Advanced Test Equipment Corp.

Rentals • Sales • Calibration • Service

Test & Measurement

TIMES
MICROWAVE SYSTEMS
An Amphenol Company

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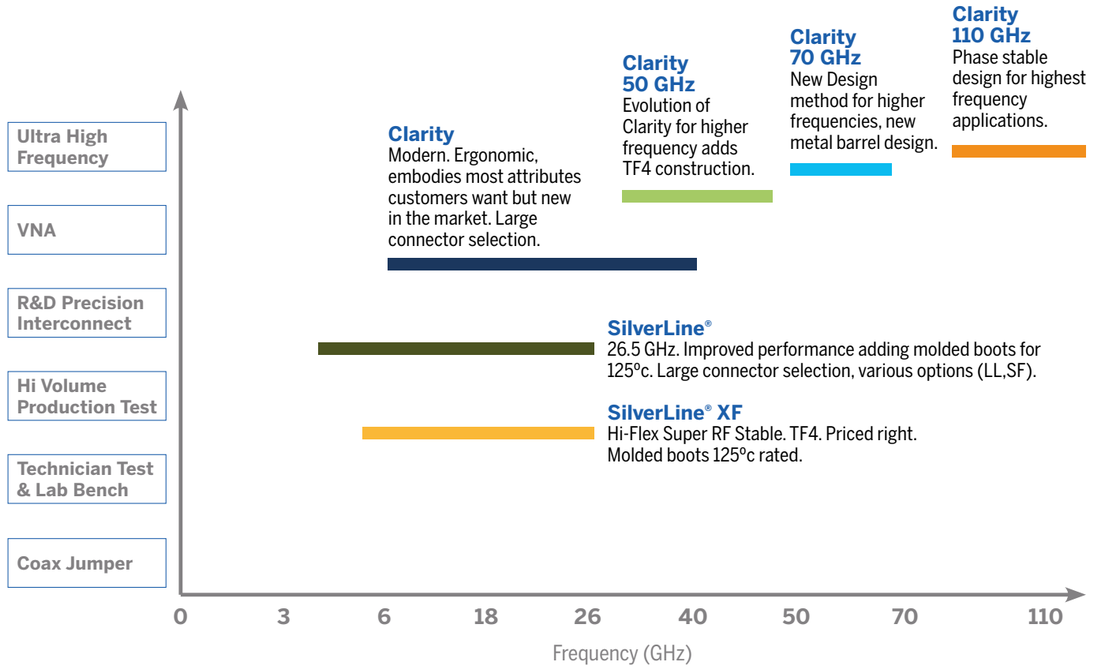
Test Cable Assembly comparison chart

Test Cable	Max.Frequency	Flexibility	Stability	Armored/Unarmored	Attenuation
Clarity 18	18 GHz	Very Good	Excellent	Both	Excellent
Clarity26	26.5 GHz	Very Good	Excellent	Both	Excellent
Clarity 40	40 GHz	Very Good	Excellent	Both	Excellent
Clarity 50	50 GHz	Very Good	Very Good	Armored	Very Good
Clarity 70	70 GHz	Excellent	Excellent	Armored	Excellent
Clarity 110	110 GHz	Excellent	Excellent	Armored	Very Good
Silverline	26.5 GHz	Very Good	Very Good	Both	Very Good
Silverline XF	26.5 GHz	Very Good	Excellent	Unarmored	Very good

Test Cable Assembly Guide

Selecting the correct assembly for the right application is not always an easy task. Below are some considerations when selecting RF test assemblies.



- Application- Above chart shows specific applications and associated product family.
- Frequency- As there are some products that use a specific frequency range, this can help with selection, especially with higher frequencies.
- Specification requirements - Each product line lists its mechanical, environmental, electrical data to help compare and narrow down the right product family. Comparing these to your known requirements can make the job of selecting a cable easier.
- Connectors- Knowing what connector you need can also narrow down product family, and frequency. There are some overlap on connectors VS product series, but the enclosed data should help with selection.
- Price VS performance- Sometimes the absolute most expensive is not required, looking at the requirements and comparing them to the products, can yield the perfect product at the perfect price.
- Contact the Times Application team, there many Times Microwave applications engineers worldwide who can assist with product selection or new design.

Clarity™ Series

18, 26.5, and 40 GHz Test Cables

TIMES MICROWAVE SYSTEMS
An Amphenol Company

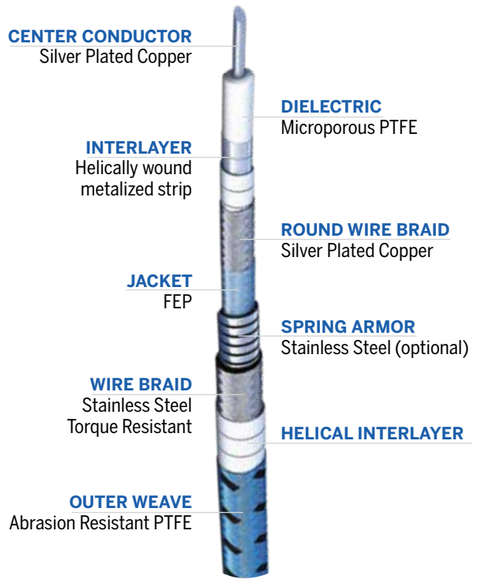
Clarity™ Series 18, 26.5, and 40 test cables provide industry-leading performance, unparalleled value, and stock to 4-week lead times.

Applications:

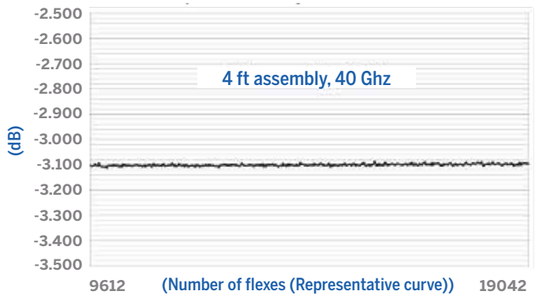
- Research & Development Labs
- VNA Test Port Extension Cables
- Scalar Analyzers
- High Volume Production Test
- System Level RF Connection
- Test Rack Interconnect
- Bench or Portable Test Equip.
- Antenna Ranges
- Anechoic Chambers
- RF Module Testing

CONNECTORS & STRAIN RELIEF:

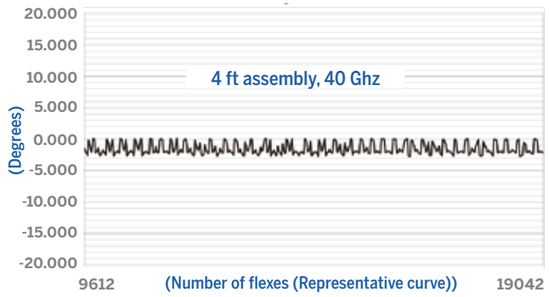
- User friendly stainless steel SureGrip™ knurled coupling nut
- Unique, elliptical-shaped, Sure-Grip™ injection molded strain relief (Armored version only)



Amplitude Stability While in Motion



Phase Stability While in Motion



Specifications

Ω Impedance 50 Ohms | Op Temp -67 to 221°F -55 to 125°C

MECHANICAL

		Units	
Armored Diameter:	armor	in (mm)	0.29 (7.37)
	strain relief	in (mm)	0.50 (12.70)
Unarmored Diameter:	cable	in (mm)	0.190 (4.83)
	strain relief	in (mm)	0.425 (10.8)
Minimum Bend Radius	armored	in (mm)	1.5 (38)
	armored max flex life	in (mm)	3.0 (76)
	unarmored	in (mm)	1.0 (25)
	unarmored max flex	in (mm)	2.0 (50)
Flex Life[1]	unarmored		25.000
	armored		50.000
Crushing	(armored version)	lbs/lin.in	200
Mating life cycle[2]			5000

ELECTRICAL

	Units	
Velocity of Propagation	%	78
Shielding Effectiveness	dB	>100
Capacitance	pF/ft (pF/m)	26 (85)

	Units	18 GHz	26.5 GHz	40 GHz
VSWR (Maximum)		1.20:1	1.25:1	1.35:1
Phase Stability typical *	°	+/- 1.0	+/- 1.5	+/- 2.0
Amplitude Stability typical *	dB	+/- 0.02	+/- 0.035	+/- 0.04

*The assembly is terminated with a short circuit and bent 90 degrees around the mandrel of 1-inch radius.

Attenuation	1 GHz	18 GHz	26.5 GHz	40 GHz
dB/FT (dB/M)	0,099 (0,301)	0,441 (1,364)	0,543 (1,655)	0,679 (2,070)

CALCULATION

$$IL = (K1 \times \sqrt{(f)}) + K2 \times (f) \times \text{Cable Length}$$

Cable Insertion Loss (f) is in MHz

Length unit must match K value unit

k values	dB/ft	dB/m
K1	0.377	0.1149096
K2	0.000159	4.84632e-5

CABLE POWER HANDLING (Cable only)

	18 GHz	26.5 GHz	40 GHz
@77°F (25°C) sea level, watts (max)	18	15	13

Ordering Guide

CL **X** **XX** - **XXX** **XXX** - **XX.XX** **X**

- **X**: U = Unarmored, S = Steel armored
- **XX**: 18 = 18 GHz, 26 = 26.5 GHz, 40 = 40 GHz
- **XXX**: - Connector A
- **XXX**: Connector B -
- **XX.XX**: Length
- **X**: M = Meters, F = Feet

Connector Code	Description	Connector Code	Description
SM	SMA male SureGrip knurl (18 or 26.5 GHz)	NMR	N Male Right Angle
SH	SMA male hex nut (18 or 26.5 GHz)	KM	2.92mm male SureGrip knurl (40 GHz)
SF	SMA female (18 or 26.5GHz)	KH	2.92mm male hex nut (40 GHz)
SMR	SMA right angle SureGrip knurl (18 GHz)	KMR	K (2.92mm) right angle SureGrip knurl (40 GHz)
35M	3.5mm male SureGrip knurl (26.5 GHz only)	KF	2.92mm female (40 GHz)
35H	3.5mm male hex nut (26.5 GHz only)	KRF	K ruggedized female (40 GHz only)
35F	3.5mm female (26.5 GHz only)	24M	2.4mm male SureGrip knurl (40 GHz only)
3RF	3.5mm ruggedized female (NMD) 26.5 GHz only	24H	2.4mm male hex nut (40 GHz only)
NM	Type N male (18 GHz)	24F	2.4mm female (40 GHz only)
NF	Type N Female (18 GHz)	2RF	2.4mm ruggedized female (NMD) (40 GHz only)

Specifications subject to change without notice.

Clarity™ Series

50 GHz Test Cables

TIMES MICROWAVE SYSTEMS
An Amphenol Company

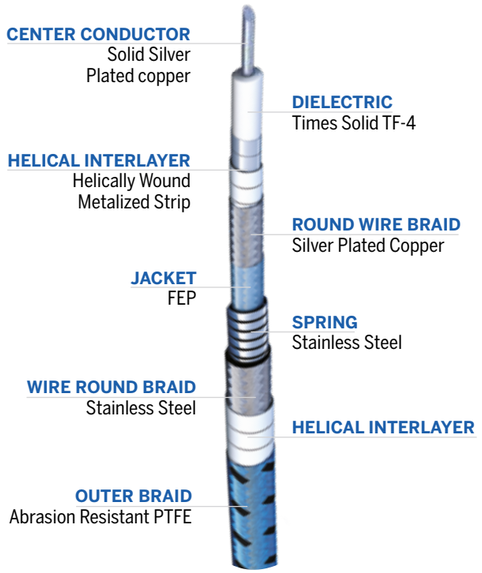
Clarity™ 50 test cable boasts steel torque crush and overbend protection with abrasion resistance - without compromising flexibility. The cable is ultra-stable through 50 GHz with exceptionally low attenuation. The design includes an ergonomic, injection molded strain relief and Times' SureGrip™ coupling nut.

Applications:

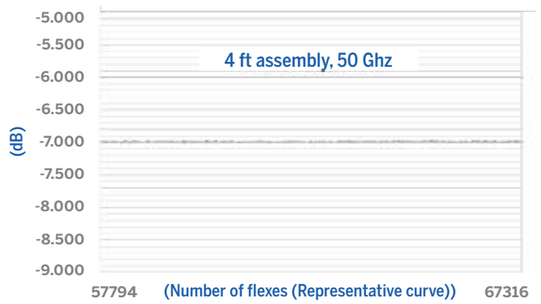
- 5G development
- Research & Development Labs
- Bench VNA's and Analyzers
- High Volume Production Test
- RF Module Testing

CONNECTORS & STRAIN RELIEF:

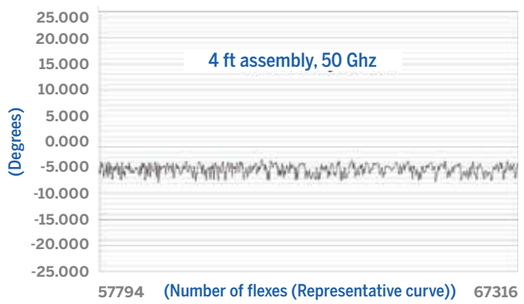
- User friendly stainless steel SureGrip™ knurled coupling nut
- Unique, elliptical-shaped, Sure-Grip™ injection molded strain relief



Amplitude Stability While in Motion



Phase Stability While in Motion



Specifications

Impedance 50 Ohms | Op Temp -67 to 257°F -55 to 125°C

MECHANICAL

		Units	
Armored Diameter:	armor	in (mm)	0.29 (7.95)
	strain relief	in (mm)	0.50 (12.70)
Minimum Bend Radius	armored	in (mm)	1.5 (38)
	armored max flex life	in (mm)	3.0 (76)
Crushing	(armored version)	lbs/lin.in	200
Flex Life[1]			50.000

*The assembly is terminated with a short circuit and bent 90 degrees around the mandrel of 1-inch radius.

ELECTRICAL (50GHZ)

	Units	
Velocity of Propagation	%	70
Shielding Effectiveness	dB	>100
Capacitance	pF/ft (pF/m)	29 (95)
VSWR (typ/max)		1.30:1 / 1.40:1
Phase Stability typical*	°	+/- 4.0
Amplitude Stability typical*	dB	+/- 0.08

Attenuation	1 GHz	18 GHz	26.5 GHz	50 GHz
dB/FT (dB/M)	0,184 (0,560)	0,889 (2,711)	1,116 (3,403)	1,642 (5,006)

CABLE POWER HANDLING (Cable only)

	18 GHz	40 GHz	50 GHz
@77°F (25°C) sea level, watts (max)	24.3	15.2	13.2

CALCULATION

$$IL = (K1 \times \sqrt{(f)}) + K2 \times (f) \times \text{Cable Length}$$

Cable Insertion Loss (f) is in MHz

Length unit must match K value unit

k values	dB/ft	dB/m
K1	0.5556	0.16934688
K2	0.0008	0.00024384

Ordering Guide

CLS50 - XXX XXX - XX.XX X

- XXX: - Connector A
- XXX: Connector B -
- XX.XX: Length
- X: M = Meters, F = Feet

Connector Code	Description
18M	1.85mm male
18F	1.85mm female
18RF	1.85mm ruggedized female
24M	2.4mm male SureGrip knurl
24F	2.4mm female
24RF	2.4mm ruggedized female

Specifications subject to change without notice.

Clarity™ Series

70 GHz Test Cables

TIMES MICROWAVE SYSTEMS
An Amphenol Company

The Clarity™ 70 test cable boasts steel torque crush and overbend protection with abrasion resistance - without compromising flexibility. The cable is ultra-stable through 70 GHz with exceptionally low attenuation. The design includes an ergonomic, stainless steel protective barrel strain relief and a hex coupling nut.

Features:

- Broad Frequency Response
- Rugged & Durable
- Phase Stable Over Temperature
- Long Flex Life

Specifications

Ω Impedance 50 Ohms | Op Temp -67 to 302°F -55 to 150°C

MECHANICAL

	Units	
Diameter	in (mm)	0.20 (5.08)
Weight	lb/ft (kg/m)	(0.02)
Minimum Bend Radius	in (mm)	1.00 (25.4)
Crushing	lb/in (kg/m)	200 (35.75)
Flex Life		> 50000
Maximum Frequency	GHz	70

ELECTRICAL

	Units	
Velocity of Propagation	%	80
Capacitance	pF/ft (pF/m)	24.6 (80.7)
Delay	ns/ft (ns/m)	1.27 (4.14)
Sheilding	dB	>-90
VSWR Typical		1.35:1
VSWR Max		1.40:1
Phase Stability	°	+/- 5
Amplitude Stability	dB	+/- 0.10

Attenuation	18 GHz	26.5 GHz	40 GHz	70 GHz
dB/FT (dB/M)	0.820 (2.5)	0.995 (3.03)	1.22 (3.72)	1.62 (4.93)

CABLE POWER HANDLING (Cable only)

	18 GHz	40 GHz	70 GHz
@77°F (25°C) sea level, watts (max)	16.7	11.1	8.3

CALCULATION

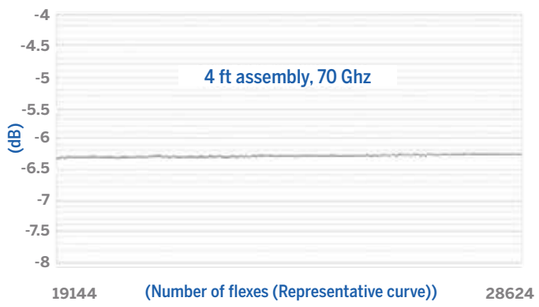
$$IL = (K1 \times \sqrt{(f)} + K2 \times (f) \times \text{Cable Length}$$

Cable Insertion Loss (f) is in MHz

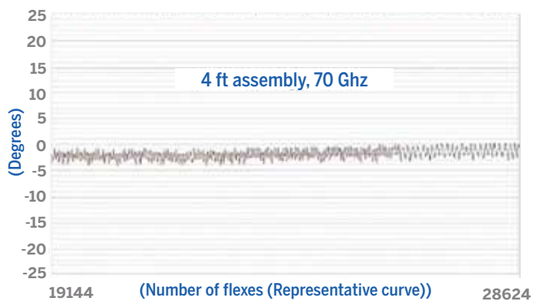
Length unit must match K value unit

k values	dB/ft	dB/m
K1	0.00611	0.01862328
K2	0.000000258	4.14528E-06

Amplitude Stability While in Motion



Phase Stability While in Motion



Ordering Guide

CLS70 - XXX XXX - XX.XX X

- XXX: - Connector A
- XXX -: Connector B -
- XX.XX: Length
- X: M = Meters, F = Feet

Connector Code	Description
18M	1.85mm Male Connector
18F	1.85mm Female Connector
18RF	1.85mm Ruggedized Female

Specifications subject to change without notice.

Clarity™ Series

110 GHz Test Cables

TIMES MICROWAVE SYSTEMS
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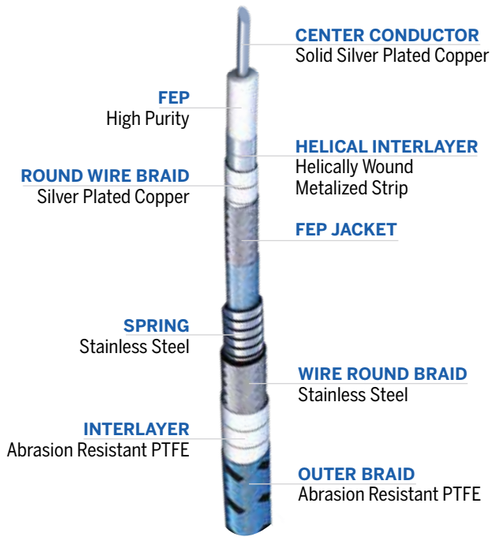
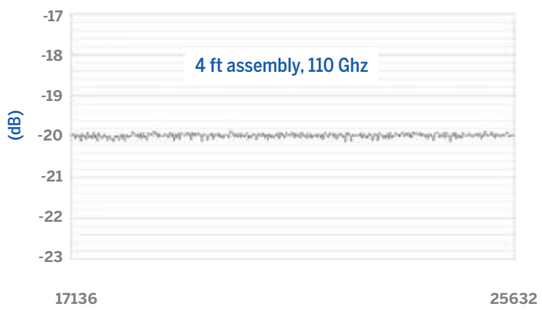
The Clarity™ 110 test cable boasts steel torque crush and overbend protection with abrasion resistance - without compromising flexibility. The cable is ultra-stable through 110 GHz. The design includes an ergonomic, stainless steel protective barrel strain relief and a hex coupling nut.

Features:

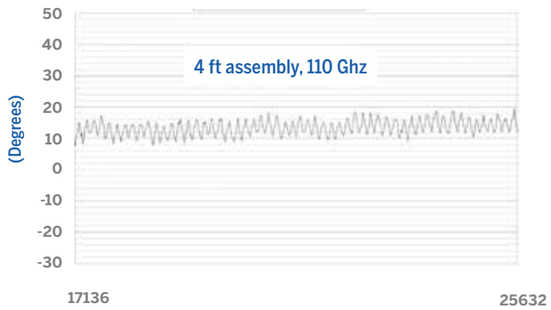
- Broad Frequency Response
- Rugged & Durable
- Phase Stable Over Temperature
- Long Flex Life



Amplitude Stability While in Motion



Phase Stability While in Motion



Specifications

Ω Impedance 50 Ohms | Op Temp -67 to 257°F -55 to 125°C

MECHANICAL

	Units	
Armored Diameter: armor	in (mm)	0.19 (4.70)
Armored Diameter: strain relief	in (mm)	0.31 (8.00)
Minimum Bend Radius armored	in (mm)	1.0 (25.4)
Minimum Bend Radius max flex life	in (mm)	2.0 (50.8)
Crushing (armored version)	lbs/lin.in	200
Flex Life		>50000

*The assembly is terminated with a short circuit and bent 90 degrees around the mandrel of 1-inch radius.

ELECTRICAL

	Units	
Velocity of Propagation	%	70
Shielding Effectiveness	dB	>100
Capacitance	pF/ft (pF/m)	29 (95)
VSWR Typical		1.40:1
VSWR Max		1.45:1
Phase Stability typical*	°	+/- 2
Amplitude Stability typical*	dB	+/- 0.075

Attenuation	18 GHz	26.5 GHz	70 GHz	110 GHz
dB/FT (dB/M)	1,489 (0,045)	1,813 (0,055)	2,980 (0,091)	3,763 (0,115)

CABLE POWER HANDLING (Cable only)

	18 GHz	50 GHz	110 GHz
@77°F (25°C) sea level, watts (max)	11.7	6.0	3.5

CALCULATION

$$IL = (K1 \times \sqrt{(f)}) + K2 \times (f) \times \text{Cable Length}$$

Cable Insertion Loss (f) is in MHz

Length unit must match K value unit

k values	dB/ft	dB/m
K1	1.0932	0.33320736
K2	0.000125	3.81e-5

Ordering Guide

CLS110 - XXX XXX - XX CM

- Connector A | Connector B - | Length | Centimeters

Connector Code	Description
10M	1.0mm Male Connector
10F	1.0mm Female Connector

Specifications subject to change without notice.

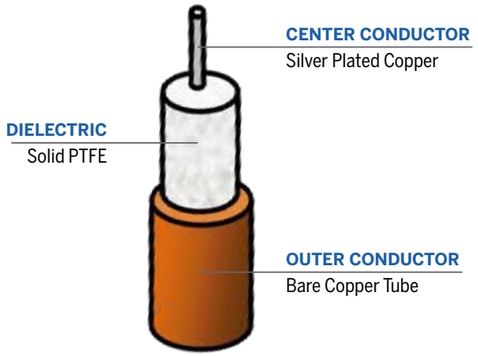
Clarity™ 110 SR

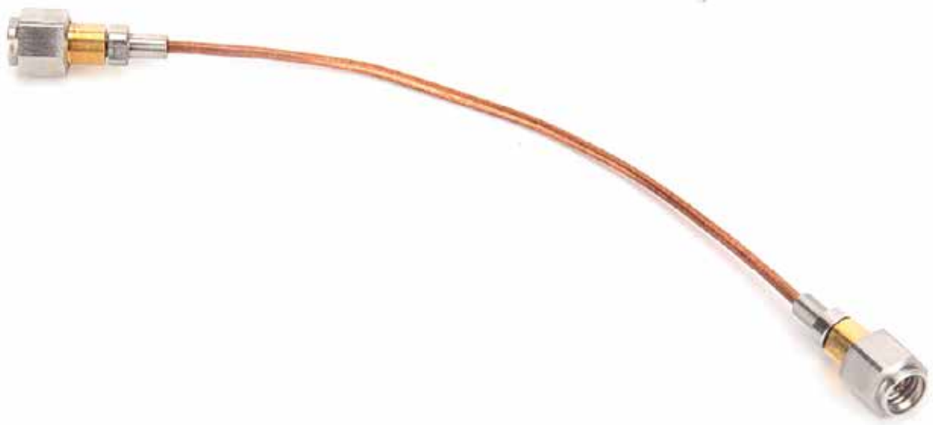
Test and Measurement

Clarity 110-SR is for applications that require not only low loss and phase stability but, solves requirements for maintain a specific shape once installed. This can useful for inside and enclosure or applications that require no movement of the cable assembly.

Features:

- Semi-Rigid design
- Low Loss
- Simple robust design
- Phase stable to 110 GHz





Specifications

Ω Impedance 50 Ohms | Op Temp -67 to 257°F -55 to 125°C

MECHANICAL

	Units	
Diameter (max, unarmored)	in (mm)	0,26 (6,7)
Weight	pounds per 1000 ft	1.3
Min Bend Radius (unarmored)	in (mm)	0,25 (6,3)

ELECTRICAL

	Units	
Velocity of Propagation	%	69,5%
Shielding Effectiveness	dB	>100
Capacitance	pF/ft (pF/m)	29.2 (95)
VSWR Typical		1.45:1
VSWR Max		1.50:1

Attenuation @77°F (+25°C)

Frequency GHz	dB/ft	dB/m
1	0.342	1.042
10	1.167	3.564
26.5	2.034	6.202
70	3.6545	11.139
110	4.868	14.837

Attenuation (per 100ft) at any frequency:
1.04025*sqrt(f(MHz)) + 0.001289*f(MHz)

CALCULATION

$$IL = (K1 \times \sqrt{(f)}) + K2 \times (f) \times \text{Cable Length}$$

Cable Insertion Loss (f) is in MHz

Length unit must match K value unit

k values	dB/ft	dB/m
K1 Max(MHz)	1.040250	3.170682
K2 Max(MHz	0.001289	0.00392887

1) All tests performed in accordance with MIL-DTL-17 (current issue).
2) All materials are RoHS and REACH compliant.

Ordering Guide

CSR110 - 10M 10M - 10.0 CM

- 10M: - Connector A
- 10M: Connector B -
- 10.0: Length / 3 dig
- CM: CM Centimeters

Connector Code	Description
10M	1.0mm Male connector
10F	1.0mm Female connector

Specifications subject to change without notice.

SilverLine®

Test Cables

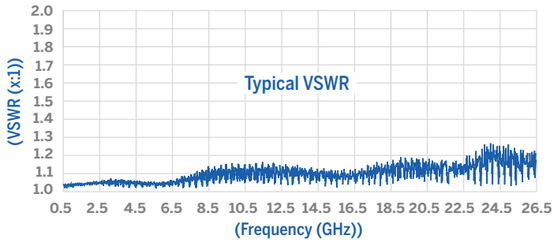
SilverLine® Test Cables are cost effective, durable, high performance cable assemblies designed for use in a broad range of test and interconnect applications. Fabricated from rugged, solid PTFE dielectric cable with stainless steel connectors and a proven strain relief system, these cables provide long life and excellent stability in applications where they are repeatedly flexed and mated/unmated. SilverLine test cables are ideal for use in production and field and laboratory test environments. They are also economical enough to be used as interconnects in test systems.

Features & Benefits:

- Phase & Loss Stable
- Long Flex Life
- Triple Shielded Cable
- High Mating Cycle, Stainless Steel Connectors
- Rugged, Solder-Clamp Attachment
- Redundant, Long Life Strain Relief System
- ROHS Compliant

Coax Test Cables for:

- High volume, in-process production test
- Incoming/final test inspection
- RF test systems interconnects



** Phase stability data IAW Times' phase/flex test criteria as demonstrated. (26.5 GHz SMA Male/SMA Male, 3 ft long)

INNER CONDUCTOR
Solid silver plated copper clad steel

INNER SHIELD
Silver-plated copper flat ribbon braid Aluminum-Polyimide tape

OUTER SHIELD
Silver-plated copper flat ribbon braid Aluminum-Polyimide tape

DIELECTRIC
Solid PTFE

INTERLAYER
36 GA silver-plated copper round braid (90%k)

CABLE JACKET
Clear FEP

ARMOR
Full, 100% non-interleaved spiral steel sheath overlaid with captured opposing-force structure for anti-torque resistance. Waterpfoof, UV resistant, black TPR outer jacket.

CONNECTORS:
• Passivated stainless steel finish • Captive center contact • Thick wall, 26.5 GHz SMA • Type N & SMA OneTurn™ (1 full rotation to mate) • Knurl/hex coupling nut (Type N and TNC)

CONNECTOR ATTACHMENT/STRAIN RELIEF:
• Rugged, solder-clamp to braid, 175-300 lb pull force. Additional crimp system on armored version.
• Redundant triple layer strain relief system (dual layer on armored version)

Flex Test
(one full cycle)

Cable is pulled off center 10" in both directions

TIMES MICROWAVE SYSTEMS
An Amphenol Company

Specifications

Ω Impedance 50 Ohms | Op Temp -67 to 185°F -55 to 125°C

MECHANICAL

		Units	
Armored Diameter: armor		in (mm)	0.450 (11.50)
Unarmored Diameter: strain relief		in (mm)	0.195 (4.950)
Minimum Bend Radius	armored	in (mm)	2.25 (57)
	armored max flex life	in (mm)	2.25 (57)
	unarmored	in (mm)	1.0 (25)
	unarmored max flex	in (mm)	1.00 (25)
Crushing (armored version)	PVC	lbs/lin.in	1.200
	Steel	lbs/lin.in	1.500
Crushing	(unarmored version)	lbs/lin.in	200
Mating Life Cycle	SMA,Type N:		>5000

CABLE POWER HANDLING (Cable only)

	6 GHz	18 GHz	26.5 GHz
@77°F (25°C) sea level, watts (max)	180	88	65

ELECTRICAL

	Units	
Velocity of Propagation	%	70
Shielding Effectiveness	dB	>-90

		4 GHz	6 GHz	18 GHz	26.5 GHz
VSWR (Maximum)	BNC	1.20:1			
	7-16 DIN		1.25:1		
	SMA, 3.5mm		1.20:1		1.35:1
	Type N, TNC	1.30:1, 1.35:1			
Phase Stability Typical* (50,000 cycles)				+/- 2.0	+/- 3.0
Amplitude Stability Typical dB*		+/- 0.1			

Attenuation	1000 MHz	5000 MHz	18000 MHz	26500 MHz
dB/FT (dB/M)	0,122 (0,372)	0,306 (0,933)	0,683 (2,081)	0,885 (2,696)

CALCULATION IL = (K1 x √(f)) + K2 x (f) x Cable Length

Cable Insertion Loss (f) is in MHz

Length unit must match K value unit

k values	dB/ft	dB/m
K1	0.348	0.1060704
K2	0.0012	0.00036576

Ordering Guide

SL X XX - XXX XXX - XX.XX X

- X: U = Unarmored 1ft (0.25m) minimum assembly length; A = Armored 2 ft (0.5m) minimum assembly length; S = Steel, torque & crush resistant armor 3 ft (1.0m) min. length
- XX: 04 = 4.0 GHz, 06 = 6.0 GHz, 18 = 18.0 GHz, 26 = 26.5 GHz
- XXX: Connector A
- XXX: Connector B
- XX.XX: Length
- X: M = Meters, F = Feet

Connector Code	Description	Connector Code	Description
BM	BNC Male (for 4GHZ only)	N1T	Type N Male OneTurn™
SM	SMA Male	NF	Type N Female
S1T	SMA Male OneTurn™	NMR	N Male Right Angle
SF	SMA Female	76F	7-16 Female
SMR	SMA Right Angle	43M	4.3/10 male (this is not a low PIM assembly)
35M	3.5mm Male	43F	4.3/10 female (this is not a low PIM assembly)
35F	3.5mm Female	TM	ETNC Male (Extended range)
3RF	3.5mm Ruggedized Female	TF	ETNC Female (Extended range)
NM	Type N Male		

Specifications subject to change without notice.

SilverLine® ExtraFlex

Test Cables

SilverLine®-ExtraFlex was designed for testing delicate components such as exposed RF circuits with edge launch connectors. Thin, lightweight and flexible, this coax makes handling PC boards easy yet does not compromise RF stability and isolation. Using Times' proprietary TF-4 dielectric SilverLine-ExtraFlex goes one step further, exhibiting linear phase change from 0ºC to +30ºC (see graph).

SilverLine®-ExtraFlex uses the same robust, proven connector attachment system that has made SilverLine the preferred choice in RF test labs everywhere. A new injection-molded strain relief system designed to match the cable's flexibility assures the cable will bend tightly but not fail prematurely behind the connector.

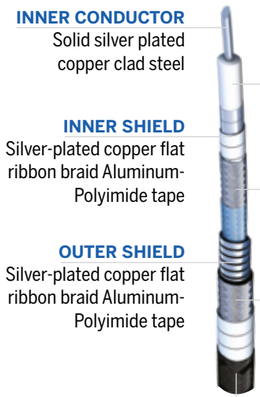
Features & Benefits:

- 30% Smaller Than Standard SilverLine®
- Improved Flexibility
- RF Stable With Flexure
- Better Than -90dB Isolation
- 26.5 Ghz Operation
- Linear Phase Change From 0º to 30ºC
- Injection-Molded Strain Relief
- ROHS Compliant

- Production test for small sized RF products
- Edge launch testing
- General purpose RF Interconnects through 26.5 Ghz

CONNECTORS:

- Stainless steel
- Solder/Clamp attachment
- Captive contact construction



INNER CONDUCTOR
Solid silver plated copper clad steel

DIELECTRIC
TF4

INNER SHIELD
Silver-plated copper flat ribbon braid Aluminum-Polyimide tape

INTERLAYER
36 GA silver-plated copper round braid (90%k)

OUTER SHIELD
Silver-plated copper flat ribbon braid Aluminum-Polyimide tape

CABLE JACKET
Clear FEP

ARMOR
Full, 100% non-interleaved spiral steel sheath overlaid with captured opposing-force structure for anti-torque resistance. Waterpfoof, UV resistant, black TPR outer jacket.

Test fixture photo courtesy of Inter-Continental Microwave
www.icmicrowave.com

** Phase stability data IAW Times' phase/flex test criteria as demonstrated above.

Specifications

Impedance 50 Ohms | Op Temp -67 to 257°F -55 to 125°C

MECHANICAL

	Units	
Jacket Diameter	in (mm)	0.15 (3.80)
Minimum Bend Radius (max flex life)	in (mm)	0.75 (19)
Mating Life Cycle*		5000

* Mating life assumes the use of a calibrated torque wrench, interfaces are clean and within mil specs limits.

ELECTRICAL

	Units	
Velocity of Propagation	%	70
Shielding Effectiveness	dB	>-90

	18 GHz	26.5 GHz
VSWR (Maximum)	1.30:1	1.35:1
Phase Stability Max (50,000 cycles)**	+/- 2.0º	+/- 3.0º
Amplitude Stability Max dB**	+/- 0.1	+/- 0.1

Attenuation	1000 MHz	5000 MHz	18000 MHz	26500 MHz
dB/FT (dB/M)	0,165 (0,503)	0,391 (1,192)	0,810 (2,470)	1,020 (3,110)

CABLE POWER HANDLING (Cable only)

	6 GHz	18 GHz	26.5 GHz
@77°F (25°C) sea level, watts (max)	59.2	31.8	25.3

CALCULATION

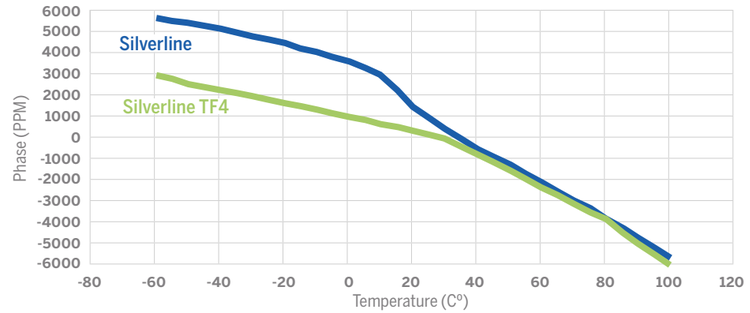
$$IL = (K1 \times \sqrt{(f)}) + K2 \times (f) \times \text{Cable Length}$$

Cable Insertion Loss (f) is in MHz

Length unit must match K value unit

k values	dB/ft	dB/m
K1	0.49656	0.151351488
K2	0.0008	0.0008

Phase Change VS Temperature



Ordering Guide

SLUXF **XX** - **XXX** **XXX** - **XX.XX** **X**

- XX: 18 = 18 GHz; 26 = 26.5 GHz
- - Connector A
- Connector B -
- Length
- X: F = Feet; M = Meters

Connector Code	Description
SM	SMA male
S1T	SMA OneTurn ™
NM	Type N male

Specifications subject to change without notice.

SilverLine® TG TuffGrip®

Test Leads

SilverLine®-TG test cables are designed for sweep testing cellular infrastructure site cables and antennas. TuffGrip employs a hefty handgrip at the system end to better withstand the rigors of field work. Steel armored assemblies for crush resistance make this assembly robust for any environment.

For Wireless System Testing:

- Cell Site Antenna & Cable Sweep Test
- Troubleshooting
- RF Maintenance
- Field RF Test

CONNECTORS:

- Passivated stainless steel finish
- Captive contact
- Precision grade connectors
- Knurl/hex Type N coupling nut
- 7-16 male includes retractable coupling nut with Times exclusive OneTurn™ fast mating feature

CONNECTOR ATTACHMENT:

- System side: TuffGrip (patented)
- Analyzer side: solder/clamp/crimp

INNER CONDUCTOR
Solid silver plated copper clad steel

DIELECTRIC
Solid PTFE

INNER SHIELD
Silver-plated copper flat ribbon braid Aluminum-Polyimide tape

INTERLAYER
36 GA silver-plated copper round braid (90%k)

OUTER SHIELD
Silver-plated copper flat ribbon braid Aluminum-Polyimide tape

CABLE JACKET
Clear FEP

ARMOR
Full, 100% non-interleaved spiral steel sheath overlaid with captured opposing-force structure for anti-torque resistance. Waterpfoof, UV resistant, black TPR outer jacket

Specifications

Impedance 50 Ohms | Op Temp -67 to 221°F -55 to 105°C

MECHANICAL	Units	
Dimensions Armored O.D.	in (mm)	0.430 (10.92)
Minimum Bend Radius	in (mm)	2.50 (63.5)
Connector Retention	lbs	>290
Armor Crush Resistance	lbs. per linear inch	>1200
Mating Life Cycle		>5000*
Flex Life		>50,000**

* Assumes the use of a calibrated torque wrench, proper care and cleaning of interface, and mated connector is within mil spec limits.

** Minimum bend radius not to be exceeded.

*** Connector configuration may limit cable assembly maximum power handling capability.

ELECTRICAL	Units	
Velocity of Propagation	%	70
Shielding Effectiveness	dB	>100
Capacitance		-29.4 pf/ft (96.4 pf/m)
Phase Stability		DC to 10 GHz: +/- 1.1° 10 to 18 GHz: +/- 2.0°

	6 GHz	18 GHz
VSWR Max Type N	1.20:1	1.35:1
VSWR Max 7 - 16	1.25:1	
Amplitude Stability Max dB**	+/- 0.1	+/- 0.1

Attenuation	1.0 MHz	2.0 MHz	6.0 MHz	18.0 MHz
dB/FT (dB/M)	12 (40)	18 (59)	34 (112)	68 (224)

POWER HANDLING	1.0 MHz	2.0 MHz	6.0 MHz	18.0 MHz
@ 77°F (25°C) (Sea Level) (Cable Only)*** watts	539	363	180	88

CALCULATION IL = (K1 x √(f)) + K2 x (f) x Cable Length

Cable Insertion Loss (f) is in MHz

Length unit must match K value unit

k values	dB/ft	dB/m
K1	0.348	0.1060704
K2	0.0012	0.00036576

Ordering Guide

SLS XX - XX S - XXX XXX - XX.XX X

- XX: 06 = 6 GHz; 18 = 18 GHz (NFG only)
- XX: S = Short grip (N female only)
- XXX: Connector A
- XXX: Connector B-
- XX.XX: 01.50 = 1.5 m; 03.00 = 3.0 m; 05.00 = 5.0 m
- X: F = Feet; M = Meters

Connector Code	Description
NFG	N female TuffGrip®
7FG	7-16 female TuffGrip®
7MG	7-16 male TuffGrip® with OneTurn™ retractable coupling nut

Specifications subject to change without notice.

SilverLine® 75

Test Cables

TIMES MICROWAVE SYSTEMS
An Amphenol Company

SilverLine® 75 (75 Ohm) exhibits similar RF performance to major test equipment maker's OEM cables yet with vastly increased durability and ruggedness. That's because SilverLine® 75 uses the same robust, proven connector attachment and strain relief systems that have made our 50 Ohm version the first choice of demanding customers around the world. Times uses only the highest quality, highest performing connector and cable designs in all SilverLine® products. SilverLine® 75 follows the same tradition.

INNER CONDUCTOR
Solid silver plated copper clad steel

DIELECTRIC
Solid PTFE

INNER SHIELD
Silver-Plated Copper flat ribbon braid aluminum-polyimide tape interlayer 36 GA silver-plated copper round braid (90%k)

INTERLAYER
PVC: Steel reinforced, thick wall high flex life clear PVC

OUTER SHIELD
TPR-Steel: 100% coverage, square locked, galvanize steel hose, high angle steel braid and TPR jackete

CONNECTORS
Captive contact, stainless steel construction

JACKET
Clear FEP

ARMOR
PVC and steel options

Features & Benefits:

- Replaces Agilent 11857 series and similar 75 Ohm test port cables.
- Use with Agilent, Rohde & Schwarz or other 75 Ohm network analyzers
- Precision stainless steel 75 Ohm Type N & F connectors
- Exceptional return loss
- Proven connector attachment method Replaces Agilent 11857 series and similar 75 Ohm test port cables.

Specifications

Ω Impedance 75 Ohms | Op Temp -67 to 257°F -55 to 125°C

MECHANICAL

		Units	
Outside Diameter		in (mm)	0.195 (4.95)
Armor (optional)		in (mm)	0.450 (11.50)
Minimum Bend Radius		in (mm)	1 (25)
Connector Retention	unarmored	lbs	>175
	armored	lbs	300
Crush Resistance (armored)	PVC	lbs/lin.in	1200
	Steel	lbs/lin.in	1500
Mating Life Cycle			>5000*

* Mating life assumes the use of a calibrated torque wrench, interfaces are clean and within mil spec limits.

ELECTRICAL

		1 GHz	3 GHz
VSWR (Maximum)	F Type and Type N	1.11:1 (26dB RL)	1.20:1 (21dB RL)

	Units	
Velocity of Propagation	%	70
Shielding Effectiveness	dB	>100
Capacitance	pf/ft (pf/m)	19.2 (63)

Attenuation	0.5 GHz	1 GHz	2 GHz	3 GHz
dB/100FT (dB/100M)	8.4 (27.6)	12.2 (39.4)	17.9 (58.7)	22.7 (74.5)

CABLE POWER HANDLING (Cable only)

	0.5 GHz	1 GHz	2 GHz	3 GHz
@77°F (25°C) sea level, watts (max)	400	280	190	150

CALCULATION $IL = (K1 \times \sqrt{(f)}) + K2 \times (f) \times \text{Cable Length}$

Cable Insertion Loss (f) is in MHz

Length unit must match K value unit

k values	dB/ft	dB/m
K1	0.348	0.1060704
K2	0.0012	0.00036576

Ordering Guide

SL X 75 - XXX XXX - XX.XX X

- X: U = unarmored; A = PVC armor; S = Steel armor
- 75: 75 Ohm
- - XXX: - Connector A
- XXX -: Connector B -
- XX.XX: Length
- X: M = Meters; F = Feet

Connector Code	Description
FM	F type male
FF	F type female
NM7	Type N male
NF7	Type N female

Specifications subject to change without notice.

CONNECTOR MATRIX

Clarity Connector Matrix

		Cable Series					
Connector Code	Connector Description	CLU/CLS 18 GHz	CLU/CLS 26 GHz	CLU/CLS 40 GHz	CLS 50 GHz	CLS 70 GHz	CLS 110 GHz
SM	SMA Male	●	●				
SF	SMA Female	●	●				
SMR	SMA Male Right Angle	●	●				
NM	N Male	●					
NF	N Female	●					
NMR	N Male Right Angle	●					
35M	3.5mm Male		●				
35F	3.5mm Female		●				
3RF	3.5mm Ruggedized Female		●				
KM	K 2.92mm Male			●	●		
KF	K 2.92mm Female			●			
KMR	K 2.92mm Male Right Angle			●			
KRF	K 2.92mm Right Angle Female			●			
24M	2.4mm Male			●			
24F	2.4mm Female			●			
2RF	2.4mm Ruggedized Female			●			
24M	2.4mm Male (50 GHz)				●		
24F	2.4mm Female (50 GHz)				●		
2RF	2.4mm Ruggedized Female (50 GHz)				●		
18M	1.85 mm Male				●		
18F	1.85 mm Ruggedized Female				●		
18RF	1.85 mm Male (70 GHz)					●	
18F	1.85 mm Female (70 GHz)					●	
18RF	1.85 mm Ruggedized Female (70 GHz)					●	
1M	1.0mm Male						●
1F	1.0mm Female						●
1RF	1.0mm Ruggedized Female						●

Silverline Connector Matrix

		Cable Series						
Connector Code	Connector Description	Silverline 04 GHz	Silverline 06 GHz	Silverline 18 GHZ	Silverline 26 GHZ	Silverline XF	Silverline 75 Ohm	Silverline Tuff Grip
BM	BNC Male	●						
SM	SMA Male		●	●	●	●		
S1T	SMA 1 Turn		●	●	●	●		
SF	SMA Female		●	●	●			
SMR	SMA Male Right Angle		●	●	●			
NM	N Male		●	●		●	●	
N1T	N Male 1 Turn		●	●				
NF	N Female		●	●			●	
NMR	N Male Right Angle		●	●				
76M	7-16 Male		●					
76F	7-16 Female		●					
43M	4.3/10 Male		●					
43F	4.3/10 Female		●					
70M	7.0mm Male			●				
TM-ETNC	TNC Male ext range		●	●				
TF-ETNC	TNC Female Ext. Range		●	●				
QMM	Q Male		●					
35M	3.5mm Male			●	●			
35F	3.5mm Female			●	●			
3RF	3.5mm Ruggedized Female			●	●			
NFG	N Male Tuff Grip							●
7FG	7-16 Female Tuff Grip							●
7MG	7-16 Male 1 turn Tuff Grip							●
FM	F Male						●	
FF	F Female						●	

Specifications subject to change without notice.

SilverLine® LPA

Low PIM Adapters

SilverLine®- LPA low PIM adapters exhibit exceptional PIM performance in any cellular or wireless frequency range.

Times uses only the most robust designs for long product life regardless of the environment. All product is 100% tested and individually packaged prior to shipping.

DIN, MINI-DIN & TYPE N FOR PIM SENSITIVE SYSTEMS:

- Cellular or Wireless
- Tower or in-building
- Production or laboratory

3191-331

3191-332

3191-376

3191-377

3191-378

3191-379

3191-380

3191-381

3191-394

3191-395

3191-396

3191-397

TWO 45° CONFIGURATIONS

3191-382

3191-387

Specifications

Impedance 50 Ohms

Op Temp -40 to 185°F -40 to 85°C

MECHANICAL

Body and Coupling Nut	Tri-metal plated brass
Center Contact	Gold or Silver Plated
Mating Life	500 min*

ELECTRICAL

	All straight configurations	45° or right angle
Frequency.Max	6 GHz	3 GHz
VSWR (Maximum)	1.1:1 (3 GHz) 1.2:1 (6 GHz)	1.25:1
PIM* (IM3)	-125 dBm +/- 3 dBm (2 x 43 dBm carriers)	

* Interfaces must be clean and proper torque forces applied. Specifications subject to change without notice.

Ordering Guide

SLK - XXXX - XXX

(Insert designator from below in alphabetical order (20 max) . Duplicate designators acceptable)

Code	Description	Kit Designator	Code	Description	Kit Designator
3191-331	7-16 female bullet	A	3191-415	4.3/10 female/7-16 female	S
3191-332	7-16 male/female right angle	B	3191-416	4.3/10 male/7-16 female	T
3191-376	7-16 male bullet	C	3191-417	4.3/10 female/Type N male	U
3191-377	7-16 male/female	D	3191-418	4.3/10 male/Type N male	V
3191-378	7-16 male/Type N male	E	3191-419	4.1/9.5 female/7-16 male	W
3191-379	7-16 male/Type N female	F	3191-420	4.1/9.5 male/7-16 male	X
3191-380	7-16 female/Type N female	G	3191-421	4.3/10 female/7-16 male	Y
3191-381	7-16 female/Type N male	H	3191-422	4.3/10 male/Type N female	Z
3191-382	7-16 male/female 45°	I	3191-6125	NEX10 male/NEX10 female	3
3191-387	7-16 female/female 45°	J	3191-6126	NEX10 male/7-16 male	4
3191-394	4.1/9.5 male/7-16 female	K	3191-6127	NEX10 female/7-16 male	5
3191-395	4.1/9.5 female/7-16 female	L	3191-6128	NEX10 male/7-16 female	6
3191-396	Type N male/Type N male	M	3191-6129	NEX10 female/7-16 female	7
3191-397	Type N female/Type N female	N	3191-6130	NEX10 male/Type N male	8
3191-411	4.1/9.5 female/Type N female	O	3191-6131	NEX10 female/Type N male	9
3191-412	4.1/9.5 female/Type N male	P	3191-6132	NEX10 male/Type N female	$
3191-413	4.1/9.5 male/Type N female	Q	3191-6133	NEX10 female/Type N female	@
3191-414	4.1/9.5 male/Type N male	R			

Standard (small) SilverLine Adapter Kits: (Hard case with foam insert containing seven adapters)
660-0234: Contains one each A, D, E, F, G, H and I
660-0235: Contains one each A, D, G, H, I, K and L
660-0236: Contains one each A, C, M, T, W, Y and Z

Custom (Large) SilverLine Adapter Kits: (Hard case with foam. 10 pieces min, 20 max (max of four 45's or r/a's combined).
Specifications subject to change without notice.

SPECIFICATION INFORMATION AND GUIDELINES

Flex Testing Method:

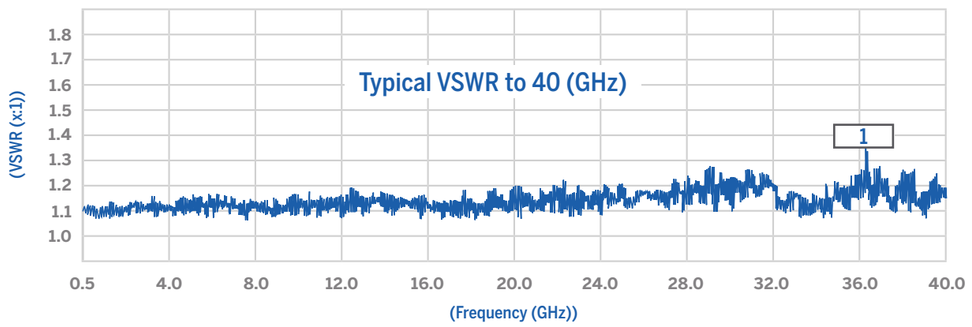
As tested using Times' flex testing methods. 4ft long cable stop at 50000 cycles. Longer cables can have more total instability. Assumes test equipment is calibrated every 8 hours. New cables can have a break in period of several hundred flexes before optimum stability occurs. Contact your Times representative or the factory for a copy of this test procedure and/or actual test results.

Times Phase Stability test method:

** Phase stability data IAW Times' phase/flex test criteria as demonstrated below.

Flex Test (one full cycle)

Cable is pulled off center 10" in both directions



Time's Silverline® Product Guarantee: Times will repair or replace your SilverLine test cable at its option if the connector attachment fails within four months of shipment. This guarantee excludes cable or connector interface damage from misuse or abuse.

Labels on unarmored assemblies under 1.5 feet (0.5m) long remain loose to increase flexibility. Some connector combinations and / or lengths may be unavailable. Please contact Times or your Times authorized representative. Specifications subject to change without notice.

Attachment Method:

*Requires mating connections to be clean and within mechanical specifications. Calibrated torque wrench required.
**RF stability and flex life are in accordance with the flex test method example. Data is for cables 4ft or shorter. Longer cables may exhibit different stability characteristics. A cable will exhibit some instability when new. A very brief period of use is required to alleviate cable component stresses from manufacturing after which the cable will "settle" and maintain the values stated solder/clamp/crimp. Protective metal back shell.

Care and Handling Guidelines:

While armored, 26.5 & 40 GHz cables are sensitive microwave instruments. Small, flexible cables can easily be forced beyond the recommended minimum bend radius. This will likely degrade or destroy the RF performance. All flexible cables have a limited flex life. Develop procedures that limit flexing. 2.4 and 1.85mm interfaces are delicate. Keep them meticulously clean and the center contacts concentric within the outer contact. Use a microscope to examine if necessary. DO NOT mate connectors that are dirty, suspected of being damaged or outside concentric tolerances. Connectors must be aligned when mating. Misalignment could damage the interfaces and voids the warranty. Test equipment makers publish extensive use and handling procedures on their web sites that cover these and related topics.

ALWAYS:

- Inspect interfaces before every mate. Clean if needed.
- Gently start the coupling nut and fully thread with fingers first.
- Hand tighten, but if a calibrated torque wrench is used 8 lbs max.
- Limit use to experienced technicians.
- Cap connectors and store cables separately in a protective container.
- Keep a spare pair of cables ready, just in case.

NEVER:

- Force the cable to bend beyond the recommended minimum radius.
- Force two connectors. If any resistance is felt STOP and examine.
- Mate to another series.
- Mate connectors that are not aligned and concentric.
- Put foreign or dirty objects into the interface.

Warranty:

Product to be free from workmanship and materials defects and to meet stated data sheet performance for a period of 90 days. Excludes cable or connector interface damage from misuse, abuse, mishandling or mis-mating outside the data sheet recommendations. Warranty claims are subject to factory analysis and may include analysis charges depending on findings.

NOTES

TIMES
MICROWAVE SYSTEMS
AN AMPHENOL COMPANY

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