Performance over Temperature
- Extremely Flexible, Low Minimum Bend Radius
- Superior Shielding Effectiveness (>100 dB)

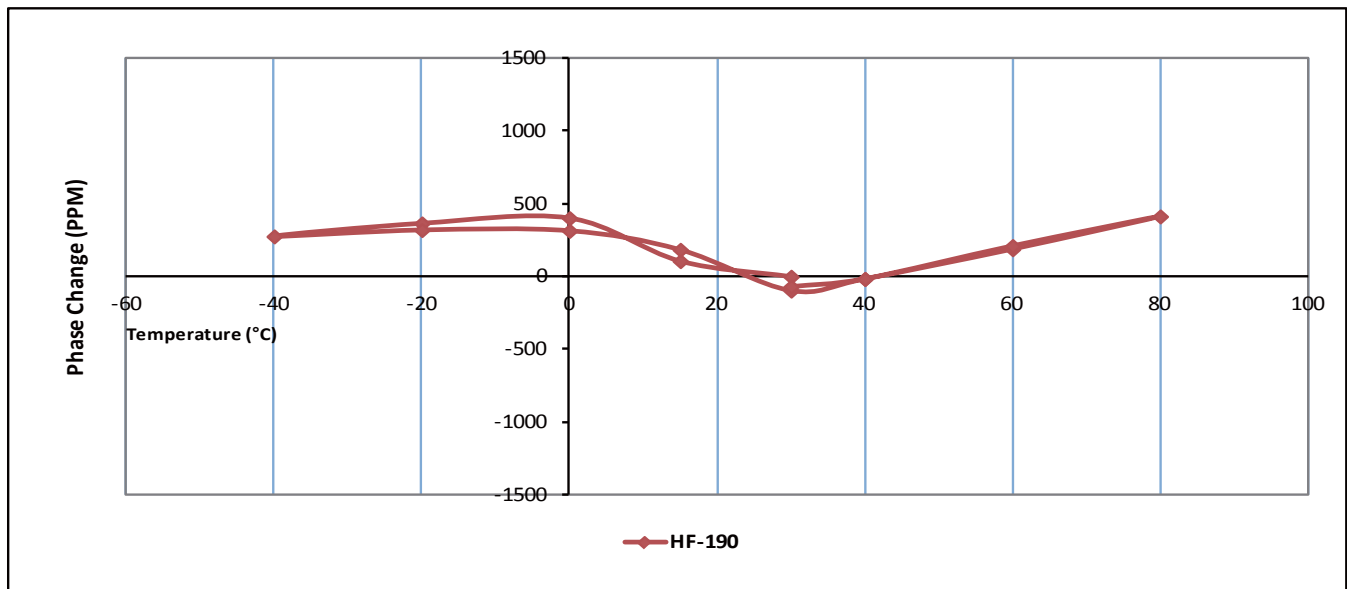
HeliFoil® ultra low loss, flexible microwave coaxial cable and assemblies provide excellent performance over the DC-18 GHz frequency range. HeliFoil® cable comes in four different sizes, with options of stranded center conductors for better flexibility. All sizes provide lowest attenuation, excellent phase stability, broad operating temperature range and high power handling making them a good choice for interconnect and testing applications in both field and laboratory conditions.

Installation of the connectors requires induction soldering and is only recommended for experienced assembly shops. Custom assemblies can be provided to meet your requirements.

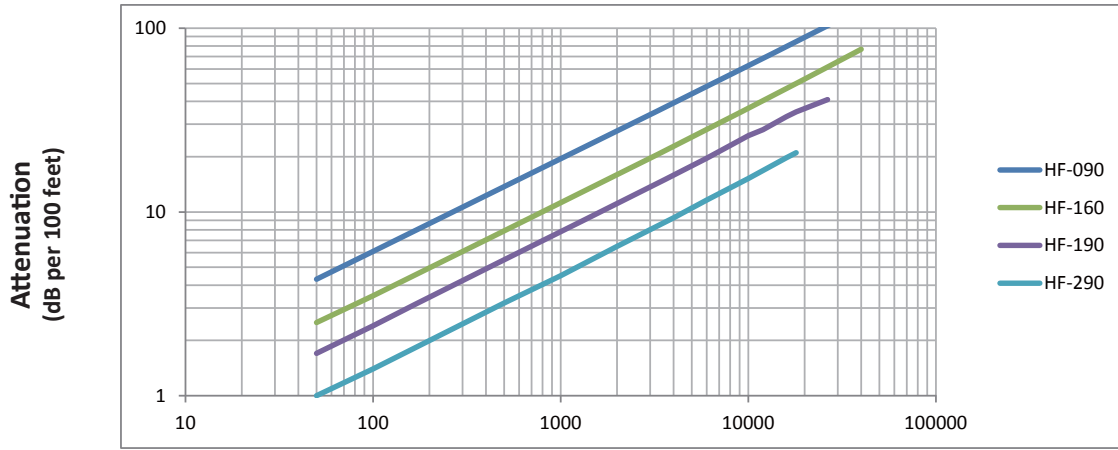
Cable	AA number MI Number	Conductor in (mm)	Dielectric in (mm)	Shields in (mm)	Outer braid in (mm)	Jacket in (mm)	Weight lb/ft (kg/m)	Impedance ohms Vp (%)	Capacitance pF/ft (pF/m)	Temp. Range F (°C)	Min.Bend Radius in (mm)	Cut-off Frequency (GHz)
HF-090	AA-11892 510-0145	SC	PTFE	SC	SC	Blue FEP	0.010	50 +/-1	24.6	-67 +342	0.38	80.80
		0.020	0.056	0.063	0.077	0.087	(0.015)	80%	(80.7)	(-55 +150)	(9.65)	
		0.51	1.42	1.60	1.96	2.21						
HF-160	AA-11594 510-0101	SC	PTFE	SC	SC	Blue FEP	0.025	50 +/-1	25.4	-67 +342	0.75	42.68
		0.036	0.105	0.112	0.130	0.150	(0.038)	80%	(83.3)	(-55 +150)	(19.05)	
		0.91	2.67	2.84	3.30	3.81						
HF-190	AA-9185 51881	SC	PTFE	SC	SC	Blue FEP	0.042	50 +/-1	24.0	-67 +342	1.00	31.25
		0.052	0.145	0.158	0.175	0.197	(0.063)	81%	(78.7)	(-55 +150)	(25.4)	
		1.32	3.68	4.01	4.45	5.00						
HF-290	AA-9186 51909	SC	PTFE	SC	SC	Blue FEP	0.092	50 +/-1	24.6	-67 +342	1.50	18.96
		0.088	0.240	0.255	0.273	0.301	(0.138)	82%	(80.7)	(-55 +150)	(38.1)	
		2.24	6.10	6.48	6.93	7.65						

\* PUR Jacket is available as an option, for detailed information please consult the factory.

## HF-190 Phase Change vs. Temperature



### Attenuation vs. Frequency (Typical)

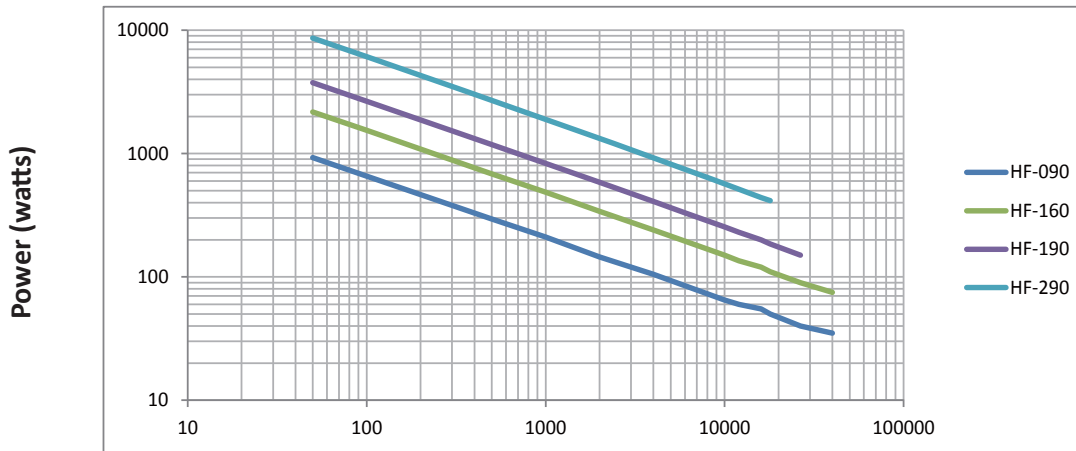


### Frequency (MHz)

Frequency (MHz)	50	100	500	1,000	2,000	4,000	6,000	10,000	12,000	16,000	18,000	26,500	40,000	K1	K2
HF-090	4.3	6.1	13.7	19.5	27.6	39.2	48.1	62.5	68.6	79.5	84.4	103.1	127.6	0.61100	0.00014
HF-160	2.5	3.5	7.9	11.2	15.9	22.8	28.1	36.6	40.3	46.9	50.0	61.4	76.8	0.34880	0.00018
HF-190	1.7	2.4	5.5	7.8	11.1	15.9	19.6	26.0	28.0	33.0	35.0	40.9		0.24210	0.00014
HF-290	1.0	1.4	3.2	4.5	6.5	9.3	11.6	15.2	16.8	19.7	21.0			0.13896	0.00013

Attenuation at Any Frequency = [ k1 x SQRT (Fmhz)] + [ k2 x Fmhz ]; dB per 100 feet

### Power Handling vs. Frequency (Maximum)



### Frequency (MHz)

Frequency (MHz)	50	100	500	1,000	2,000	4,000	6,000	10,000	12,000	16,000	18,000	26,500	40,000
HF-090	930	655	295	210	145	105	85	65	60	55	50	40	35
HF-160	2175	1540	685	485	340	240	195	150	135	120	110	90	75
HF-190	3765	2660	1180	830	585	410	330	255	230	200	185	150	
HF-290	8645	6100	2700	1895	1325	925	745	570	515	440	415		

Watts; Sea Level; Ambient +40 C VSWR 1:1

# StripFlex<sup>®</sup>-II (SFT)

## Features & Benefits

- Lower Loss than SF Versions
- Superior Shielding Effectiveness
- Low Passive Intermod (-155dBc)
- Stable Loss & VSWR vs. Flexing
- Excellent Connector Selection



SFT cables provides the ultimate performance in a flexible cable. The low density PTFE tape dielectric provides the lowest dielectric loss of any practical dielectric and silver plated conductors make these the ideal choice for microwave applications and other commercial interconnect systems.

The high temperature dielectric and jacket enable their use in high ambient temperature up to +200C. They have losses slightly smaller than their low temperature TCOM counterparts as well as high power handling capability.

The Shielding systems, pioneered by Times Microwave Systems in the mid-sixties, consists of an inner silver plated ribbon braid (FSC), a spirally applied and overlapped composite aluminum tape interlayer (Intl), and an overall silver plated round wire braid (SC). The flat ribbon shield affords approximately 30% lower loss and >95 Db shielding compared with the typical M17/RG round wire braided shield (40 to 60 dB).

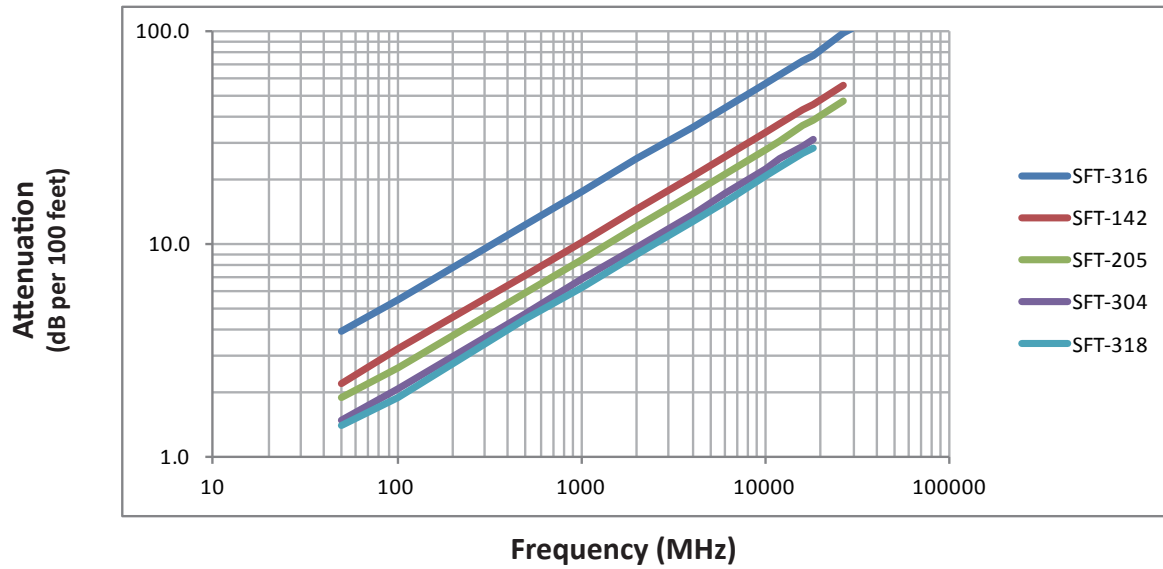
Standard M17/RG cables are shielded with high coverage single or double round wire braids. While these shields provide 40 dB and 60 dB shielding effectiveness respectively. They are not particularly stable (loss & VSWR) nor is the shielding adequate for today's sensitive wireless communications.

VSWR is lower since the flat ribbon can be applied over the dielectric much more uniformly than multi-end round wire braids. The VSWR and attenuation variation due to aging and flexure is substantially lower at all frequencies, and especially above 12 GHz. StripFlex-II cables are also available from Times that have been sweep tested for broadband VSWR and attenuation performance. Please contact the factory with your specific requirements.

A good selection of standard interface connectors (crimp or clamp style) are available. SFT cable can be purchased in bulk reels or as preterminated and tested cable assemblies.

Cable	AA number MI Number	Conductor in (mm)	Dielectric in (mm)	inner Shield in (mm)	Interlayer in (mm)	Outer Shield in (mm)	Jacket in (mm)	Weight lb/ft (kg/m)	Impedance ohms Vp (%)	Capacitance pF/ft (pF/m)	Temp. Range F (C)	Min.Bend Radius in (mm)	Cut-off Frequency (GHz)
SFT-316	AA-8649 51743	SC 0.023 (0.57)	LDPTFE 0.068 (1.73)	FSC 0.078 (1.98)	Al/Kapton 0.083 (1.85)	SC 0.096 (2.44)	Blue FEP 0.120 (3.05)	0.018 (0.027)	50+/-1 76%	26.7 (87.6)	-67 +392 (-55 +200)	0.50 (12.7)	62.95
SFT-142	AA-8650 51742	SC 0.040 (1.02)	LDPTFE 0.121 (3.07)	FSC 0.131 (3.33)	Al/Kapton 0.136 (3.48)	SC 0.158 4.01	Blue FEP 0.180 (4.57)	0.036 (0.054)	50+/-1 76%	26.7 (87.6)	-67 +392 (-55 +200)	0.75 (19.1)	35.40
SFT-205	AA-8651 51802	SC 0.051 (1.29)	LDPTFE 0.154 (3.91)	FSC 0.164 (4.17)	Al/Kapton 0.169 (4.29)	SC 0.187 (4.75)	Blue FEP 0.205 (5.21)	0.042 (0.063)	50+/-1 76%	26.7 (87.6)	-67 +392 (-55 +200)	1.00 (25.4)	27.84
SFT-304	AA-8652 51807	SC 0.062 (1.57)	LDPTFE 0.185 (4.70)	FSC 0.195 (4.95)	Al/Kapton 0.200 (5.08)	SC 0.227 (5.77)	Blue FEP 0.250 (6.35)	0.067 (0.100)	50+/-1 76%	26.7 (87.6)	-67 +392 (-55 +200)	1.25 (31.8)	23.09
SFT-318	AA-9702 51972	SC 0.074 (1.88)	LDPTFE 0.221 (5.61)	FSC 0.231 (5.87)	Al/Kapton 0.240 (6.10)	SC 0.263 (6.68)	Blue FEP 0.291 (7.39)	0.095 (0.140)	50+/-1 76%	26.7 (87.6)	-67 +392 (-55 +200)	1.75 (44.45)	19.33

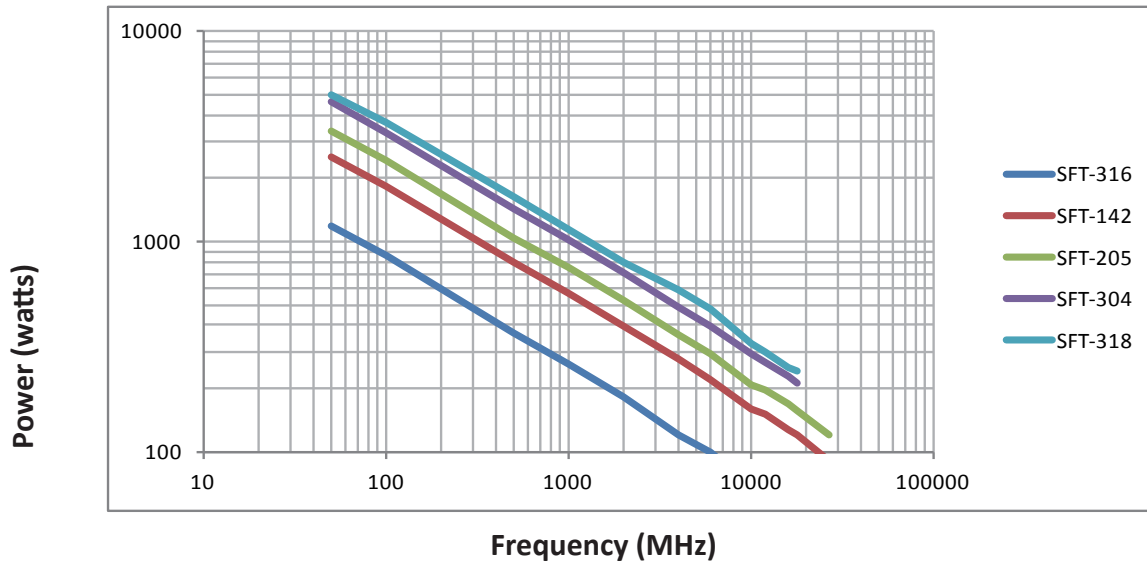
### Attenuation vs. Frequency (Typical)



Frequency (MHz)	50	100	500	1,000	2,000	4,000	6,000	10,000	12,000	16,000	18,000	26500	40,000	K1	K2
SFT-316	3.9	5.5	12.4	17.6	25.0	35.6	43.8	57.0	62.6	72.7	77.3	98.3	117.5	0.55168	0.00018
SFT-142	2.2	3.2	7.1	10.2	14.5	20.7	25.5	33.3	36.7	42.8	45.6	56.1		0.31533	0.00018
SFT-205	1.9	2.6	5.9	8.4	12.0	17.2	21.3	27.9	30.7	36.0	38.3	47.3		0.26098	0.00018
SFT-304	1.5	2.1	4.7	6.8	9.7	13.9	17.2	22.6	25	29	31.2			0.20810	0.00018
SFT-318	1.4	1.9	4.4	6.2	8.9	12.8	15.8	20.7	22.8	26.7	28.4			0.19236	0.00015

Attenuation at Any Frequency = [ k1 x SQRT (Fmhz)] + [ k2 x Fmhz ]; dB per 100 feet

### Power Handling vs. Frequency (Maximum)



Frequency (MHz)	50	100	500	1,000	2,000	4,000	6,000	10,000	12,000	16,000	18,000	26500	40,000
SFT-316	1180	854	370	263	183	120	100	70	69	58	54	40	30
SFT-142	2540	1843	790	569	397	275	221	160	151	128	120	90	
SFT-205	3360	2430	1040	750	523	362	291	210	198	168	157	120	
SFT-304	4590	3309	1420	1020	710	491	394	290	268	227	212		
SFT-318	5000	3690	1630	1140	790	590	474	330	300	250	240		

Watts; Sea Level; Ambient +40C; VSWR 1:1

## Features & Benefits

- Meets all MIL-C-17 Requirements
- Excellent Shielding Effectiveness
- Low Passive Intermod (PIM)
- Stable Loss, Phase, &VSWR vs Flexing
- Uses Standard Solder-on Semirigid Connectors



TFlex® employs a thin helical wrap of silver plated copper tape and overall braid sized such that standard solder-on connectors can be used.

TFlex® was developed 10 years ago and have been widely adopted by the commercial and military OEM's.

Some of the key characteristics of TFlex® are:

**Passive Intermod** – typically > -150dBc (2x20 watt carriers)

**Shielding Effectiveness** – comparable to standard semirigid and like semirigid is beyond measurable limits.

**Small/Lightweight** – same size but lighter weight than standard CL semirigid coax.

**Phase Stable** – the helical tape outer conductor minimized electrical length change with temperature to yield substantial improvement over equivalent size flexible cables.

**Low Loss** – can achieve loss comparable to standard CL semirigid coax.

**Attenuation Stability** – silver plated outer conductor prevents oxidation of the conductors thereby minimizing attenuation change vs time.

**Power Handling** – comparable to standard CL semirigid.

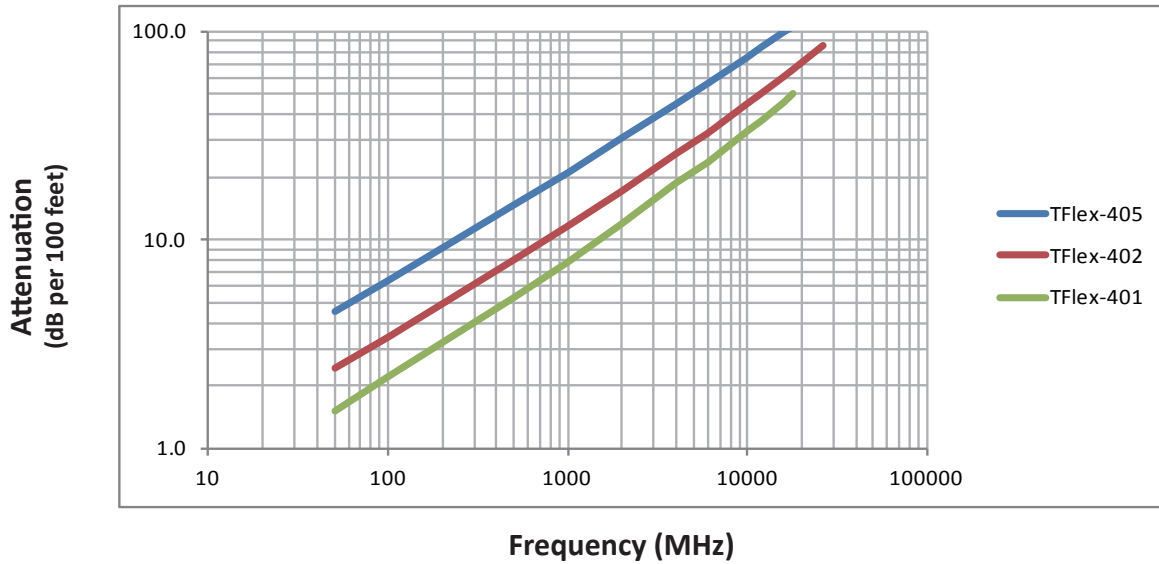
**Corrosion Resistance** – jacketing of the cable with FEP provides excellent protection when cable is deployed in a corrosive environment.

**Formability** – the flexible nature of TFlex eliminates the need for hand or precision machine bending. TFlex is preterminated in it's approximate desired length and just "plugged in" using the most convenient/desirable routing.

**Connectors (Solder-on)** – are available from a variety of sources to fit standard semirigid coax and TFlex.

Cable	AA number MI Number	Conductor in (mm)	Dielectric in (mm)	Shields in (mm)	Jacket in (mm)	Weight lb/ft (kg/m)	Impedance ohms Vp (%)	Capacitance pF/ft (pF/m)	Temp. Range F ( C )	Min.Bend Radius in (mm)	Cut-off Frequency (GHz)
TFlex-405	AA-7741 51670	SCCS 0.020 (0.51)	PTFE 0.064 (1.63)	SC 0.085 (2.16)	Blue FEP 0.104 (2.64)	0.015 (0.022)	50 +/-1 70%	29.3 (96.1)	-85 +267 (-65 +125)	0.25 (6.4)	61.87
TFlex-402	AA-7740 51688	SC 0.036 (0.91)	PTFE 0.118 (3.00)	SC 0.141 (3.58)	Blue FEP 0.160 (4.06)	0.033 (0.049)	50 +/-1 70%	29.3 (96.1)	-85 +267 (-65 +125)	0.25 (6.4)	33.86
TFlex-401	AA-8642 51778	SC 0.064 (1.63)	PTFE 0.208 (5.28)	SC 0.249 (6.32)	Blue FEP 0.270 (6.9)	0.095 (0.142)	50 +/-1 70%	29.3 (96.1)	-85 +267 (-65 +125)	0.25 (6.4)	19.16

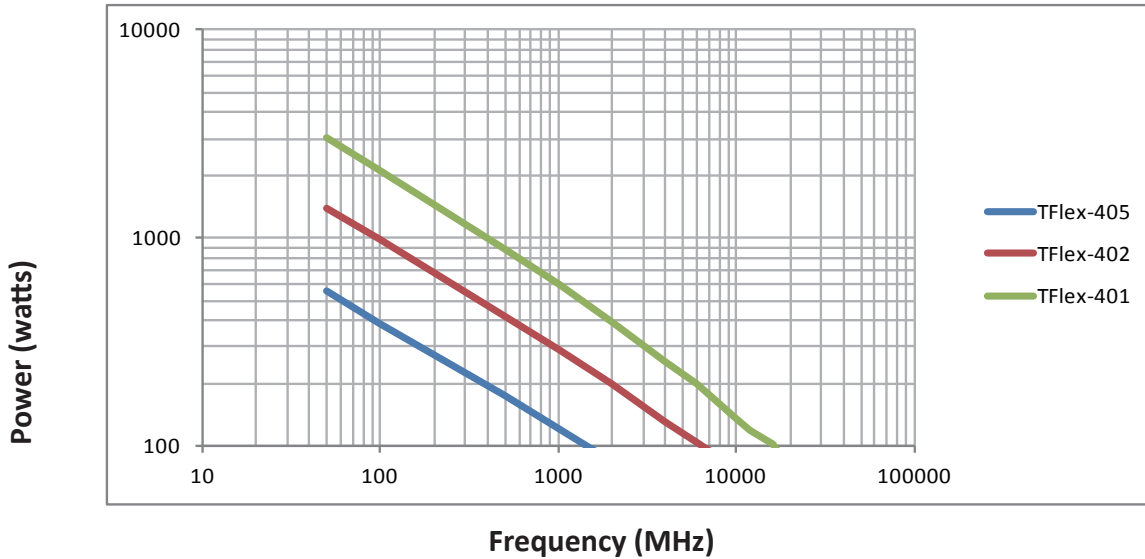
### Attenuation vs. Frequency (Typical)



Frequency (MHz)	50	100	500	1,000	2,000	4,000	6,000	10,000	12,000	16,000	18,000	26,500	40,000	K1	K2
TFlex-405	4.5	6.4	14.7	21.1	30.5	44.6	56.0	75.0	83.4	98.9	106.1	134.4	174.0	0.63000	0.00120
TFlex-402	2.4	3.4	8.0	11.6	17.1	25.7	32.8	45.0	50.6	60.9	65.9	85.5		0.33000	0.00120
TFlex-401	1.5	2.2	5.3	7.8	11.8	18.8	23.5	33.0	37.4	45.8	50.0			0.21000	0.00120

Attenuation at Any Frequency = [ k1 x SQRT (Fmhz)] + [ k2 x Fmhz ]; dB per 100 feet

### Power Handling vs. Frequency (Maximum)



Frequency (MHz)	50	100	500	1,000	2,000	4,000	6,000	10,000	12,000	16,000	18,000	26,500	40,000
TFlex-405	560	390	173	121	85	59	47	36	33	28	26	21	17
TFlex-402	1386	980	418	290	198	132	105	78	69	58	54	41	
TFlex-401	3010	2095	885	595	394	257	198	136	120	102	88		

Watts; Sea Level; Ambient +40C; VSWR 1:1

# Coppersol® CLL

## Features and Benefits:

- Lower Loss than Standard Semi-Rigid
- Excellent Shielding Effectiveness
- Low Passive Intermod (PIM)
- Stable Loss, Phase and VSWR



Coppersol®-CLL employs a thin tubular copper outer conductor and low-density PTFE dielectric which provide the lowest loss and highest shielding giving it significant performance advantages over semirigid coax of similar size.

Coppersol®-CLL was developed 25 years ago and have been widely adopted.

Some of the key characteristics of Coppersol®-CLL are: Shielding Effectiveness- the highest achievable for any cable and is estimated at > 165dB, well below measureable limits.

Small/Lightweight –same size but lighter weight than standard CL semirigid coax.

Phase Stable – the solid outer conductor and low density PTFE minimizes electrical length change with temperature to yield 100% improvement over standard CL semirigid coax.

Low Loss – can achieve up to 30% less loss than standard CL semirigid coax.

Attenuation Stability – impervious outer conductor prevents oxidation of the conductors thereby minimizing attenuation change vs time.

Power Handling – higher operating temperature provides 200% increase in power handling vs standard CL semirigid.

Corrosion Resistance – jacketing of the bare copper tube or plating with tin or silver is recommended when cable is deployed in a corrosive environment.

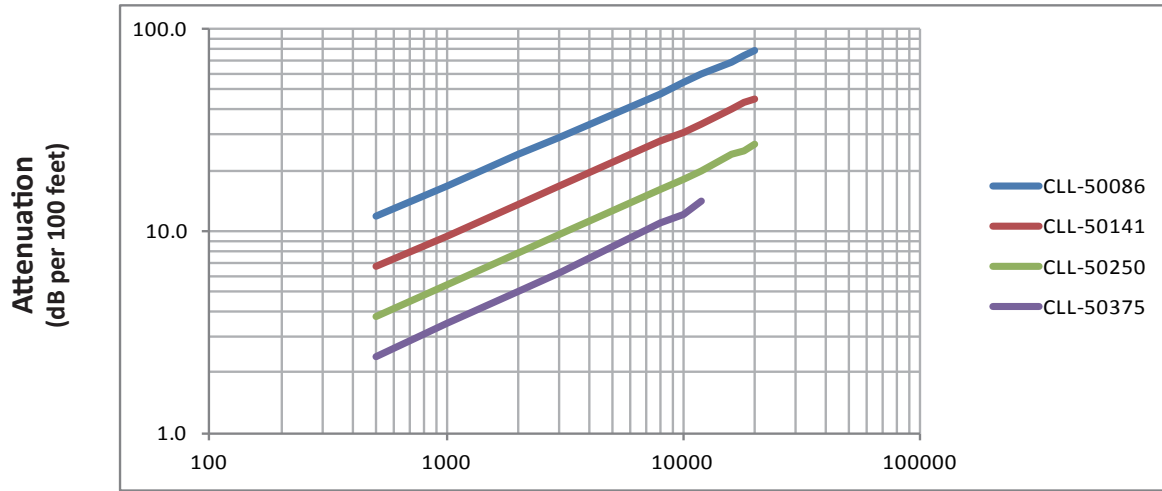
Formability – the solid copper tube enables the cable to be bent to any 3 dimensional configuration and have it retain its shape.

Connectors – are available from a variety of sources to fit Coppersol-CLL.

Cable	AA number MI Number	Conductor in (mm)	Dielectric in (mm)	Shields in (mm)	Weight lb/ft (kg/m)	Impedance ohms Vp (%)	Capacitance pF/ft (pF/m)	Temp. Range F ( C )	Min.Bend Radius in (mm)	Cut-off Frequency (GHz)
CLL -50086	AA-5186 15163	SCCS 0.022 (0.56)	LD PTFE 0.066 (1.68)	BC Tube 0.086 (2.18)	0.013 (0.019)	50+/-1.5 76%	26.8 (87.9)	-85 +482 (-65 +250)	0.25 (6.4)	64.60
CLL-50141	AA-5187 15164	SC 0.039 (0.99)	LD PTFE 0.118 (3.00)	BC Tube 0.141 (3.58)	0.029 (0.0431)	50+/-1 76%	26.8 (87.9)	-85 +482 (-65 +250)	0.50 (12.7)	36.30
CLL-50250	AA-5199 15162	SC 0.070 (1.78)	LD PTFE 0.210 (5.33)	BC Tube 0.250 (6.35)	0.091 (0.136)	50+/-1 76%	26.8 (87.9)	-85 +482 (-65 +250)	2.00 (50.8)	20.40
CLL-50375	AA-7152 15165	SC 0.112 (2.84)	LD PTFE 0.335 (8.51)	BC Tube 0.375 (9.535)	0.187 (0.279)	50+/-1 76%	26.8 (87.9)	-85 +482 (-65 +250)	3.25 (82.6)	12.80



### Attenuation vs. Frequency (Typical)

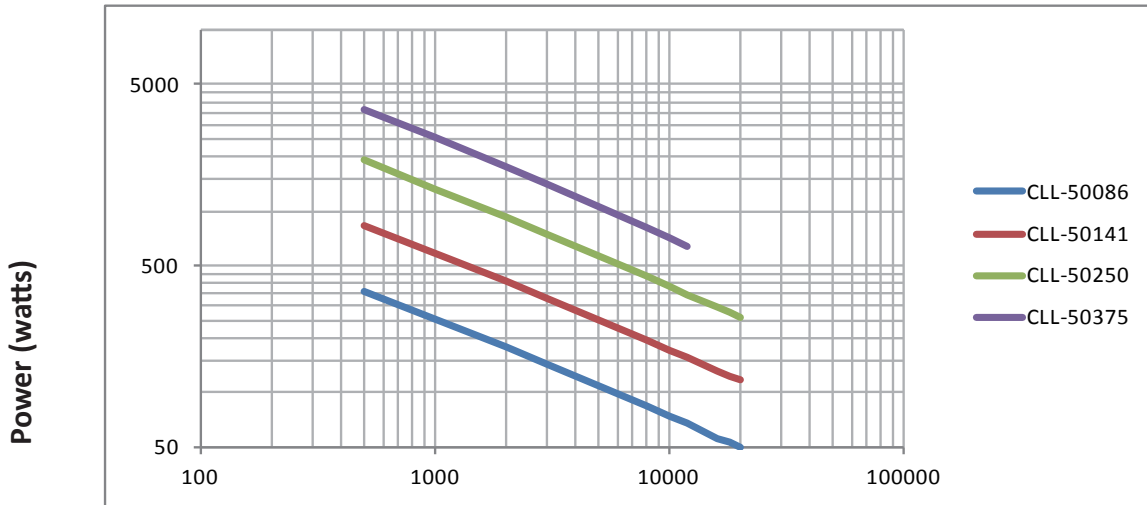


Frequency (MHz)

Frequency (MHz)	500	1,000	2,000	3,000	8,000	10,000	12,000	16,000	18,000	20,000	K1	K2
CLL-50086	11.8	16.8	23.9	29.0	48.0	54.0	60.0	69.0	74.0	78.0	0.525	0.00018
CLL-50141	6.7	9.5	13.5	16.6	28.0	31.0	34.0	40.0	43.0	45.0	0.293	0.00018
CLL-50250	3.8	5.4	7.8	9.6	16.0	18.0	20.0	24.0	25.0	27.0	0.165	0.00018
CLL-50375	2.4	3.5	5.0	6.2	11.0	12.0	14.0				0.104	0.00018

Attenuation at Any Frequency = [ k1 x SQRT (Fmhz)] + [ k2 x Fmhz ]; dB per 100 feet

### Power Handling vs. Frequency (Maximum)



Frequency (MHz)

Frequency (MHz)	500	1,000	2,000	3,000	8,000	10,000	12,000	16,000	18,000	20,000
CLL-50086	363	254	177	143	84	74	67	56	53	50
CLL-50141	834	584	407	329	194	171	155	131	123	116
CLL-50250	1908	1332	925	745	436	384	347	294	274	257
CLL-50375	3633	2525	1743	1397	805	707	635			

Watts; Sea Level; Ambient +40C; VSWR 1:1

# Connectors & Cable Assemblies

Times Microwave Systems designs and manufactures high performance RF and Microwave coaxial cables, connectors and cable assemblies for aerospace, telecommunications, compliance testing and industrial applications. We are an engineering organization committed to innovation and development of new products for demanding applications, but also a fully integrated manufacturer of cable, connectors and assemblies with cost effective production facilities and the resources of Amphenol behind us.

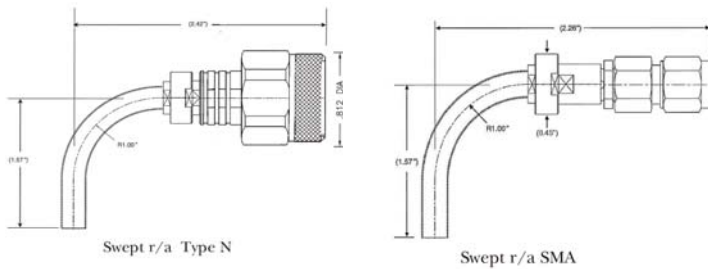
We offer a full range of connectors with all standard interfaces designed to match our microwave and provide optimum performance. Our integrated design and production expertise positions to provide custom cable assemblies to meet your requirements including phase matching, special testing, custom connectors, improved strain relief, armoring, special markings, traceability, color coding, kitting and other special requirements.

Here is the summary of the connectors we have developed for microwave cables:

Cable Connector	HF-090	HF-160	HF-190	HF-290	SFT-316	SFT-142	SFT-205	SFT-304	TFlex-405	TFlex-402
SMA Male Straight	3190-6389	CF	3190-2722	3190-2604	3190-2738	3190-2793	3190-2289	3190-2288	3190-2711	3190-6248
SMA Male Right Angle	CF	CF	3190-6042	CF	3190-2952	3190-6315	3190-2733	CF	3190-2901	3190-2902
SMA Male Swept	CF	CF	3190-6105	CF	CF	CF	3190-6089	CF	CF	CF
N Male Straight	CF	CF	3190-2710	3190-2605	3190-2996	3190-2794	3190-2291	3190-2290	CF	3190-2921
N Male Right Angle	CF	CF	CF	3190-6117	CF	CF	CF	CF	CF	CF
N Male Swept	CF	CF	3190-6106	CF	CF	CF	3190-6090	CF	CF	CF
TNC Male Straight	CF	CF	3190-2723	3190-2606	3190-2994	CF	3190-2676	3190-2584	CF	CF
TNC Male Swept	CF	CF	3190-6107	CF	CF	CF	3190-6091	CF	CF	CF
3.5MM Male Straight	CF	CF	3190-6044	CF	CF	CF	3190-2925	CF	CF	CF
3.5MM Male Swept	CF	CF	3190-6108	CF	CF	CF	3190-6156	CF	CF	CF
2.92MM Male Straight	3190-6394	3190-6269	CF	CF	CF	CF	CF	CF	3190-6225	3190-2842
2.92MM Male Swept	CF	3190-6308	CF	CF	CF	CF	CF	CF	CF	CF
Steel Armor Option	CF	MI-10642	MI-10630	MI-10635	CF	CF	MI-10630	CF	CF	CF

\*CF: Consulting Factory

Swept option: Swept replaceable screw tube is available to satisfy the right angle requirement with an effective cost, while the performance could be maintained the same as the straight connectors.



\* Dimension is just for reference, detailed information please contact factory.



Armored option: Steel armor is available as an option to provide the cable assembly the additional protection for rough field application.



# Thermal Vacuum Test Cable Assemblies

Times Microwave Systems provide a wide variety of customized cable assemblies design for Thermal Vacuum Test application, that meets with the below critical requirements:

## Outgassing

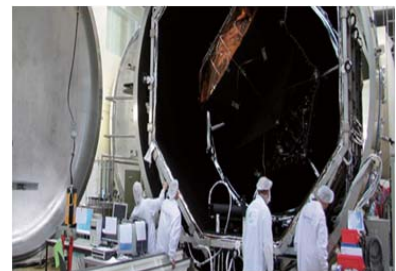
Cable assemblies must utilize low outgassing materials in a vacuum environment. It is imperative that non-polymeric materials are used in the cable assembly. TMS (Times Microwave Systems) proprietary material conditioning and vacuum testing of assemblies ensures outgassing is minimized in space flight and thermal vacuum rated test cable assemblies. All TMS assemblies meet the NASA standards outlined in ASTM E-595 for outgassing characteristics.

## Radiation

Special jackets are required when cable assemblies are directly exposed to radiation to prevent cable breakdown. TMS offers several radiation resistance materials for such applications. All space flight (SPFLT) cable assemblies are jacketed with Tefzel® (a DuPont product), which is used to meet the demanding requirements for exposure to gamma radiation and can withstand up to 100 MRads of radiation. Tefzel® is certified to IEEE-383 standard for nuclear and space applications. The stainless steel outer jacket material of TMS' SiO<sub>2</sub> cable assemblies will enable it to withstand up to 300 MRads of radiation.

## Multipaction Breakdown of Connector and Cable Teflon Dielectrics

A multipactor discharge can vaporize some of the dielectric material within the coaxial line and create ionized gas particles. If the coaxial line is not properly vented, these collected gas particles can initiate an ionization breakdown within the structure. This condition can cause catastrophic electrical failure of the cable assembly. In many cases, the use of overlapping interface dielectrics will also help to minimize this condition from occurring. TMS offers most major connector interfaces, SMA, TNC, Type N, SMP, SC and GPO types for associated cable groups.



## MISSION

TIMES MICROWAVE SYSTEMS designs and manufactures high performance RF and microwave transmission lines. These products consist of coaxial cables, connectors, accessories and cable assemblies.

We are committed to understanding the needs and requirements of our customers and providing highly engineered, cost effective products.

TIMES MICROWAVE SYSTEMS is dedicated to total customer satisfaction and superior results for our shareholders in all we do.



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