Performance Change vs. Flexure using Cable Flexure Test Fixture (AN-46-003)

Keywords: Flexible Test Cable

1. 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 FLC-3FT-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.

2. Qualification Testing – Electrical Performance vs. Flexure Test

2.1 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.

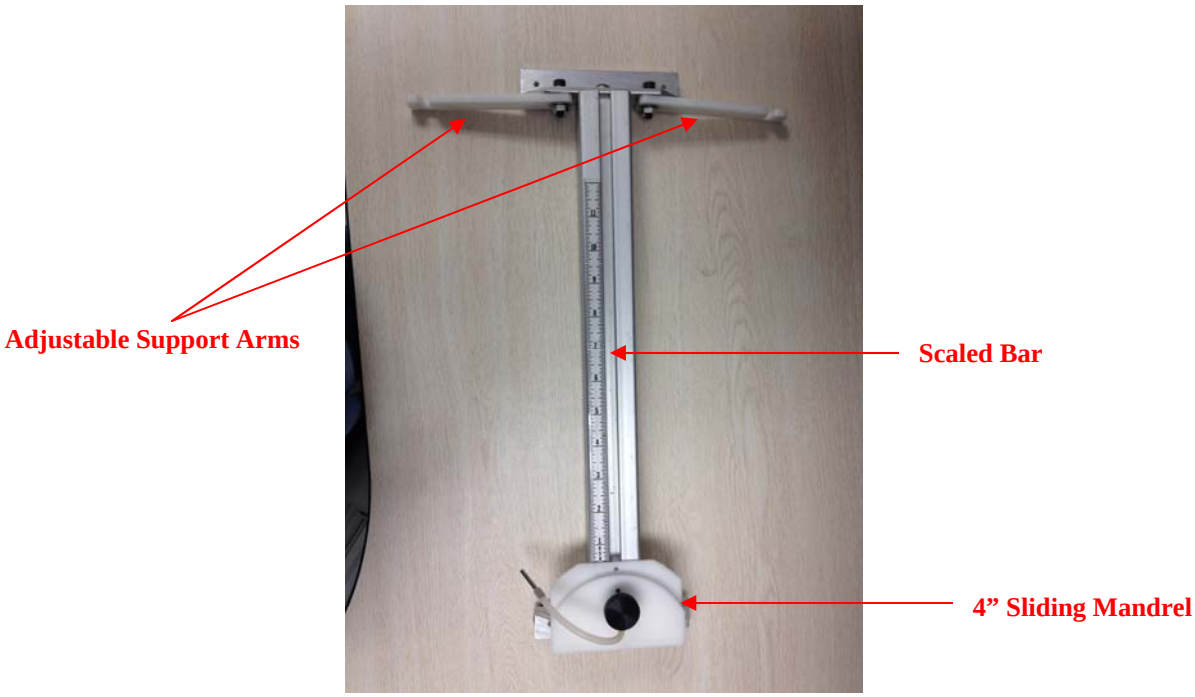

Figure 1: Cable Flexure Test Cable (MCL P/N: B85-L26000-00

2.2 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.

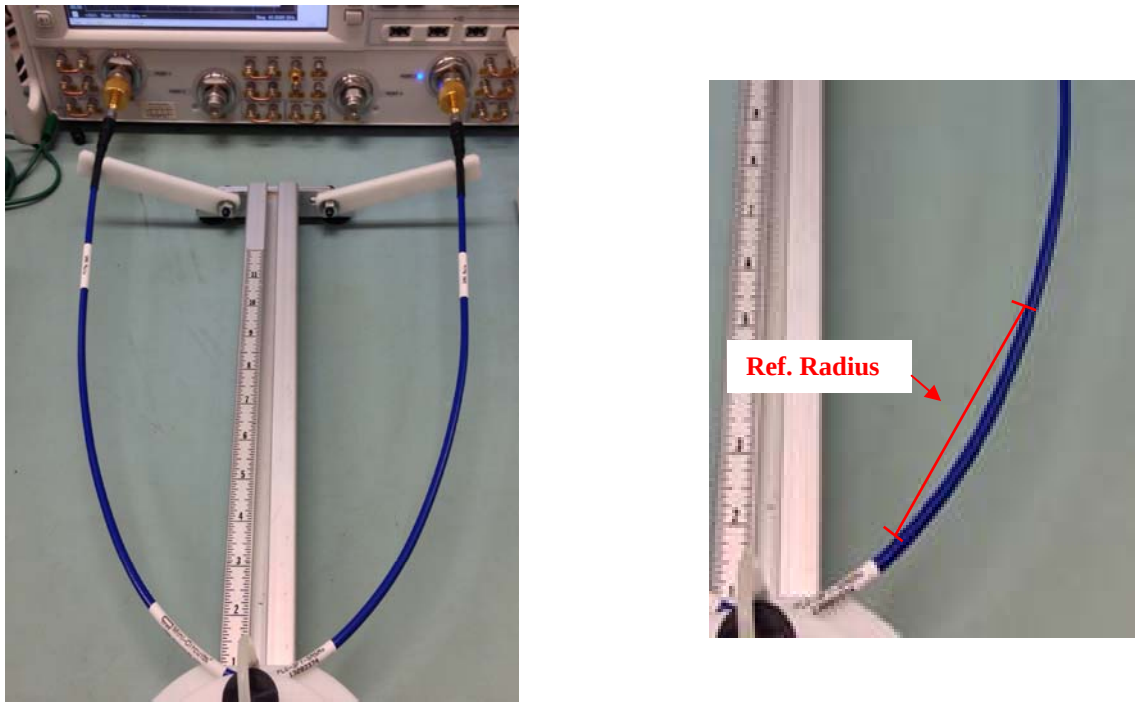

Figure 2: 3ft. Flexible Test Cable attached to the Cable Flexure Test Fixture at its reference start position

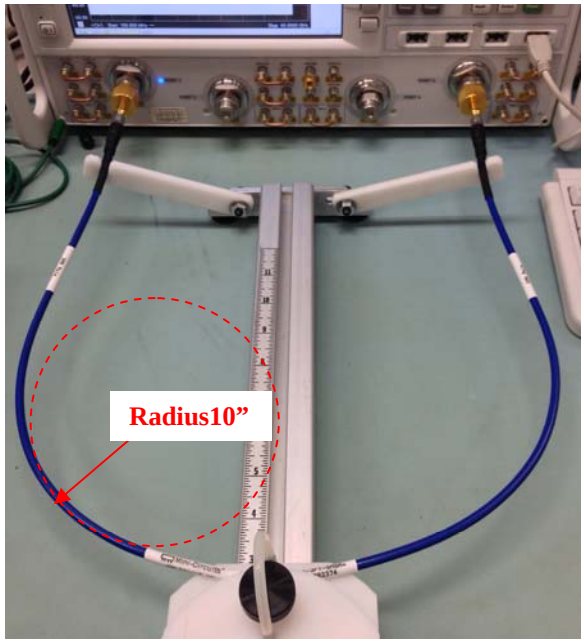

Figure 3: 3ft. Flexible Test Cable with a bend radius of 10”

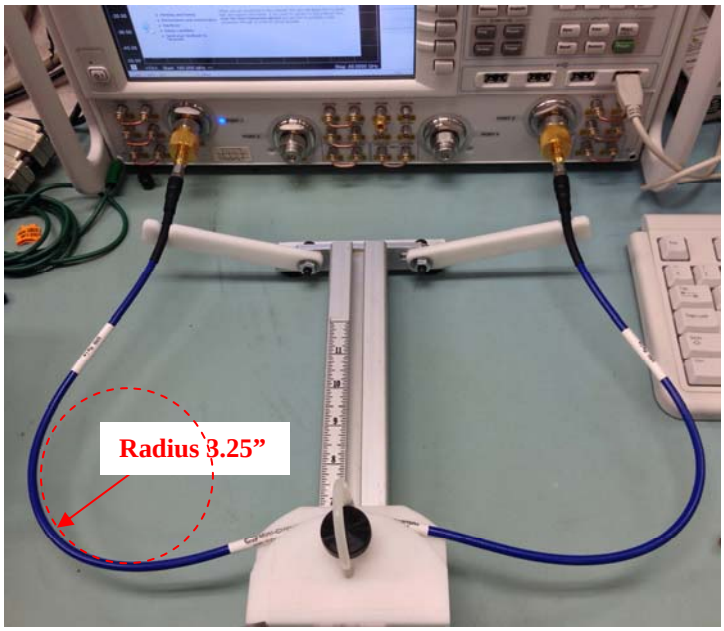

Figure 4: 3ft. Flexible Test Cable with a bend radius of 3.25”

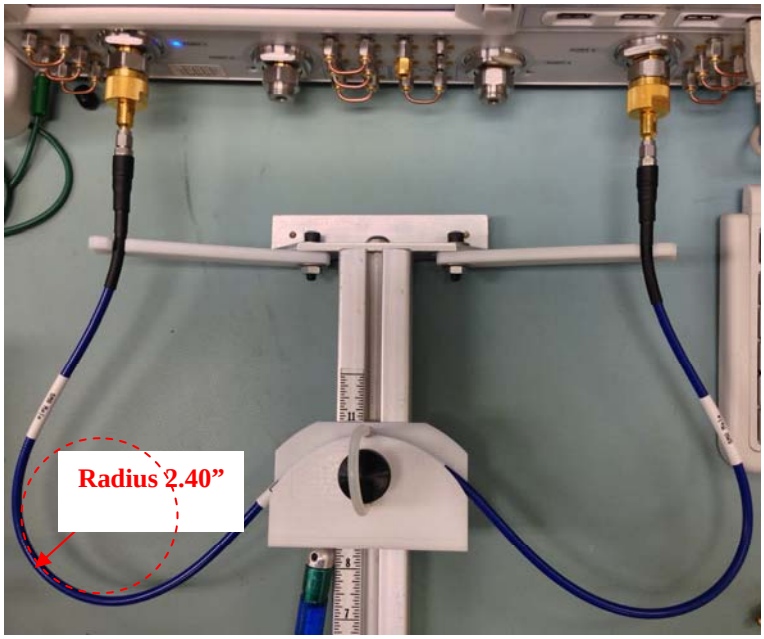

Figure 5: 3ft. Flexible Test Cable with a bend radius of 2.40”

2.3 Performance Change vs. Flexure

Data

Figure 5 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 6-18 18-26	0.00 0.01 0.01	0.01 0.02 0.04	0.01 0.03 0.05	dB
Insertion Phase	DC-6 6-18 18-26	0.03 0.03 0.07	0.49 1.7 2.9	0.09 0.31 1.6	Deg
VSWR	DC-6 6-18 18-26	0.00 0.01 0.01	0.01 0.02 0.08	0.01 0.02 0.11	:1

Figure 6

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

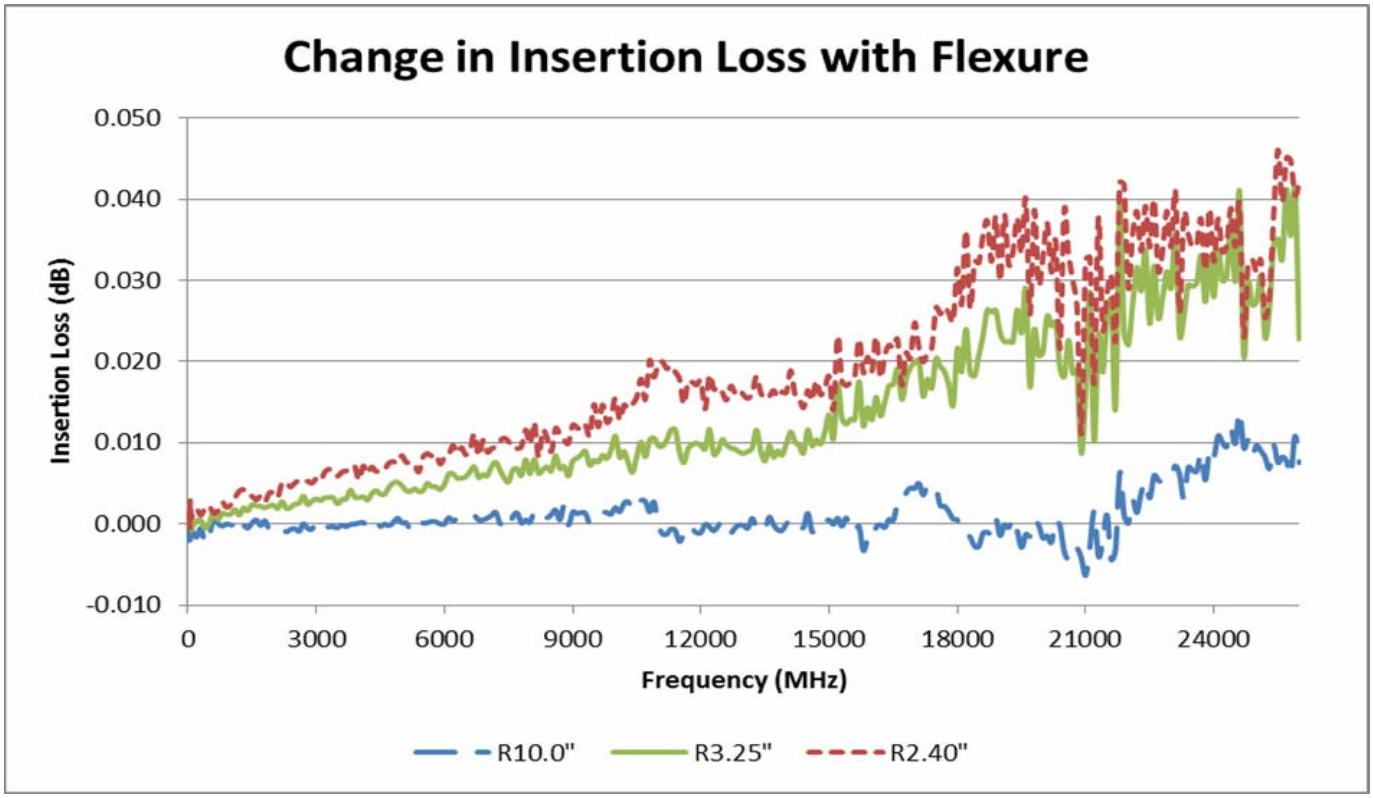

Figure 7: Change in Insertion Loss with flexure in reference to start position

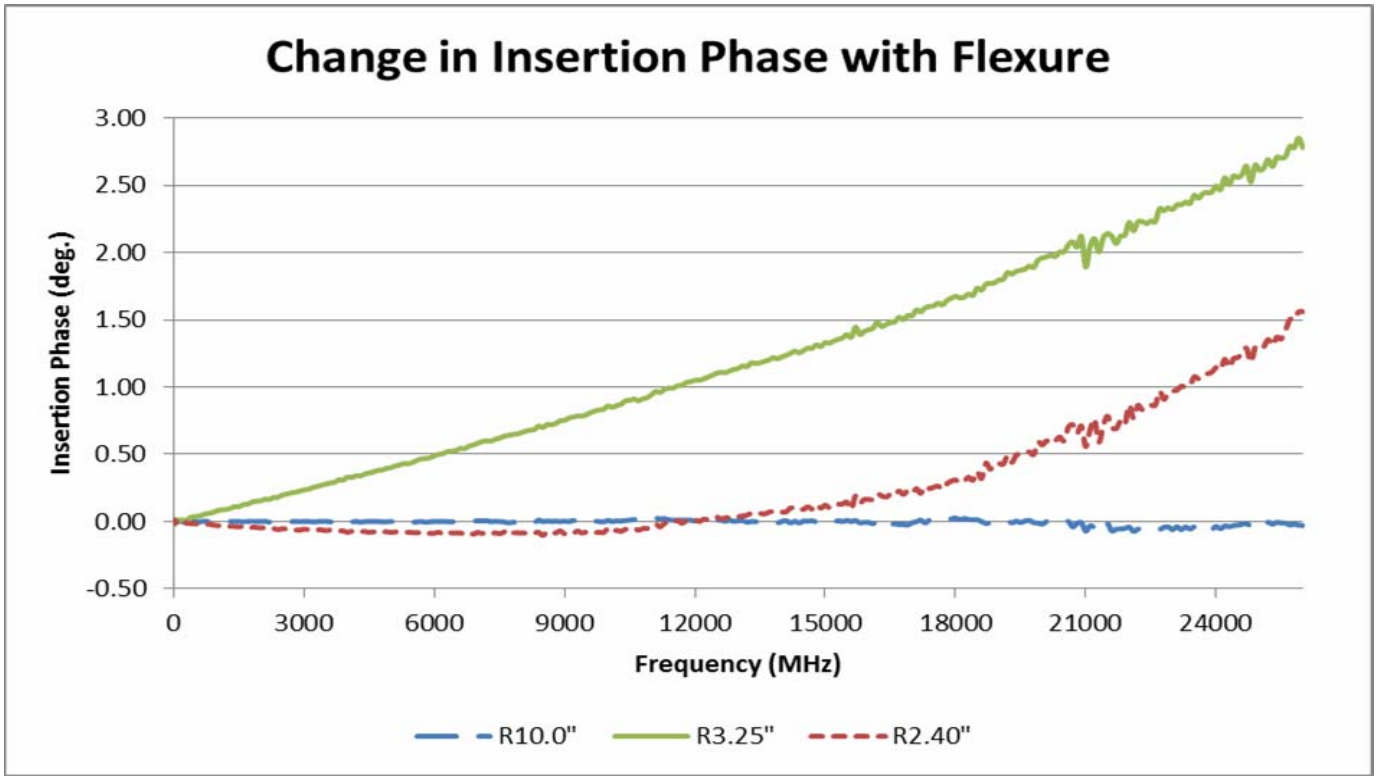

Figure 8: Change in Insertion Phase with flexure in reference to start position

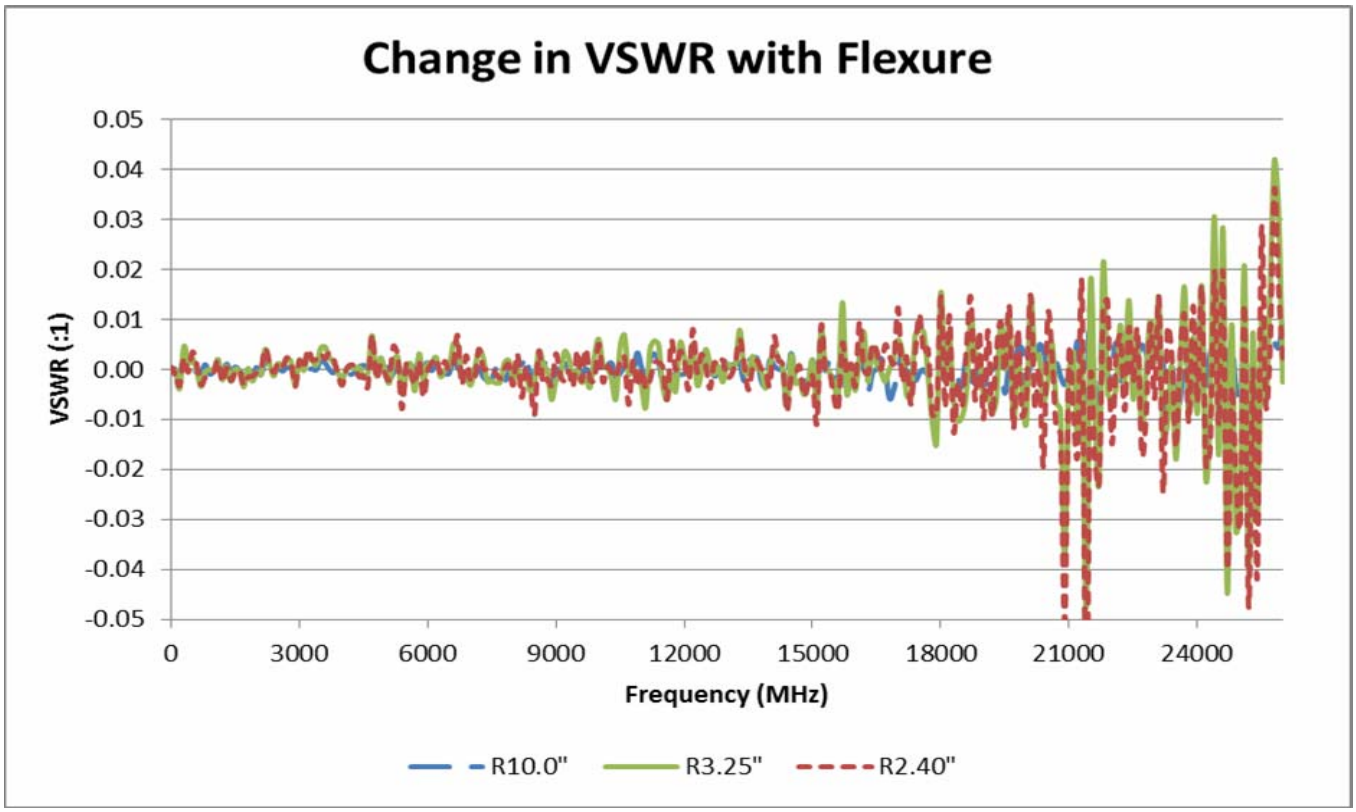

Figure 9: Change in VSWR with flexure in reference to start position

3. 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.