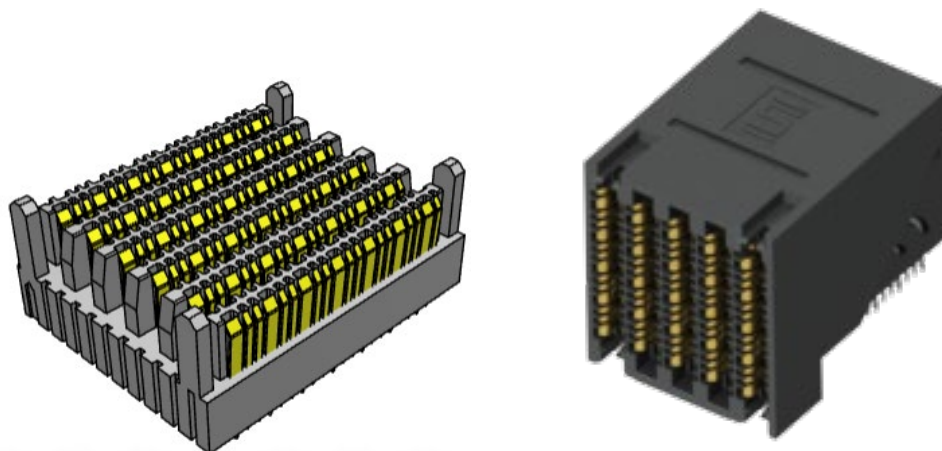




## High Speed Characterization Report ExaMAX® Second Source Verification Report

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

Amphenol ICC  
10123162-101LF  
10131766-101LF



### Description

#### Performance Comparison of Samtec and Amphenol ICC ExaMAX® 6 Pair High Speed Backplane Connector Vertical Header mating to Right-Angle Receptacle

**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA

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**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

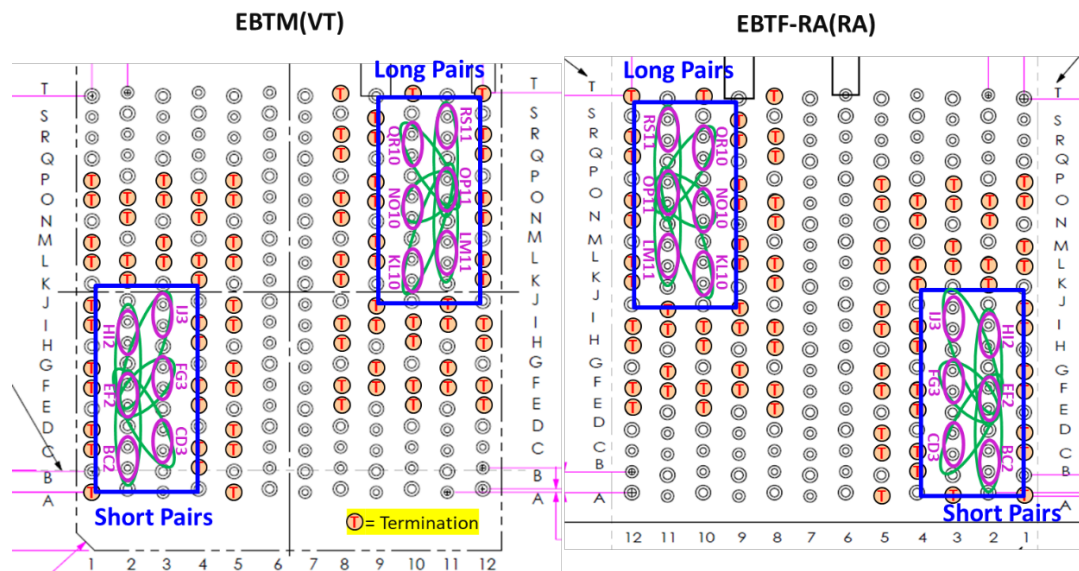
## Connector Overview

Samtec is a second source to Amphenol ICC's ExaMAX® 2mm high speed backplane connector. The Samtec EBTx features an EBTM series vertical 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-VT-1 will be referred to as "Samtec EBTM".
- The Samtec EBTF-6-12-2.0-S-RA-1 will be referred to as "Samtec EBTF-RA".
- The Amphenol ICC 10123162-101LF will be referred to as "AFCI EBTM".
- 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](mailto:sig@samtec.com).



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

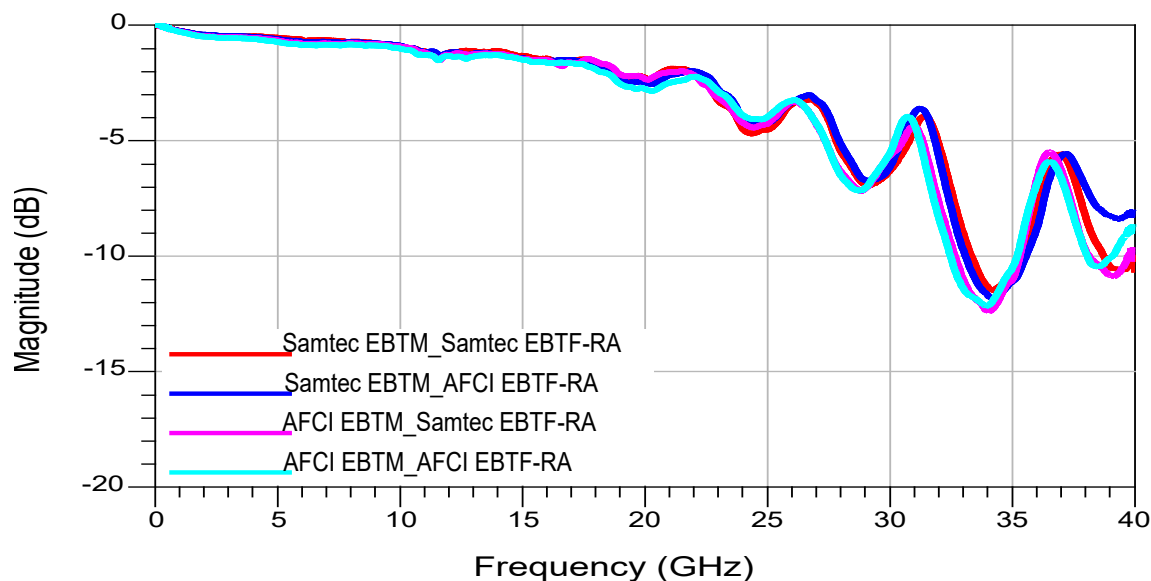
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA

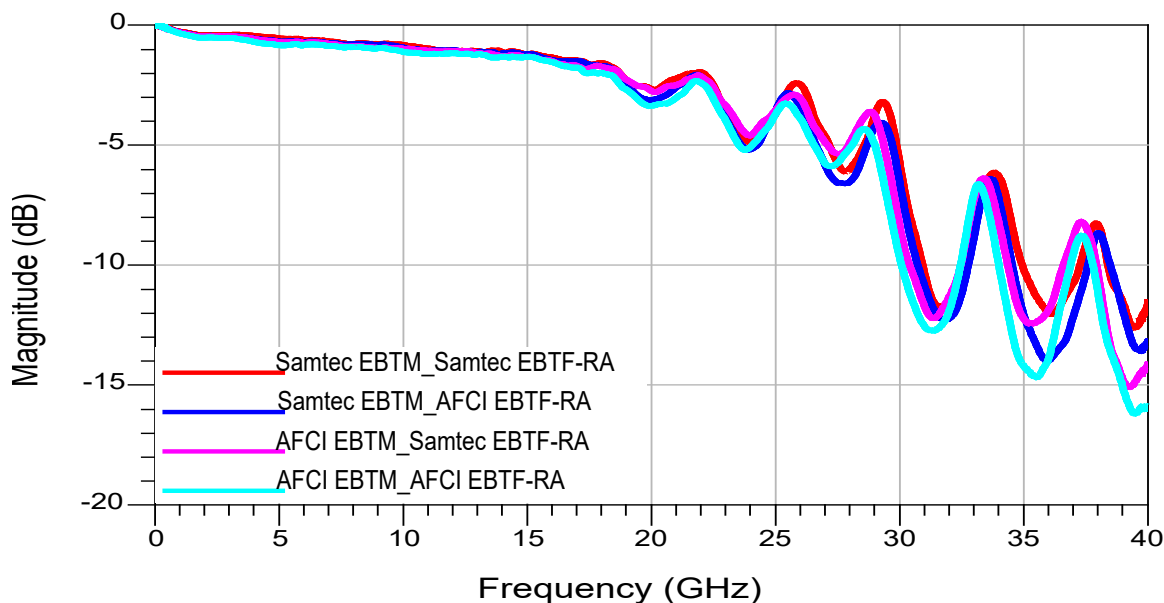
## Frequency Domain Responses

### Differential Insertion Loss (IL)

Differential IL: Pair B2-C2



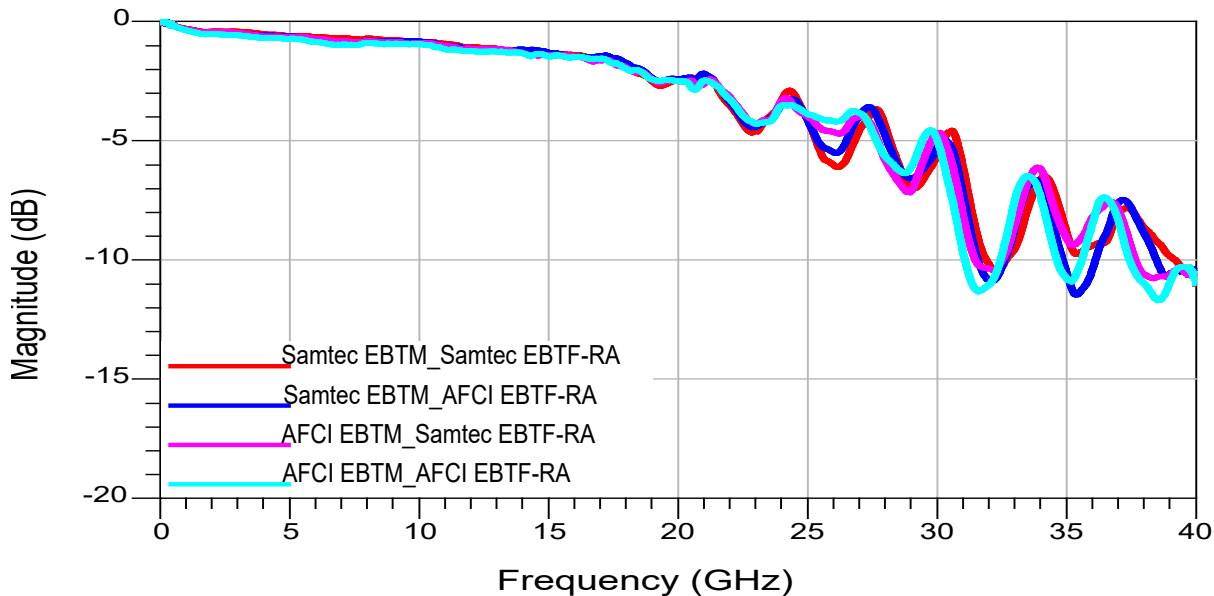
Differential IL: Pair E2-F2



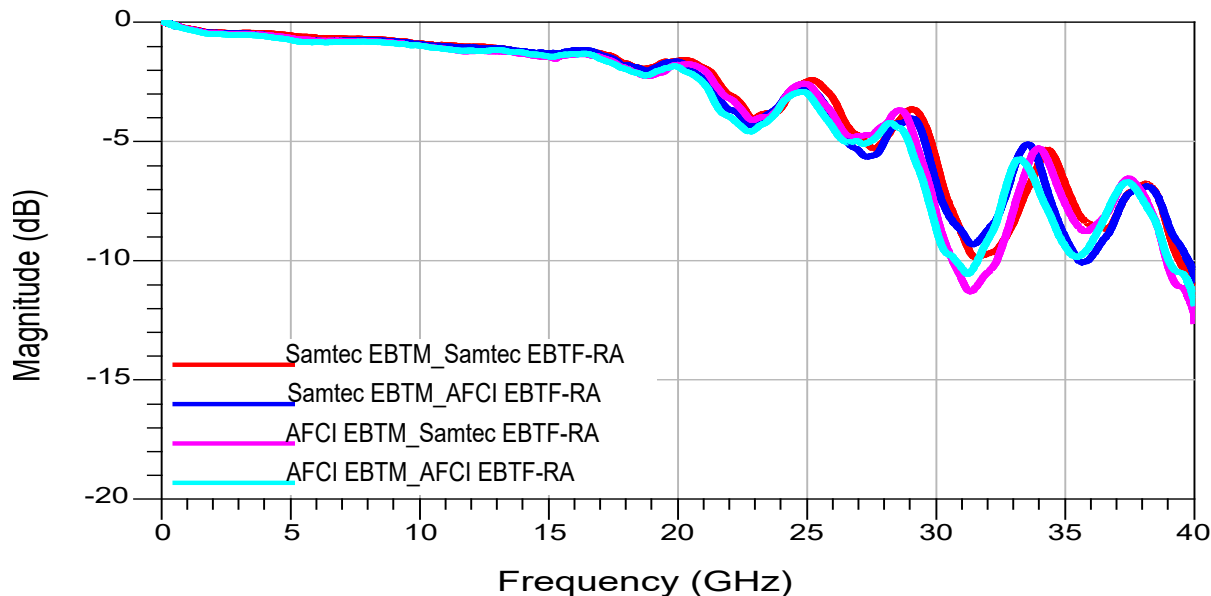
**Series:** EBTM / EBTF-RA

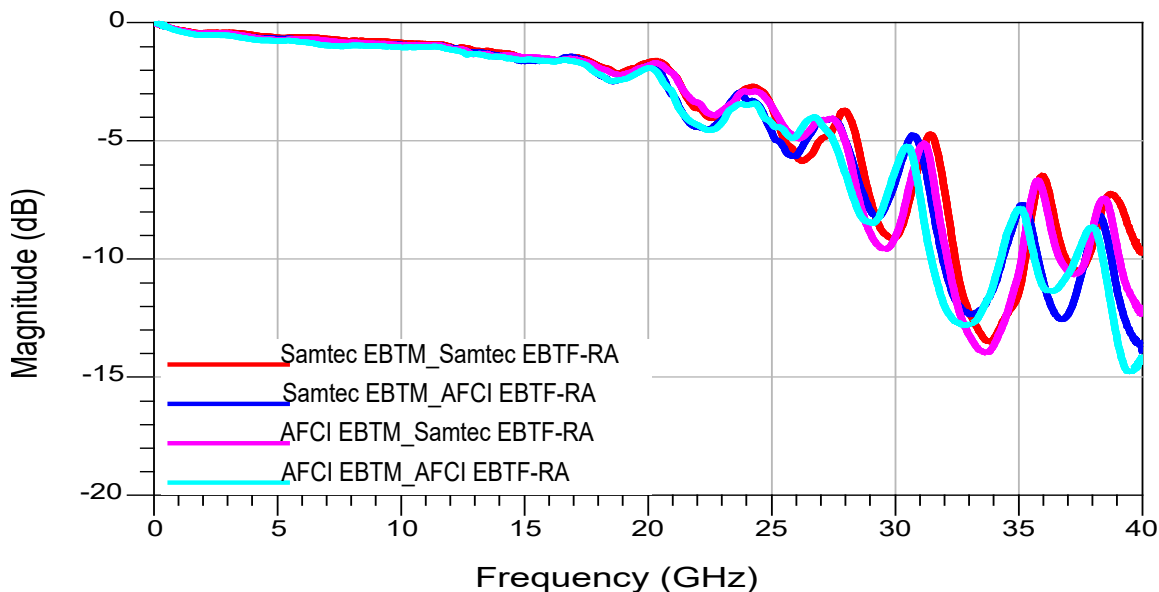
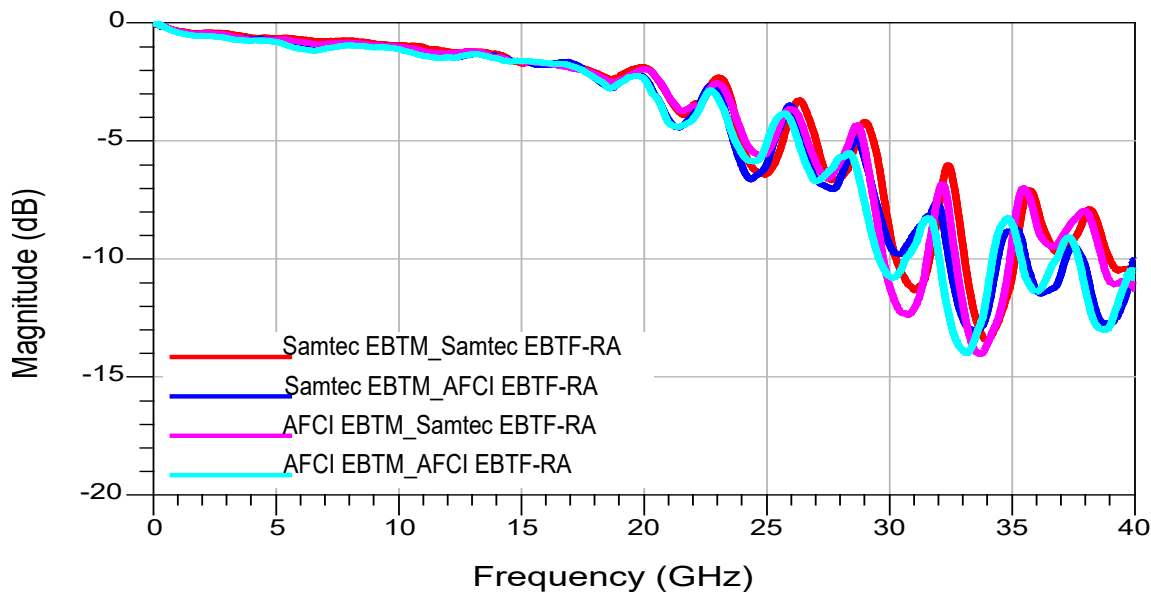
**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA

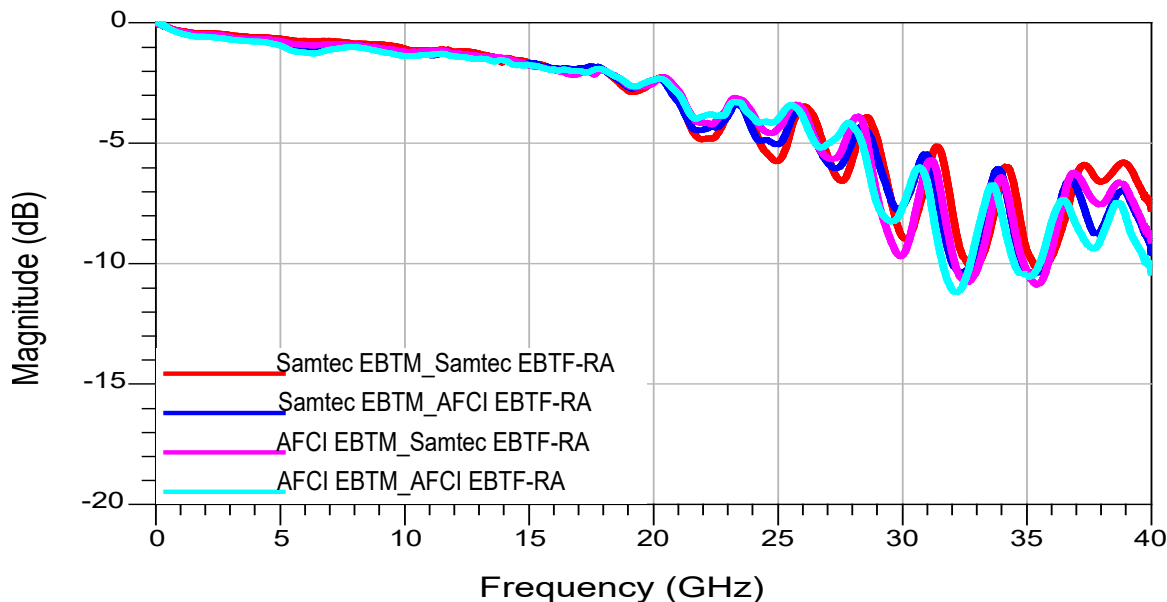
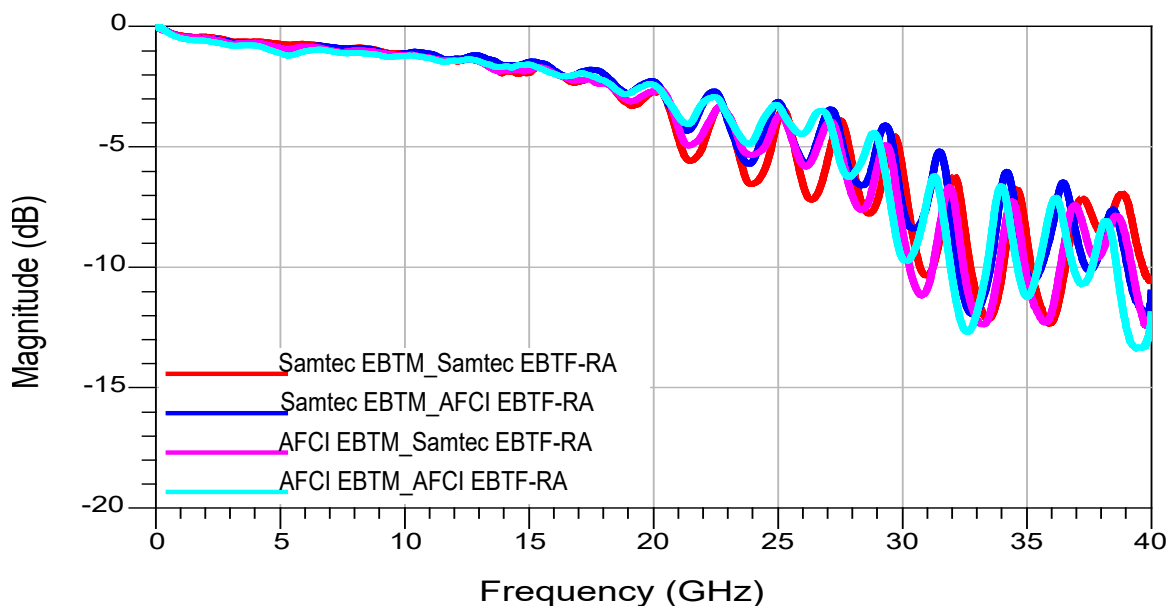
Differential IL: Pair H2-I2



Differential IL: Pair C3-D3



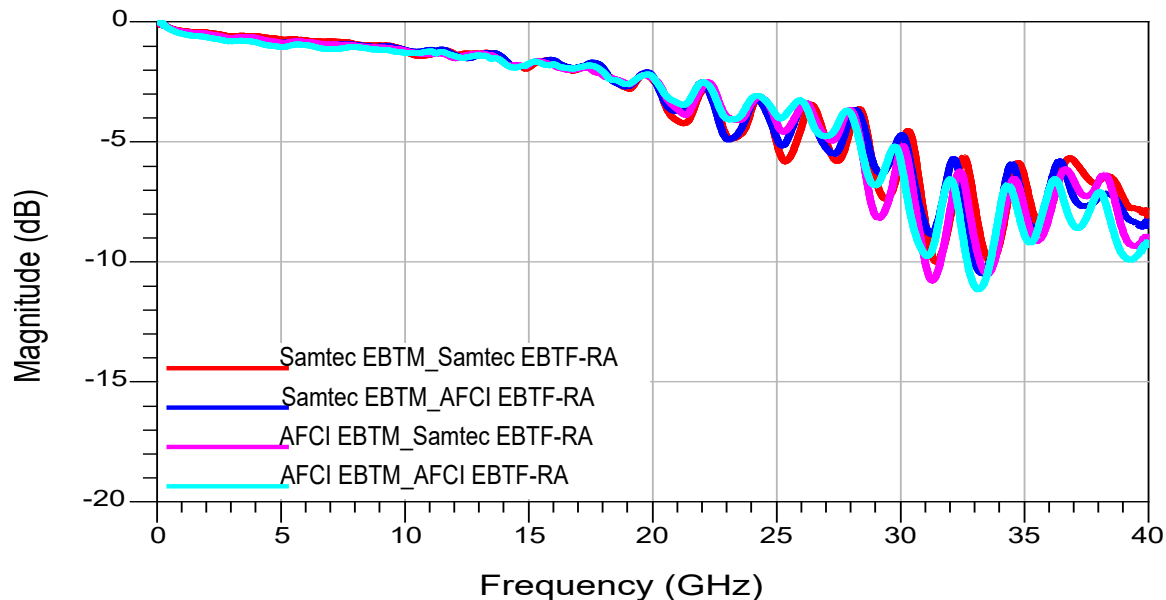
**Series:** EBTM / EBTF-RA**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA**Differential IL: Pair F3-G3****Differential IL: Pair I3-J3**

**Series:** EBTM / EBTF-RA**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA**Differential IL: Pair K10-L10****Differential IL: Pair N10-O10**

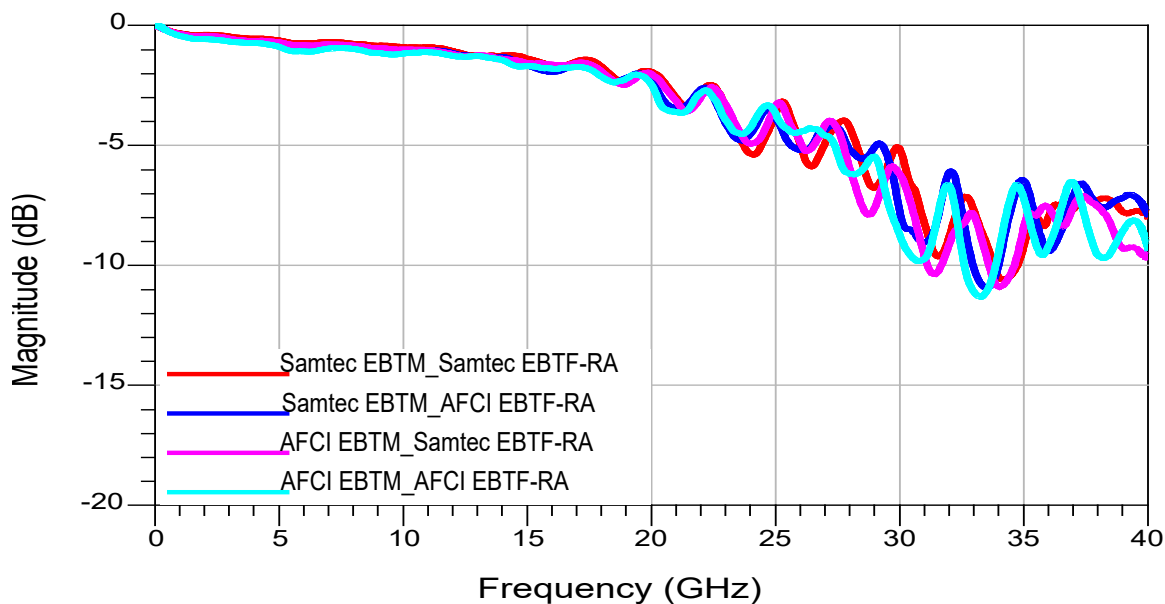
**Series:** EBTM / EBTF-RA

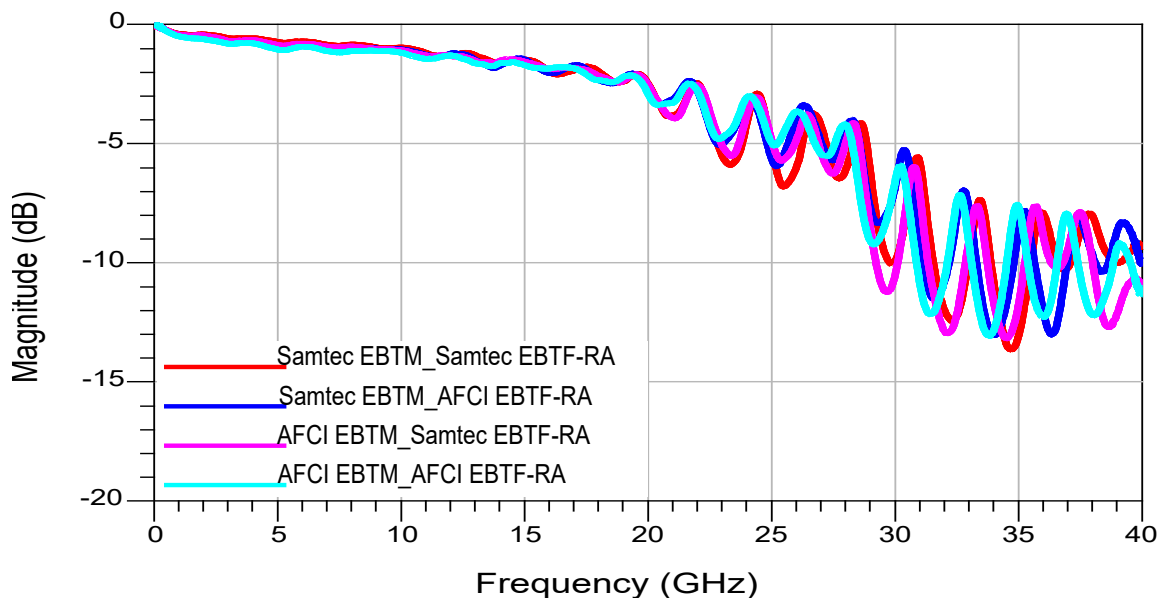
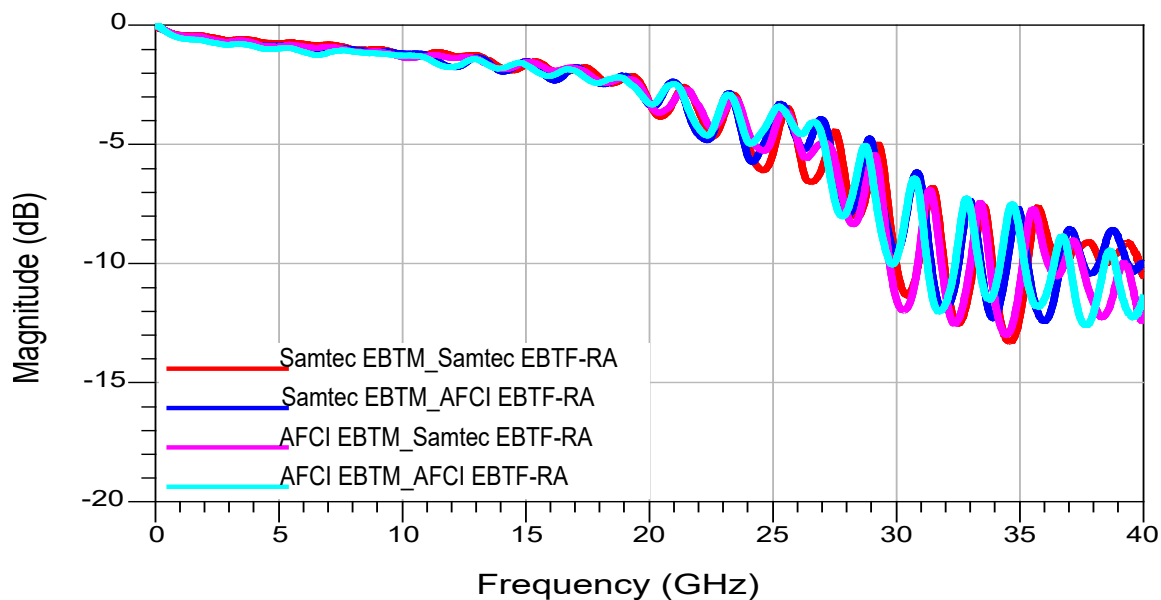
**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

Differential IL: Pair Q10-R10



Differential IL: Pair L11-M11

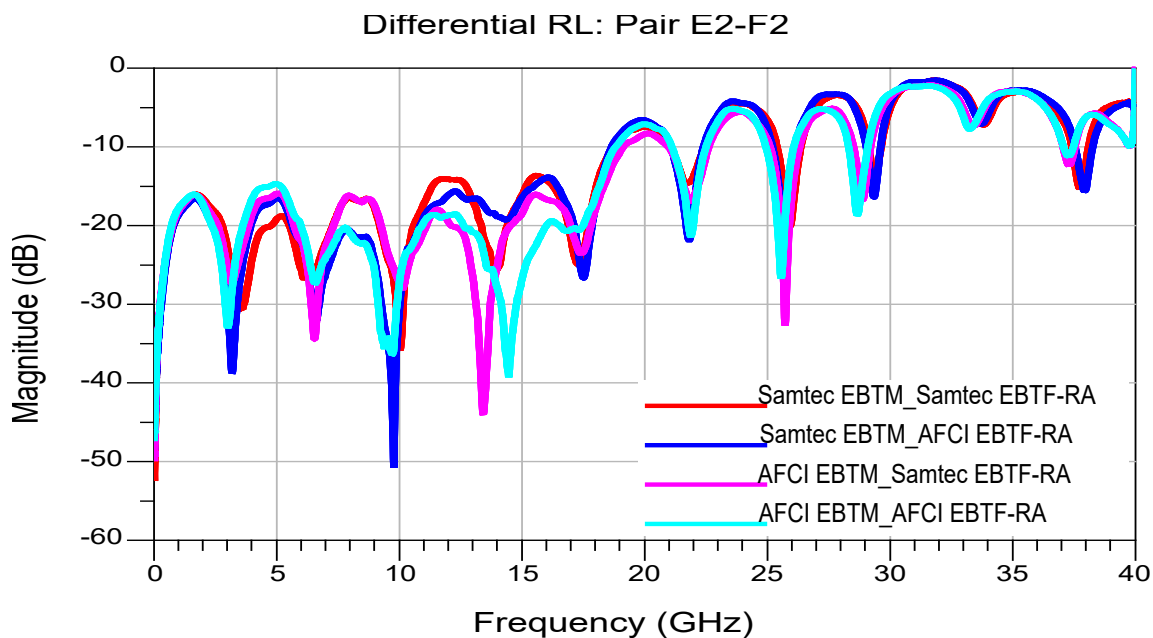
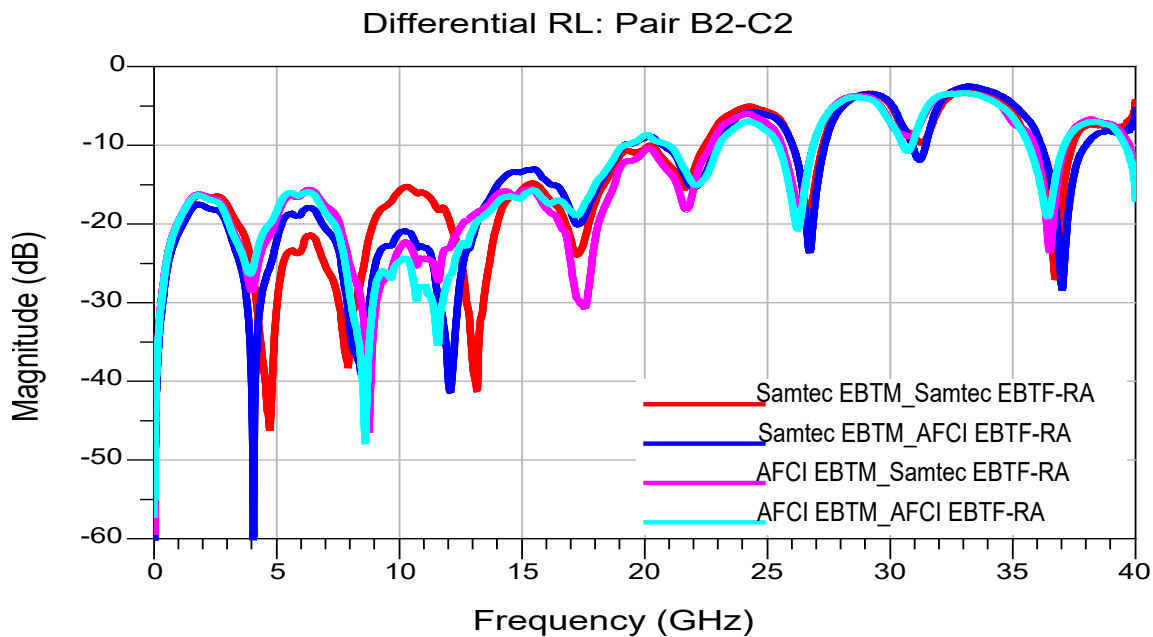


**Series:** EBTM / EBTF-RA**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA**Differential IL: Pair O11-P11****Differential IL: Pair R11-S11**

**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA

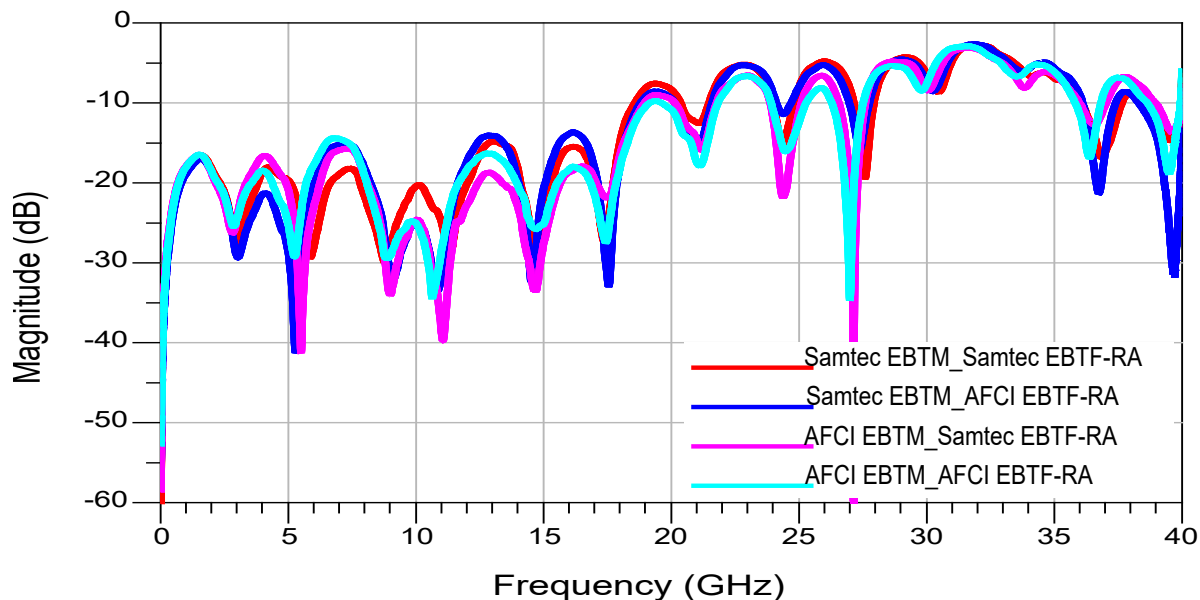
### Differential Return Loss (RL)



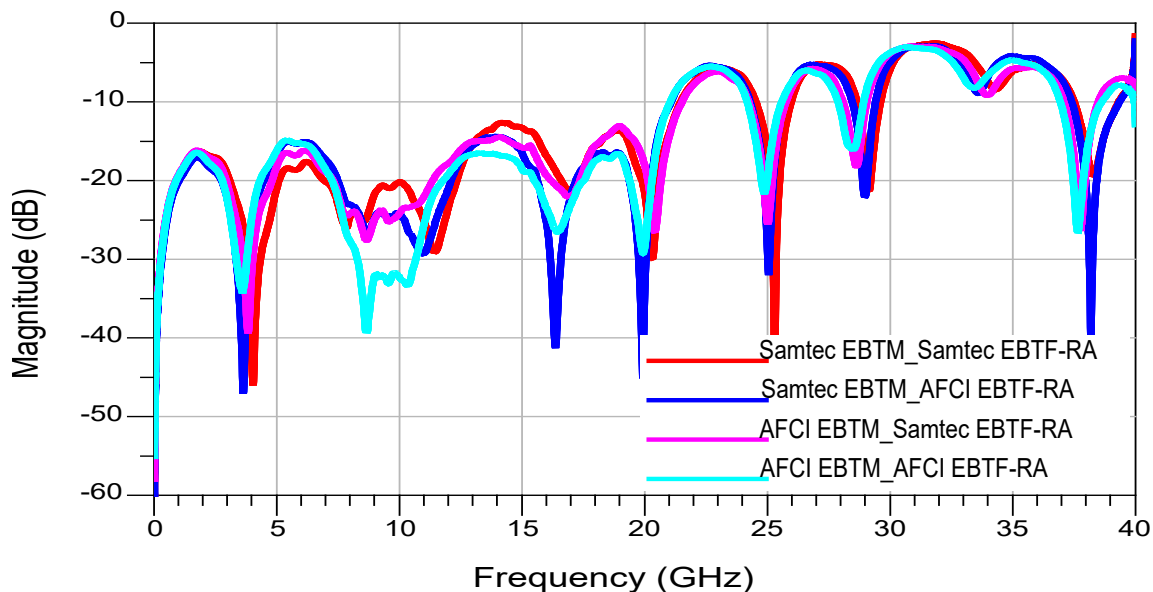
**Series:** EBTM / EBTF-RA

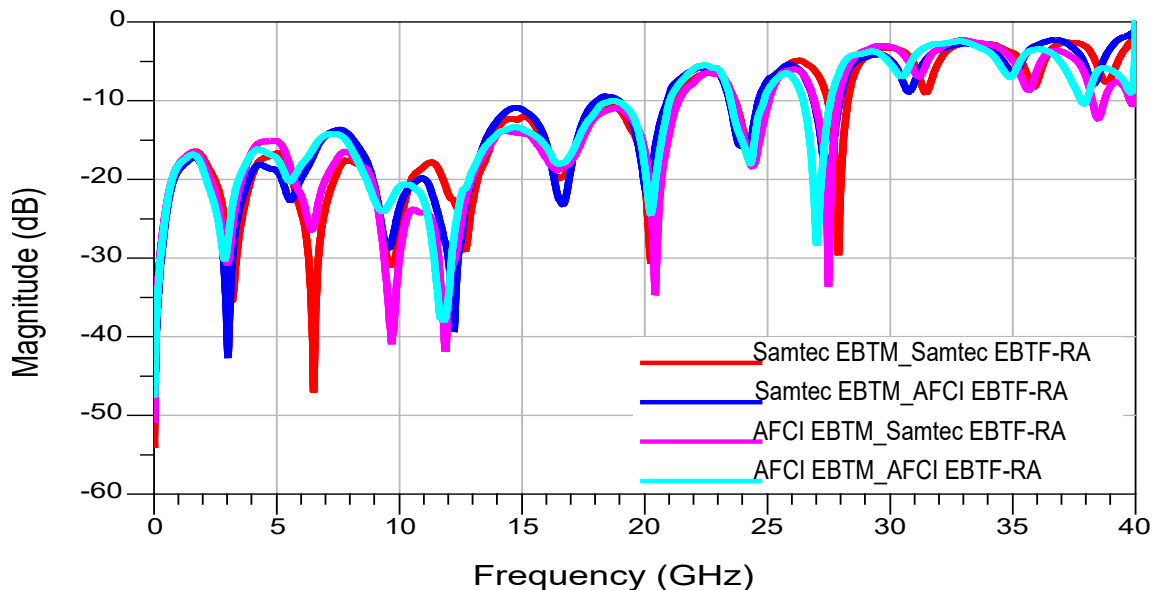
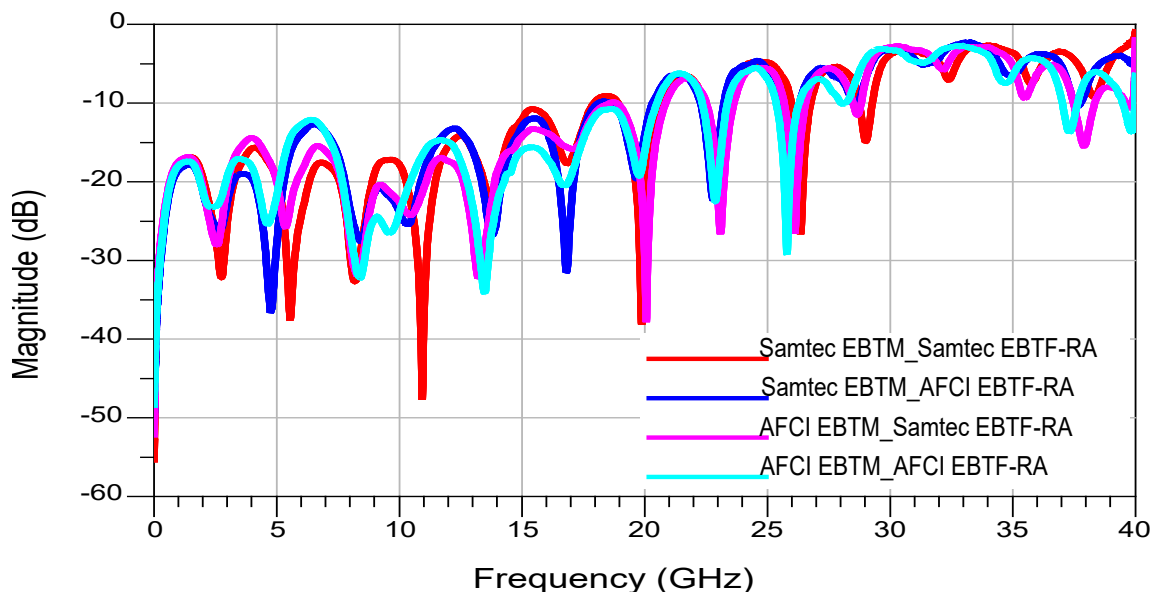
**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

Differential RL: Pair H2-I2



Differential RL: Pair C3-D3

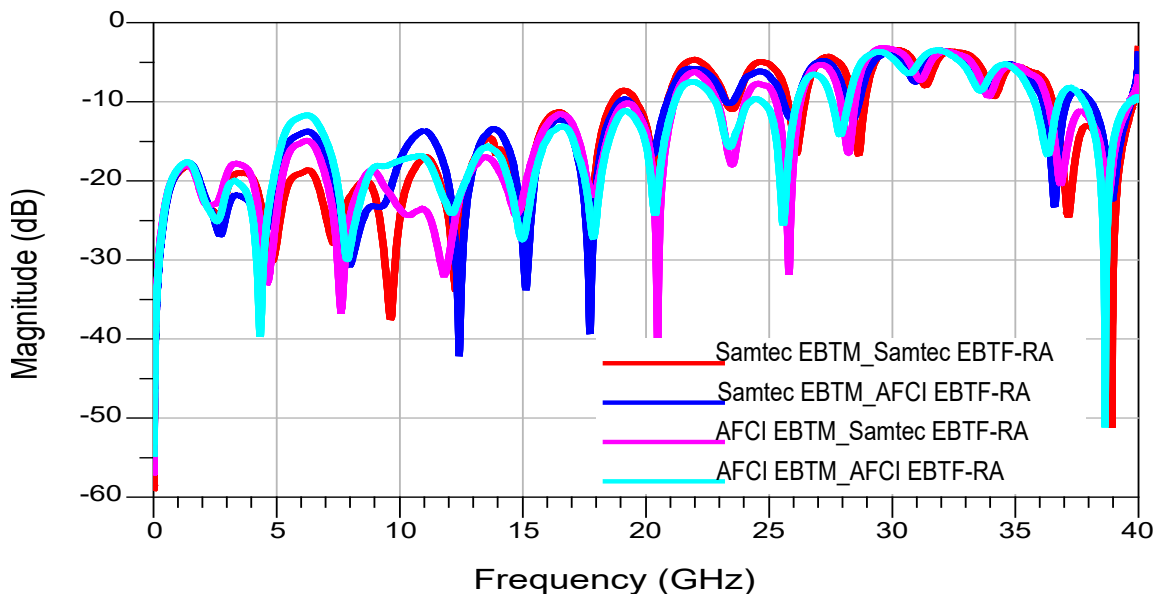


**Series:** EBTM / EBTF-RA**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA**Differential RL: Pair F3-G3****Differential RL: Pair I3-J3**

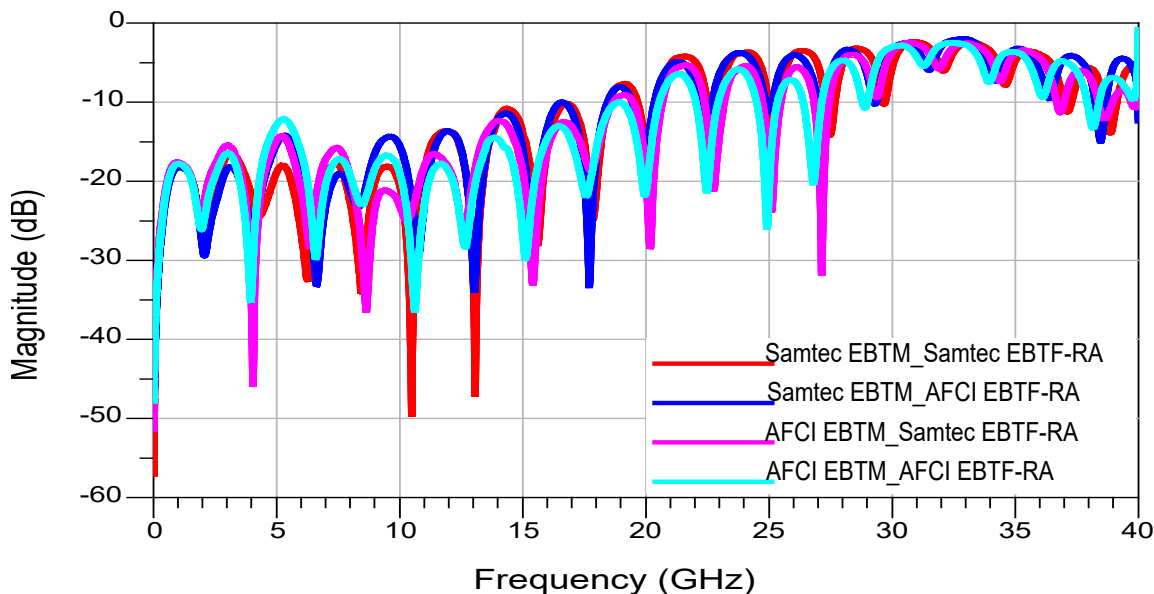
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

Differential RL: Pair K10-L10



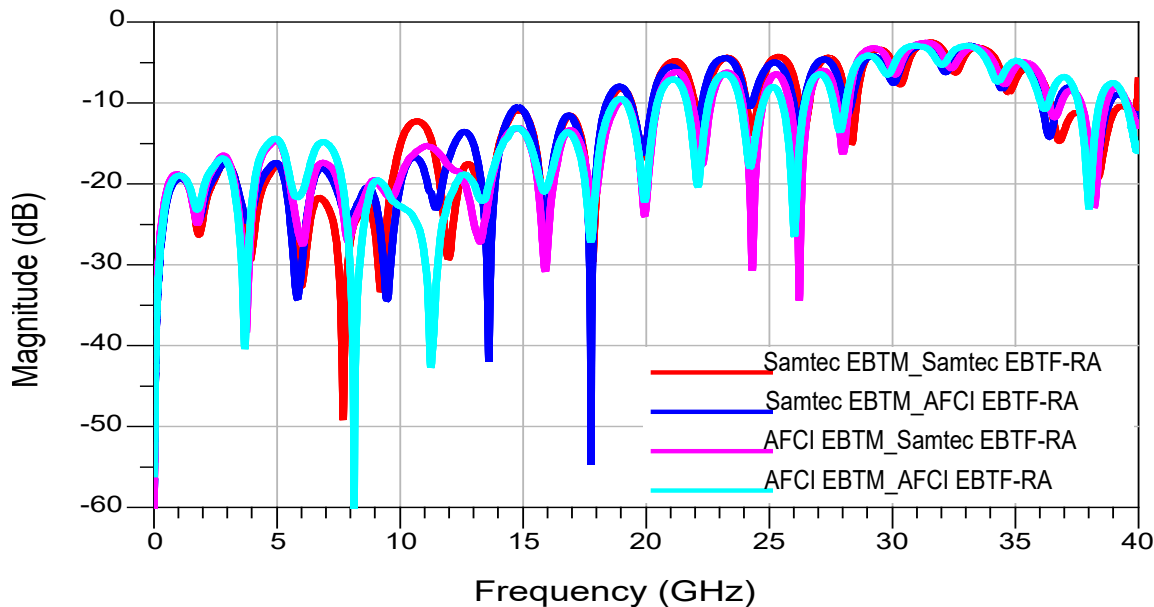
Differential RL: Pair N10-O10



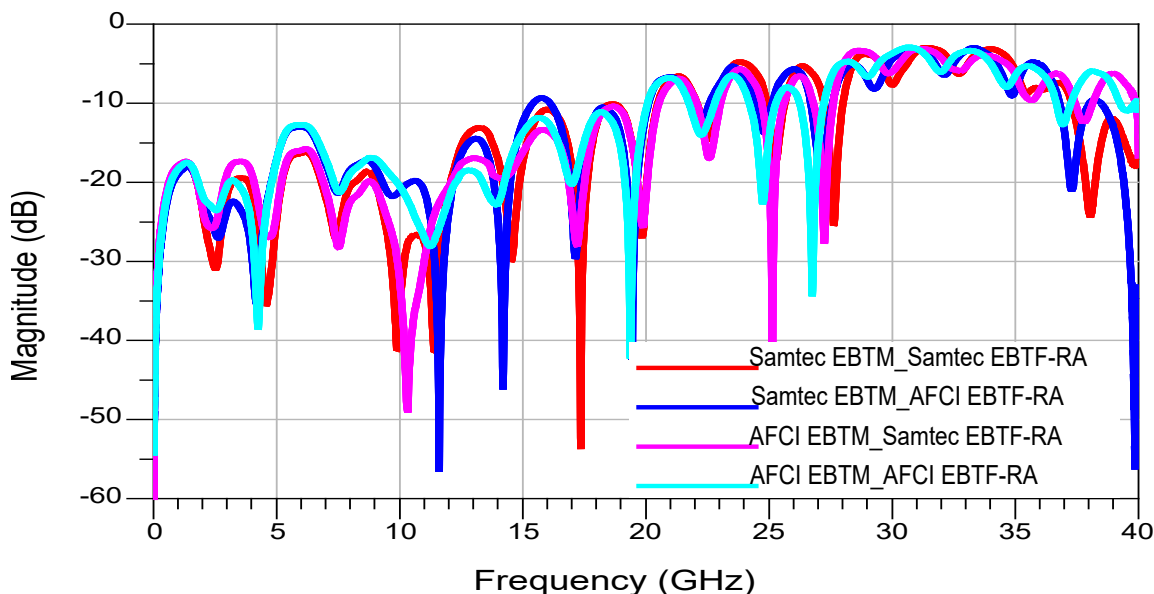
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

Differential RL: Pair Q10-R10



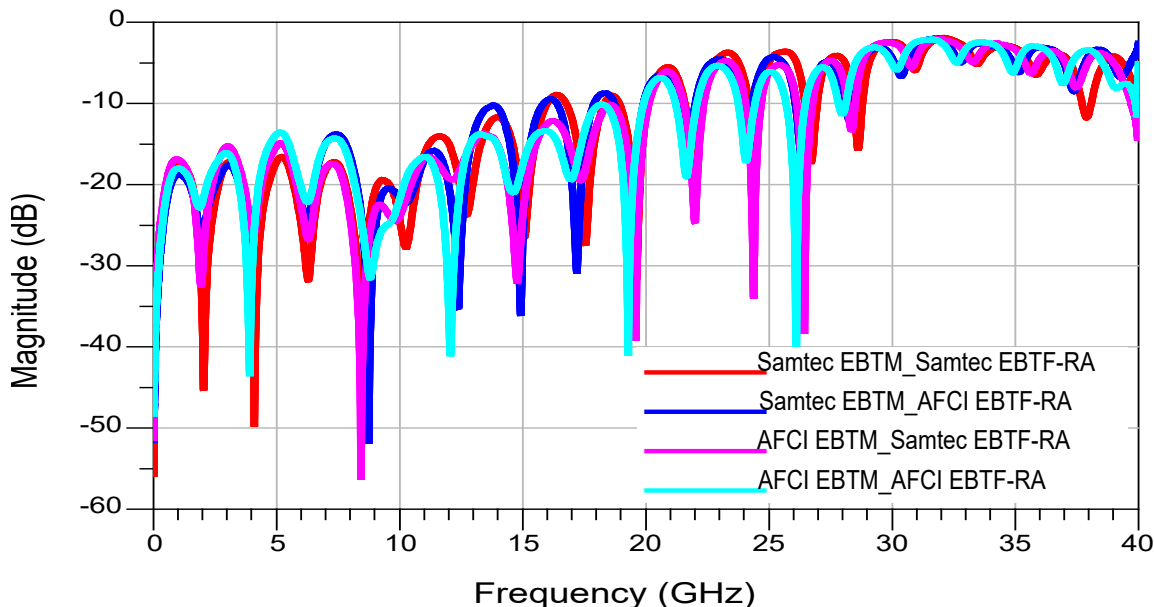
Differential RL: Pair L11-M11



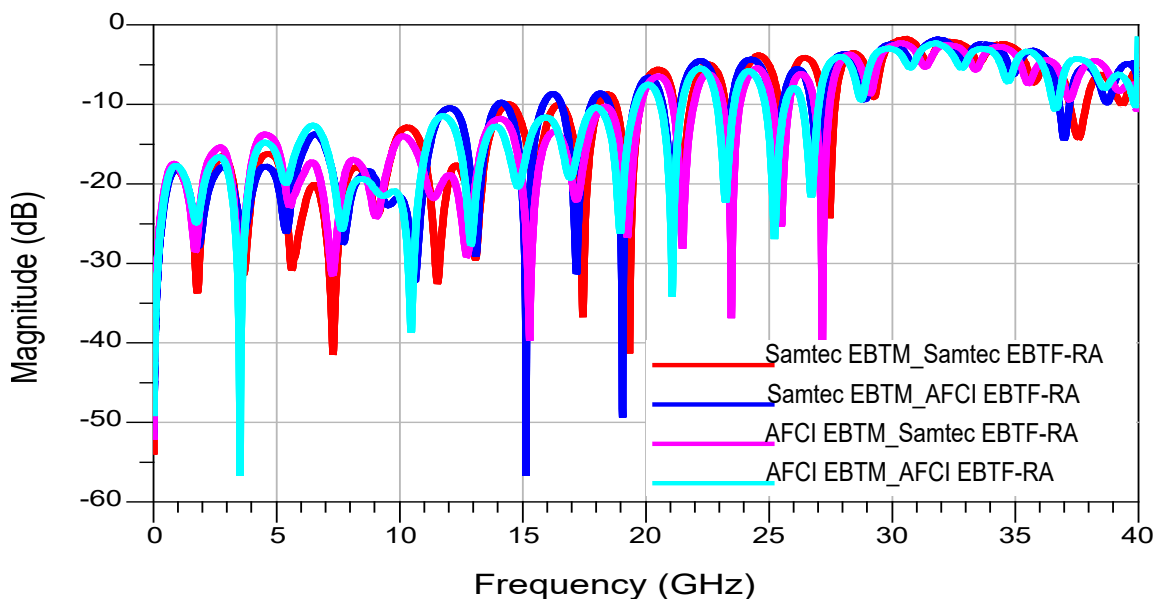
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

Differential RL: Pair O11-P11



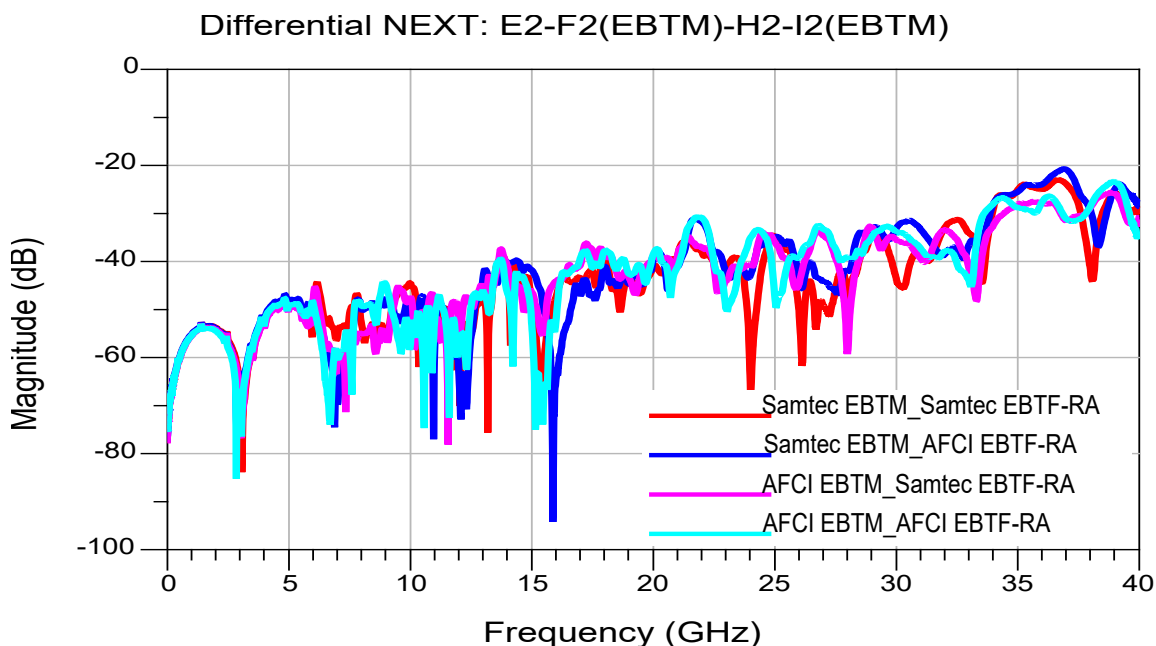
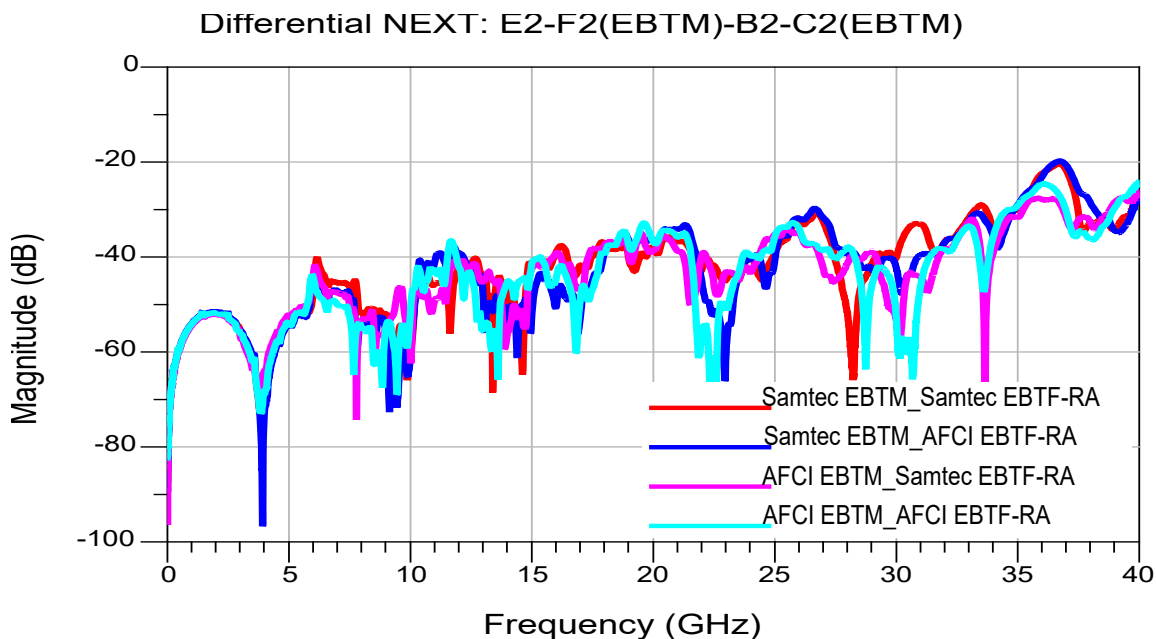
Differential RL: Pair R11-S11



**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA

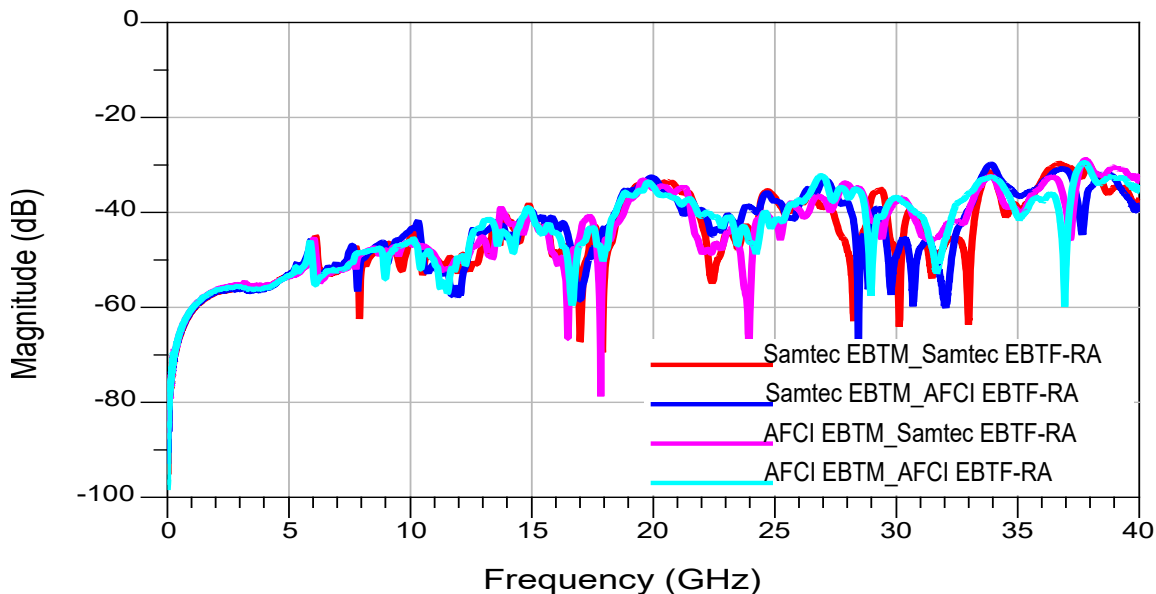
**Differential Near End Crosstalk (NEXT) from Backplane Vertical Header**



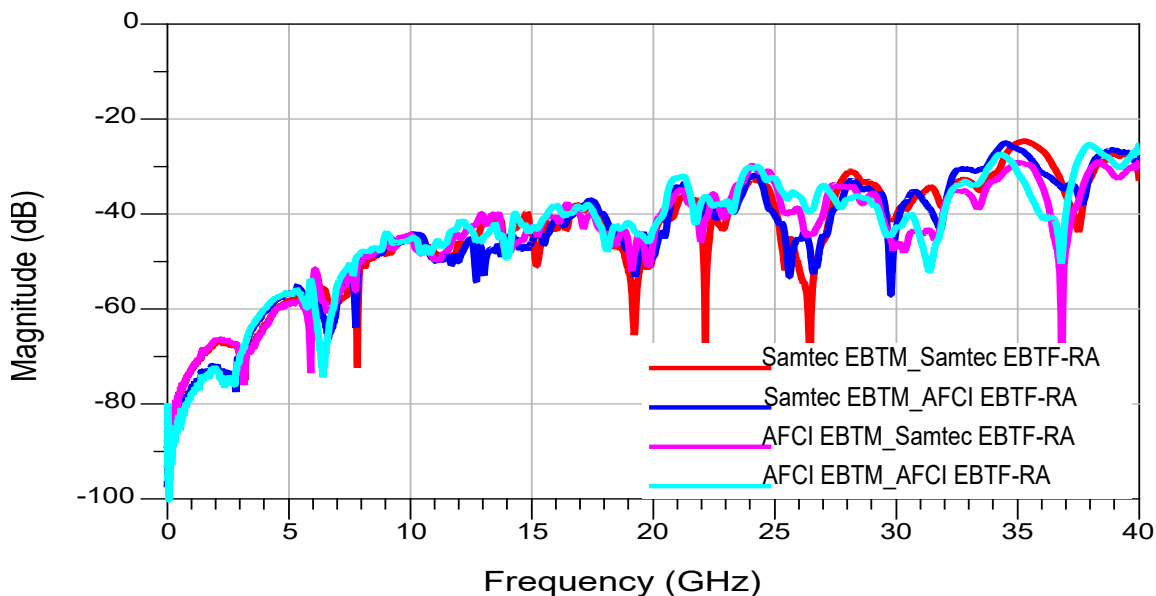
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



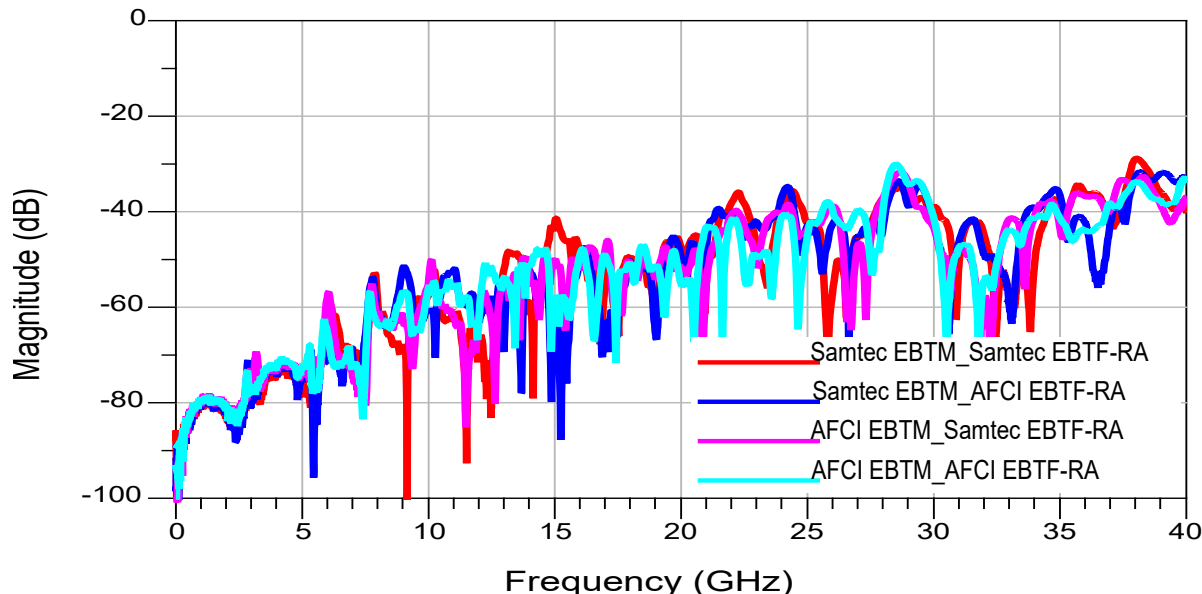
Differential NEXT: E2-F2(EBTM)-F3-G3(EBTM)



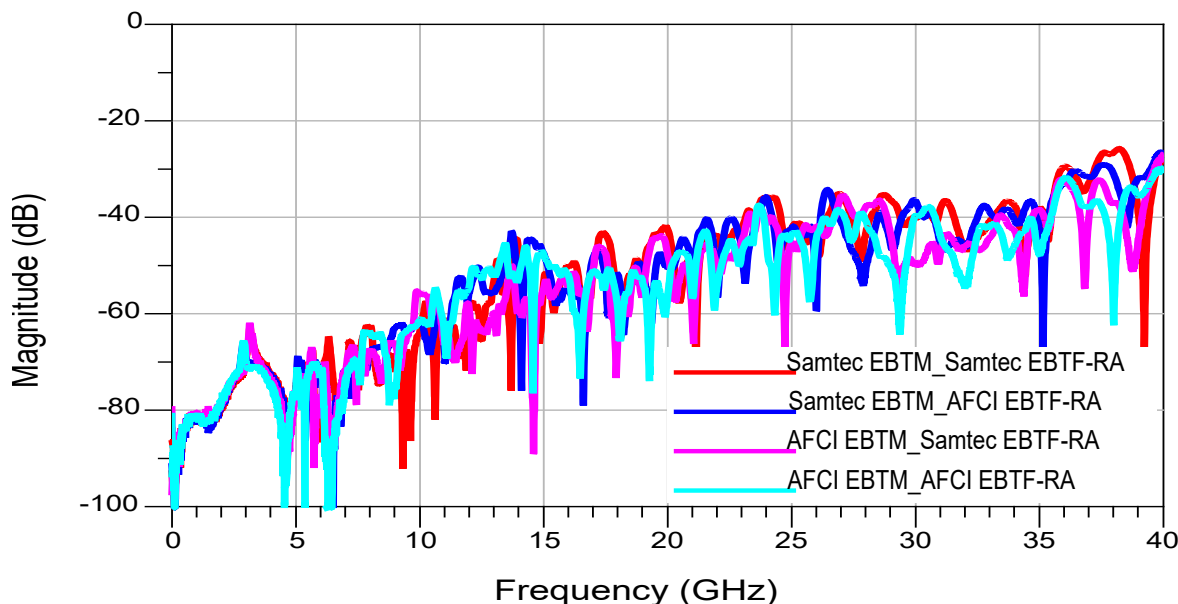
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



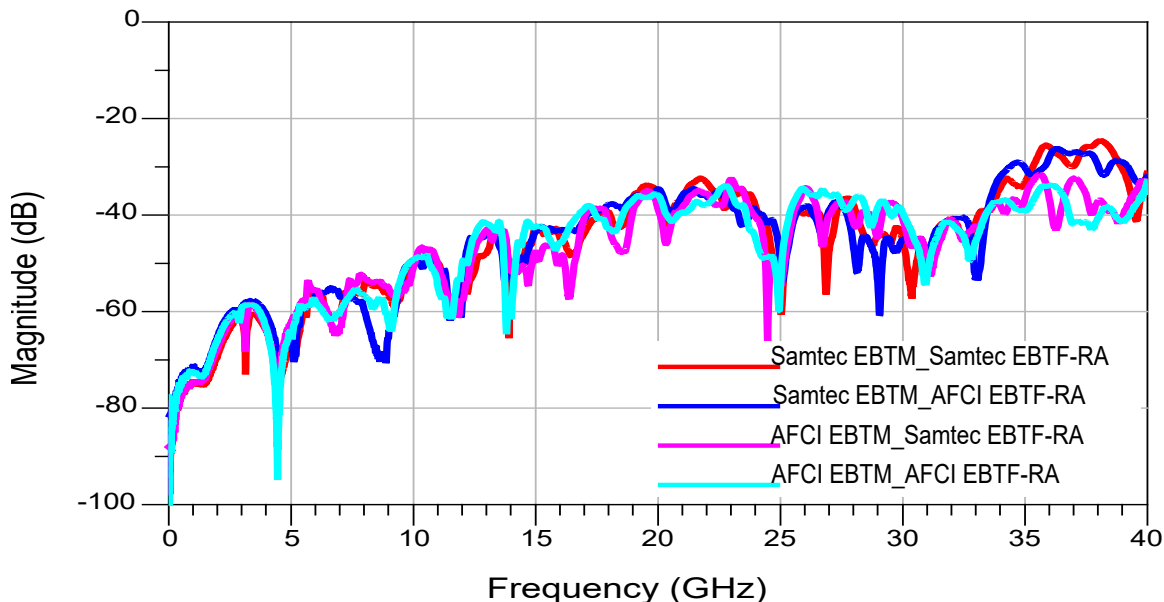
Differential NEXT: O11-P11(EBTM)-K10-L10(EBTM)



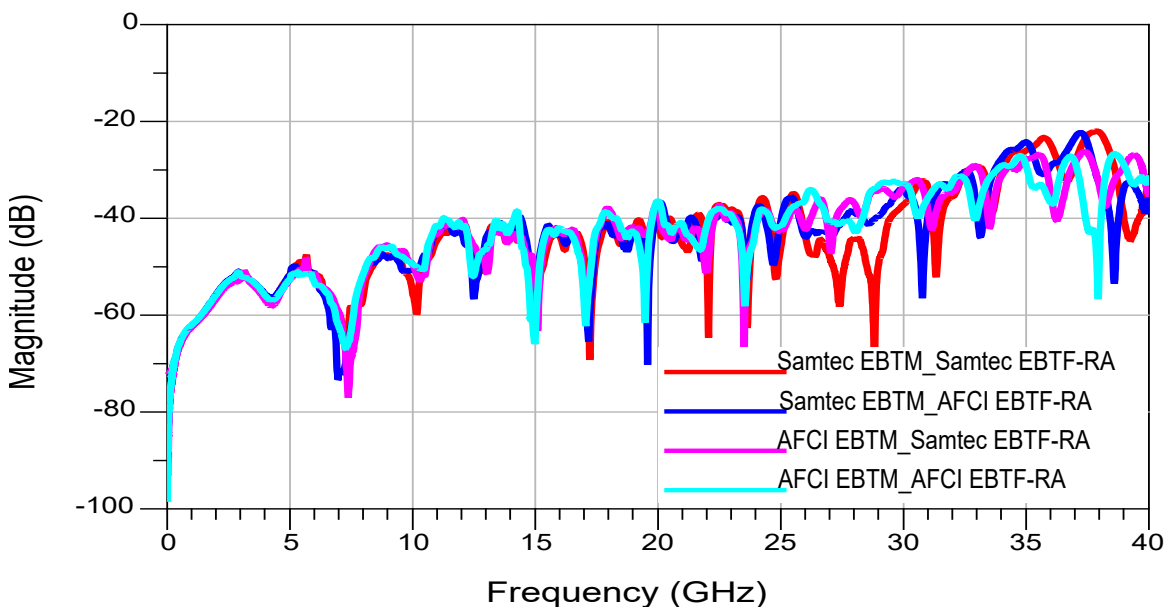
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



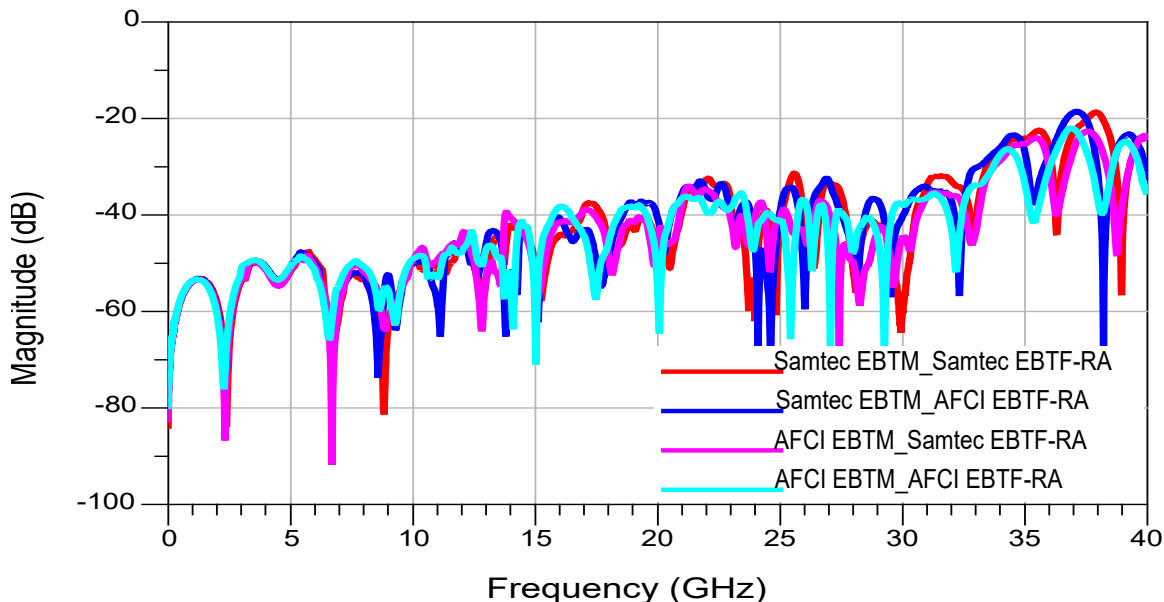
Differential NEXT: O11-P11(EBTM)-Q10-R10(EBTM)



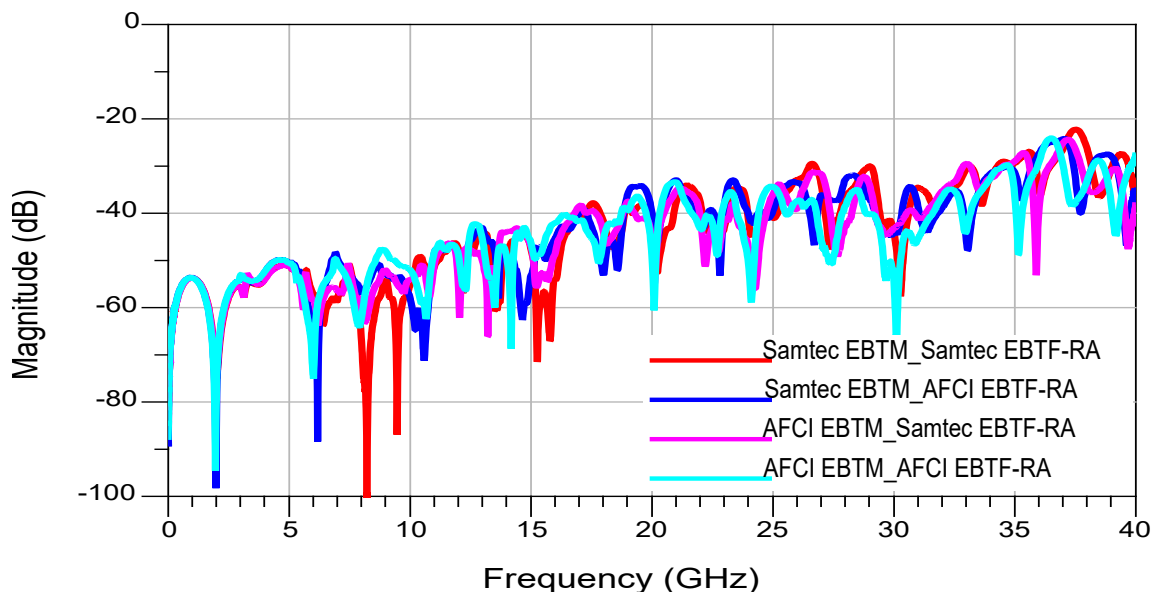
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



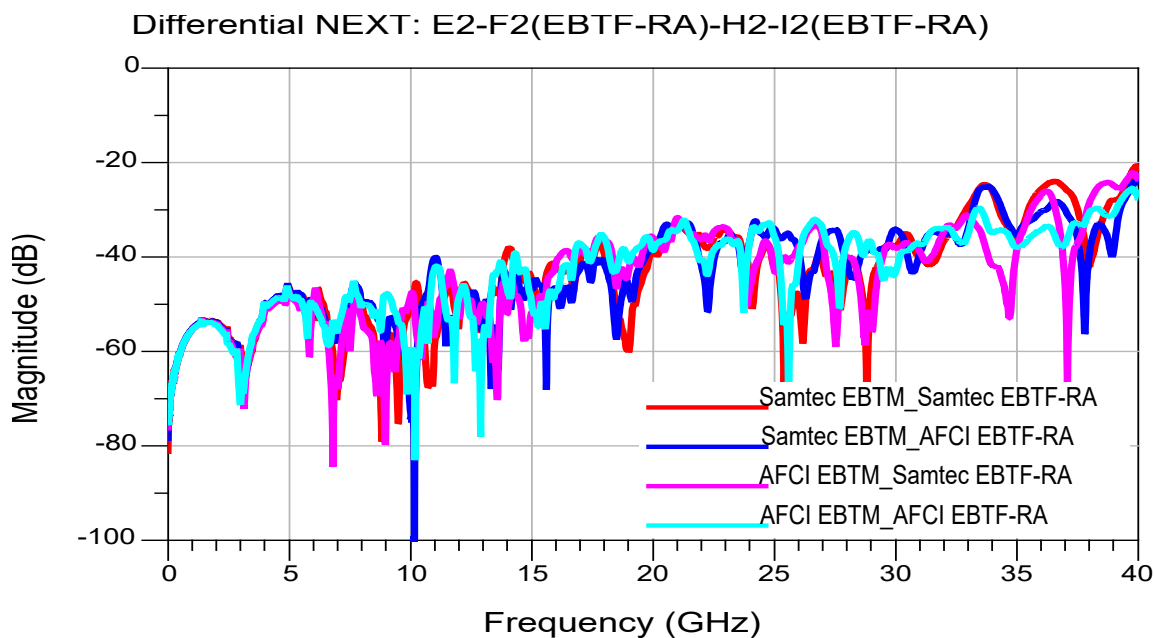
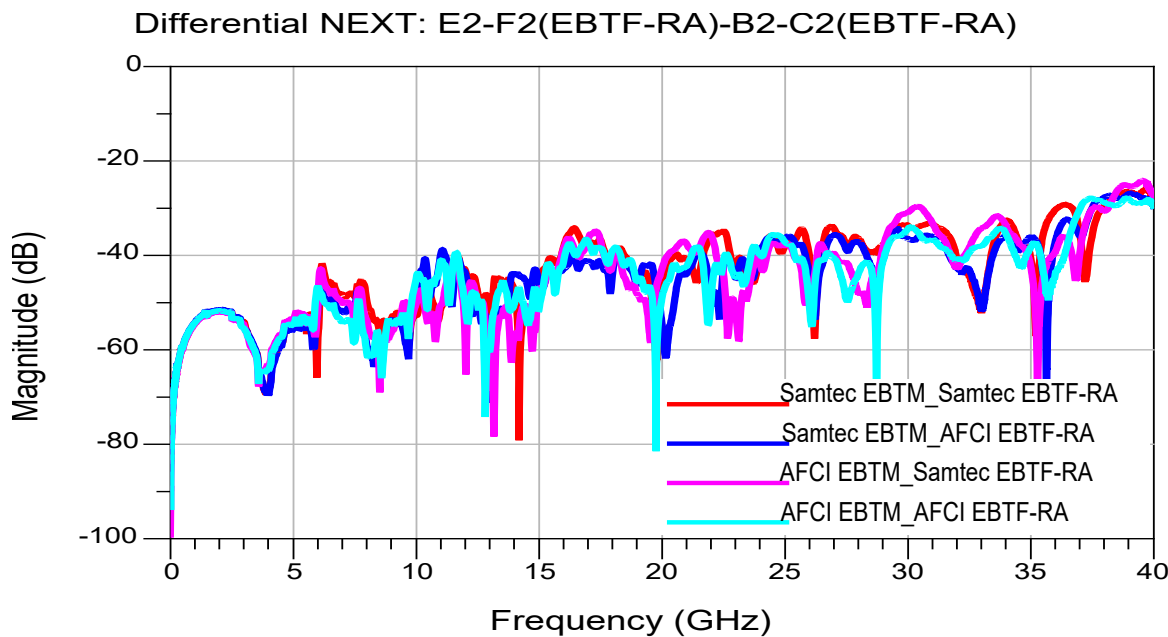
Differential NEXT: O11-P11(EBTM)-R11-S11(EBTM)



**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

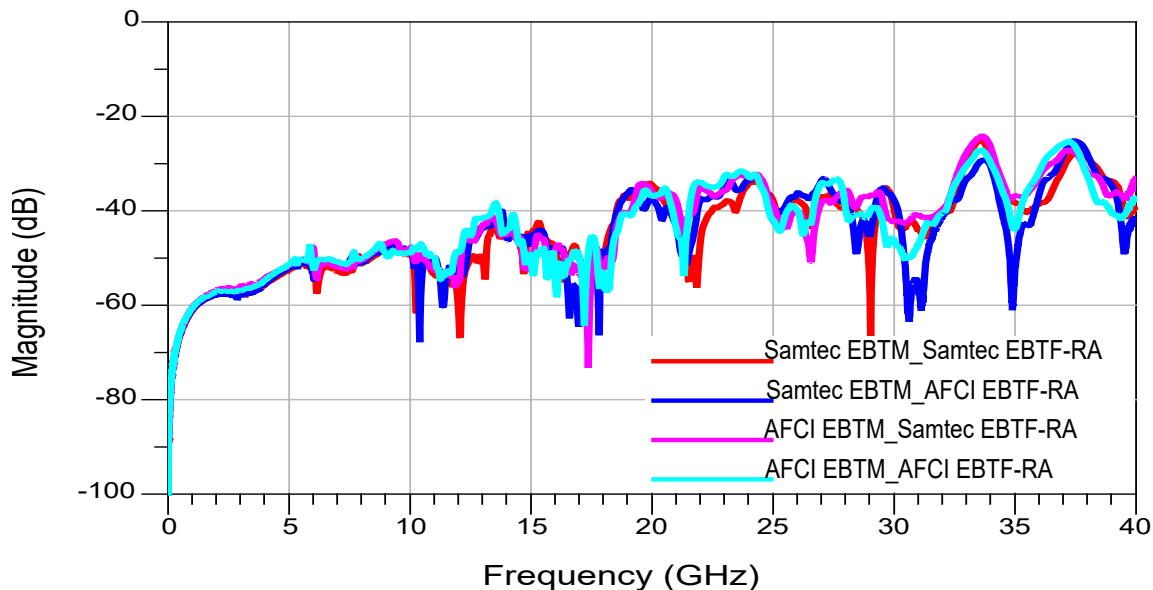
## Differential Near End Crosstalk (NEXT) from Right Angle(RA) Receptacle



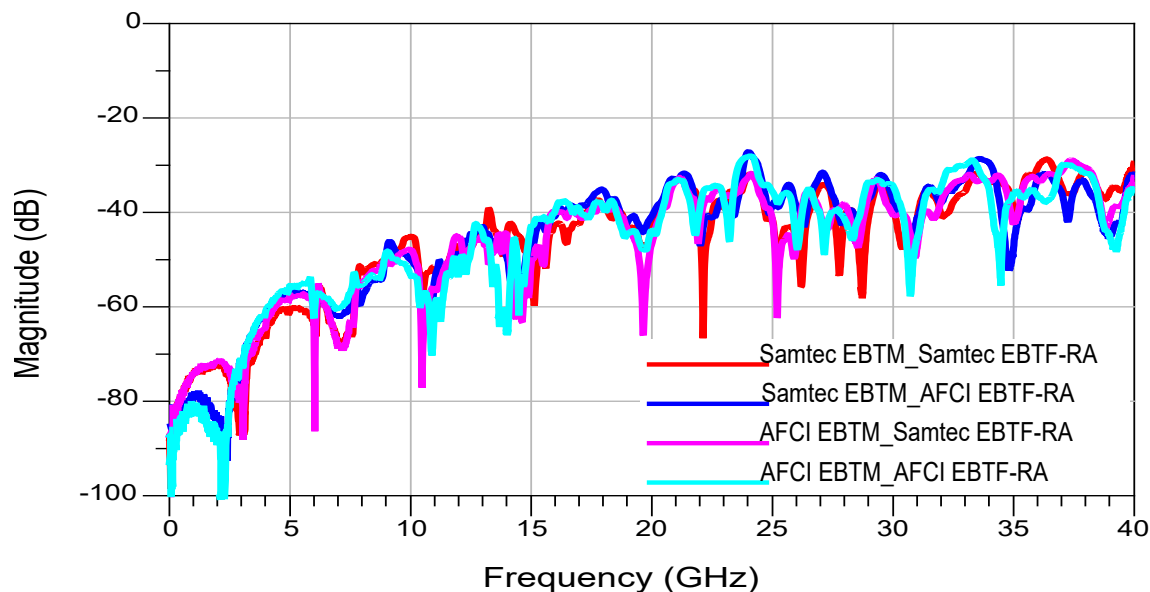
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



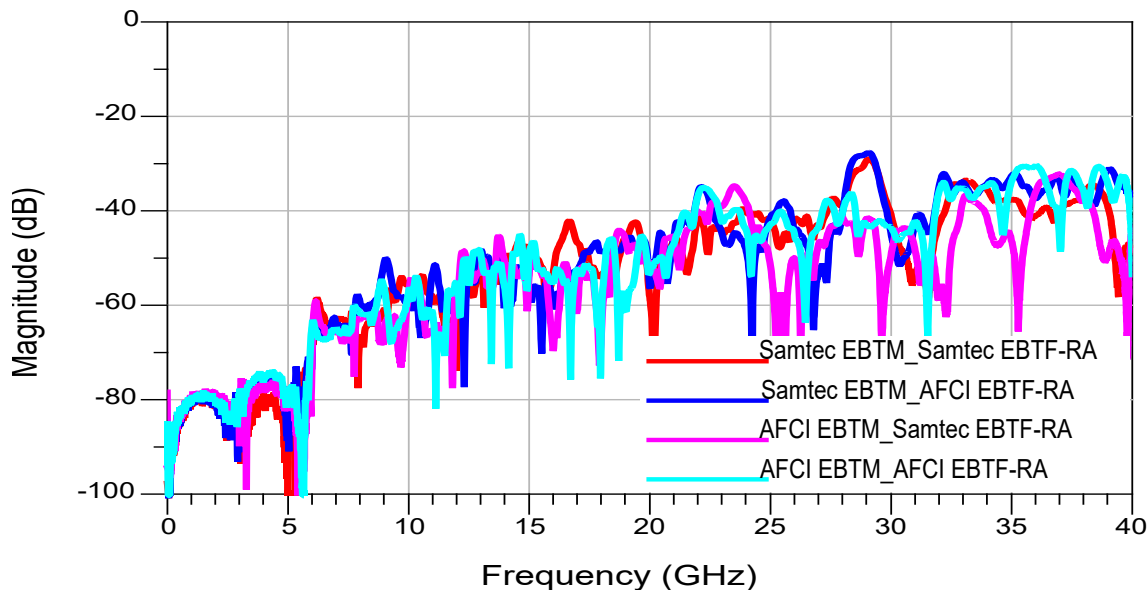
Differential NEXT: E2-F2(EBTF-RA)-F3-G3(EBTF-RA)



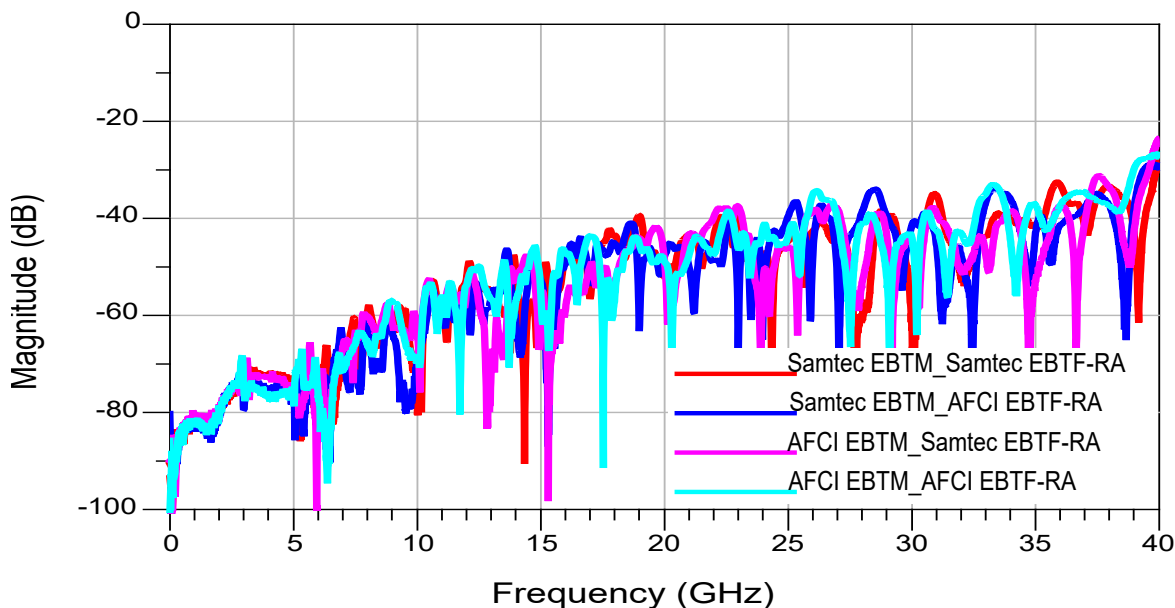
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



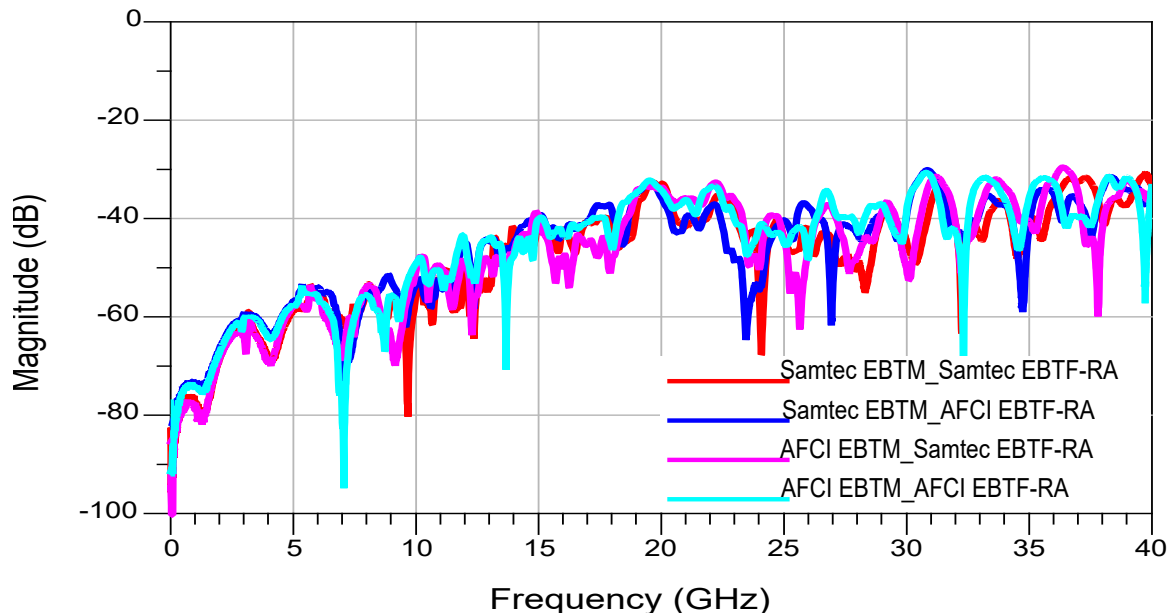
Differential NEXT: O11-P11(EBTF-RA)-K10-L10(EBTF-RA)



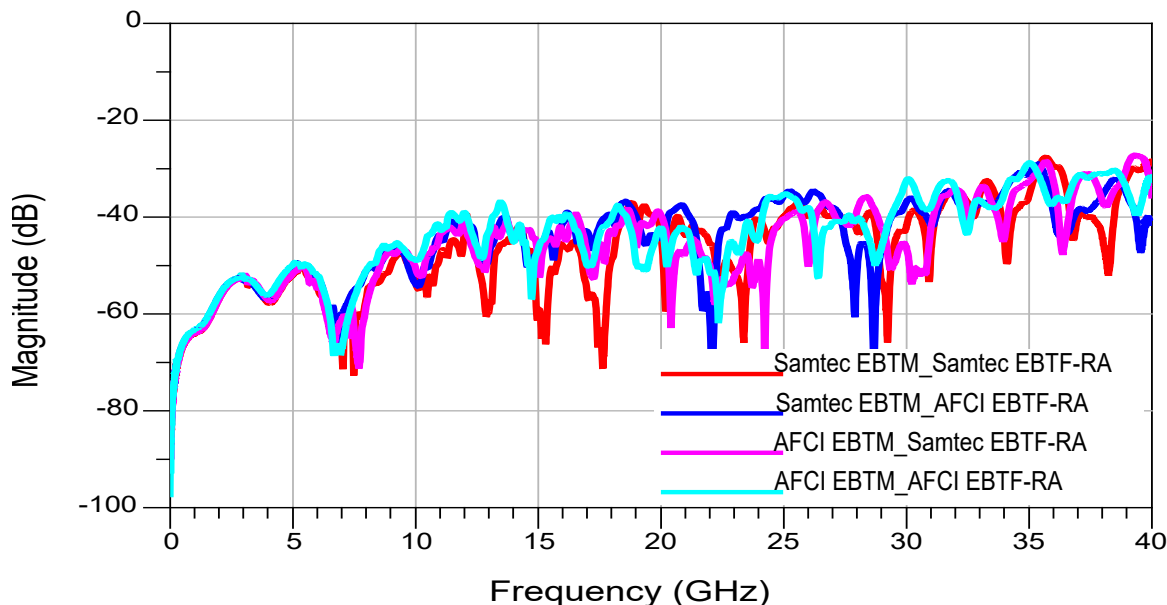
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



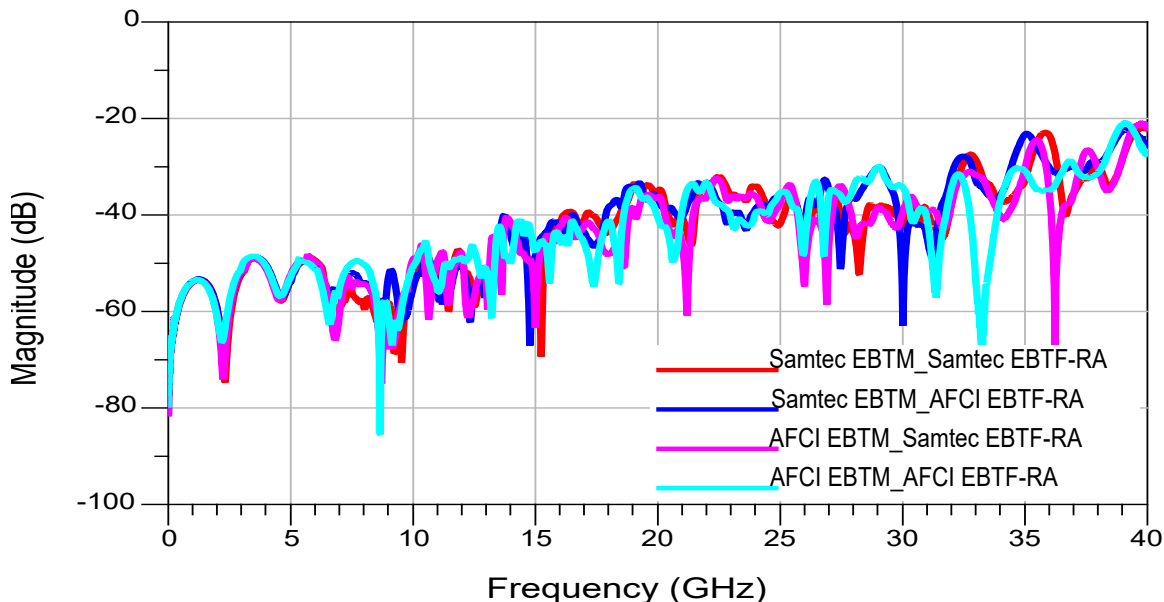
Differential NEXT: O11-P11(EBTF-RA)-Q10-R10(EBTF-RA)



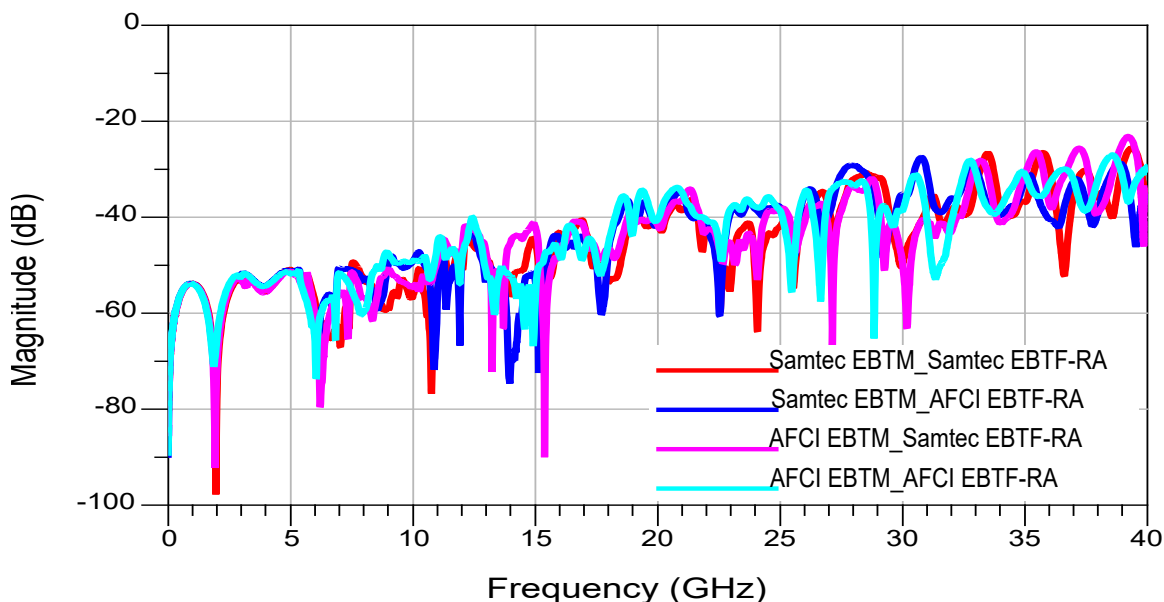
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA

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



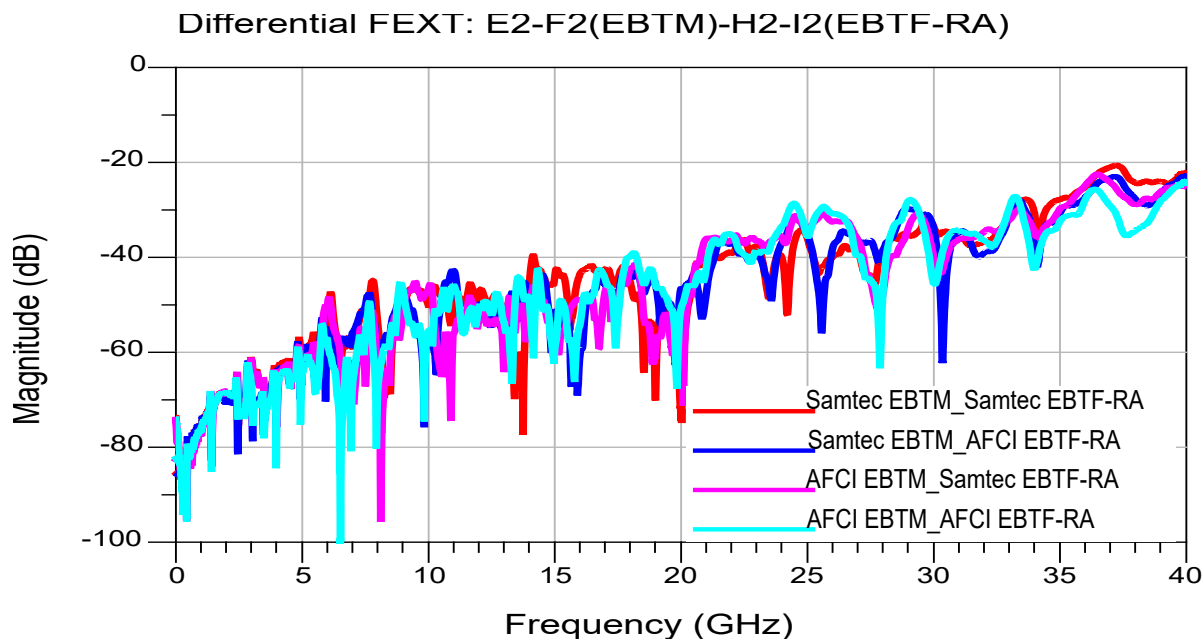
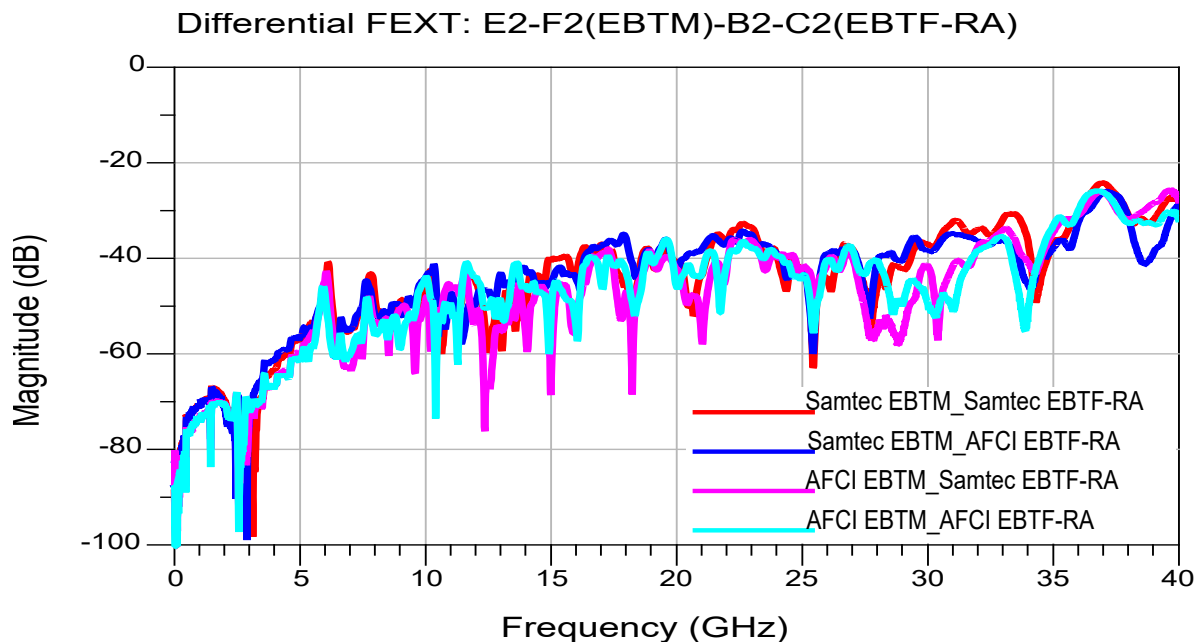
Differential NEXT: O11-P11(EBTF-RA)-R11-S11(EBTF-RA)



**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

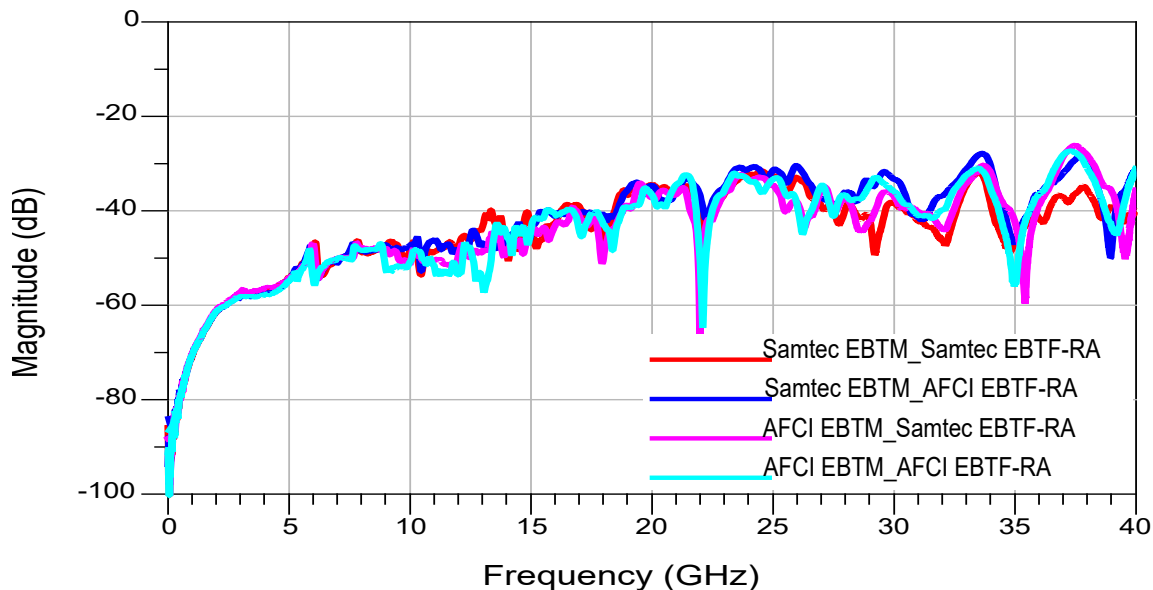
## Differential Far End Crosstalk (FEXT)



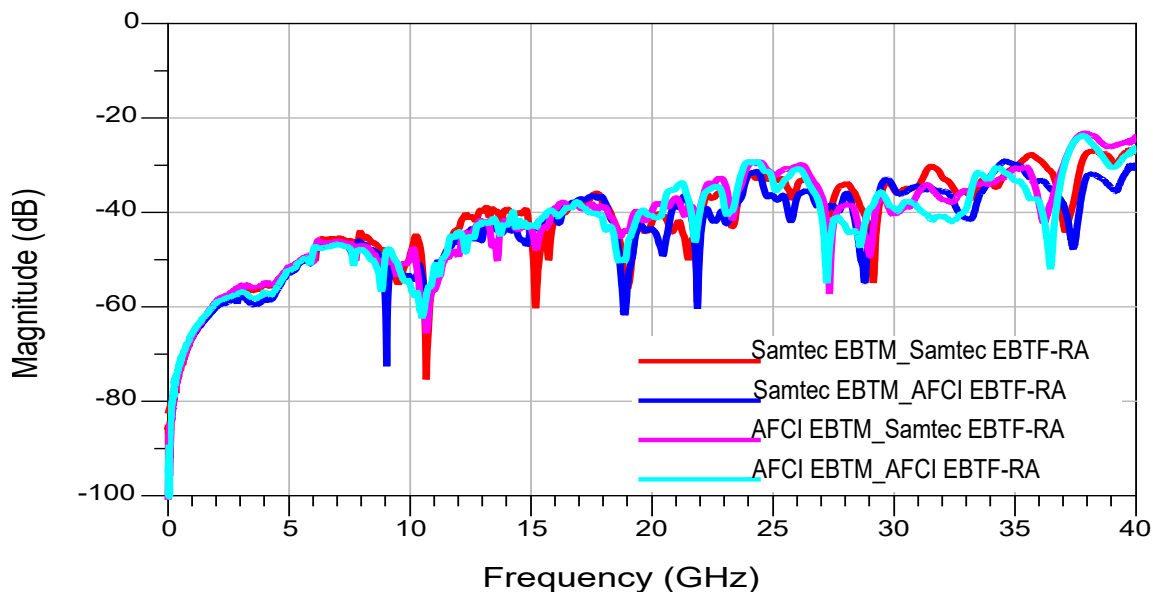
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



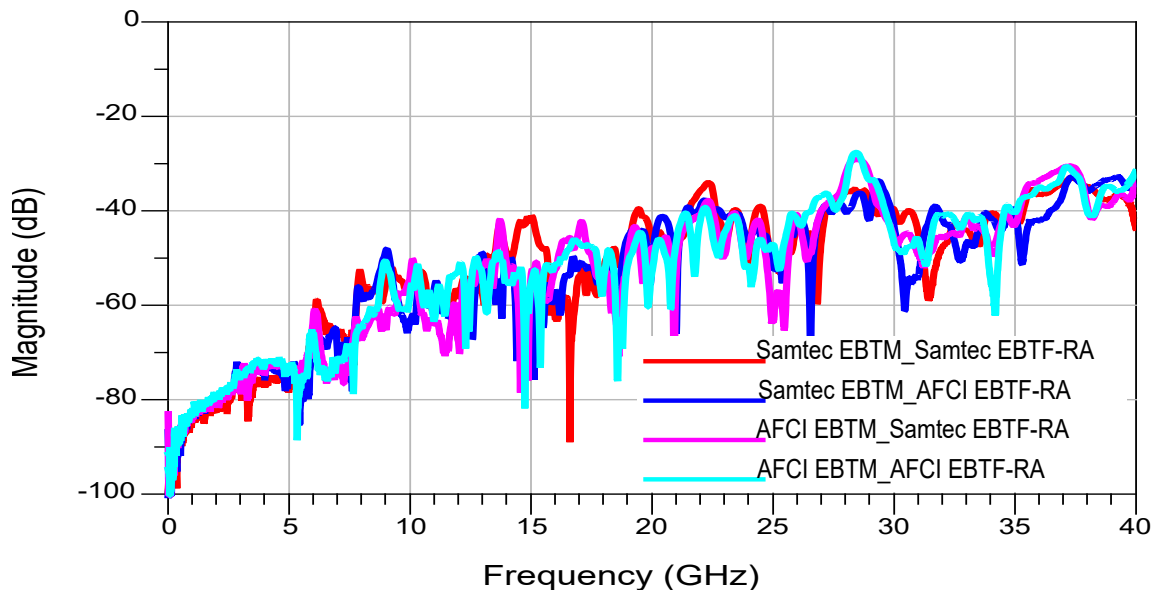
Differential FEXT: E2-F2(EBTM)-F3-G3(EBTF-RA)



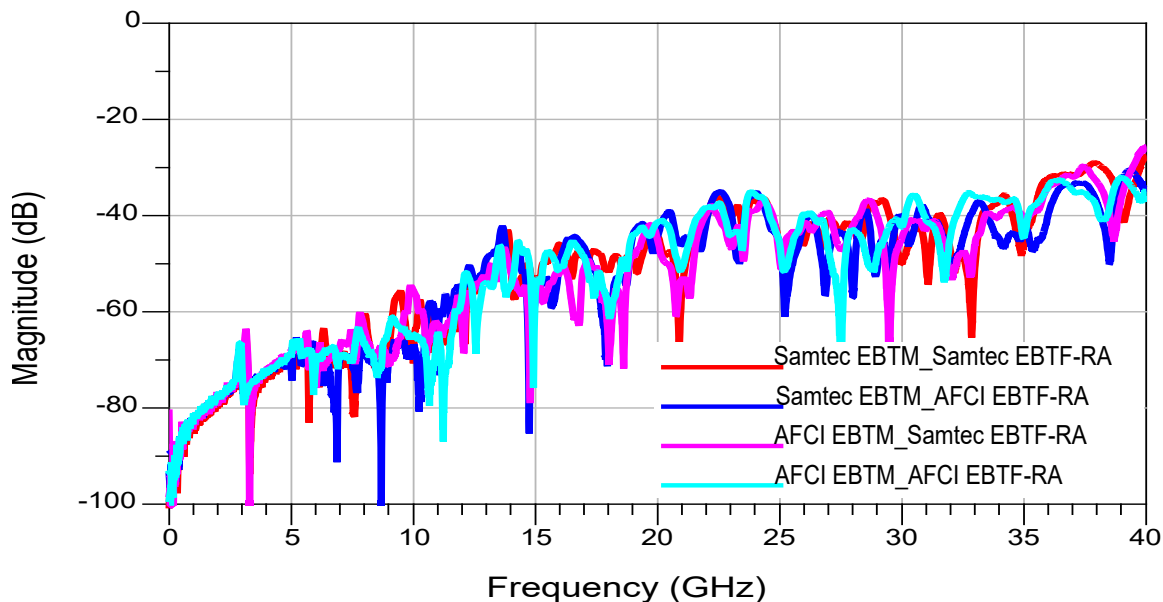
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



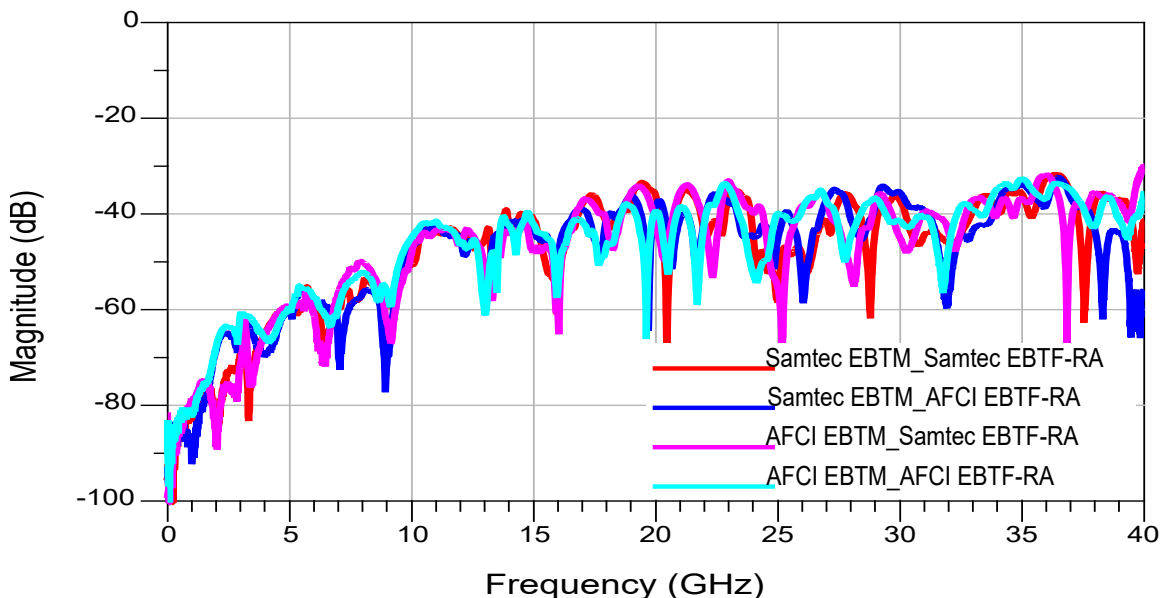
Differential FEXT: O11-P11(EBTM)-K10-L10(EBTF-RA)



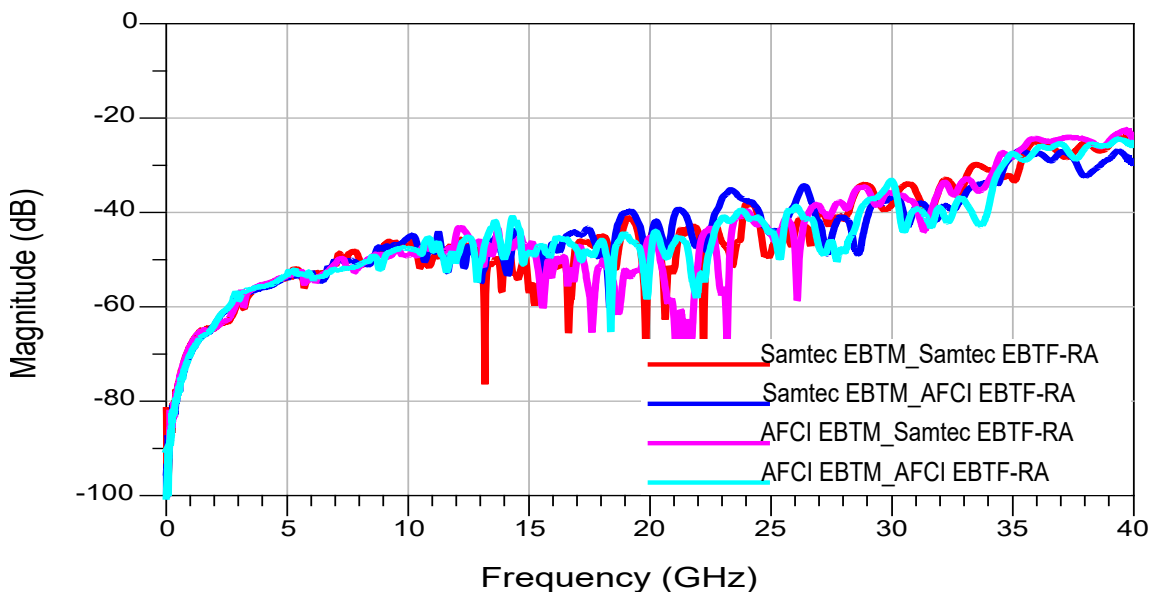
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



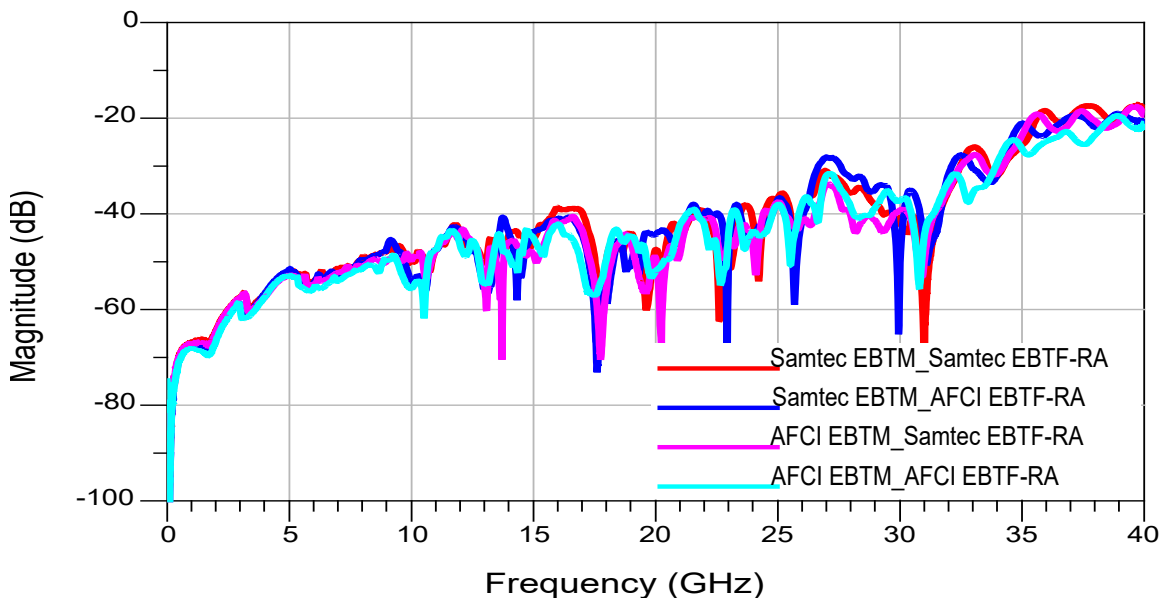
Differential FEXT: O11-P11(EBTM)-Q10-R10(EBTF-RA)



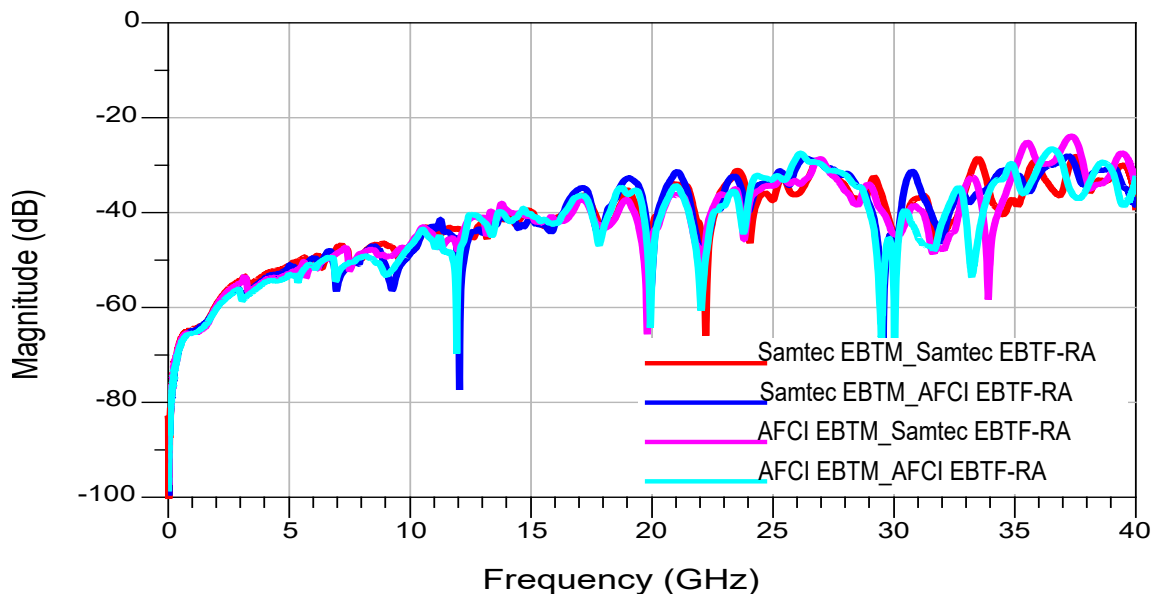
**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

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



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



**Series:** EBTM / EBTF-RA

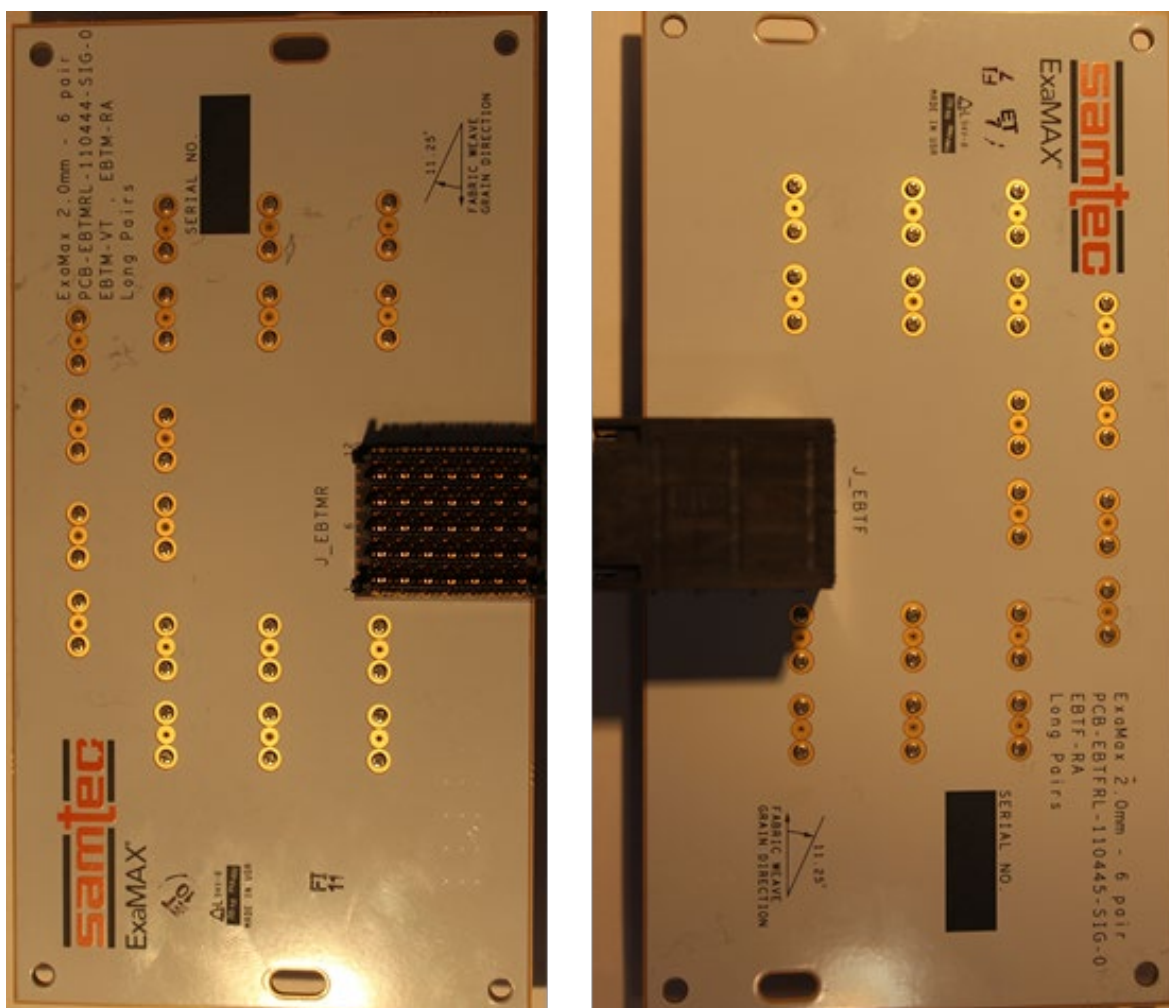
**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

## Appendix A – Product and Test System Descriptions

### Product Description

Product test samples are EBTM/EBTF-RA Series connectors. The part number is EBTM-6-12-2.0-S-VT-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 reliable out to 50 GHz.

PCB-EBTMRL-110444-SIG-0 and PCB-EBTFRL-110445-SIG-0



**Figure 2: Test Boards and Samples**

**Series:** EBTM / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm 6 Pairs High Speed Backplane Connector, VT mating to RA

## 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:

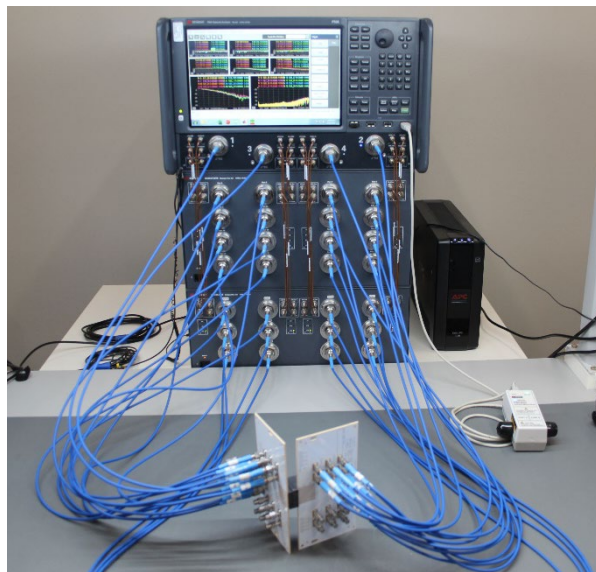
Start Frequency – 10 MHz

Stop Frequency – 40 GHz

Number of points – 4000

IFBW – 1KHz

### N5225B Measurement Setup



### 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 / EBTF-RA

**Description:** Performance Comparison of Samtec and Amphenol-FCI ExaMAX® 2 mm  
6 Pairs High Speed Backplane Connector, VT mating to RA

## **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