RF Microwave Cable Assembly Catalogue

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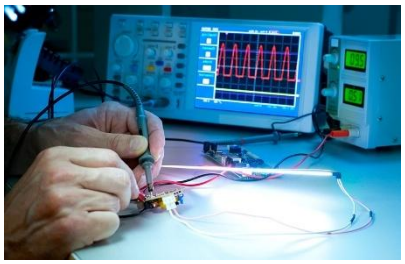
About Us

AWAN Wireless & Antenna Inc. was established in December 2017 in Taiwan as a subsidiary of ACON Holding. As one of the leading companies for developing and designing antennas and wireless systems for low frequency design AWAN take the next step into RF Microwave.

Since 2025 AWAN is also specialized in high frequency RF Parts, military, defense, commercial, industrial and Satellite application. With our new product line in RF Microwave AWAN is expanding it's business to meet our customer needs and above. RF Adapter, RF Connectors, RF Cable Assemblies and RF Tools are just a small example of the product we can offer.

AWAN is working closely together with more than 500 customers worldwide, develop their products especially and for our customers and continuously research for new and environmentally friendly manufacturing processes.

Our products are also ISO certified, MIL-STD and measured and tested with the newest VNA measurement system.



Main products for RF Microwave:

- mmWave Coaxial Adapter / Connector (Up to 110 GHz)
- Flexible Cable Assembly (Up to 110 GHz)

Introduction of Cable and Cable Assembly

AWAN offers a complete line of high-performance microwave flexible cables up to 110 GHz, with a variety of options in cable size, flexibility, loss and affordability. Furthermore, we provide highly reliable cable assemblies widely used in test & measurement, high frequency inter-connection, 5G system as well as in harsh environments such as defense, naval etc. Every cable assembly is tested for insertion loss, VSWR and shipped with an individual test plot.

Features and Benefits

- Versatile cable selections in different flexibility, loss and affordability
- Low loss cables available to 18, 26.5, 40, 50, 67, 110 GHz
- Proven phase stability vs. temperature and flexure
- Precise phase match available
- Various ruggedized armor and connector options
- Competitive price and very quick delivery
- Custom designs available

Testing and Inspections

AWAN performs below inspections and tests for cable and cable assemblies.

Acceptance Testing		Qualification Testing
Test Items	**Inspection Rate**	**Test Items**
Insertion loss	100%	Minimum Static Bend Radius
VSWR	100%	Minimum Dynamic Bend Radius
Amplitude vs.Shaking	100%	Flex life
Connector Interface	100%	Connector Retention
Assembly Marking	100%	Coupling Mechanisim Proof Torque
Assembly Length	100%	Insertion loss vs. Temperature
Workmanship	100%	Phase Stability vs. Temperature
Cable Diameter	100%	Phase Change vs. Bending
Cable Weight	Sampling each lot	Thermal Shock
Velocity of Propagation	Sampling each lot	Vibration
Dielectric Withstanding Voltage	Sampling each lot	Cold Bend
Characteristic Impedance	Sampling each lot	Salt Spray
Tensile Strength and Elongation	Sampling each lot	Stress Crack Resistance
Center Conductor Adhesion	Sampling each lot	Aging Stability

Contents

PUL Series-Ultra-low Loss Phase and Amplitude Stable Flexible Cable

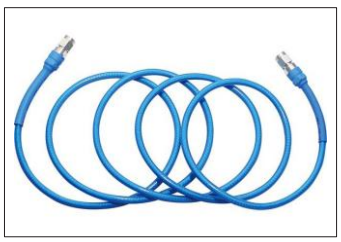
- Minimal phase and attenuation change versus flexure
- Ultra-low loss & VSWR, up to 110 GHz
- Robust and reliable, ruggedized armors available
- Broad options in frequency, cable size, connector

FL Series-Long Flex Life Triple-shielding Flexible Cable

- Long flex life, ideal as test or interconnect cables
- Triple shielding with superior shielding effectiveness
- Torque resistant and high pull off strength
- Low loss and good amplitude stability with flexure

TB Series-Tight Bend Triple-shielding Flexible Cable

- Flexible alternatives to semi-rigid cables
- Allowing multiple times of bending from connector end
- Eliminating use of right angle connectors
- Small bending radius, ideal for high density interconnect



ULL Series-Ultra-Flexible Phase Stable Low Loss Cable

- Ultra-flexible with stranded inner conductor
- Excellent phase stability over to 40GHz
- Durable design, long flex life
- Ruggedized armors available

SF Series-Low Loss Flexible Cable Replacing Semi-flexible Cable

- Superior flexible alternative to semi-flexible cables
- Up to 67 GHz, available in 047, 086 and 141 sizes
- Highly competitive pricing, from stock
- Lower loss than equivalent hand-formable cables

Contents

EL Series-Economical Low Loss Flexible Cable

- Attractive cost vs performance ratio
- Good amplitude stability vs flex and shaking
- Low Loss with LD-PTFE dielectric wrapping

TPH Series-Temperature Phase Stable Cable

- Excellent temperature phase stability 300PPM
- PTFE “Knee”is Non-existent
- Low loss to 40GHz
- Small bending radius and low profile for easy routing

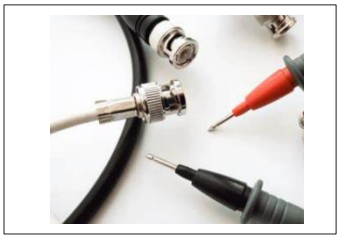
Armored Cable Assemblies

- Repeatable and precise performance, ideal for bench-top test
- Available in SMA, N, 3.5mm, 2.92mm, 2.4mm, 1.85mm and 1.0mm connectors
- Multi-layer armors against crush and abrasion
- Long service life, 20,000 flex cycles

Phase Matched Cable Assemblies

- Phase matching available up to 110 GHz
- Precise matching in electrical length or time delay
- Available ±4° @ 18 GHz, or ±1 ps
- Fast delivery, competitive price

3. Engineering Information



Selection Guide

Cable Series Designation	Part Number	Max Operation Freq(GHz)	Super Flexibility	Low Loss	Phase Stability vs. Flex	Phase Stability vs.Temp	High Power	Low Profile	High Mechanical Strength with multi-shielding	Addtional Remarks
Ultra-Low Loss Phase and Amplitude Stable PUL Series	PUL180	110	★★★	★★	★★	★		★★★		Precision Test or high end inter-connect
	PUL220	67	★★	★★	★★	★★		★★		
	PUL230P	67	★★	★★	★★★	★		★★	★★	
	PUL360P	50		★★	★★★	★			★★	
	PUL360	40		★★★	★★	★★				
	PUL380P	40		★★★★	★★★	★★			★★	
	PUL390P	40		★★★	★★★	★★			★★	
	PUL520	26.5		★★★	★★★	★★				
	PUL520P	26.5		★★★	★★★	★★			★★	
	PUL800	18		★★★	★★★	★★	★★			
	PUL1200	10		★★★	★★★	★★	★★★			
Long Flex Life Triple-Shielding FL Series	FL460	26.5		★★	★				★★★	General Purpose Test or interconnect
	FL520	18		★★	★				★★★	
	FL620	18		★★	★		★		★★★	
Low cost flexible alternative to semi-flexible SF Series	SF160	67	★★★					★★★		Interconnect use
	SF280	40	★					★		
	SF400	18								
Tight Bend Replacing Semi-rigid TB Series	TB200	40	★★		★			★★	★★★	Super small bending radius, bend-to-end
	TB250	40	★★		★	★		★	★★★	
	TB250L	40	★★		★	★		★	★★★	
	TB260L	50	★★		★★			★	★★★	
	TB360	26.5	★		★				★★★	
Ultra-Flexible Phase Stable Low Loss ULL Series	ULL360	40	★★★	★★	★★★	★★				Stranded SPC center conductor
	ULL450	40	★★★	★★	★★★	★				
	ULL520	26.5	★★★	★	★★★	★				
	ULL550	26.5	★★★	★★	★★★	★★				
Economical Low Loss Interconnect EL Series	EL280	26.5	★	★★	★			★		Low cost
	EL350	18		★★	★					
	EL520	18		★★	★					
	EL780	13.5		★★	★		★			
Temperature Phase Stable TPH Series	TPH220		★★	★	★★	★★★★		★★		300PPM

★ Good ★★ Very good ★★★ Excellent ★★★★ Outstanding

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Overview PUL Series

Ultra-low Loss Phase and Amplitude Stable Flexible Cable

Our PUL series are phase and amplitude stable low loss cables with max operating frequency options of 18GHz, 26.5GHz, 30GHz, 40GHz, 50GHz, 67GHz and 110GHz. Using micro-porous PTFE dielectrics which provide consistent performance over temperature changes, these cables are ideally for high frequency signal transmission between systems or used in test instruments when low loss and stability are critical. PUL series cable assemblies are available with a broad selection of connectors and ruggedized armors. Bulk cables available as well.

Features

- Minimal phase and attenuation change versus flexure
- Robust for dynamic use with multiple inter-layers
- Very low VSWR and loss, typ VSWR 1.30 to 67GHz
- Broad options of frequency, cable size, connector and armor

Cable Data

Part Number	Outer Diameter(mm)	Static Bend Radius(mm)	Max Operation Freq(GHz)	Phase Stability @ max freq	Loss(dB/m @ max freq)	Avg Power(watts@ max freq)
PUL180P	1.8	10	110	<±12º@110GHz	13.1	3
PUL220	2.2	11	67	<±8º@67GHz	6.0	29
PUL230P	2.6	11	67	<±7º@67GHz	6.0	29
PUL360P	3.6	18	50	<±5º@50GHz	3.3	55
PUL360	3.6	18	40	<±6º@40GHz	2.6	75
PUL380P	3.8	18	40	<±5º@40GHz	2.2	74
PUL390P	3.9	18	40	<±5º@40GHz	2.6	75
PUL520	5.2	25	26.5	<±5º@26.5GHz	1.3	160
PUL520P	5.4	26	26.5	<±5º@26.5GHz	1.3	160
PUL800	7.9	40	18	<±5º@18GHz	0.7	398
PUL1200	12.0	60	10	<±4º@10GHz	0.4	867

Cross Reference

Model	GORE	Insulated Wire	Micro-Coax	Harbour	TIMES	Semflex
PUL220, PUL230P	CXN3506					
PUL360, PUL360P	CXN3507	1401	UFB142A			
PUL520, PUL520P	CXN3449	1801	UFB205A		HF190	
PUL800	CXN3450	2801	UFB311A	LLS290	HF290	LA290

PUL Series

Ultra-low Loss Phase and Amplitude Stable Flexible Cable

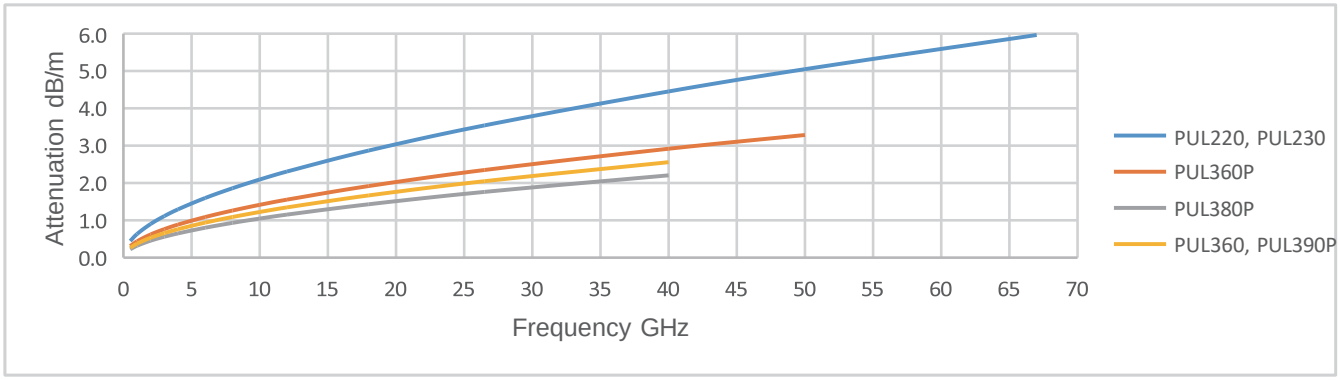
	PUL180	PUL220	PUL230P	PUL360P	PUL360	PUL380P
Cable Construction(Diameter in mm)						
Center Conductor	0.29	0.51	0.51	0.72	0.91	1.02
Dielectric	0.94	1.43	1.60	2.15	2.50	2.85
Outer Conductor	1.06	1.55	1.70	2.30	2.66	3.06
Interlayer	1.20	/	2.00	2.60	/	3.22
Outer Shield	1.50	1.85	2.25	3.05	3.06	3.67
Jacket	1.80	2.20	2.60	3.60	3.60	3.80
*Armor Option	AL380	/	AL500&A640	AL640	AL640	AL640
* Please refer to Page 33 for armor details.						
Mechanical						
Min. Bending Radius Static	10mm	11mm	13mm	18mm	18mm	19mm
Min. Bending Radius Repeated	20mm	22mm	26mm	36mm	36mm	38mm
Weight	9g/m	18g/m	18g/m	34g/m	33g/m	37g/m
Temperature range	-50℃ to +150℃ (cable only), -50℃ to +85℃ (cable assembly)					
Electrical						
Operating Frequency	DC-110 GHz	DC-67 GHz	DC-67 GHz	DC-50 GHz	DC-40 GHz	DC-40 GHz
Impedance	50 Ω	50 Ω	50 Ω	50 Ω	50 Ω	50 Ω
Velocity of Propagation	82%	81%	74%	76%	82%	82%
Shielding Effectiveness	>90 dB	>90 dB	>90 dB	>90 dB	>90 dB	>90 dB
Withstanding Voltage	500 V	500 V	500 V	1000 V	1000 V	1000 V
**Mechanical Phase Stability	<±12º	<±8º	<±7º	<±5º	<±6º	<±5º
***Amplitude Stability vs Shaking	< ±0.2dB	< ±0.2dB	<±0.15dB	<±0.1dB	<±0.15dB	<±0.1dB
Temp Phase Stability (-40℃ to +85℃)	<1500ppm	<700ppm	<1500ppm	<1300ppm	<680ppm	<680ppm
Cable attenuation at 25℃	see graph					
Power handling	see graph					
** Wrapped the cable 360 degree around a mandrel whose diameter is ten times of cable outer diameter. *** Shaked the cable assembly at a rate of 90 times per minute at a height of 10 cm.						

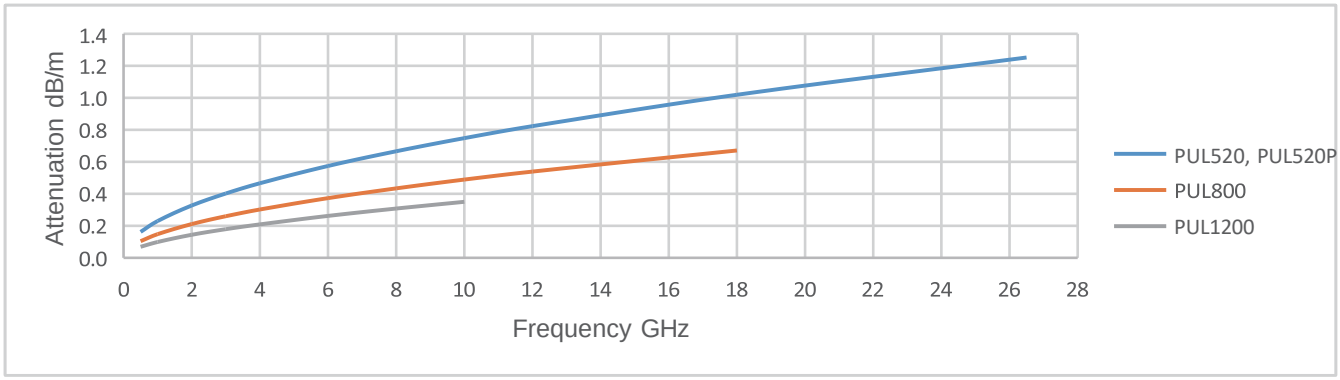
PUL Series

Ultra-low Loss Phase and Amplitude Stable Flexible Cable

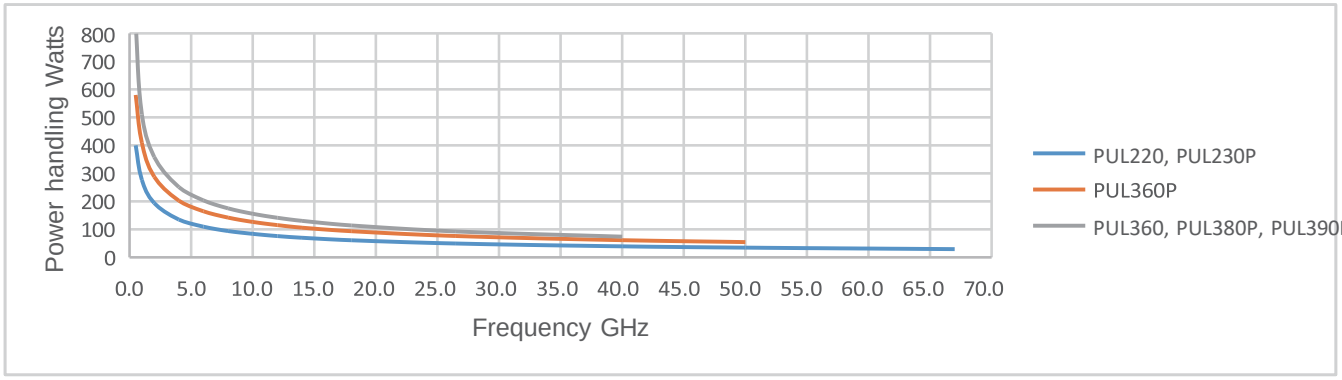
	PUL390P	PUL520	PUL520P	PUL800	PUL1200
Cable Construction(Diameter in mm)					
Center Conductor	0.91	1.45	1.45	2.30	3.80
Dielectric	2.50	4.00	4.00	6.30	10.40
Outer Conductor	2.70	4.20	4.20	6.50	10.78
Interlayer	3.00	/	4.45	/	/
Outer Shield	3.46	4.70	4.90	7.10	11.35
Jacket	3.90	5.20	5.40	7.85	12.00
*Armor Option	AL640	AL780	AL780	AL1050	/
* Please refer to Page 33 for armor details.					
Mechanical					
Min. Bending Radius Static	18mm	25mm	26mm	40mm	60mm
Min. Bending Radius Repeated	36mm	52mm	52mm	80mm	120mm
Weight	35g/m	52g/m	63g/m	130g/m	280g/m
Temperature range	-50℃ to +150℃ (cable only), -50℃ to +85℃ (cable assembly)				
Electrical					
Frequency	DC-40 GHz	DC-26.5 GHz	DC-26.5 GHz	DC-18 GHz	DC-10 GHz
Impedance	50 Ω	50 Ω	50 Ω	50 Ω	50 Ω
Velocity of Propagation	82%	83%	83%	83%	83%
Shielding Effectiveness	>90 dB	>90 dB	>90 dB	>90 dB	>90 dB
Withstanding Voltage	900 V	1500 V	1500 V	2000 V	2000 V
*Mechanical Phase Stability	<±5°	<±5°	<±5°	<±5°	<±4°
***Amplitude Stability vs Shaking	<±0.1dB	<±0.15dB	<±0.1dB	<±0.1dB	<±0.1dB
Temp Phase Stability (-40℃ to +85℃)	<680ppm	<550ppm	<550ppm	<500ppm	<500ppm
Cable attenuation at 25℃	see graph				
Power handling	see graph				
** Wrapped the cable 360 degree around a mandrel whose diameter is ten times of cable outer diameter. *** Shaked the cable assembly at a rate of 90 times per minute at a height of 10 cm.					

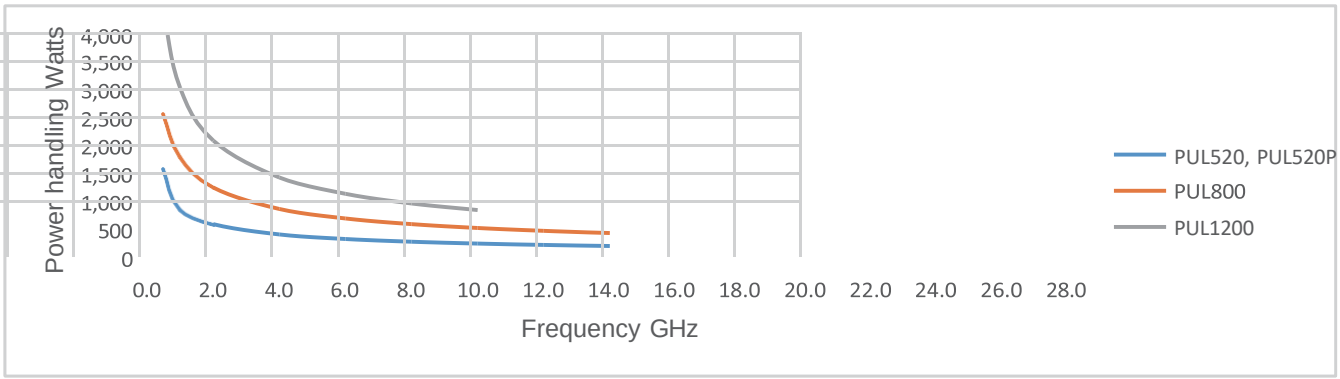
Attenuation (nominal values at +25 °C ambient temperature)



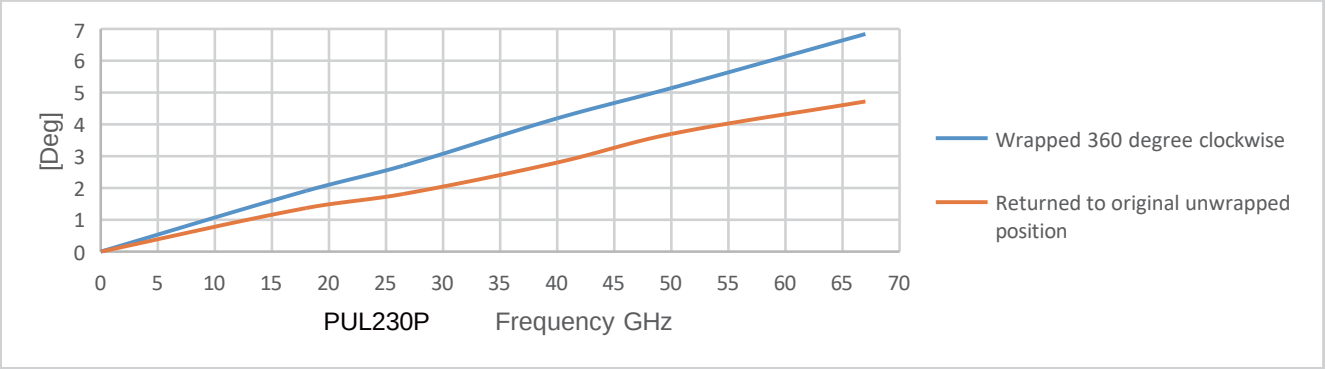


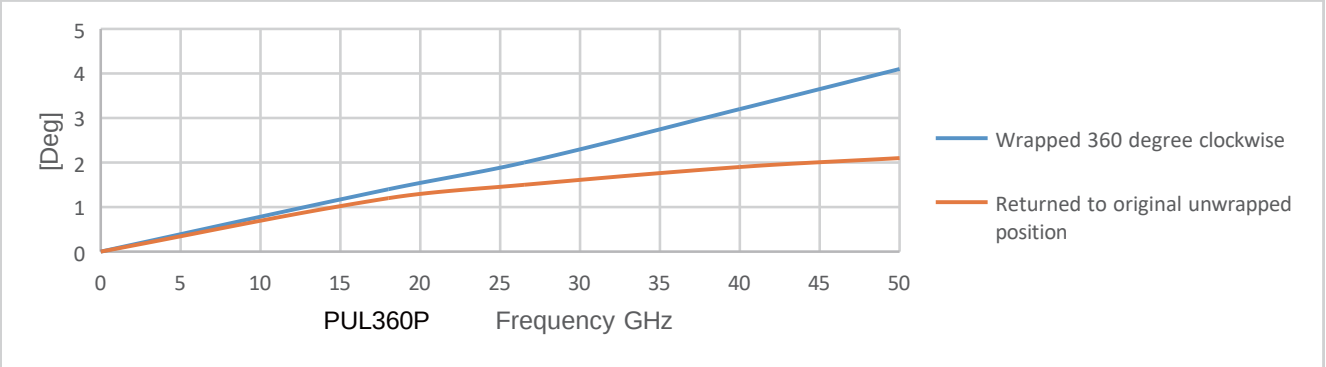
Power handling (maximum values at 40 °C ambient temperature and sea level)





Mechanical Phase Stability

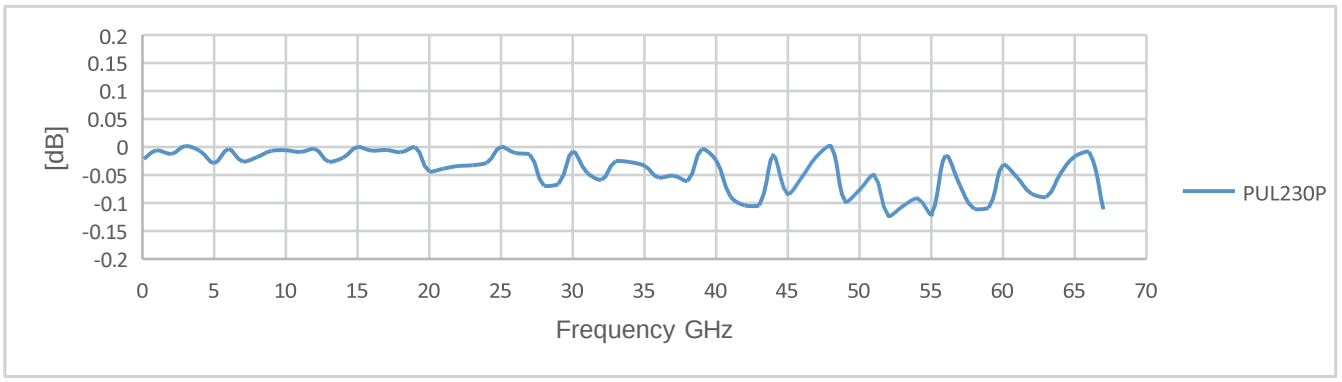


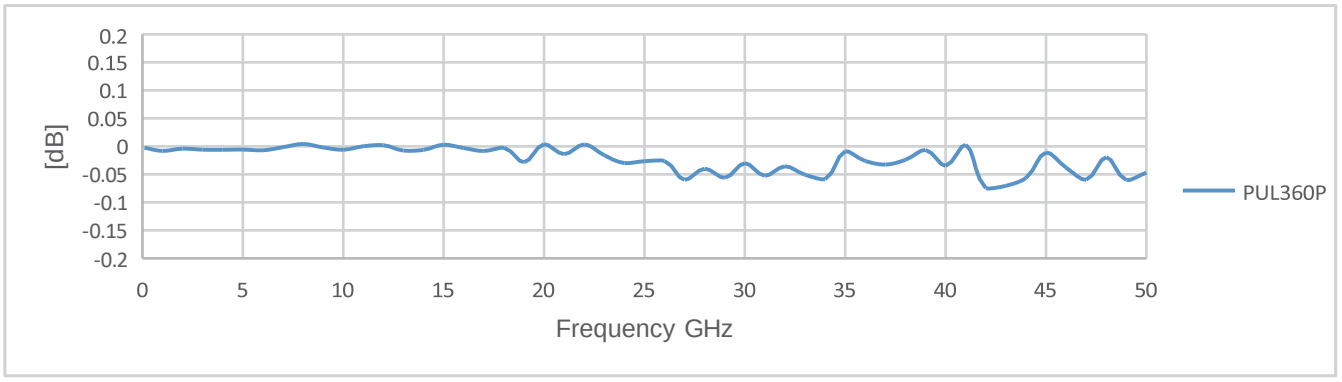


Steps	Test Method
Initial Test	1) Connect the two ports of cable under test(CUT) with VNA, the cable is held in an initial unwrapped position and is measured in the phase and attenuation. 2) Normalize VNA in the phase. *CUT is 1 meter in length.
Test with cable wrapped 360° clockwise	1) Disconnect the CUT cable and wrap it 360° clockwise around a mandrel (diameter is ten times of cable outer diameter). 2) The CUT cable is held in such position for measurement, record the max phase and attenuation change over frequency range.
Test with cable returned to original unwrapped position	1) Disconnect the CUT cable and return it to its original unwrapped position. 2) The CUT cable is held in such position for measurement, record the max phase change. 3) The worst-case phase variation in the above procedure is recorded as the phase stability value.

Amplitude Stability vs Shaking

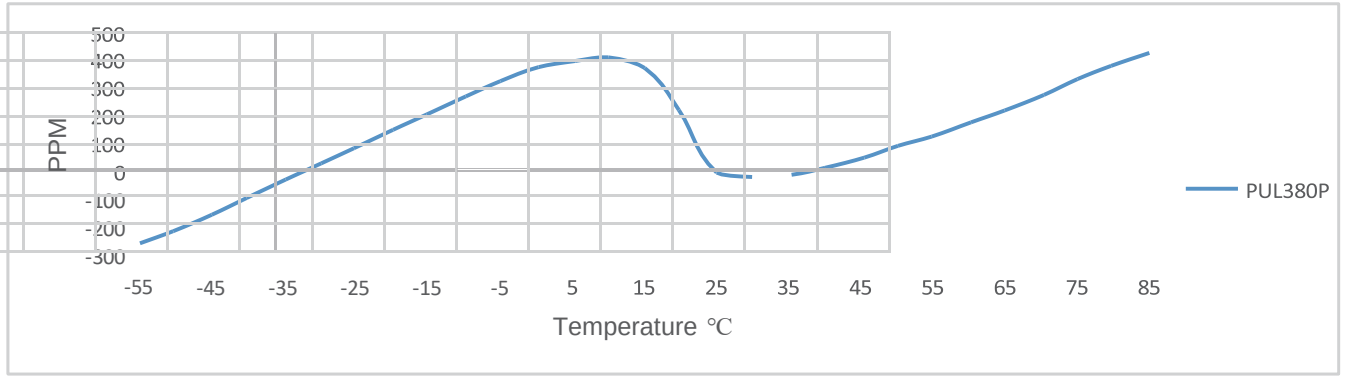
Shake the cable assembly at a rate of 90 times per minute at a height of 10 cm.

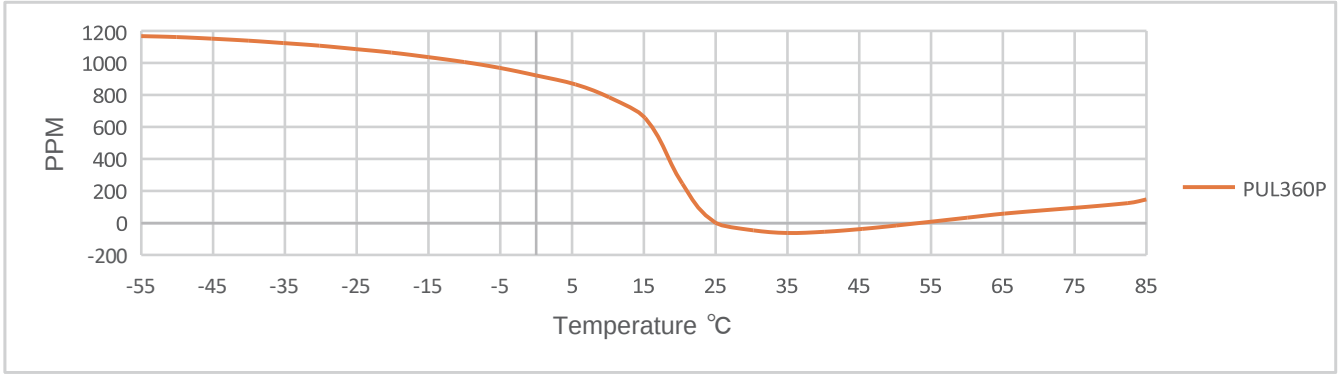




Temperature Phase Stability

Test procedure is detailed on Page 40.





Available Connectors

Cable P/N	Connectors	Gender	Orientation	Mounting	Max Freq (GHz)	VSWR Max
PUL180P	1.0mm	M/F	Straight	Standard	110	1.45
PUL220	SMA	M/F	Straight	Standard	26.5	1.3
	2.92mm	M/F	Straight	Standard	40	1.3
	2.4mm	M/F	Straight	Standard	50	1.35
	1.85mm	M/F	Straight	Standard	67	1.4/1.45
	SSMA	Male	Straight	Standard	33	1.4
	SMP	Female	Right Angle	Standard	26.5	1.35
	SMP	M/F	Straight	Standard	40	1.4
	SSMP	M/F	Straight	Standard	67	1.5
PUL230P	SMA	M/F	Straight	Standard	26.5	1.25
	2.92mm	M/F	Straight	Standard	40	1.3
	2.4mm	Male	Straight	Standard	50	1.35
	1.85mm	M/F	Straight	Standard	67	1.4/1.45
PUL360P	N	Male	Straight	Standard	18	1.3
	SMA	M/F	Straight	Standard	26.5	1.25
	3.5mm	M/F	Straight	Standard	33	1.3
	2.92mm	M/F	Straight	Standard	40	1.3
	2.92mm	M	Right Angle	Standard	38	1.4
	2.92mm	Female	Straight	Bulkhead	40	1.4
	2.4mm	M/F	Straight	Standard	50	1.35
PUL360	N	Male	Straight	Standard	18	1.35
	SMA	M/F	Straight	Standard	26.5	1.3
	SMA	Male	Right Angle	Standard	18	1.35
	3.5mm	M/F	Straight	Standard	33	1.3
	2.92mm	M/F	Straight	Standard	40	1.3
	2.92mm	Male	Right Angle	Standard	38	1.4
	2.4mm	Male	Straight	Standard	40	1.35
	SSMA	Male	Right Angle	Standard	33	1.4
PUL380P	SMA	Male	Straight	Standard	26.5	1.3
	2.92mm	Male	Straight	Standard	40	1.3
PUL390P	N	Male	Straight	Standard	18	1.35
	SMA	M/F	Straight	Standard	26.5	1.3
	SMA	Male	Right Angle	Standard	18	1.35
	3.5mm	M/F	Straight	Standard	33	1.3
	2.92mm	M/F	Straight	Standard	40	1.3

Available Connectors

Cable P/N	Connectors	Gender	Orientation	Mounting	Max Freq (GHz)	VSWR Max
PUL520	N	M/F	Straight	Standard	18	1.3/1.4
	N	Male	Right Angle	Standard	18	1.35
	TNC	Male	Straight	Standard	18	1.35
	TNC	Male	Right Angle	Standard	18	1.4
	3.5mm	Male	Straight	Standard	26.5	1.3
	SMA	M/F	Straight	Standard	26.5	1.3
	SMA	Female	Straight	Bulkhead	18	1.3
PUL520P	SMA	Male	Right Angle	Standard	18	1.35
	N	Male	Straight	Standard	18	1.25
	N	Male	Right Angle	Standard	18	1.35
	N	Female	Straight	Standard	18	1.35
	TNC	Male	Straight	Standard	18	1.35
	SMA	Male/Female	Straight	Standard	26.5	1.3
	SMA	Male	Right Angle	Standard	18	1.35
	3.5mm	Male	Straight	Standard	26.5	1.3
PUL800	N	M/F	Straight	Standard	18	1.3
	N	Male	Right Angle	Standard	18	1.35
	TNC	M/F	Straight	Standard	18	1.35
	TNC	Male	Right Angle	Standard	18	1.4
	SMA	M/F	Straight	Standard	18	1.3
	SMA	Male	Right Angle	Standard	18	1.35
PUL1200	N	Male	Straight	Standard	6	1.3
	DIN 7/16	Male	Straight	Standard	6	1.3

Note: Other connectors available upon request.

Overview FL Series

Long Flex Life Triple-shielding Flexible Cable

FL series are long flexing life low loss cables with max operating frequency options of 18GHz, 26.5GHz. These cables are highly robust with triple shield construction of woven flat braid, foil, and round braid, delivering excellent shielding effectiveness and high pull strength. FL series cable assemblies can be widely used in both interconnection and test applications, where low loss and harsh handling are required.

Features

- Long flex life, ideal as test cables or as interconnect cables in harsh condition
- Superior shielding effectiveness
- Torque resistant and high pull off strength
- Low loss and good phase & amplitude stability with flexure

Cable Data

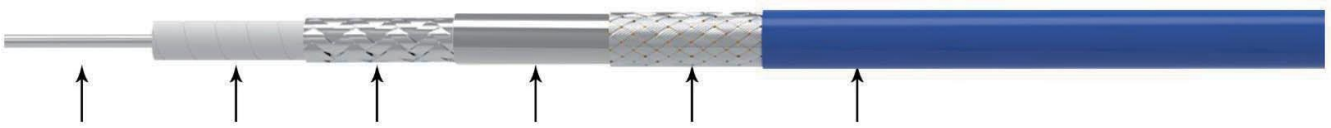
Part Number	Outer Diameter(mm)	Static Bend Radius(mm)	Max Operation Freq(GHz)	Loss (dB/m @ max freq)	Avg Power (watts@ max freq)
FL460	4.6	20	26.5	1.8	128
FL520	5.2	25	18	1.3	166
FL620	6.2	32	18	1.0	202

Cross Reference

Model	Huber Suhner	TIMES	Harbour Industries	ASTROLAB	Semflex	Micro-Coax
FL460	SUCOFLEX102	SFT-142	LL160	32022	HP160S	UFA147A
FL520	SUCOFLEX104	SFT-205	LL142	32055	HP190S	UFA205A
FL620		SFT-304	LL235	32051	HP305S	

FL Series

Long Flex Life Triple-shielding Flexible Cable



	FL460	FL520	FL620
Cable Construction(Diameter in mm)			
Center Conductor	1.02	1.29	1.57
Dielectric	3.05	3.90	4.72
Outer Conductor	3.25	4.15	4.96
Interlayer	3.49	4.28	5.10
Outer Shield	4.00	4.73	5.55
Jacket	4.60	5.20	6.20
Mechanical			
Min. Bending Radius Static	20mm	25mm	31mm
Min. Bending Radius Repeated	46mm	52mm	62mm
Weight	50g/m	60g/m	85g/m
Temperature range	-50℃ to +150℃ (cable only), -50℃ to +85℃ (cable assembly)		
Electrical			
Operating Frequency	DC-26.5 GHz	DC-18 GHz	DC-18 GHz
Impedance	50 Ω	50 Ω	50 Ω
Velocity of Propagation	76%	76%	76%
Shielding Effectiveness	>100 dB	>100 dB	>90 dB
Withstanding Voltage	1000 V	1500 V	2500 V
*Mechanical Phase Stability	<±6º@ DC-18GHz	<±6º	<±5º
**Amplitude Stability vs Shaking	<±0.2dB	<±0.2dB	<±0.15dB
Cable attenuation at 25℃	see graph		
Power handling	see graph		

* Wrapped the cable 360 degree around a mandrel whose diameter is ten times of cable outer diameter.
** Shaked the cable assembly at a rate of 90 times per minute at a height of 10 cm.

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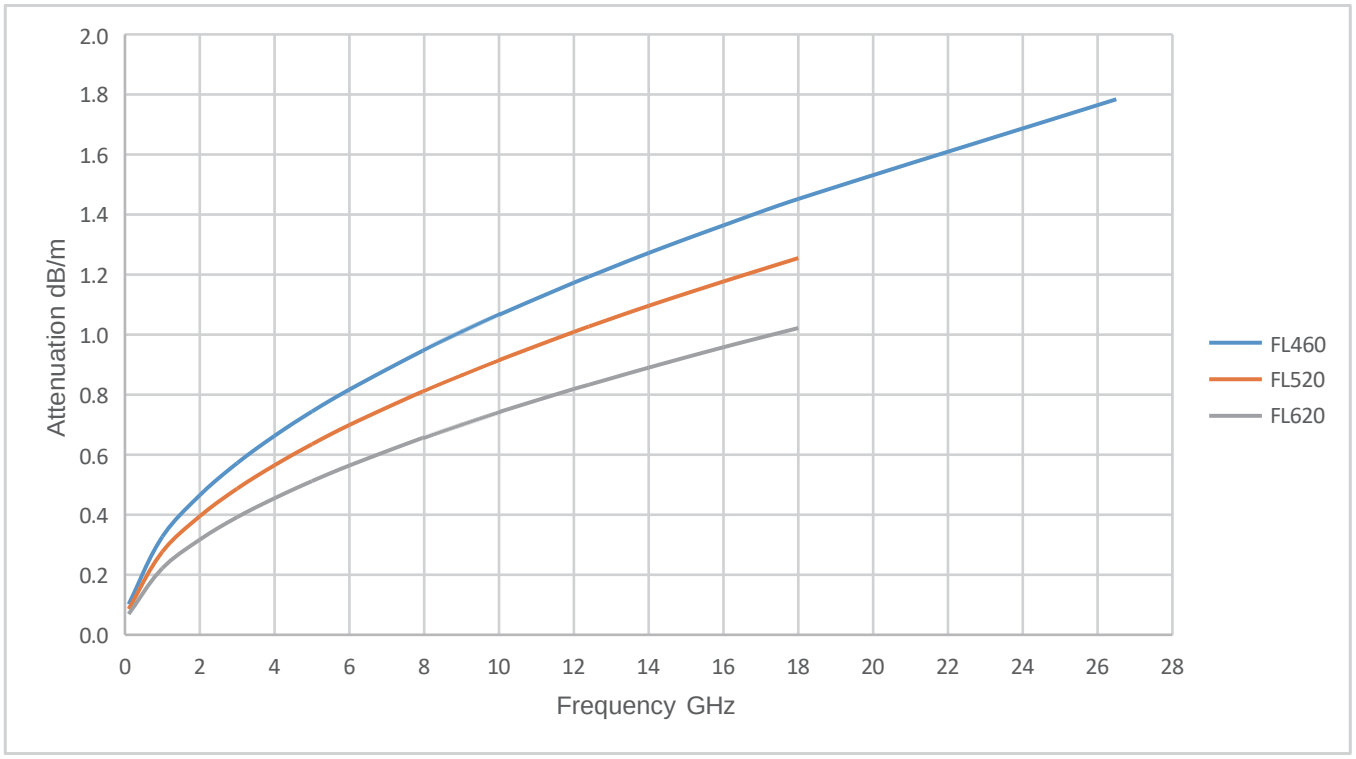
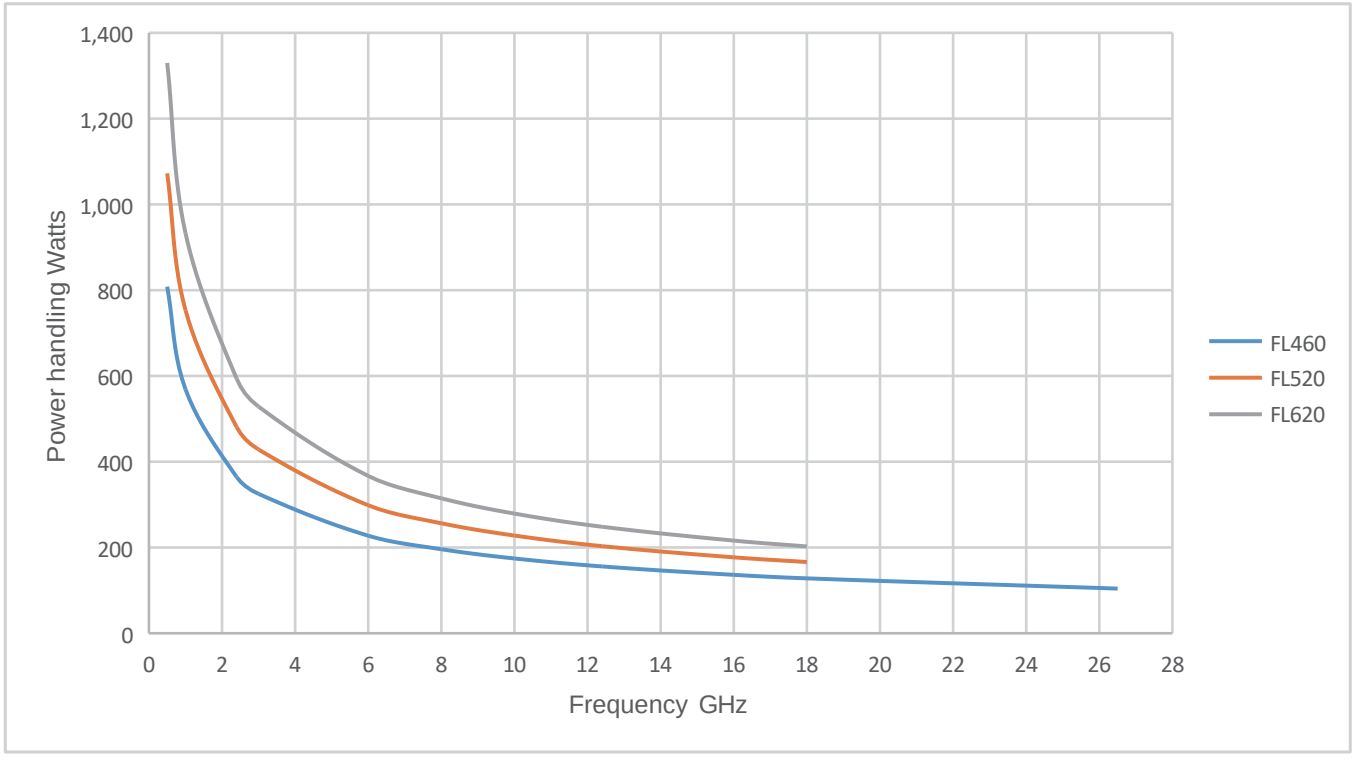
Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 40 °C ambient temperature and sea level)



Available Connectors

Cable P/N	Connectors	Gender	Orientation	Mounting	Max Freq (GHz)	VSWR Max
FL460	SMA	Male	Straight	Standard	18	1.25
	SMA	Female	Straight	Standard	18	1.3
	SMA	Male	Right Angle	Standard	18	1.35
	N	Male	Straight	Standard	18	1.3
	N	Male	Right Angle	Standard	18	1.35
	N	Female	Straight	Standard	18	1.35
	TNC	Male	Straight	Standard	18	1.3
	TNC	Male	Right Angle	Standard	18	1.35
FL520	SMA	Male	Straight	Standard	18	1.25
	N	Male	Straight	Standard	18	1.3
FL620	SMA	Male	Straight	Standard	18	1.25
	N	Male	Straight	Standard	18	1.3
	N	Female	Straight	Standard	18	1.35
	TNC	Male	Straight	Standard	18	1.35

Note: Other connectors available upon request.

Overview TB Series

Tight Bend Triple-shielding Flexible Cable

TB series cable assemblies excel in their bendability from connector end, resulting from its unique cable structure and connector design. As alternatives to Minibend cables, TB series feature superior mechanical phase stability and robustness, operating max to 50 GHz. Now available in 047, 086, 141 cable sizes, with a complimentary connector range of SSMP, SMP, 2.4mm, 2.92mm and SMA.

Features

- Allowing bend from connector end and can be repeatedly bent
- Alternative to Minibend
- High pull force with stainless steel wire braid
- Direct replacement of semi-rigid cables with lower loss, better phase stability
- Cost and space saving by eliminating use of right angle connectors and complicated bend configuration

Replacing right angle connector

Cable Data

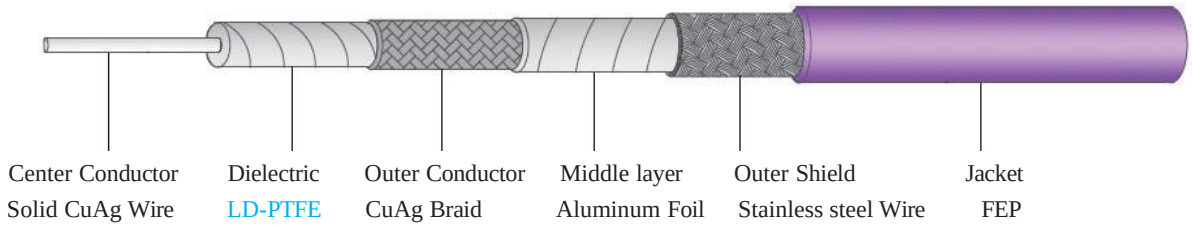
Part Number	Outer Diameter(mm)	Static Bend Radius(mm)	Max Operation Freq(GHz)	Loss (dB/m @ max freq)	Avg Power (watts@ max freq)
TB200	2.0	8	40	7.3	7
TB250	2.5	10	50	6.4	35
TB250L	2.5	10	40	5.0	15
TB260L	2.6	11	50	4.8	13
TB360	3.6	8	26.5	2.2	63

Cross Reference

Model	Huber Suhner	ASTROLAB
MB200	Microbend	
MB250	Minibend	32081
MB260L	Minibend L, Minibend R	32024
MB360	Mini141	32022

TB Series

Tight Bend Triple-shielding Flexible Cable



	TB200	TB250	TB250L	TB260L	TB360
Cable Construction(Diameter in mm)					
Center Conductor	0.36	0.51	0.51	0.56	0.91
Dielectric	1.14	1.65	1.55	1.70	2.72
Outer Conductor	1.30	1.82	1.71	1.85	2.79
Interlayer	1.45	1.90	1.81	1.98	2.95
Outer Shield	1.66	2.12	2.04	2.24	3.20
Jacket	2.00	2.50	2.50	2.64	3.61
Mechanical					
Min. Bending Radius Static	8mm	10mm	10mm	10.5mm	15 mm
Min. Bending Radius Repeated	20mm	25mm	25mm	26mm	36mm
Weight	12g/m	17g/m	16g/m	17g/m	31g/m
Temperature range	-50℃ to +125℃ (cable assembly)				
Electrical					
Operating Frequency	DC-40 GHz	DC-50 GHz	DC-40 GHz	DC-50 GHz	DC-26.5 GHz
Impedance	50 Ω	50 Ω	50 Ω	50 Ω	50 Ω
Velocity of Propagation	70%	70%	74%	75%	76%
Shielding Effectiveness	>90 dB	>90 dB	>90 dB	>90 dB	>90 dB
Withstanding Voltage	700 V	500 V	500 V	500 V	1000 V
*Mechanical Phase Stability	/	<±15°	<±8°	<±6° @ 40GHz <±8° @ 50GHz	<±6°
**Amplitude Stability vs Shaking	/	<±0.15dB	<±0.15dB	<±0.15dB	<±0.1dB
Cable attenuation at 25℃	see graph				
Power handling	see graph				

* Wrapped the cable 360 degree around a mandrel whose diameter is ten times of cable outer diameter.
** Shaked the cable assembly at a rate of 90 times per minute at a height of 10 cm.

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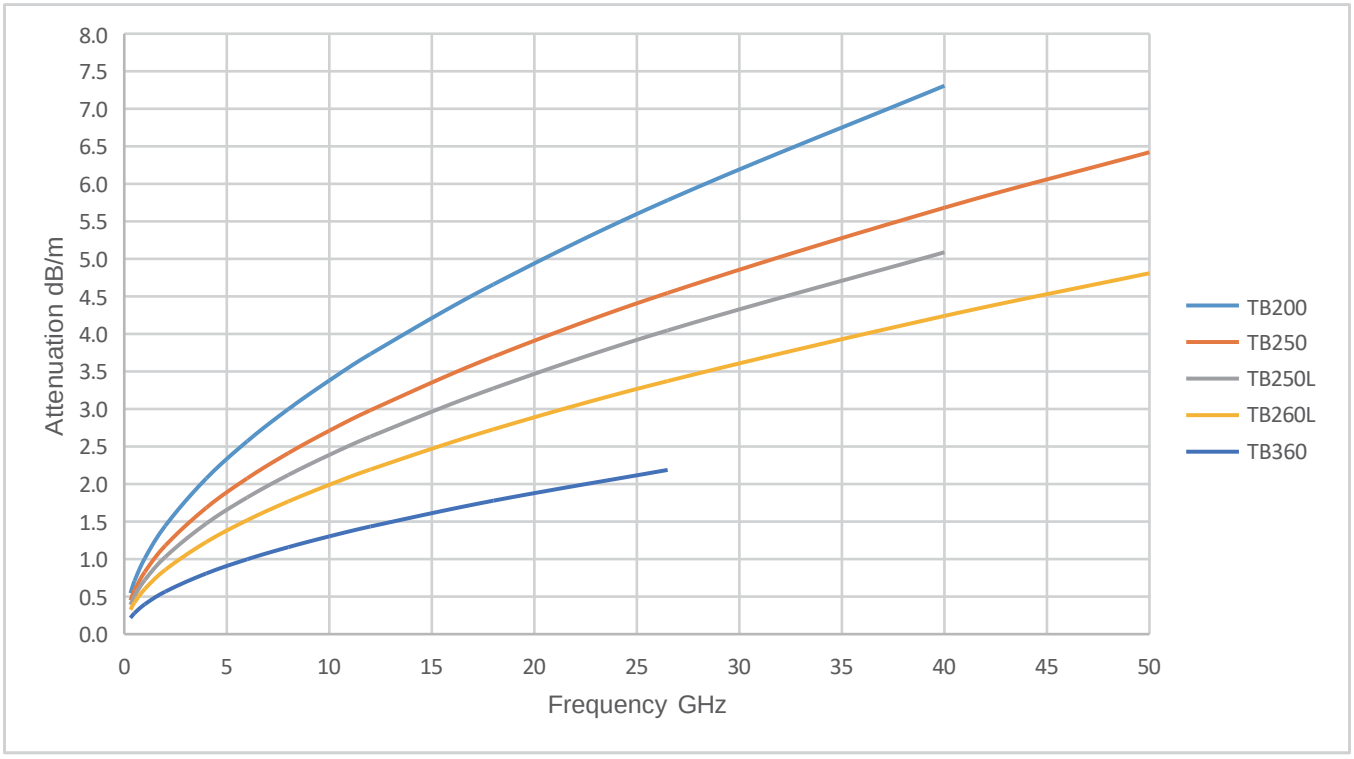
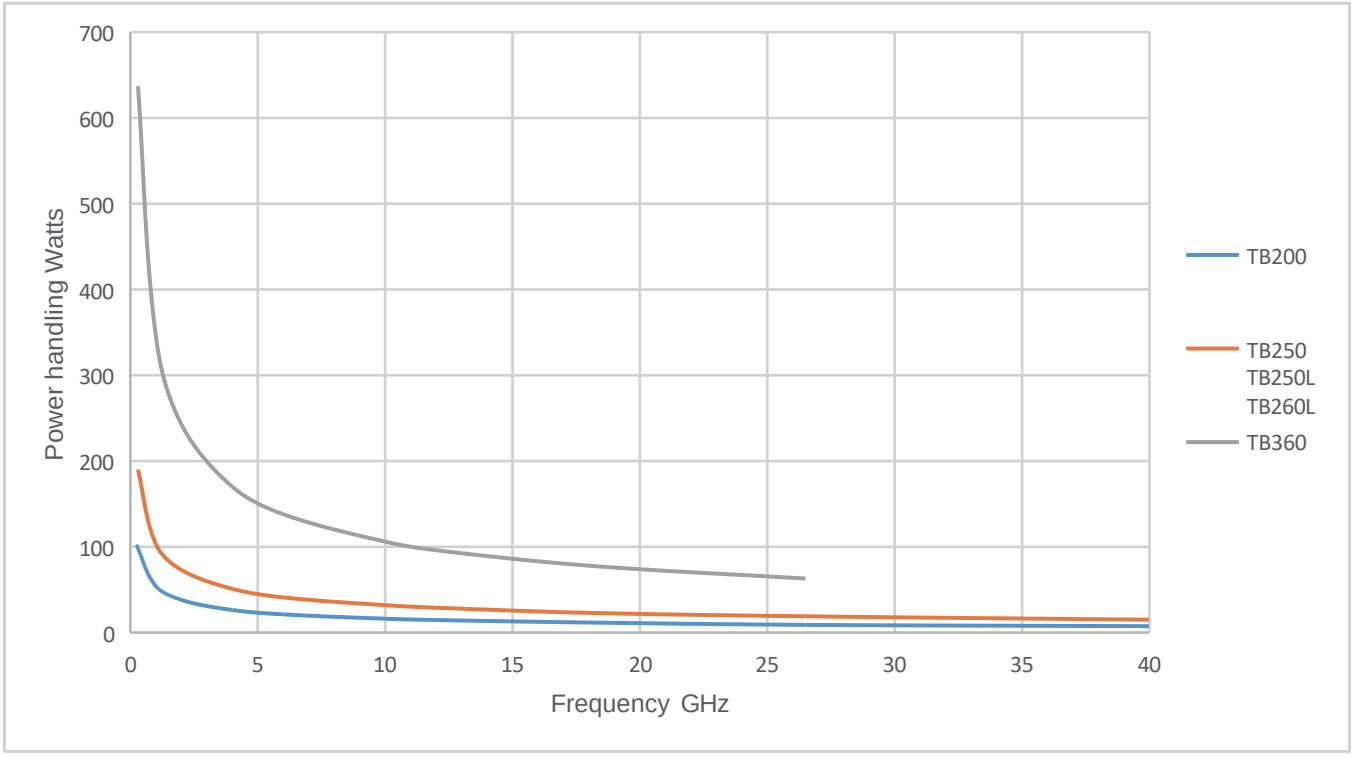
Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 40 °C ambient temperature and sea level)



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Available Connectors

Cable P/N	Connectors	Gender	Orientation	Mounting	Max Freq (GHz)	VSWR Max
TB200	SMA	Male	Straight	Standard	26.5	1.35
	SMP	Female	Straight	Standard	26.5	1.35
	SSMP	Female	Straight	Standard	26.5	1.35
TB250	SMA	Male	Straight	Standard	26.5	1.35
	SMA	Female	Straight	Standard	26.5	1.35
	2.92mm	Male	Straight	Standard	40	1.4
	2.4mm	Male	Straight	Standard	50	1.45
TB250L	2.92mm	Male	Straight	Standard	40	1.4
TB260L	SMA	Male	Straight	Standard	26.5	1.35
	2.92mm	Male	Straight	Standard	40	1.4
	2.4mm	Male	Straight	Standard	50	1.45
	2.4mm	Female	Straight	Standard	50	1.45
TB360	SMA	Male	Straight	Standard	26.5	1.35

Note: Other connectors available upon request.

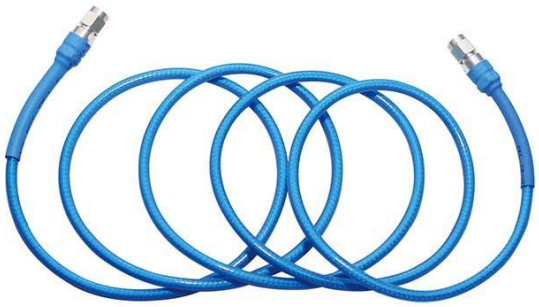
Overview ULL Series

Ultra-Flexible Phase Stable Low Loss Cable

UF series cable assemblies feature super flexibility and mechanical phase stability with stranded SPC center conductor. ULL360 works to 40GHz with unique PTFE wrapping jacket that enhances its flexibility while accomplishing operating temp up to 200℃ . ULL520 and ULL450 work to 26.5GHz and 40GHz respectively, in PUR or FEP jacket. These cables are alternative to H+S Sucoflex, rugged armors available.

Features

- Ultra-flexible with stranded inner conductor
- Excellent phase and amplitude stability over flex
- Durable design, long life time
- Rugged armors available
- Fast delivery for custom lengths



Cable Data

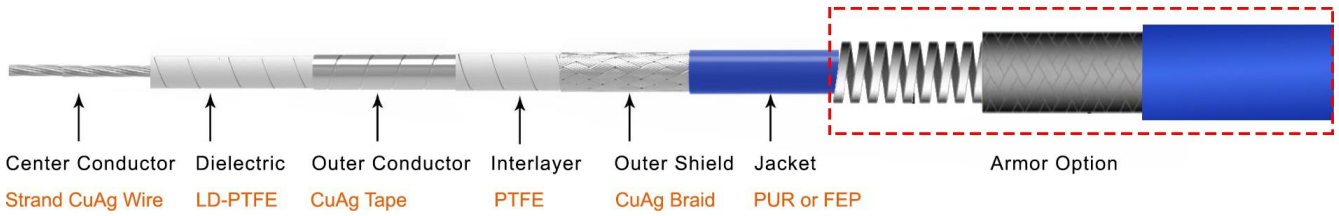
Part Number	Outer Diameter(mm)	Jacket	Static Bend Radius(mm)	Max Operation Freq(GHz)	Loss(dB/m @ max freq)	Avg Power (watts@ max freq)
ULL360	3.8	PTFE	18	40	3.1	54
ULL450	4.5	PUR or FEP	22	40	3.0	57
ULL520	5.2	PUR	18	26.5	2.5	23
ULL550	5.5	FEP	22	26.5	1.6	114

Cross Reference

Model	Huber Suhner	
ULL360		ULL series from features multi-stranded center conductor, available in PUR or PTFE jacket which make it highly flexible and ideal to use where frequent flexing is required and phase stability, low loss are uncompromised.
ULL450		
ULL520		
ULL550	SUCOFLEX 126	

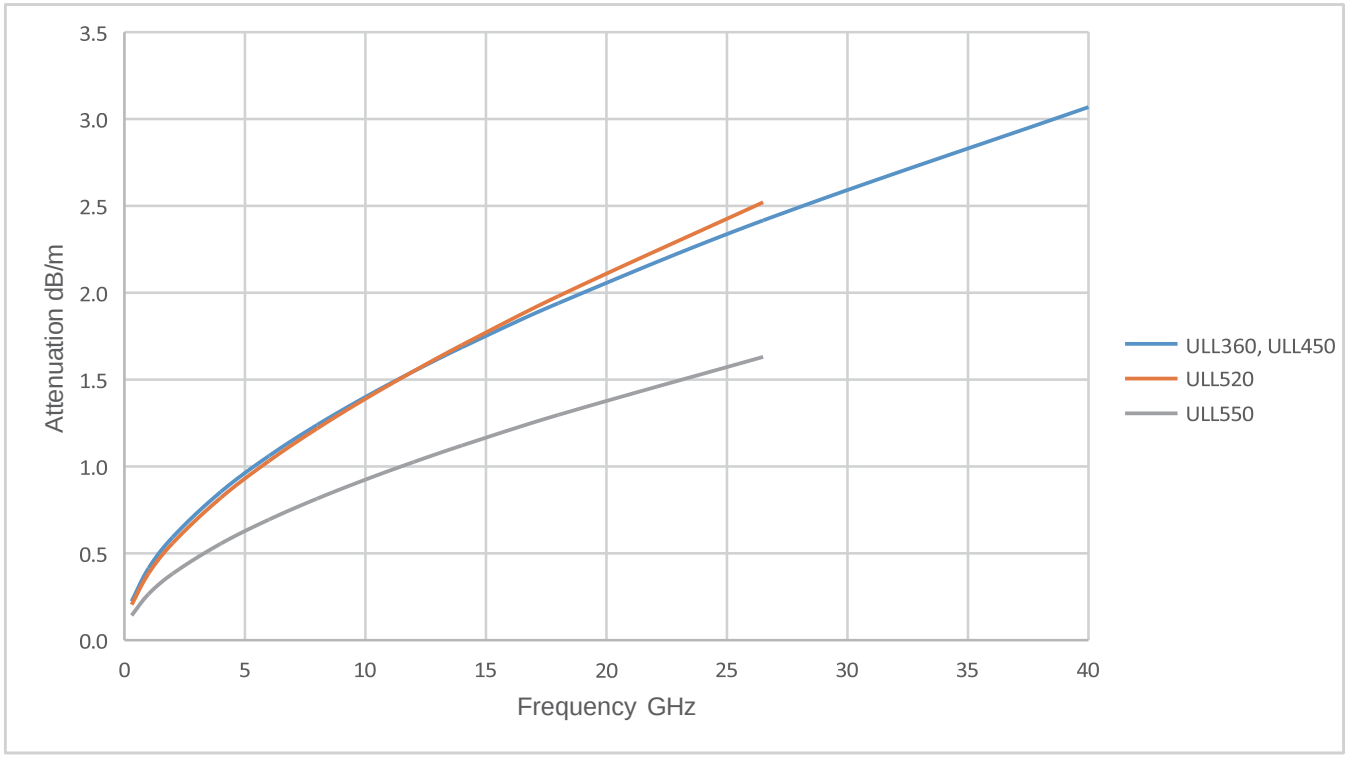
ULL Series

Ultra-Flexible Phase Stable Low Loss Cable

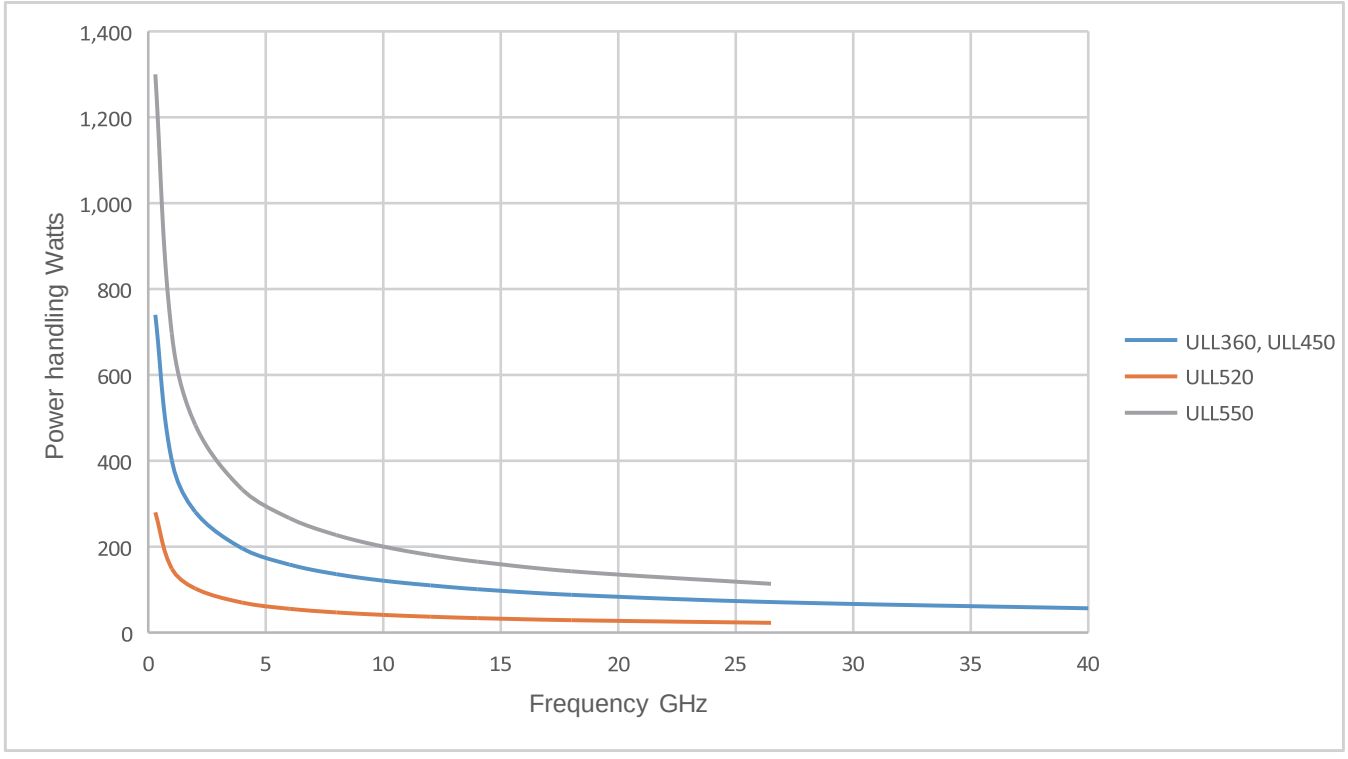


	ULL360	ULL450	ULL520	ULL550
Cable Construction(Diameter in mm)				
Center Conductor	0.91	0.91	1.02	1.44
Dielectric	2.50	2.65	3.03	1.60
Outer Conductor	2.66	2.80	3.22	4.20
Interlayer	2.90	3.08	3.47	4.55
Outer Shield	3.30	3.53	4.05	5.00
Jacket	3.80	4.50	5.20	5.50
*Armor Option	/	/	AU880	AU880
* Please refer to Page 33 for armor details.				
Mechanical				
Min. Bending Radius Static	18mm	22mm	18mm	22mm
Min. Bending Radius Repeated	36mm	45mm	50mm	55mm
Weight	36g/m	37g/m	55g/m	63g/m
Operating Temperature (Cable only)	-50℃ to +85℃ (PUR Jacket), -50℃ to +150℃ (FEP Jacket)			
Electrical				
Operating Frequency	DC-40 GHz	DC-40 GHz	DC-26.5 GHz	DC-26.5 GHz
Impedance	50 Ω	50 Ω	50 Ω	50 Ω
Velocity of Propagation	81%	76%	76%	83%
Shielding Effectiveness	>90 dB	>90 dB	>90 dB	>90 dB
Withstanding Voltage	1000 V	900 V	2000 V	1500 V
**Mechanical Phase Stability	<±5º	<±5º	<±5º	<±3º @18GHz <±7º @26.5GHz
***Amplitude Stability vs Shaking	<±0.15dB	<±0.15dB	<±0.1dB	<±0.2dB
Cable attenuation at 25℃	see graph			
Power handling	see graph			
** Wrapped the cable 360 degree around a mandrel whose diameter is ten times of cable outer diameter. *** Shaked the cable assembly at a rate of 90 times per minute at a height of 10 cm.				

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 40 °C ambient temperature and sea level)



Available Connectors

Cable P/N	Connectors	Gender	Orientation	Mounting	Max Freq (GHz)	VSWR Max
ULL360	SMA	Male	Straight	Standard	26.5	1.3
	SMA	Male	Right Angle	Standard	18	1.35
	3.5mm	Male	Straight	Standard	33	1.3
	2.92mm	M/F	Straight	Standard	40	1.3
ULL450	SMA	Male	Straight	Standard	26.5	1.25
	SMA	Female	Straight	Standard	26.5	1.3
	2.92mm	Male	Straight	Standard	40	1.3
ULL520	TNC	Male	Straight	Standard	13.5	1.35
	N	Male	Straight	Standard	18	1.3
	N	Male	Right Angle	Standard	18	1.4
	SMA	Male	Straight	Standard	26.5	1.25
	SMA	Male	Right Angle	Standard	18	1.35
ULL550	N	Male	Straight	Standard	18	1.3
	SMA	Male	Straight	Standard	26.5	1.3

Note: Other connectors available upon request.

Overview SF Series

Low Loss Flexible Cable Replacing Semi-flexible Cable

SF series are low cost flexible cables as replacement for semi-flexible cables. Size for size, they offer lower insertion loss and better flexibility than the hand-formable cables. Available in 047, 086 and 141 sizes, they are ideal for high density interconnection use. Bulk cables are offered as well, allowing greater flexibility for end user in connector terminations.

Features

- Superior flexible cable alternative to semi-flexible cables
- Up to 67 GHz, available in 047, 086 and 141 sizes
- Highly competitive pricing, from stock
- Each cable assembly delivered with test plot

Cable Data

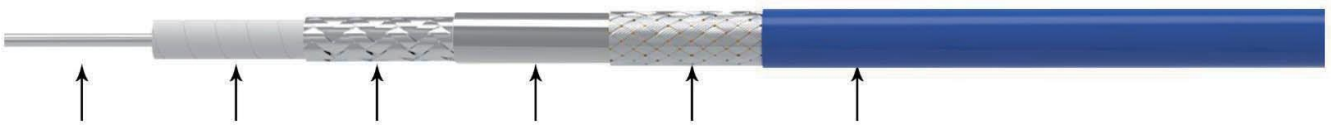
Part Number	Outer Diameter(mm)	Static Bend Radius(mm)	Max Operation Freq(GHz)	Loss (dB/m @ max freq)	Avg Power (watts@ max freq)
SF160	1.6	6	67	11.9	4
SF280	2.8	14	40	4.4	16
SF400	4.0	20	26.5	2.8	36

Cross Reference

Model	Huber Suhner	TIMES	Harbour	HABIA
SF160				
SF280	Multiflex 86	TFlex-405	SS405	Multibend86
SF400	Multiflex 141	TFlex-402	SS402	Multibend141

SF Series

Low Loss Flexible Cable Replacing Semi-flexible Cable



	SF160	SF280	SF400
Cable Construction(Diameter in mm)			
Center Conductor	0.29	0.51	0.91
Dielectric	0.94	1.63	3.00
Outer Conductor	1.14	1.79	3.20
Outer Shield	1.34	2.16	3.60
Jacket	1.60	2.80	4.00
Mechanical			
Min. Bending Radius Static	6mm	14mm	20mm
Min. Bending Radius Repeated	16mm	28mm	40mm
Weight	22g/m	22g/m	49g/m
Temperature range	-50℃ to +150℃ (cable only), -50℃ to +85℃ (cable assembly)		
Electrical			
Operating Frequency	DC-67 GHz	DC-40 GHz	DC-26.5 GHz
Impedance	50 Ω	50 Ω	50 Ω
Velocity of Propagation	70%	70%	70%
Shielding Effectiveness	>90 dB	>90 dB	>90 dB
Withstanding Voltage	500 V	1000 V	1000 V
Cable attenuation at 25℃	see graph		
Power handling	see graph		

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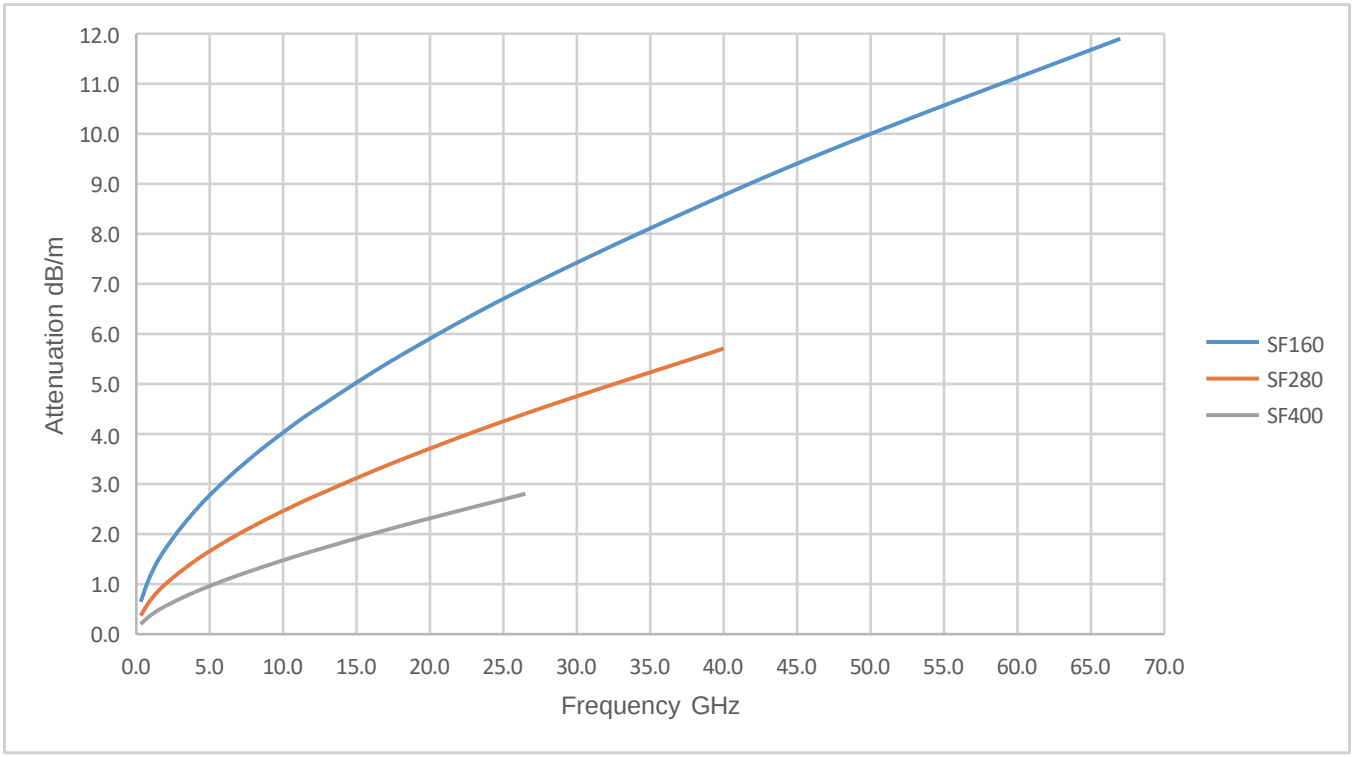
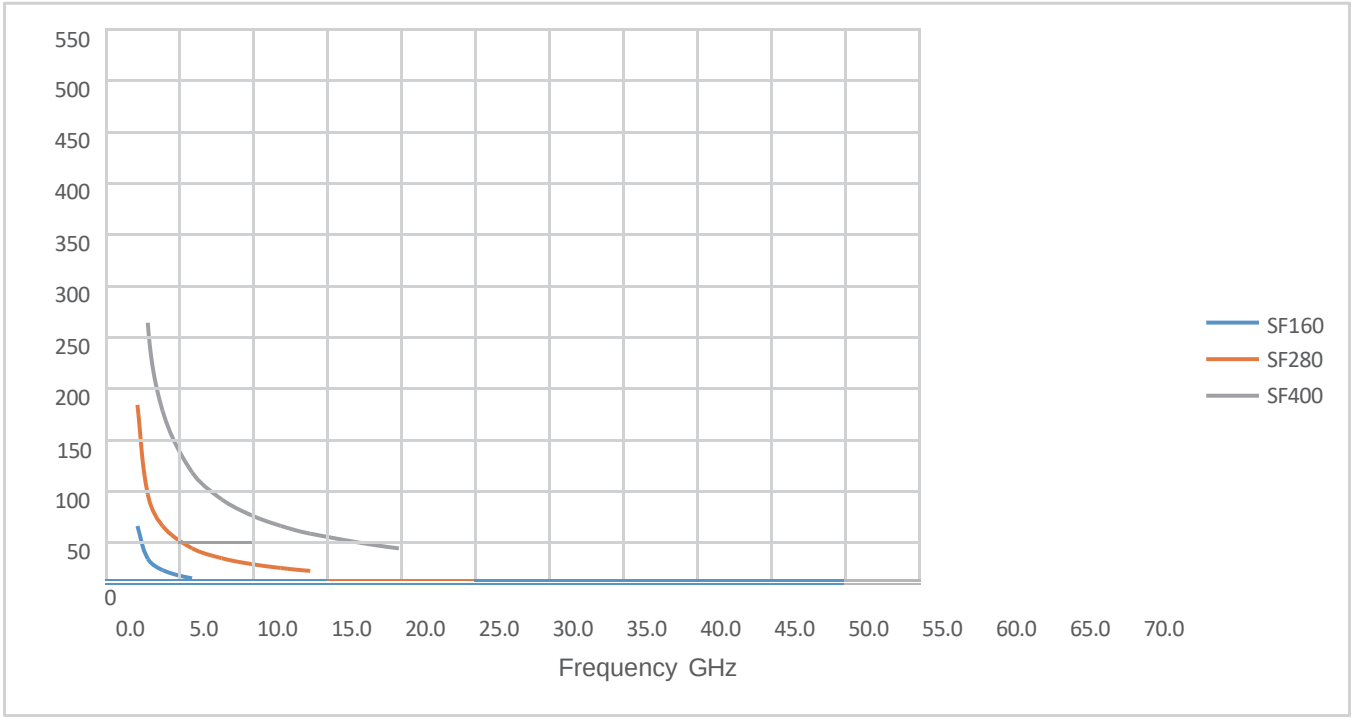
Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 40 °C ambient temperature and sea level)



Available Connectors

Cable P/N	Connectors	Gender	Orientation	Mounting	Max Freq (GHz)	VSWR Max
SF160	SMA	Male	Straight	Standard	18	1.2
	SMA	Female	Straight	Standard	18	1.25
	SMP	Female	Straight	Standard	18	1.35
	SSMP	Female	Straight	Standard	40	1.4
	SSMP	Male	Right Angle	Standard	40	1.6
	2.92	Male	Straight	Standard	40	1.3
	2.4	Male	Straight	Standard	50	1.35
	1.85	Male	Straight	Standard	67	1.4
SF280	N	Male	Straight	Standard	18	1.3
	SMA	Male	Straight	Standard	18	1.2
	2.92	Male	Straight	Standard	40	1.3
	2.92	Female	Straight	Standard	40	1.35
SF400	N	Male	Straight	Standard	18	1.3
	SMA	Male	Straight	Standard	26.5	1.25

Note: Other connectors available upon request.

Overview EL Series

Economical Low Loss Flexible Cable

EL series cable assemblies are very affordable low loss flexible cables with max operating frequency options of 13.5GHz, 18GHz and 26.5GHz. Built from low density PTFE dielectric, these cables are well suited for high frequency signal transmission use when low loss is desired but phase stability is not highly critical.

Features

- Attractive cost vs performance ratio
- Good amplitude stability vs flex and shaking
- Low Loss with low density PTFE dielectric

Applications

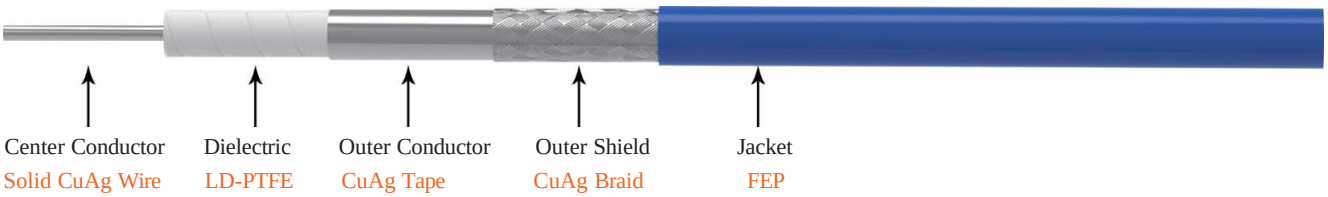
- Ideal for interconnect of assembled systems
- Communication receivers and transmitters
- Low loss test accessory

Cable Data

Part Number	Outer Diameter(mm)	Static Bend Radius(mm)	Max Operation Freq(GHz)	Loss (dB/m @ max freq)	Avg Power (watts@ max freq)
EL280	2.8	12	26.5	3.7	16
EL350	3.5	14	18	1.8	101
EL520	5.2	20	18	1.2	157
EL780	7.8	32	13.5	0.7	392

EL Series

Economical Low Loss Flexible Cable



	EL280	EL350	EL520	EL780
Cable Construction(Diameter in mm)				
Center Conductor	0.56	0.94	1.45	2.3
Dielectric	1.67	2.75	4.30	6.6
Outer Conductor	1.83	2.80	4.38	6.7
Outer Shield	2.20	3.20	4.78	7.3
Jacket	2.80	3.50	5.20	7.8
Mechanical				
Min. Bending Radius Static	12mm	14mm	20mm	35mm
Min. Bending Radius Repeated	28mm	35mm	52mm	75mm
Weight	18g/m	29g/m	60g/m	110g/m
Temperature range	-50℃ to +150℃ (cable only), -50℃ to +85℃ (cable assembly)			
Electrical				
Operating Frequency	DC-26.5 GHz	DC-18 GHz	DC-18 GHz	DC-13.5 GHz
Impedance	50 Ω	50 Ω	50 Ω	50 Ω
Velocity of Propagation	76%	76%	76%	76%
Shielding Effectiveness	>90 dB	>90 dB	>90 dB	>90 dB
Withstanding Voltage	500 V	800 V	1500 V	2000 V
*Mechanical Phase Stability	<±10º	<±8º	<±6º@ DC-13.5GHz	<±6º
**Amplitude Stability vs Shaking	<±0.1dB	<±0.1dB	<±0.1dB	<±0.1dB
Cable attenuation at 25℃	see graph			
Power handling	see graph			

* Wrapped the cable 360 degree around a mandrel whose diameter is ten times of cable outer diameter.
** Shaked the cable assembly at a rate of 90 times per minute at a height of 10 cm.

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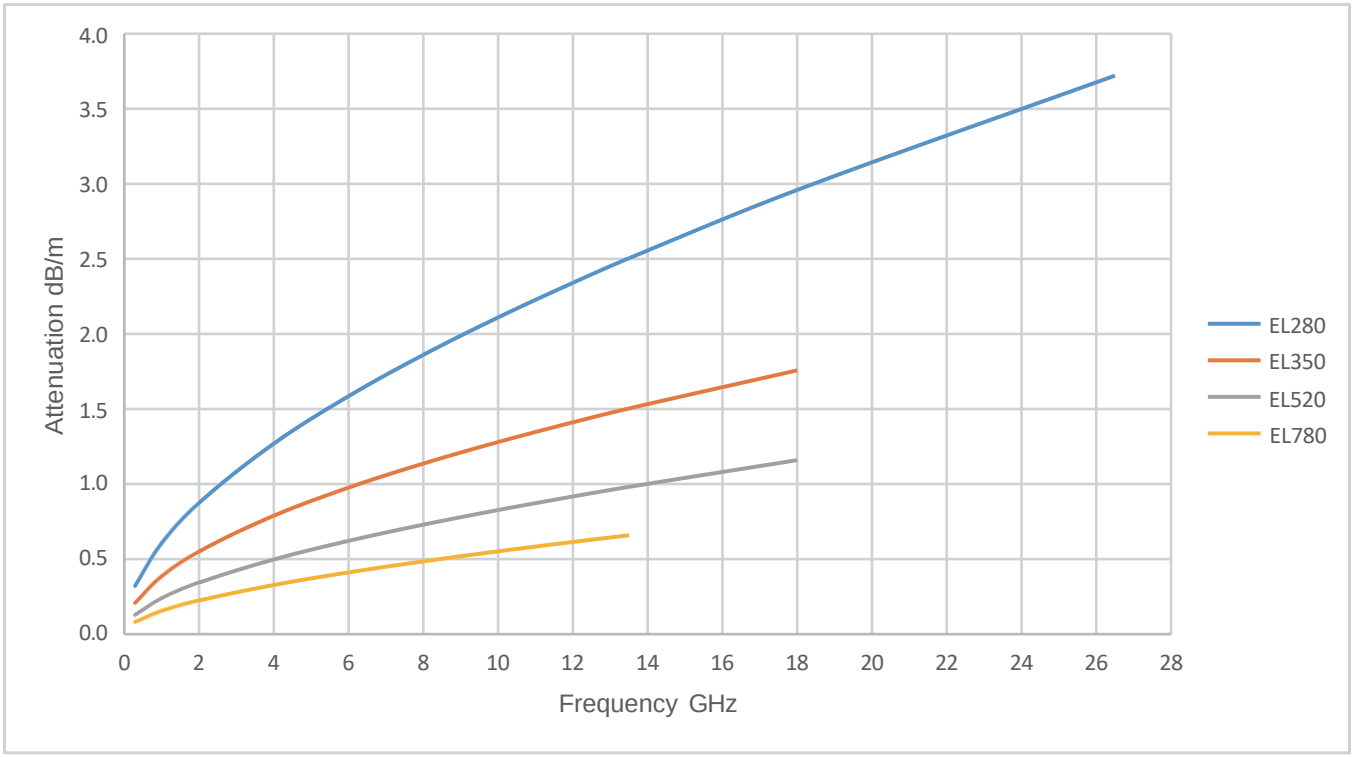
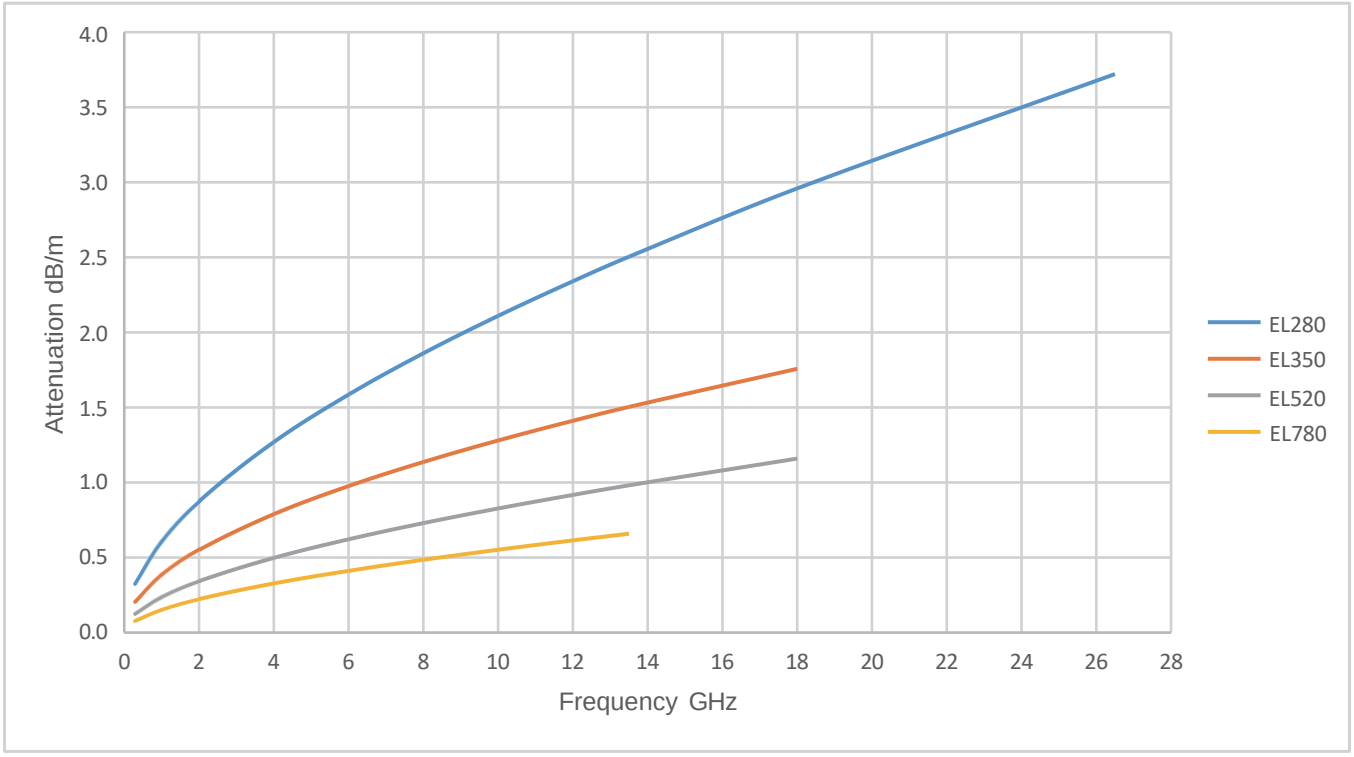
Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 40 °C ambient temperature and sea level)



Available Connectors

Cable P/N	Connectors	Gender	Orientation	Mounting	Max Freq (GHz)	VSWR Max
EL280	SMA	Male	Straight	Standard	26.5	1.25
	N	Male	Straight	Standard	18	1.3
EL350	SMA	Male	Straight	Standard	18	1.25
	N	Male	Straight	Standard	18	1.3
EL520	SMA	Male	Straight	Standard	18	1.35
	N	Male	Straight	Standard	13.5	1.3
	N	Male	Right Angle	Standard	13.5	1.35
	N	Female	Straight	Standard	13.5	1.35
	TNC	Male	Straight	Standard	13.5	1.35
EL780	SMA	Male	Straight	Standard	13.5	1.3
	SMA	Male	Right Angle	Standard	13.5	1.35
	N	Male	Straight	Standard	13.5	1.3
	N	Male	Right Angle	Standard	13.5	1.35
	N	Female	Straight	Standard	13.5	1.35
	TNC	Male	Straight	Standard	13.5	1.35

Note: Other connectors available upon request.

Overview TPH Series

Temperature Phase Stable Cable

TPH series is Low-loss and Phase-stable vs. temperature cables designed for phase-sensitive applications where minimal phase change over temperature is demanded.
Built from PFA dielectric, TPH series cables offer outstanding 300 PPM (-40 to 60 °C) phase stability. PTFE, despite its excellent properties at high frequencies, shows a steep shift in phase in the temperature range of 15°C to 25°C. This phenomenon also known as PTFE knee could cause several problems such as detecting inefficiency, test measurement error etc. TPH series cables are developed to solve this challenge.

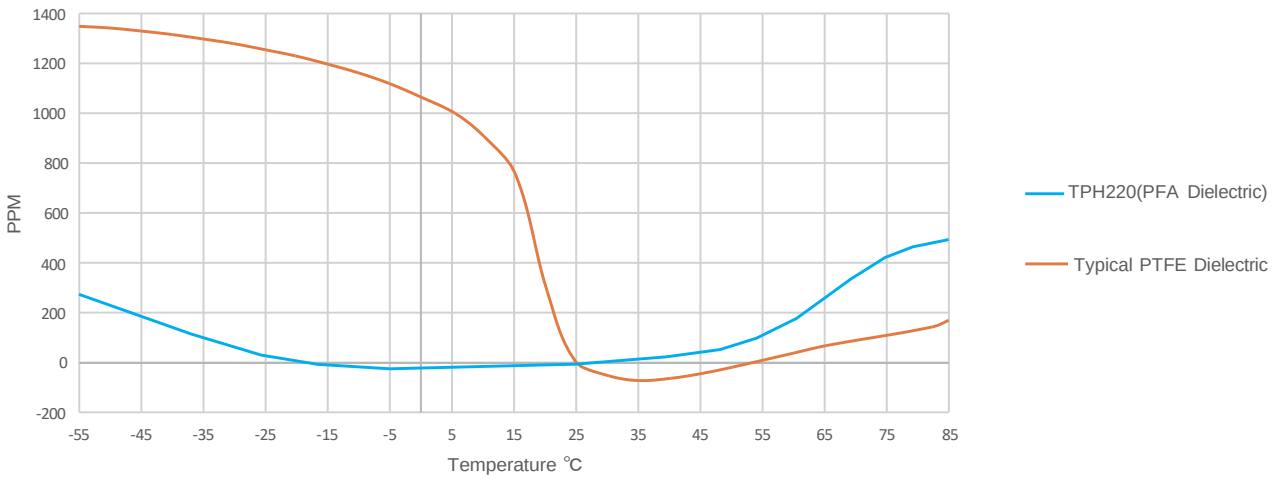
Features

- Excellent phase and insertion loss stability vs temperature
- No PTFE “Knee”
- Low loss operating to 40GHz
- Small bending radius and low profile for easy routing
- Available with 2.92mm, SMP, SSMP cable assemblies

Applications

- Phased array antennas
- Synthetic aperture radar satellites
- Network analyzer measurements

Temperature Phase Stability (PFA versus PTFE)



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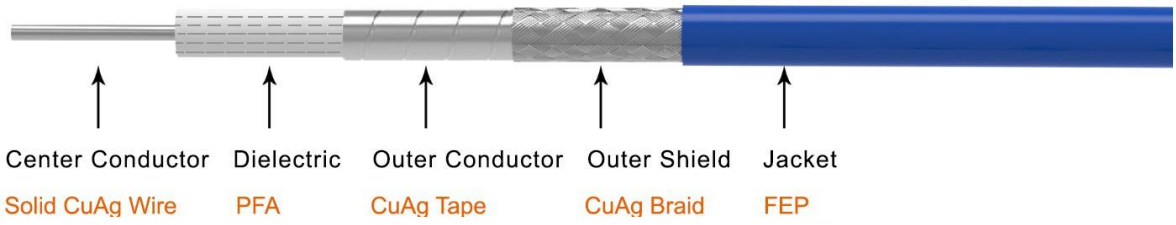
TPH Series

Temperature Phase Stable Cable



	TPH220
Cable Construction(Diameter in mm)	
Center Conductor	0.51
Dielectric	1.40
Outer Conductor	1.56
Outer Shield	1.87
Jacket	2.20
Mechanical	
Min. Bending Radius Static	15mm
Min. Bending Radius Repeated	22mm
Weight	13g/m
Temperature range	-50℃ to +150℃ (cable only), -50℃ to +85℃ (cable assembly)
Electrical	
Operating Frequency	DC-40 GHz
Impedance	50 Ω
Velocity of Propagation	82%
Shielding Effectiveness	>90 dB
Withstanding Voltage	400 V
*Mechanical Phase Stability	<±6º
**Amplitude Stability vs Shaking	<±0.15dB
Temp Phase Stability (-40℃ to +60℃)	<300ppm
Cable attenuation at 25℃	see graph
Power handling	see graph

* Wrapped the cable 360 degree around a mandrel whose diameter is ten times of cable outer diameter.
** Shaked the cable assembly at a rate of 90 times per minute at a height of 10 cm.

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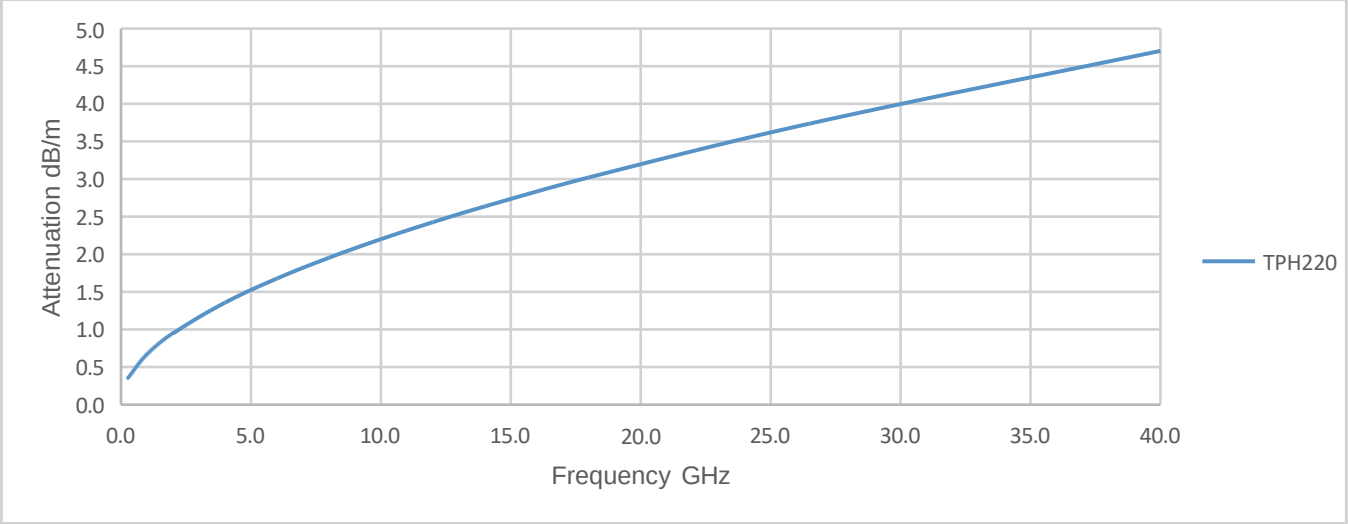
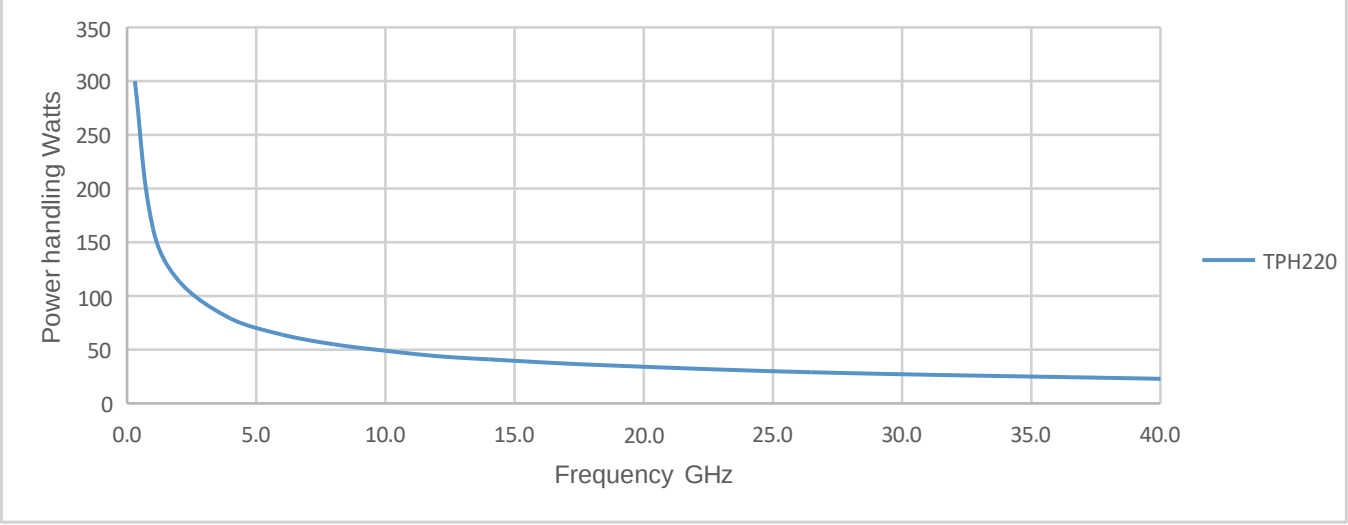
Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 40 °C ambient temperature and sea level)



Available Connectors

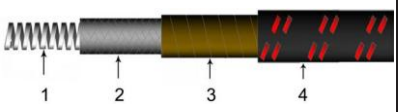
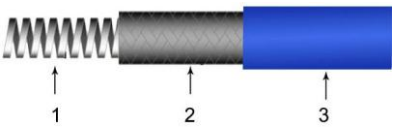
Cable P/N	Connectors	Gender	Orientation	Mounting	Max Freq (GHz)	VSWR Max
TPH220	SMA	Male	Straight	Standard	26.5	1.3
	SMA	Female	Straight	Standard	18	1.3
	2.92mm	F/M	Straight	Standard	40	1.3
	SMP	Female	Straight	Standard	40	1.4
	SMP	Female	Right Angle	Standard	26.5	1.45
	SSMP	Female	Straight	Standard	40	1.4

Note: Other connectors available upon request.

Armored Cable Assembly

Introduction

Armors are designed to withstand harsh environments and rough handling, significantly extending the life of cable assembly. WE offer a number of rugged armor options to suit different applications and budgets.

Armor Code	Armor Illustration	Armor Construction	Features
AL		1. Crush Resistance Layer: Stainless steel spiral 2. Strengthening Layer: Silver plated copper braid 3. Waterproof Layer: PTFE Binder 4. Armor Jacket: Braiding PTFE	● Operating temperature to +200℃ ● Providing four layers of protection ● Ultimate crush and abrasion resistance ● Long-term reliability with pull relief design ● Excellent flexibility ● Flexing life: 20,000 times
AE		1. Crush Resistance Layer: Stainless steel spiral 2. Strengthening Layer: Silver plated copper braid 3. Armor Jacket: PUR	● Operating temperature limited to +85℃ ● High mechanical strength and ruggedness ● Highest flexibility ● Flexing life: 15,000 times
AS		1.Armor Jacket: Stainless steel interlock	● Superior flexibility but heavy in weight ● Excellent crush resistance, withstanding outdoor or harsh environment ● Lower cost options
APV		1.Armor Jacket: PVC	● Operating temperature limited to +75℃ ● Waterproof, resistant to most chemicals ● Lowest cost options

Armored Cable Assembly in AL Armor

Features and Benefits

- Specially designed for Phase Stable Low Loss PL series cables
- Available in standard and low-profile armor sizes
- Excellent phase and amplitude stability with flexure
- Precise and repeatable measurements
- Highly flexible and longer flex life
- Strain relief design and multi-layer armors against tension, torsion and abrasion

Applications

- Test cables for VNA and RF/Microwave instruments
- Bench-top, RF production testing
- Wafer probing
- Automatic test equipment systems

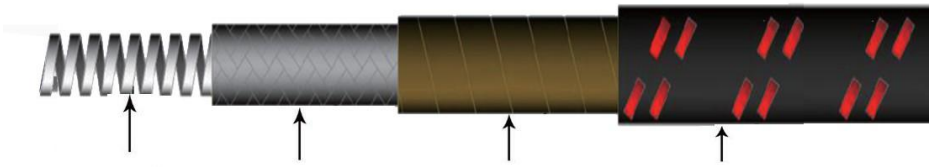
Standard AL Armored Cable Assemblies

Freq Range (GHz)	VSWR Max	IL Max (dB)	Mechanical Phase Stability (Deg)	Amplitude Stability vs Shaking (dB)	Flex Life Min (cycles)	Connector
DC-110	1.45	14.4	<±12	<±0.2	20000	1.0mm
DC-67	1.4	7.1	<±7	<±0.15	20000	1.85mm
DC-50	1.35	4	<±5	<±0.1	20000	2.4mm
DC-40	1.3	2.8	<±5	<±0.1	20000	2.92mm
DC-26.5	1.3	1.7	<±5	<±0.1	20000	SMA
DC-18	1.25	1.5	<±5	<±0.1	20000	N Type

Notes:

1. Insertion loss refers to the loss of 1 meter cable assembly.
2. Custom length and other connector types as right angle, female etc are available.

Structure of AL Armor



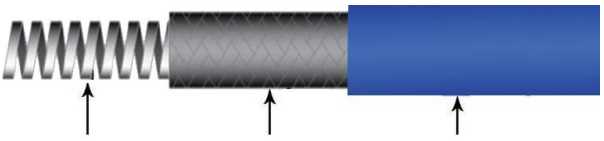
Armor P/N	AL380	AL500	AL640	AL780	AL1050
Armor Size					
Crush Resistance Layer I.D.	2.3mm	3.0mm	4.0mm	5.5mm	8.5mm
Crush Resistance Layer O.D.	2.8mm	3.6mm	4.8mm	6.4mm	9.3mm
Strengthening Layer	3.1mm	3.9mm	5.4mm	7.0mm	9.9mm
Waterproof Layer	3.2mm	4.1mm	5.4mm	7.1mm	10.0mm
Armor Jacket	3.8mm	4.7mm	6.4mm	7.8mm	10.9mm
Mechanical					
Weight	25g/m	42g/m	66g/m	93g/m	115g/m
Static Bend Radius	20mm	24mm	32mm	39mm	50mm
Crush Resistance	> 1000N/cm				
Temperature range	-55℃ to +200℃				
Applicable Cables	PUL180P	PUL230P	PUL230P PUL360 PUL360P PUL380P PUL390P	PUL520P FL460 FL520	PUL800

Armored Cable Assembly in AE Armor

Features and Benefits

- Operating temperature limited to +85℃
- High mechanical strength and ruggedness
- Highest flexibility
- Flexing life: 15,000 times

Structure of AE Armor



Crush Resistance Layer — stainless steel spiral

Strengthening Layer — silver plated copper braid

Armor Jacket — PUR

Armor P/N	AE660	AE880	AE1200
Armor Size			
Crush Resistance Layer I.D.	4.0mm	5.5mm	8.5mm
Crush Resistance Layer O.D.	4.8mm	6.5mm	9.3mm
Strengthening Layer	5.4mm	7.1mm	9.9mm
Armor Jacket	6.6mm	8.8mm	11.9mm
Mechanical			
Weight	65g/m	105g/m	150g/m
Static Bend Radius	33mm	44mm	60mm
Crush Resistance	800N/cm		
Temperature range	-55℃ to +85℃		
Applicable Cables	PL360 PL360P PL380P PL390P	PL520P FL520 UF520 UF550	PL800

Standard AE Armored Cable Assemblies

Freq Range (GHz)	VSWR Max	IL Max (dB)	Mechanical Phase Stability (Deg)	Amplitude Stability vs Shaking (dB)	Flex Life Min (cycles)	Connector
DC-26.5	1.25	3.1	<±5	<±0.1	15000	SMA
DC-18	1.25	2.5	<±4	<±0.1	15000	N Type

Notes:

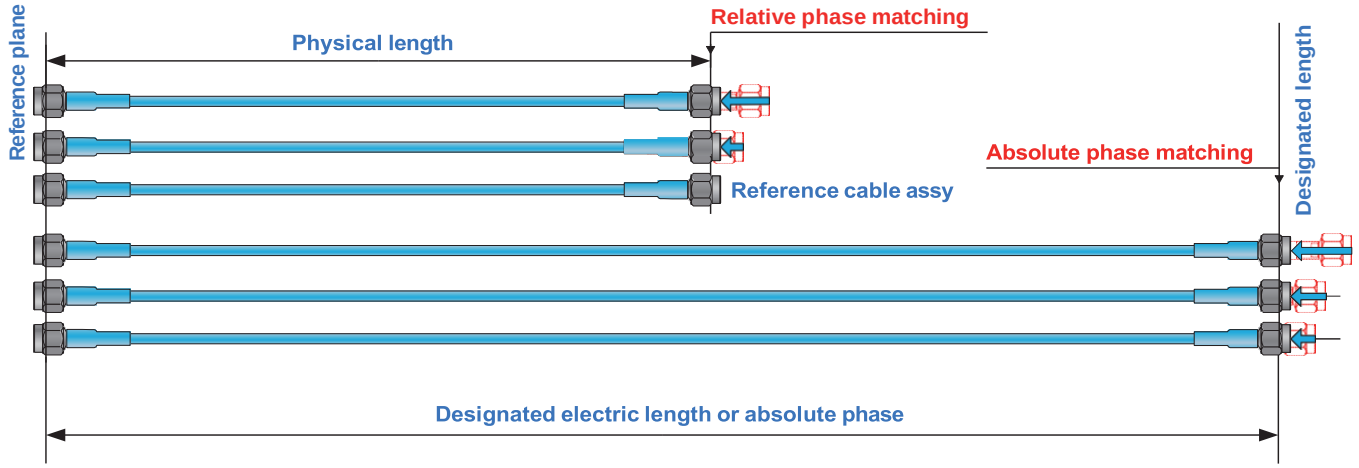
1. Insertion loss refers to the loss of 1 meter cable assembly.

Phase Matched Cable Assemblies

Nowadays the microwave systems are in increased need for phase matched coaxial cable assemblies, with applications in Phased Array Radars, Multi-Beam Antenna Arrays, Multi-Channel Amplifiers and Environmental, Production or Lab Testing etc.

AWAN offers two different versions of phase matching as shown in below diagram:

Absolute Phase Matching and **Relative Phase Matching**



The match can be specified in **Electrical Length Match in Degrees** at a Specified Frequency(i.e.±5° @ 18 GHz) or in **Time Delay Match** (i.e.±2 ps). Please refer to Page 42 for detailed engineering information.

Thanks to our precisely controlled cable manufacturing process and highly skilled & experienced technicians, AWAN is able to offer phase matched cable assemblies up to 110 GHz matched in a pair, or in a set to meet tolerance such as +/- 2ps to 67 GHz or +/-4 degree through 18 GHz.

Depending on the application, a variety of cable series available in phase match:

- PUL series–Ultra-low Loss Phase and Amplitude Stable Flexible Cable
- FL series–Long Flex Life Triple-shielding Flexible Cable
- EL series–Economical Low Loss Flexible Cable
- TB series–Tight Bend Triple-shielding Flexible Cable
- TPH series–Temperature Phase Stable Cable

When phase or delay matched cable assemblies are needed, please specify the below requirements:

1) Frequency of operation
2) Required phase match or delay match in ± ps or in ± degree@ x GHz
3) Quantity of cable assemblies in one set which are to be matched
4) Length of cable assemblies
5) Connectors of the assemblies in one set or pair

Engineering Information

Phase Stability Test with Flexure

Phase stability vs. flexure is a measure of the phase change as a result of cable flexing. The phase stability can be affected by the following factors:

- Cable material and construction
- Assembly technique
- Cable bend radius and bend angle
- The number of flexures

1. Initial Test

1) Connect the two ports of cable under test(CUT) with VNA, the cable is held in an initial unwrapped position and is measured in the phase and attenuation.

2) Normalize VNA in the phase.

2. Test with cable wrapped 360° clockwise

1)Disconnect the CUT cable and wrap it 360° clockwise around a mandrel (diameter is ten times of cable outer diameter).

2) The CUT cable is held in such position for measurement, record the max phase and attenuation change over frequency range.

3. Test with cable returned to original unwrapped position

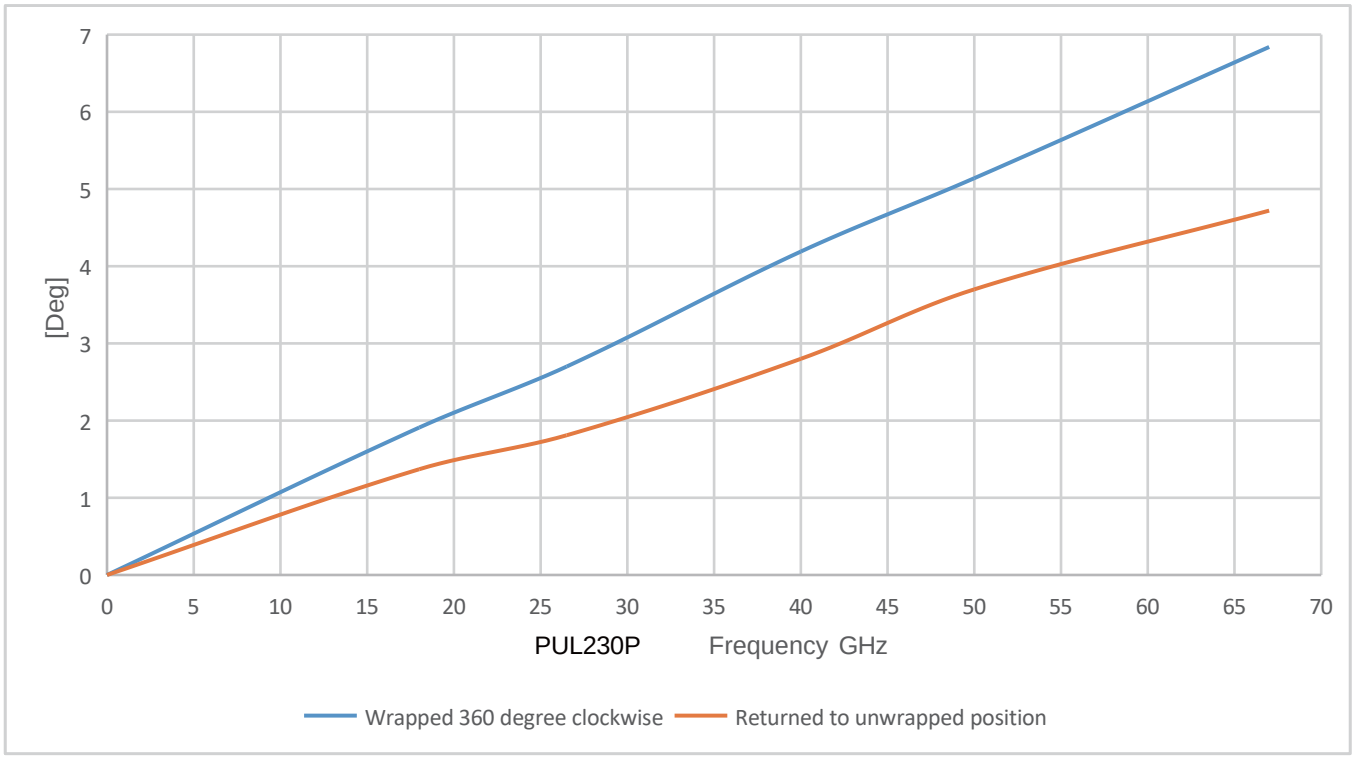
1) Disconnect the CUT cable and return it to its original unwrapped position.

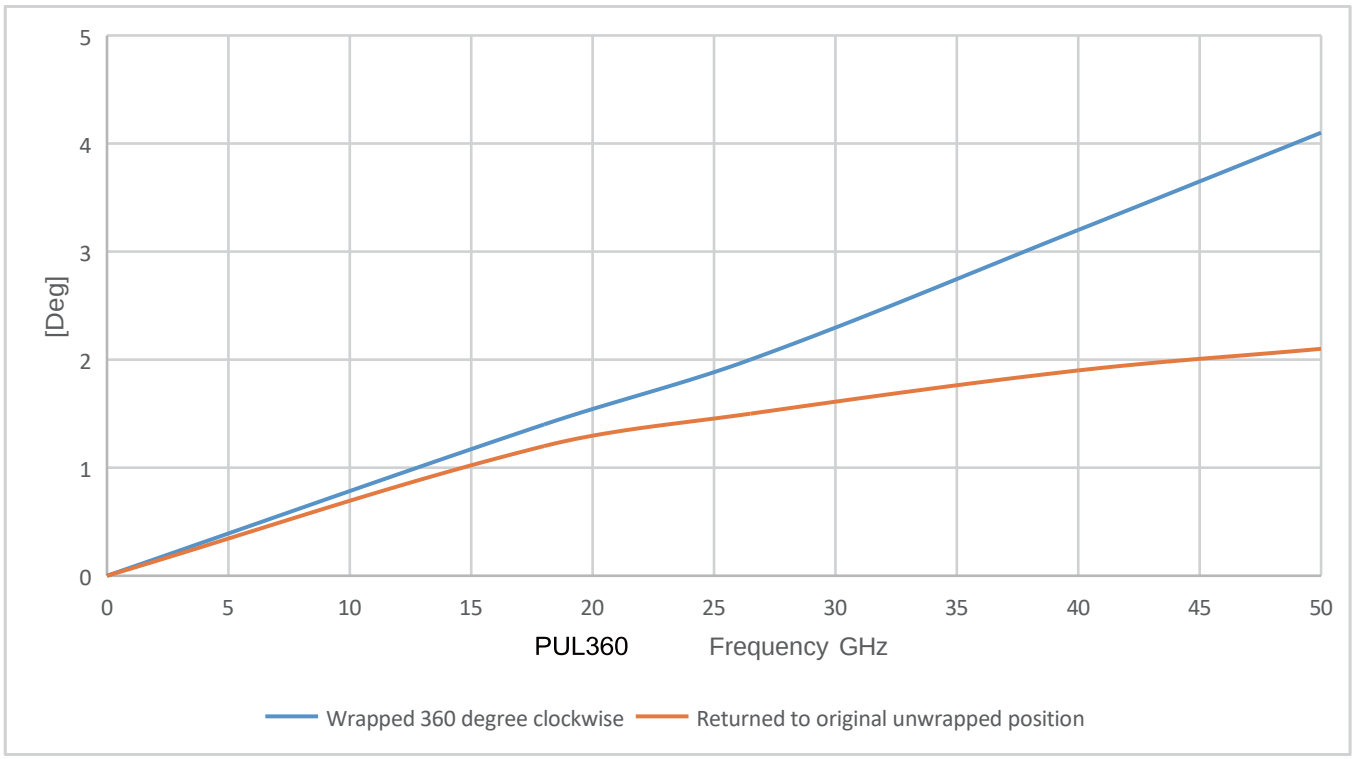
2) The CUT cable is held in such position for measurement, record the max phase change.

3) The worst-case phase variation in the above procedure is recorded as the phase stability value.

Engineering Information

Test Data on Phase Stability with Flexure





Engineering Information

Phase Stability Test over Temperature

Phase stability vs. temperature is a measure of the signal speed variation when the cable is exposed to different temperatures. The temperature variation will induce the change of the dielectric constant εr, mechanical length, material character which will cause its phase variation. This variation can be unidirectional or multidirectional. The phase variation is characterized by the temperature coefficient of phase η_t, and the maximum variation of temperature coefficient of phase $\Delta|\eta|_{max}$

$$\eta_t = (\varphi_{25℃} - \varphi_t) / \Phi_{25℃} \qquad \Delta|\eta|_{max} = |\eta_{max} - \eta_{min}|$$

where

$\varphi_{25℃}$ is the phase at temperature 25℃ , in (°)
φ_t is the phase at temperature t, in (°)
$\Phi_{25℃}$ is the total phase at 25℃ , in (°)
$\Delta|\eta|_{max}$ is the maximum phase variation coefficient, in ppm

Test Equipment
A vector network analyzer (VNA), a temperature chamber.

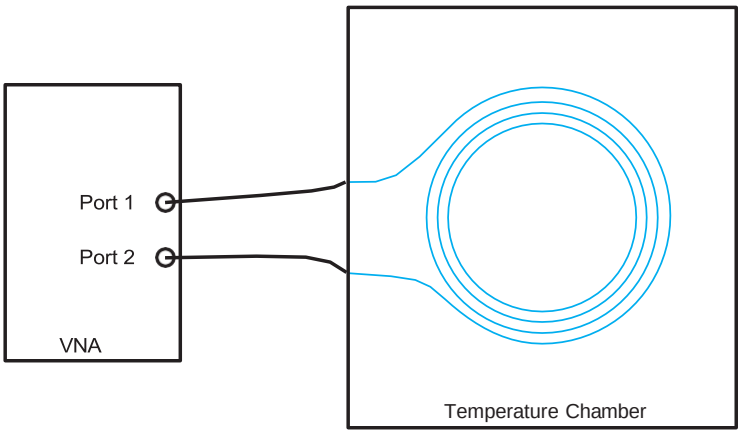
Test Sample
The test cable shall be 3 m long and terminated with suitable connectors at each end.

Test Procedure
1. Test sample shall be put into a temperature chamber in loose coils with the diameter not less than 10 times the cable's minimum static bending radius. Adjust temperature of the chamber for 6 cycles and maintain at least 30 min at each limit temperature (85℃ and -55℃).

2. Set the temperature chamber to 85℃ and maintain 10 min at least when it reaches the temperature. Connect Test sample with the VNA, test $\Phi_{25℃}$ and $\varphi_{25℃}$.

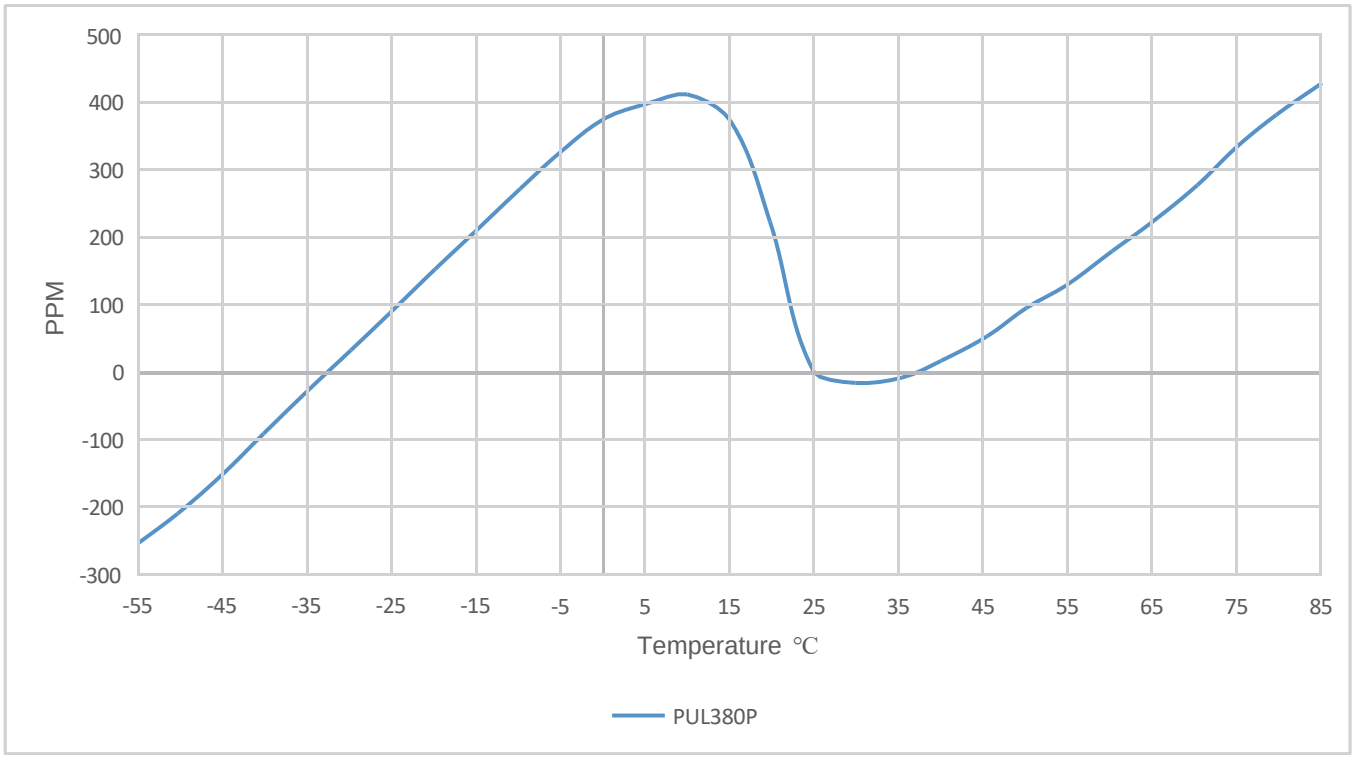
3. Adjust the temperature of the chamber from the lowest temperature -55 ℃ to each higher temperature until to the maximum temperature 85℃ , and record φ_t .

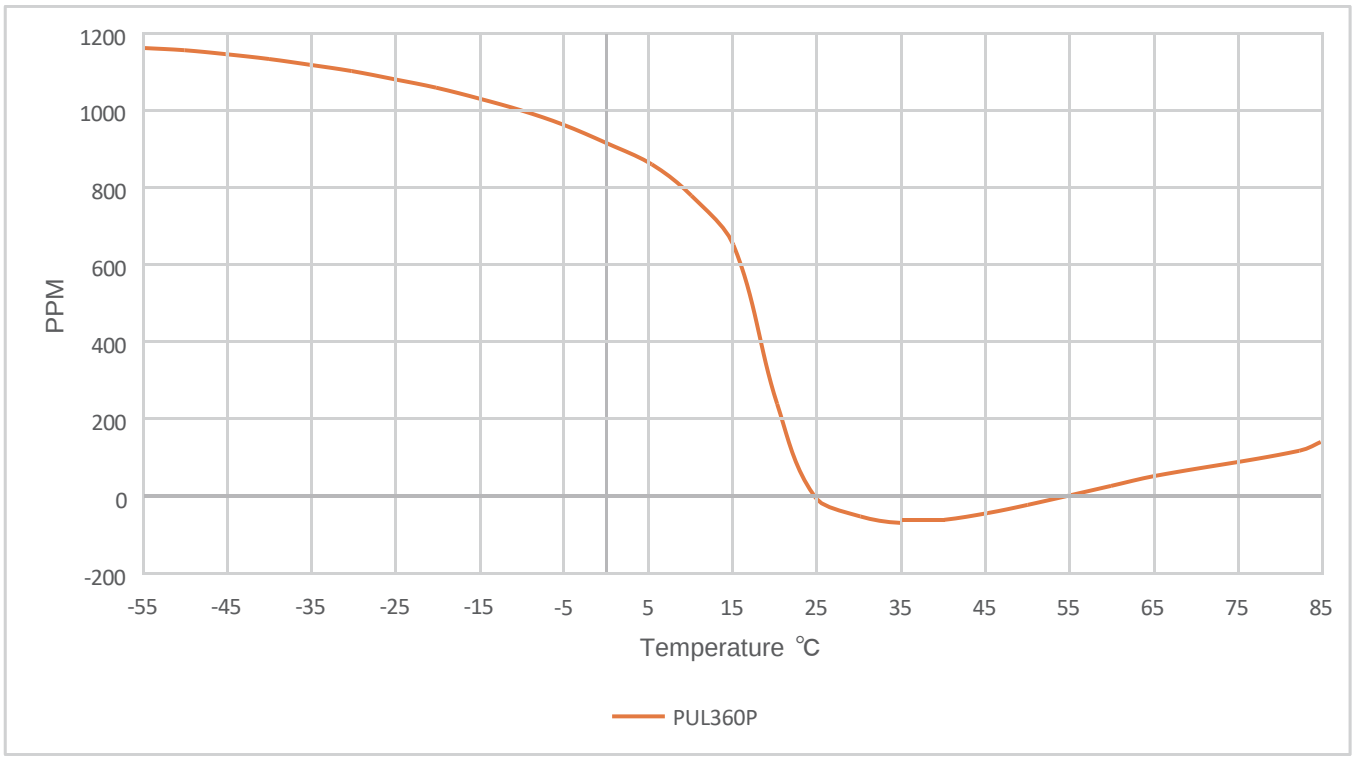
4. Use each η_t and temperature t draw the curve of phase variation with temperature at specified frequency f.



Engineering Information

Test Data on Phase Stability vs Temperature





Engineering Information

Phase Matching of Cable Assemblies

Phase matching is a term generally used to describe two or more cable assemblies with the same electrical length. Normally two specifications are used for phase matched cables assemblies:

1. Time Delay Match

Measure the time delay of each cable assembly by VNA, mark the time delay data typically at the middle point of the frequency range.

For example, a pair of 4 pcs cable assembly matched as DC-67GHz, time delay +/-2ps. Typical phase matching data as in below table.

S/N	01 Cable	02 Cable	03 Cable	04 Cable
Measured Delay	4048.8ps@33.5GHz	4048.9ps@33.5GHz	4047.7ps@33.5GHz	4049.3ps@33.5GHz
* Result	Max: 4049.3ps, Min:4047.7ps, Range:1.6ps(±0.8ps), Judgement: Pass			

Notes:

* When the range of min & max data is within the phase match limit, it is judged Pass.

2. Electrical Length Match in Degrees at a Specified Frequency

Measure the phase of each cable assembly by VNA across the required frequency range.

For example, a pair of 4 pcs cable assembly matched as DC-26.5GHz, +/-5 degree. Typical phase matching data as in below table.

S/N	01 Cable	02 Cable	03 Cable	04 Cable
* Measured Phase	0 degree	0.9 degree	2.0 degree	-1.1 degree
** Result	Max: 2.0 degree, Min:-1.1 degree, Range:3.1 degree(±1.6 degree), Judgement: Pass			

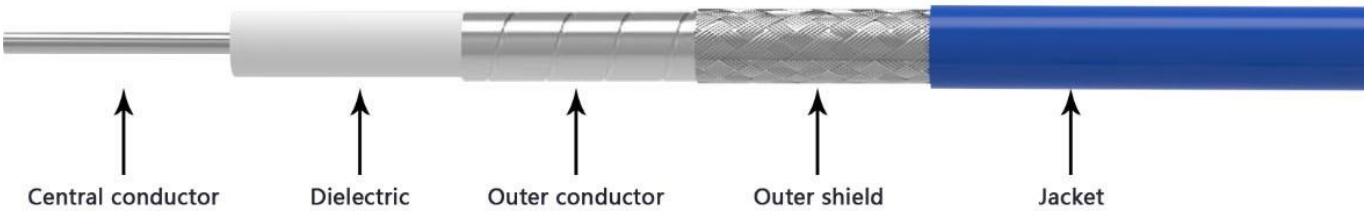
Notes:

* Using S/N 001 as reference cable, phase of which is normalized on VNA. Measuring the phase for each of the rest cables.

** When the range of min & max data is within the phase match limit, it is judged Pass.

Engineering Information

Typical Cable Structure



Center Conductor (Silver Plated Copper)

1. With equal size, solid center conductor cables tend to be more amplitude stable with flexing, stranded center conductor cables tend to be more phase stable with flexing.
2. Stranded center conductor cable is more flexible and endurable than solid center conductor cables under repeated bending.
3. With the same structure, material and processing, cables with thicker diameter center conductor features better attenuation and higher power handling than cables with thinner diameter center conductor.

Dielectric

A microporous low density PTFE dielectric cable will typically have better phase stability, lower loss and higher temperature handling than a solid PTFE or foamed FEP dielectric cable.

Outer Conductor

- Outer conductor in silver plated copper braiding features low loss, long flex life.
- Outer conductor in silver plated copper taping features ultra-low loss, phase and amplitude stability
- Outer conductor in aluminum foil features lower cost, low loss.

Shielding

Silver plated copper wire braiding contributes to mechanical strength and additional RF shielding.

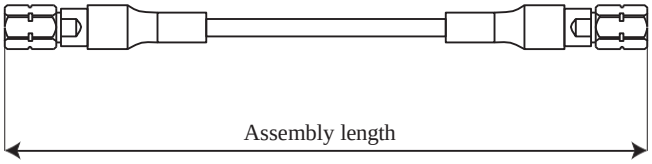
Jacket

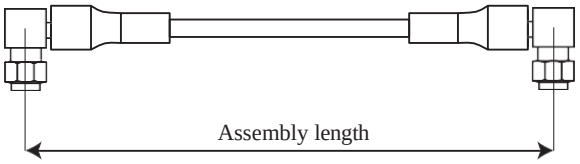
- FEP jacket is high temperate and chemical resistant, operating -65 to 200℃ .
- PUR jacket is super flexible, operating to 85℃ only.
- PTFE jacket is very flexible, operating to 250℃.

General Assembly Information

Length definition

1. For straight connectors, the assembly length is measured from one connector end to the other connector end, for right angle connectors, use the pin center-line as shown in below drawing.
2. For non-phase matched cable assemblies, standard length tolerance is ±1.5% for cables over 50 cm. For cables less than 50 cm, length tolerance is ±5mm.





Care and handling instructions

1. Avoid kinking cables when straightening from a coil or reel.
2. Choose the installation routing using the largest bend radius possible. Small bend radius may affect electrical performance. Exceeding the specified limits during the installation process could cause a permanent degradation.
3. Avoid twisting microwave cable assemblies. Torsion of this type of assembly can alter the relative diameters of cable layers and affects the electrical characteristics.
4. When mating connectors with a screwed interface always hold the connector bodies and turn only the coupling nut. This avoids twisting the cable and ensures minimum wear on the connector pins.
5. Do not exceed the specified torque. Recommended torque value for S/Steel SMA and 2.92mm connector installation is 8 in lbs.