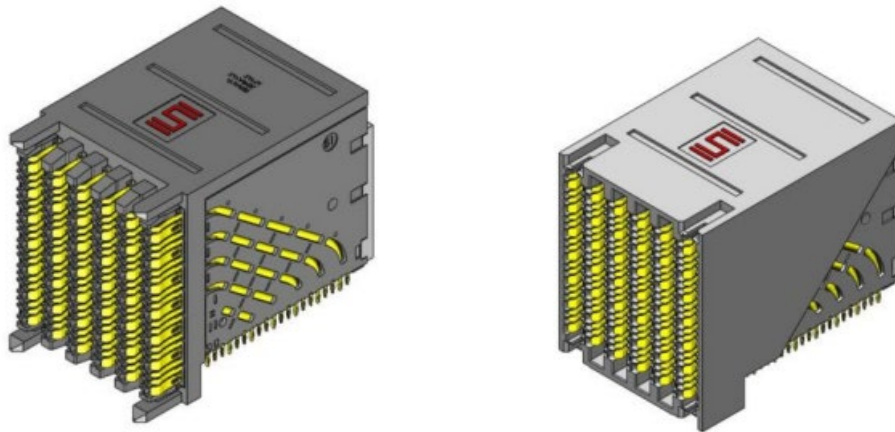




High Speed Characterization Report ExaMAX® Second Source Verification Report

Samtec
EBTM-6-12-2.0-S-RA-1
EBTF-6-12-2.0-S-RA-1

Amphenol ICC
10124560-101LF
10131766-101LF



Description:
**Performance Comparison of Samtec and Amphenol ICC
ExaMAX® 6 Pair High Speed Backplane Interconnect
Right-Angle Header mating to Right-Angle Receptacle,
Standard Coplanar Configuration (Pin A1 to Pin A1)**

Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Table of Contents

Connector Overview.....	1
Frequency Domain Responses	2
Differential Insertion Loss (IL).....	2
Differential Return Loss (RL)	8
Differential Near End Crosstalk (NEXT) from Backplane Right-Angle Header	14
Differential Near End Crosstalk (NEXT) from Right Angle(RA) Receptacle.....	19
Differential Far End Crosstalk (FEXT)	24
Appendix A – Product and Test System Descriptions	29
Product Description	29
Appendix B – Test and Measurement Setup.....	30
N5225B Measurement Setup	30
Test Instruments.....	30
Test Cables & Adapters.....	30
Appendix C - Frequency Domain Measurements.....	31
Frequency (S-Parameter) Domain Procedures	31
Appendix D – Glossary of Terms	31

Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Connector Overview

Samtec is a second source to Amphenol ICC’s ExaMAX® 2mm high speed backplane connector. The Samtec EBTx features an EBTM-RA series right-angle header mated to an EBTF-RA series right-angle receptacle. At the time of testing, the EBTx connectors are available in 4-pair and 6-pair; 6, 8, 10, and 12 column designs. The data in this report is applicable to the 6-pair option.

Since Samtec and Amphenol ICC’s ExaMAX® connectors are being compared for equivalence, both series were tested in different mating combinations. For the purposes of data labeling:

- The Samtec EBTM-6-12-2.0-S-RA-1 will be referred to as “Samtec EBTM-RA”.
- The Samtec EBTF-6-12-2.0-S-RA-1 will be referred to as “Samtec EBTF-RA”.
- The Amphenol ICC 10124560-101LF will be referred to as “AFCI EBTM-RA”.
- The Amphenol ICC 10131766-101LF will be referred to as “AFCI EBTF-RA”.

Footprint and the pairs tested on the DUT are shown in the figure below. The pairs shown in the data below were selected to represent behavior of pairs in various wafers, and various positions in a wafer. For any inquiries about the DUT or test plan, please contact sig@samtec.com.

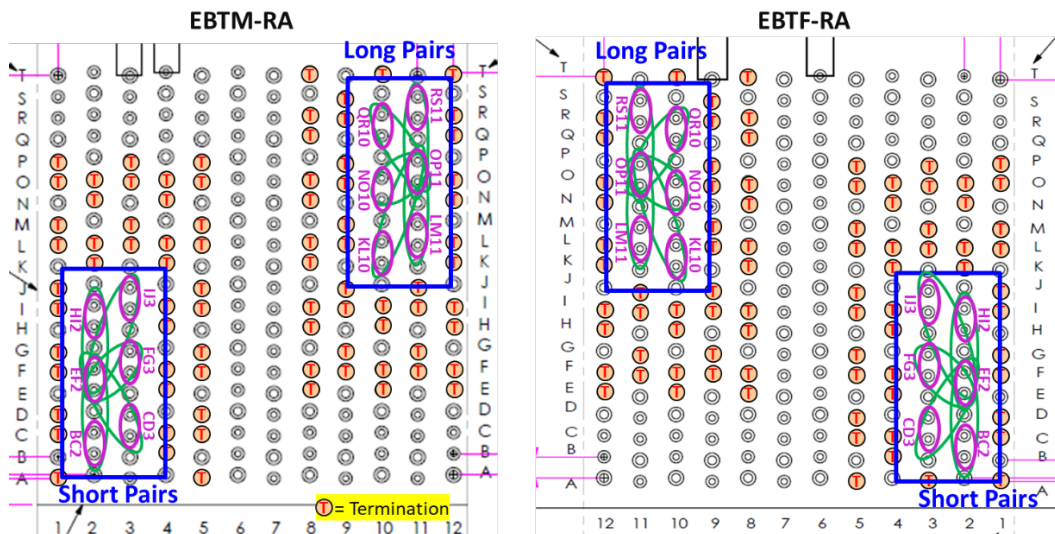


Figure 1: Footprint and Pairs Under Test in 6-Pairs/12-Columns ExaMAX RA mating to RA

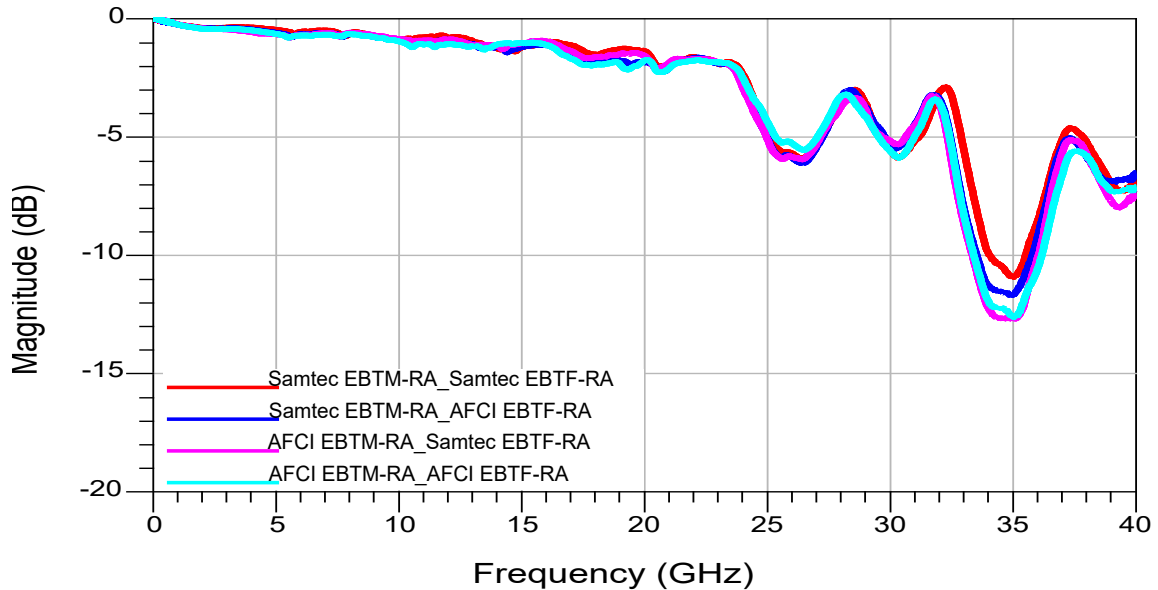
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

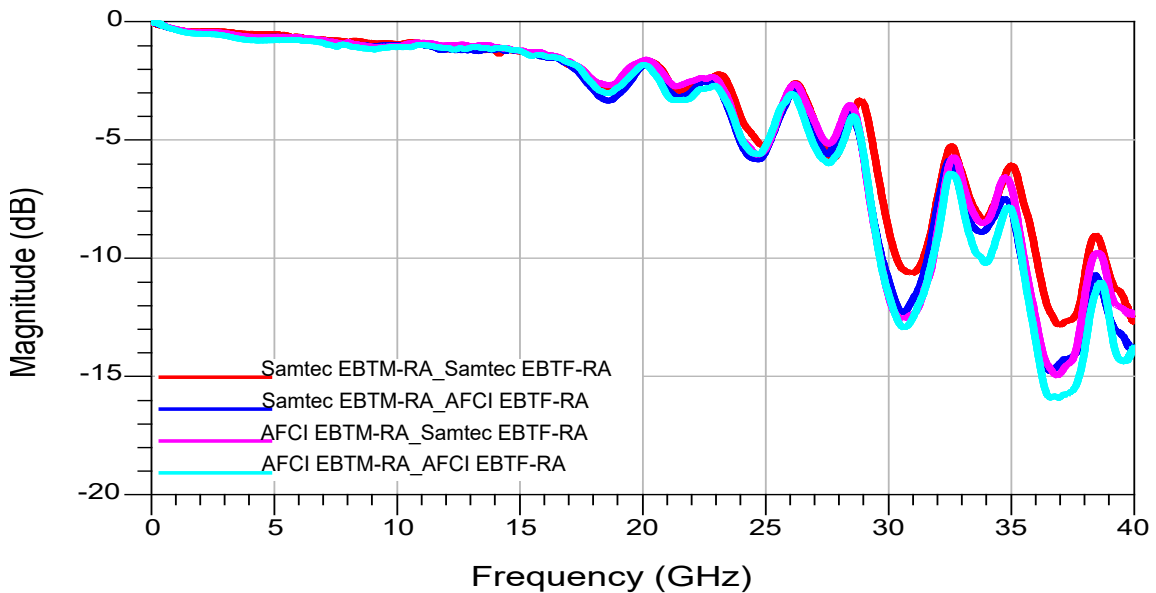
Frequency Domain Responses

Differential Insertion Loss (IL)

Differential IL: Pair B2-C2

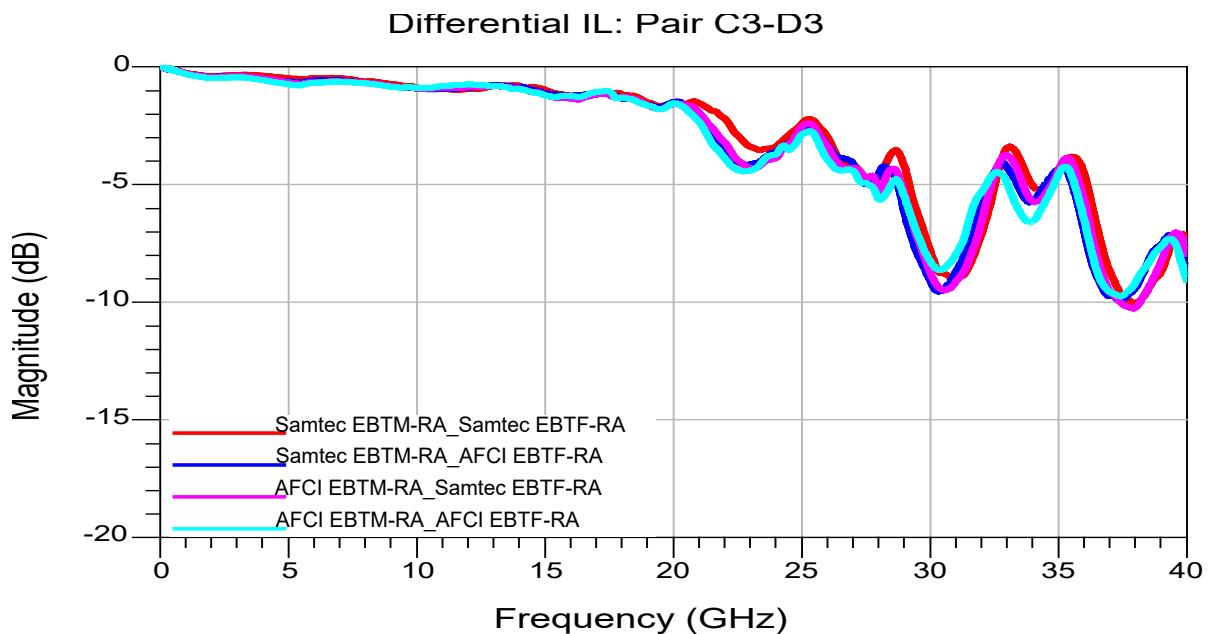
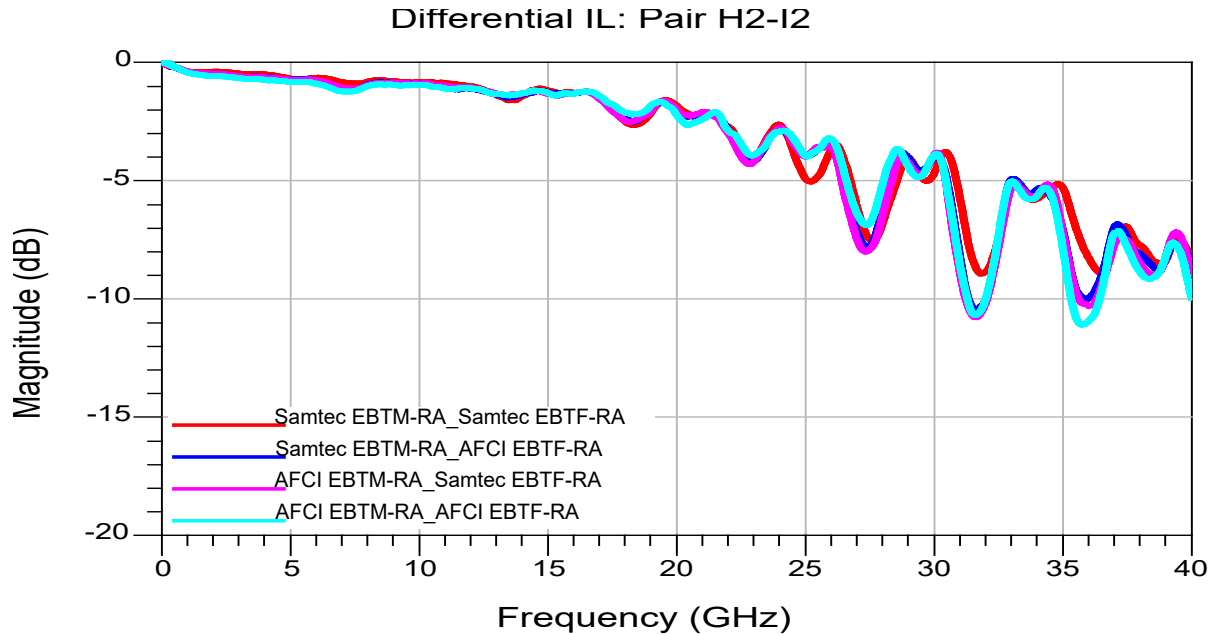


Differential IL: Pair E2-F2



Series: EBTM-RA / EBTF-RA

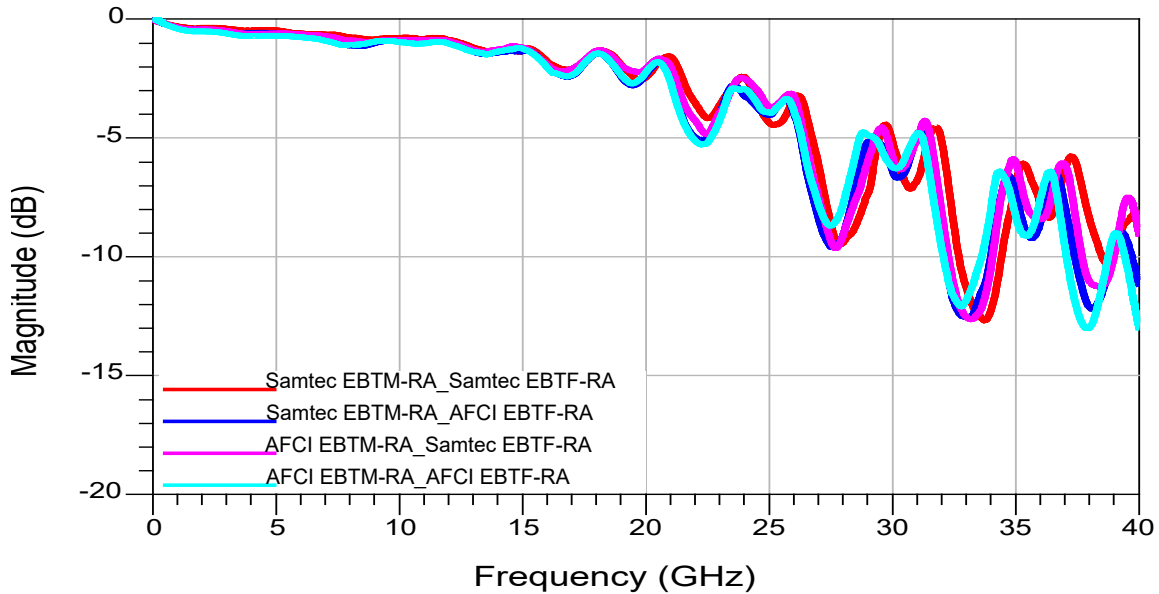
Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)



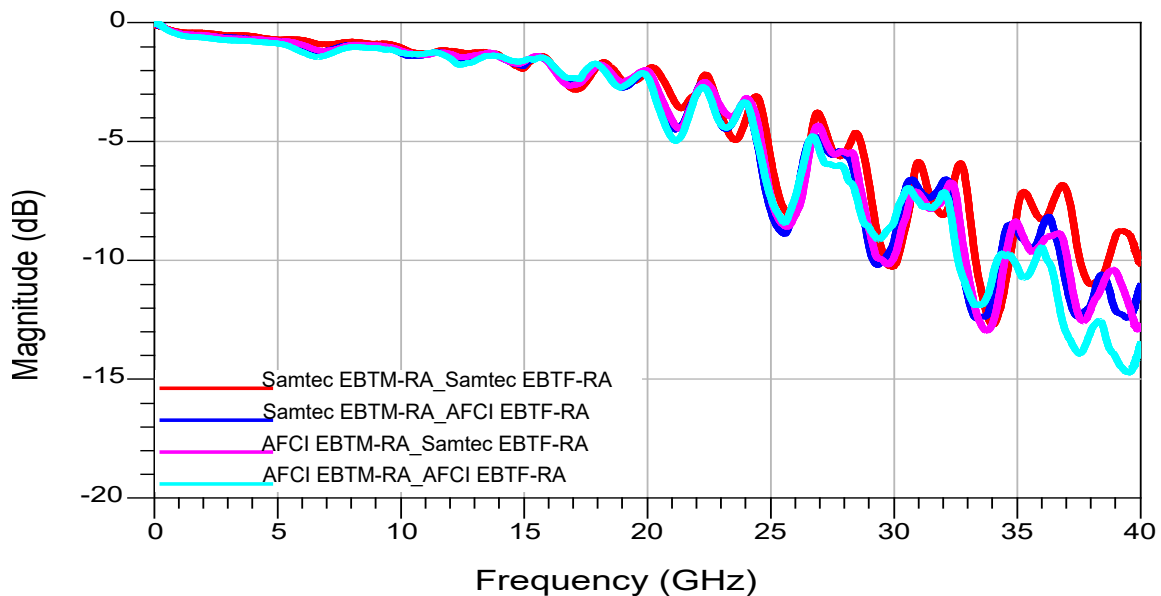
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential IL: Pair F3-G3



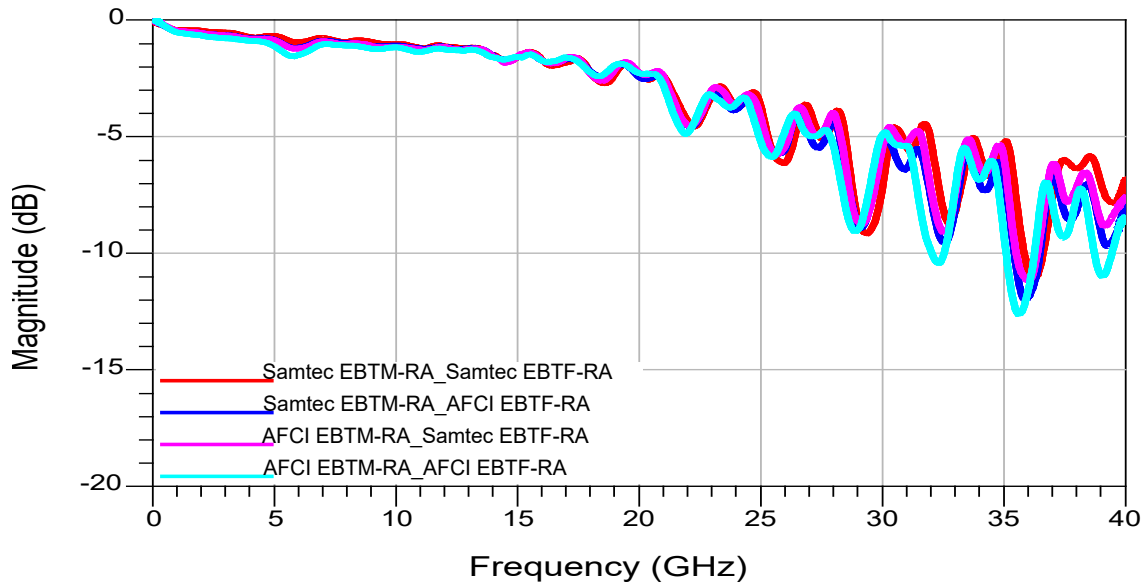
Differential IL: Pair I3-J3



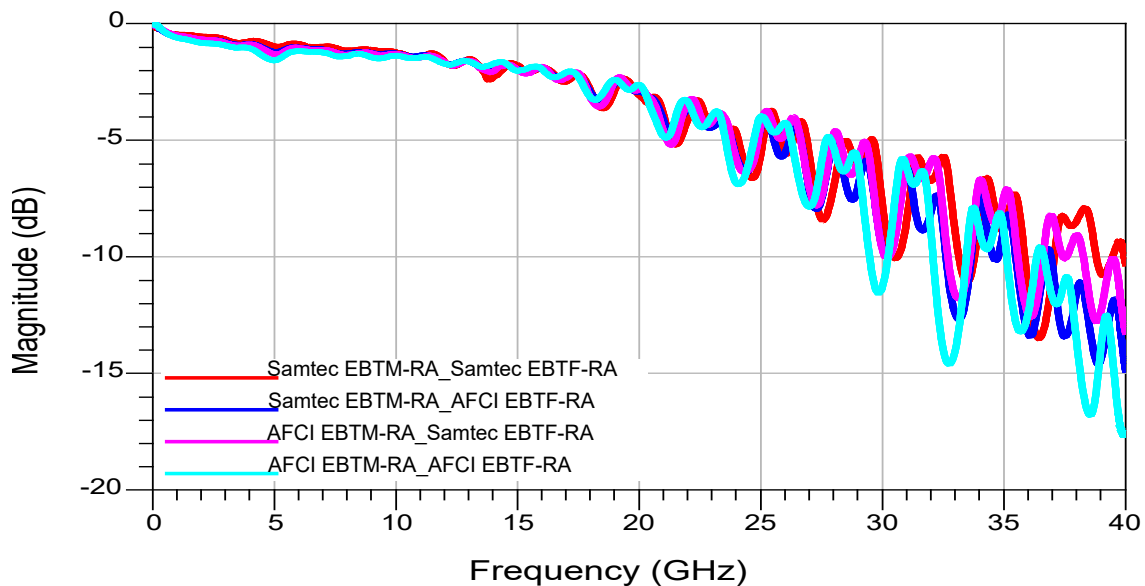
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential IL: Pair K10-L10



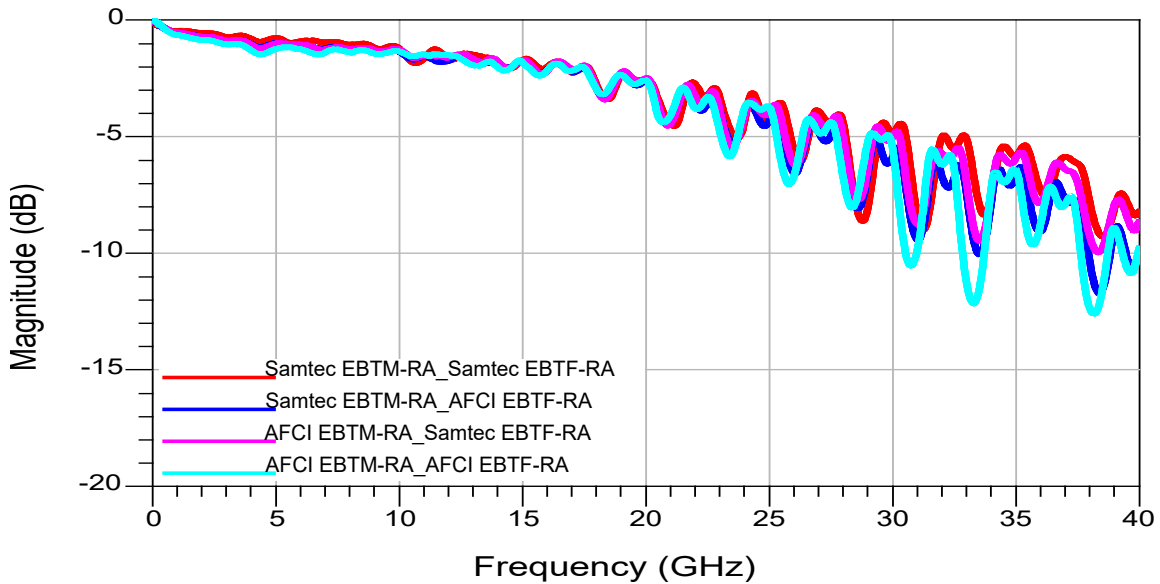
Differential IL: Pair N10-O10



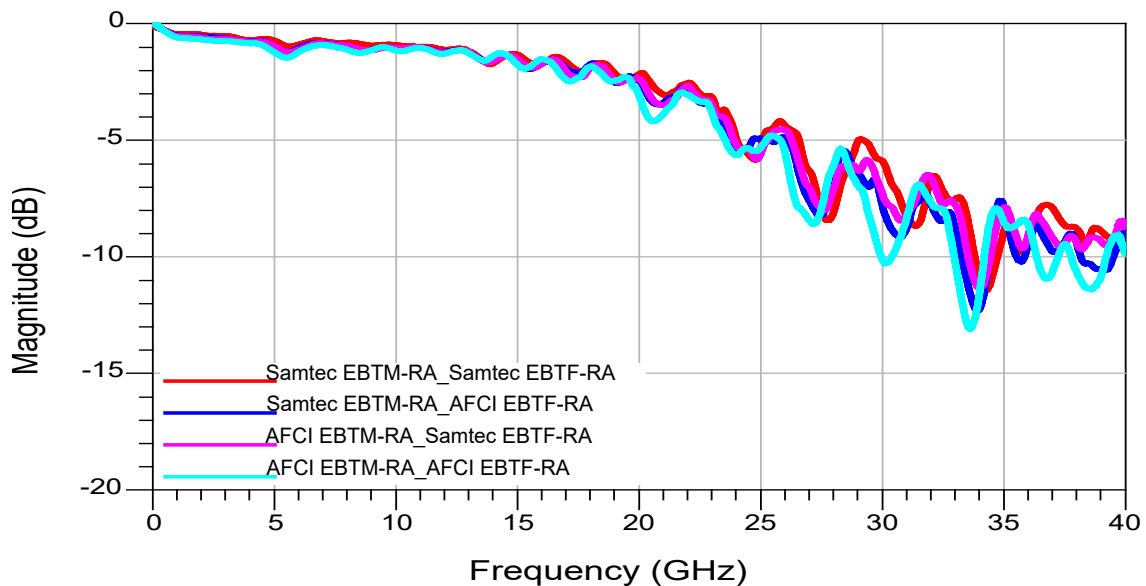
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential IL: Pair Q10-R10



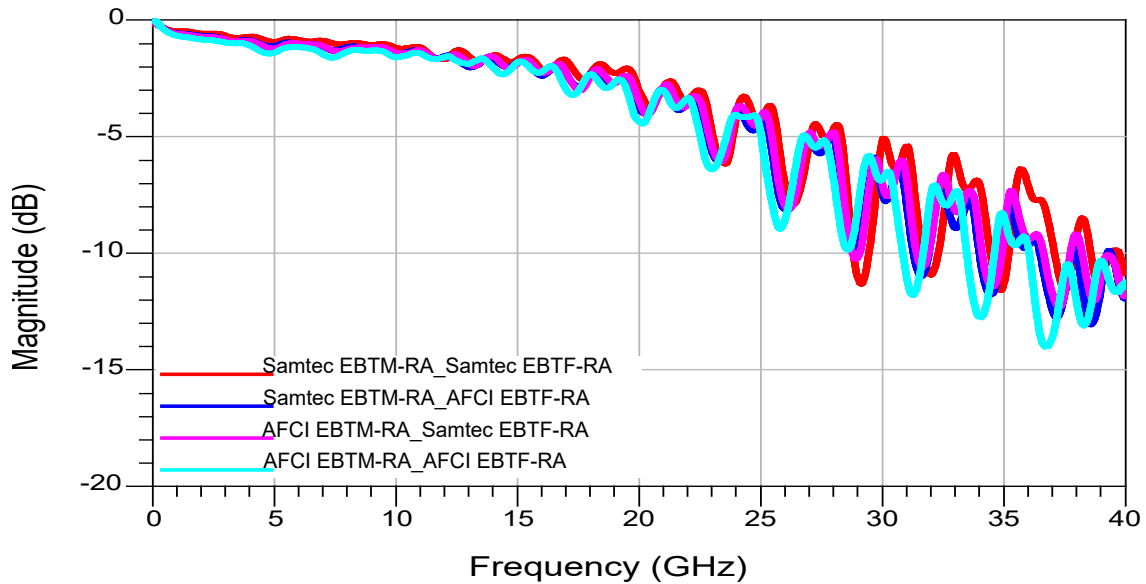
Differential IL: Pair L11-M11



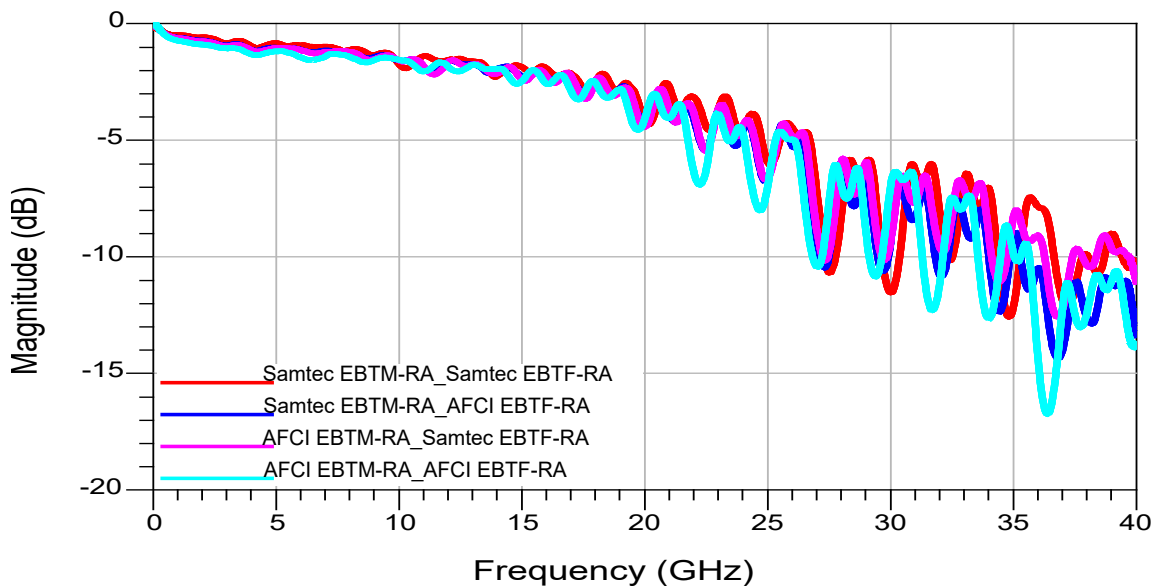
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential IL: Pair O11-P11



Differential IL: Pair R11-S11

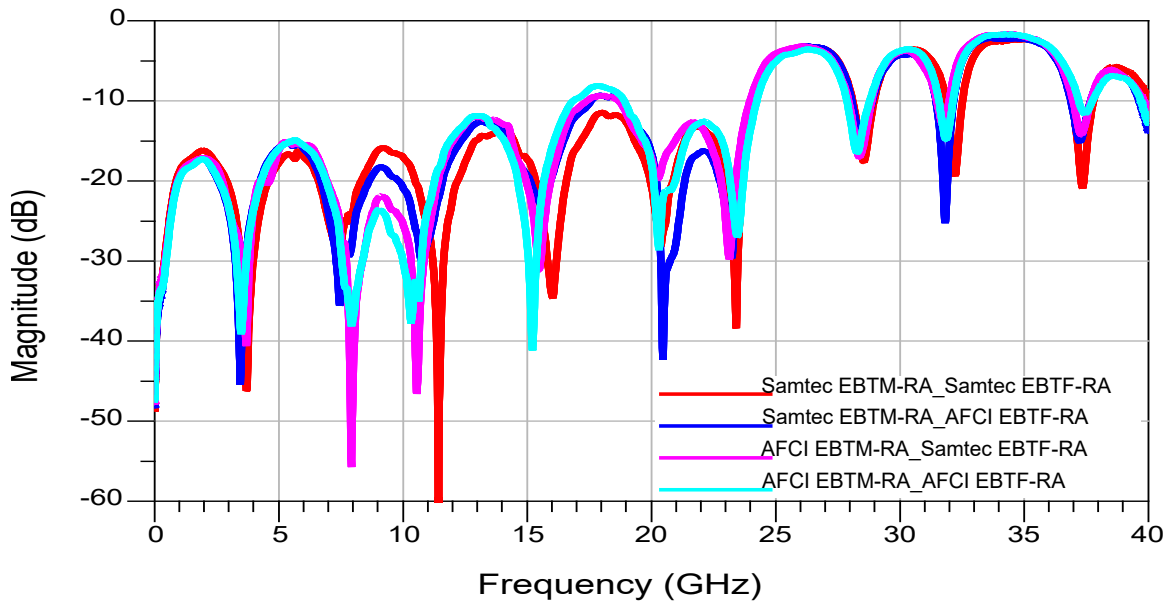


Series: EBTM-RA / EBTF-RA

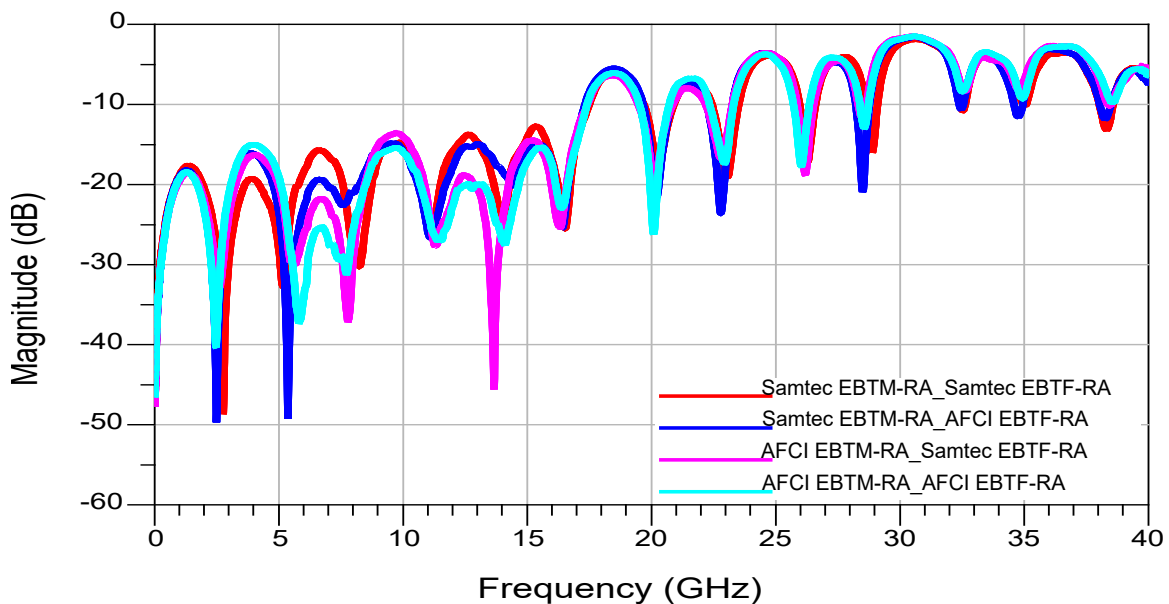
Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential Return Loss (RL)

Differential RL: Pair B2-C2



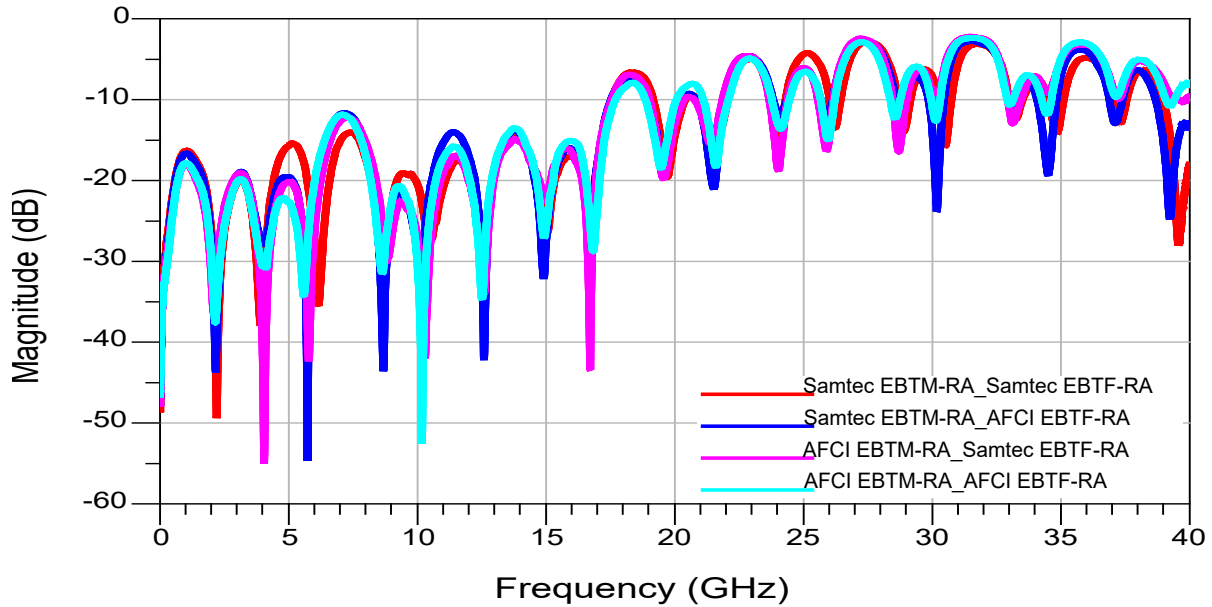
Differential RL: Pair E2-F2



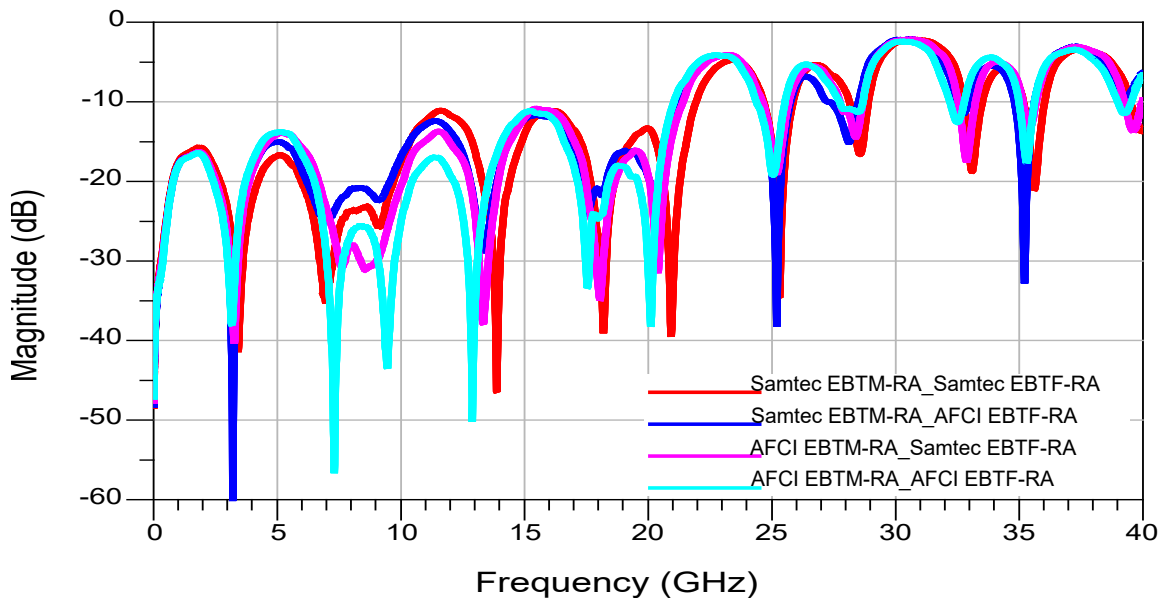
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential RL: Pair H2-I2



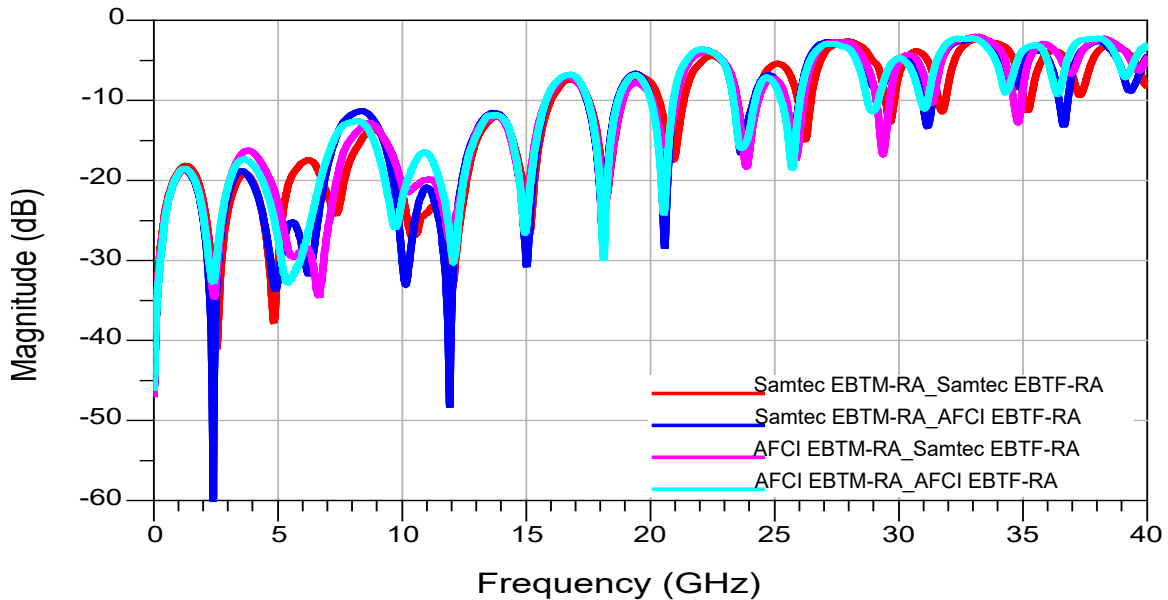
Differential RL: Pair C3-D3



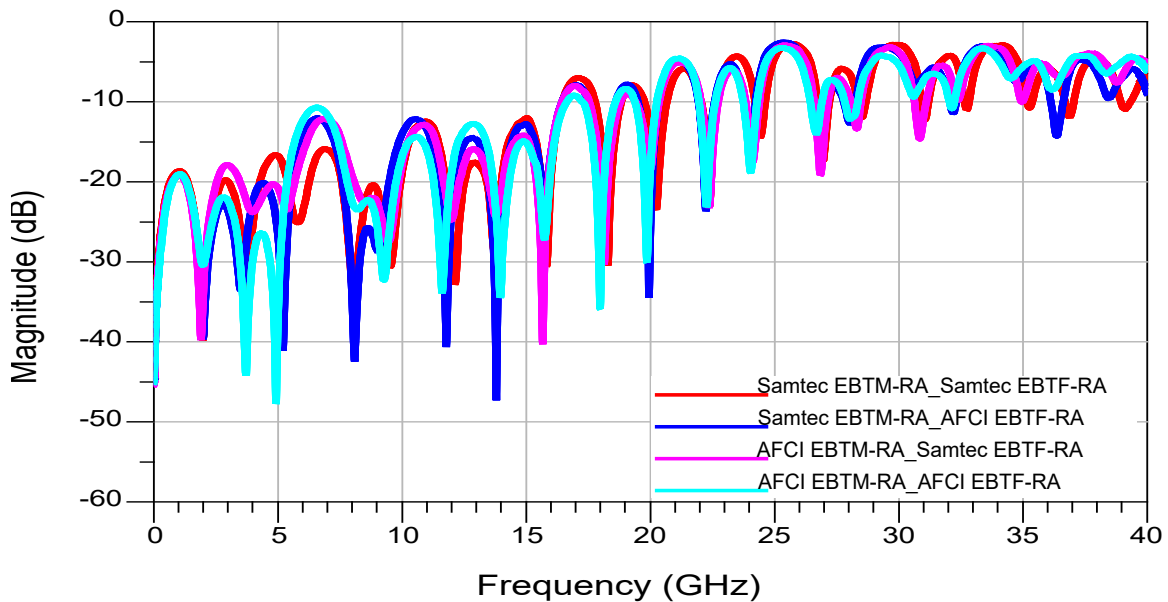
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential RL: Pair F3-G3



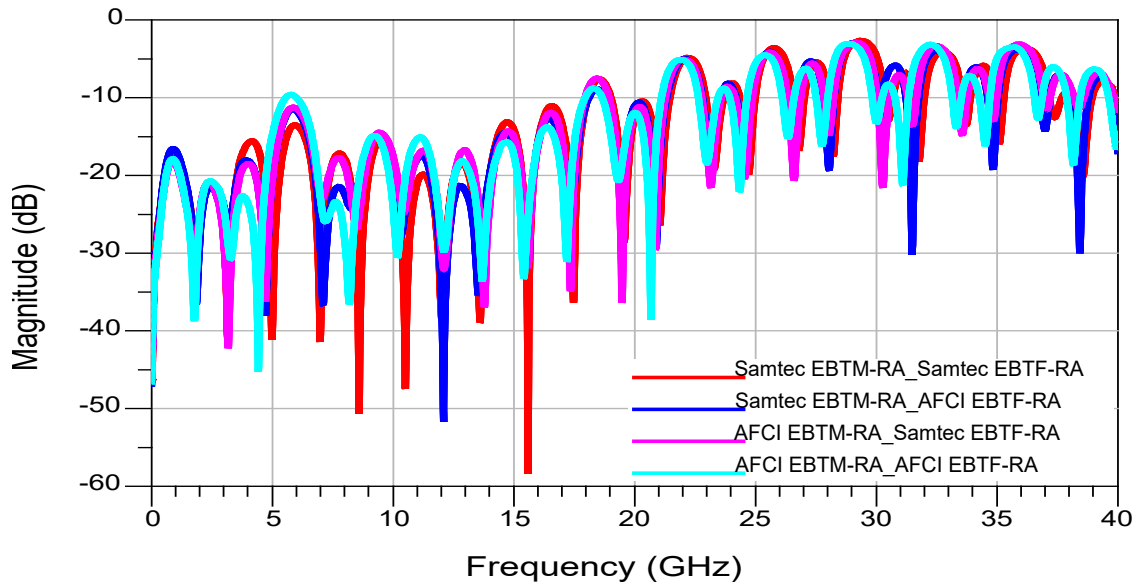
Differential RL: Pair I3-J3



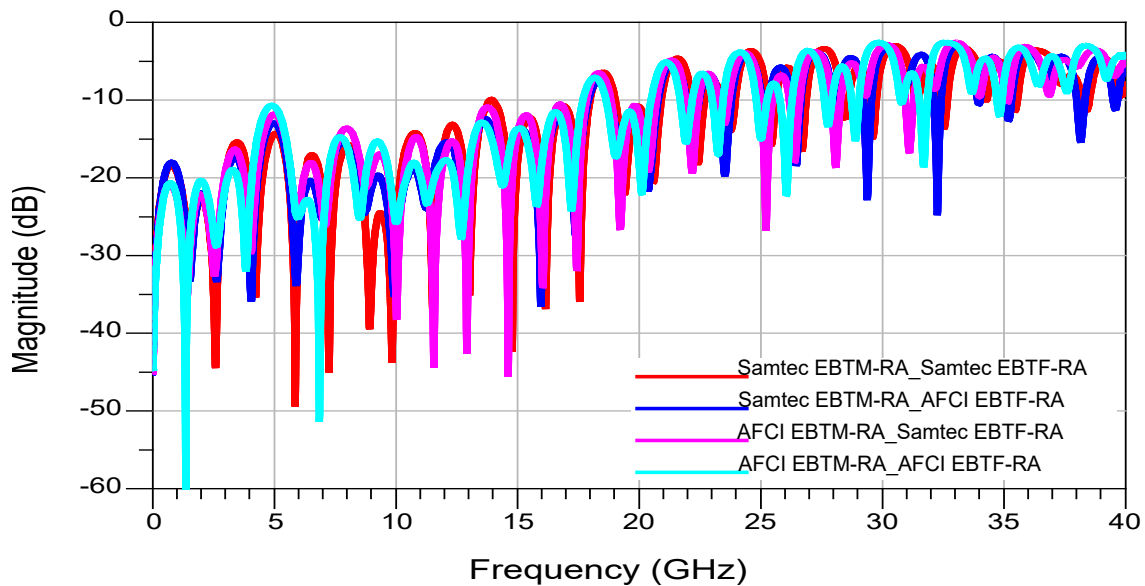
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential RL: Pair K10-L10



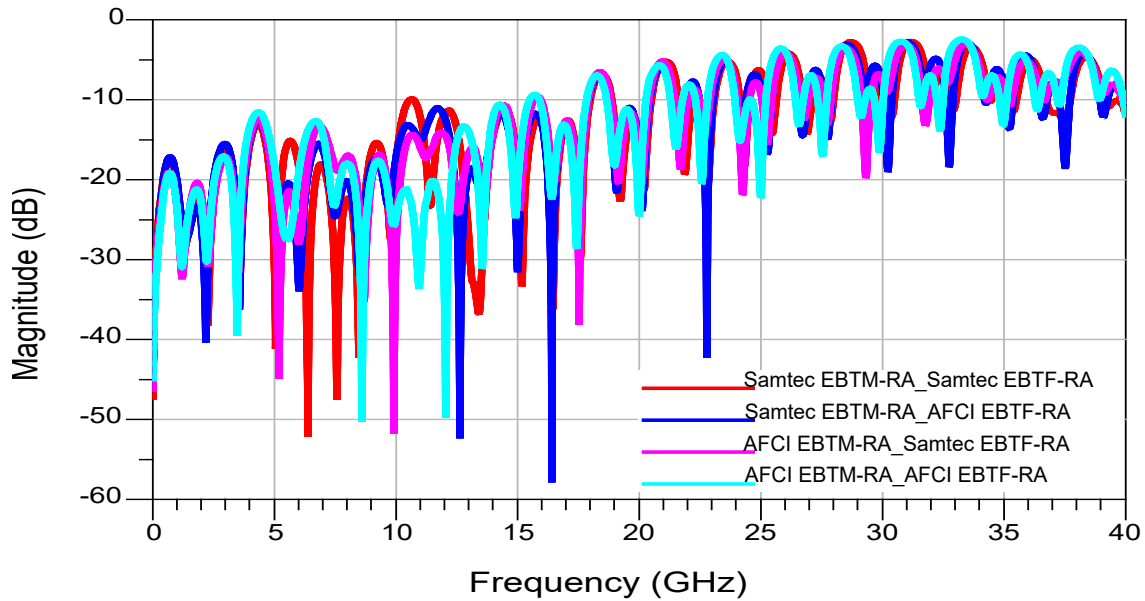
Differential RL: Pair N10-O10



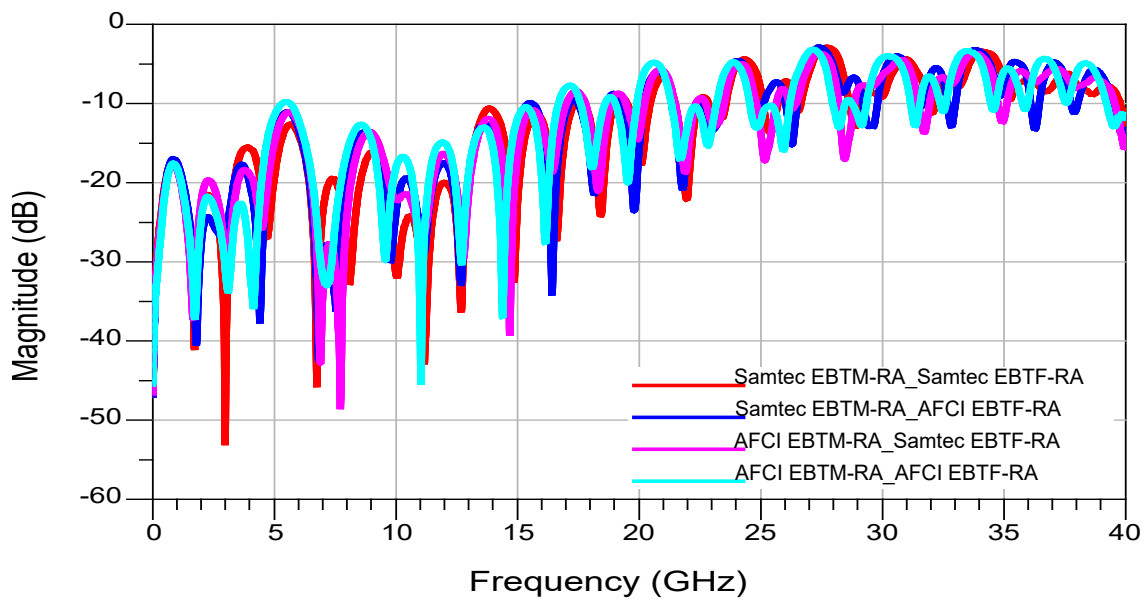
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential RL: Pair Q10-R10



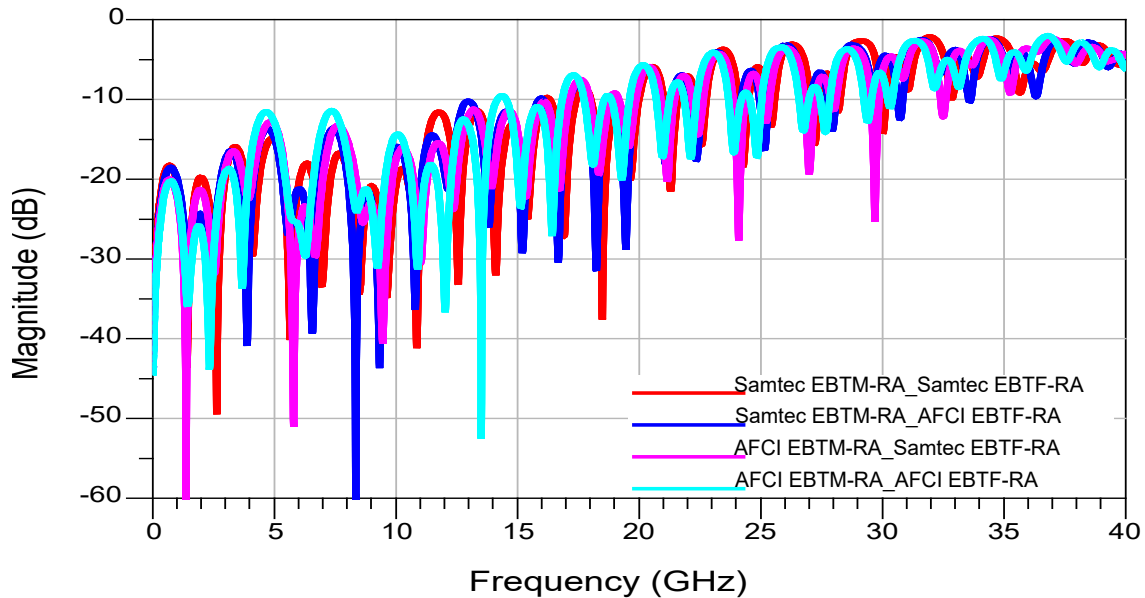
Differential RL: Pair L11-M11



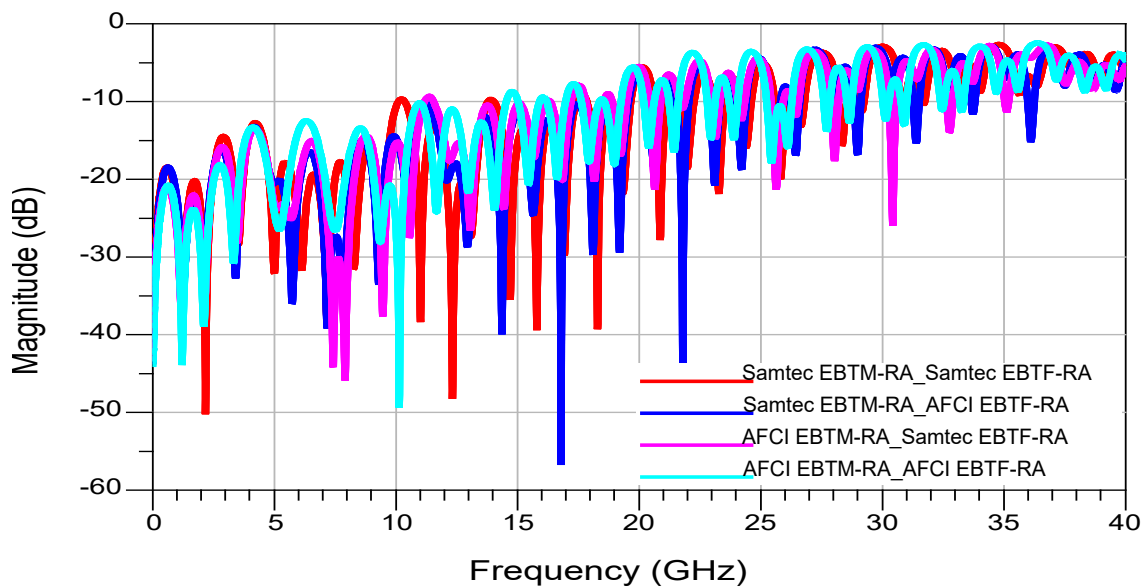
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential RL: Pair O11-P11



Differential RL: Pair R11-S11

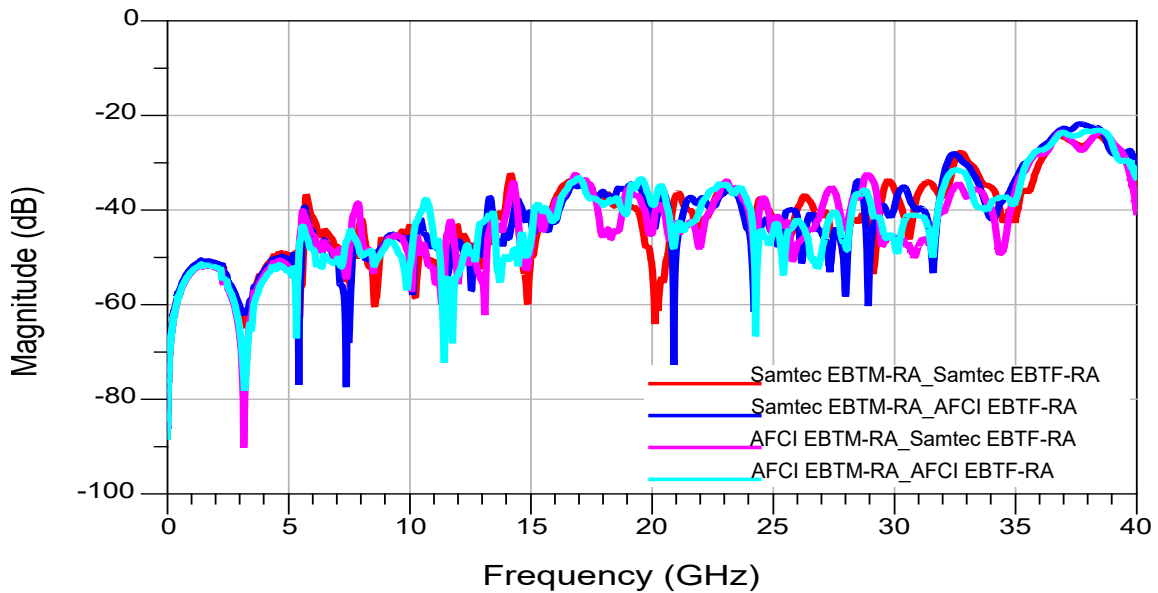


Series: EBTM-RA / EBTF-RA

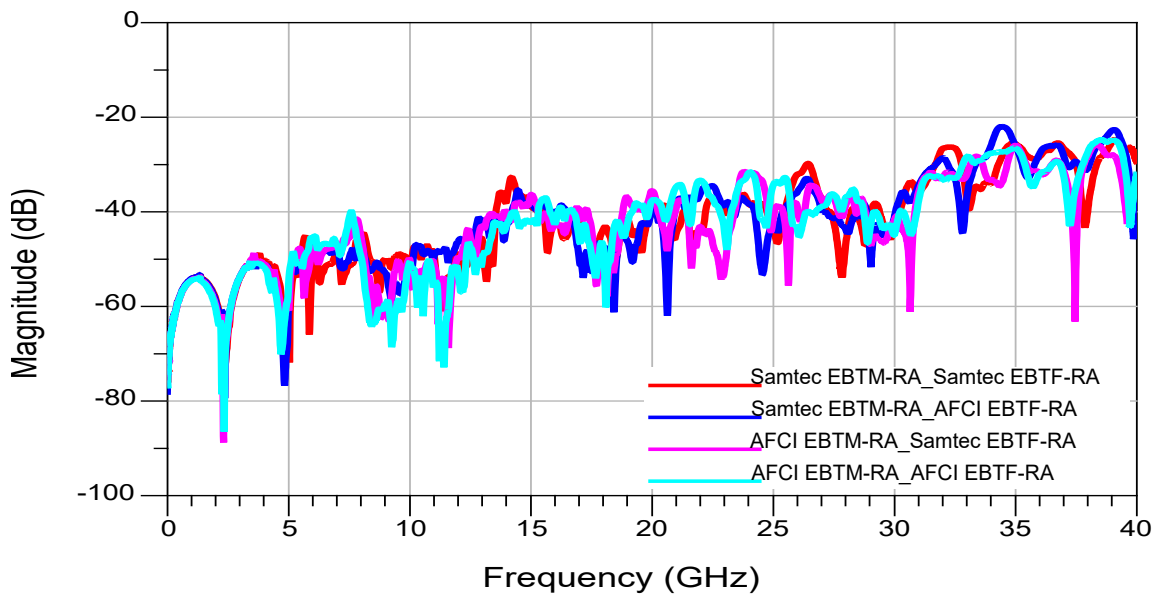
Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential Near End Crosstalk (NEXT) from Backplane Right-Angle Header

Differential NEXT: E2-F2(EBTM-RA)-B2-C2(EBTM-RA)



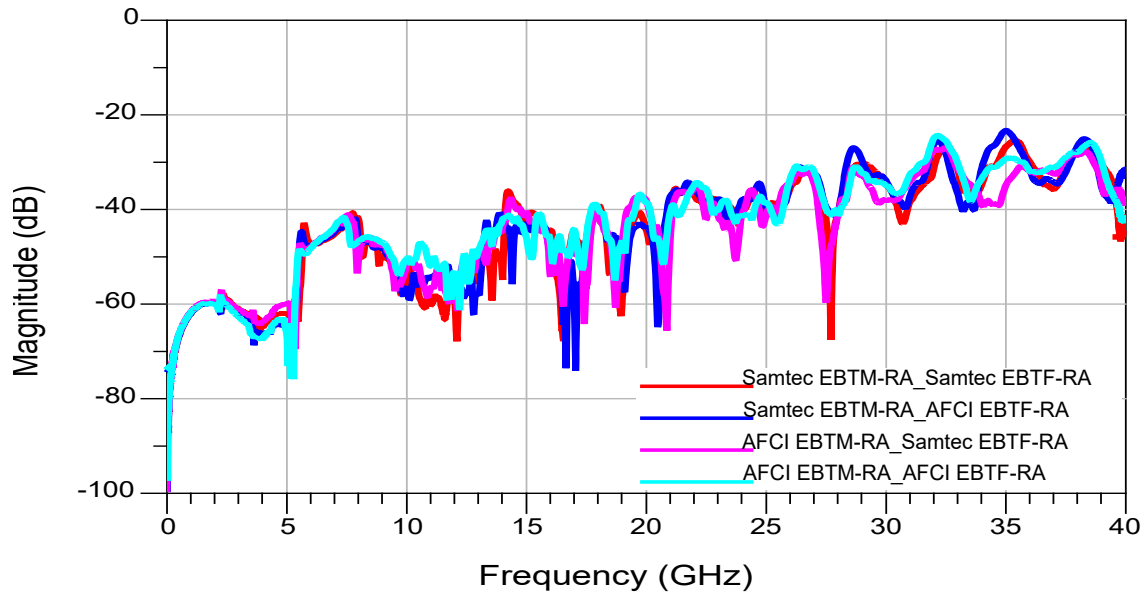
Differential NEXT: E2-F2(EBTM-RA)-H2-I2(EBTM-RA)



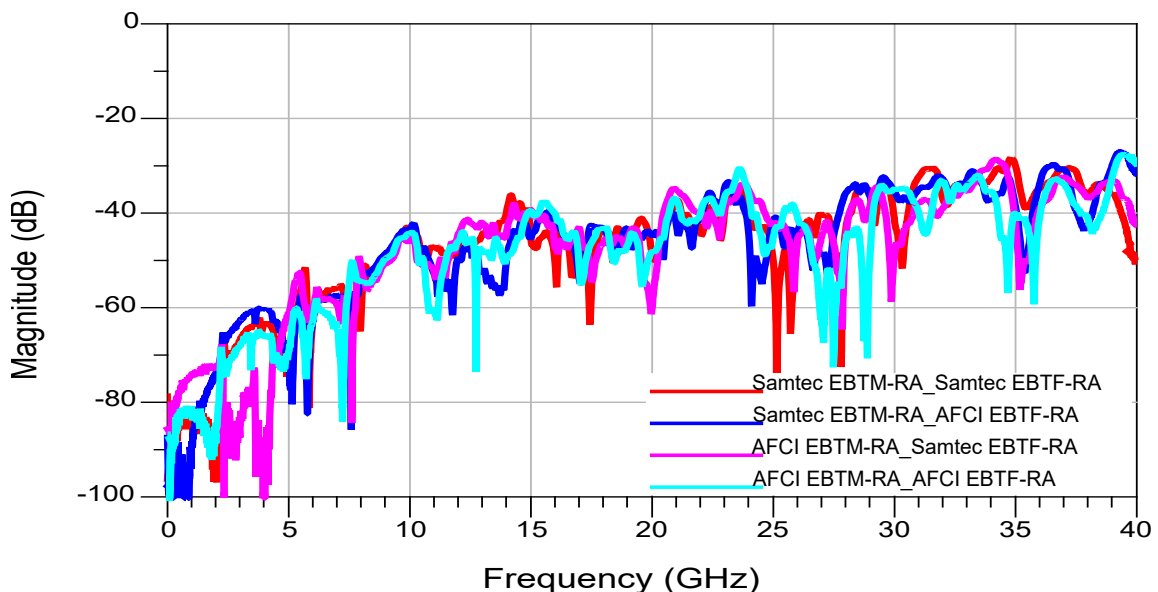
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential NEXT: E2-F2(EBTM-RA)-C3-D3(EBTM-RA)



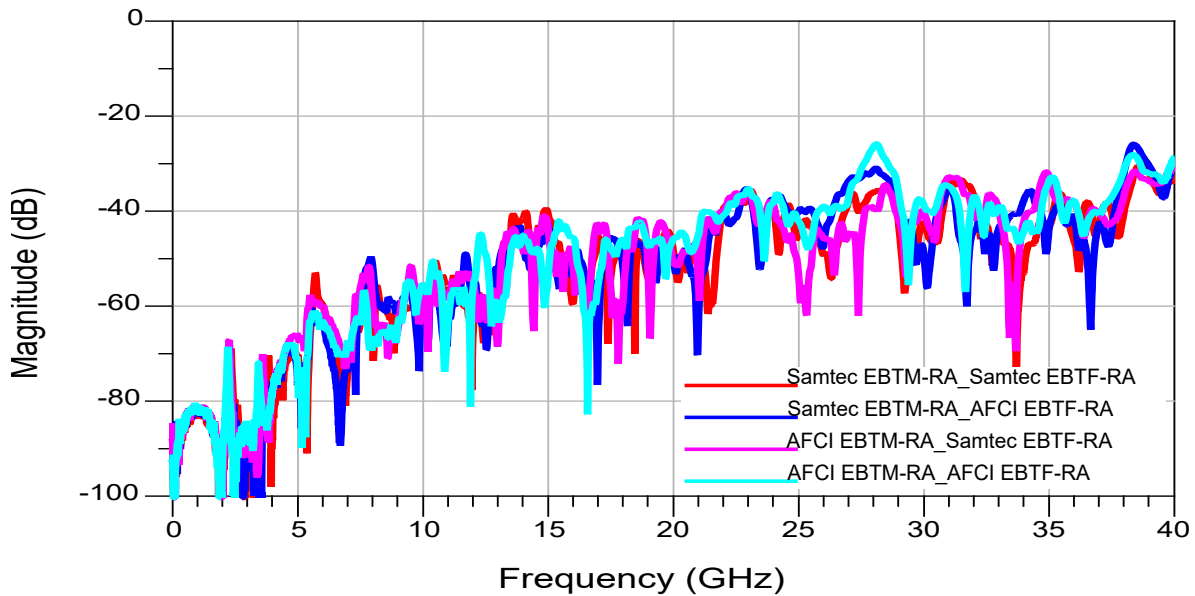
Differential NEXT: E2-F2(EBTM-RA)-F3-G3(EBTM-RA)



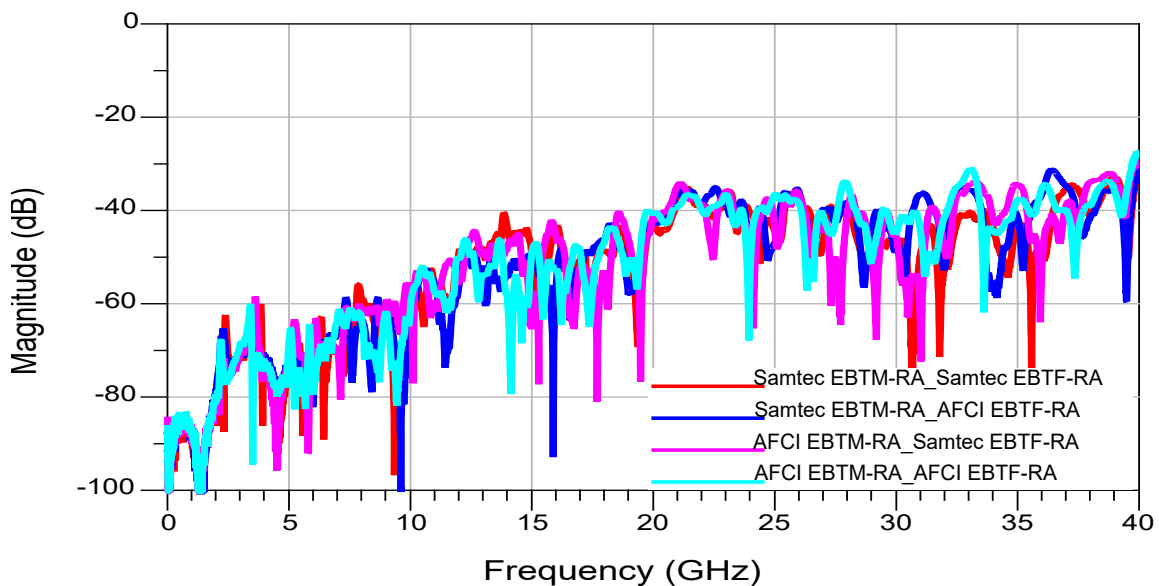
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential NEXT: E2-F2(EBTM-RA)-I3-J3(EBTM-RA)



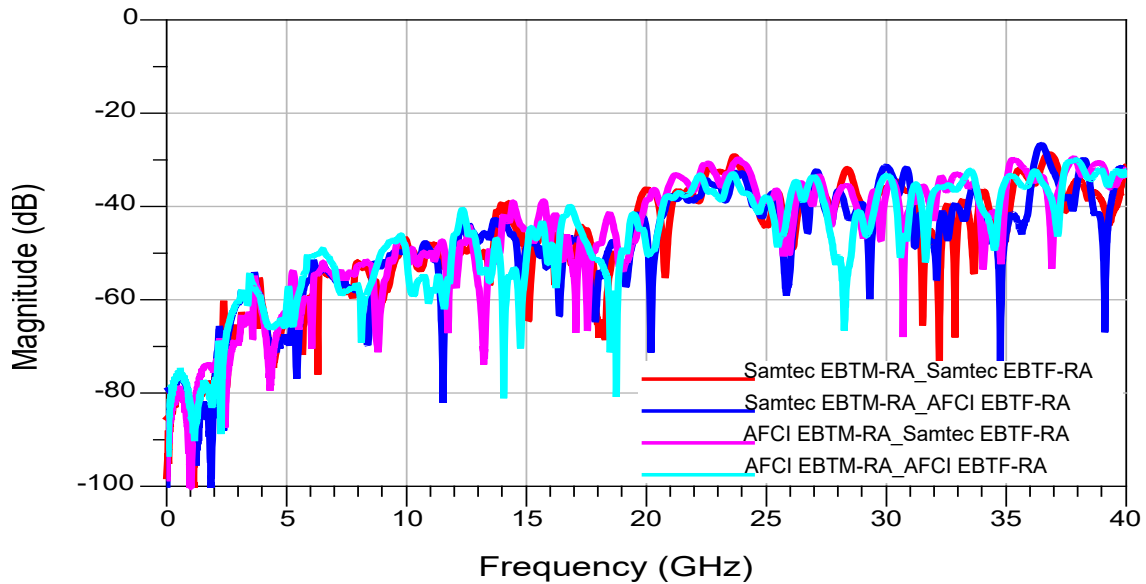
Differential NEXT: O11-P11(EBTM-RA)-K10-L10(EBTM-RA)



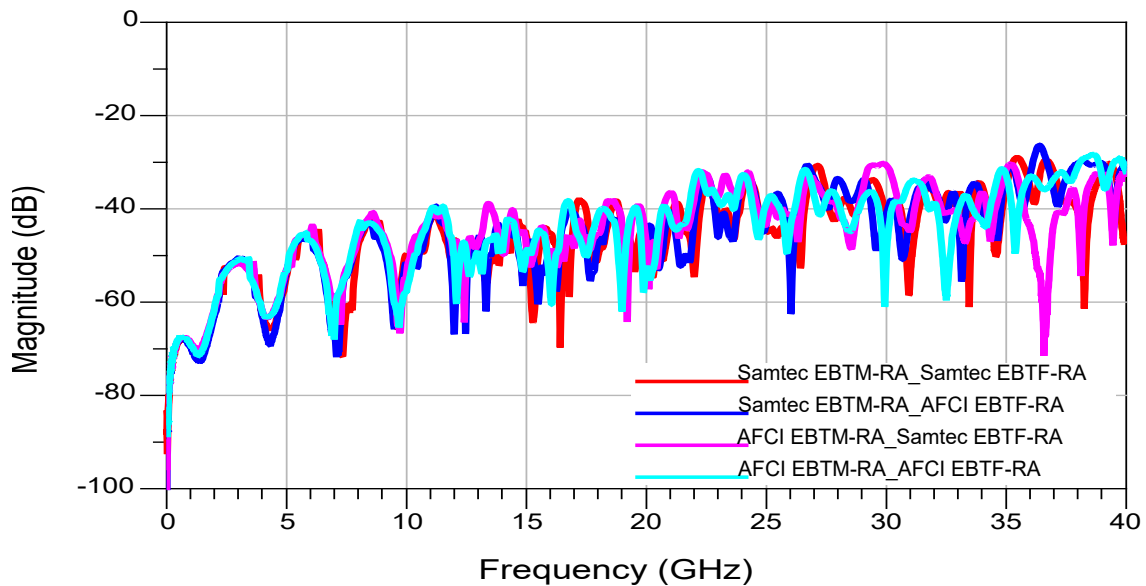
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential NEXT: O11-P11(EBTM-RA)-N10-O10(EBTM-RA)



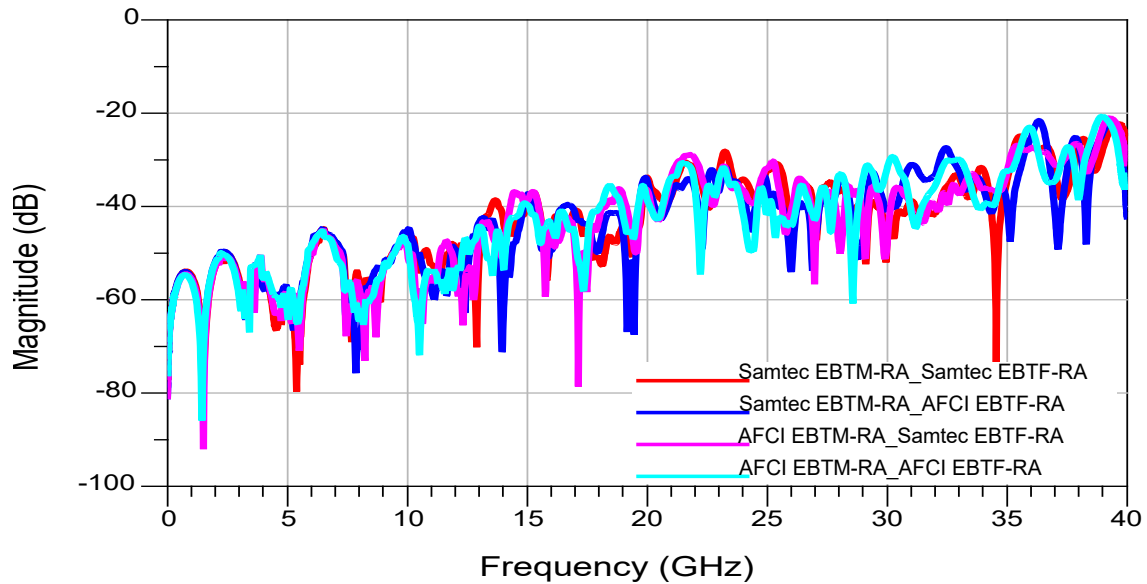
Differential NEXT: O11-P11(EBTM-RA)-Q10-R10(EBTM-RA)



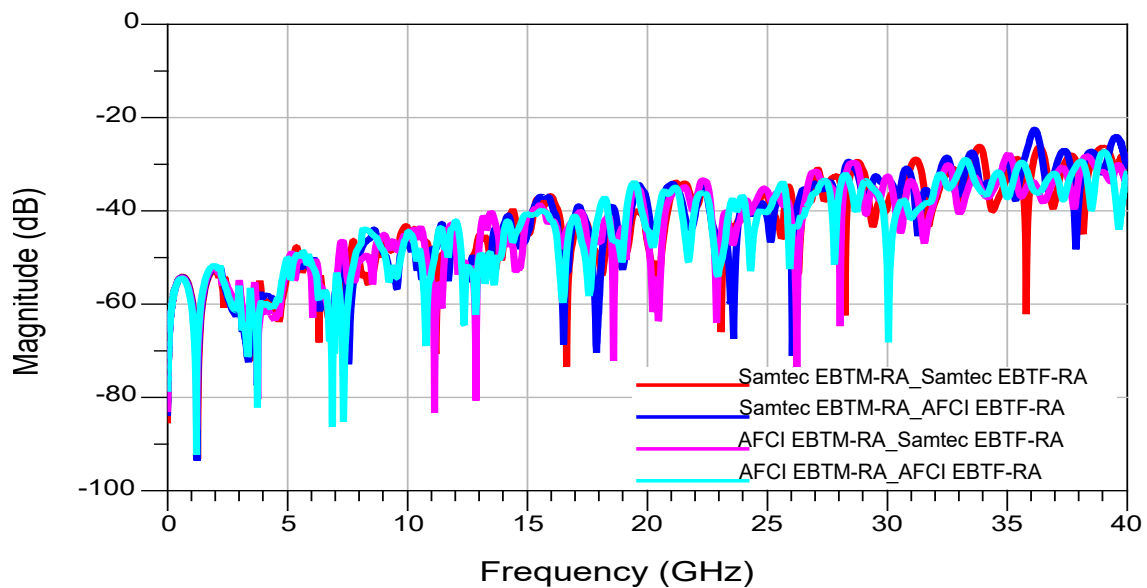
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential NEXT: O11-P11(EBTM-RA)-L11-M11(EBTM-RA)



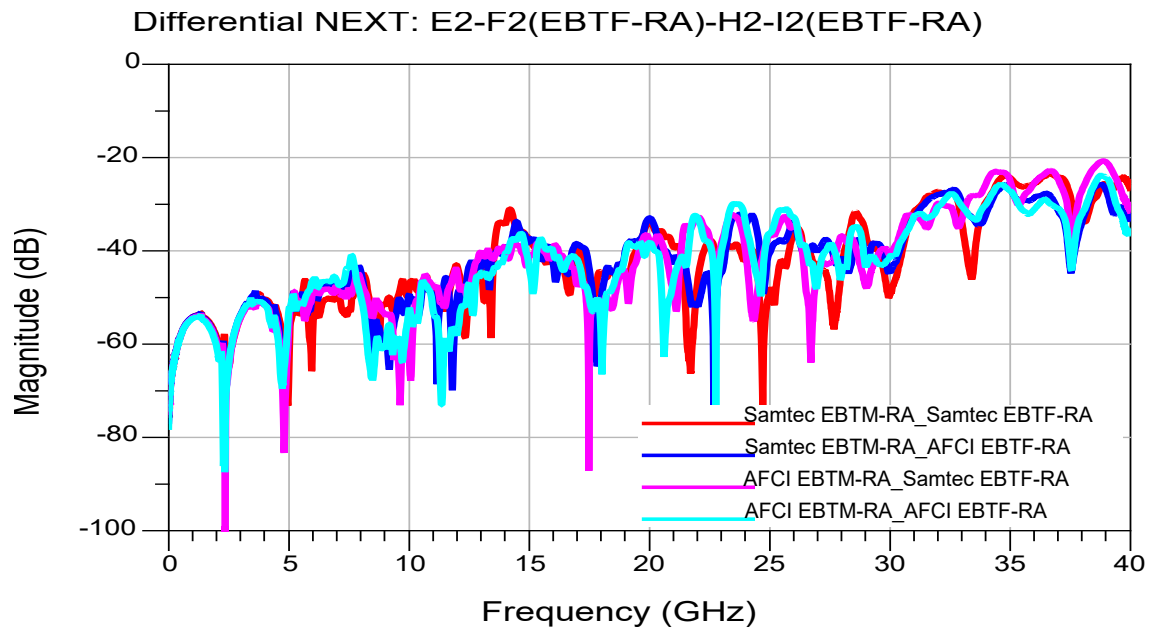
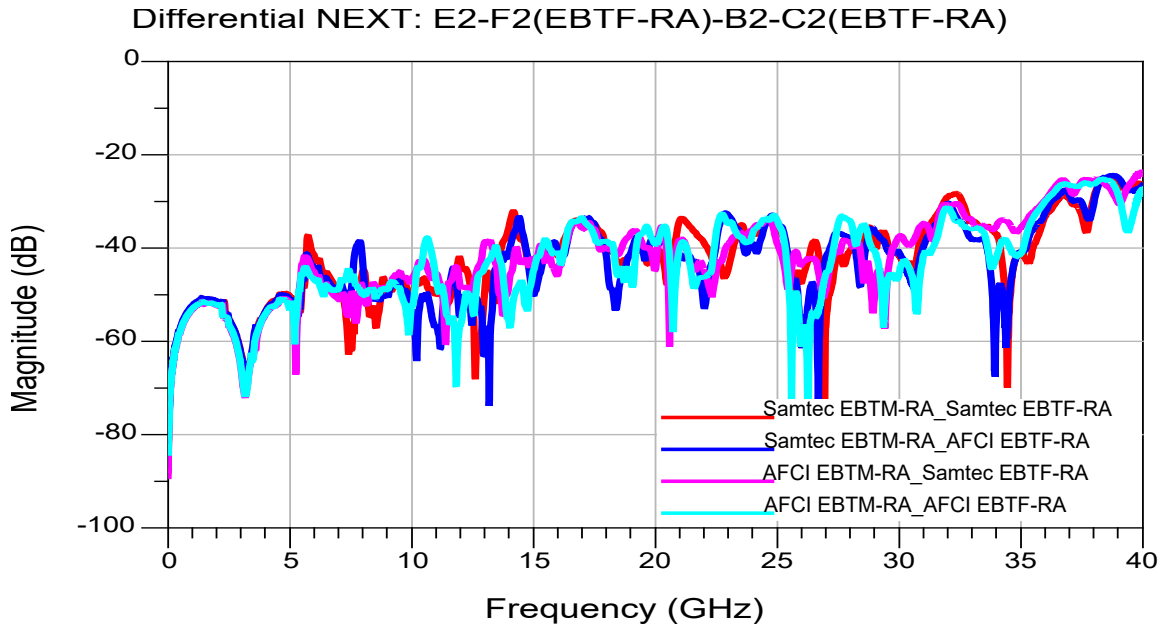
Differential NEXT: O11-P11(EBTM-RA)-R11-S11(EBTM-RA)



Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

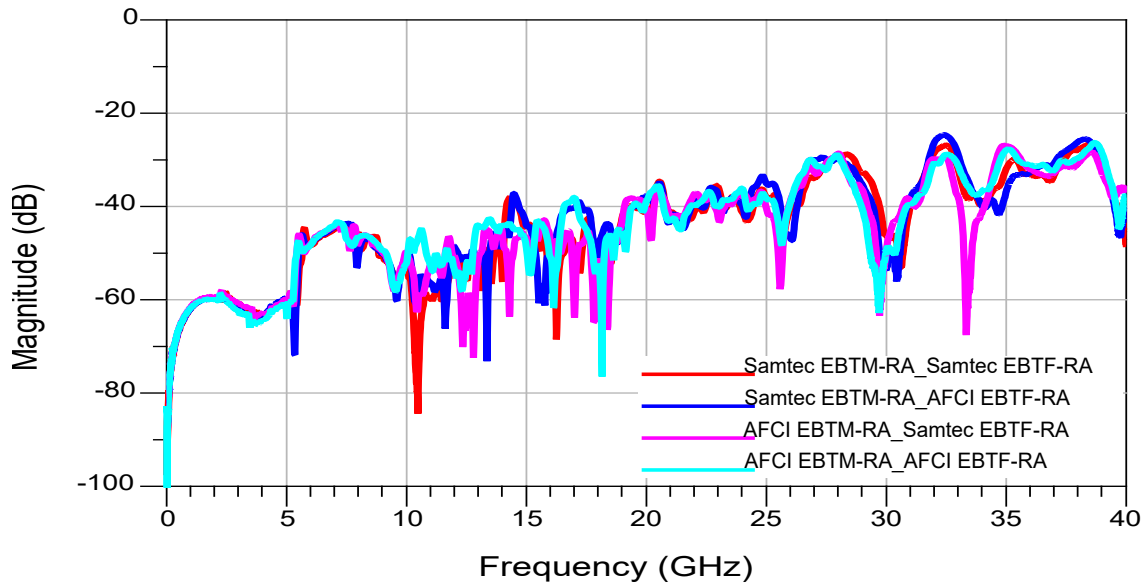
Differential Near End Crosstalk (NEXT) from Right Angle(RA) Receptacle



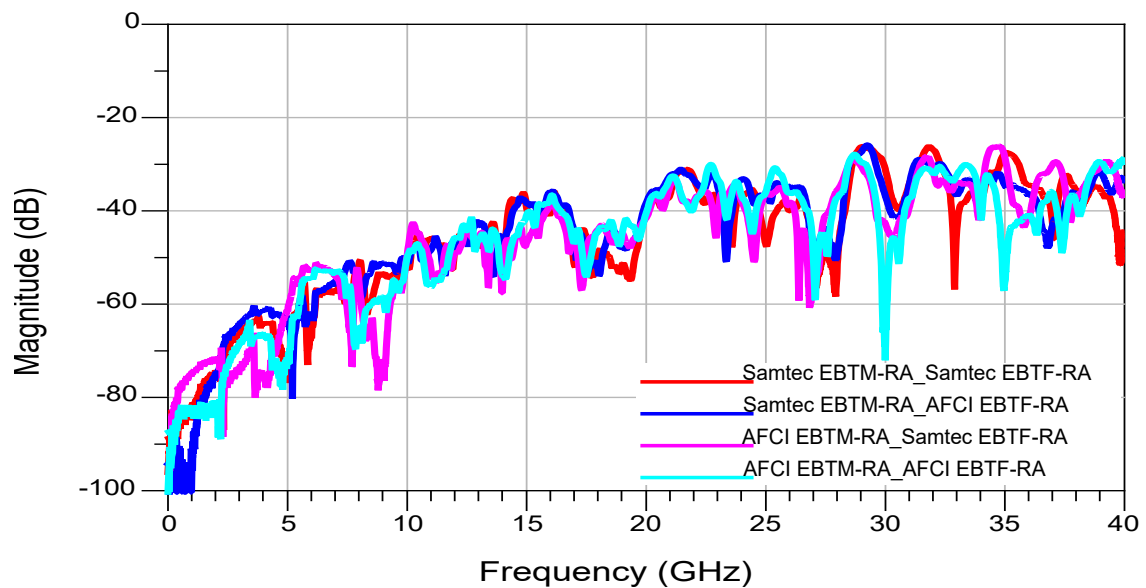
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential NEXT: E2-F2(EBTF-RA)-C3-D3(EBTF-RA)



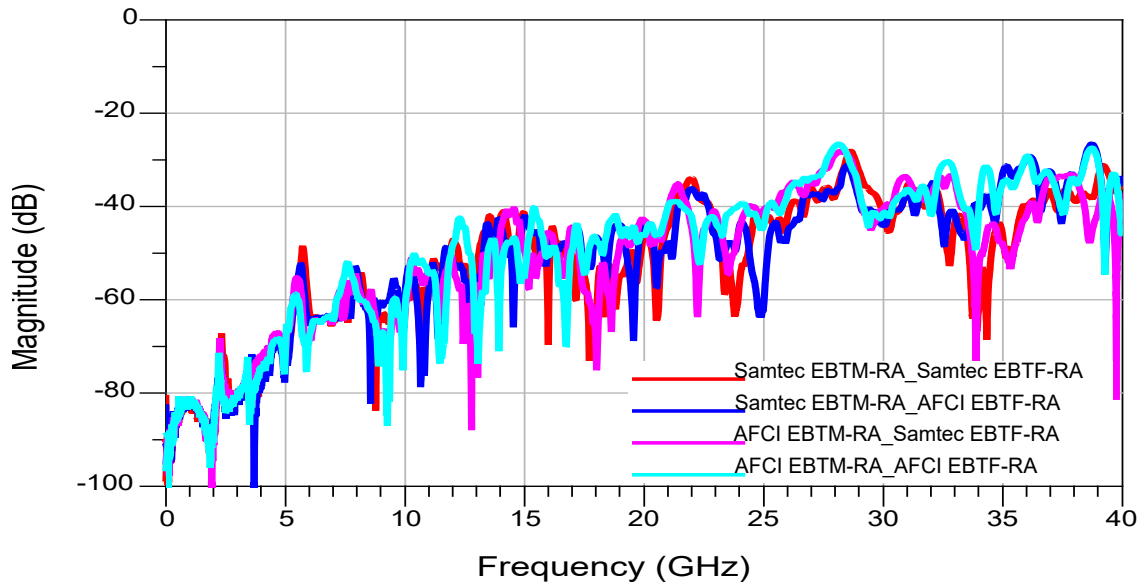
Differential NEXT: E2-F2(EBTF-RA)-F3-G3(EBTF-RA)



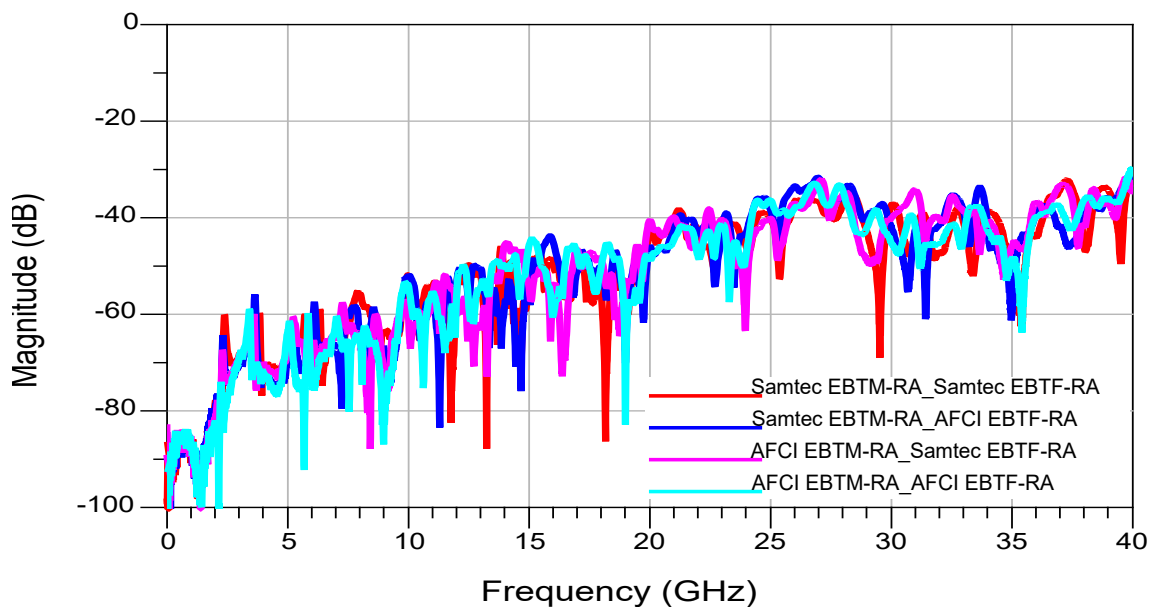
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential NEXT: E2-F2(EBTF-RA)-I3-J3(EBTF-RA)



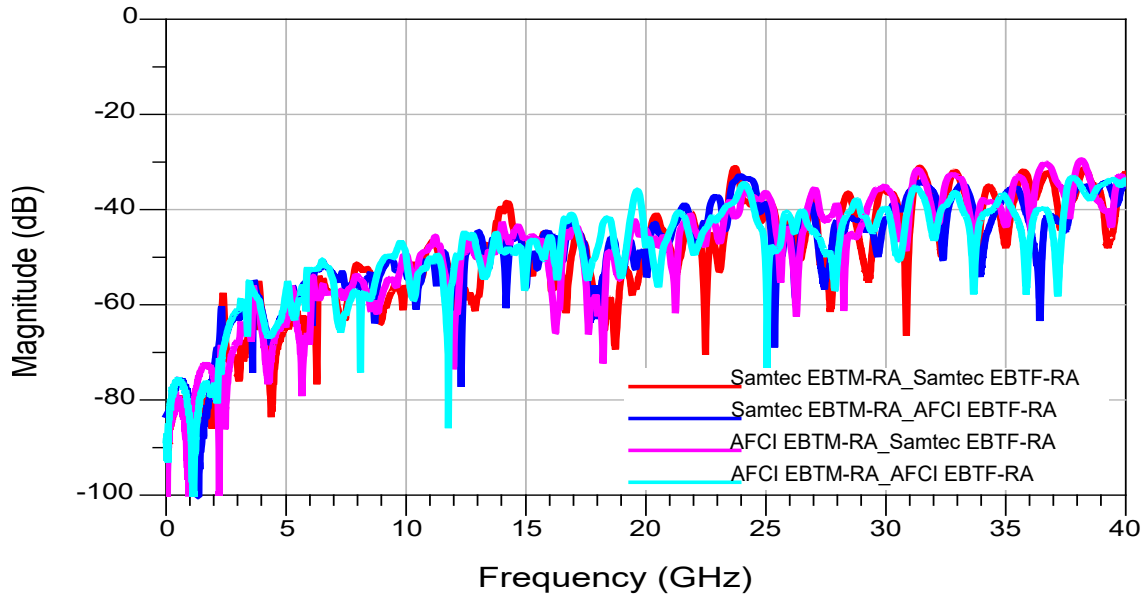
Differential NEXT: O11-P11(EBTF-RA)-K10-L10(EBTF-RA)



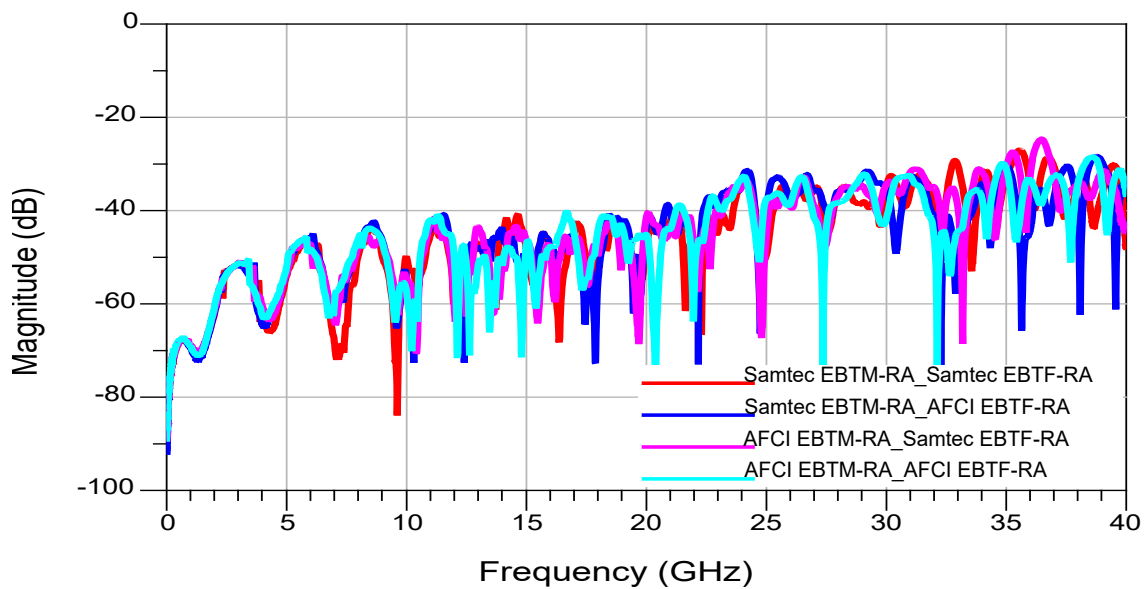
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential NEXT: O11-P11(EBTF-RA)-N10-O10(EBTF-RA)



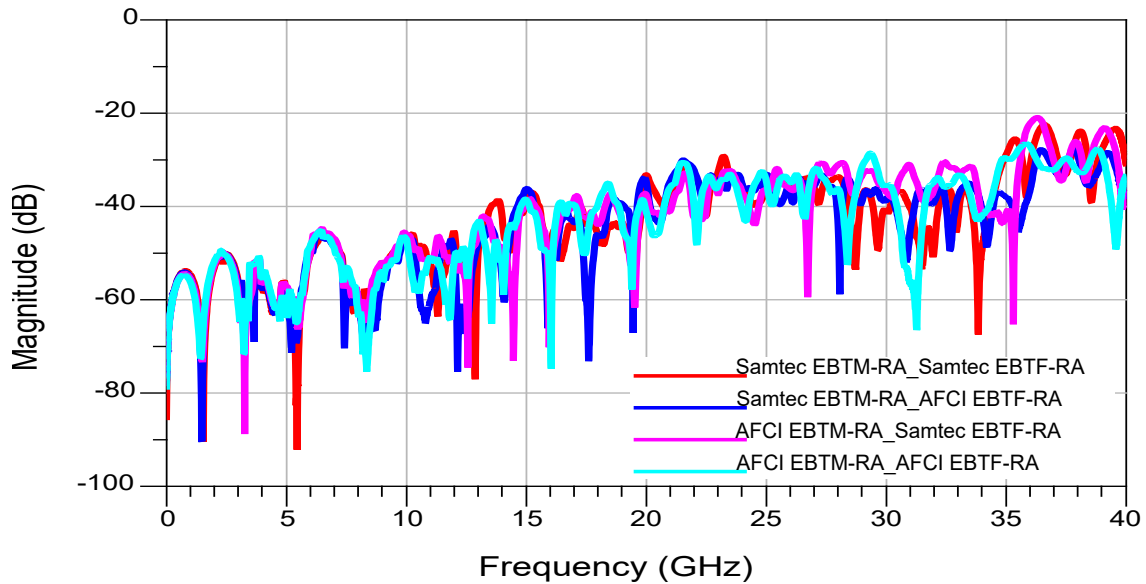
Differential NEXT: O11-P11(EBTF-RA)-Q10-R10(EBTF-RA)



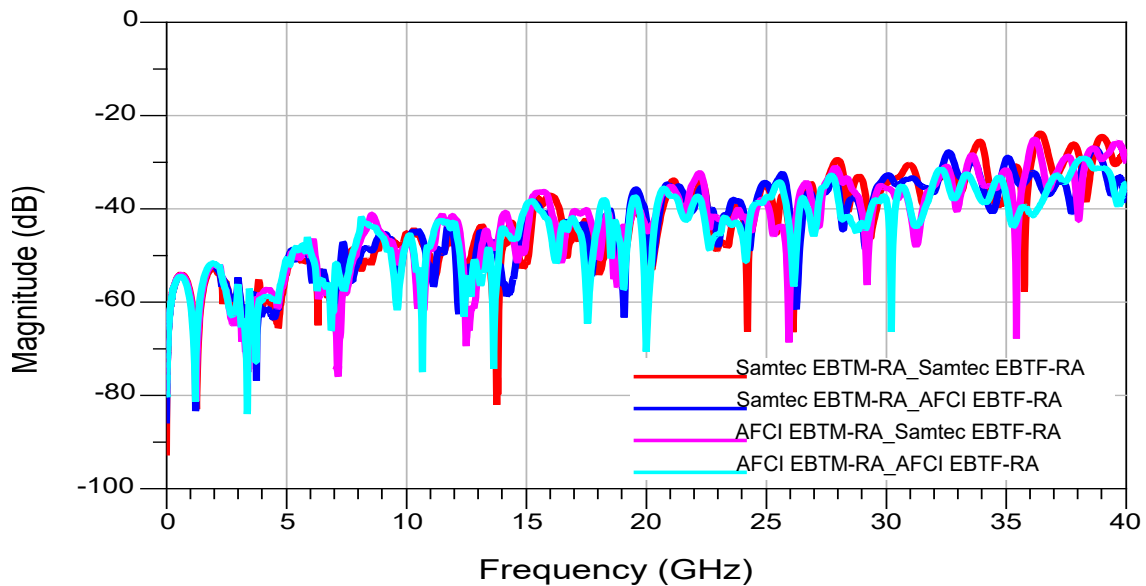
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential NEXT: O11-P11(EBTF-RA)-L11-M11(EBTF-RA)



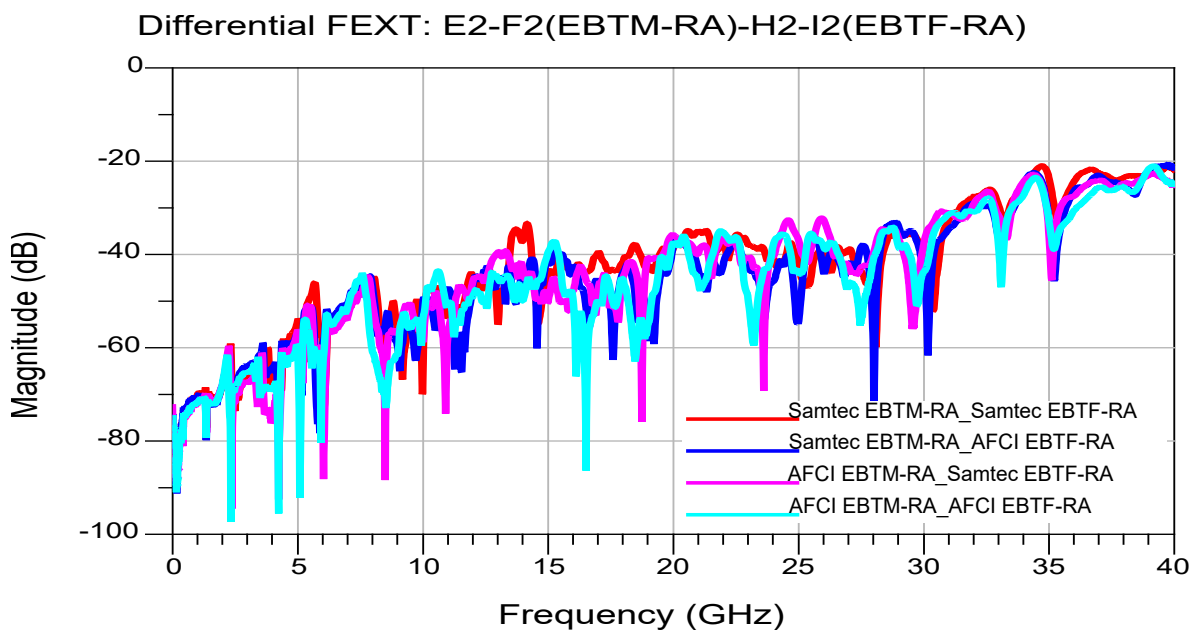
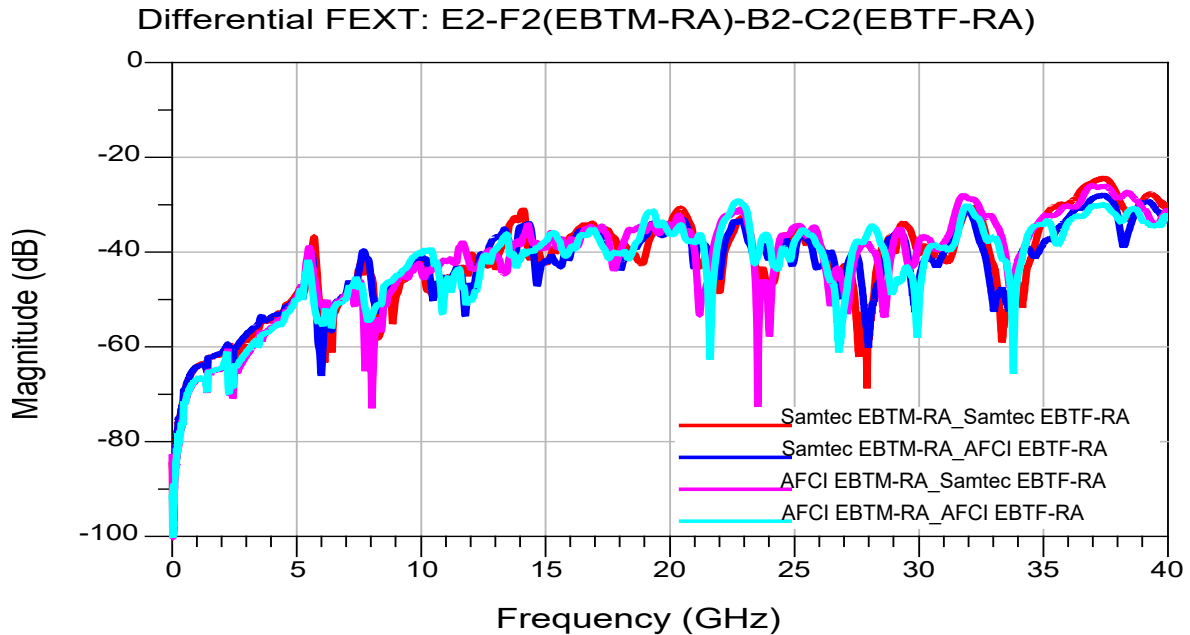
Differential NEXT: O11-P11(EBTF-RA)-R11-S11(EBTF-RA)



Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

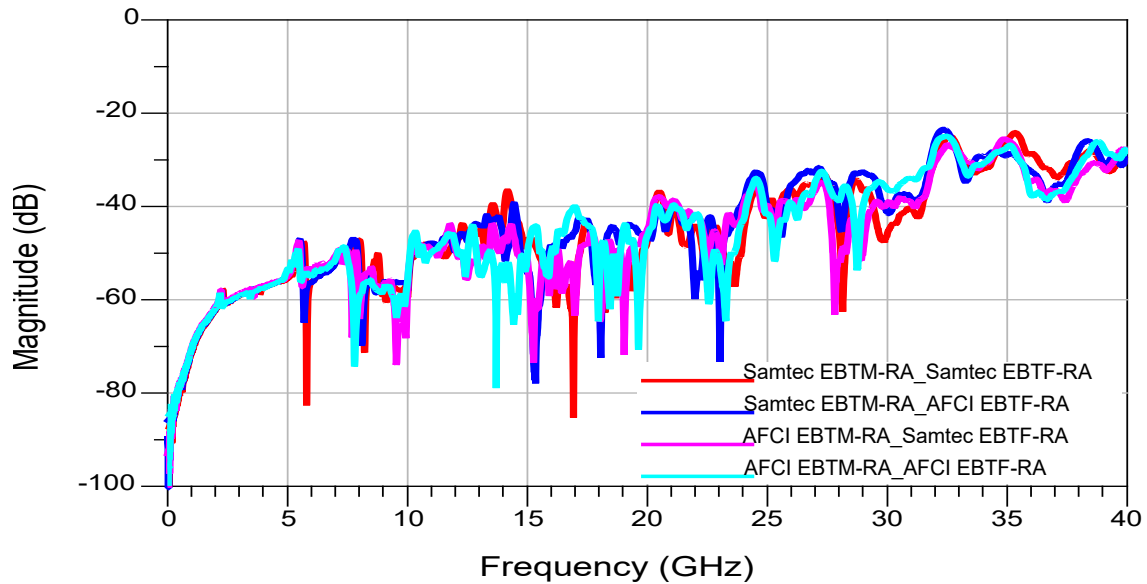
Differential Far End Crosstalk (FEXT)



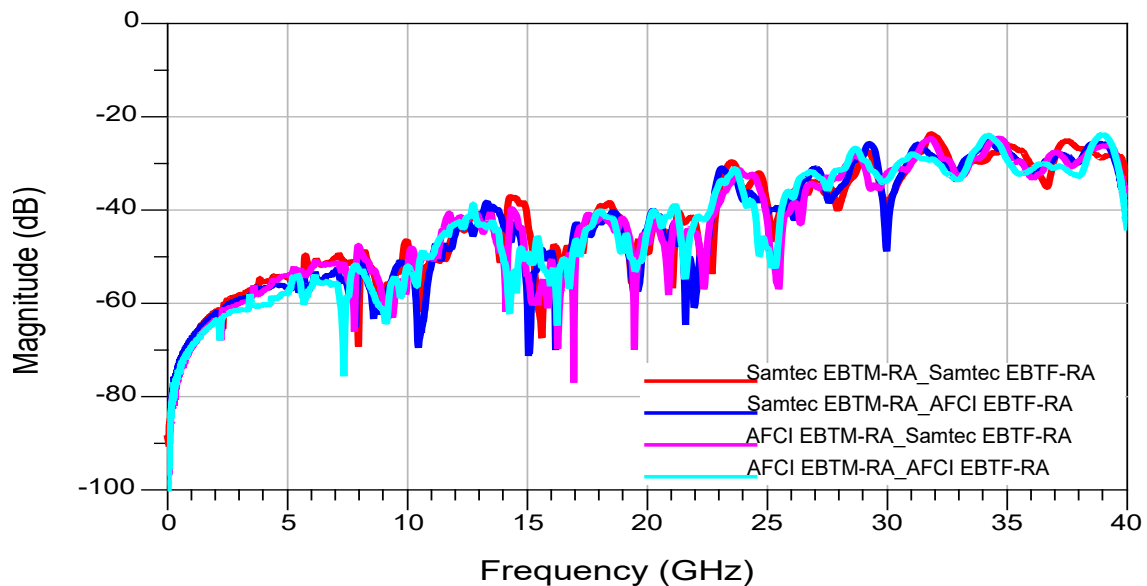
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential FEXT: E2-F2(EBTM-RA)-C3-D3(EBTF-RA)



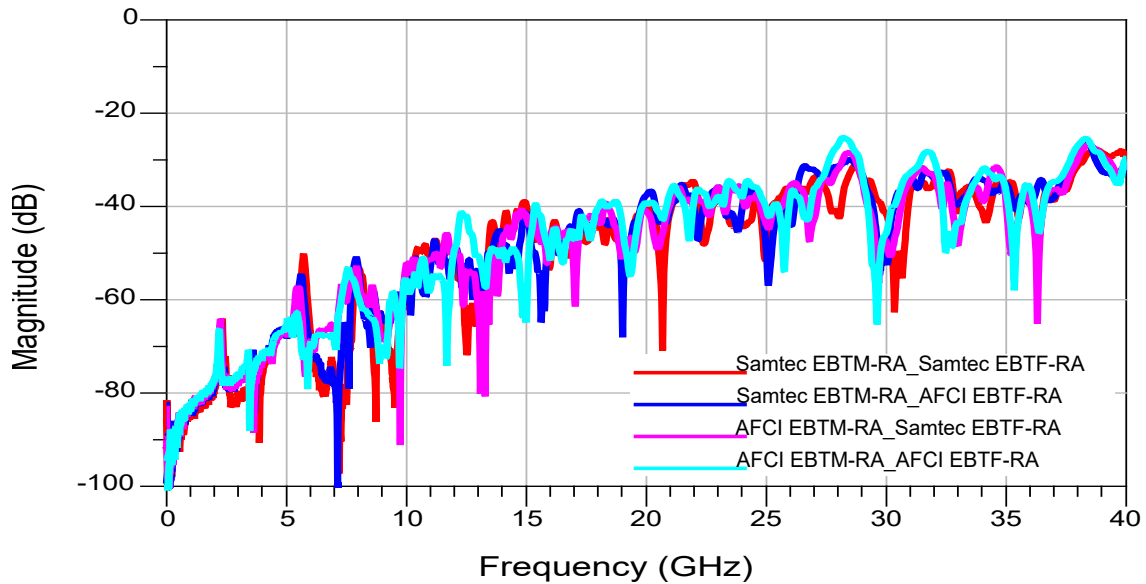
Differential FEXT: E2-F2(EBTM-RA)-F3-G3(EBTF-RA)



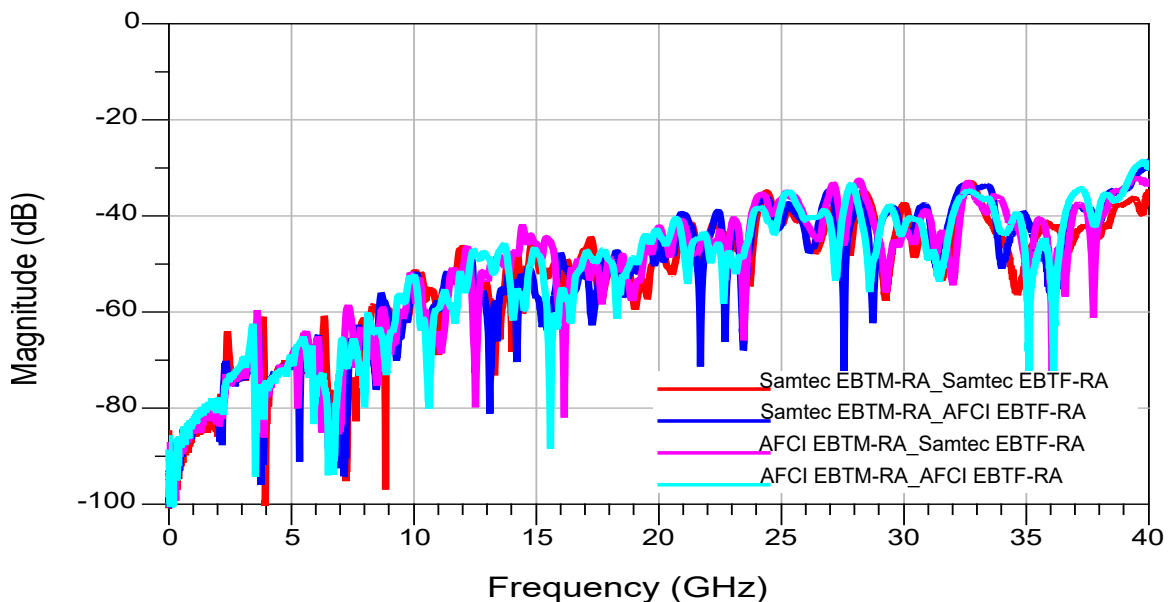
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential FEXT: E2-F2(EBTM-RA)-I3-J3(EBTF-RA)



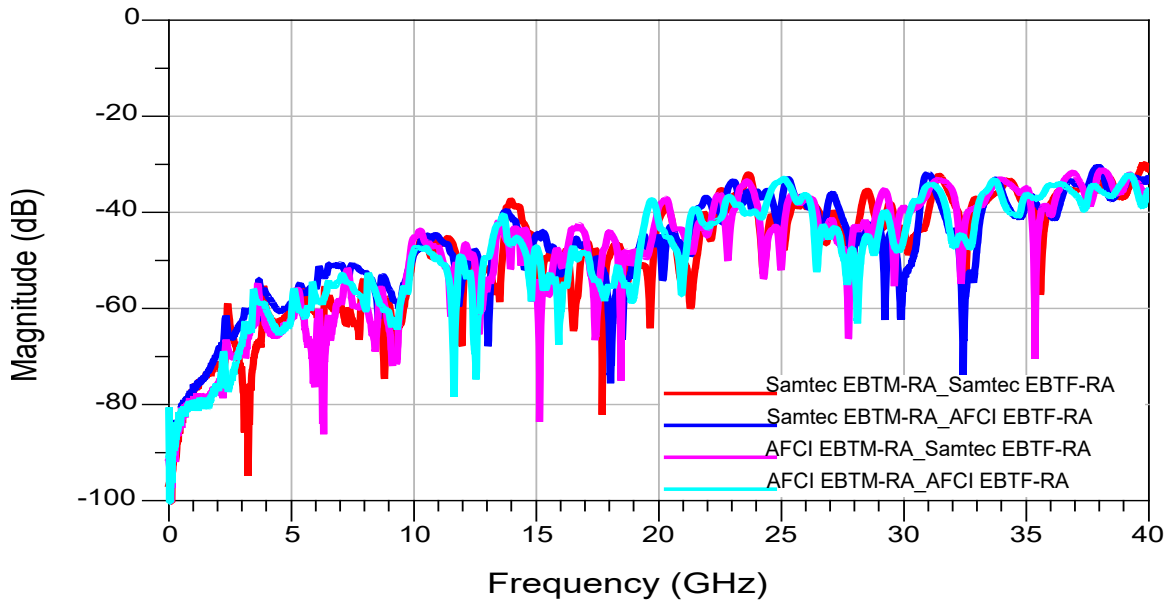
Differential FEXT: O11-P11(EBTM-RA)-K10-L10(EBTF-RA)



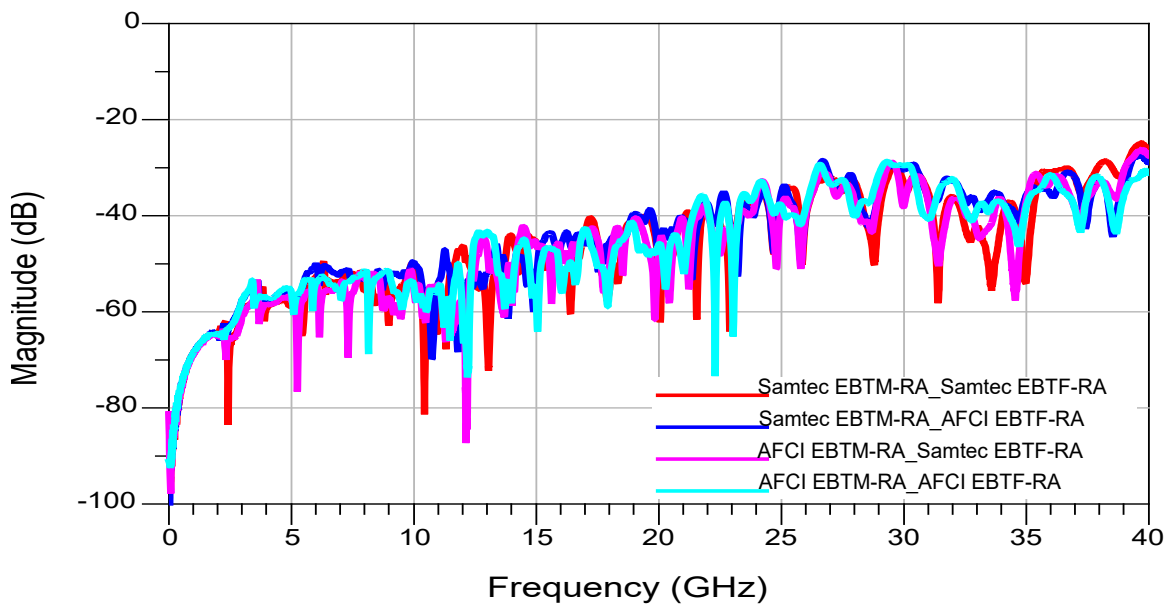
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential FEXT: O11-P11(EBTM-RA)-N10-O10(EBTF-RA)



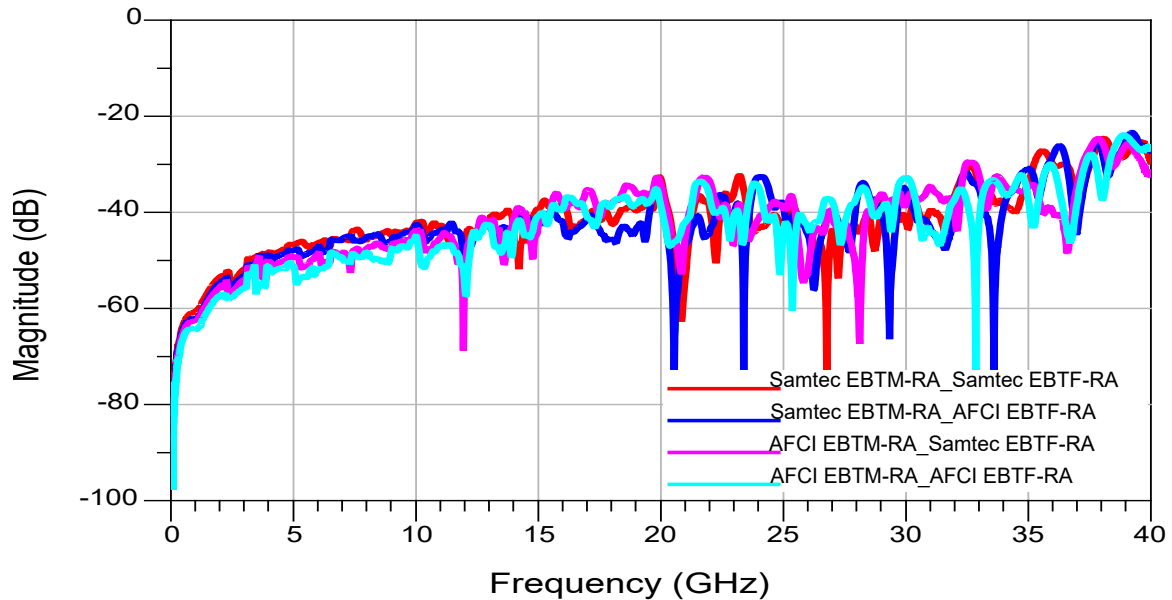
Differential FEXT: O11-P11(EBTM-RA)-Q10-R10(EBTF-RA)



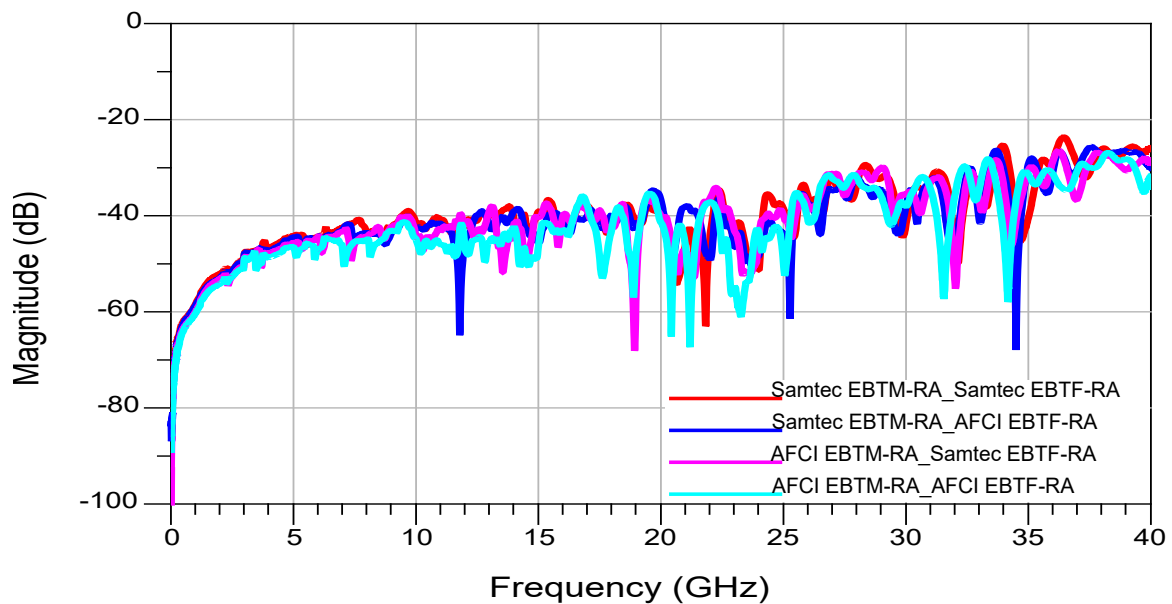
Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Differential FEXT: O11-P11(EBTM-RA)-L11-M11(EBTF-RA)



Differential FEXT: O11-P11(EBTM-RA)-R11-S11(EBTF-RA)



Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Appendix A – Product and Test System Descriptions

Product Description

Product test samples are EBTM-RA/EBTF-RA Series connectors. The part number is EBTM-6-12-2.0-S-RA-1 and EBTF-6-12-2.0-S-RA-1. A photo of the test samples mounted to SI test boards is shown below. The boards were populated with 2.4 mm connectors to reliably out to 50 GHz.

PCB-EBTMRX-110444-SIG-0 and PCB-EBTFRX-110445-SIG-0

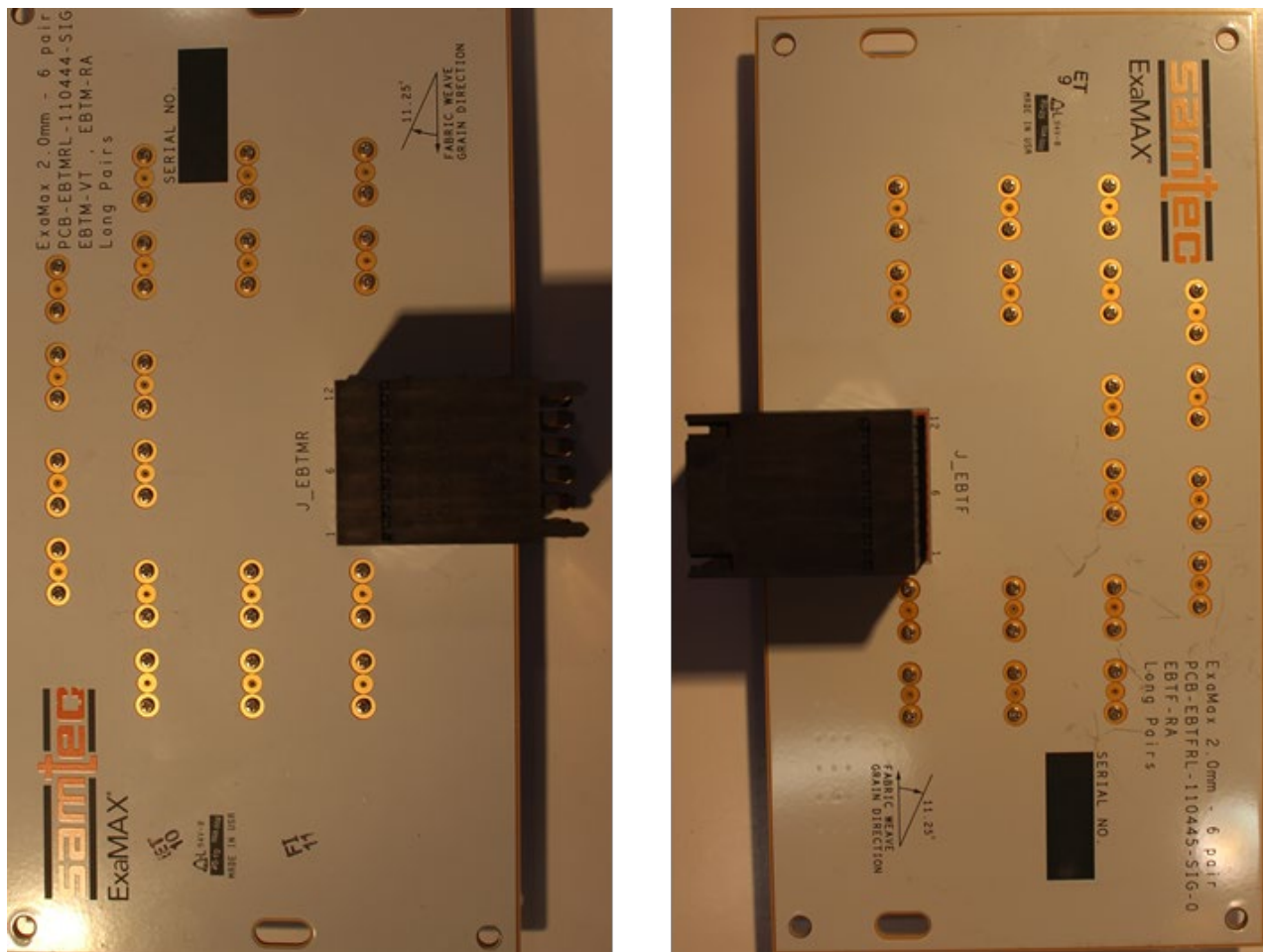


Figure 2: Test Boards and Samples

Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Appendix B – Test and Measurement Setup

For frequency domain measurements, the test instrument is the Keysight N5225B PNA-L network analyzer. Frequency domain data are obtained directly from the instrument and figures are generated by Keysight ADS. The network analyzer is configured as follows:

Start Frequency – 10 MHz
Stop Frequency – 40 GHz
Number of points – 4000
IFBW – 1KHz

N5225B Measurement Setup

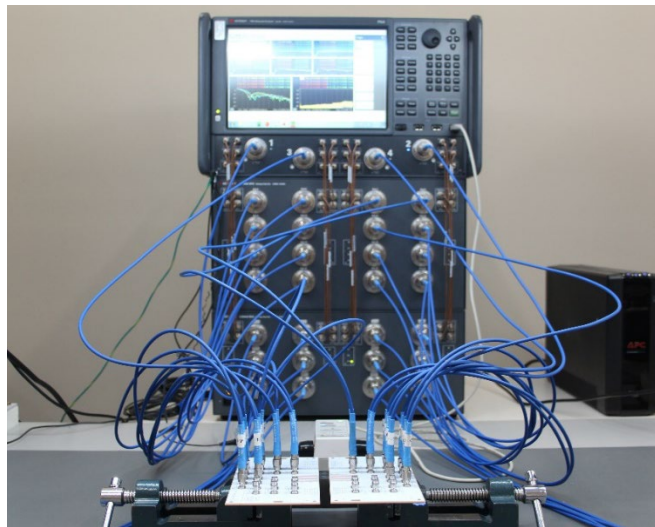


Figure 3: Measurement Setup

Test Instruments

<u>QTY</u>	<u>Description</u>
1	Keysight N5225B PNA-L Network Analyzer (10 MHz to 67 GHz)
1	Keysight N4694-60003 ECAL Module (10 MHz to 67 GHz)

Test Cables & Adapters

<u>QTY</u>	<u>Description</u>
16	1 m Junkosha 2.4mm male to female cables

Series: EBTM-RA / EBTF-RA

Description: Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High-Speed Backplane Interconnect, RA mating to RA, Standard Coplanar Configuration (Pin A1 to Pin A1)

Appendix C - Frequency Domain Measurements

Frequency (S-Parameter) Domain Procedures

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 through calibration standards, the SI test boards, and the selection of the PCB vendor.

A coaxial SOLT calibration is performed using a N4694-60003 ECAL module. Then DUT measurements are performed under SOLT calibration. The measurements include the effect of test fixture. The measurements of the 2X THRU line standards are required to remove the test fixture effect.

The boards PCB-EBTMRS-110444-SIG-0, PCB-EBTMRL-110444-SIG-0 and PCB-EBTFRS-110445-SIG-0, PCB-EBTFRL-110445-SIG-0 were used. The bandwidth of all calibration traces is higher than 40 GHz.

Appendix D – Glossary of Terms

ADS – Advanced Design Systems

DUT – Device under test

FEXT – Far-End Crosstalk

NEXT – Near-End Crosstalk

PCB – Printed Circuit Board

SE – Single-Ended

SI – Signal Integrity

SOLT – used to define Short, Open, Load & Thru Calibration Standards