



Mini-Circuits Exclusive Representative in Israel



# CABLES PRODUCT GUIDE



**RF/microwave interconnect and precision test cables for 50-Ohm and 75-Ohm systems from DC to 50 GHz with a wide selection of connectors including 2.4mm, 2.92mm, SMA, N-Type, F-Type and BNC!**

- All combinations of male and female connectors
- Options for straight, right angle, bulkhead, and quick-connect connections
- Performance qualified for reliability in the most demanding environments

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## NEW PRODUCTS



**086 KM Series**

**Handflex  
2.92mm Coaxial Cables**

- DC to 40 GHz
- Hand Formable
- Excellent Return Loss and Insertion Loss
- Ideal for interconnect of assembled systems



**VNAX-2FT-VMVRF**

**Instrumentation Test Cable**

- Ultra-wideband operation, DC to 50 GHz
- 2.4mm Rugged Female connector for direct interface with VNA ports up to 50 GHz
- Low insertion loss and excellent return loss
- Rugged construction, crush and torque resistant



**VNAX-2FT-KMVRF**

**Instrumentation Test Cable**

- Ultra-wideband operation, DC to 40 GHz
- 2.4mm Rugged Female connector for direct interface with 40 GHz VNA ports
- Low insertion loss and excellent return loss
- Rugged construction, crush and torque resistant



**TMP40 Series**

**2.92mm Male Test Cables**

- Wideband, DC to 40 GHz
- Useful over temperature range, -55°C to 105°C
- Low Insertion Loss
- Good amplitude and phase stability vs flexing over frequency
- 40 GHz connector mates with 2.92 mm, K\*, 3.5mm, SMA



**FL086-SM+ Series**

**SMA Flexible Coaxial Cables**

- DC to 18 GHz
- Tight Bend Radius, 6mm
- Excellent Return Loss and Insertion Loss
- Ideal for interconnect of assembled systems

**For the latest information on Mini-Circuits' Cables, new products, product datasheets, product videos, professional articles and more please visit our website:**

**[www.mcdi-ltd.com/cables](http://www.mcdi-ltd.com/cables)**

**or speak with our Engineers directly by calling 077-5406075**

## VNA Cable | 50 Ω | DC to 50 GHz

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
VNAC-2R1-K+	40.0	2.3	2.08 2.92 mm		Female	Straight	Rugged	2.92 mm	Male	Straight	Standard
VNAX-2FT-KMVRF+	40.0	2.0	2.0 2.4 mm		Female	Straight	Rugged	2.92 mm	Male	Straight	Standard
VNAX-2FT-VMVRF+	50.0	2.4	2.0 2.4 mm		Female	Straight	Rugged	2.4 mm	Male	Straight	Standard



VNAX Connector Series



VNAX Connector Series



VNAC Connector Series

## Armored Test Cables | 50 Ω | DC to 40 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (ft)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIEN- TATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORIEN- TATION	CON 2 MOUNTING TYPE
APC-10FT-NMNM+	18.0	6.3	10.0 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
APC-15FT-NMNM+	18.0	9.0	15.0 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
APC-4FT-SMNM+	18.0	2.55	4.0 N-Type	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
APC-6FT-NMNM+	18.0	3.8	6.0 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
KBL-1.5FT-LOW+	40.0	1.41	1.5 2.92 mm	Male	Straight	Standard	Standard	2.92 mm	Male	Straight	Standard
KBL-1M-LOW+	40.0	3.05	3.28 2.92 mm	Male	Straight	Standard	Standard	2.92 mm	Male	Straight	Standard
KBL-2FT-LOW+	40.0	1.74	2.0 2.92 mm	Male	Straight	Standard	Standard	2.92 mm	Male	Straight	Standard
KBL-2M-LOW+	40.0	5.46	6.56 2.92 mm	Male	Straight	Standard	Standard	2.92 mm	Male	Straight	Standard
KBL-4FT-LOW+	40.0	3.41	4.0 2.92 mm	Male	Straight	Standard	Standard	2.92 mm	Male	Straight	Standard



KBL Connector Series



APC Connector Series

# Precision Test Cable | 50 Ω | DC to 50 GHz | 1/3

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIEN- TATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CONR 2 ORI- ENTATION	CON 2 MOUNTING TYPE
CBL-0.5M-NMNM+	18.0	1.2	1.64 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-0.5M-SMNM+	18.0	1.2	1.64 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-0.5M-SMSM+	18.0	1.1	1.64 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-1.5FT-SMSM+	18.0	1.0	1.5 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-1.5M-NMNM+	18.0	3.4	4.92 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-1.5M-SMNM+	18.0	3.2	4.92 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-1.5M-SMSM+	18.0	3.1	4.92 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-10FT-NMNM+	18.0	6.3	10.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-10FT-SMNM+	18.0	6.06	10.0 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-10FT-SMSM+	18.0	6.1	10.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-12FT-SMSM+	18.0	7.3	12.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-15FT-NMNM+	18.0	9.2	15.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-15FT-SMNM+	18.0	9.2	15.0 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-15FT-SMSM+	18.0	9.25	15.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-1FT-SMSM+	18.0	0.75	1.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-1M-NMNM+	18.0	2.3	3.28 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-1M-SMNM+	18.0	2.2	3.28 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-1M-SMSM+	18.0	2.0	3.28 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-20FT-NMNM+	18.0	12.0	20.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-20FT-SMSM+	18.0	12.5	20.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-25FT-NMNM+	18.0	15.0	25.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-25FT-SMSM+	18.0	15.0	25.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard



CBL Connector Series



CBL Connector Series



CBL Connector Series

# Precision Test Cable | 50 Ω | DC to 50 GHz | 2/3

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIEN- TATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CONR 2 ORI- ENTATION	CON 2 MOUNTING TYPE
CBL-2FT-NMNM+	18.0	1.4	2.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-2FT-SFNM+	18.0	1.4	2.0 N-Type	Male	Straight		Standard	SMA	Female	Straight	Standard
CBL-2FT-SMNM+	18.0	1.4	2.0 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-2FT-SMSM+	18.0	1.4	2.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-2M-NMNM+	18.0	4.0	6.56 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-2M-SMNM+	18.0	4.2	6.56 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-2M-SMSM+	18.0	4.0	6.56 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-3FT-NMNM+	18.0	1.9	3.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-3FT-SFNM+	18.0	1.9	3.0 N-Type	Male	Straight		Standard	SMA	Female	Straight	Standard
CBL-3FT-SFSM+	18.0	1.9	3.0 SMA	Male	Straight		Standard	SMA	Female	Straight	Standard
CBL-3FT-SMNM+	18.0	1.9	3.0 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-3FT-SMSM+	18.0	1.9	3.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-4FT-SMNM+	18.0	2.55	4.0 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-4FT-SMSM+	18.0	2.55	4.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-50FT-SMSM+	18.0	31.0	50.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-5FT-NMNM+	18.0	2.5	5.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-5FT-SMSM+	18.0	3.4	5.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-6FT-NMNM+	18.0	3.8	6.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Standard
CBL-6FT-SFNM+	18.0	3.8	6.0 N-Type	Male	Straight		Standard	SMA	Female	Straight	Standard
CBL-6FT-SMNM+	18.0	3.8	6.0 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL-6FT-SMSM+	18.0	3.8	6.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard



CBL Connector Series



CBL Connector Series



CBL Connector Series

# Precision Test Cable | 50 Ω | DC to 50 GHz | 3/3

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIEN- TATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CONR 2 ORI- ENTATION	CON 2 MOUNTING TYPE
CBL1.5SMQ-SM+	18.0	1.0	1.5 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
CBL10SMQ-SM+	18.0	6.1	10.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Quick Connect
CBL2SMQ-NM+	18.0	1.4	2.0 N-Type	Male	Straight		Standard	SMA	Male	Straight	Quick Connect
CBL2SMQ-SM+	18.0	1.4	2.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Quick Connect
CBL3NMQ-NM+	18.0	2.0	3.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Quick Connect
CBL3NMQ-SM+	18.0	1.9	3.0 SMA	Male	Straight		Standard	N-Type	Male	Straight	Quick Connect
CBL3NMQ-SMQ+	18.0	1.9	3.0 N-Type	Male	Straight		Quick Connect	SMA	Male	Straight	Quick Connect
CBL3SMQ-SM+	18.0	1.9	3.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Quick Connect
CBL6NMQ-NM+	18.0	3.8	6.0 N-Type	Male	Straight		Standard	N-Type	Male	Straight	Quick Connect
CBL6NMQ-SM+	18.0	3.8	6.0 SMA	Male	Straight		Standard	N-Type	Male	Straight	Quick Connect
CBL6SMQ-SM+	18.0	3.8	6.0 SMA	Male	Straight		Standard	SMA	Male	Straight	Quick Connect
T40-2FT-KFKM+	40.0	2.2	2.0 2.92 mm	Male	Straight		Standard	2.92 mm	Female	Straight	Standard
T40-2FT-KMKM+	40.0	2.2	2.0 2.92 mm	Male	Straight		Standard	2.92 mm	Male	Straight	Standard
T40-2FT-VFVM+	40.0	2.2	2.0 2.4 mm	Male	Straight		Standard	2.4 mm	Female	Straight	Standard
T40-3FT-KFKM+	40.0	3.3	3.0 2.92 mm	Male	Straight		Standard	2.92 mm	Female	Straight	Standard
T40-3FT-KMKM+	40.0	3.3	3.0 2.92 mm	Male	Straight		Standard	2.92 mm	Male	Straight	Standard
T40-3FT-VFVM+	40.0	3.3	3.0 2.4 mm	Male	Straight		Standard	2.4 mm	Female	Straight	Standard
T50-2FT-VFVM+	50.0	2.2	2.0 2.4 mm	Male	Straight		Standard	2.4 mm	Female	Straight	Standard
T50-3FT-VFVM+	50.0	3.7	3.0 2.4 mm	Male	Straight		Standard	2.4 mm	Female	Straight	Standard



CBL Connector Series



T40 Connector Series



CBL Connector Series

## Precision Test Cable | 75 Ω | DC to 3 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
CBL-1MFM-75+	3.0	0.89	3.28 F-Type	Male		Straight	Standard	F-Type	Male	Straight	Standard
CBL-2FM-75+	3.0	0.61	2.0 F-Type	Male		Straight	Standard	F-Type	Male	Straight	Standard
CBL-3FM-75+	3.0	0.77	3.0 F-Type	Male		Straight	Standard	F-Type	Male	Straight	Standard
CBL-3NM-75+	3.0	0.7	3.0 N-Type	Male		Straight	Standard	N-Type	Male	Straight	Standard
CBL-6FM-75+	3.0	1.43	6.0 F-Type	Male		Straight	Standard	F-Type	Male	Straight	Standard
CBL-6NM-75+	3.0	1.43	6.0 N-Type	Male		Straight	Standard	N-Type	Male	Straight	Standard



CBL Connector Series



CBL Connector Series

## Precision Test Cable, Economy | 50 Ω | DC to 50 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN-ORDER	CON 1 ORI-ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN-ORDER	CON 2 ORI-ENTATION	CON 2 MOUNTING TYPE
E40-1M-KMKM+	40.0	5.4	3.28 2.92 mm	Male		Straight	Standard	2.92 mm	Male	Straight	Standard
E40-2FT-KMKM+	40.0	3.4	2.0 2.92 mm	Male		Straight	Standard	2.92 mm	Male	Straight	Standard
E40-3FT-KMKM+	40.0	5.1	3.0 2.92 mm	Male		Straight	Standard	2.92 mm	Male	Straight	Standard
E40-6FT-KMKM+	40.0	8.7	6.0 2.92 mm	Male		Straight	Standard	2.92 mm	Male	Straight	Standard
E50-2FT-VMVM+	50.0	3.5	2.0 2.4 mm	Male		Straight	Standard	2.4 mm	Male	Straight	Standard
E50-3FT-VMVM+	50.0	6.3	3.0 2.4 mm	Male		Straight	Standard	2.4 mm	Male	Straight	Standard



E50 Connector Series



E40 Connector Series

# Flexible Test Cable | 50 Ω | DC to 26 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORIENTATION	CON 2 MOUNTING TYPE
FLC-1.5FT-SMSM+	26.0	1.26	1.5 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
FLC-1M-SMSM+	26.0	2.62	3.28 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
FLC-2FT-SMSM+	26.0	1.61	2.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
FLC-2M-SMNM+	18.0	4.03	6.56 N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
FLC-2M-SMSM+	26.0	5.5	6.56 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
FLC-3FT-SMSM+	26.0	2.5	3.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
FLC-4FT-SMSM+	26.0	3.55	4.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
FLC-6FT-SMSM+	26.0	5.04	6.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard



FLC Connector Series



FLC Connector Series

# Flexible Test Cable, Booted Joints | 50 Ω | DC to 18 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
ULC-1.5FT-SMSM+	18.0	1.4	1.5 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-10FT-SMSM+	18.0	7.5	10.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-1FT-SMSM+	18.0	0.7	1.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-1M-NMNM+	18.0	2.6	3.28 N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard	
ULC-1M-SMNM+	18.0	2.5	3.28 N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-1M-SMSM+	18.0	2.8	3.28 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-2FT-NMNM+	18.0	1.6	2.0 N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard	
ULC-2FT-SMNM+	18.0	1.5	2.0 N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-2FT-SMSM+	18.0	1.8	2.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-3FT-NMNM+	18.0	2.2	3.0 N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard	
ULC-3FT-SMNM+	18.0	2.2	3.0 N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-3FT-SMSM+	18.0	2.7	3.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-4FT-SMNM+	18.0	3.1	4.0 N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-4FT-SMSM+	18.0	3.4	4.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-6FT-NMNM+	18.0	4.6	6.0 N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard	
ULC-6FT-SMNM+	18.0	4.4	6.0 N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard	
ULC-6FT-SMSM+	18.0	5.2	6.0 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	



ULC Connector Series



ULC Connector Series



ULC Connector Series

## Temperature Stable Cable | 50 $\Omega$ | DC to 40 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
TMP40-1M-KMKM+	40.0	2.6	3.28	2.92 mm	Male	Straight	Standard	2.92 mm	Male	Straight	Standard
TMP40-3FT-KMKM+	40.0	2.4	3.0	2.92 mm	Male	Straight	Standard	2.92 mm	Male	Straight	Standard
TMP40-6FT-KMKM+	40.0	4.6	6.0	2.92 mm	Male	Straight	Standard	2.92 mm	Male	Straight	Standard



TMP40 Connector Series

# Super Flexible Interconnect, 0.047" center diameter | 50 Ω | DC to 18 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
SLC-1M-SMSM+	18.0	4.9	3.28	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
SLC-2FT-SMSM+	18.0	2.9	2.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
SLC-3FT-SMSM+	18.0	4.4	3.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
SLC-4FT-SMSM+	18.0	6.0	4.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
SLC-6FT-SMSM+	18.0	8.8	6.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard



SLC Connector Series

# Flexible Interconnect, 0.086" center diameter | 50 $\Omega$ | DC to 18 GHz

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (ft)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORIEN- TATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORIEN- TATION	CON 2 MOUNTING TYPE
FL086-12NM+	18.0	0.6	1.0 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
FL086-12SM+	18.0	0.9	1.0 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL086-12SMNM+	18.0	0.7	1.0 N-Type	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL086-24NM+	18.0	1.4	2.0 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
FL086-24SM+	18.0	1.5	2.0 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL086-24SMNM+	18.0	1.4	2.0 N-Type	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL086-6NM+	18.0	0.3	0.5 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
FL086-6SM+	18.0	0.4	0.5 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL086-6SMNM+	18.0	0.3	0.5 N-Type	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL086-9SM+	18.0	0.64	0.75 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard



FL086 Connector Series



FL086 Connector Series



FL086 Connector Series

# Flexible Interconnect, 0.141" center diameter | 50 Ω | DC to 18 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORIEN- TATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORIEN- TATION	CON 2 MOUNTING TYPE
FL141-12NM+	18.0	0.4	1.0 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
FL141-12SM+	18.0	0.5	1.0 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL141-12SMNM+	18.0	0.4	1.0 N-Type	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL141-24NM+	18.0	0.9	2.0 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
FL141-24SM+	18.0	1.0	2.0 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL141-24SMNM+	18.0	0.9	2.0 N-Type	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL141-6NM+	18.0	0.2	0.5 N-Type	Male	Straight	Standard	Standard	N-Type	Male	Straight	Standard
FL141-6SM+	18.0	0.3	0.5 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL141-6SMNM+	18.0	0.2	0.5 N-Type	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
FL141-9SM+	18.0	0.37	0.75 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard



FL141 Connector Series



FL141 Connector Series



FL141 Connector Series

# Hand-Flex Interconnect, 0.047" center diameter | 50 Ω | DC to 18 GHz

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
047-12SMP+	18.0	1.51	1.0 SMP		Female	Straight	Standard	SMP	Female	Straight	Standard
047-12SMPR+	18.0	1.53	1.0 SMP		Female	Right Angle 0° Clock	Standard	SMP	Female	Right Angle 0° Clock	Standard
047-12SMPRC+	18.0	1.55	1.0 SMP		Female	Right Angle 180° Clock	Standard	SMP	Female	Right Angle 0° Clock	Standard
047-12SMPSM+	18.0	1.51	1.0 SMA		Male	Straight	Standard	SMP	Female	Straight	Standard
047-3SMP+	18.0	0.34	0.25 SMP		Female	Straight	Standard	SMP	Female	Straight	Standard
047-3SMPR+	18.0	0.39	0.25 SMP		Female	Right Angle 0° Clock	Standard	SMP	Female	Right Angle 0° Clock	Standard
047-3SMPRC+	18.0	0.39	0.25 SMP		Female	Right Angle 180° Clock	Standard	SMP	Female	Right Angle 0° Clock	Standard
047-3SMPSM+	18.0	0.35	0.25 SMA		Male	Straight	Standard	SMP	Female	Straight	Standard
047-6SMP+	18.0	0.72	0.5 SMP		Female	Straight	Standard	SMP	Female	Straight	Standard
047-6SMPR+	18.0	0.75	0.5 SMP		Female	Right Angle 0° Clock	Standard	SMP	Female	Right Angle 0° Clock	Standard
047-6SMPRC+	18.0	0.78	0.5 SMP		Female	Right Angle 180° Clock	Standard	SMP	Female	Right Angle 0° Clock	Standard
047-6SMPSM+	18.0	0.75	0.5 SMA		Male	Straight	Standard	SMP	Female	Straight	Standard



047 Connector Series



047 Connector Series



047 Connector Series

# Hand-Flex Interconnect, 0.086" center diameter | 50 $\Omega$ | DC to 40 GHz | 1/5

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
086-10BM+	3.0	0.22	0.83 BNC	Male	Straight	Standard	Standard	BNC	Male	Straight	Standard
086-10SBSM+	18.0	0.78	0.83 SMA	Male	Straight	Standard	Standard	SMA	Female	Straight	Bulkhead
086-10SM+	18.0	0.85	0.83 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-10SMR+	18.0	1.16	0.83 SMA	Male	Right Angle	Standard	Standard	SMA	Male	Right Angle	Standard
086-10SMRSM+	18.0	1.12	0.83 SMA	Male	Straight	Standard	Standard	SMA	Male	Right Angle 0° Clocked	Standard
086-11SBSM+	18.0	1.1	0.92 SMA	Male	Straight	Standard	Standard	SMA	Female	Straight	Bulkhead
086-11SM+	18.0	1.17	0.92 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-11SMR+	18.0	1.22	0.92 SMA	Male	Right Angle	Standard	Standard	SMA	Male	Right Angle	Standard
086-11SMRSM+	18.0	0.8	0.92 SMA	Male	Straight	Standard	Standard	SMA	Male	Right Angle 0° Clocked	Standard
086-12BM+	3.0	0.27	1.0 BNC	Male	Straight	Standard	Standard	BNC	Male	Straight	Standard
086-12KM+	40.0	1.7	1.0 2.92 mm	Male	Straight	Standard	Standard	2.92 mm	Male	Straight	Standard
086-12SBSM+	18.0	0.9	1.0 SMA	Male	Straight	Standard	Standard	SMA	Female	Straight	Bulkhead
086-12SM+	18.0	1.01	1.0 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-12SMR+	18.0	1.3	1.0 SMA	Male	Right Angle	Standard	Standard	SMA	Male	Right Angle	Standard
086-12SMRC+	18.0	1.22	1.0 SMA	Male	Right Angle	Standard	Standard	SMA	Male	Right Angle	Standard
086-12SMRSM+	18.0	1.24	1.0 SMA	Male	Straight	Standard	Standard	SMA	Male	Right Angle 0° Clocked	Standard



086 Connector Series



086 Connector Series



086 Connector Series

# Hand-Flex Interconnect, 0.086" center diameter | 50 Ω | DC to 40 GHz | 2/5

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
086-13SM+	18.0	1.0	1.08 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-14SBSM+	18.0	1.03	1.17 SMA	Male	Straight	Standard	Standard	SMA	Female	Straight	Bulkhead
086-14SM+	18.0	1.13	1.17 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-14SMR+	18.0	1.49	1.17 SMA	Male	Right Angle	Standard	Standard	SMA	Male	Right Angle	Standard
086-14SMRSM+	18.0	1.36	1.17 SMA	Male	Straight	Standard	Standard	SMA	Male	Right Angle 0° Clock	Standard
086-15KM+	40.0	2.2	1.25 2.92 mm	Male	Straight	Standard	Standard	2.92 mm	Male	Straight	Standard
086-15SM+	18.0	1.19	1.25 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-15SMRSM+	18.0	1.43	1.25 SMA	Male	Straight	Standard	Standard	SMA	Male	Right Angle 0° Clock	Standard
086-16SBSM+	18.0	1.1	1.33 SMA	Male	Straight	Standard	Standard	SMA	Female	Straight	Bulkhead
086-16SM+	18.0	1.33	1.33 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-16SMRSM+	18.0	1.5	1.33 SMA	Male	Straight	Standard	Standard	SMA	Male	Right Angle 0° Clock	Standard
086-18BM+	3.0	0.39	1.5 BNC	Male	Straight	Standard	Standard	BNC	Male	Straight	Standard
086-18KM+	40.0	2.4	1.5 2.92 mm	Male	Straight	Standard	Standard	2.92 mm	Male	Straight	Standard
086-18SBSMR+	18.0	1.71	1.5 SMA	Male	Right Angle 0° Clock	Standard	Standard	SMA	Female	Straight	Bulkhead
086-18SM+	18.0	1.41	1.5 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-18SMR+	18.0	1.9	1.5 SMA	Male	Right Angle	Standard	Standard	SMA	Male	Right Angle	Standard
086-20SM+	18.0	1.87	1.67 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard
086-22SM+	18.0	2.02	1.83 SMA	Male	Straight	Standard	Standard	SMA	Male	Straight	Standard



086 Connector Series



086 Connector Series



086 Connector Series

# Hand-Flex Interconnect, 0.086" center diameter | 50 Ω | DC to 40 GHz | 3/5

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
086-24BM+	3.0	0.51	2.0	BNC	Male	Straight	Standard	BNC	Male	Straight	Standard
086-24KM+	40.0	3.2	2.0	2.92 mm	Male	Straight	Standard	2.92 mm	Male	Straight	Standard
086-24SM+	18.0	2.02	2.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
086-24SMR+	18.0	1.7	2.0	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-24SMRSM+	18.0	2.25	2.0	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clocked	Standard
086-2SM+	18.0	0.33	0.17	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
086-2SMR+	18.0	0.47	0.17	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-2SMRC+	18.0	0.47	0.17	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-36SM+	18.0	2.44	3.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
086-3KM+	40.0	0.49	0.25	2.92 mm	Male	Straight	Standard	2.92 mm	Male	Straight	Standard
086-3SBSM+	18.0	0.47	0.25	SMA	Male	Straight	Standard	SMA	Female	Straight	Bulkhead
086-3SBSMR+	18.0	0.36	0.25	SMA	Male	Right Angle 0° Clocked	Standard	SMA	Female	Straight	Bulkhead
086-3SM+	18.0	0.31	0.25	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
086-3SMR+	18.0	0.39	0.25	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-3SMRC+	18.0	0.45	0.25	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-3SMRSM+	18.0	0.38	0.25	SMA	Male	Straight	Standard	SMA	Male	Right Angle	Standard



086 Connector Series



086 Connector Series



086 Connector Series

# Hand-Flex Interconnect, 0.086" center diameter | 50 $\Omega$ | DC to 40 GHz | 4/5

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
086-4KM+	40.0	0.6	0.33 2.92 mm		Male	Straight	Standard	2.92 mm	Male	Straight	Standard
086-4SBSMR+	18.0	0.56	0.33 SMA		Male	Right Angle	Standard	SMA	Female	Straight	Bulkhead
086-4SM+	18.0	0.34	0.33 SMA		Male	Straight	Standard	SMA	Male	Straight	Standard
086-4SMR+	18.0	0.59	0.33 SMA		Male	Right Angle 0° Clock	Standard	SMA	Male	Right Angle 0° Clock	Standard
086-4SMRSM+	18.0	0.57	0.33 SMA		Male	Straight	Standard	SMA	Male	Right Angle	Standard
086-5SBSM+	18.0	0.42	0.42 SMA		Male	Straight	Standard	SMA	Female	Straight	Bulkhead
086-5SBSMR+	18.0	0.71	0.42 SMA		Male	Right Angle	Standard	SMA	Female	Straight	Bulkhead
086-5SM+	18.0	0.41	0.42 SMA		Male	Straight	Standard	SMA	Male	Straight	Standard
086-5SMR+	18.0	0.66	0.42 SMA		Male	Right Angle 0° Clock	Standard	SMA	Male	Right Angle 0° Clock	Standard
086-5SMRSM+	18.0	0.57	0.42 SMA		Male	Straight	Standard	SMA	Male	Right Angle	Standard
086-6BM+	3.0	0.14	0.5 BNC		Male	Straight	Standard	BNC	Male	Straight	Standard
086-6KM+	40.0	0.89	0.5 2.92 mm		Male	Straight	Standard	2.92 mm	Male	Straight	Standard
086-6SBMMCR+	6.0	0.3	0.5 MMCX		Male	Right Angle	Standard	SMA	Female	Straight	Bulkhead
086-6SBSM+	18.0	0.47	0.5 SMA		Male	Straight	Standard	SMA	Female	Straight	Bulkhead
086-6SBSMR+	18.0	0.76	0.5 SMA		Male	Right Angle	Standard	SMA	Female	Straight	Bulkhead
086-6SM+	18.0	0.52	0.5 SMA		Male	Straight	Standard	SMA	Male	Straight	Standard
086-6SMR+	18.0	0.76	0.5 SMA		Male	Right Angle 0° Clock	Standard	SMA	Male	Right Angle 0° Clock	Standard
086-6SMRC+	18.0	0.68	0.5 SMA		Male	Right Angle 180° Clock	Standard	SMA	Male	Right Angle 0° Clock	Standard
086-6SMRSM+	18.0	0.57	0.5 SMA		Male	Straight	Standard	SMA	Male	Right Angle 0° Clock	Standard



086 Connector Series



086 Connector Series



086 Connector Series

# Hand-Flex Interconnect, 0.086" center diameter | 50 $\Omega$ | DC to 40 GHz | 5/5

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GEN- DER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GEN- DER	CON 2 ORI- ENTATION	CON 2 MOUNTING TYPE
086-7SBSM+	18.0	0.59	0.58	SMA	Male	Straight	Standard	SMA	Female	Straight	Bulkhead
086-7SM+	18.0	0.6	0.58	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
086-7SMR+	18.0	0.97	0.58	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-7SMRSM+	18.0	0.88	0.58	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clocked	Standard
086-8BM+	3.0	0.18	0.67	BNC	Male	Straight	Standard	BNC	Male	Straight	Standard
086-8SBSMR+	18.0	0.56	0.67	SMA	Male	Right Angle 0° Clocked	Standard	SMA	Female	Straight	Bulkhead
086-8SM+	18.0	0.69	0.67	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
086-8SMR+	18.0	0.9	0.67	SMP	Female	Right Angle	Standard	SMP	Female	Right Angle	Standard
086-8SMR+	18.0	0.93	0.67	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-8SMRSM+	18.0	0.92	0.67	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clocked	Standard
086-9KM+	40.0	1.4	0.75	2.92 mm	Male	Straight	Standard	2.92 mm	Male	Straight	Standard
086-9SBSM+	18.0	0.72	0.75	SMA	Male	Straight	Standard	SMA	Female	Straight	Bulkhead
086-9SM+	18.0	0.79	0.75	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
086-9SMR+	18.0	1.01	0.75	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-9SMRC+	18.0	1.0	0.75	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle	Standard
086-9SMRSM+	18.0	1.01	0.75	SMA	Male	Straight	Standard	SMA	Male	Right Angle	Standard



086 Connector Series



086 Connector Series



086 Connector Series

# Hand-Flex Interconnect, 0.141" center diameter | 50 Ω | DC to 18 GHz | 1/6

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ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORIEN- TATION	CON 2 MOUNTING TYPE
141-0.5MSM+	18.0	0.86	1.64	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-1.5MSM+	18.0	3.53	4.92	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-10BM+	3.0	0.15	0.83	BNC	Male	Straight	Standard	BNC	Male	Straight	Standard
141-10NM+	12.5	0.53	0.83	N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard
141-10SM+	18.0	0.59	0.83	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-10SMNB+	12.5	0.4	0.83	N-Type	Female	Straight	Bulkhead	SMA	Male	Straight	Standard
141-10SMNM+	18.0	0.69	0.83	N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard
141-10SMRNM+	18.0	0.5	0.83	N-Type	Male	Straight	Standard	SMA	Male	Right Angle 0° Clockwise	Standard
141-10SMRSM+	18.0	0.8	0.83	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clockwise	Standard
141-11SM+	18.0	0.57	0.92	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-11SMRSM+	18.0	0.8	0.92	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clockwise	Standard
141-12BM+	3.0	0.17	1.0	BNC	Male	Straight	Standard	BNC	Male	Straight	Standard
141-12NM+	12.5	0.69	1.0	N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard
141-12SM+	18.0	0.66	1.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-12SMNB+	12.5	0.58	1.0	N-Type	Female	Straight	Bulkhead	SMA	Male	Straight	Standard
141-12SMNM+	18.0	0.77	1.0	N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard
141-12SMR+	18.0	0.76	1.0	SMA	Male	Right Angle 0°	Standard	SMA	Male	Right Angle 0°	Standard
141-12SMRC+	18.0	0.72	1.0	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle 0°	Standard
141-12SMRSM+	18.0	0.8	1.0	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0°	Standard



141 Connector Series



141 Connector Series



141 Connector Series

# Hand-Flex Interconnect, 0.141" center diameter | 50 Ω | DC to 18 GHz | 2/6

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORIENTATION	CON 2 MOUNTING TYPE
141-13SM+	18.0	0.5	1.08 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
141-13SMRSM+	18.0	0.92	1.08 SMA	Male	Straight		Standard	SMA	Male	Right Angle 0° Clock	Standard
141-14BM+	3.0	0.2	1.17 BNC	Male	Straight		Standard	BNC	Male	Straight	Standard
141-14SM+	18.0	0.73	1.17 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
141-14SMNB+	12.5	0.64	1.17 N-Type	Female	Straight		Bulkhead	SMA	Male	Straight	Standard
141-14SMRSM+	18.0	1.03	1.17 SMA	Male	Straight		Standard	SMA	Male	Right Angle 0° Clock	Standard
141-15SM+	18.0	0.85	1.25 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
141-15SMRSM+	18.0	1.0	1.25 SMA	Male	Straight		Standard	SMA	Male	Right Angle 0° Clock	Standard
141-16SM+	18.0	0.9	1.33 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
141-16SMNB+	12.5	0.76	1.33 N-Type	Female	Straight		Bulkhead	SMA	Male	Straight	Standard
141-16SMRSM+	18.0	1.04	1.33 SMA	Male	Straight		Standard	SMA	Male	Right Angle 0° Clock	Standard
141-17SM+	18.0	0.96	1.42 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
141-17SMRSM+	18.0	1.11	1.42 SMA	Male	Straight		Standard	SMA	Male	Right Angle 0° Clock	Standard
141-18BM+	3.0	0.25	1.5 BNC	Male	Straight		Standard	BNC	Male	Straight	Standard
141-18SM+	18.0	0.89	1.5 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard
141-18SMNB+	12.5	0.81	1.5 N-Type	Female	Straight		Bulkhead	SMA	Male	Straight	Standard
141-18SMNM+	18.0	1.19	1.5 N-Type	Male	Straight		Standard	SMA	Male	Straight	Standard
141-18SMRSM+	18.0	0.93	1.5 SMA	Male	Straight		Standard	SMA	Male	Right Angle 0° Clock	Standard
141-19SM+	18.0	0.86	1.58 SMA	Male	Straight		Standard	SMA	Male	Straight	Standard



141 Connector Series



141 Connector Series



141 Connector Series

# Hand-Flex Interconnect, 0.141" center diameter | 50 Ω | DC to 18 GHz | 3/6

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORIENTATION	CON 2 MOUNTING TYPE
141-1MSM+	18.0	1.67	3.28	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-20SM+	18.0	0.92	1.67	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-20SMNB+	12.5	1.01	1.67	N-Type	Female	Straight	Bulkhead	SMA	Male	Straight	Standard
141-20SMRSM+	18.0	1.12	1.67	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clock	Standard
141-22SM+	18.0	1.12	1.83	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-24BM+	3.0	0.31	2.0	BNC	Male	Straight	Standard	BNC	Male	Straight	Standard
141-24NM+	12.5	1.21	2.0	N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard
141-24SBSM+	18.0	1.1	2.0	SMA	Male	Straight	Standard	SMA	Female	Straight	Bulkhead
141-24SM+	18.0	1.12	2.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-24SMNB+	12.5	1.18	2.0	N-Type	Female	Straight	Bulkhead	SMA	Male	Straight	Standard
141-24SMNM+	18.0	1.32	2.0	N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard
141-24SMRSM+	18.0	1.55	2.0	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clock	Standard
141-26SM+	18.0	1.2	2.17	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-2MSM+	18.0	3.36	6.56	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-2SM+	18.0	0.15	0.17	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-30SM+	18.0	1.27	2.5	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-32SM+	18.0	1.3	2.67	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-36SBSMR+	18.0	1.6	3.0	SMA	Male	Right Angle 0° Clock	Standard	SMA	Female	Straight	Bulkhead
141-36SM+	18.0	1.51	3.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-36SMRSM+	18.0	2.19	3.0	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0°	Standard



141 Connector Series



141 Connector Series



141 Connector Series

# Hand-Flex Interconnect, 0.141" center diameter | 50 Ω | DC to 18 GHz | 4/6

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORIENTATION	CON 2 MOUNTING TYPE
141-3NM+	12.5	0.42	0.25 N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard	Standard
141-3SM+	18.0	0.21	0.25 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
141-3SMR+	18.0	0.2	0.25 SMA	Male	Right Angle 0°	Standard	SMA	Male	Right Angle 0°	Standard	Standard
141-3SMRC+	18.0	0.2	0.25 SMA	Male	Right Angle	Standard	SMA	Male	Right Angle 0°	Standard	Standard
141-3SMRSM+	18.0	0.28	0.25 SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clockwise	Standard	Standard
141-40SM+	18.0	1.9	3.33 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
141-4SBSM+	18.0	0.21	0.33 SMA	Male	Straight	Standard	SMA	Female	Straight	Standard	Bulkhead
141-4SM+	18.0	0.2	0.33 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
141-4SMNM+	18.0	0.49	0.33 N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
141-4SMR+	18.0	0.31	0.33 SMA	Male	Right Angle 0°	Standard	SMA	Male	Right Angle 0°	Standard	Standard
141-4SMRC+	18.0	0.45	0.33 SMA	Male	Right Angle	Standard	SMA	Male	Right Angle 0°	Standard	Standard
141-4SMRSM+	18.0	0.39	0.33 SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clockwise	Standard	Standard
141-50SM+	18.0	2.5	4.17 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
141-5SM+	18.0	0.29	0.42 SMA	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
141-5SMNM+	18.0	0.84	0.42 N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard	Standard
141-5SMR+	18.0	0.4	0.42 SMA	Male	Right Angle 0°	Standard	SMA	Male	Right Angle 0°	Standard	Standard
141-5SMRC+	18.0	0.56	0.42 SMA	Male	Right Angle	Standard	SMA	Male	Right Angle 0°	Standard	Standard
141-5SMRSM+	18.0	0.31	0.42 SMA	Male	Straight	Standard	SMA	Male	Right Angle 0°	Standard	Standard



141 Connector Series



141 Connector Series



141 Connector Series

# Hand-Flex Interconnect, 0.141" center diameter | 50 Ω | DC to 18 GHz | 5/6

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORIENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORIENTATION	CON 2 MOUNTING TYPE
141-60SM+	18.0	2.5	5.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-6BM+	3.0	0.1	0.5	BNC	Male	Straight	Standard	BNC	Male	Straight	Standard
141-6NM+	12.5	0.35	0.5	N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard
141-6SM+	18.0	0.39	0.5	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-6SMNB+	12.5	0.32	0.5	N-Type	Female	Straight	Bulkhead	SMA	Male	Straight	Standard
141-6SMNM+	18.0	0.67	0.5	N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard
141-6SMR+	18.0	0.46	0.5	SMA	Male	Right Angle 0°	Standard	SMA	Male	Right Angle 0°	Standard
141-6SMRC+	18.0	0.46	0.5	SMA	Male	Right Angle	Standard	SMA	Male	Right Angle 0°	Standard
141-6SMRSM+	18.0	0.5	0.5	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clockwise	Standard
141-72SM+	18.0	3.1	6.0	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-7NM+	12.5	0.46	0.58	N-Type	Male	Straight	Standard	N-Type	Male	Straight	Standard
141-7SM+	18.0	0.47	0.58	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-7SMNM+	18.0	0.27	0.58	N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard
141-7SMR+	18.0	0.45	0.58	SMA	Male	Right Angle 0°	Standard	SMA	Male	Right Angle 0°	Standard
141-7SMRSM+	18.0	0.72	0.58	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0° Clockwise	Standard
141-8BM+	3.0	0.12	0.67	BNC	Male	Straight	Standard	BNC	Male	Straight	Standard
141-8SM+	18.0	0.42	0.67	SMA	Male	Straight	Standard	SMA	Male	Straight	Standard
141-8SMNB+	12.5	0.32	0.67	N-Type	Female	Straight	Bulkhead	SMA	Male	Straight	Standard
141-8SMNM+	18.0	0.86	0.67	N-Type	Male	Straight	Standard	SMA	Male	Straight	Standard
141-8SMR+	18.0	0.51	0.67	SMA	Male	Right Angle 0°	Standard	SMA	Male	Right Angle 0°	Standard
141-8SMRSM+	18.0	0.7	0.67	SMA	Male	Straight	Standard	SMA	Male	Right Angle 0°	Standard



141 Connector Series



141 Connector Series



141 Connector Series

# Hand-Flex Interconnect, 0.141" center diameter | 50 $\Omega$ | DC to 18 GHz | 6/6

[Click here](#) to view the products online with advanced filtering options.

ITEM	FREQ HI (GHz)	INS LOSS (dB)	LENGTH (FT)	CON 1 TYPE	CON 1 GENDER	CON 1 ORI- ENTATION	CON 1 MOUNTING TYPE	CON 2 TYPE	CON 2 GENDER	CON 2 ORIEN- TATION	CON 2 MOUNTING TYPE
141-9SM+	18.0	0.55	0.75 SMA	Male	Male	Straight	Standard	SMA	Male	Straight	Standard
141-9SMR+	18.0	0.58	0.75 SMA	Male	Male	Right Angle 0°	Standard	SMA	Male	Right Angle 0°	Standard
141-9SMRC+	18.0	0.72	0.75 SMA	Male	Male	Right Angle	Standard	SMA	Male	Right Angle 0°	Standard
141-9SMRSM+	18.0	0.72	0.75 SMA	Male	Male	Straight	Standard	SMA	Male	Right Angle 0°	Standard



141 Connector Series



141 Connector Series



141 Connector Series

# Application Note | CBL Series Ruggedized Test Cable - Super Flex Testing | 1/3

## Introduction

Mini-Circuits CBL Series Test Cables are specifically designed and manufactured for use in stringent test lab environments where cables are often bent and twisted many times during normal use. This stress can ultimately result in catastrophic failure. It is however the degradation that can occur prior to total failure that is the real danger as this can result in erroneous measurements. To ensure performance in this environment, Mini-Circuits has qualified the CBL Series through extensive Flex Testing - up to 20,000 flex-cycles.

## Qualification Testing - Flex Cycles

### Flex Test Setup

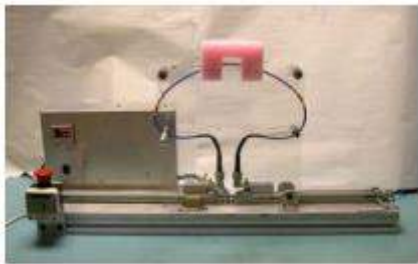


Figure 1 Flex Test Setup-Close

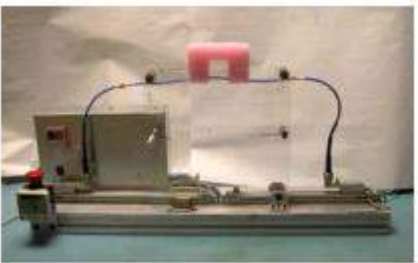


Figure 2 Flex Test Setup-Open

# Application Note | CBL Series Ruggedized Test Cable - Super Flex Testing | 2/3

## Mini-Circuits Cable Test Data

Figure 3 below shows insertion loss taken after 1000, 1500, 2000, 3000, 4000, 5000, 7000, 10000, 15000, and 20000 bends and repeatable performance for return loss as shown below in Figures 4 & 5.

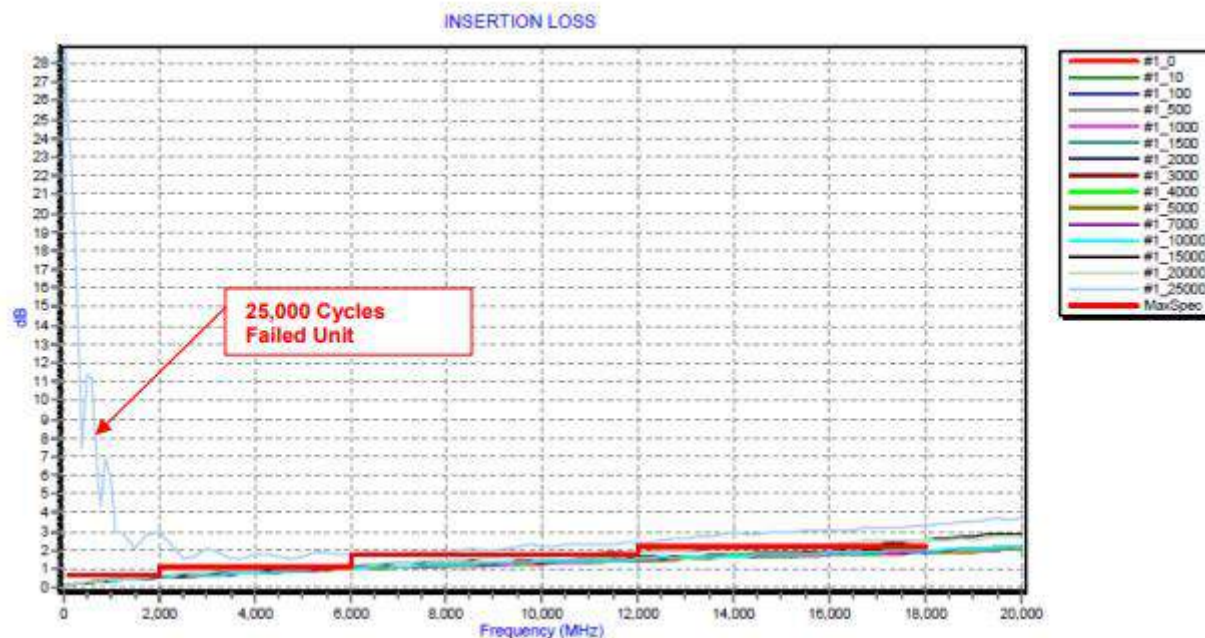


Figure 3 Insertion Loss

# Application Note | CBL Series Ruggedized Test Cable - Super Flex Testing | 3/3

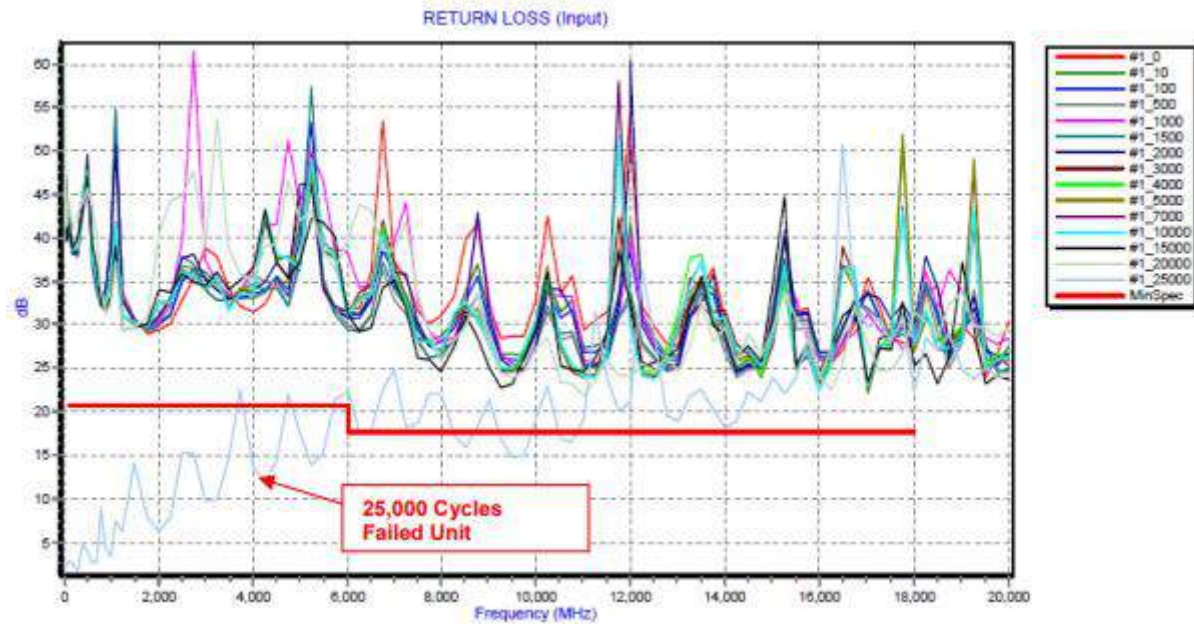


Figure 4 Return Loss-Input

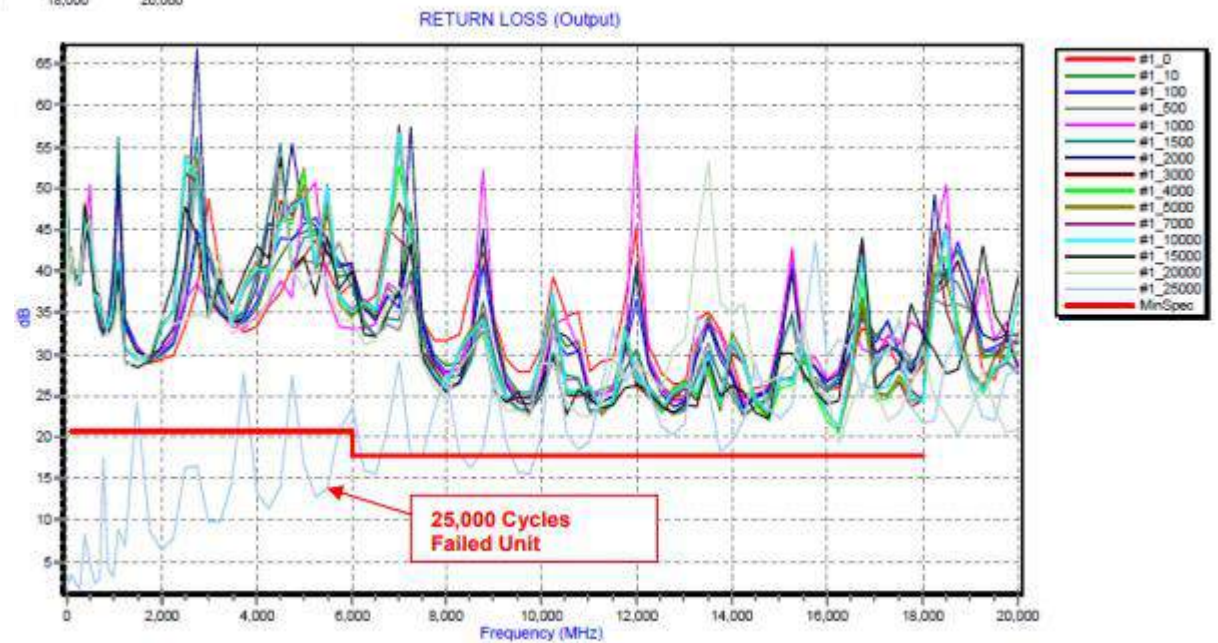


Figure 5 Return Loss-Output

# Application Note | Mating Cycle Validation of Mini Circuits QBL Series Quick-Lock Test Cables | 1/7

## Background & Introduction

Mini-Circuits has introduced a QBL Series of test cables is based upon an industry-unique Quick Lock Connector which enables a quick, secure locked connection directly to a standard SMA female jack. This high integrity connection enables users to connect to an SMA Jack without the need for twisting and torquing as with any normal SMA connector, making it ideal for test applications.

In test applications, the number of cycles becomes of significant importance, although standard mating cycle testing is limited to 500 cycles (per mil-spec), in an RF test lab environment it is possible that this number of actual insertions can far exceed this standard and therefore validation of this new interconnect system at higher mating cycles is performed by Mini Circuits.

### Purpose

The purpose of this experiment is to establish baseline performance over a large number of mating cycles for the new Quick Lock interconnect system up to a maximum of 20,000 cycles. The basis of this extended reliability and qualification standards apply to all products including laboratory testing cables.

### Scope

QBL Series Quick Lock interconnect cable assemblies.

### Conclusion

All 5 samples tested meet or exceed product specifications up to 20,000 cycles and meet or exceed acceptable limits of degradation over same period.

### Test Apparatus & Setup

Description of Device under test:

1. Mini-Circuits Quick-Lock connector (Fig.1)
2. Standard SMA Connector (Stainless Steel Jack) (Fig.2)
3. DUT (Test Cable Assembly) (Fig.3)
4. Test Setup

## Application Note | Mating Cycle Validation of Mini Circuits QBL Series Quick-Lock Test Cables | 2/7

As outlined in Figure 4, a custom test fixture insertion assembly was developed to engage the DUT, (see Figure 4) at the Quick Lock connector end of the assembly and execute a quick lock connection to a standard SMA stainless steel jack which is fixed in the test jig. One (1) insertion cycle includes:

1. Insertion of the Quick Lock Connector on the fixed SMA Male Connector.
2. Engagement of the Quick Lock locking push-on shroud.
3. Dis-Engagement of the Quick Lock locking push-on shroud.
4. Extraction of the Quick Lock Connector from the fixed SMA Connector.

This sequence was repeated for 4 sets of 5,000 cycles with validation testing at each interrupt. See test sequence below



Fig. 1 Quicklock



Fig. 2 Mating SMA



Fig. 3 DUT Test Cable



Locked position:



unlocked position:

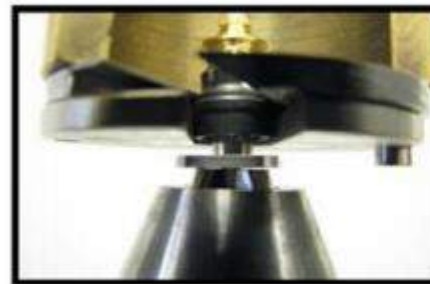


Fig. 4 Locked and Unlocked Position

### Test Sequence

1. Five (5) DUT Cable Assemblies prepared for Mating Cycle Test. Pre Test Sweep from DC to 18 GHz, S Parameters compared to DUT Specification
2. DUT No. 1 Mounted in Test Fixture
3. Perform Mating Interconnection - 5000 Mating Cycles

## Application Note | Mating Cycle Validation of Mini Circuits QBL Series Quick-Lock Test Cables | 3/7

4. Dismount DUT and Sweep from DC to 18 GHz, S Parameters compared to DUT Specification and previous measurements
5. Perform Mating Interconnection - 5000 Mating Cycles (10,000 total cycles)
6. Dismount DUT and Sweep from DC to 18 GHz, S Parameters compared to DUT Specification and previous measurements
7. Perform Mating Interconnection - 5000 Mating Cycles (15,000 total cycles)
8. Dismount DUT and Sweep from DC to 18 GHz, S Parameters compared to DUT Specification and previous measurements
9. Perform Mating Interconnection - 5000 Mating Cycles (20,000 total cycles)
10. Dismount DUT and Sweep from DC to 18 GHz, S Parameters compared to DUT Specification and previous measurements
11. REPEAT for DUT No.2 through DUT No.5

## Test Results

Returnloss measurements of DUT 01:

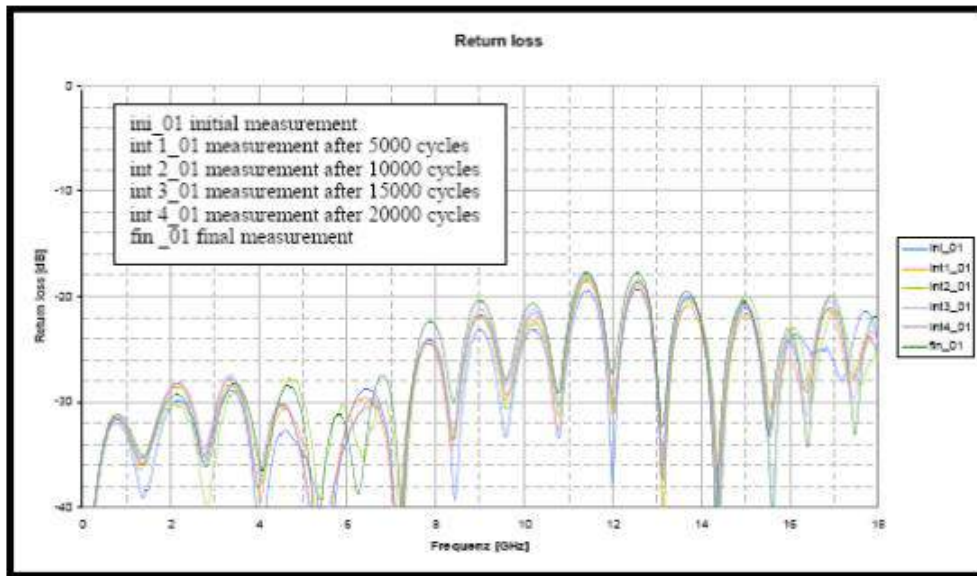


Fig. 5 Return Loss DUT 01

# Application Note | Mating Cycle Validation of Mini Circuits QBL Series Quick-Lock Test Cables | 4/7

Insertion loss measurement of DUT 01:

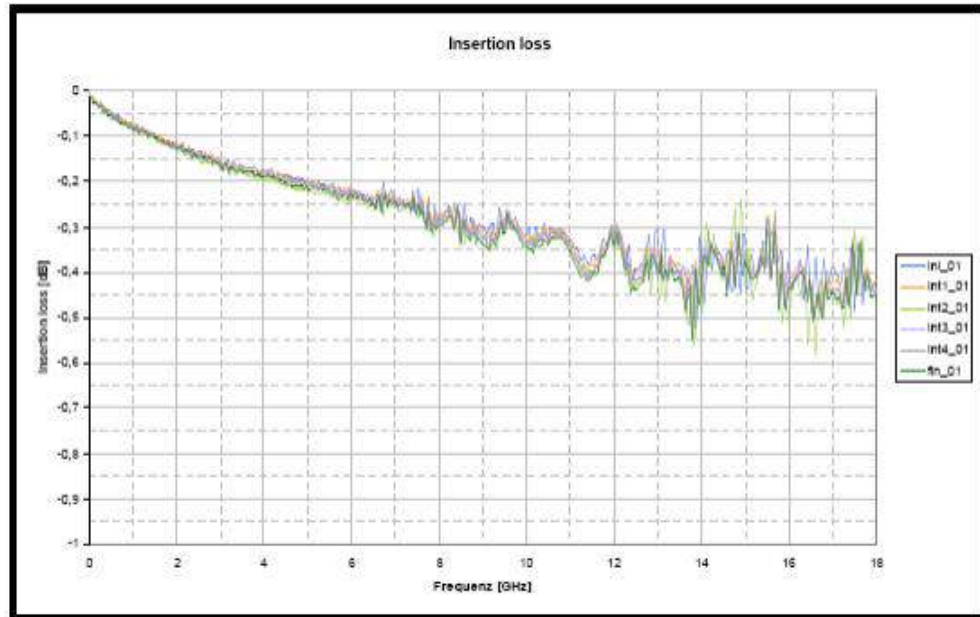


Fig. 6 Insertion Loss DUT 01

Return loss measurements of DUT 02:

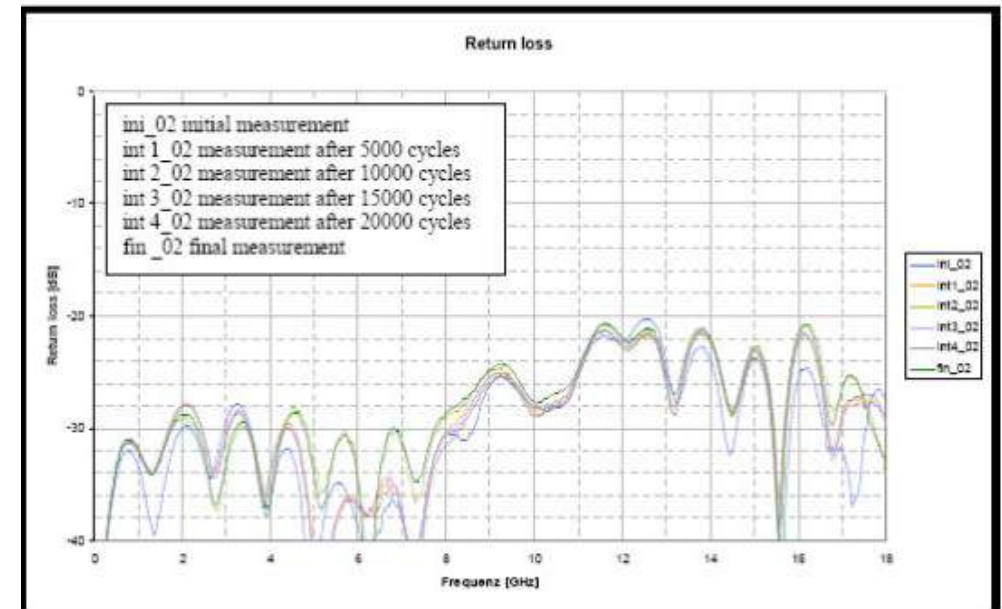


Fig. 7 Return Loss DUT 02

# Application Note | Mating Cycle Validation of Mini Circuits QBL Series Quick-Lock Test Cables| 5/7

Insertion loss measurements of DUT 02:

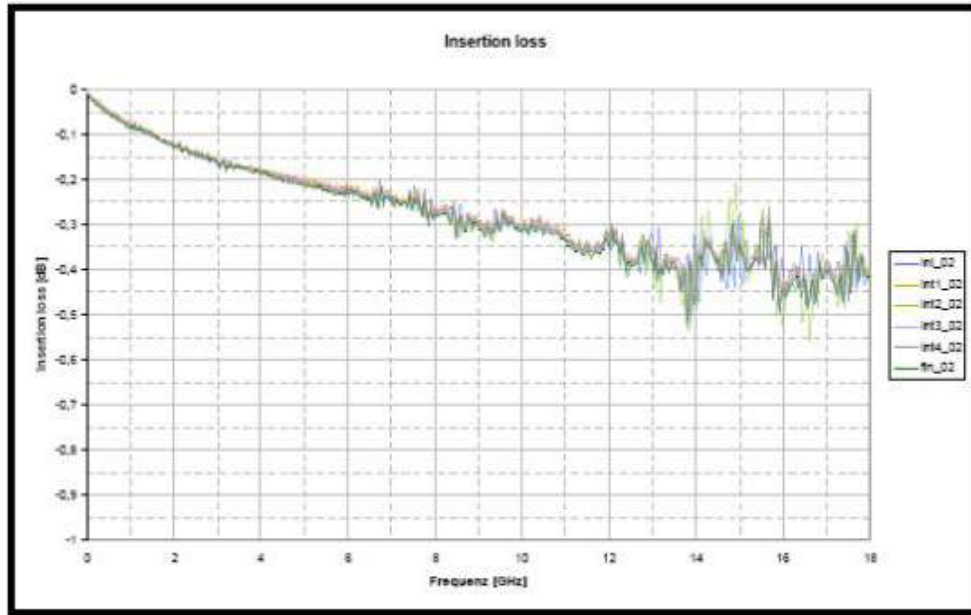


Fig. 8 Insertion Loss DUT 02

Return loss measurements of DUT 03:

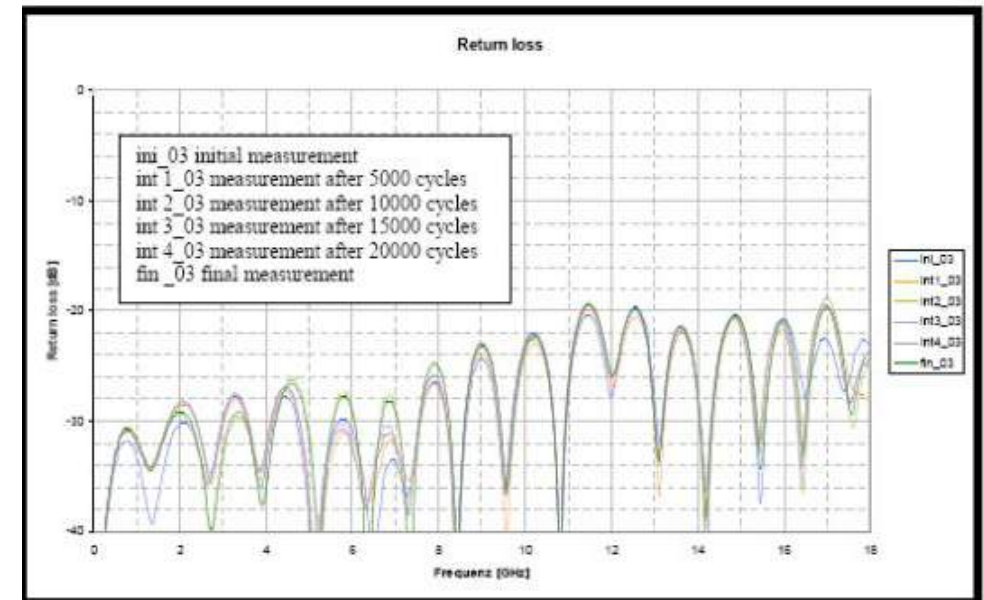


Fig. 9 Return Loss DUT 03

# Application Note | Mating Cycle Validation of Mini Circuits QBL Series Quick-Lock Test Cables| 6/7

Insertion loss measurements of DUT 03:

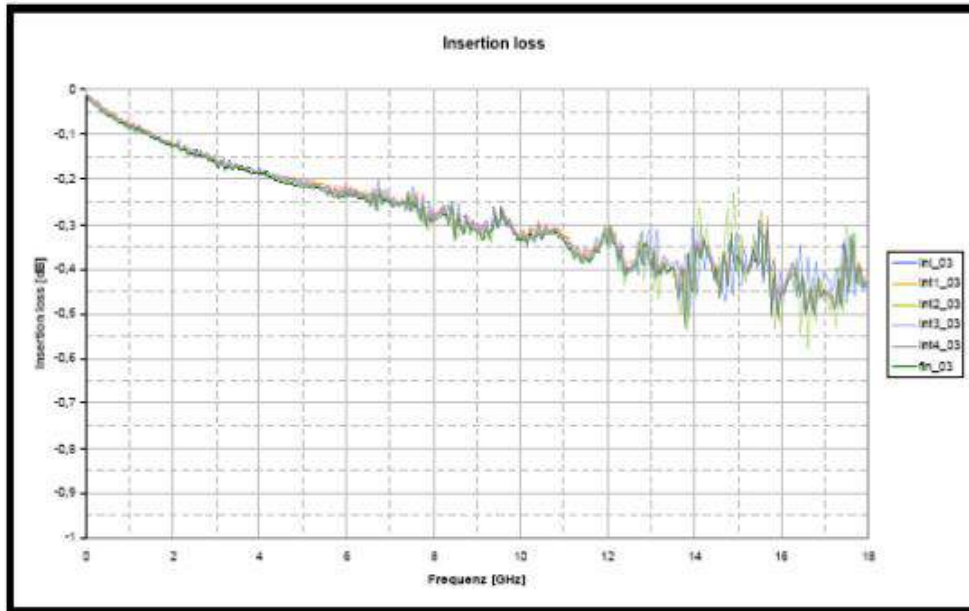


Fig. 10 Insertion Loss DUT 03

Return loss measurements of DUT 04:

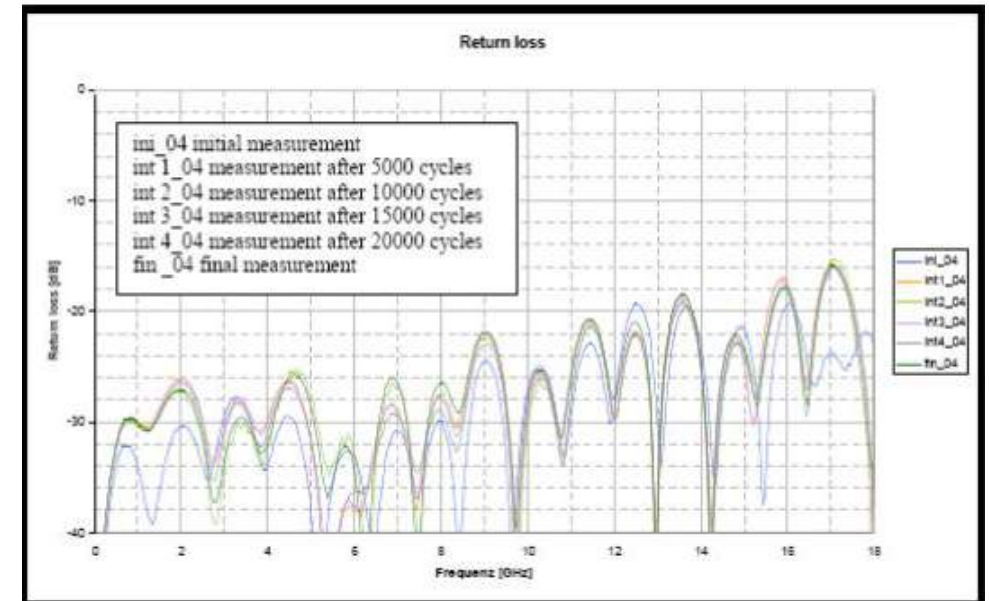


Fig. 11 Return Loss DUT 04

## Application Note | Performance Change vs. Flexure using Cable Flexure Test Fixture | 1/7

### Introduction

Mini-Circuits FLC Series Test Cables are specifically designed and manufactured for use in stringent test lab environments where cables often undergo bending during normal use. This can result in a change of performance versus flexure. To demonstrate performance change versus flexure, Mini-Circuits has developed a controlled method of test and evaluated our FLC3FT-SMSM+ model by applying various bend radii to a 3ft cable and measuring the change in insertion loss, insertion phase, and VSWR versus flexure normalized to the reference position.

### Qualification Testing - Electrical Performance vs. Flexure Test

#### Cable Flexure Test Fixture

Fixture (B85-L26000-00) used in the setup is designed and built by MCT specifically for the performance vs. flexure test. The fixture as shown in figure 1 below has 2 adjustable arms to support the connector ends when connected to Agilent PNA-X Network Analyzer at Ports 1 & 2. A 3ft flexible cable is wrapped around a 4 inch mandrel which slides along the scaled bar creating the specified bend radius.



Figure 1: Cable Flexure Test Cable (MCL P/N: B85-L26000-00)

## Application Note | Performance Change vs. Flexure using Cable Flexure Test Fixture | 2/7

### Cable Flexure Test Fixture Setup

Figures 2 to 5 below show the Flexure Test Setup used in assessing the electrical performance vs. flexure. This flexure test fixture applies a symmetric bend radius to apply a stress on the cable.

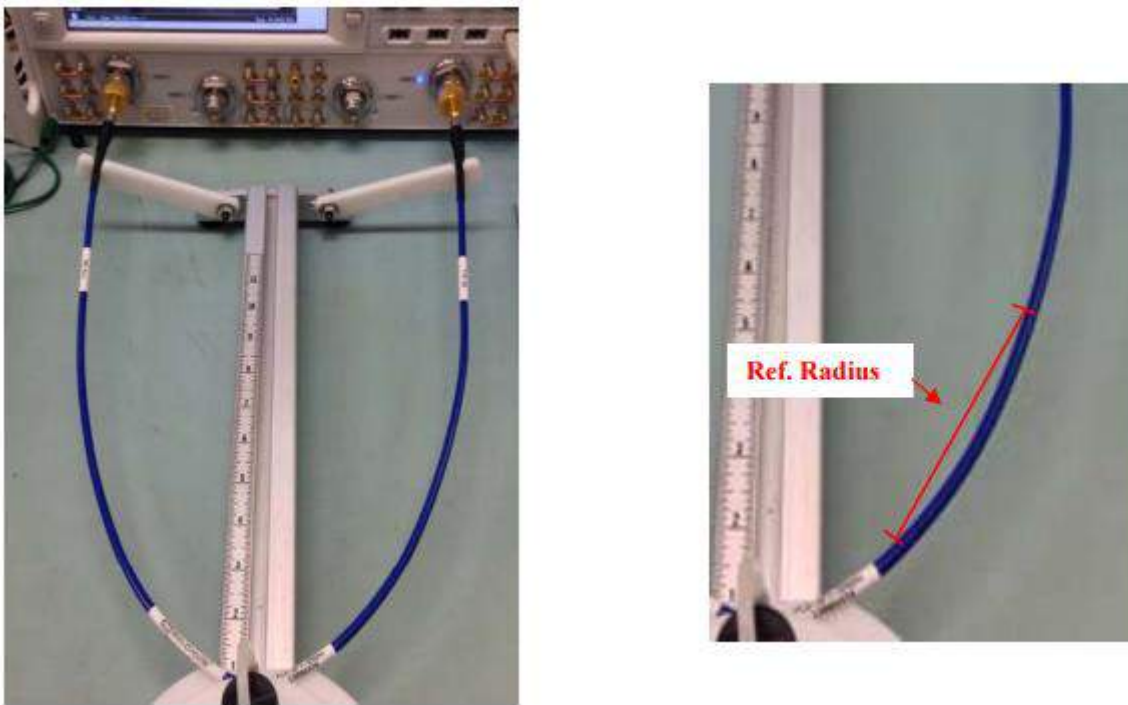


Figure 2: 3ft. Flexible Test Cable attached to the Cable Flexure Test Fixture at its reference start position

## Application Note | Performance Change vs. Flexure using Cable Flexure Test Fixture | 3/7

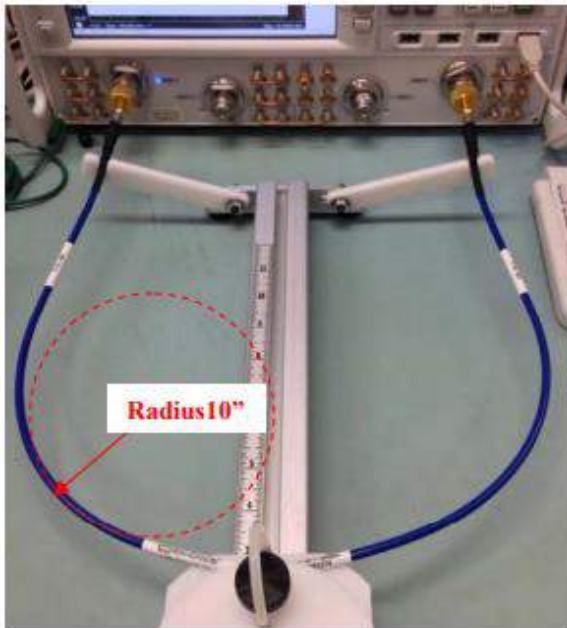


Figure 3: 3ft. Flexible Test Cable with a bend radius of 10"

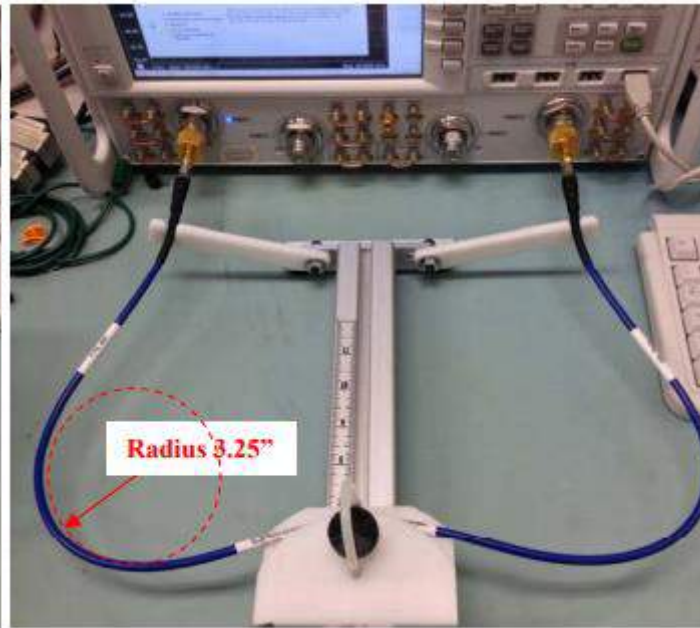


Figure 4: 3ft. Flexible Test Cable with a bend radius of 3.25"



Figure 5: 3ft. Flexible Test Cable with a bend radius of 2.40"

## Application Note | Performance Change vs. Flexure using Cable Flexure Test Fixture | 4/7

### Performance Change vs. Flexure Data

Figure 6 below shows the typical absolute values normalized to the reference position 0, for each electrical performance from DC-26GHz measured using a 3ft cable.

Parameter	Condition (GHz)	Bend Radius (Inches)			Units
		10	3.25	2.40	
Insertion Loss	DC-6	0.00	0.01	0.01	dB
	6-18	0.01	0.02	0.03	
	18-26	0.01	0.04	0.05	
Insertion Phase	DC-6	0.03	0.49	0.09	Deg
	6-18	0.03	1.7	0.31	
	18-26	0.07	2.9	1.6	
VSWR	DC-6	0.00	0.01	0.01	:1
	6-18	0.01	0.02	0.02	
	18-26	0.01	0.08	0.11	

Figure 6

Note: Cable Flexure Test Fixture specifically designed to take measurements using Agilent PNA-X Network Analyzer at Port-1 & Port-2.

## Application Note | Performance Change vs. Flexure using Cable Flexure Test Fixture | 5/7

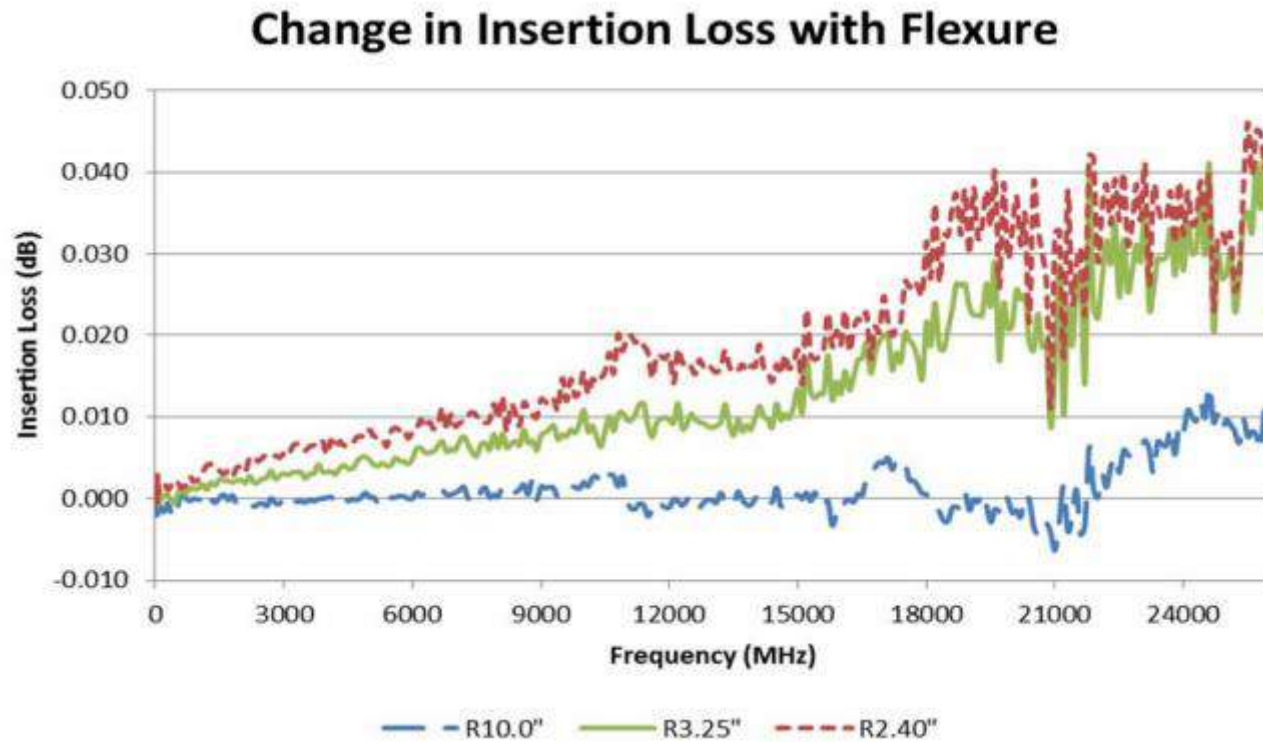


Figure 7: Change in Insertion Loss with flexure in reference to start position

## Application Note | Performance Change vs. Flexure using Cable Flexure Test Fixture | 6/7

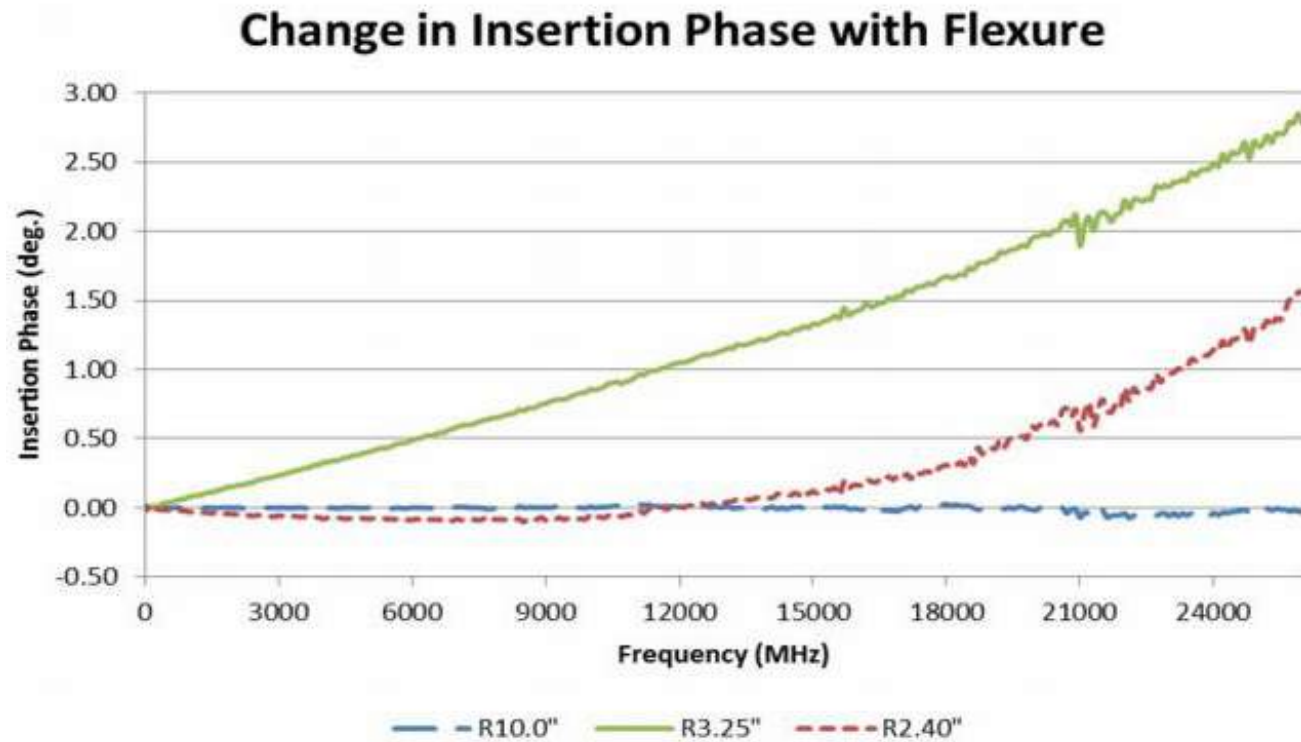


Figure 8: Change in Insertion Phase with flexure in reference to start position

## Application Note | Performance Change vs. Flexure using Cable Flexure Test Fixture | 7/7

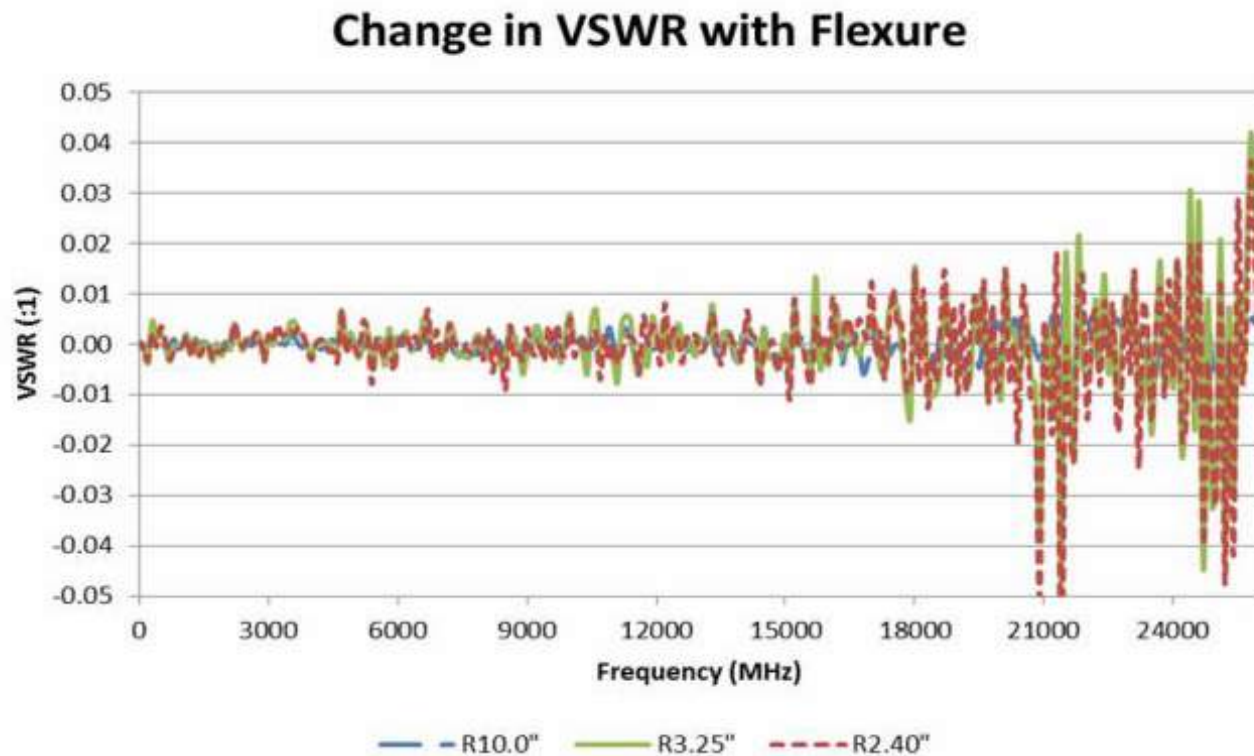


Figure 9: Change in VSWR with flexure in reference to start position

## Conclusion

Max change in insertion loss at the most extreme case bend radius of 2.40" is 0.05dB, which is found at the frequency range of 18-26 GHz. Max change in insertion phase is 2.9 degrees with a 3.25" bend radius flexure, which is seen at the higher frequencies. Max change in VSWR at the most extreme case bend radius of 2.40" is 0.11 and is also found at higher frequencies. In conclusion, change in performance change versus flexure is minimal and suitable for lab use.

# Application Note | Understanding Phase Stability in RF Test Cables | 1/8

## More than Just a Phase: Understanding Phase Stability in RF Test Cables

AN- 46- 004

### I. Introduction

One important factor in ensuring accurate, repeatable measurements in RF test applications is the stability of performance of the test cable used. In most test environments, cables undergo frequent bending during normal use, which can result in changes in phase and other performance parameters. Depending on the cable, these changes can be significant enough to degrade the accuracy and precision of your measurements. Therefore, in choosing the right test cable for your needs, it's important to consider how bending affects cable phase performance and how a cable is (or isn't) qualified for stability of phase versus flexure.

This article will review the basics of phase stability in RF coaxial cables and identify the factors that affect phase performance. Two methods of testing phase change versus flexure will be explored, and the preferred method used to qualify Mini-Circuits' T40 and T50-series phase-stable cables presented and explained in detail.

### II. Why Phase Matters

Phase stability is desirable in test cables because it:

- Ensures good phase tracking with changing temperature, and lowers residual errors and uncertainties
- Improves antenna gain for better system performance and accuracy
- Provides better bit error rate (BER) which increases effective range
- Extends the length of time between calibrations and minimizes drift between calibrations

### III. What Causes Phase Change?

In general, phase is affected by the physical length of the cable assembly, the cable bend radius, and the cable assembly technique. Recall that the electrical length of an RF line in degrees is defined by:

$$\text{Electrical Length [deg]} = 360^\circ * \frac{L}{\lambda}$$

$$\text{And } \lambda = \frac{c}{\sqrt{\epsilon_r} f}$$

## Application Note | Understanding Phase Stability in RF Test Cables | 2/8

Where  $f$  is frequency in Hz,  $L$  is physical length in meters,  $\epsilon_r$  is the dielectric constant of the cable material,  $c$  is the speed of light in meters per second, and  $\lambda$  is the wavelength.

Cables are typically designed to operate over a wide frequency range and minimize attenuation (loss). The longer the electrical length, the greater the loss. Since electrical length (and loss) is directly proportional to the square root of  $\epsilon_r$ , most RF cables are manufactured from materials with a low dielectric constant, usually PTFE (Teflon) and in some cases  $\text{SiO}_2$ . PTFE is more common because it's easy to bend without damaging, while  $\text{SiO}_2$  is brittle and only suitable for semi-rigid cable assemblies. All Mini-Circuits' cables use PTFE, as a good degree of flexibility is needed in most applications.

One drawback of the flexible PTFE construction is, of course, the potential for phase changes (and other performance changes) due to bending. Bending the cable changes the physical length at the point of bend. It may also constrict and loosen the dielectric, shielding, and braiding around the center conductor, which can also affect the electrical length and result in phase changes.

Depending on the design and construction, some cables will exhibit greater sensitivity of phase with bending than others. Mini-Circuits' T40- and T50-series cables are specifically designed and tested for stability of phase versus flexure. What follows will explain the methodology Mini-Circuits uses to qualify phase stability in these models.



Figure 1: Mini-Circuits

T50-3FT-VFVM+ phase-stable

## Application Note | Understanding Phase Stability in RF Test Cables | 3/8

### IV. How Phase Change is Measured

Measuring phase change versus flexure involves connecting the cable to a VNA and sweeping phase across frequency with some setup to bend the cable into specified radii to show corresponding changes in phase. There are, of course, many setups we could conceive to measure phase stability, and the reliability of this parameter depends on the robustness of the test method used. Mini-Circuits has explored multiple test methods to determine the most reliable procedure to characterize phase stability in our test cables.

#### Unexpected Result from the “Cross-Bow” Two-Port Method

The cross-bow-like fixture shown in Figure 2 below was built as one possible solution for measurement of cable performance vs. flexure. The apparatus has two adjustable arms to support the connector ends when connected to VNA ports 1 and 2. The cable is wrapped around a 4 inch mandrel which slides along the scaled bar, creating the specified bend radius. Figure 2 pictures the setup with measurements being made on Mini-Circuits model T50-3FT-KMKM+ at 10”, 3.25”, and 2.4” radii.

We would expect the relationship between bend radius and phase change to be linear. However, the data collected on the cable using this method exhibited a parabolic-shaped phase vs. flexure curve. This result is likely due to the multiple radial bends in the cable in this configuration: two in one direction, and one in the opposite direction. The data from this test is unusable because it gives the appearance of the cable being more resistant to phase change in tighter bends, which deviates from the expected performance.

#### Preferred Procedure: The One-Port Method for Testing

In the setup pictured in Figure 4, one-port calibration was performed on the VNA. The DUT (cable T50-3FTKMKM+) was connected to the VNA and terminated at the end with a short. The VNA was then normalized in the straight position. The cable was then wrapped one full turn (360°) around a mandrel of specified radius in one direction, and measurement was taken by sweeping phase across frequency. The cable was straightened, and the VNA normalized again. A second measurement was taken with the cable wrapped one full turn in the opposite direction, around a second mandrel on the opposite side. This procedure was repeated for radii of 2” and 3”. The data collected on the cable using this method exhibited the expected linear relationship between phase change and flexure (Figure 5). This method avoids any effects of additional bends in the cable and other factors that may distort the measurement, and the data is usable.

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### V. Conclusion

The measurement of phase versus flexure varies from

company to company in the RF cable industry, and it's important to understand how manufacturers specify phase stability when selecting a cable for an application in which this is a desired feature. Mini-Circuits uses the one-port method explained above to test phase stability in all of our T40- and T50-series phase-stable RF test cables. Data from this test is presented on the datasheet for all models in these families.

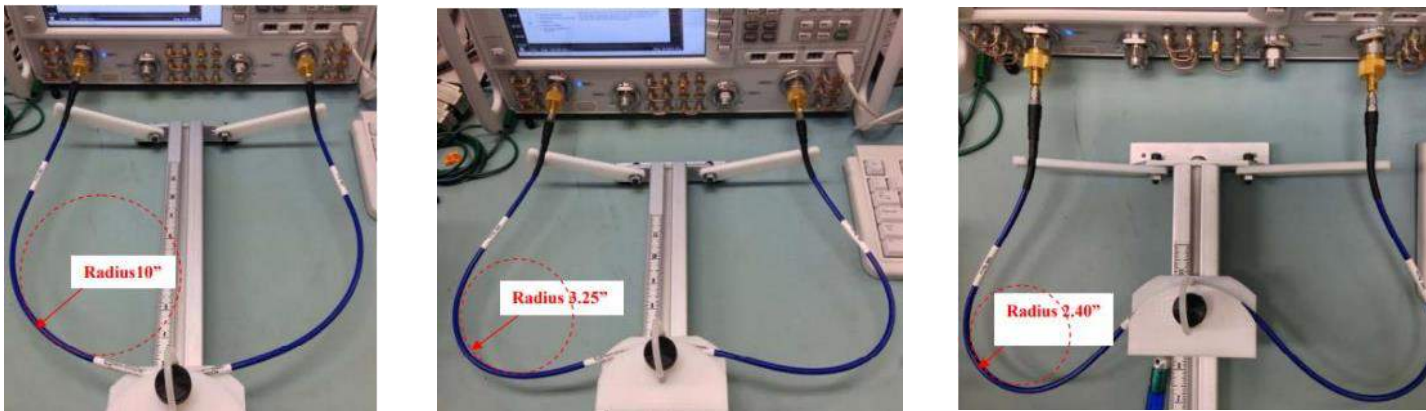


Figure 1: "Cross Bow" apparatus for measuring cable performance versus bend at 10", 3.25", and 2.4" bend radii.

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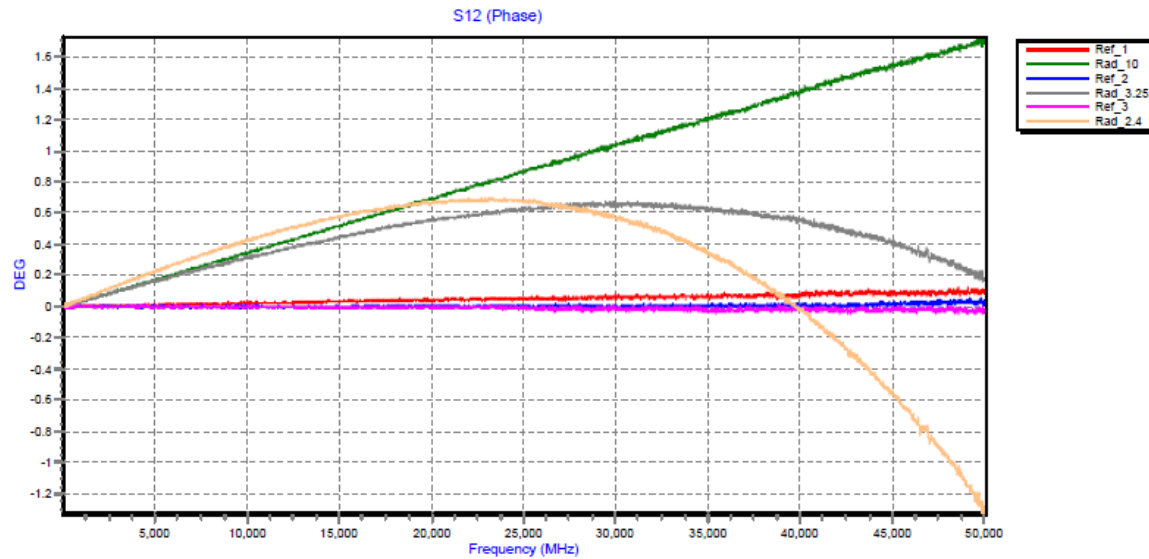


Figure 2: T50-3FT-KMKM+ using the “cross-bow” two port method, exhibiting a parabolic relationship between phase change and flexure.

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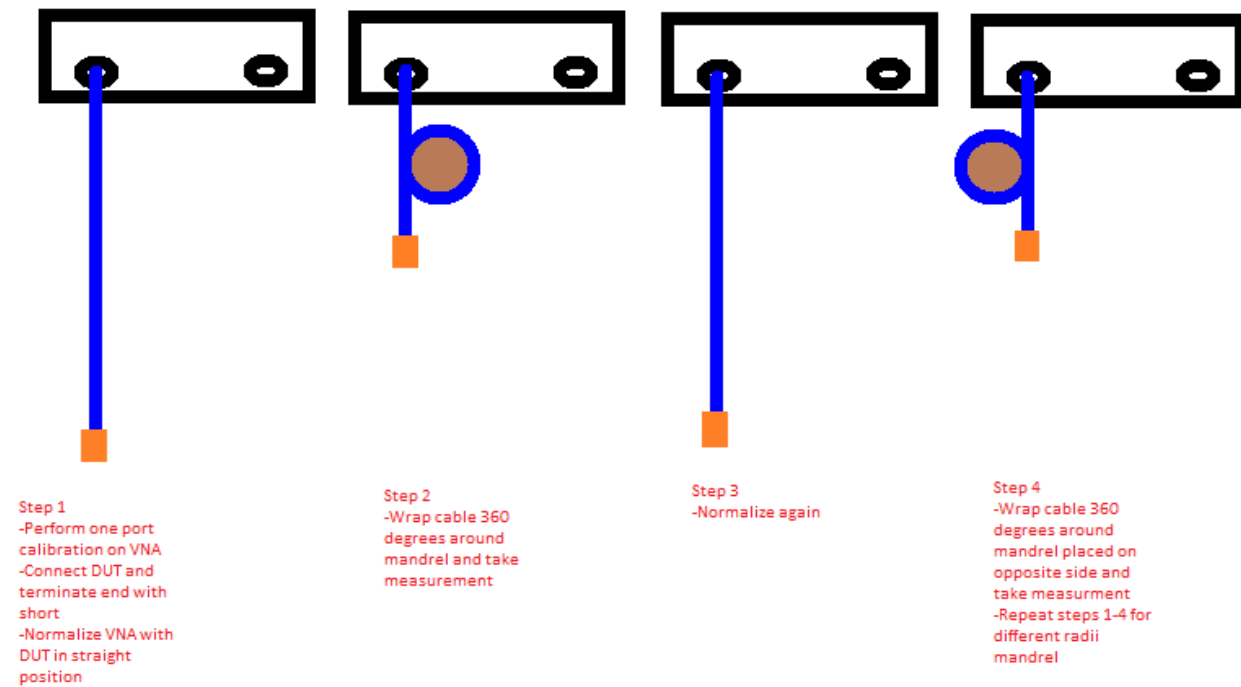


Figure 3: Simple visualization of the one-port method for testing phase stability vs. flexure.

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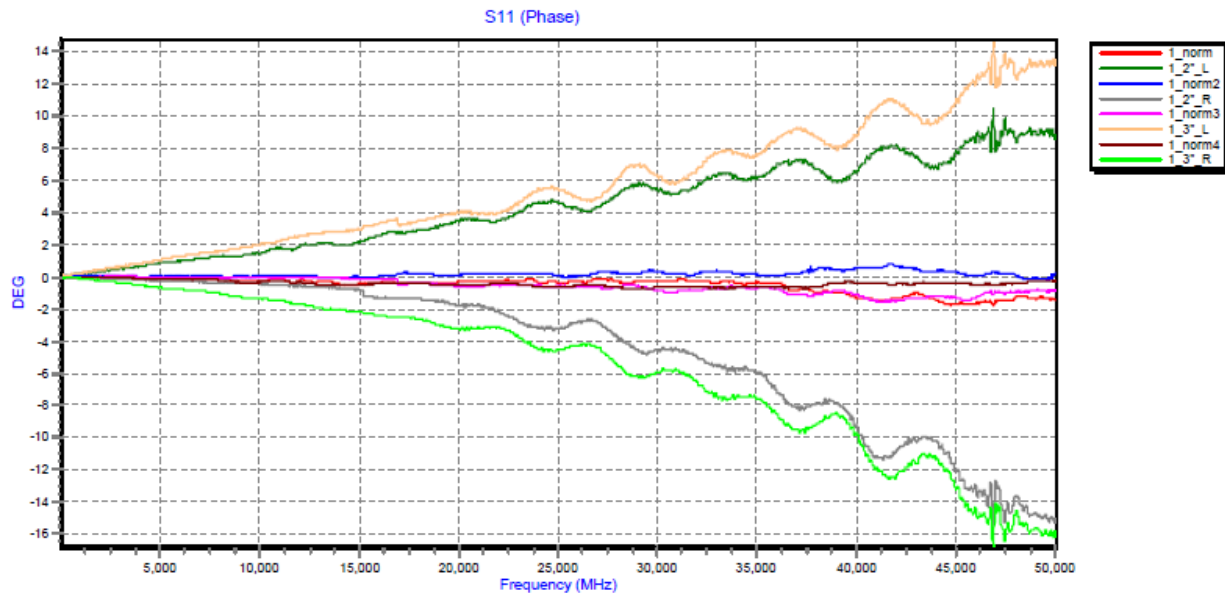


Figure 4: T50-3FT-KMKM+ using the one-port method, exhibiting the expected relationship between phase change and flexure. \*S11 halved to obtain phase change.

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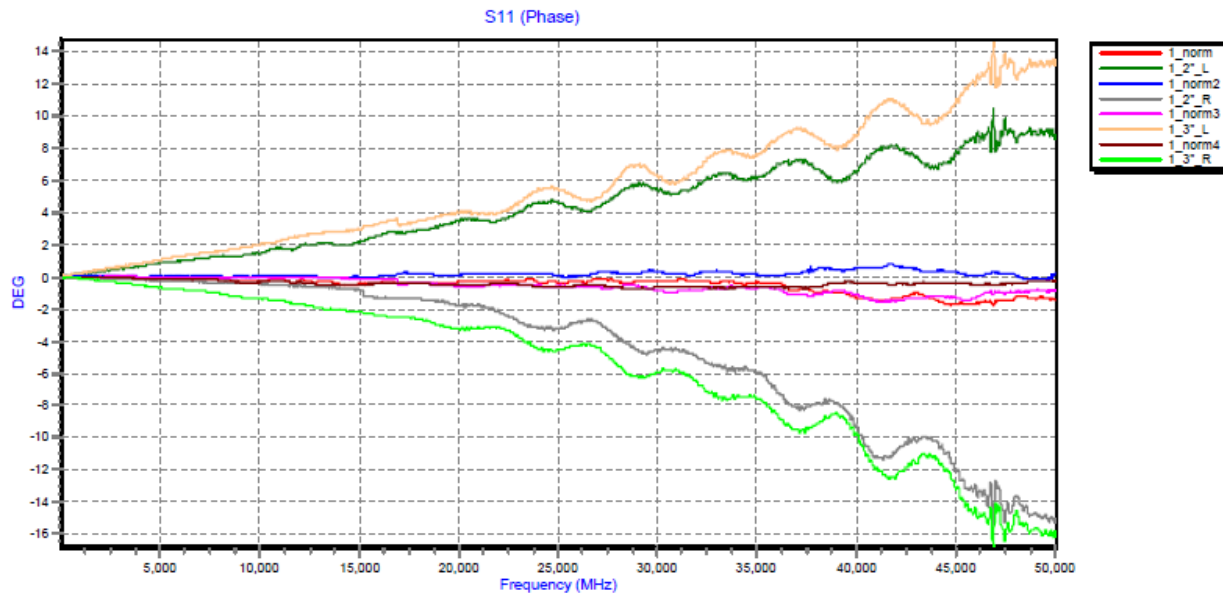


Figure 4: T50-3FT-KMKM+ using the one-port method, exhibiting the expected relationship between phase change and flexure. \*S11 halved to obtain phase change.

## Recommended Accessories | Torque Wrench

### Torque Wrench TRQ-516-08

Mini-Circuits' Precise Break-over Torque Wrench TRQ-516-08 allows for precise mating force and easy use in tight spaces. The head will break over to signal the user when preset torque is achieved. It will effectively prevent over/under tightening.

#### Features:

- Lab quality
- Accuracy
- Precise preset torque
- Prevent over or under tightening
- Light weight, easy to use
- SMA, 3.5mm, 2.92mm, 2.4mm, 1.85mm connectors

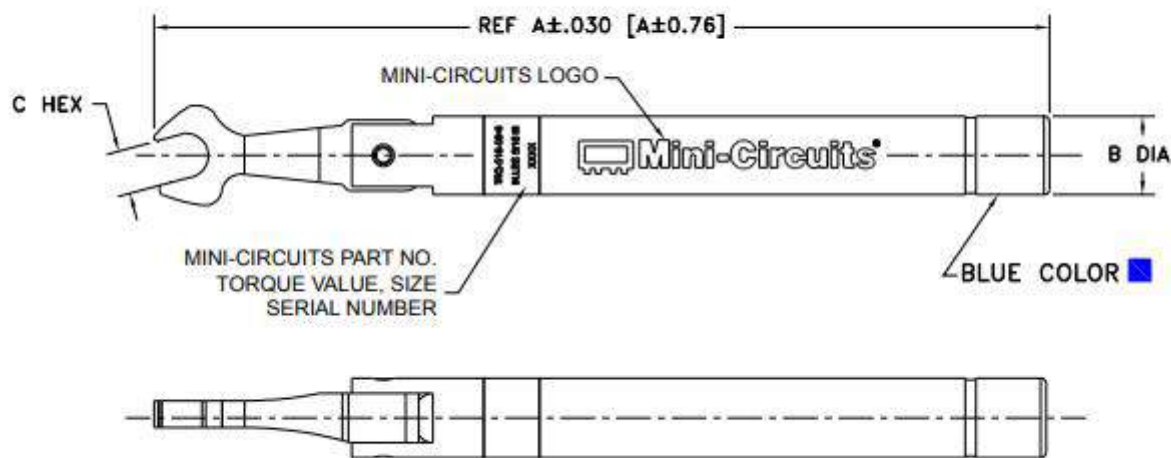


Wrench Torque	8±0.32 inch-lbs (0.9±0.04 NM)
Wrench Size	8.0 mm (5/16 inches)
Wrench Head	Stainless steel
Color	Blue Handle
Handle	Aluminum blue anodized
Length	6.44±.030
Weight	83.05 gms

Performance standards are in compliance with ANSI/NC SL Z540 and ISO 10011

### Outline Drawing

Performance standards are in compliance with ANSI/NC SL Z540 and ISO 10011



[Click for more Information & Datasheet](#)



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