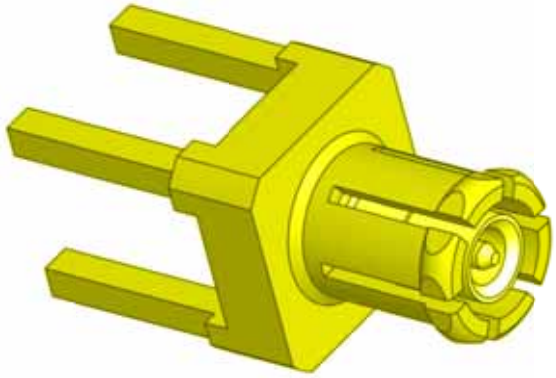
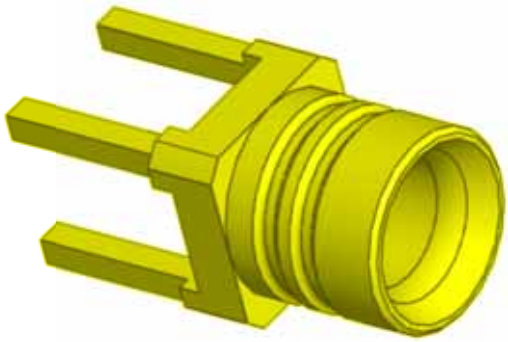
RF Characterization Report

MMCX Plug



Mated with:
MMCX Jack



Description:
50Ω MMCX and MMCXV High-Vibration Board Mount Plugs

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Report Revision: 12/17/2013

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

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Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

MMCX Testing

Introduction

This testing was performed to evaluate the electrical performance of the MMCX Vertical Board Mount Plug. Samtec's MMCX is a 50Ω connector featuring a snap-lock mechanism that enables 360-degree rotation at performance up to 6GHz.

Return Loss, VSWR Insertion Loss and NEXT measurements were made over the frequency range from 300 KHz to 12 GHz for mated pairs of connectors. The measured results include only the mated connectors. The termination and board effects were calibrated out using Automatic Fixture Removal (AFR). See Appendix B.

The actual part number that was tested is shown in Table 1. A representative sample picture is shown in Figure 1.

Part Number	Board Mount Connector Type
MMCX-P-P-H-ST-TH1	Straight PCB mount through-hole plug
MMCX-J-P-H-ST-TH1	Straight PCB mount through-hole jack

Table 1: Sample Description

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

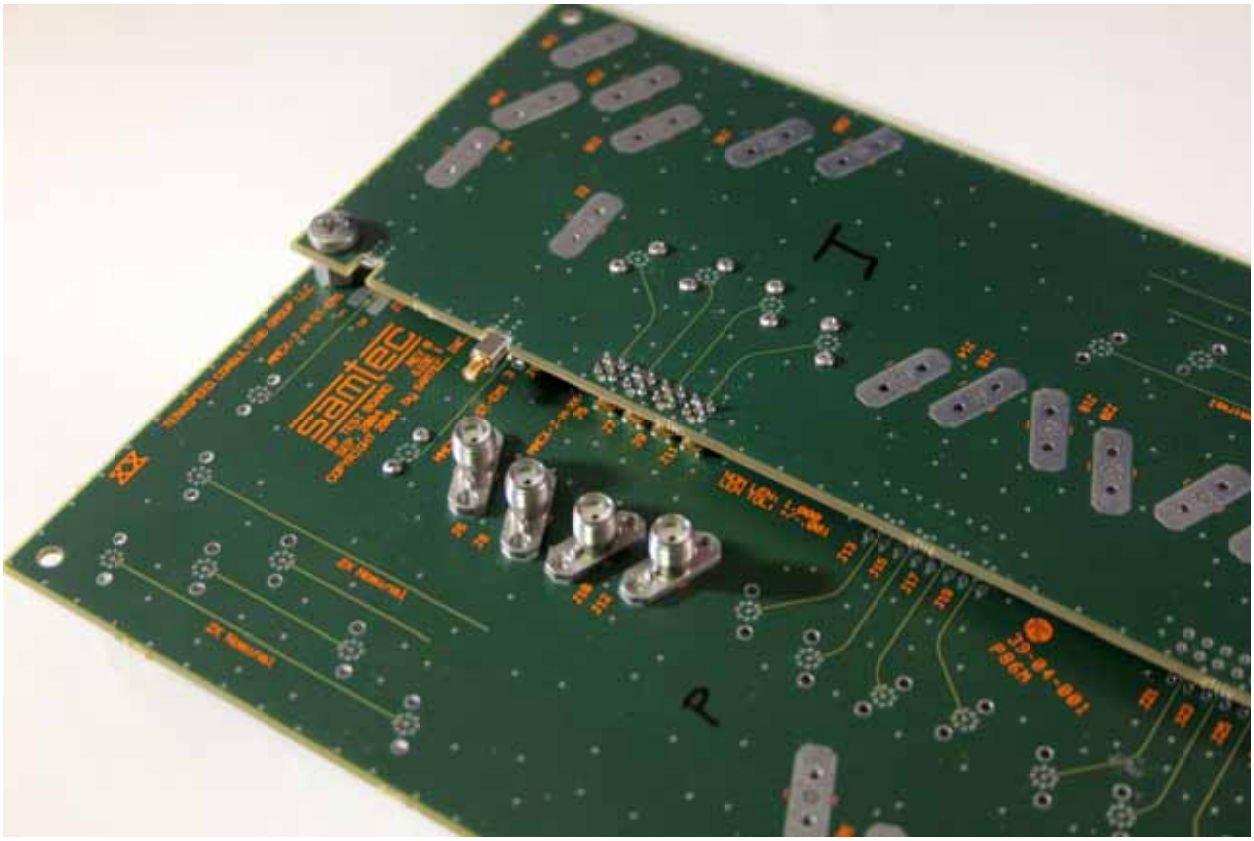


Figure 1: Test Sample Configuration

MMCX Data Summary

Board Mount Connector	Return Loss	VSWR	Insertion Loss	NEXT
MMCX-P-P-H-ST-TH1	-2.3 dB	7.7	-4.7 dB	-35.0 dB

Table 2: MMCX Worst Case RL, VSWR, IL, & NEXT

See Appendix A for details on test setup

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

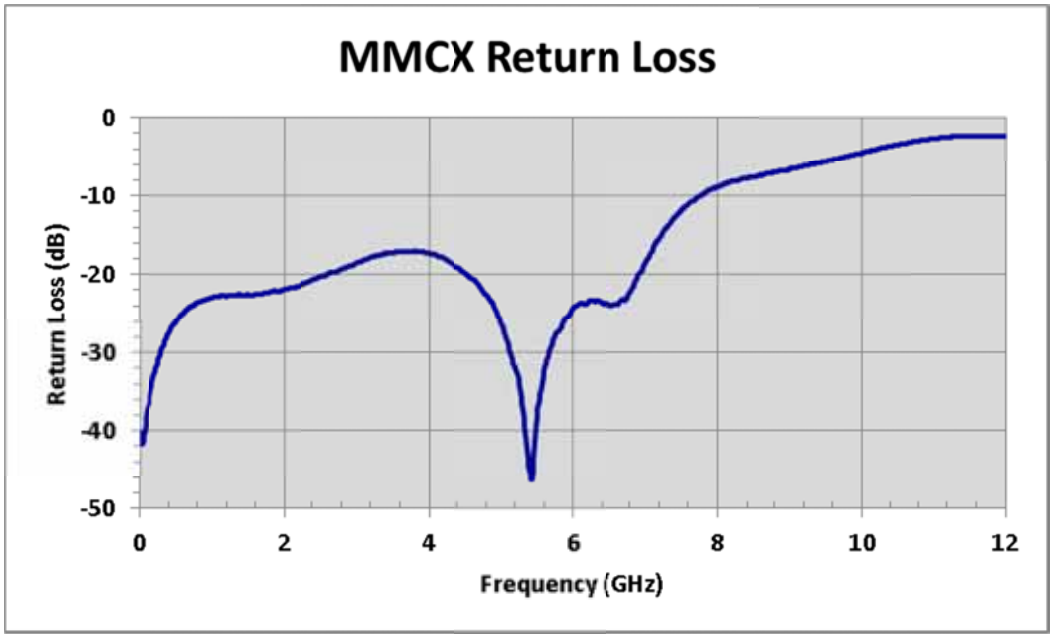


Figure 2: MMCX-P-P-H-ST-TH1 Return Loss

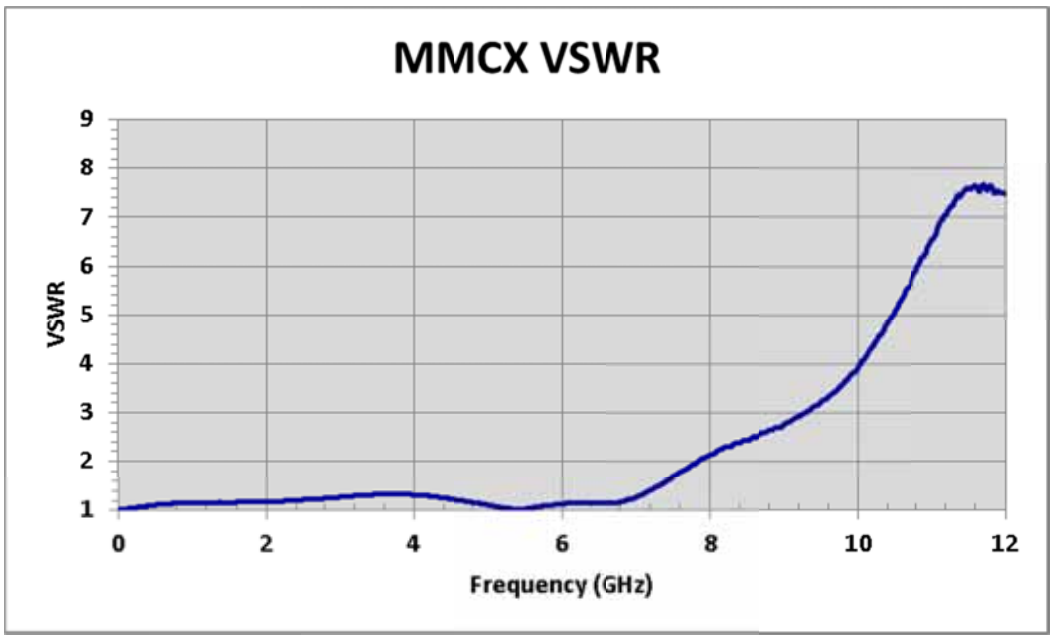


Figure 3: MMCX-P-P-H-ST-TH1 VSWR

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

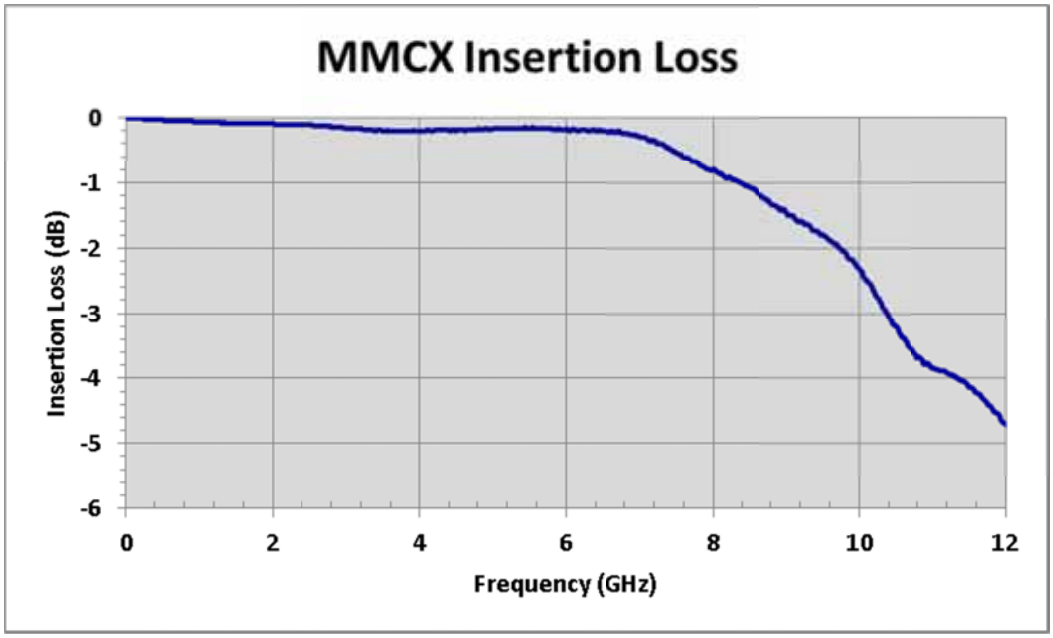


Figure 4: MMCX-P-P-H-ST-TH1 Insertion Loss

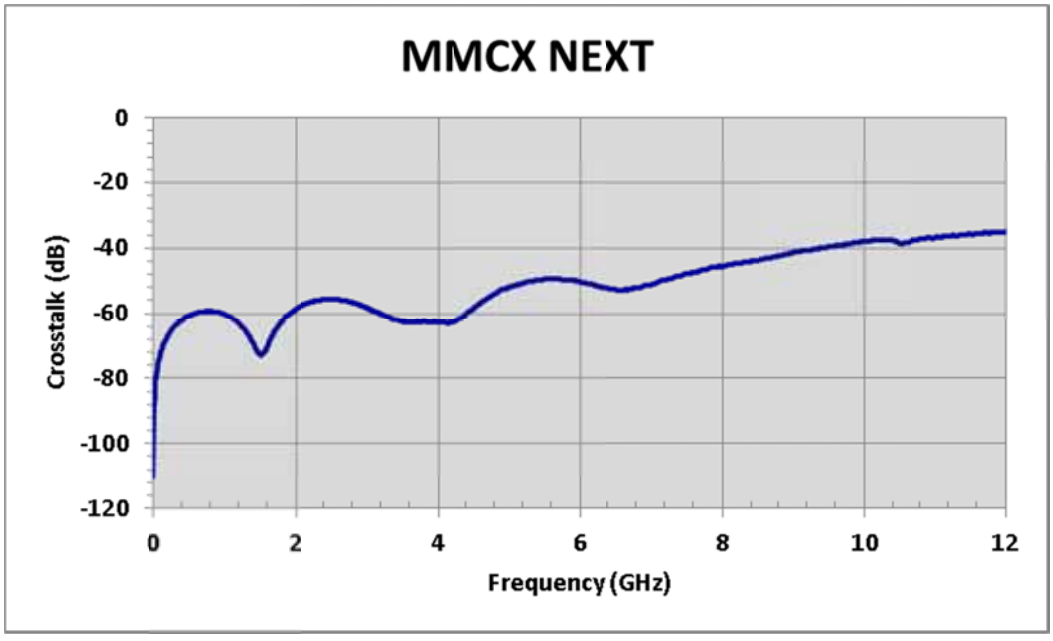


Figure 5: MMCX-P-P-H-ST-TH1 NEXT

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

MMCXV Testing

Introduction

This testing was performed to evaluate the electrical performance of the MMCXV High-Vibration Vertical Board Mount Plug. Samtec's MMCXV is a high-vibration version of the MMCX 50Ω connector.

Return Loss, VSWR Insertion Loss and NEXT measurements were made over the frequency range from 300 KHz to 12 GHz for mated pairs of connectors. The measured results include only the mated connectors. The termination and board effects were calibrated out using Automatic Fixture Removal (AFR). See Appendix B.

The actual part number that was tested is shown in Table 3. A representative sample picture is shown in Figure 6.

Part Number	Board Mount Connector Type
MMCXV-P-P-H-ST-TH1	Straight PCB mount through-hole high-vibration plug
MMCX-J-P-H-ST-TH1	Straight PCB mount through-hole jack

Table 3: Sample Description

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

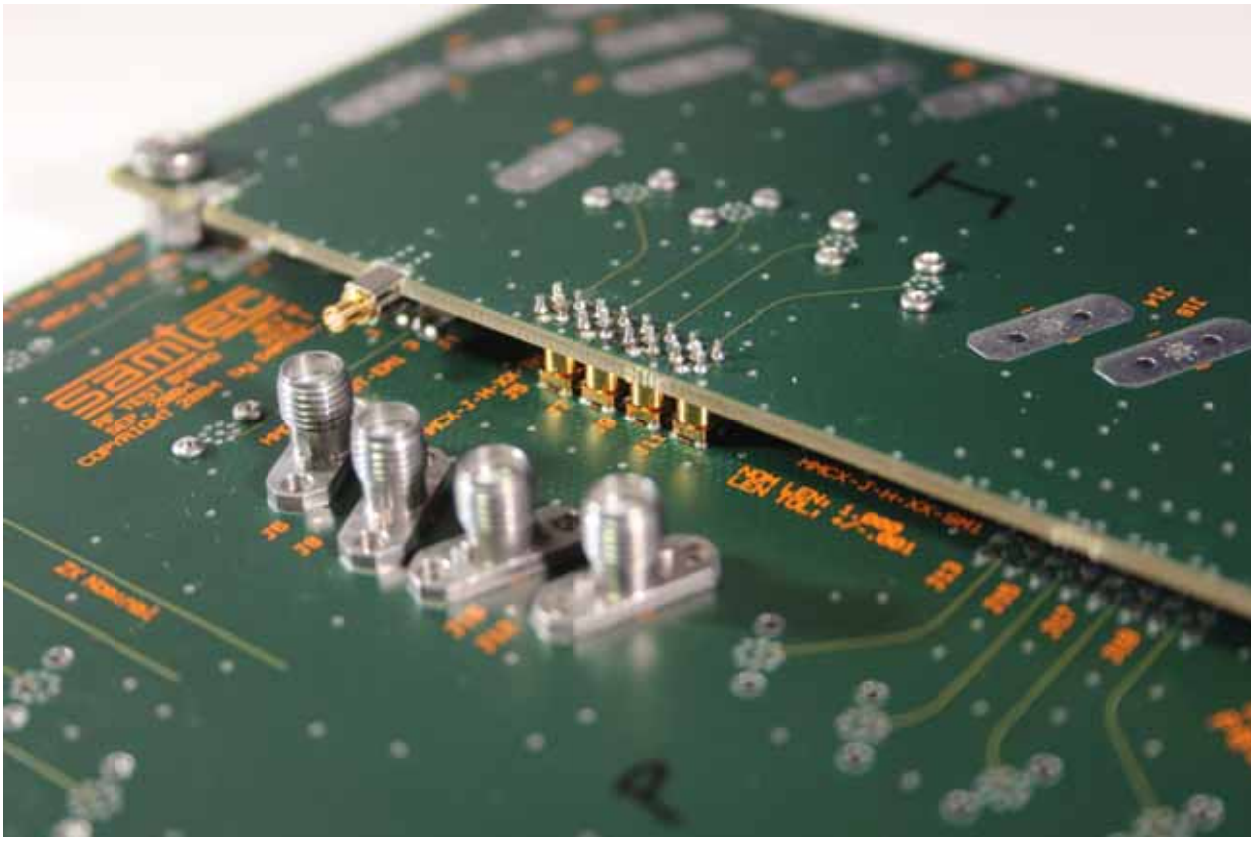


Figure 6: Test Sample Configuration

MMCXV Data Summary

Board Mount Connector	Return Loss	VSWR	Insertion Loss	NEXT
MMCXV-P-P-H-ST-TH1	-3.0 dB	5.9	-3.5 dB	-35.7 dB

Table 4: MMCXV Worst Case RL, VSWR, IL & NEXT

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

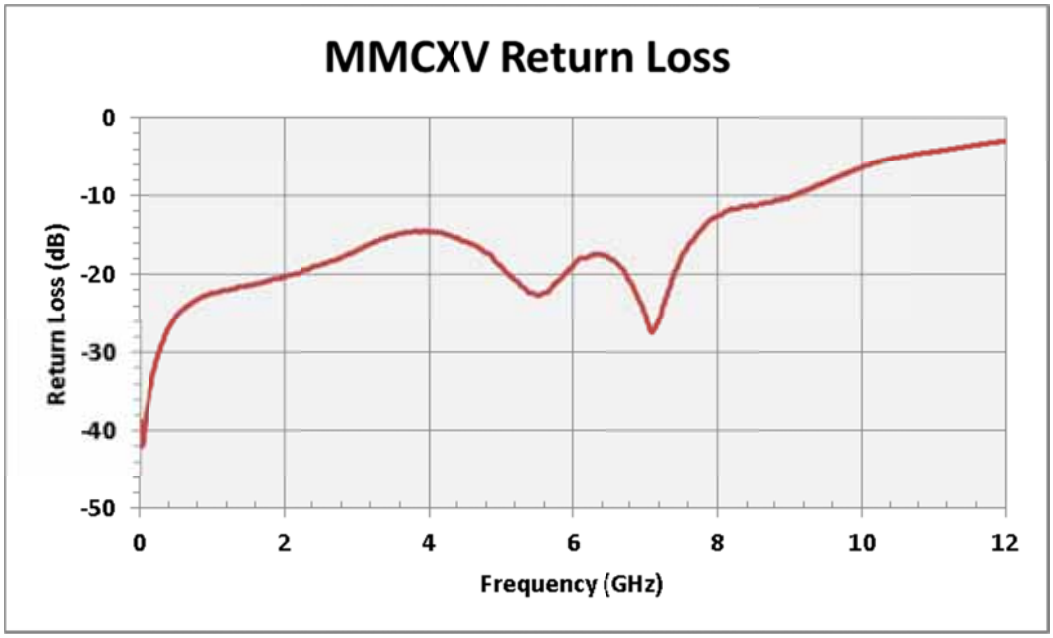


Figure 7: MMCXV-P-P-H-ST-TH1 Return Loss

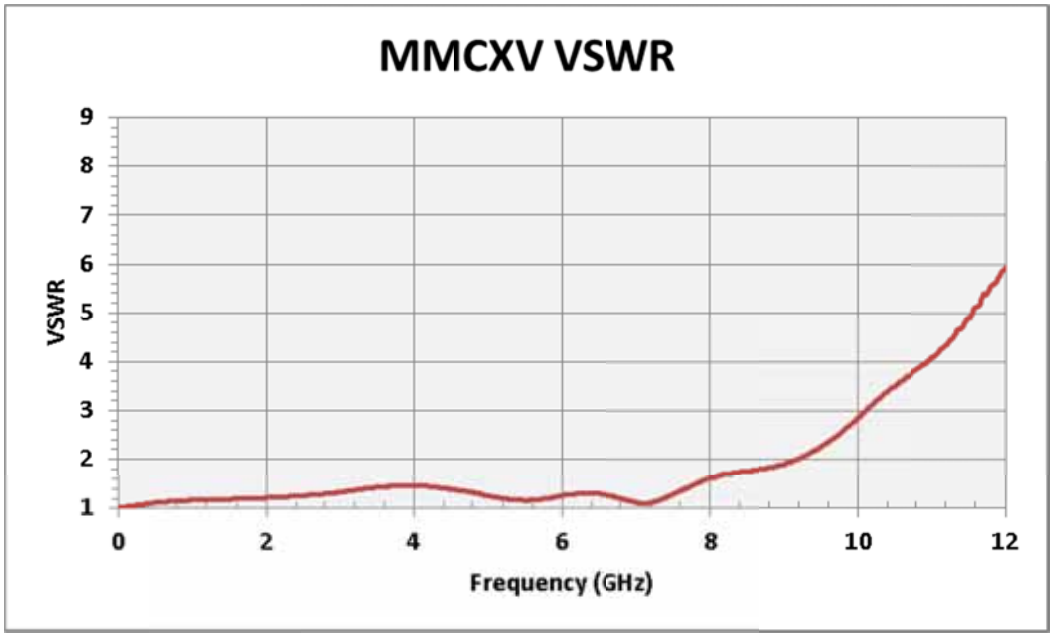


Figure 8: MMCXV-P-P-H-ST-TH1 VSWR

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

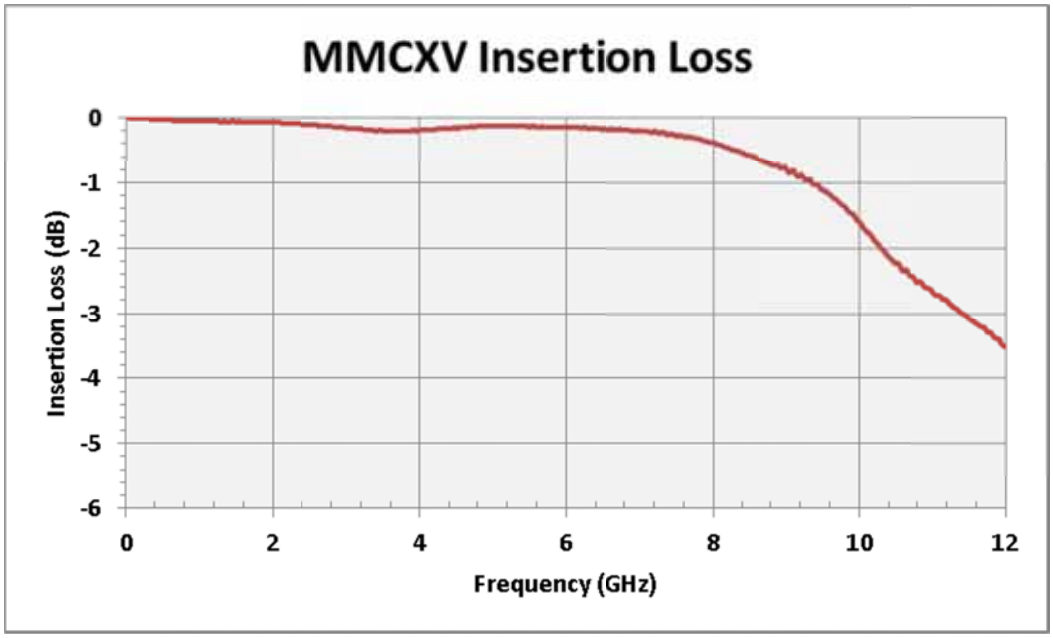


Figure 9: MMCXV-P-P-H-ST-TH1 Insertion Loss

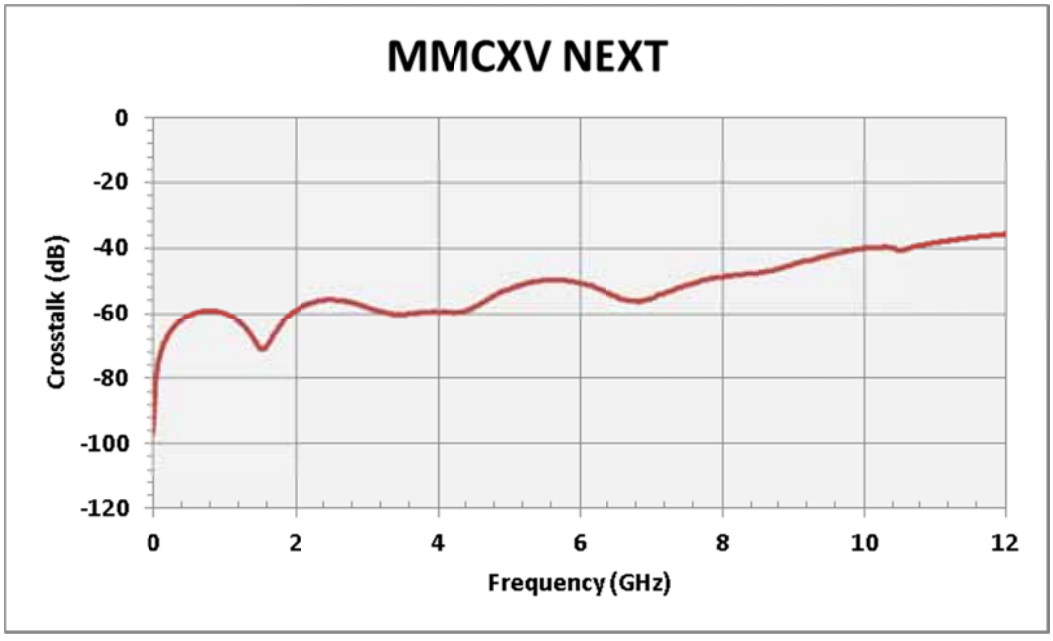


Figure 10: MMCXV-P-P-H-ST-TH1 Isolation

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

MMCX vs. MMCXV Comparison

Introduction

The electrical performance of the MMCX 50Ω Board Mount Plug was compared to the electrical performance of the MMCXV 50Ω High-Vibration Board Mount Plug.

Return Loss, VSWR and Insertion Loss and NEXT measurements were compared over the frequency range from 300 KHz to 12 GHz for mated pairs of connectors. The measured results include only the mated connectors. The termination and board effects were calibrated out using Automatic Fixture Removal (AFR). See Appendix B.

The actual part numbers tested are shown in Table 5. A representative sample picture is shown in Figure 11.

Part Number	Board Mount Connector Type
MMCX-P-P-H-ST-TH1	Straight PCB mount through-hole plug
MMCXV-P-P-H-ST-TH1	Straight PCB mount through-hole high-vibration plug
MMCX-J-P-H-ST-TH1	Straight PCB mount through-hole jack

Table 5: Sample Description

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

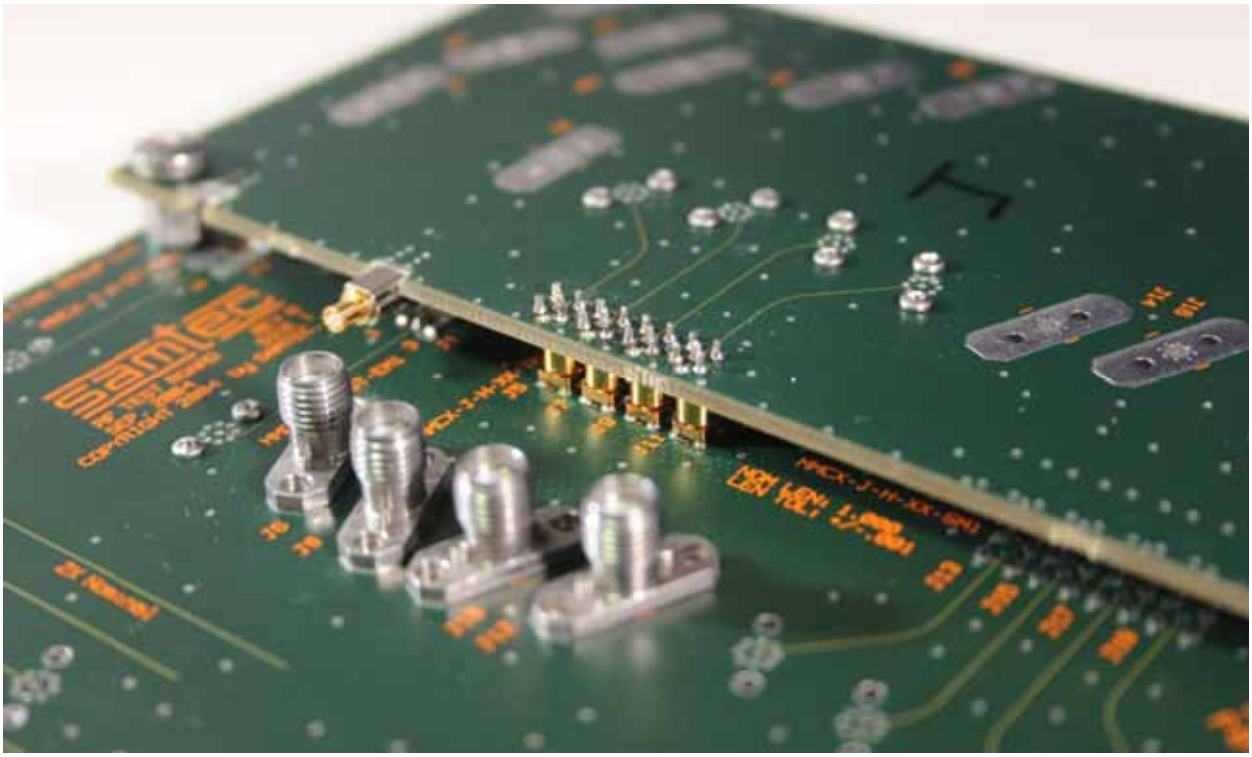


Figure 11: Test Sample Configuration

MMCX vs MMCXV Data Comparison

Worst Case Comparison

	RL	VSWR	IL	Isolation
MMCX	-2.3 dB	7.7	-4.7 dB	-35.0 dB
MMCXV	-3.0 dB	5.9	-3.5 dB	-35.7 dB
Difference	0.7 dB better	1.8 better	1.2 dB better	0.7 dB better

Average Comparison

	RL	VSWR	IL	Isolation
MMCX	-16.3 dB	2.3	-1.0 dB	-51.0 dB
MMCXV	-15.6 dB	1.9	-0.7 dB	-52.0 dB
Difference	0.7 dB worse	0.5 better	0.3 dB better	1.0 dB better

Table 6: Return Loss, VSWR & Isolation Data Comparison

The MMCXV performs comparably to the standard MMCX. In most cases, the performance is the same or better.

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

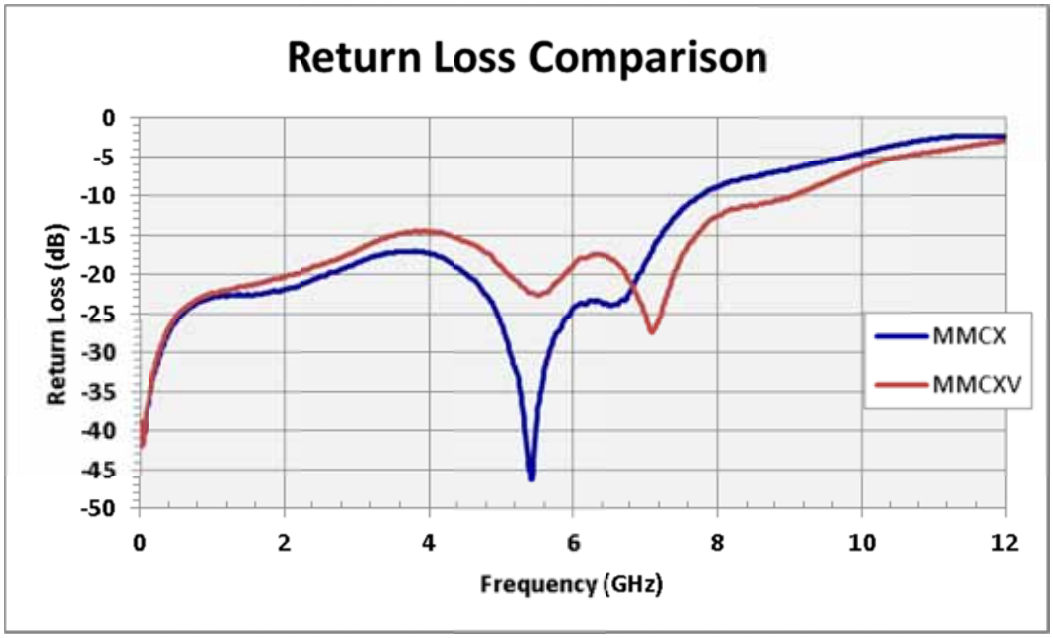


Figure 12: MMCX vs. MMCXV Return Loss

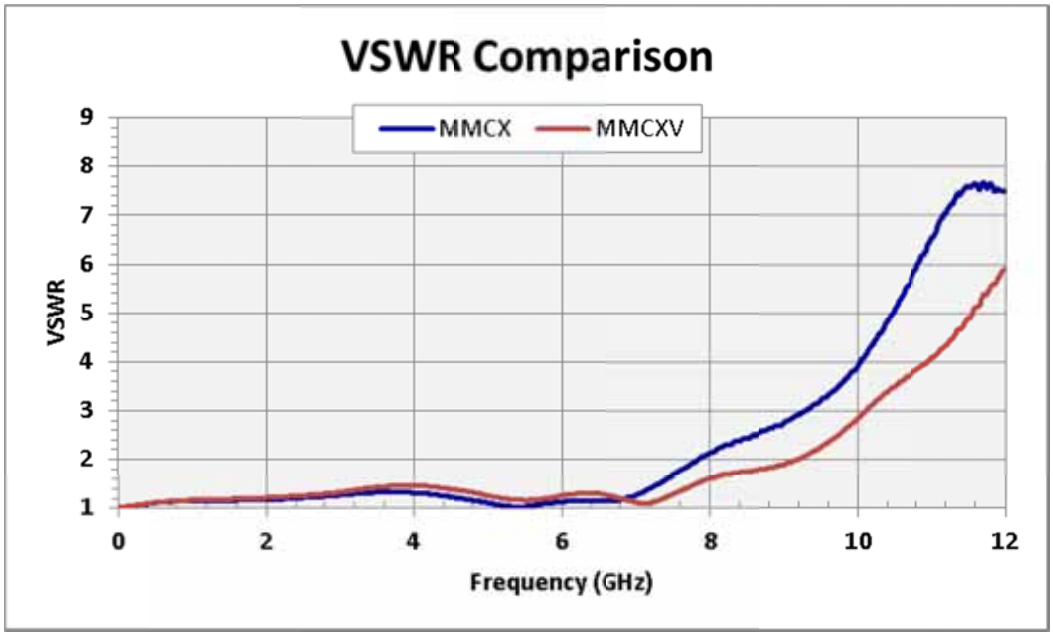


Figure 13: MMCX vs. MMCXV VSWR

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

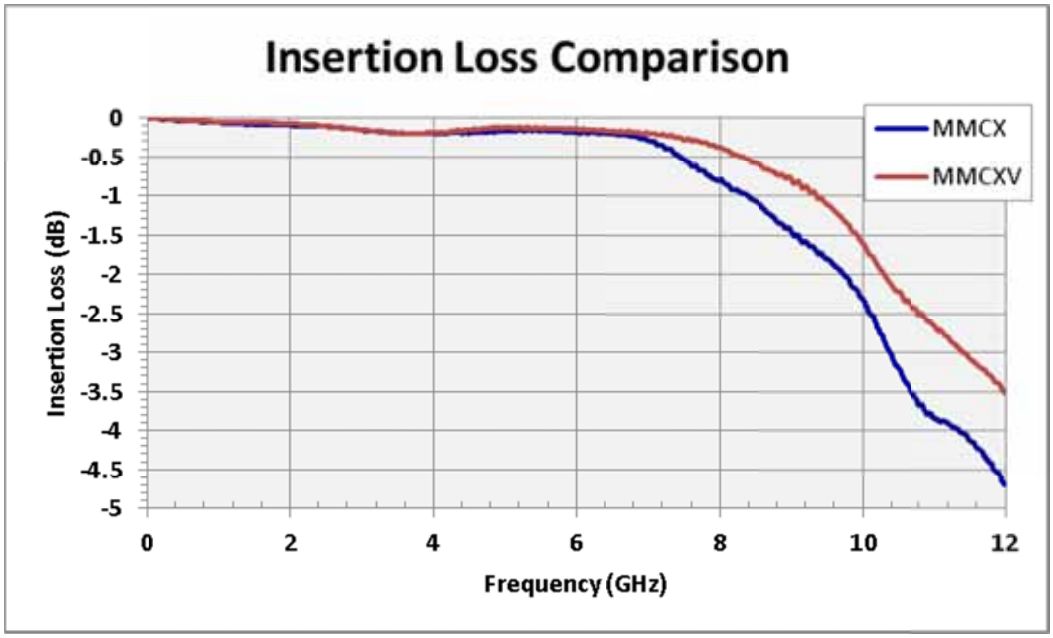


Figure 14: MMCX vs. MMCXV Insertion Loss

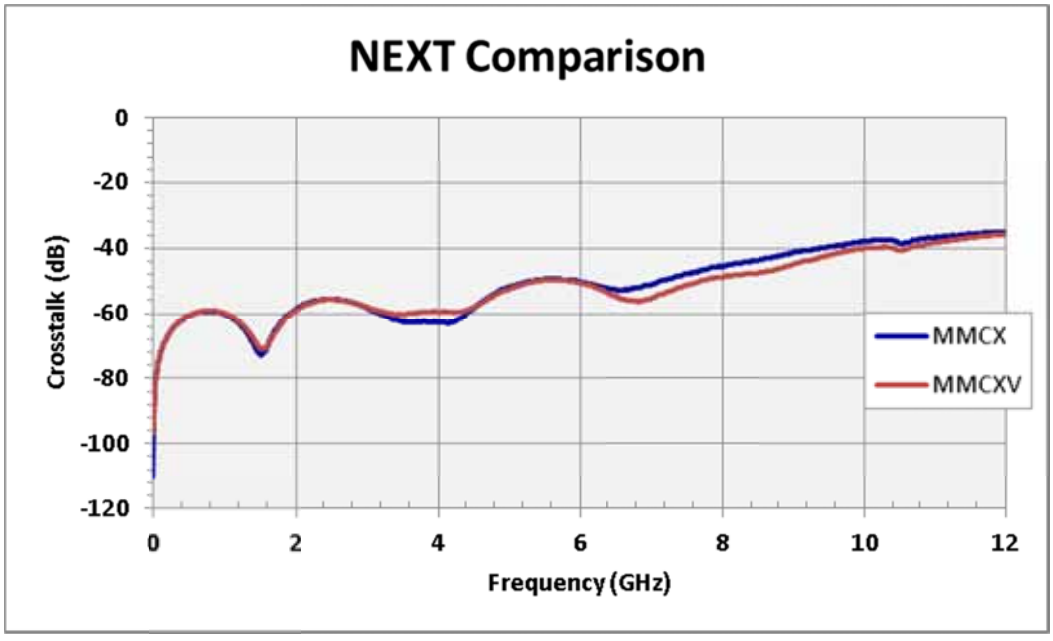


Figure 15: MMCX vs. MMCXV NEXT

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

Appendix A: Characterization Details

Fixturing

All measurements were performed using the test board set, which has 50-Ω traces (nominal impedance) that connect the MMCX connectors to field replaceable SMA connectors. A row of four adjacent MMCX plugs on 5mm (196.9mil) centers were mated to MMCX jacks. The center pair was connected to an Agilent PNA-L N5230C 4-port network analyzer. The outer SMA jacks were terminated in 50Ω.

After characterization, the MMCX plugs were unsoldered from the test board and replaced with MMCXV plugs. The MMCXV plugs were then characterized the same way.

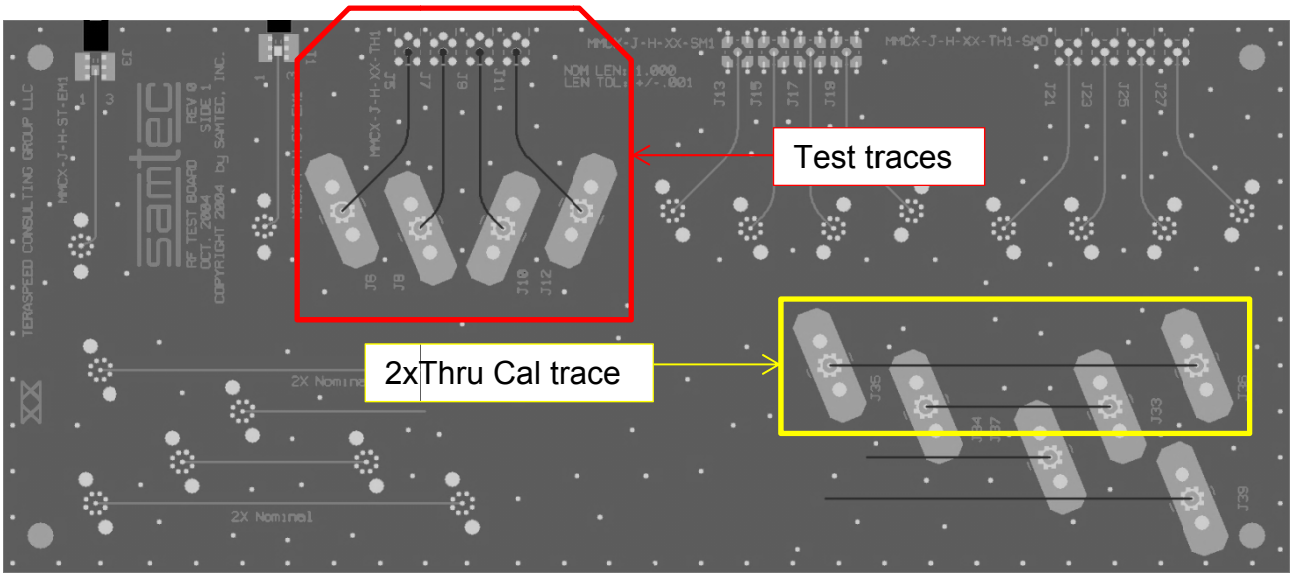


Figure 16: Test PCB

Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

Frequency (S-Parameter) Domain Procedures

All measurements were made using an Agilent PNA-L N5230C vector network analyzer. It was set for a 1601-point measurement response over the frequency range from 300 KHz to 20 GHz. Response averaging was turned off. The IF bandwidth was set to 1 KHz. A full 4-port calibration was performed at the end of the SMA test cables with an N4433A E-Cal module.

The test fixture response was removed in Agilent PLTS 2013 using Automatic Fixture Removal (AFR). Through calibration traces were measured for each test board. The Through traces are twice the length of the test traces. This places the reference plane inside the middle of the MMCX center pin. The Agilent AFR routine mathematically de-embeds the response of the test cables, the field replaceable SMAs, and the test board. The de-embedded data from 300 KHz to 12 GHz was exported. The effects of placing the reference plane inside the MMCX connectors are not accounted for and are a small source of error.

For more details on AFR, see Appendix B.

Equipment

Agilent PNA-L N5230C Network Analyzer

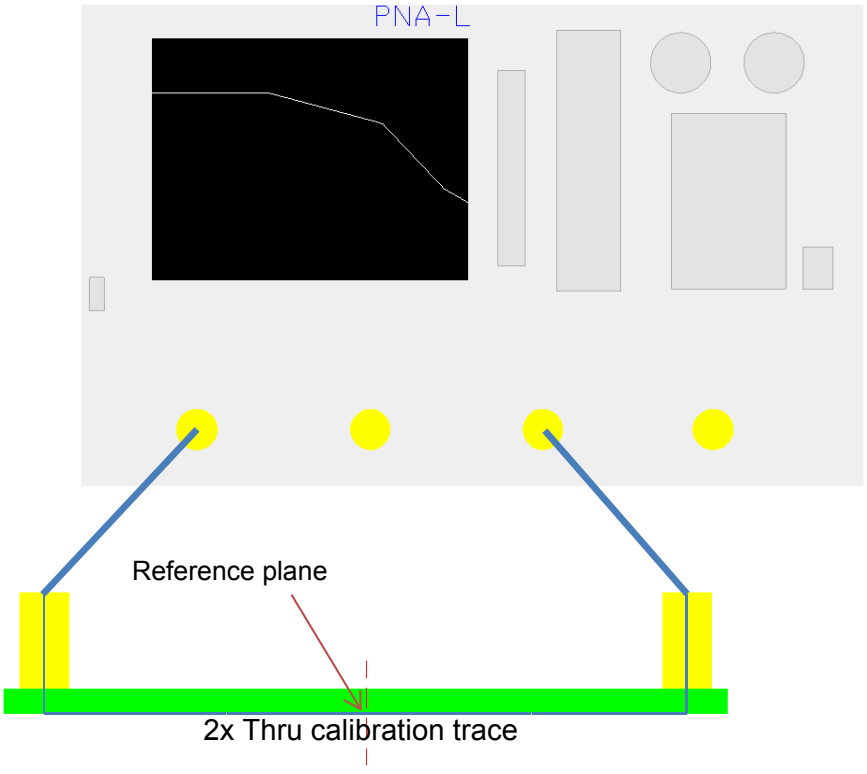
Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

Appendix B: Automatic Fixture Removal (AFR)

The quality of any data taken with a network analyzer is directly related to the quality of the calibration standards and the use of proper test procedures. For this reason, extreme care is taken in the design of the AFR calibration standards, the SI test boards, and the selection of the PCB vendor.

The measurement process begins with a measurement of the AFR calibration standards. A coaxial SOLT calibration is performed using an N4433A E-cal module. This measurement is required in order to obtain precise values of the line standard offset delay and frequency bandwidths. Measurements of the 2x through line standard can be used to determine the maximum frequency for which the calibration standards are valid. For these test boards, this is greater than 20 GHz.

The figure below shows how the THRU reference traces are utilized to compensate for the losses due to the coaxial test cables and the test fixture during testing. The calibration board is characterized to obtain parameters required to define the 2x Thru.



Series: MMCX
Description: 50Ω MMCX Board Mount Plug, MMCXV High-Vibration Board Mount Plug

Measurements are then performed using the test boards as shown below. The test board effects are removed in post-processing via AFR in Agilent PLTS. The calibrated reference plane is usually located 10 mils from the connector footprint on each side. The S-Parameter measurements include:

A. Test board vias, pads (footprint effects) for the MMCX series plug
B. The MMCX series plug
C. The MMCX series jack
D. Test board vias, pads (footprint effects) for the MMCX series jack

The figure below shows the location of the measurement reference plane.