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CARLISLE®
INTERCONNECT TECHNOLOGIES

UTiFLEX®

Flexible Microwave Cable Assemblies

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Service & Ordering Information

Applications Engineering

Our Applications Engineering staff is available for technical support in the design, utilization, testing, and production of any UTiFLEX cable assembly.

Prototype Capability

Samples can be manufactured for specific applications and supplied to you promptly. If new connector or cable designs are required, our experienced staff can offer a quick turnaround.

Qualification Testing

CarlisleIT can economically perform all qualification testing including writing of required test procedures.

Program Management

CarlisleIT has participated in many large military and commercial programs. We maintain complete program management capability necessary to successfully complete development and production of any sized project.

Warranty

All UTiFLEX cable assemblies have a limited one year warranty subject to CarlisleIT review.

How to Order

Please order by UTiFLEX part number (see page 20) and/or drawing number, adding any special requirements. Your order should include the length required, connector type, and frequency range. The CarlisleIT webstore is the quickest way to order and receive custom configured test cables.

Where to Order

Carlisle Interconnect Technologies
206 Jones Boulevard Pottstown, PA 19464-3465
Phone: 610.495.0110 Fax: 610.495.6656
E-mail: quotes@CarlisleIT.com
Web: CarlisleIT.carlisleit.com

Terms

Formal price quotations remain in effect for 30 days unless otherwise specified on quotation. Terms of payment are Net 30 days, subject to credit approval.

Shipments

Unless specific instructions accompany the order, shipment is made FOB Pottstown, PA. CarlisleIT will use its judgment as to the best method of shipment. CarlisleIT reserves the right to ship COD or upon receipt of advance payment. All claims of shortages must be made within 10 days of receipt of material.

Return Policy

Please contact CarlisleIT for an RMA number before returning product. The RMA should be referenced on the packing container and all associated paperwork.

Additional Information

Please visit our web site at CarlisleIT.carlisleit.com.

Introduction



UTiFLEX® is a complete line of high performance flexible microwave cables built by CarlisleIT. The entire UTiFLEX product line is constructed using a low or ultra low density PTFE dielectric offering excellent loss characteristics, outstanding phase stability, and unsurpassed flexibility compared to standard flexible cables — all without sacrificing mechanical integrity. CarlisleIT has greatly increased connector reliability through a unique connector attachment that withstands mechanical and thermal stresses far better than standard connectors.

With UTiFLEX assemblies, the connector is no longer the weak link in your flexible cable assembly.

Microwave cable for almost any application

» Versatile Low Loss cables offer outstanding performance in almost any environment.
» Low Loss cables have the lowest insertion loss available to 18, 26.5, 40, 50, 65 GHz.
» Miniature cables are a superior alternative to traditional RG or semi-rigid cables.
» Ultra Light cables provide up to 25% weight savings for spaceflight applications.

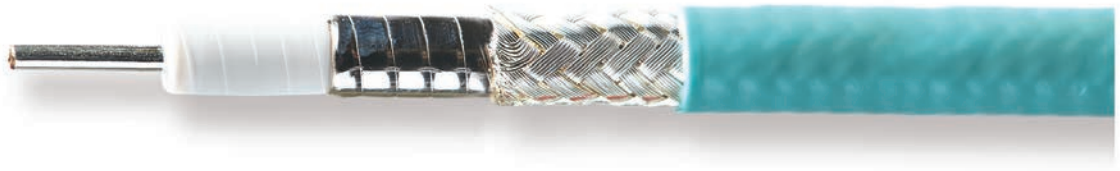
Key features

» Low SWR (1.25:1 to 40 GHz typical)
» Excellent shielding effectiveness
» Precision phase matching
» ARACON® outer shield for superior weight savings on
» Ultra Light cables

Space qualified

» J-STD-001 Space Addendum certified assemblers and inspectors
» Class 10,000 clean room assembly processes
» Low-outgassing materials (1% TML, 0.1% CVCM per ASTM E-595)
» Radiation resistant up to 100 Mrads
» Real time x-ray capability

Typical Cable Construction



UTiFLEX high performance cable assemblies are manufactured in Pottstown, PA, under the guidance of our professional Engineering staff. Every cable assembly is tested for insertion loss and SWR and shipped with an individual test certificate.

Center Conductor

Solid or stranded silver-plated copper wire per ASTM B-298 or silver-plated copper clad steel wire per ASTM B-501. In comparison to equal size center conductors, the solid center conductor has less RF resistance, lower attenuation, and is more amplitude stable with flexure. The stranded center conductor is more flexible and more phase stable with flexure.

Dielectric

Low density PTFE per MIL-DTL-17, with a dielectric constant ranging from 1.4 to 1.7 depending on the cable type. Most transmission losses are caused either directly or indirectly by the dielectric. In addition, the dielectric determines the velocity of propagation, temperature range, power rating, phase and amplitude stability, and contributes to cable flexibility. The UTiFLEX PTFE dielectric is ideal for these critical parameters due to its low density and low thermal coefficient of expansion.

Inner Shield

Silver-plated copper tape per ASTM B-298, helically wrapped with 40% minimum overlap between layers. This shield allows for outstanding flexibility while providing 100% coverage. By closely monitoring the precision wrapping process and carefully matching the elasticity of the dielectric to the properties of the silver-plated copper tape, uniform impedance and ideal contact between individual layers of the shield are maintained.

Outer Shield

Silver-plated copper wire per ASTM B-298, tightly braided over the inner shield. The braids are primarily a strength member that also add additional RF shielding. For applications where weight is critical such as spaceflight, CarlisleIT offers ARACON® as the braiding material.

Jacket

Fluorinated Ethylene Propylene (FEP), colored light aqua blue. The FEP is excellent because of its high temperature resistance and chemical inertness. Other jacket materials are available such as DuPont™ Tefzel® and carbon loaded Tefzel® for spaceflight applications.

DuPont™ and Tefzel® are trademarks or registered trademarks of E.I. duPont de Nemours and Company.

Cable Selection Guide

In order to simplify the cable selection process, individual cables have been grouped into product families. Most flexible cable users want minimal insertion loss consistent with smallest size and weight without sacrificing flexibility. Other parameters will influence price and performance. Use the tables and information below to select the cable that best suits your needs.

- » Cables with stranded center conductors tend to be more phase stable with flexure.
- » Cables with solid center conductors tend to be more amplitude stable with flexure.
- » For applications less than 26.5 GHz, start with the Low Loss UFA210A cable.
- » If the cable will be used in a test lab environment, consider MKR300C for applications less than 26.5 GHz.
- » If lower insertion loss is required, Ultra Low Loss UFB205A or UFB197C should be chosen. If the application is less than 18 GHz, choose the Ultra Low Loss UFB311A or UFB293C.
- » If size and flexibility are critical, consider the Low Loss UFA147B or Ultra Low Loss UFB142C cables.

MINIATURE LOW LOSS

Part Number		UGF070D	UFF092D	UFF092F
Impedance	ohms	50	50	50
Max. Frequency	GHz	18	18	18
Max. Insertion Loss dB/ft (db/m)	1 GHz	0.29 (0.95)	0.20 (0.66)	0.22 (0.72)
	10 GHz	1.01 (3.31)	0.66 (2.17)	0.71 (2.33)
	18 GHz	1.41 (4.63)	0.90 (2.95)	0.98 (3.22)
Power Handling	watts (CW) @ 10 GHz	36	63	60
Nominal Outer Dia.	inch (mm)	0.070 (1.78)	0.092 (2.34)	0.092 (2.34)
Maximum Weight	grams/ft (g/m)	3.0 (9.8)	5.0 (16.4)	5.0 (16.4)
Center Conductor	type	solid	solid	stranded
Static Bend Radius	inch (mm)	0.10 (2.54)	0.13 (3.30)	0.25 (6.35)
Detailed Information		page 9-10	page 9-10	page 9-10

LOW LOSS

Part Number		UFC092D	UFA125A	UFA147A	UFA147B	UFA210A	UFA210B
Impedance	ohms	50	50	50	50	50	50
Max. Frequency	GHz	65	50	40	40	26.5	26.5
Max. Insertion Loss dB/ft (dB/m)	1 GHz	0.20 (0.66)	0.14 (0.46)	0.11 (0.36)	0.16 (0.52)	0.08 (0.26)	0.09 (0.30)
	10 GHz	0.67 (2.20)	0.48 (1.57)	0.39 (1.28)	0.52 (1.71)	0.27 (0.89)	0.30 (0.98)
	18 GHz	0.92 (3.02)	0.66 (2.17)	0.54 (1.77)	0.72 (2.36)	0.38 (1.25)	0.42 (1.38)
	26.5 GHz	1.13 (3.71)	0.82 (2.69)	0.67 (2.20)	0.89 (2.92)	0.48 (1.57)	0.53 (1.74)
	40 GHz	1.42 (4.66)	1.04 (3.41)	0.85 (2.79)	1.12 (3.67)	-	-
	50 GHz	1.61 (5.28)	1.19 (3.90)	-	-	-	-
	65 GHz	1.86 (6.10)	-	-	-	-	-
Power Handling	watts (CW) @ 10 GHz	63	112	159	149	303	283
Nominal Outer Dia.	inch (mm)	0.092 (2.34)	0.125 (3.18)	0.147 (3.73)	0.147 (3.73)	0.210 (5.33)	0.210 (5.33)
Maximum Weight	grams/ft (g/m)	5.0 (16.4)	8.8 (28.9)	12.1 (39.7)	12.1 (39.7)	22 (72.2)	22 (72.2)
Center Conductor	type	solid	solid	solid	stranded	solid	stranded
Static Bend Radius	inch (mm)	0.13 (3.30)	0.20 (5.08)	0.25 (6.35)	0.25 (6.35)	0.38 (9.65)	0.38 (9.65)
Detailed Information		page 11-12	page 11-12	page 11-12	page 11-12	page 11-12	page 11-12

MKR TEST CABLE

Part Number		MKR300C
Impedance	ohms	50
Max. Frequency	GHz	26.5
Max. Insertion Loss dB/ft (dB/m)	1 GHz	0.08 (0.26)
	10 GHz	0.27 (0.89)
	18 GHz	0.36 (1.18)
	26.5 GHz	0.44 (1.44)
	40 GHz	-
Power Handling	watts (CW) @ 10 GHz	175
Nominal Outer Dia.	inch (mm)	0.300 (7.62)
Maximum Weight	grams/ft (g/m)	51 (167.3)
Center Conductor	type	stranded
Static Bend Radius	inch (mm)	1.50 (38.10)
Detailed Information		page 17-18

ULTRA LOW LOSS

Part Number		UFB088D	UFB142C	UFB142A	UFC185A	UFB197C	UFB205A	UFB293C	UFB311A
Impedance	ohms	50	50	50	50	50	50	50	50
Max. Frequency	GHz	18	40	40	32	26.5	26.5	18	18
Max. Insertion Loss dB/ft (dB/m)	1 GHz	0.20 (0.66)	0.11 (0.36)	0.10 (0.33)	0.08 (0.26)	0.09 (0.28)	0.07 (0.23)	0.06 (0.20)	0.05 (0.16)
	10 GHz	0.66 (2.17)	0.36 (1.18)	0.33 (1.08)	0.27 (0.89)	0.28 (0.93)	0.23 (0.75)	0.18 (0.59)	0.15 (0.49)
	18 GHz	0.89 (2.92)	0.49 (1.61)	0.44 (1.44)	0.36 (1.18)	0.38 (1.26)	0.32 (1.05)	0.25 (0.82)	0.21 (0.69)
	26.5 GHz	-	0.59 (1.94)	0.54 (1.77)	0.44 (1.44)	0.47 (1.55)	0.39 (1.28)	-	-
	32 GHz	-	0.66 (2.16)	0.60 (1.97)	0.49 (1.61)	-	-	-	-
	40 GHz	-	0.74 (2.43)	0.68 (2.23)	-	-	-	-	-
Power Handling	watts (CW) @ 10 GHz	66	166	175	267	296	326	570	648
Nominal Outer Dia.	inch (mm)	0.088 (2.235)	0.142 (3.61)	0.142 (3.61)	0.185 (4.699)	0.197 (5.00)	0.205 (5.21)	0.293 (7.44)	0.311 (7.90)
Maximum Weight	grams/ft (g/m)	4.2 (13.78)	9.9 (32.5)	10.1 (33.1)	17.6 (57.74)	19.8 (65.0)	20 (65.6)	42 (137.8)	44.5 (146.0)
Center Conductor	type	solid	stranded	solid	solid	stranded	solid	stranded	solid
Static Bend Radius	inch (mm)	0.25 (6.35)	0.38 (9.65)	0.38 (9.65)	0.375 (9.525)	0.50 (12.70)	0.50 (12.70)	0.75 (19.05)	1.25 (31.75)
Detailed Information		page 13-14	page 13-14	page 13-14	page 13-14	page 13-14	page 13-14	page 13-14	page 13-14

ULTRA LIGHT*

Part Number		MCJ088D	MCJ142A	MCJ185A	MCJ205A	MCJ311A
Impedance	ohms	50	50	50	50	50
Max. Frequency	GHz	18	40	32	26.5	18
Max. Insertion Loss dB/ft (dB/m)	1 GHz	0.20 (0.66)	0.10 (0.33)	0.08 (0.26)	0.07 (0.23)	0.05 (0.16)
	10 GHz	0.66 (2.17)	0.33 (1.08)	0.27 (0.89)	0.23 (0.75)	0.15 (0.49)
	18 GHz	0.89 (2.92)	0.44 (1.44)	0.36 (1.18)	0.32 (1.05)	0.21 (0.66)
	26.5 GHz	-	0.54 (1.77)	0.44 (1.44)	0.39 (1.28)	-
	32 GHz	-	0.60 (1.97)	0.49 (1.61)	-	-
	40 GHz	-	0.68 (2.23)	-	-	-
Power Handling	watts (CW) @ 10 GHz	64	173	267	326	648
Nominal Outer Dia.	inch (mm)	0.088 (2.24)	0.142 (3.61)	0.185 (4.70)	0.205 (5.21)	0.310 (7.87)
Maximum Weight	grams/ft (g/m)	3.6 (11.8)	8.8 (28.9)	12.4 (40.7)	16.0 (52.5)	35 (114.8)
Center Conductor	type	solid	solid	solid	solid	solid
Static Bend Radius	inch (mm)	0.25 (6.35)	0.38 (9.65)	0.38 (9.65)	0.50 (12.70)	1.25 (31.75)
Detailed Information		page 15-16	page 15-16	page 15-16	page 15-16	page 15-16

*Ultra Light cables are also available with an aluminum center conductor which offers an additional weight savings of up to 10% depending on cable type.

Connector Selection Guide

Carlisle Interconnect Technologies specializes in custom, high-performance connectors that cannot be obtained from conventional sources. Please contact us to discuss your unique and demanding connector requirements.

Design and materials of all connectors and connector parts conform to MIL-PRF-39012. The UTiFLEX connectors have been optimized to achieve the lowest possible SWR across the bandwidth. In addition, the unique connector attachment has been designed to provide high reliability and withstand heavy stress. The connector body, dielectric, and center contact are completely captivated guaranteeing the cable assembly will keep its excellent properties even after hard use.

Description	Part Number	Cable Group*	Rated Frequency	Maximum SWR (per connector)
2.4 mm Plug	100	04, 05	40 / 50 GHz	1.16:1 to 18 GHz
				1.22:1 to 40/50 GHz
2.4 mm Jack	110	04, 05	40 / 50 GHz	1.16:1 to 18 GHz
				1.22:1 to 40/50 GHz
SMK Plug	200 (20V Space)	05, 09	32/40 GHz	1.16:1 to 18 GHz
				1.20:1 to 40 GHz
SMK Right Angle Plug	280 (2QV Space)	05, 09	32/40 GHz	1.16:1 to 18 GHz
				1.20:1 to 40 GHz
SMK Jack	210	05	40 GHz	1.16:1 to 18 GHz
				1.20:1 to 40 GHz
Precision 3.5 mm Plug	000	05, 07	26.5 GHz	1.16:1 to 18 GHz
				1.20:1 to 26.5 GHz
Precision 3.5 mm Jack	010	05, 07	26.5 GHz	1.16:1 to 18 GHz
SMA Plug	300 (30V Space)	01,02,05,06,07,08,09	18 GHz	1.16:1 to 18 GHz
SMA Jack	310 (31V Space)	01,02,05,06,07,08	18 GHz	1.16:1 to 18 GHz
SMA Right Angle Plug	380 (3QV Space)	02,05,06,07,08	18 GHz	1.20:1 to 18 GHz
SMA Bulkhead Jack	320 (32V Space)	02,05,06,07	18 GHz	1.16:1 to 18 GHz
Precision 7 mm	460	05,06,07,08	18 GHz	1.16:1 to 18 GHz
Precision N Plug 50U	50U	05,06,07,08	18 GHz	1.16:1 to 18 GHz
Precision N Jack	510	05,06,07,08	18 GHz	1.16:1 to 18 GHz
Precision TNC Plug	60u (A0V Space)	05,06,07,08	18 GHz	1.20:1 to 18 GHz
Precision TNC Jack	610 (A1R Space)	05,06,07,08	18 GHz	1.20:1 to 18 GHz
N Plug 70U	70U	07,08	12.4 GHz	1.16:1 to 12.4 GHz
N Jack	710	07,08	12.4 GHz	1.16:1 to 12.4 GHz
BNC Plug	804	07	4 GHz	1.20:1 to 4 GHz
SMP Jack	F10	01,02,04	18 GHz	1.16:1 to 18 GHz
SMP Right Angle Jack	F80	01,02,04	18 GHz	1.20:1 to 18 GHz

*Cable Groups	Number
UGF070D	01
UFF092D, UFF092F, MCJ088D, UFB088D, UFC092D	02
UFA125A	04
UFA147A, UFB142A, MCJ142A	05
UFA147B, UFB142C	06
UFA210A, UFA210B, UFB205A, UFB197C, MCJ205A	07
UFB311A, UFB293C, MCJ311A	08
MCJ185A, UFC185A	09

Most connector types are also available in a right angle elbow configuration. Additional connector types (not listed) are available upon request. Please contact Carlisle Interconnect Technologies for outline drawings or any special requirements.

Connector Selection Guide

Most UTiFLEX cable assemblies are available with armor. The armor extends the assembly life and adds additional physical protection. Two standard armors are detailed below. Additional armor types are also available. Please contact Carlisle Interconnect Technologies with any special requirements.

-1 POLYURETHANE JACKET OVER BRAID/STAINLESS STEEL SPIRAL			
Cable Groups (see page 7)	04,05,06	07	08
Diameter inch (mm)	0.35 (8.89)	0.41 (10.41)	0.53 (13.46)
Minimum Bend Radius inch (mm)	0.5 (12.70)	1.0 (25.40)	1.5 (38.10)
Maximum Temperature (Deg C)	80	80	80
Crush Resistance lbs./inch (Newton/mm)	450 (79.4)	450 (79.4)	450 (79.4)

Features

» Very flexible
» Waterproof and UV resistant
» Good abrasion and cut-through resistance
» Torque resistant and adds pull strength



Typical Application

» Test lab or antenna range

-2 STAINLESS STEEL INTERLOCKED HOSE			
Cable Groups (see page 7)	04,05,06	07	08
Diameter inch (mm)	0.28 (7.11)	0.38 (9.65)	0.49 (12.45)
Minimum Bend Radius inch (mm)	1.5 (38.10)	2.0 (50.80)	2.0 (50.80)
Maximum Temperature (Deg C)	165	165	165
Crush Resistance lbs./inch (Newton/mm)	420 (74.1)	420 (74.1)	420 (74.1)

Features

» High temperature
» Prevents over bending
» Excellent abrasion and cut-through resistance
» Cost effective



Typical Application

» Military hardware

UTiFLEX Miniature Low Loss Cable Assemblies

These general purpose microwave miniature cables have been designed to offer superior electrical performance in the smallest possible package for fixed installations. They are a cost-effective alternative when an RG cable cannot perform to your system needs or when a semi-rigid cable is too cumbersome. The UTiFLEX Miniature cables are available with a large selection of connectors and can be easily customized to meet your exact requirements.

Mechanical Characteristics

UTiFLEX TYPE		UGF070D	UFF092D	UFF092F
Outer Diameter	inch (mm)	0.070 (1.78)	0.092 (2.34)	0.092 (2.34)
Center Conductor Type	grams/ft (g/m)	solid	solid	stranded
Maximum Weight		3.0 (9.8)	5 (16.4)	5 (16.4)
Minimum Bend Radius	inch (mm)	0.10 (2.54)	0.13 (3.30)	0.25 (6.35)
Cable Flex Life *		100,000	25,000	170,000

* Cable shall withstand specified number of unrestrained flexures (snake test)

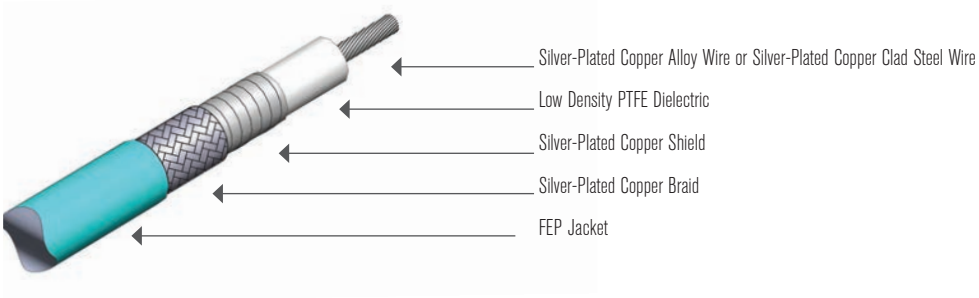
Electrical Characteristics

Impedance	ohms	50	50	50
Frequency Range	GHz	DC-18	DC-18	DC-18
Velocity of Propagation		78%	77%	77%
Capacitance	pF/ft (pF/m)	26.2 (86.0)	26.2 (86.0)	26.2 (86.0)
Shielding Effectiveness	(dB @ 1 GHz)	> 100	> 100	> 100
Maximum Insertion Loss dB/ft (dB/m)	See figure on next page			
	1 GHz	0.29 (0.95)	0.20 (0.66)	0.22 (0.72)
	10 GHz	1.01 (3.31)	0.67 (2.20)	0.71 (2.33)
	18 GHz	1.41 (4.63)	0.92 (3.02)	0.98 (3.22)
Phase Stability vs Flexure	10 GHz	2° *	2° **	2° **
	18 GHz	3° *	3° **	3° **
Phase Stability vs Temperature		See figure on next page		
Power Handling		See figure on next page		
VSWR		See connector selection guide		

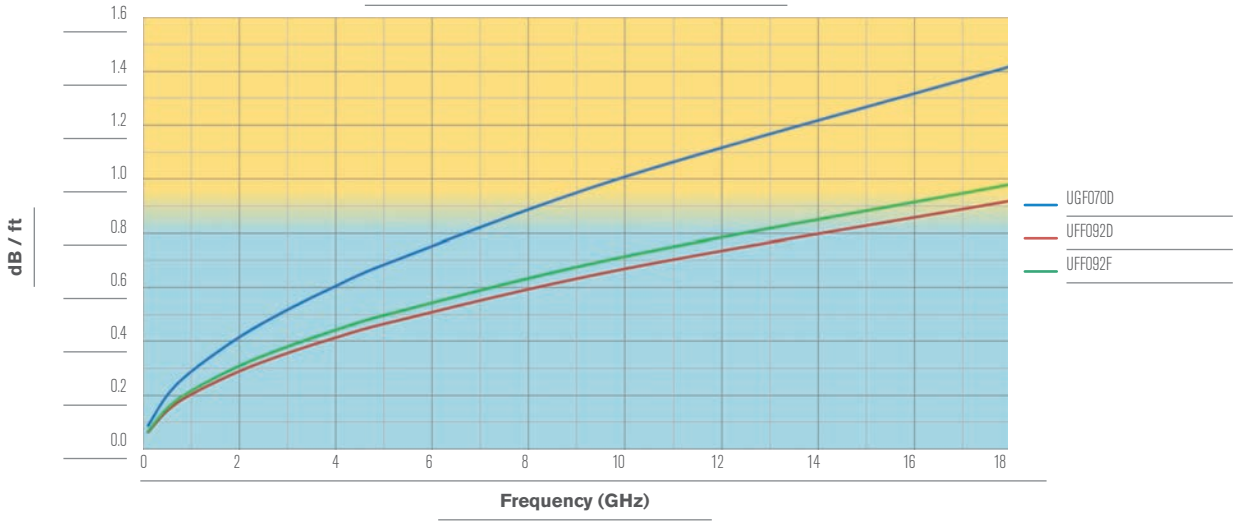
* Cable wrapped once around a 1.5 inch diameter mandrel
** Cable wrapped once around a 3 inch diameter mandrel

Environmental Characteristics

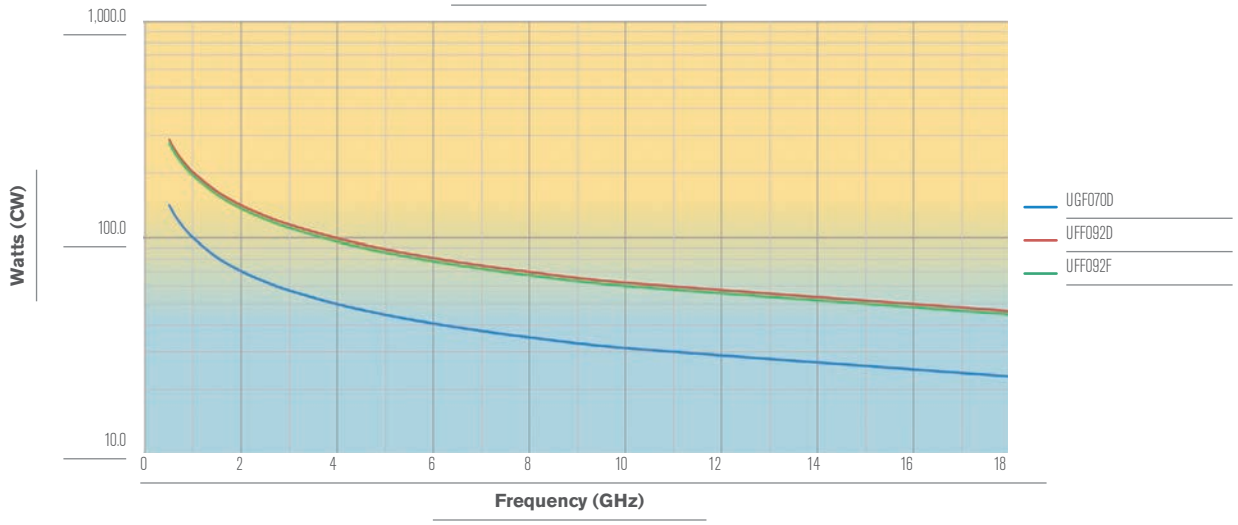
Temperature Range (Deg C)		-65/+165	-65/+165	-65/+165
	See page 21 for applicable environmental test			



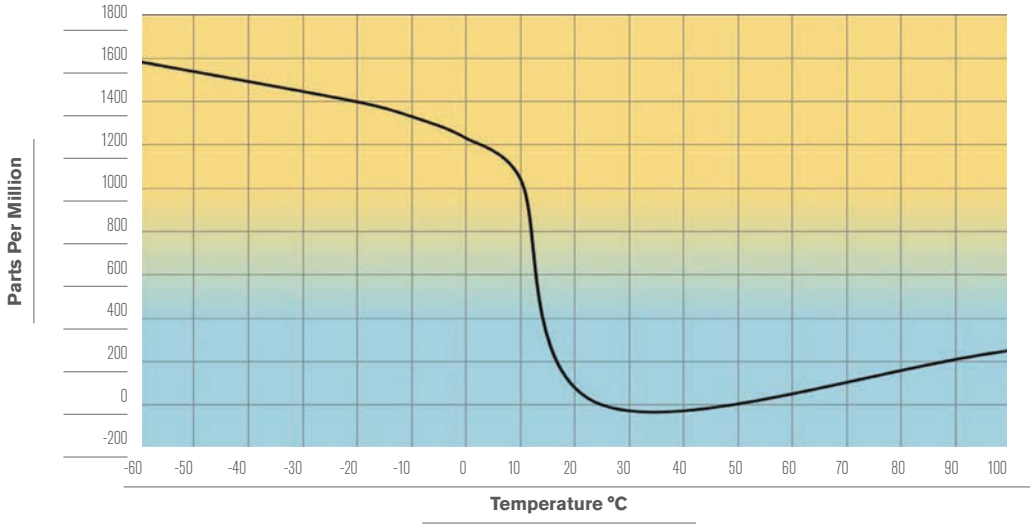
MAXIMUM INSERTION LOSS



POWER HANDLING



TYPICAL PHASE CHANGE VS. TEMPERATURE



UTiFLEX Low Loss Cable Assemblies

UTiFLEX Low Loss cable assemblies provide you with the complete high performance microwave cable. They have outstanding mechanical integrity without sacrificing insertion loss, phase stability, or SWR. UTiFLEX Low Loss cable assemblies are extremely versatile, moderately priced, and fit a large variety of applications.

Mechanical Characteristics

UTiFLEX TYPE		UFC092D	UFA125A	UFA147A	UFA147B	UFA210A	UFA210B
Outer Diameter	inch (mm)	0.092 (2.34)	0.125 (3.18)	0.147 (3.73)	0.147 (3.73)	0.210 (5.33)	0.210 (5.33)
Center Conductor Type		solid	solid	solid	stranded	solid	stranded
Maximum Weight	grams/ft (g/m)	5.0 (16.4)	8.8 (28.9)	12.1 (39.7)	12.1 (39.7)	22 (72.2)	22 (72.2)
Minimum Bend Radius	inch (mm)	0.13 (3.30)	0.20 (5.08)	0.25 (6.35)	0.25 (6.35)	0.38 (9.65)	0.38 (9.65)
Cable Flex Life *		3,000	10,000	10,000	100,000	100,000	250,000

* Cable shall withstand specified number of unrestrained flexures (snake test)

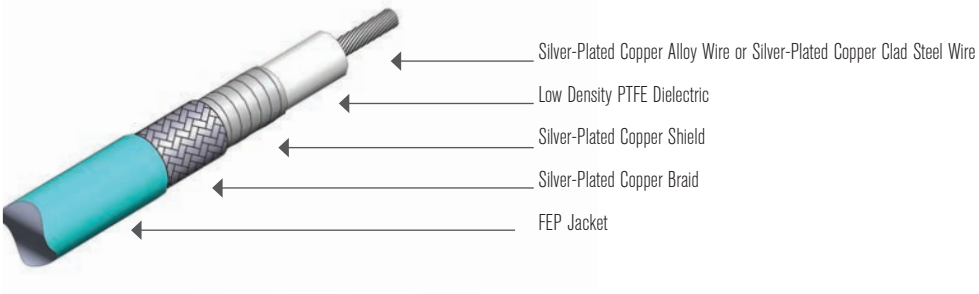
Electrical Characteristics

Impedance	ohms	50	50	50	50	50	50
Frequency Range	GHz	DC-65	DC-50	DC-40	DC-40	DC-26.5	DC-26.5
Velocity of Propagation		78%	77%	77%	77%	77%	77%
Capacitance	pF/ft (pF/m)	26.8 (87.9)	26.2 (86.0)	26.2 (86.0)	26.2 (86.0)	26.2 (86.0)	26.2 (86.0)
Shielding Effectiveness	(dB @ 1 GHz)	> 100	> 100	> 100	> 100	> 100	> 100
Maximum Insertion Loss dB/ft (dB/m)	See figure on next page						
	1 GHz	0.20 (0.66)	0.14 (0.46)	0.11 (0.36)	0.16 (0.52)	0.08 (0.26)	0.09 (0.30)
	10 GHz	0.67 (2.20)	0.48 (1.57)	0.39 (1.28)	0.52 (1.71)	0.27 (0.89)	0.30 (0.98)
	18 GHz	0.92 (3.02)	0.66 (2.17)	0.54 (1.77)	0.72 (2.36)	0.38 (1.25)	0.42 (1.38)
	26.5 GHz	1.13 (3.71)	0.82 (2.64)	0.67 (2.20)	0.89 (2.92)	0.48 (1.57)	0.53 (1.74)
	40 GHz	1.42 (4.66)	1.04 (3.41)	0.85 (2.79)	1.12 (3.67)	1.12 (3.67)	-
	50 GHz	1.61 (5.28)	1.19 (3.90)	-	-	-	-
	65 GHz	1.86 (6.10)	-	-	-	-	-
Phase Stability vs Flexure *	10 GHz	<0.5°	3°	2°	1°	2°	2°
	18 GHz	<0.5°	5°	4°	2°	4°	3°
Phase Stability vs Temperature		See figure on next page					
Power Handling		See figure on next page					
VSWR		Refer to connector selection guide					

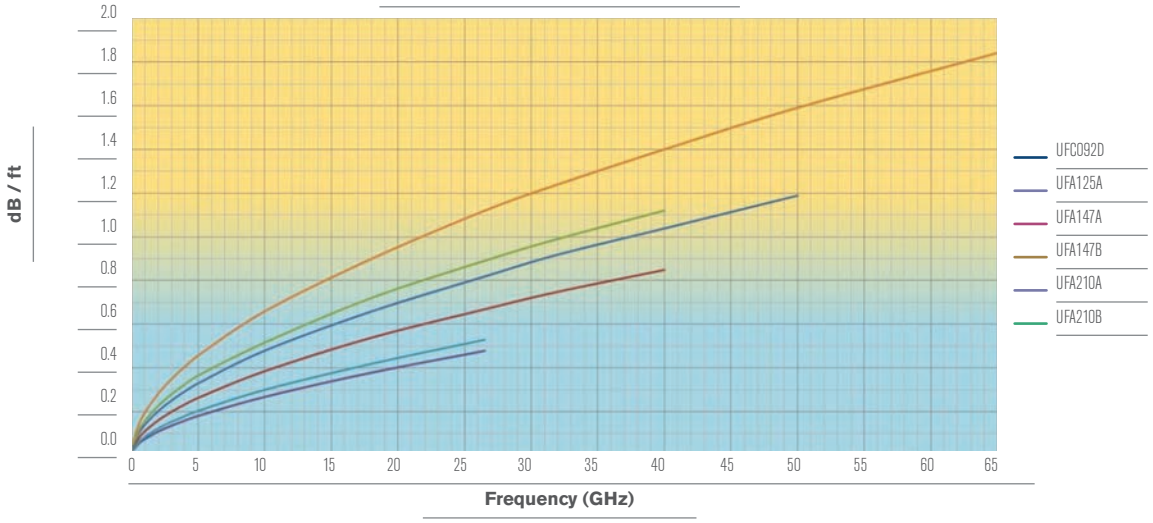
* Cable wrapped once around a 3 inch diameter mandrel

Environmental Characteristics

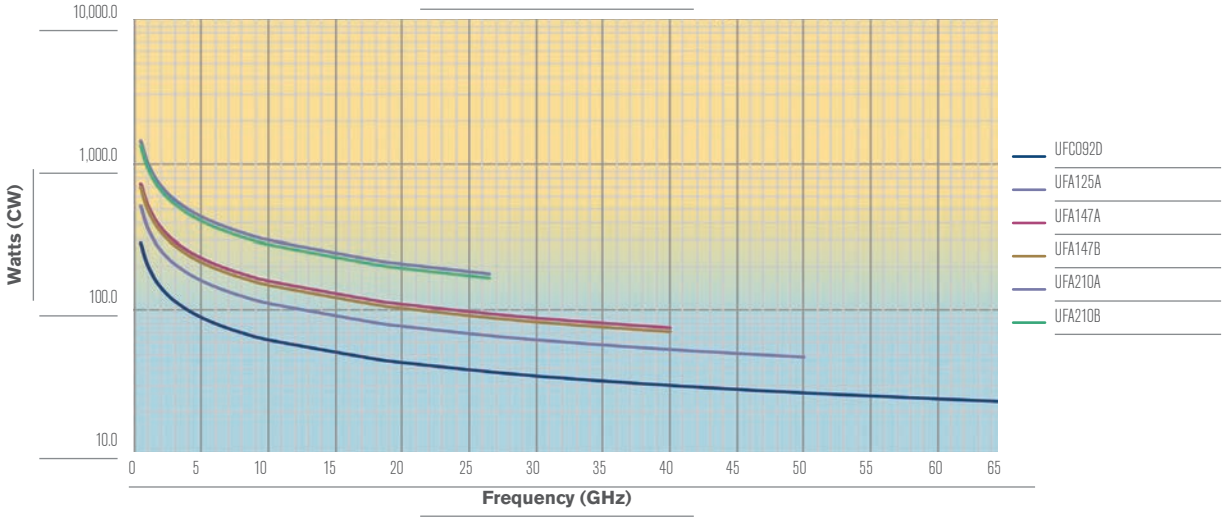
Temperature Range (Deg C)		-65/+165	-65/+165	-65/+165	-65/+165	-65/+165	-65/+165
		See page 21 for applicable environmental test					



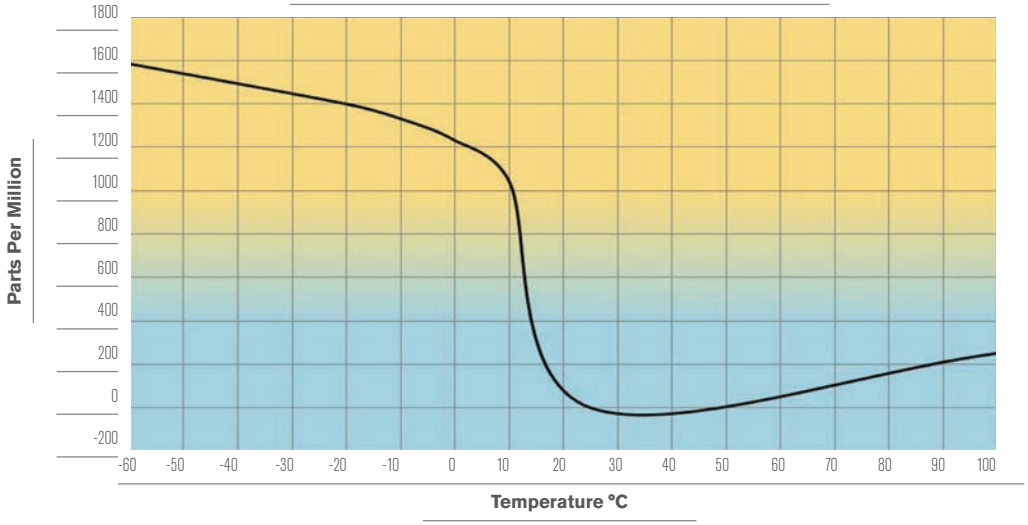
MAXIMUM INSERTION LOSS



POWER HANDLING



TYPICAL PHASE CHANGE VS. TEMPERATURE



UTiFLEX Ultra Low Loss Cable Assemblies

UTiFLEX Ultra Low Loss cable assemblies are optimized to provide the lowest insertion loss available in a flexible cable construction up to 18, 26.5, and 40 GHz. The cables utilize an ultra low density PTFE dielectric that lowers weight and insertion loss, improves electrical stability, and provides greater resilience and flexibility when compared to standard microwave cables.

Mechanical Characteristics

UTiFLEX TYPE		UFB088D	UFB142C	UFB142A	UFC185A	UFB197C	UFB205A	UFB293C	UFB311A
Outer Diameter	inch (mm)	0.088 (2.235)	0.142 (3.61)	0.142 (3.61)	0.185 (4.699)	0.197 (5.00)	0.205 (5.21)	0.293 (7.44)	0.311 (7.90)
Center Conductor Type		solid	stranded	solid	solid	stranded	solid	stranded	solid
Weight	grams/ft (g/m)	4.2 (13.78)	9.9 (32.5)	10.1 (33.1)	17.6 (57.74)	19.8 (65.0)	20.0 (65.6)	42.0 (137.8)	44.5 (146.0)
Minimum Bend Radius	inch (mm)	0.25 (6.35)	0.38 (9.65)	0.38 (9.65)	0.375 (9.525)	0.50 (12.70)	0.50 (12.70)	0.75 (19.05)	1.25 (31.75)
Cable Flex Life		25,000	75,000	75,000	10,000	150,000	25,000	50,000	15,000

* Cable shall withstand specified number of unrestrained flexures (snake test)

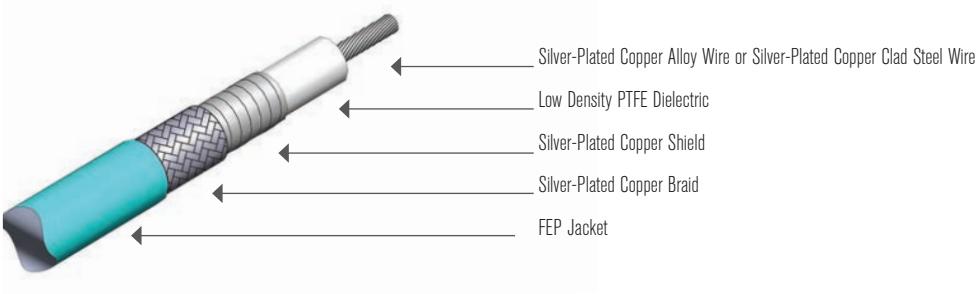
Electrical Characteristics

Impedance	ohms	50	50	50	50	50	50	50	50
Frequency Range	GHz	DC-18	DC-40	DC-40	DC-32	DC-26.5	DC-26.5	DC-18	DC-18
Velocity of Propagation		80%	83%	83%	83%	81%	83.5%	81.5%	84%
Capacitance	pF/ft (pF/m)	25.6 (84.0)	24.5 (80.4)	25.1 (82.4)	25.3 (83.0)	24.8 (81.4)	24.8 (81.4)	24.5 (80.4)	24.2 (79.4)
Shielding Effectiveness	(dB @ 1 GHz)	> 100	> 100	> 100	> 100	> 100	> 100	> 100	> 100
Maximum Insertion Loss dB/ft (dB/m)	See figure on next page								
	1 GHz	0.20 (0.66)	0.11 (0.36)	0.10 (0.33)	0.08 (0.26)	0.09 (0.28)	0.07 (0.23)	0.06 (0.20)	0.05 (0.16)
	10 GHz	0.66 (2.17)	0.36 (1.18)	0.33 (1.08)	0.27 (0.89)	0.28 (0.93)	0.23 (0.75)	0.18 (0.59)	0.15 (0.49)
	18 GHz	0.89 (2.92)	0.49 (1.61)	0.44 (1.44)	0.36 (1.18)	0.38 (1.26)	0.32 (1.05)	0.25 (0.82)	0.21 (0.69)
	26.5 GHz	-	0.59 (1.94)	0.54 (1.77)	0.44 (1.44)	0.47 (1.55)	0.39 (1.28)	-	-
	32 GHz	-	0.66 (2.16)	0.60 (1.97)	0.49 (1.61)	-	-	-	-
	40 GHz	-	0.74 (2.43)	0.68 (2.23)	-	-	-	-	-
Phase Stability vs Flexure *	10 GHz	2°	3°	2°	3°	2°	4°	2°	5°
	18 GHz	3°	5°	5°	6°	3°	7°	3°	1°
Phase Stability vs Temp		See figure on next page							
Power Handling		See figure on next page							
VSWR		Refer to Connector Selection Guide							

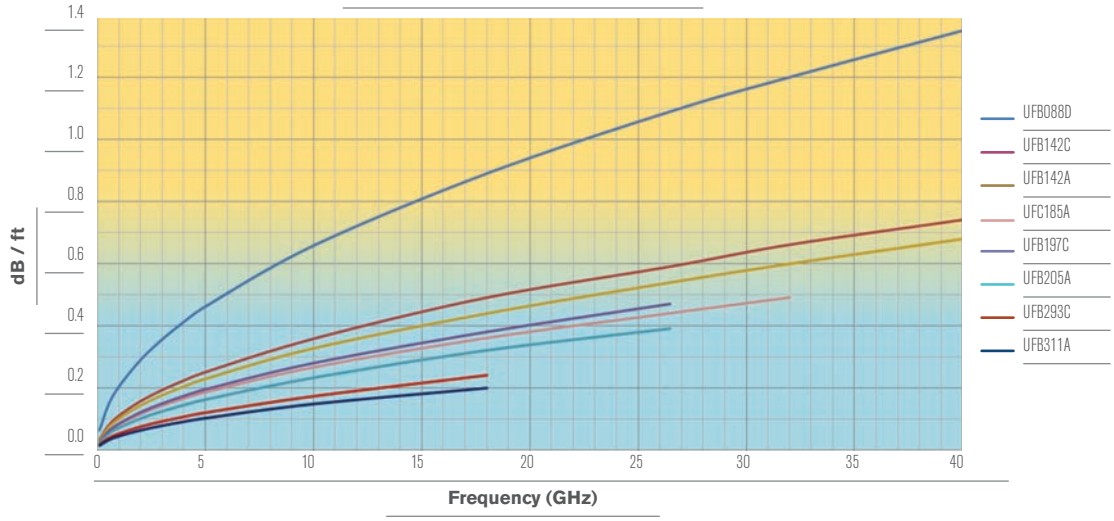
* Cable wrapped once around a 3 inch diameter mandrel

Environmental Characteristics

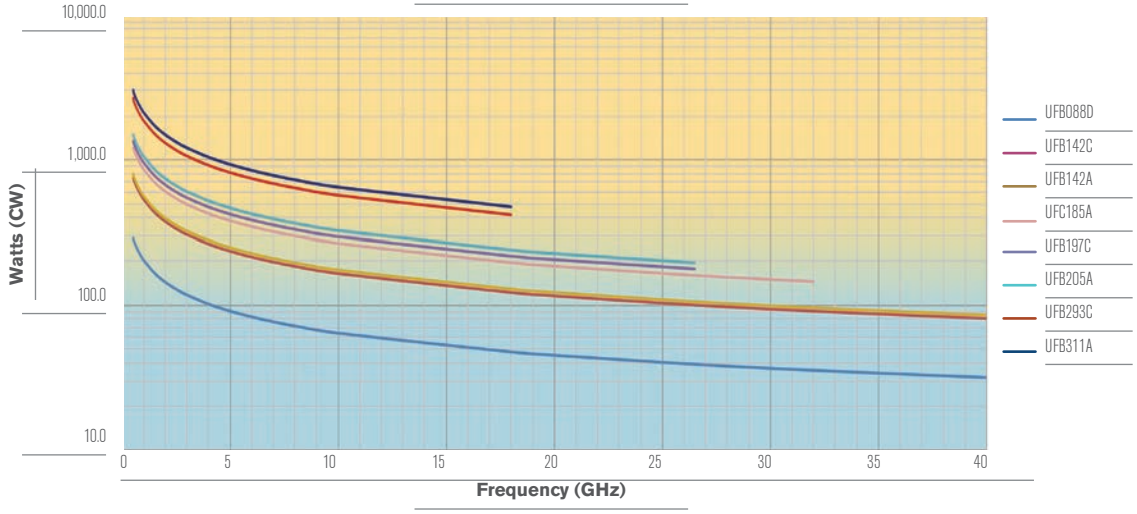
Temperature Range (Deg C)		-65/+165	-65/+165	-65/+165	-65/+165	-65/+165	-65/+165	-65/+165	-65/+165
	See page 21 for applicable environmental test								



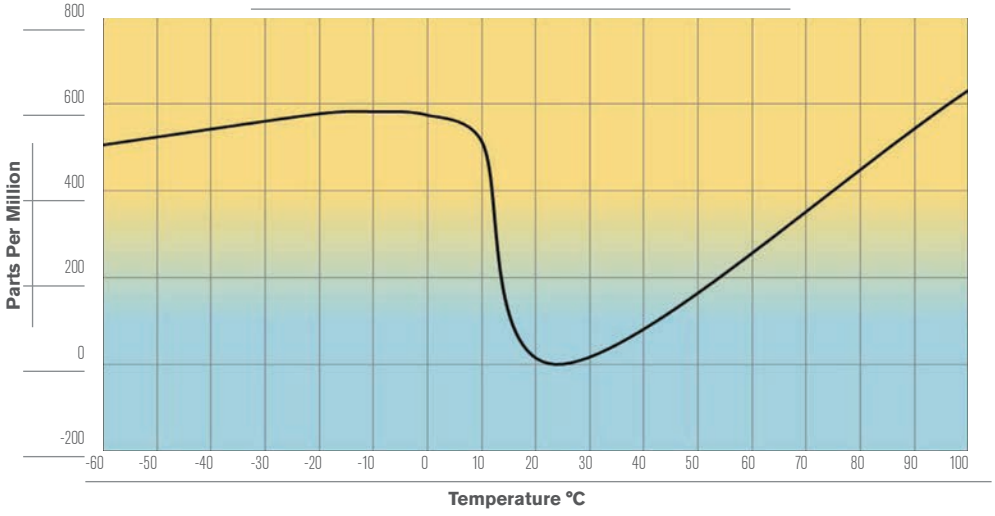
MAXIMUM INSERTION LOSS



POWER HANDLING



TYPICAL PHASE CHANGE VS. TEMPERATURE



UTiFLEX Ultra Light Cable Assemblies

UTiFLEX Ultra Light cable assemblies are optimized for spaceflight applications. They provide the lightest weight, lowest insertion loss, and best radiation resistance in a flexible cable construction. The cables utilize CarlisleIT's ARACON® for the outer shield, an ultra low density PTFE for the dielectric, and a DuPont Tefzel® jacket. If required, cable assemblies are manufactured in a Class 10,000 clean room by certified solder technicians.

Mechanical Characteristics

UTiFLEX TYPE		MCJ088D	MCJ142A	MCJ185A	MCJ205A	MCJ311A
Outer Diameter	inch (mm)	0.088 (2.24)	0.142 (3.61)	0.185 (4.70)	0.205 (5.21)	0.310 (7.87)
Center Conductor Type		Solid	Solid	Solid	Solid	Solid
Maximum Weight	g/ft (g/m)	3.6 (11.8)	8.8 (28.9)	12.4 (40.7)	16.0 (52.5)	35 (114.8)
Minimum Bend Radius	inch (mm)	0.25 (6.35)	0.38 (9.65)	0.38 (9.65)	0.5 (12.70)	1.25 (31.75)

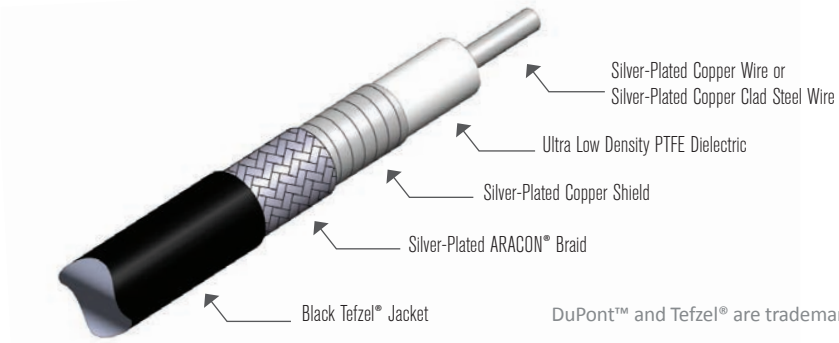
Electrical Characteristics

Impedance	ohms	50	50	50	50	50
Frequency Range	GHz	DC-18	DC-40	DC-32	DC-26.5	DC-18
Velocity of Propagation		80%	83%	83%	84%	83%
Capacitance	pF/ft (pF/m)	25.5 (83.7)	24.5 (80.4)	24.5 (80.4)	24.2 (79.4)	24.5 (80.4)
Shielding Effectiveness	(dB @ 1 GHz)	> 100	>100	>100	>100	>100
Maximum Insertion Loss dB/ft (dB/m)	See figure on next page					
	1 GHz	0.20 (0.66)	0.10 (0.33)	0.08 (0.26)	0.07 (0.23)	0.05 (0.16)
	10 GHz	0.66 (2.17)	0.33 (1.08)	0.27 (0.89)	0.23 (0.75)	0.15 (0.49)
	18 GHz	0.89 (2.92)	0.44 (1.44)	0.36 (1.18)	0.32 (1.05)	0.21 (0.66)
	26.5 GHz	-	0.54 (1.77)	0.44 (1.44)	0.39 (1.28)	-
	32 GHz	-	0.60 (1.97)	0.49 (1.61)	-	-
	40 GHz	-	0.68 (2.23)	-	-	-
Phase Stability vs Flexure *	10 GHz	2°	2°	2°	1°	3°
	18 GHz	2°	3°	6°	2°	5°
Phase Stability vs Temperature	See figure on next page					
Power Handling	See figure on next page					
VSWR	Refer to Connector Selection Guide					

* Cable wrapped once around a 3 inch diameter mandrel

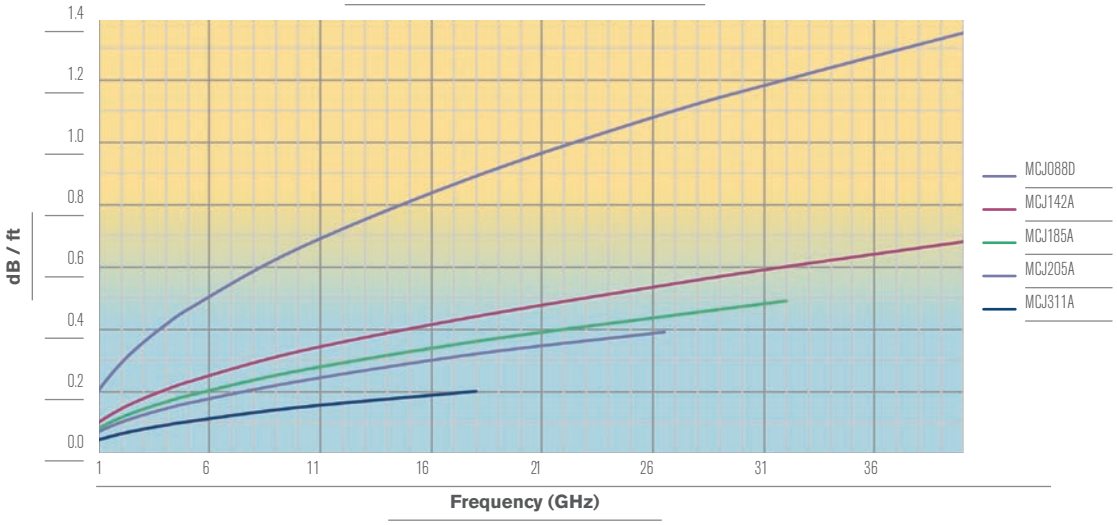
Environmental Characteristics

Temperature Range (Deg C)		-150C/+165	-150C/+165	-150C/+165	-150C/+165	-150C/+165
See page 21 for applicable environmental test						

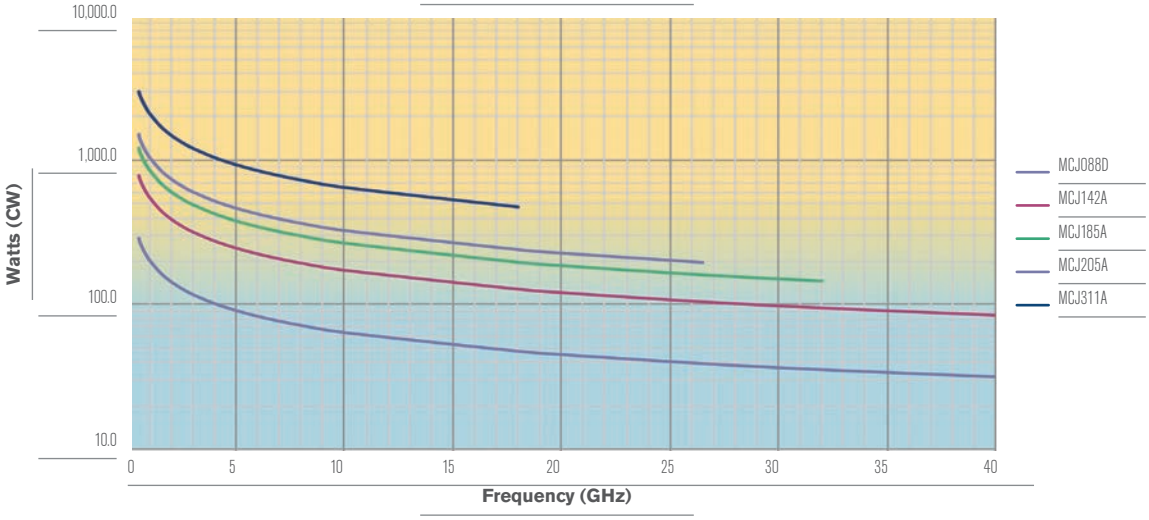


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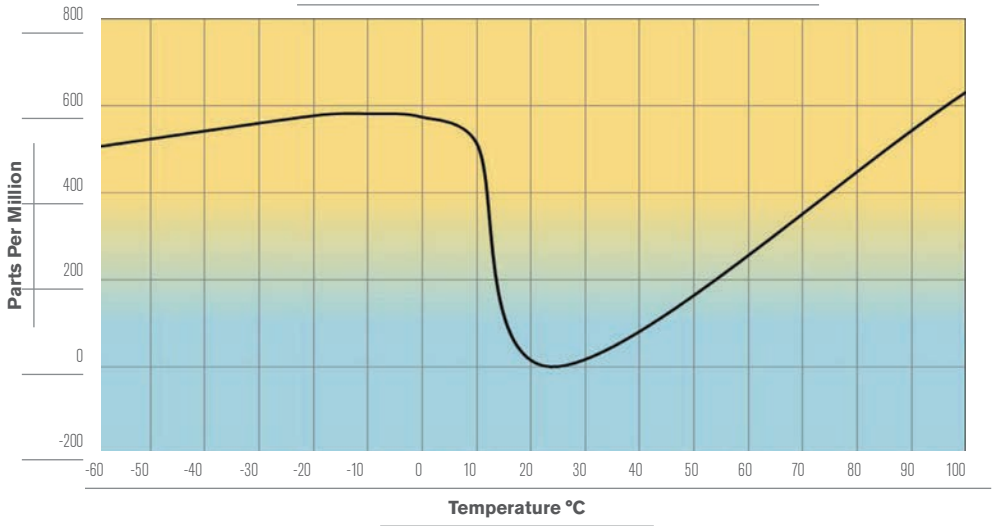
MAXIMUM INSERTION LOSS



POWER HANDLING



TYPICAL PHASE CHANGE VS. TEMPERATURE



MKR Test Cable Assemblies

MKR represents the best in CarlisleIT technology. Using its industry leading UTiFLEX microwave cable as a base, CarlisleIT then fits MKR with an additional highly flexible and abrasive resistant ruggedization.

The resulting integrated product becomes an ideal choice for test labs or any testing environment requiring excellent mechanical strength and long term reliability in a compact package. The MKR test cable assemblies have passed strenuous lifetime qualification testing to insure long term reliability. Though extremely flexible, they also feature excellent crush, torque and kink resistance ideally suited to the demanding requirements of today's test environments. MKR test cables are available in the 26.5-GHz MKR300C series capable of withstanding 150,000 unrestrained flexes with minimal degradation.

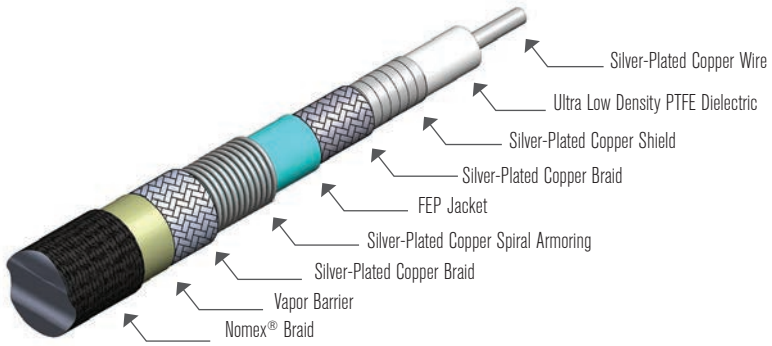
MKR Test Cable

Cable Part Number		MKR300C
MATERIALS		
Center Conductor Material		7 Strand SPC Alloy
Dielectric Material		ULD PTFE
Inner Shield Material		SPC
Outer Shield Material		SPC
Jacket Material		FEP
Internal Armor		SPC
Outer Armor		SPC BRAID
Vapor Barrier		Proprietary
Outer Abrasion Resistant Braid		NOMEX®
MECHANICAL CHARACTERISTICS		
Outer Diameter	In (mm)	0.300 (7.62)
Center Conductor Type		Stranded
Maximum Weight	g/ft (g/m)	51 (167.3)
Minimum Bend Radius	In (mm)	1.50 (38.10)

MKR Test Cable

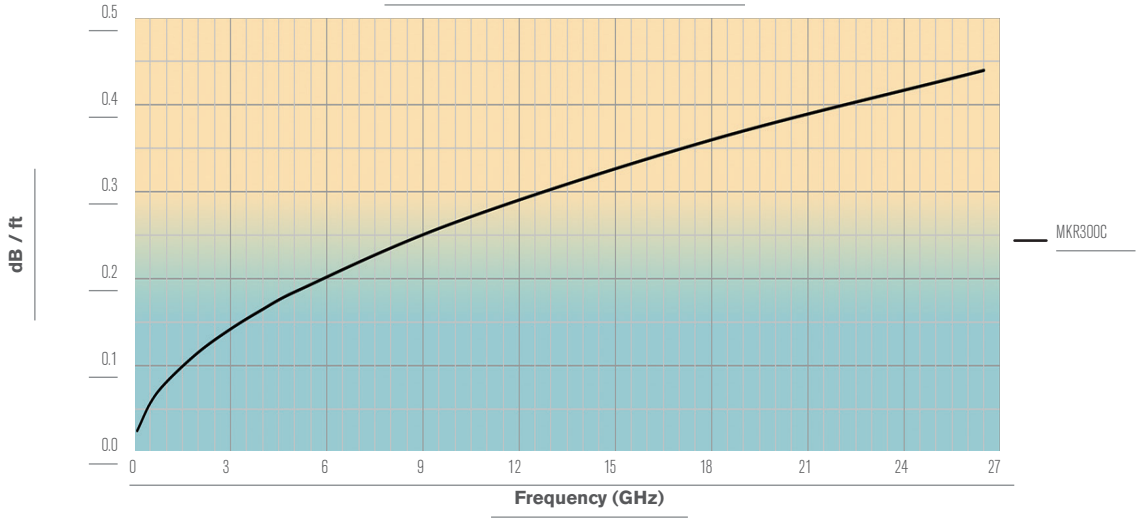
Cable Part Number		MKR300C
ENVIRONMENTAL CHARACTERISTICS		
Temperature Range (Deg C)		-65/165
ELECTRICAL CHARACTERISTICS		
Impedance (ohms)		50
Frequency Range (GHz)		DC-26.5
Velocity of Propagation		81%
Capacitance	pf/ft (pf/m)	25.1 (82.4)
Shielding Effectiveness (dB @ 1 GHz)		>100
Maximum Insertion Loss dB/ft (dB/m)	1 GHz	0.08 (0.25)
	10 GHz	0.27 (0.89)
	18 GHz	0.36 (1.18)
	26.5 GHz	0.44 (1.44)
	40 GHz	-
Phase Stability vs Flexure (10GHz)*		2°
Phase Stability vs Flexure (18 GHz)*		3°

* Cable wrapped once around a 3 inch diameter mandrel

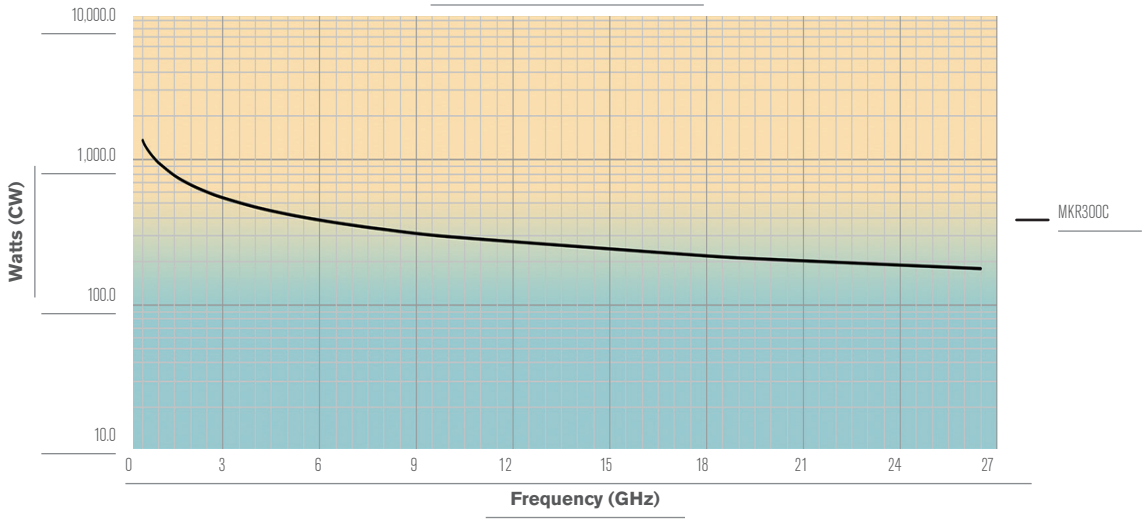


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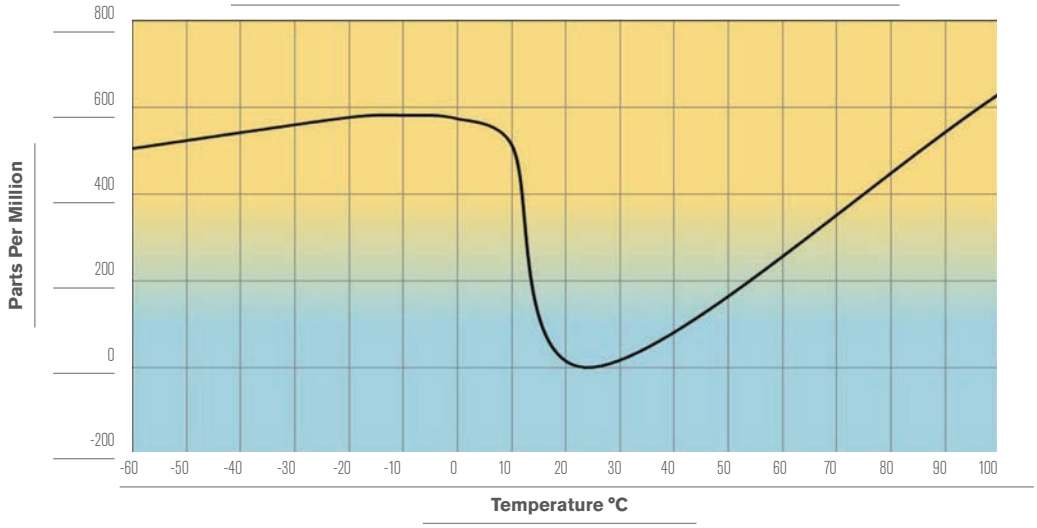
MAXIMUM INSERTION LOSS



POWER HANDLING



TYPICAL PHASE CHANGE VS. TEMPERATURE RUGGEDIZED, FLEXIBLE ULTRA LOW LOSS PTFE CABLE



TVAC Miniature Low Loss Cable Assemblies

Thermal vacuum testing is a risk mitigation strategy utilized in some high-rel applications, notably space equipment such as satellites. CarlisleIT TVAC test assemblies are thermal vacuum compatible for use in or into TVAC chambers. These assemblies utilize high performance ultra low loss UTiFLEX cable and are produced to exacting space-grade standards utilizing low-outgassing materials and vented connectors.

Key Characteristics

- Low Outgassing per ASTM E-595 (<1%TML and <0.1% CVCM) Temperature Range: -65 to +165C (Typical, consult factory for individual types)
- Ideal Phase Performance due to Ultra-Low-Loss dielectric materials
- Superior Cable Mechanical Stability and Connector Captivation Techniques to address increasing thermal extremes of the space market
- Clean-room manufacturing and real-time X-ray upon request
- High-power configurations available. All high-power TVAC assemblies are manufactured in a clean-room environment to full space-grade standards. Consult CarlisleIT for specific power/frequency requirements
- Individually bagged to prevent post-assembly contamination
- Vented connectors

Part Number Designation (example)

Base Part Number		Phase Matching (optional)
UFB142A-0-XXXX-20V20V TV		AM
tWhere	XXXX is cable assembly length in 0.1 inch increment. Length Tolerance = -0 / +0.5 inches (XXXX <= 100 inches) Length Tolerance = -0 / + 0.5% (XXXX >= 100 inches)	
	If absolute phase matching is required, then add "AM" code. For phase matched assemblies length tolerance is not applicable	



Cable Table

Part Number		UFB142A	UFC185A	UFB197C	UFB205A	UFB293C	UFB311A
Impedance	ohms	50	50	50	50	50	50
Max. Frequency	GHz	40	32	26.5	26.5	18	18
Max. Insertion Loss dB/ft (dB/m)	1 GHz	0.10 (0.33)	0.08 (0.26)	0.09 (0.28)	0.07 (0.23)	0.06 (0.20)	0.05 (0.16)
	10 GHz	0.33 (1.08)	0.27 (0.89)	0.28 (0.93)	0.23 (0.75)	0.18 (0.59)	0.15 (0.49)
	18 GHz	0.44 (1.44)	0.36 (1.18)	0.38 (1.26)	0.32 (1.05)	0.25 (0.82)	0.21 (0.69)
	26.5 GHz	0.54 (1.77)	0.44 (1.44)	0.47 (1.55)	0.39 (1.28)	–	–
	32 GHz	0.60 (1.97)	0.49 (1.61)	–	–	–	–
	40 GHz	0.68 (2.23)	–	–	–	–	–
Power Handling	watts (CW) @ 10 GHz	175	267	296	326	570	648
Nominal Outer Dia.	inch (mm)	0.142 (3.61)	0.185 (4.70)	0.197 (5.00)	0.205 (5.21)	0.293 (7.44)	0.311 (7.90)
Maximum Weight	grams/ft (g/m)	10.1 (33.1)	17.6 (57.7)	19.8 (65.0)	20 (65.6)	42 (137.8)	44.5 (146.0)
Center Conductor	type	Solid	Solid	Stranded	Solid	Stranded	Solid
Static Bend Radius	inch (mm)	0.38 (9.65)	0.38 (9.65)	0.50 (12.70)	0.50 (12.70)	0.75 (19.05)	1.25 (31.75)

Connector Table (straight and formed elbow configurations available)

Description	Part Number	Cables	Frequency	Max Swr (Per Connector)
SMK PLUG	20V	142	DC-40 GHz	1.16:1 to 18 GHz, 1.22:1 to 40 GHz
SMK PLUG	20V	185	DC-32 GHz	1.16:1 to 18 GHz, 1.22:1 to 32 GHz
SMK PLUG	20V	205	DC-26.5 GHz	1.16:1 to 18 GHz, 1.20:1 to 26.5 GHz
PC3.5MM PLUG	00V	205	DC-26.5 GHz	1.16:1 to 18 GHz, 1.20:1 to 26.5 GHz
SMA PLUG	30V	142, 197, 205, 293, 311	DC-18GHz	1.16:1 to 18 GHz
Precision N PLUG	50V	142, 197, 205, 293, 311	DC-18GHz	1.16:1 to 18 GHz
Precision TNC PLUG	60V	142, 197, 205, 293, 311	DC-18GHz	1.20:1 to 18 GHz

Evironmental Characteristics

UTiFLEX cable assemblies are designed to survive the harshest and most stringent environments including:

» Spaceflight
» Airframe
» Laboratory
» Arctic/Desert
» Battlefield

UTiFLEX cable assemblies have tested successfully for numerous environmental requirements, some of which are listed below. After exposure to these conditions, the cable assembly did not show visible damage and the insertion loss, SWR, and connector interface dimensions remained within specified limits.

» Thermal Shock per MIL-STD-202, Method 107, 20 cycles, -65 to 165 degrees C, or MIL-STD-810, Method 503, Procedure
» Vibration per MIL-STD-202, Method 204, Test Condition B
» Humidity per MIL-STD-810, Method 108
» Salt Fog per MIL-STD-810, Method 509
» Sand and Dust per MIL-STD-810, Method 510
» Stress Crack Resistance per MIL-DTL-17, Paragraph 4.8.17
» Cold Bend per MIL-DTL-17, Paragraph 4.8.19
» Chemical Resistance
  - JP-4 and JP-5 fuels
  - Hydraulic fluid
  - Lubricating oil
  - Coolants of fluorocarbon, silicon, silicate ester, and glycol families
» Flammability per 14 CFR Part 25

Carlisle Interconnect Technologies in-house test capabilities include mechanical, visual, temperature, thermal shock, humidity, real-time x-ray, RF shielding, dynamic flexing, vacuum, and a fully equipped microwave test lab for frequencies up to 67 GHz.



Mode stir RF-Shielding testing per IEC Standard 61000-4-21 Annex F

UTiFLEX Cable Assemblies Part Number System



Connector Part Number
(See page 8)

Cable assembly length (inches)
Last digit represents decimal point

Armor Code (See page 8)
1– Polyurethane Jacket Over Braid/Stainless Steel Spiral
2– Stainless Steel Interlocked Hose
Q- (Special, FEP Over Spiral)*

Center Conductor Code
A – Solid Silver-Plated Copper
B – 19 Strand Silver-Plated Copper
C – 7 Strand Silver-Plated Copper
D – Solid Silver-Plated Copper Clad Steel
F – 7 Strand High Strength SPC Alloy

Cable Diameter (inch x 1000)

Cable Code
A,C – Low Loss
B – Ultra Low Loss
F – Miniature Low Loss
J – Ultra Light
N– Low Loss (Flat Wire Braided Shield)
R– Ruggedized

Jacket Code
UF – Light Aqua FEP
UG – Light Aqua PFA
MC – Black Tefzel®
MK – Black Ruggedized

Examples

UFA210A-0-0360-300300
FEP jacketed, Low Loss, 0.210 inch diameter cable, solid silver-plated copper center conductor, no armor, 36.0 inches long, SMA plug connectors on each end.

UFB293C-2-0105-504310
FEP jacketed, Ultra Low Loss, 0.293 inch diameter cable, 7 strand silver-plated copper center conductor, stainless steel interlocked hose armor, 10.5 inches long, Precision N plug by SMA jack connectors.

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*Contact CarlisleIT for more information.

Care & Handling

General Instructions

UTiFLEX Microwave cable assemblies are precision components that require proper use, routine inspection and periodic cleaning of the connectors to maintain reliable performance. Such care will increase the life the assembly and all associated test equipment as well as ensure more accurate and reliable measurements. Failure to observe these guidelines can result in inaccurate test data or permanent damage to both the assembly and other equipment. In addition to this instruction, an excellent resource for proper care and handling is the archived Hewlett Packard Application Note 326, “Coaxial Systems Principles of microwave connector care”.

Cable Accessory Handling

» Always observe specified cable minimum bend radius, especially at the ends of the connector strain-reliefs where excessive stress may not be obvious. Failure to do so may result in permanent cable performance degradation.

» CarlisleIT cables are designed to withstand heavy use, but avoid pinching or crushing the cable and do not drop heavy objects on the cable.

» Never pull the cable when connected or use it to support any additional weight.

» Maintain a clean and dry test environment whenever possible. Foreign particles or chemicals can damage interconnects and should be avoided/prevented whenever possible.

Connector Handling

» Periodically (ideally before every critical test) inspect all connector interfaces. If necessary, clean out the connector interface by first blowing with compressed air. If contamination remains, use a cotton swab slightly moistened with isopropyl alcohol to remove impurities, then allow to dry before testing. If any part of a connector interface becomes damaged, the connector should be replaced to prevent permanent damage to other components.

» Mechanically inspect all connector interfaces using a calibrated gage to ensure the interface is in compliance with its controlling standard.

» Always align connector centerlines before attempting to mate. Take care to perform this step properly as any required play in the coupling nut may allow the threads to mate without proper center contact insertion. This could damage or destroy critical connector components.

» When threading male coupling nuts, ensure the female component remains stationary while threading the male coupling nut onto the threads of the mating interface. Otherwise, unnecessary wear will occur on both connectors causing degradation of measurements.

» Always tighten connectors to the required torque using only the correct and properly calibrated torque wrench. Make sure the wrench is held perpendicular to the connector centerline, as tilting tools or connector components will cause damage. Tighten slowly to ensure that the ratchet mechanism on the wrench engages at the true torque value. For knurled nuts, finger-tighten only.

» When nearing full mate, apply a backing wrench to the connector’s wrench flat to prevent any twisting or turning of the connector and/or cable.

Selected Other Products









Semi-Rigid Cables and Assemblies

» A full range of MIL-DTL-17 QPL models

» Impedance from 5 to 100 ohms, sizes from 0.013 to 0.500 in.

» 100% RF shielding

» Low VSWR

» Many material options

» Low loss cables available. These employ a low density PTFE dielectric for better phase stability and no thermal expansion of dielectric resulting in greater power handling ability and broader operating temperature range than standard MIL-DTL-17 cables

Coaxial Delay Lines

» Extremely reliable way to generate short delays needed by base station amplifiers, radar, ECM, instrumentation, and many other applications

» Standard delays from 5 to 200 ns

» Wide choice of custom configurations

» Low loss cable options offer excellent phase stability and a high volume solution for telecommunications applications

M-FLEX® Flexible Cable

» Same line size as Semi-Rigid to optimize assembly loss and VSWR

» Fully flexible for ease of installation

» Helical Shield for improved loss and phase stability

» Isolation greater than 90 dB to minimize cross talk and maximize system performance

Airframe Cables

» Airframe Cable Harnesses

» Many available options for combining cable assemblies into harnesses

» Multipin Connector Housing
- Size 8, 12, and 16 coaxial cables
- Various MIL-C-38999 compliant options
- Quick disconnect
- Blind mate
- High Density







ARACON® Brand Metal Clad Fiber

» Ultra Lightweight braiding material
» Improved high frequency shielding
» Increased flexibility

ARACON® Braided EMI Shielding

» Up to 80% weight reduction
» Higher coverage due to textile nature
» Stronger than steel

UTiFORM®

» Hand-Formable
» Available with low-density dielectrics
» 100% RF Shielding
» Higher temperature rating than Semi-Rigid
» Excellent attenuation and VSWR
» Low cost



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