



GT-23-192

Glenair El Ochito Blue High Speed Characterization Report for Differential Applications

Revision History

Rev	Date	Approved	Description
A	1/24/2024	L. Blackwell	Initial Release

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1. Introduction

This document contains results from testing that was performed to evaluate the high-frequency electrical performance of the Glenair EI Ochito Blue contact. This report outlines frequency domain performance metrics such as insertion loss (IL) and return loss (RL) as well as the time-domain performance metric of impedance.

2. Product Overview

High speed, harsh environment EI Ochito® octaxial contacts save size and weight. Suitable for aircraft avionics, weapons systems, satellites, radars, communications equipment and other aerospace/defense gear, EI Ochito® contacts are optimized for 40G Ethernet, SuperSpeed USB and other multi-gigabit datalink protocols including HDMI, DisplayPort and SATA. Available discrete contacts and jumper assemblies are readily incorporated into Glenair aerospace-grade circular and rectangular connectors.

3. Test Setup

This section details the test assemblies, test PCBs and equipment used to perform the high-speed characterization. All measurements were taken using a Tektronix DSA8300 Digital Serial Analyzer and a Keysight N5227B PNA network analyzer which were connected to SMA launch test fixture PCBs designed specifically for this testing.

3.1. Test Fixtures

3.1.1. Test PCBs

PCB test fixtures utilizing edge-launch SMA connectors were designed for the high-speed tests. Each set consisted of two El Ochito to SMA boards and a calibration board. One test set used straight, Series 792, PCB-mount connectors, part numbers 792-005SA-1P1MNNAC and 792-006PA-1P1MNNAC. The other set used right-angle, Series 792, PCB-mount connectors, part numbers 792-010PA-1P1MENAC and 792-009SA-1P1MNNAC. Photographs of the test boards are seen in the following two figures.

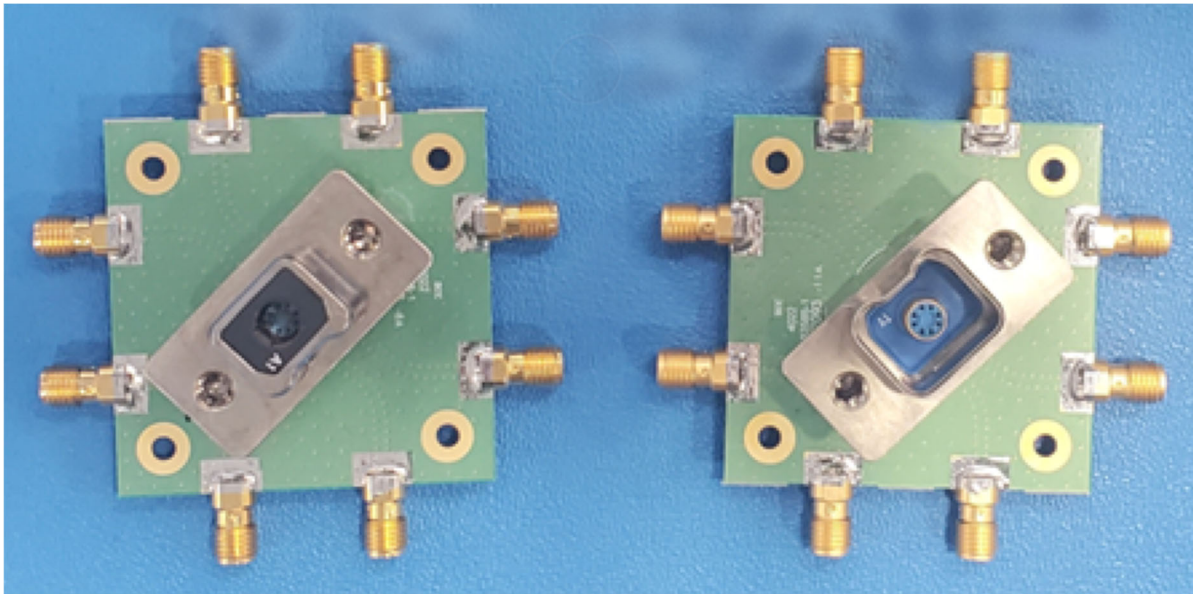


Figure 1. Straight PCB Mount El Ochito Test PCB Set

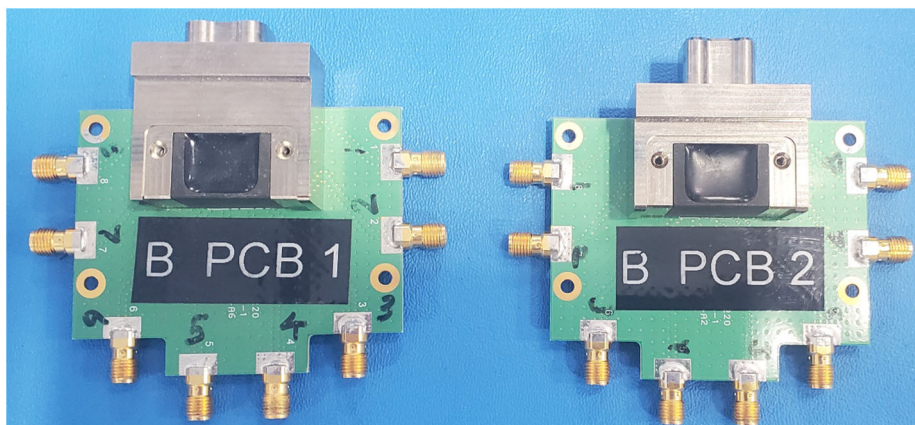


Figure 2. Right-Angle PCB Mount El Ochito Test PCB Set

The board sets were manufactured as a single panel and separated into individual test boards to give consistent signal characteristics.

3.1.2. Test Cable Assemblies

The test cable assemblies consisted of a Series 792 plug connector, part number 792-001SA-1W1MN, with 858-049 contacts, and a Series 792 receptacle connector, part number 792-002PA-1W1MNN, with 858-050 contacts. The test cable assemblies are shown in Figure 3.

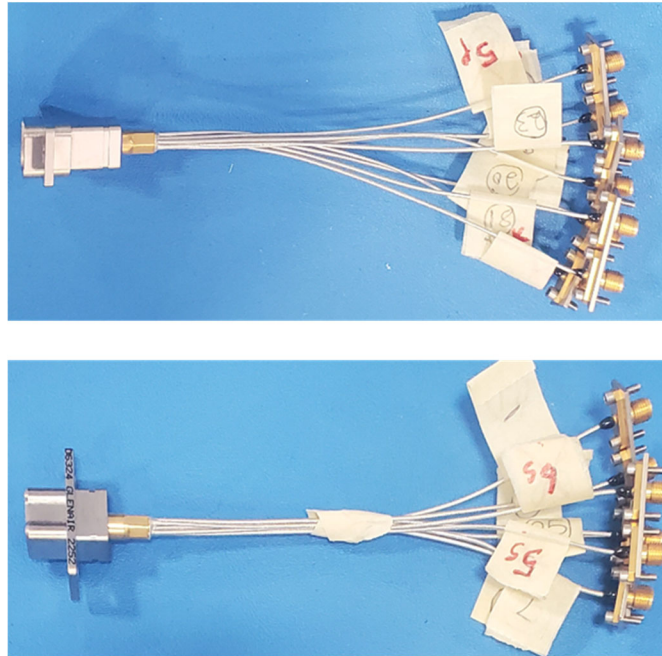


Figure 3. El Ochito Test Cable Assembly Set

3.2. Test Pairs

The encircled signal pin locations shown in the figure below denotes differential test pairs.

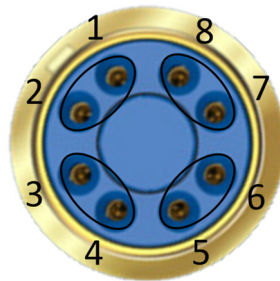


Figure 4. El Ochito Blue Test Pairs

4. Straight PCB Mount El Ochito Blue Performance

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

4.1. Frequency Domain Analysis

4.1.1. Insertion Loss / Return Loss

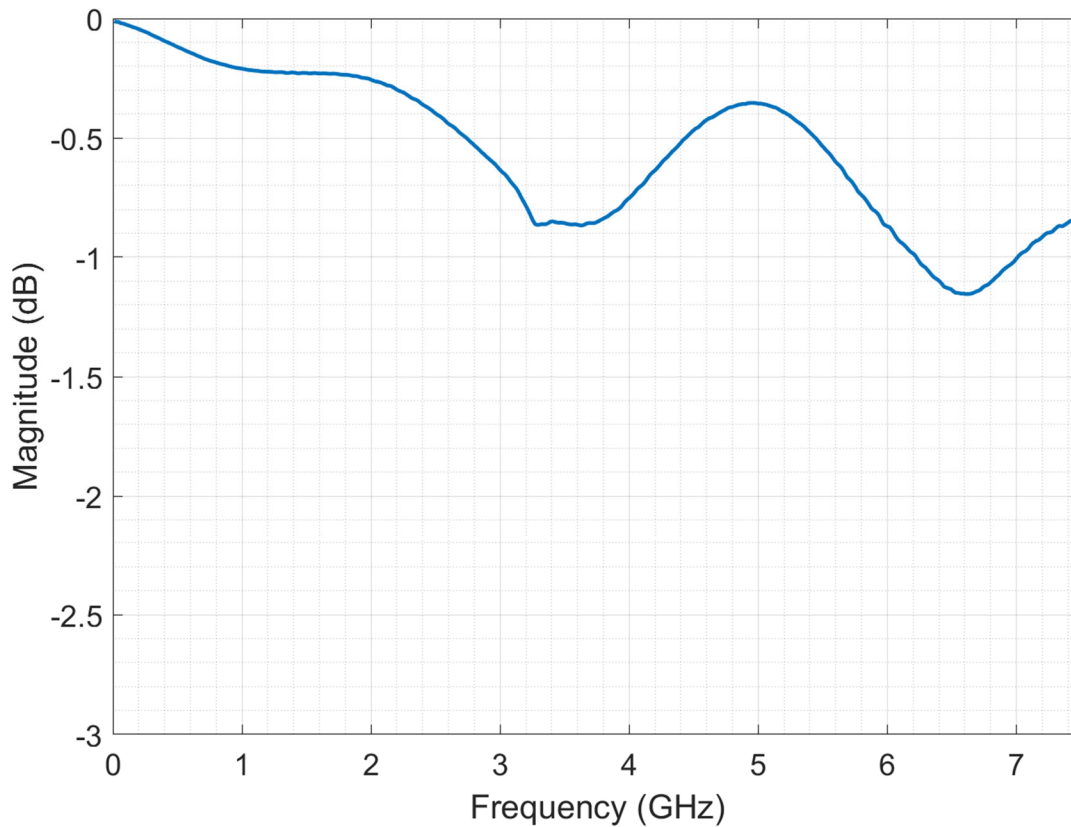


Figure 5. Straight PCB Mount El Ochito Blue Insertion Loss

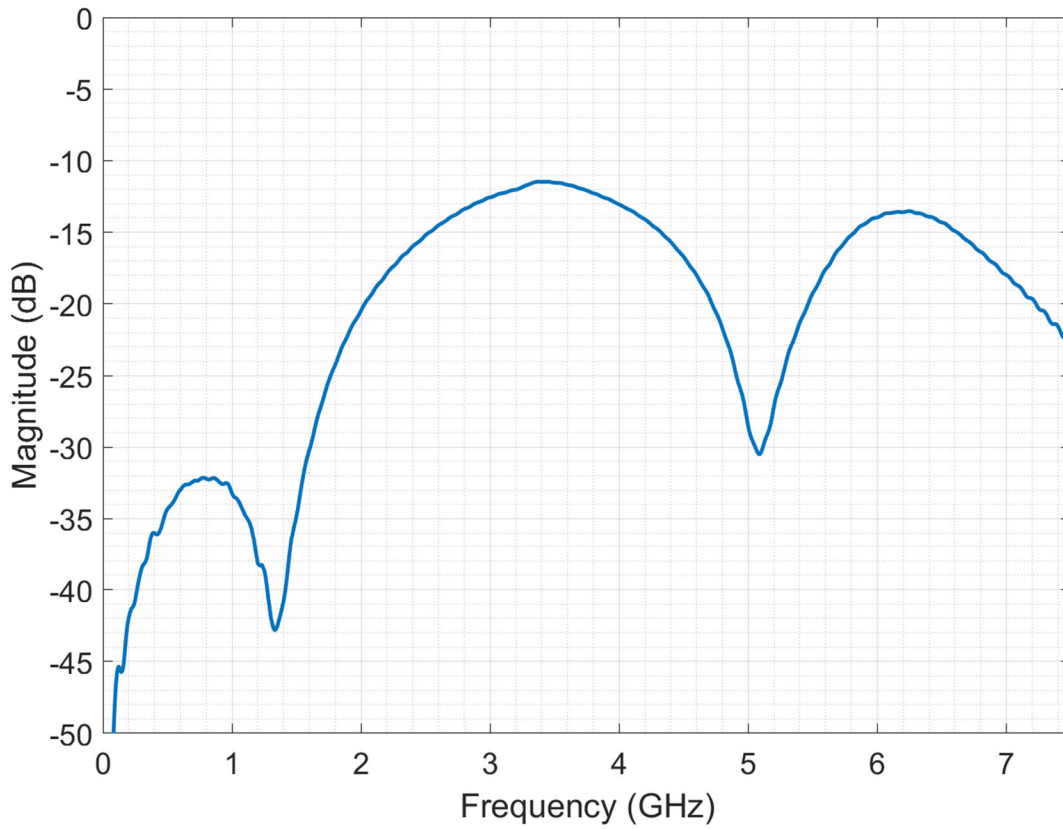


Figure 6. Straight PCB Mount EI Ochito Blue Return Loss

4.1.2. Straight PCB Mount El Ochito Blue Crosstalk

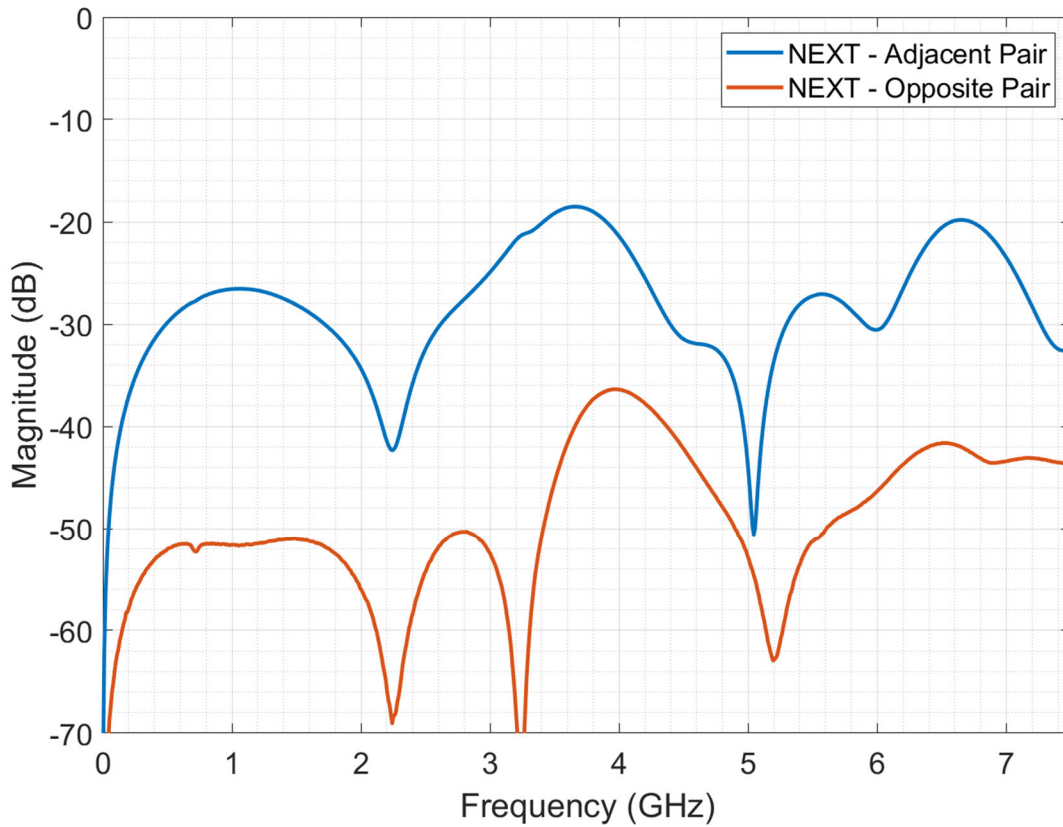


Figure 7. Straight PCB Mount El Ochito Blue NEXT

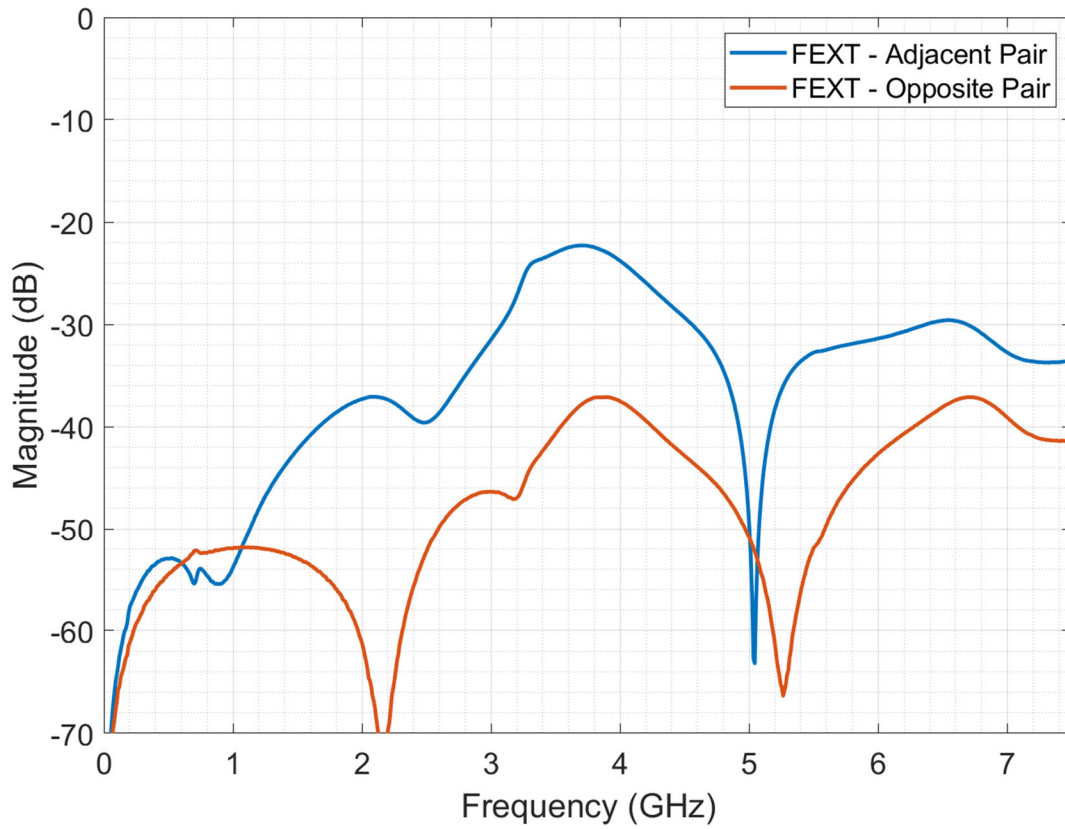


Figure 8. Straight PCB Mount EI Ochito Blue FEXT

4.2. Straight PCB Mount El Ochito Blue Time Domain Analysis

4.2.1. Straight PCB Mount El Ochito Blue TDR

A graph is shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r .

t_r (ps)	BW (GHz)
100	3.50
200	1.75

Table 1. Bandwidth to Rise Time Relationship

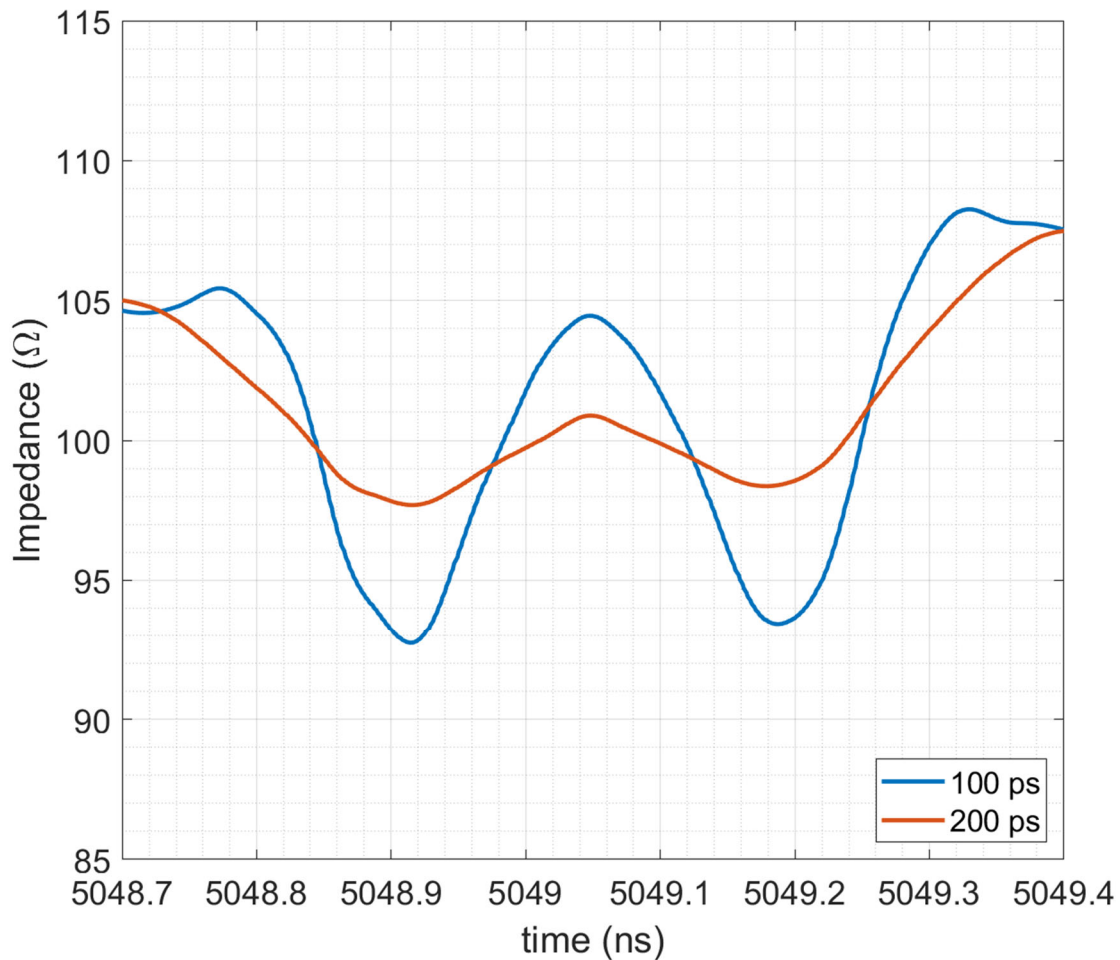


Figure 9. TDR – Straight PCB Mount El Ochito Blue

5. Right-Angle PCB Mount El Ochito Blue Performance Summary

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

5.1. Frequency Domain Analysis

5.1.1. Insertion Loss/Return Loss

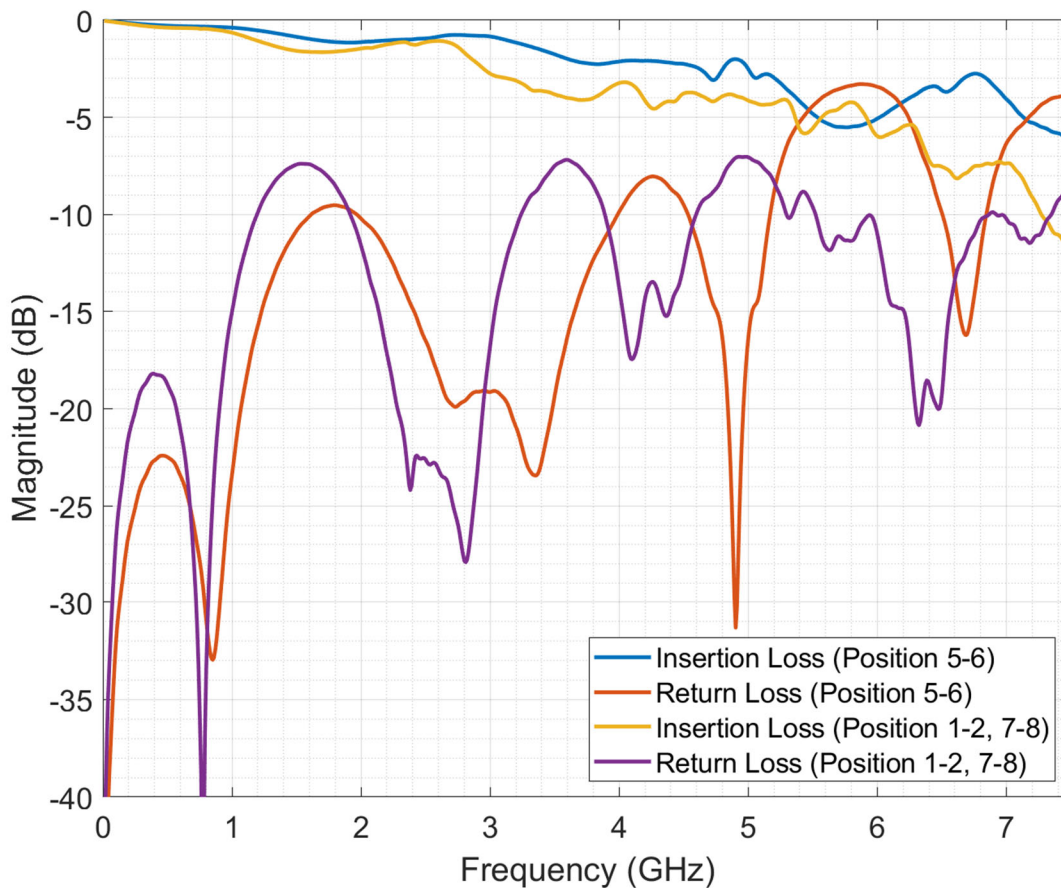


Figure 10. Right-Angle PCB Mount El Ochito Blue Response

5.1.2. Right-Angle PCB Mount El Ochito Blue Crosstalk

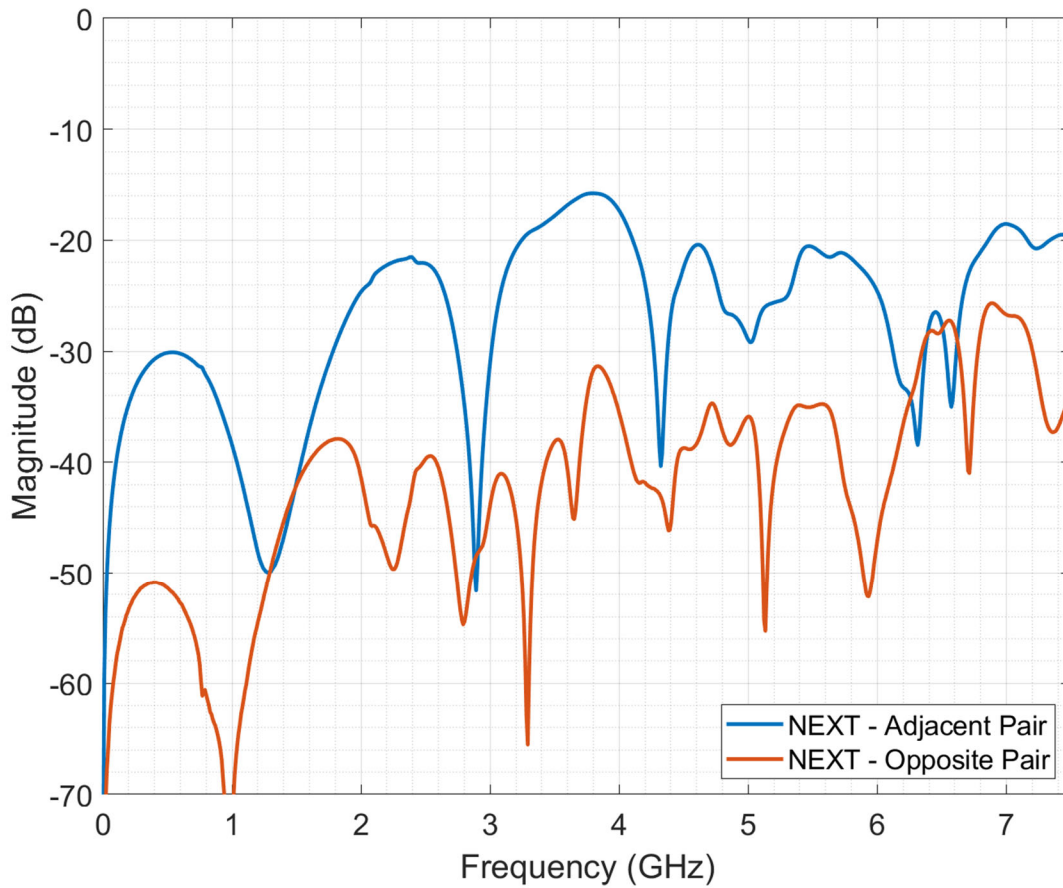


Figure 11. Right-Angle PCB Mount El Ochito Blue NEXT

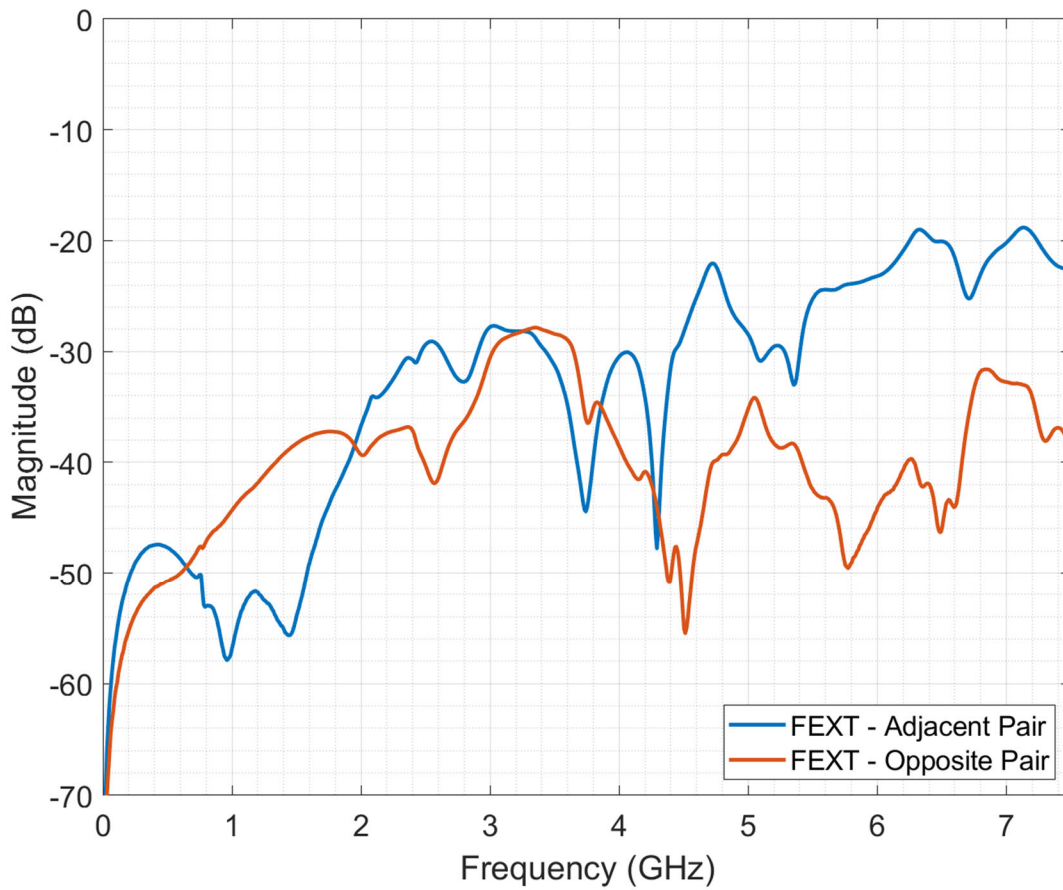


Figure 12. Right-Angle PCB Mount EI Ochito Blue FEXT

5.2.Right-Angle PCB Mount El Ochito Blue Time Domain Analysis

5.2.1. Right-Angle PCB Mount El Ochito Blue TDR

A graph is shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r .

t_r (ps)	BW (GHz)
100	3.50
200	1.75

Table 2. Bandwidth to Rise Time Relationship

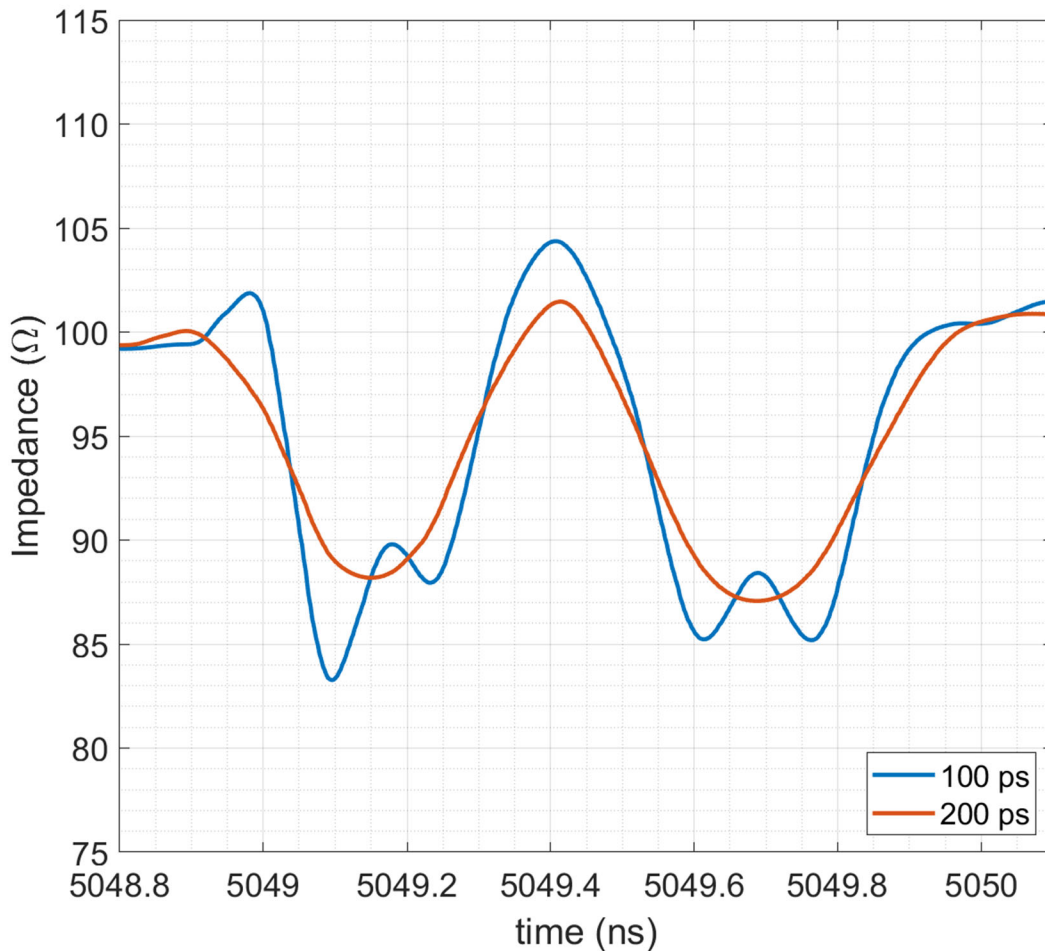


Figure 13. TDR – Right-Angle PCB Mount El Ochito Blue (Positions 1/2, 7/8)

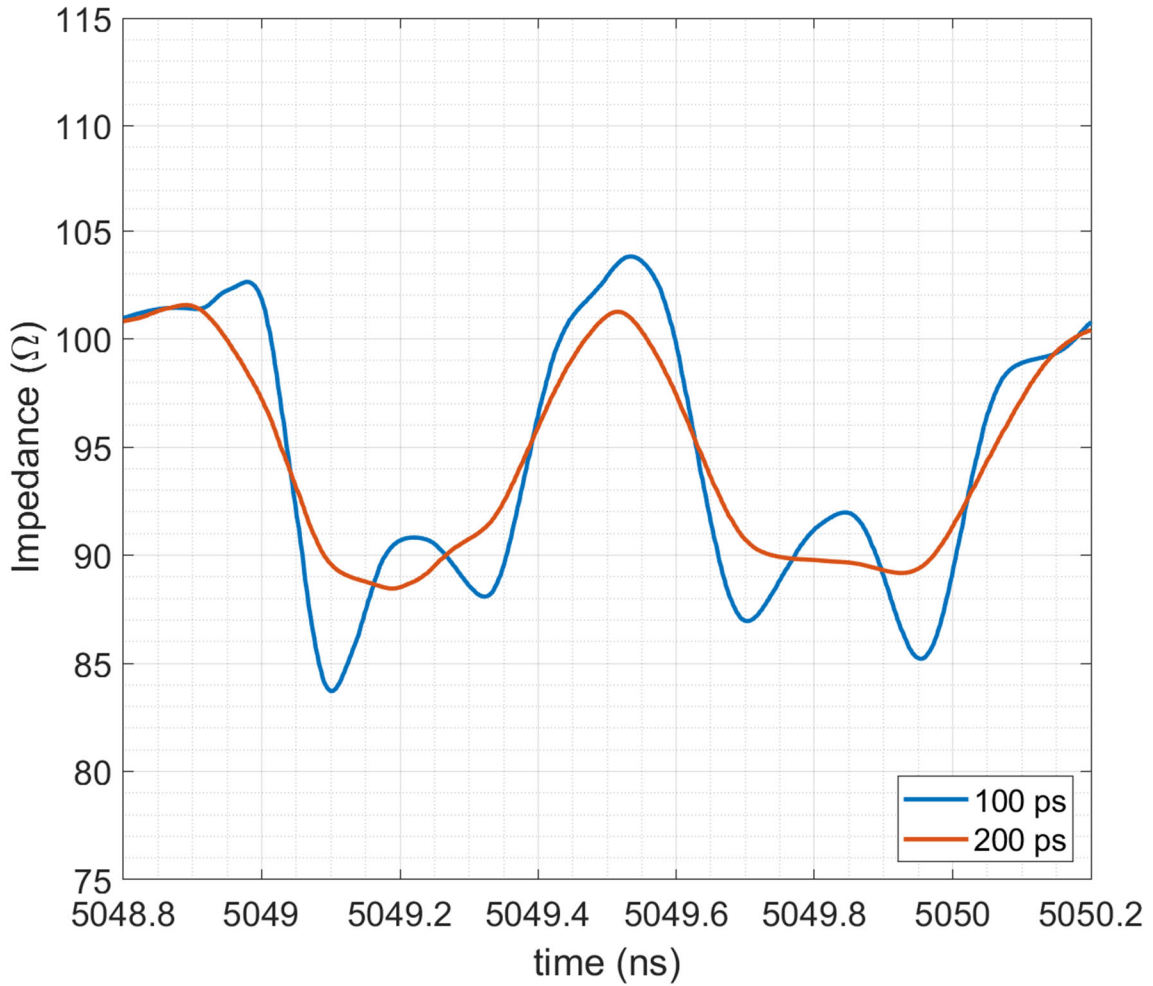


Figure 14. TDR – Right-Angle PCB Mount EI Ochito Blue (Position 5/6)

6. Cable Assembly El Ochito Blue Performance

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

6.1. Frequency Domain Analysis

6.1.1. Insertion Loss / Return Loss

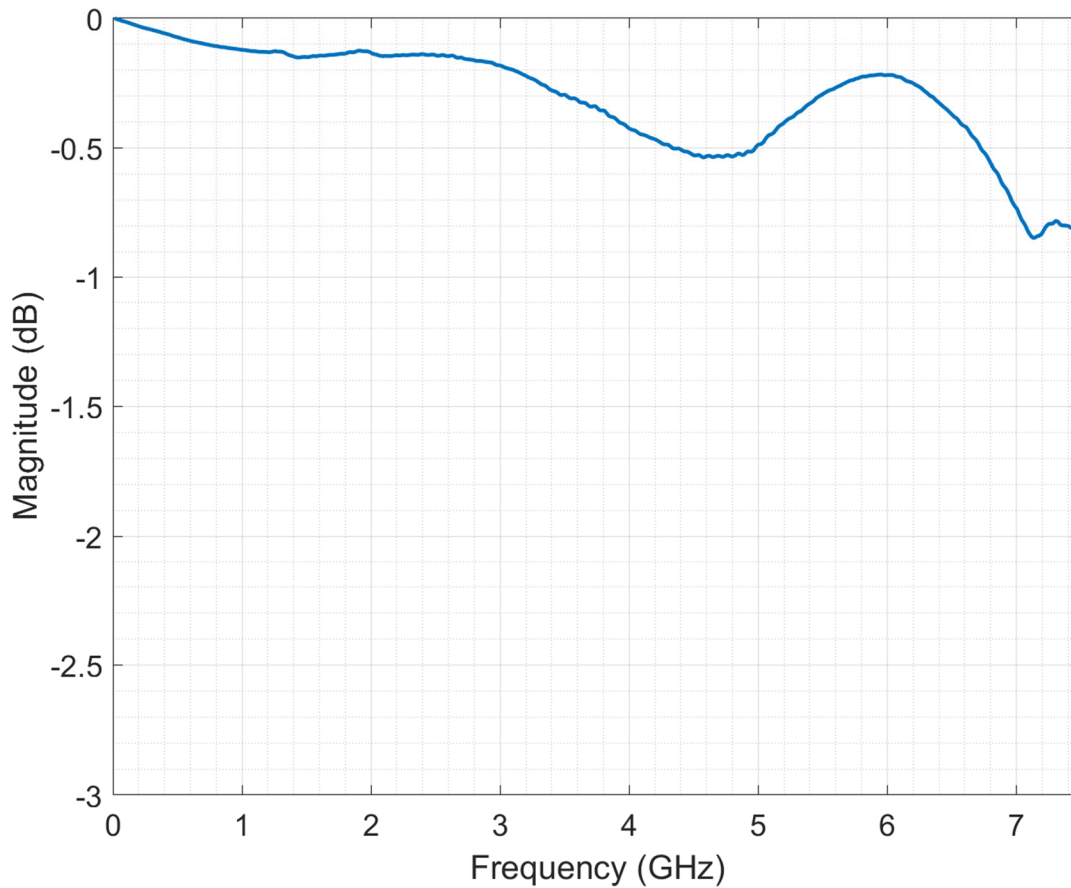


Figure 15. Cable Assembly El Ochito Blue Insertion Loss

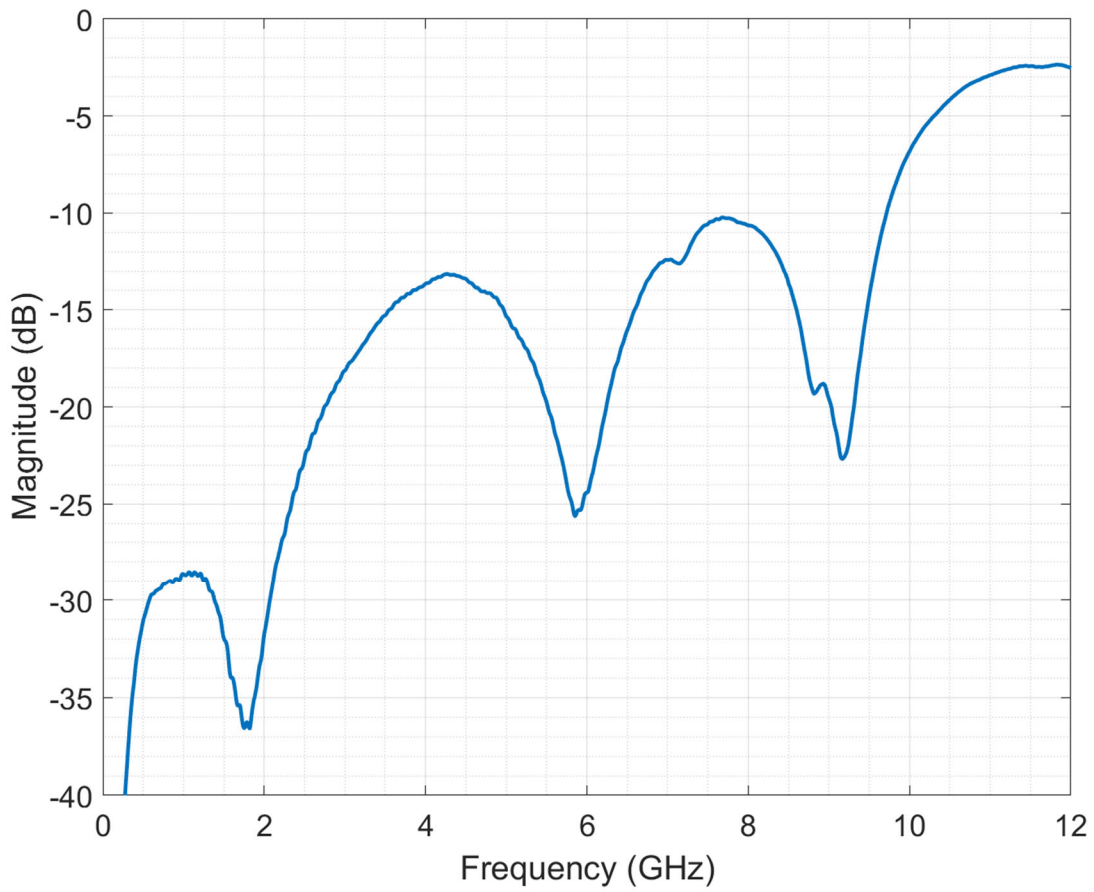


Figure 16. Cable Assembly El Ochito Blue Return Loss

6.1.2. Cable Assembly El Ochito Blue Crosstalk

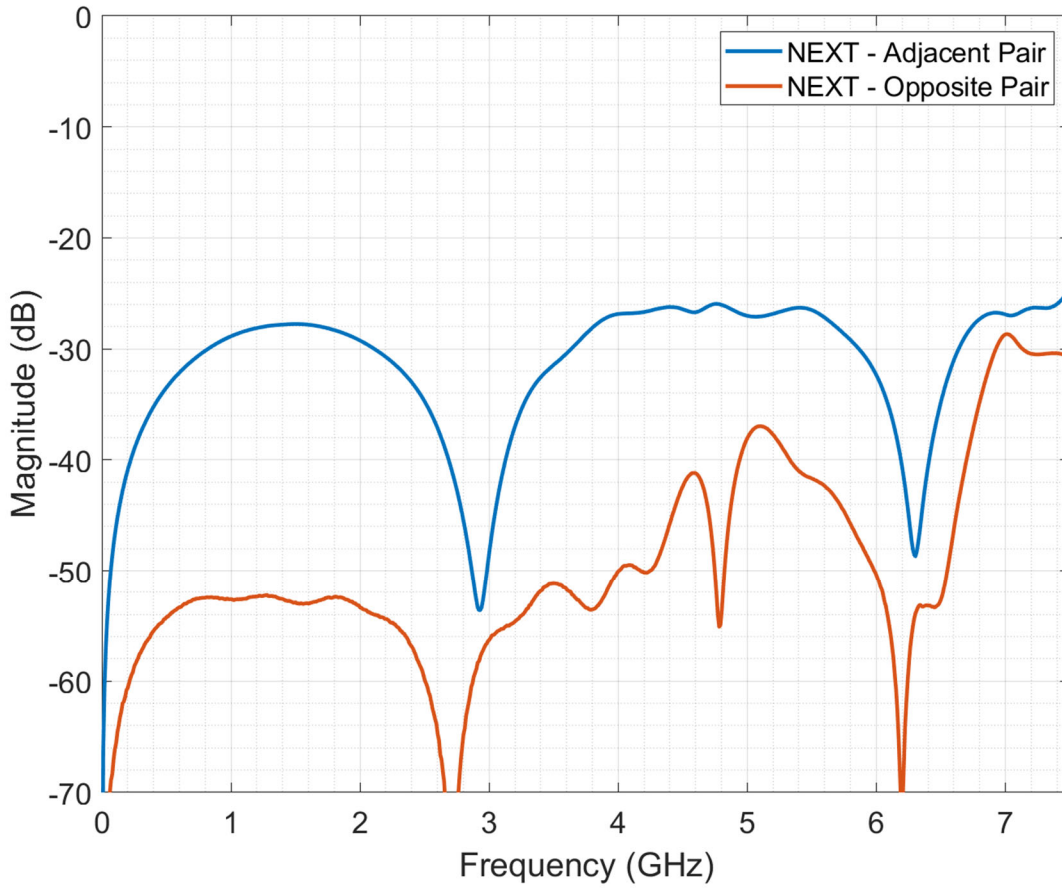


Figure 17. Cable Assembly El Ochito Blue NEXT

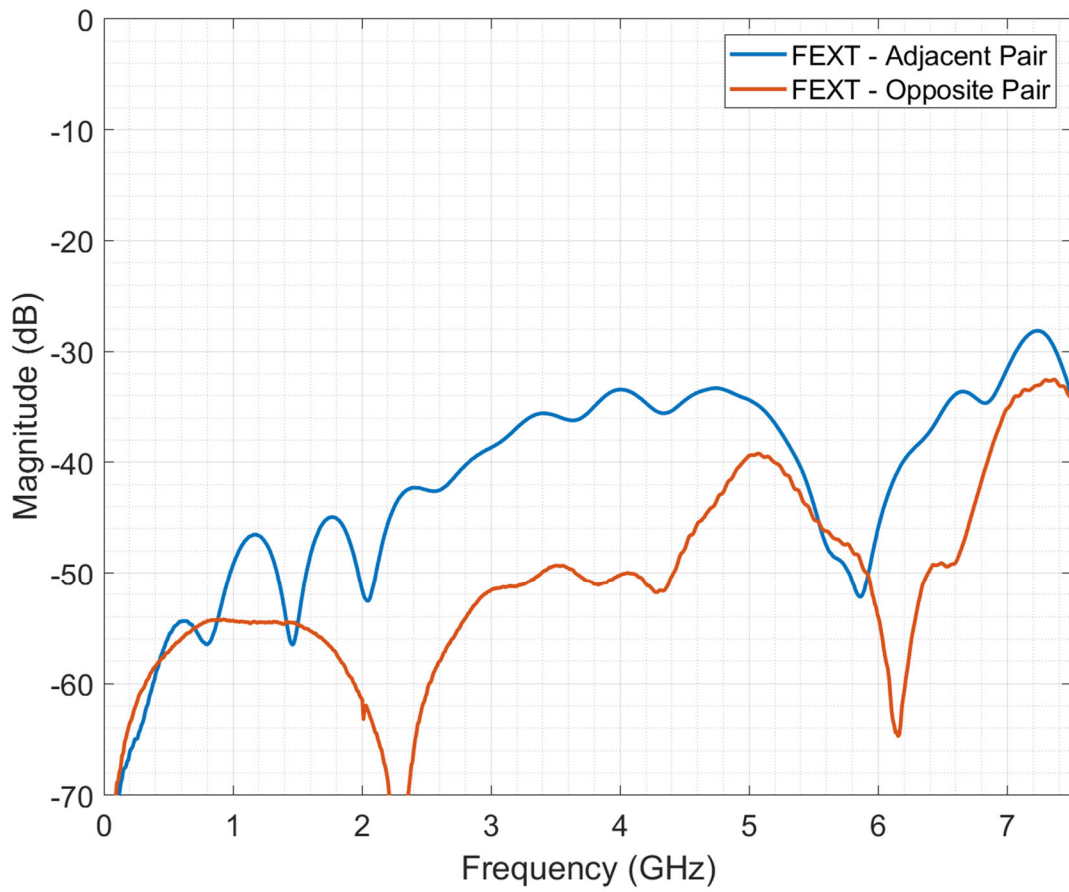


Figure 18. Cable Assembly El Ochito Blue FEXT

6.2.Cable Assembly El Ochito Blue Time Domain Analysis

6.2.1. Cable Assembly El Ochito Blue TDR

A graph is shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r .

t_r (ps)	BW (GHz)
100	3.50
200	1.75

Table 3. Bandwidth to Rise Time Relationship

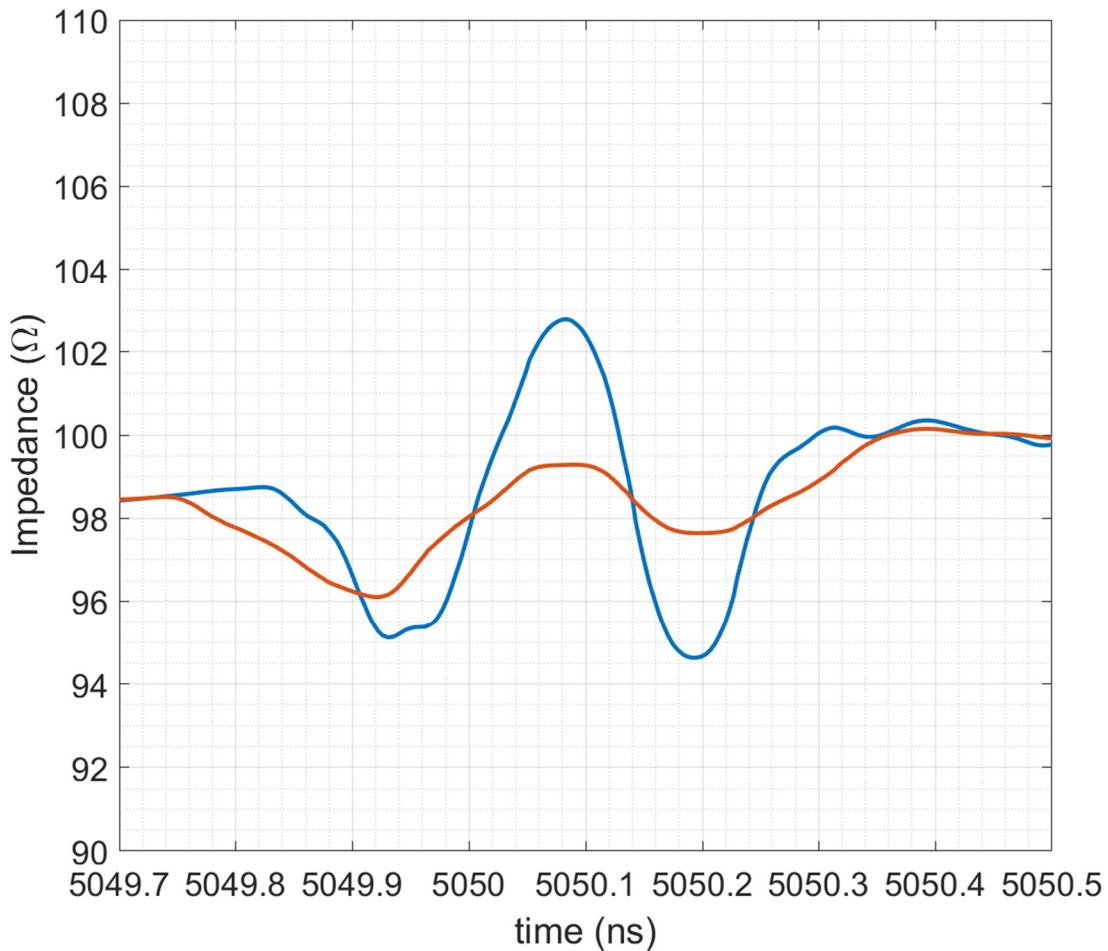


Figure 19. TDR – Cable Assembly El Ochito Blue

7. Right-Angle PCB Mount to Straight PCB Mount PCB El Ochito Blue Performance

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

7.1. Frequency Domain Analysis

7.1.1. Insertion Loss / Return Loss

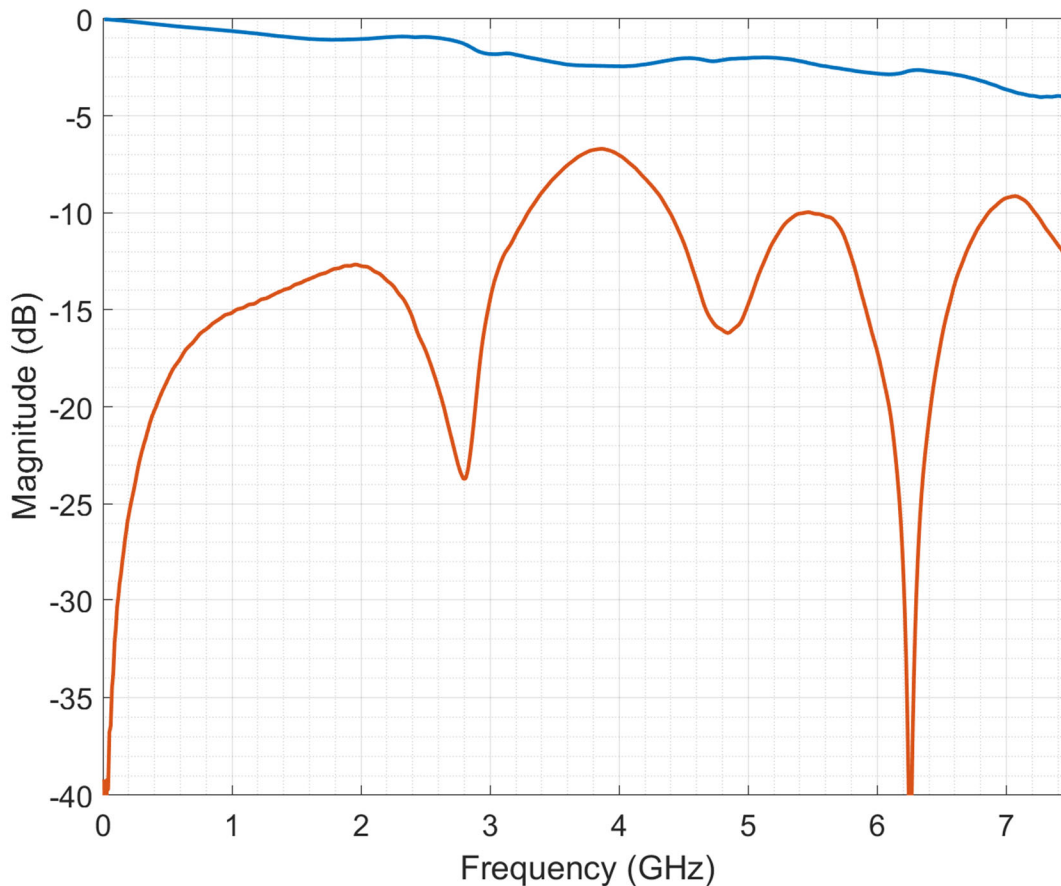


Figure 20. Right-Angle PCB Mount to Straight PCB Mount PCB El Ochito Blue Response

7.1.2. Right-Angle PCB Mount to Straight PCB Mount PCB El Ochito Blue Crosstalk

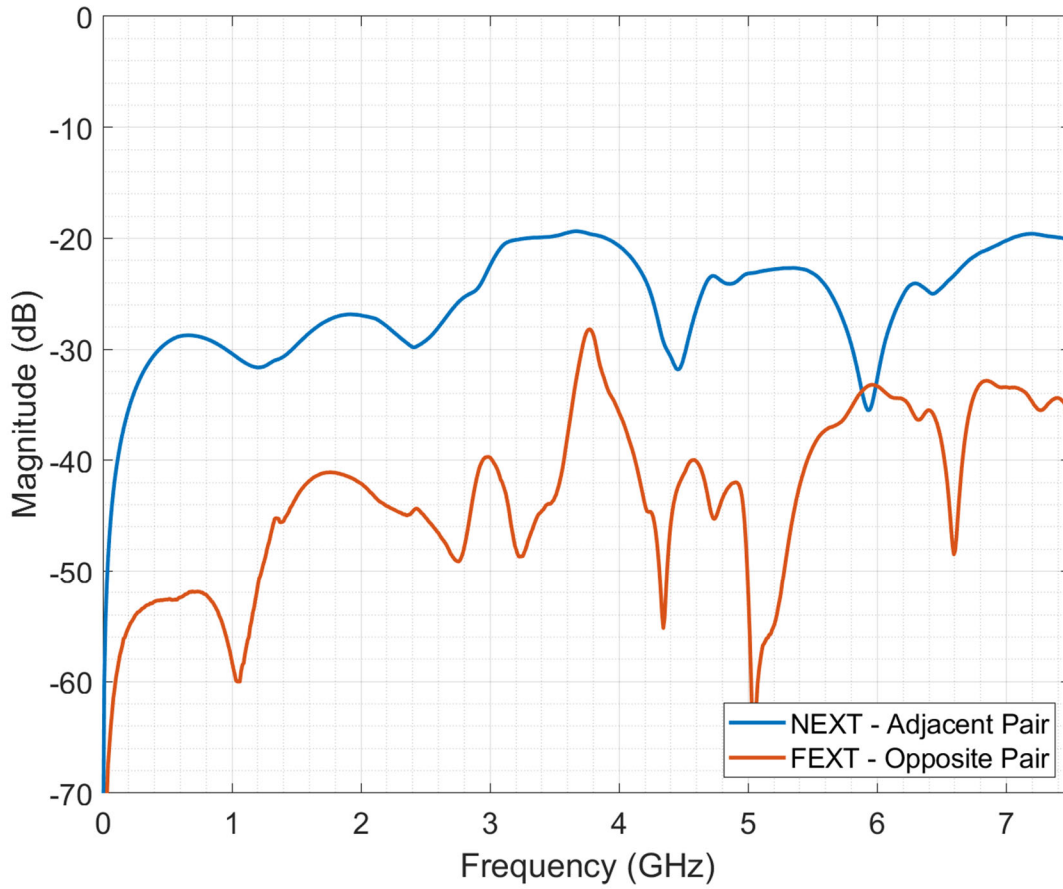


Figure 21. Right-Angle PCB Mount to Straight PCB Mount PCB El Ochito Blue NEXT

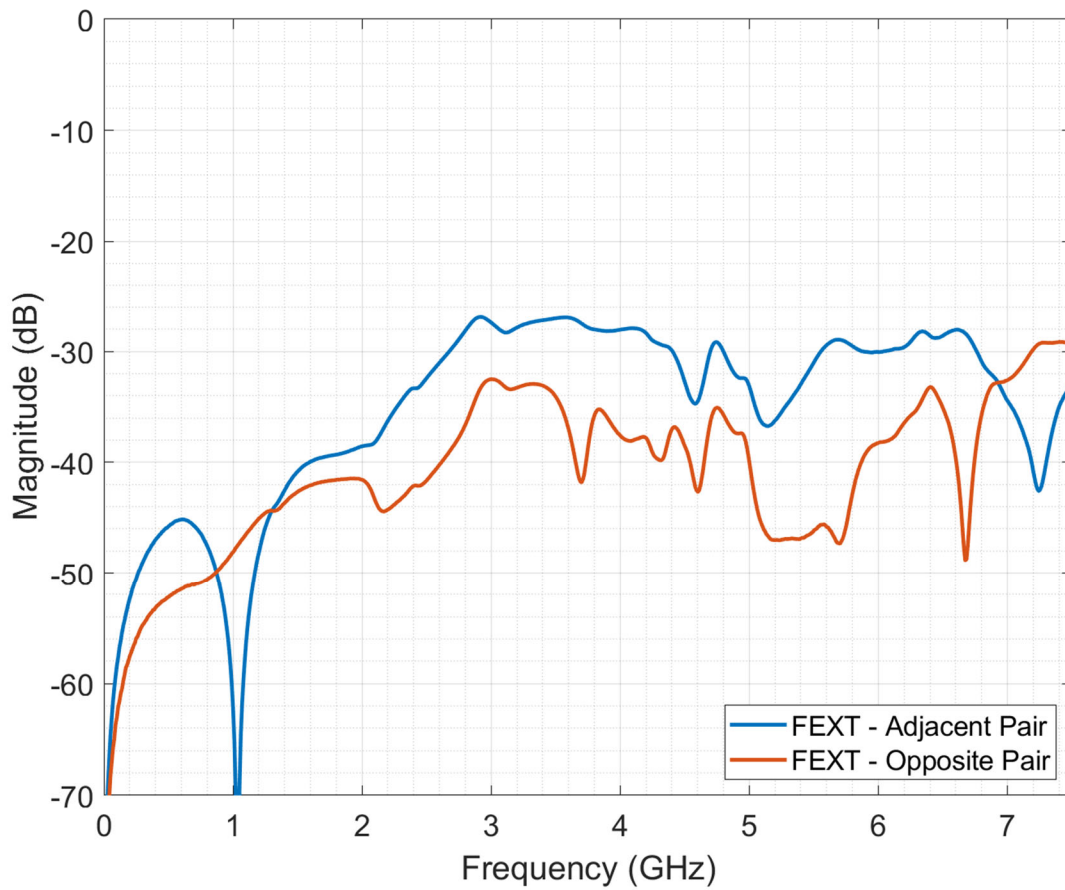


Figure 22. Right-Angle PCB Mount to Straight PCB Mount PCB EI Ochito Blue FEXT

7.2.Right-Angle PCB Mount to Straight PCB Mount PCB El Ochito Blue Time Domain Analysis

7.2.1. Right-Angle PCB Mount to Straight PCB Mount PCB El Ochito Blue TDR

A graph is shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r .

t_r (ps)	BW (GHz)
100	3.50
200	1.75

Table 4. Bandwidth to Rise Time Relationship

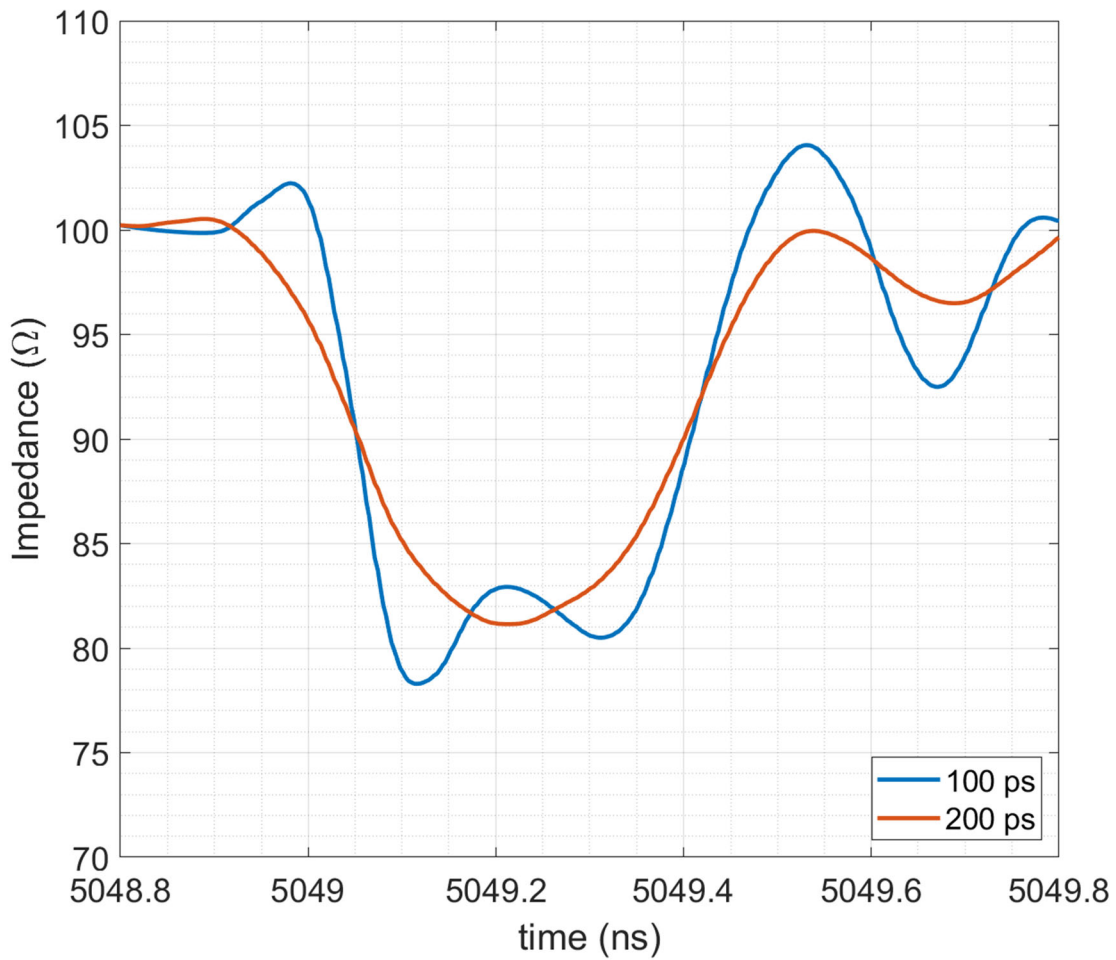


Figure 23. TDR – Right-Angle PCB Mount to Straight PCB Mount PCB EI Ochito Blue

8. Straight PCB Mount PCB to Right-Angle PCB Mount El Ochito Blue Performance

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

8.1. Frequency Domain Analysis

8.1.1. Insertion Loss / Return Loss

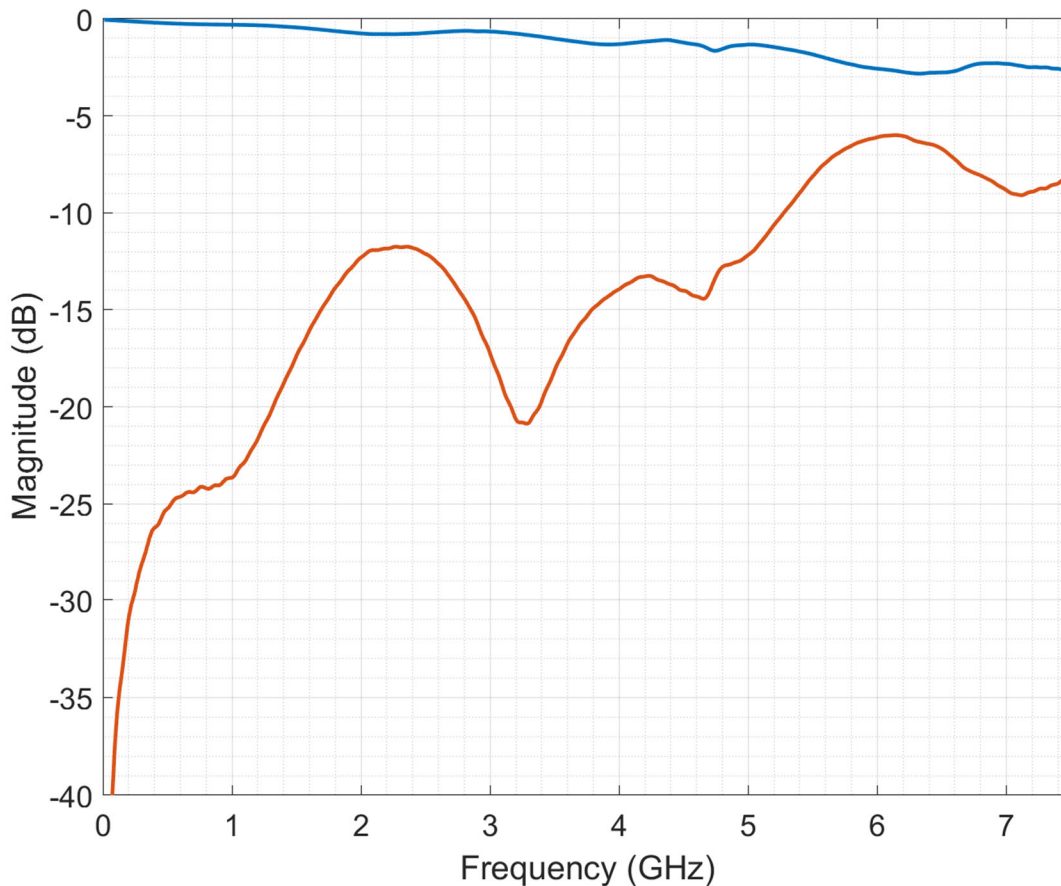


Figure 24. Straight PCB Mount PCB to Right-Angle PCB Mount El Ochito Blue Response

8.1.2. Straight PCB Mount PCB to Right-Angle PCB Mount El Ochito Blue Crosstalk

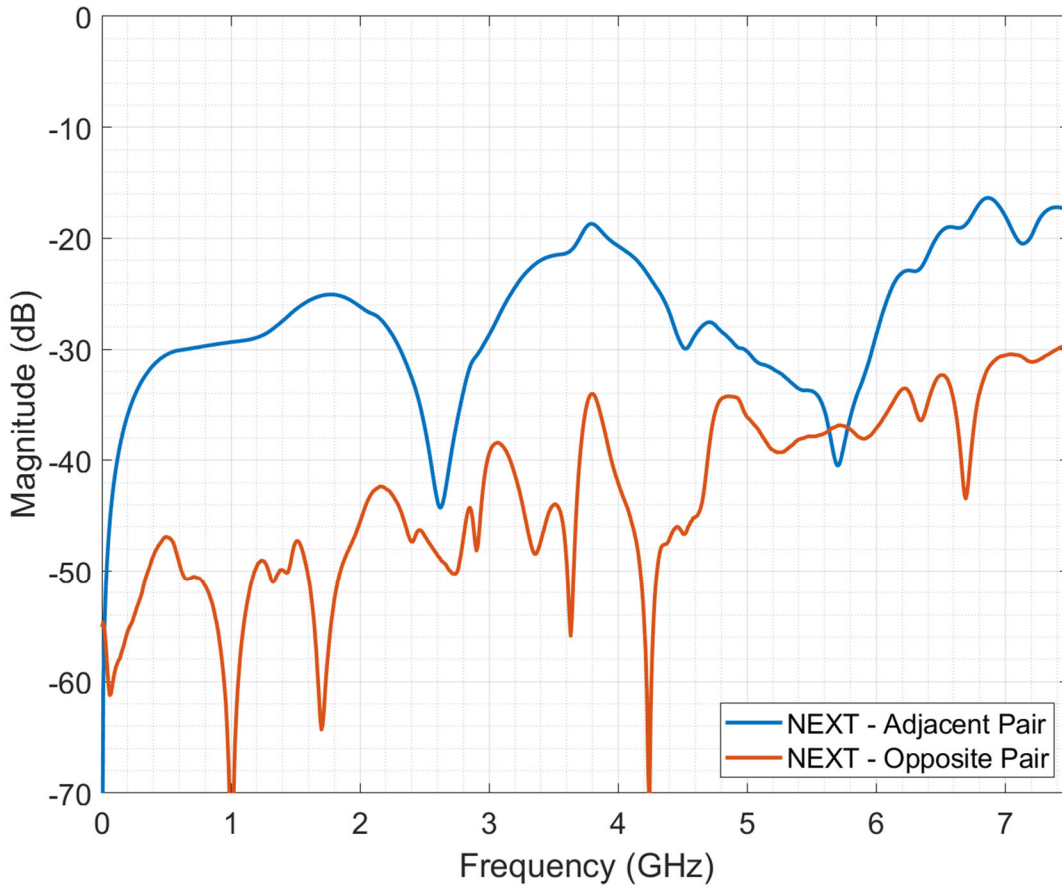


Figure 25. Straight PCB Mount PCB to Right-Angle PCB Mount El Ochito Blue NEXT

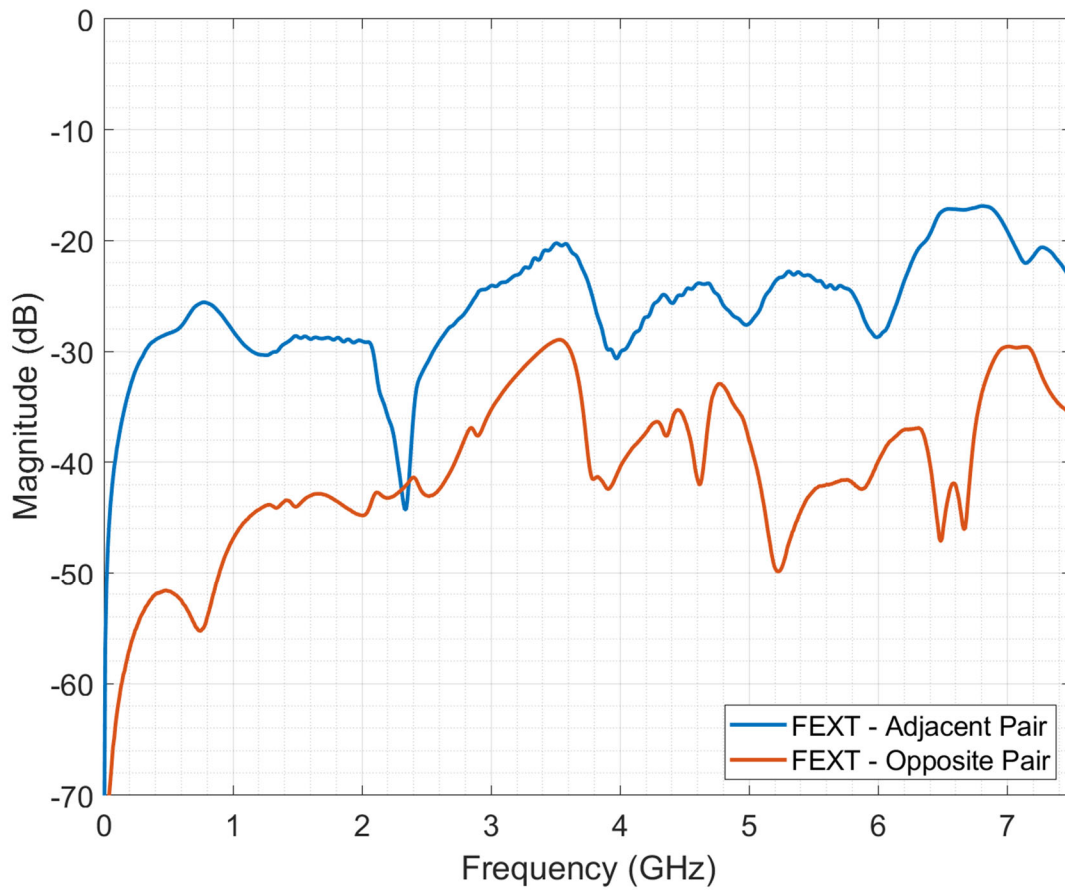


Figure 26. Straight PCB Mount PCB to Right-Angle PCB Mount EI Ochito Blue FEXT

8.2. Straight PCB Mount PCB to Right-Angle PCB Mount El Ochito Blue Time Domain Analysis

8.2.1. Straight PCB Mount PCB to Right-Angle PCB Mount El Ochito Blue TDR

A graph is shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r .

t_r (ps)	BW (GHz)
100	3.50
200	1.75

Table 5. Bandwidth to Rise Time Relationship

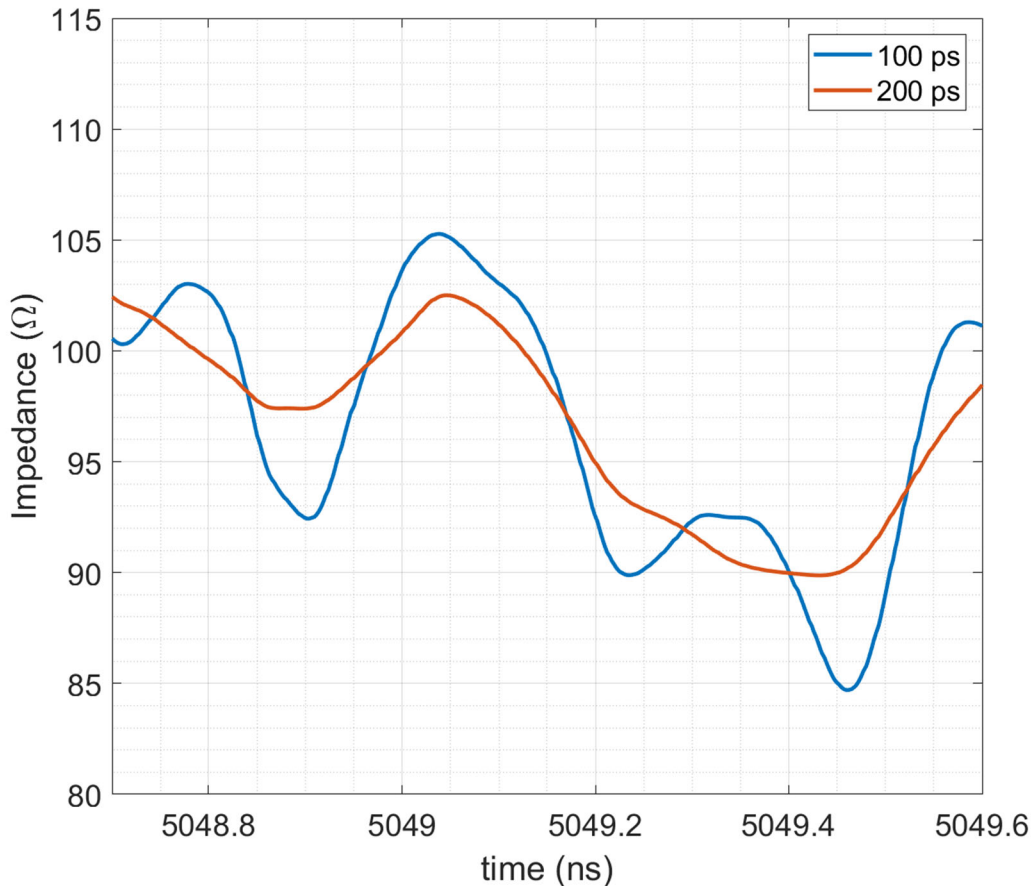


Figure 27. TDR – Straight PCB Mount PCB to Right-Angle PCB Mount El Ochito Blue

9. Straight PCB Mount PCB to Cable Assembly El Ochito Blue Performance

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

9.1. Frequency Domain Analysis

9.1.1. Insertion Loss / Return Loss

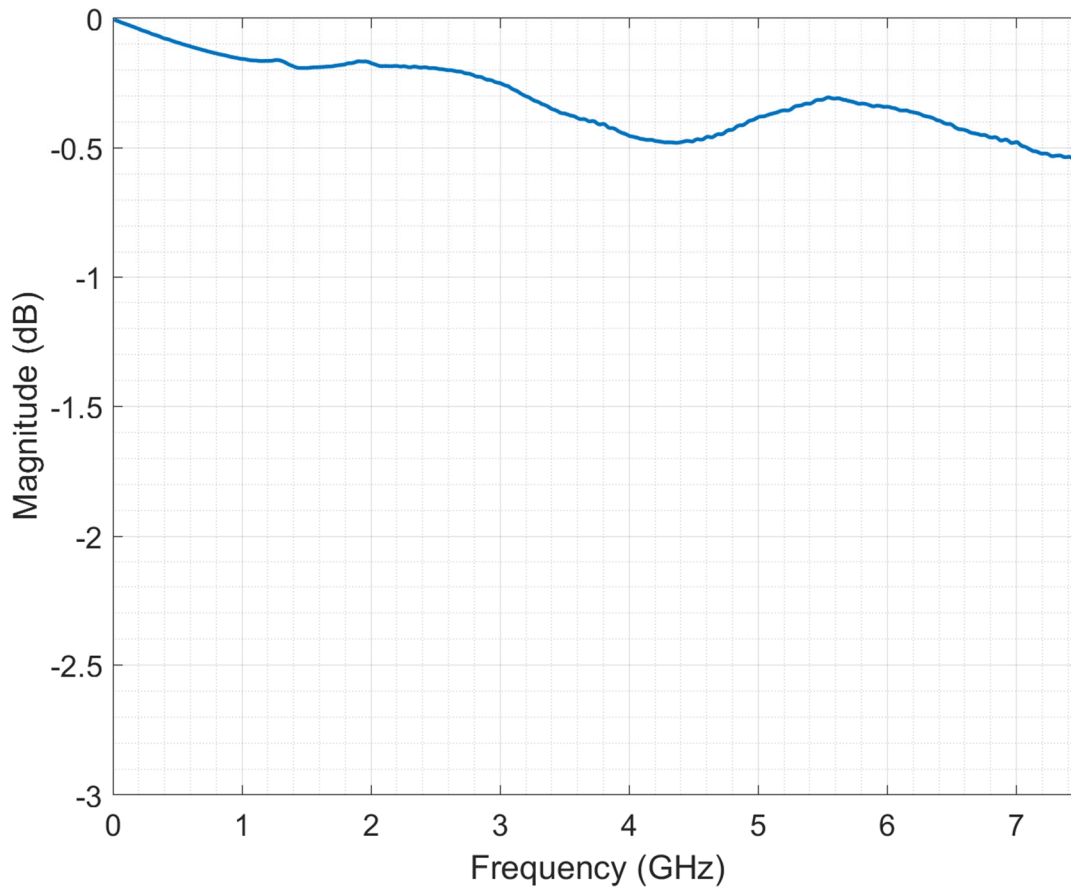


Figure 28. Straight PCB Mount PCB to Cable Assembly El Ochito Blue Insertion Loss

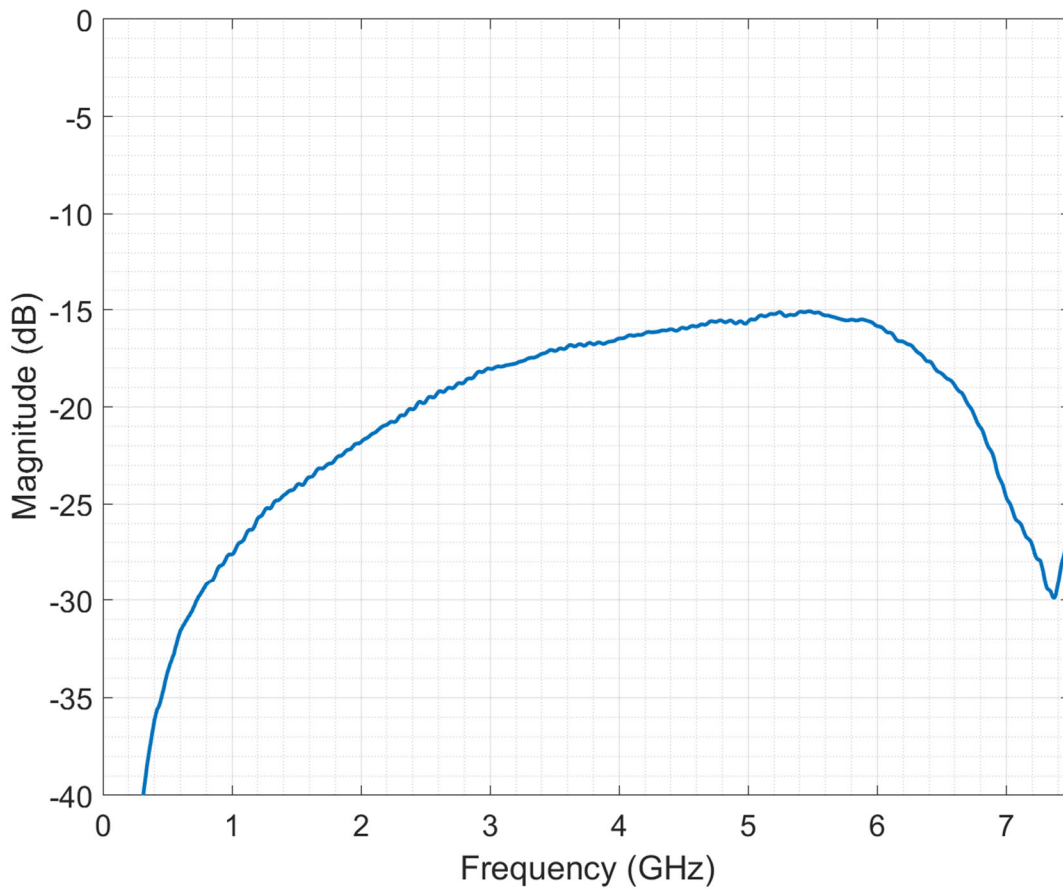


Figure 29. Straight PCB Mount PCB to Cable Assembly El Ochito Blue Return Loss

9.1.2. Straight PCB Mount PCB to Cable Assembly El Ochito Blue Crosstalk

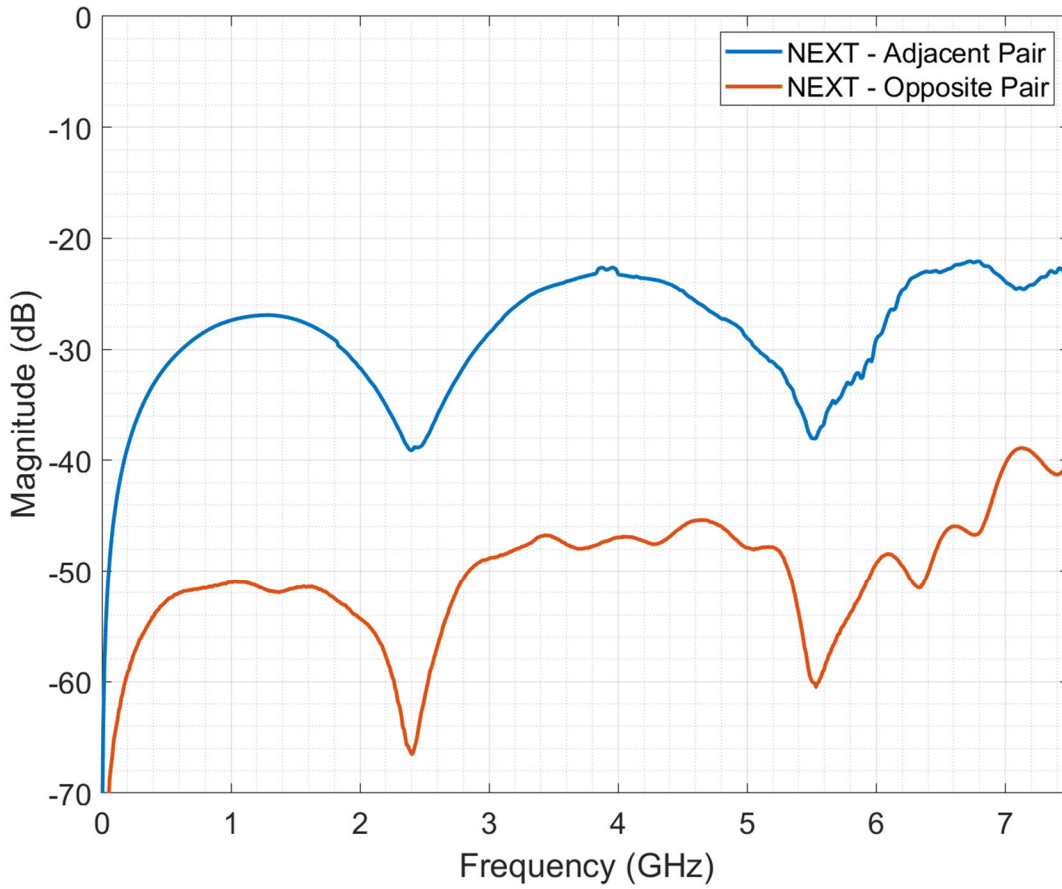


Figure 30. Straight PCB Mount PCB to Cable Assembly El Ochito Blue NEXT

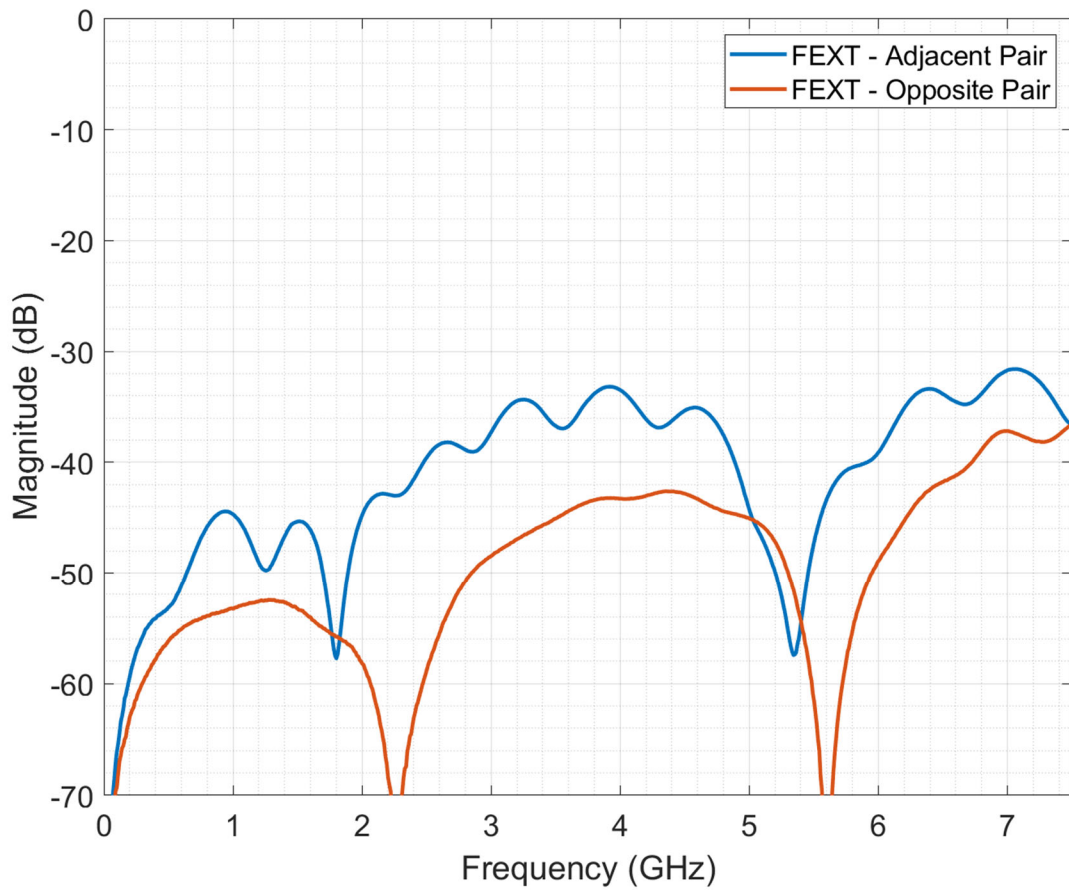


Figure 31. Straight PCB Mount PCB to Cable Assembly EI Ochito Blue FEXT

9.2. Straight PCB Mount PCB to Cable Assembly El Ochito Blue Time Domain Analysis

9.2.1. Straight PCB Mount PCB to Cable Assembly El Ochito Blue TDR

A graph is shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r .

t_r (ps)	BW (GHz)
100	3.50
200	1.75

Table 6. Bandwidth to Rise Time Relationship

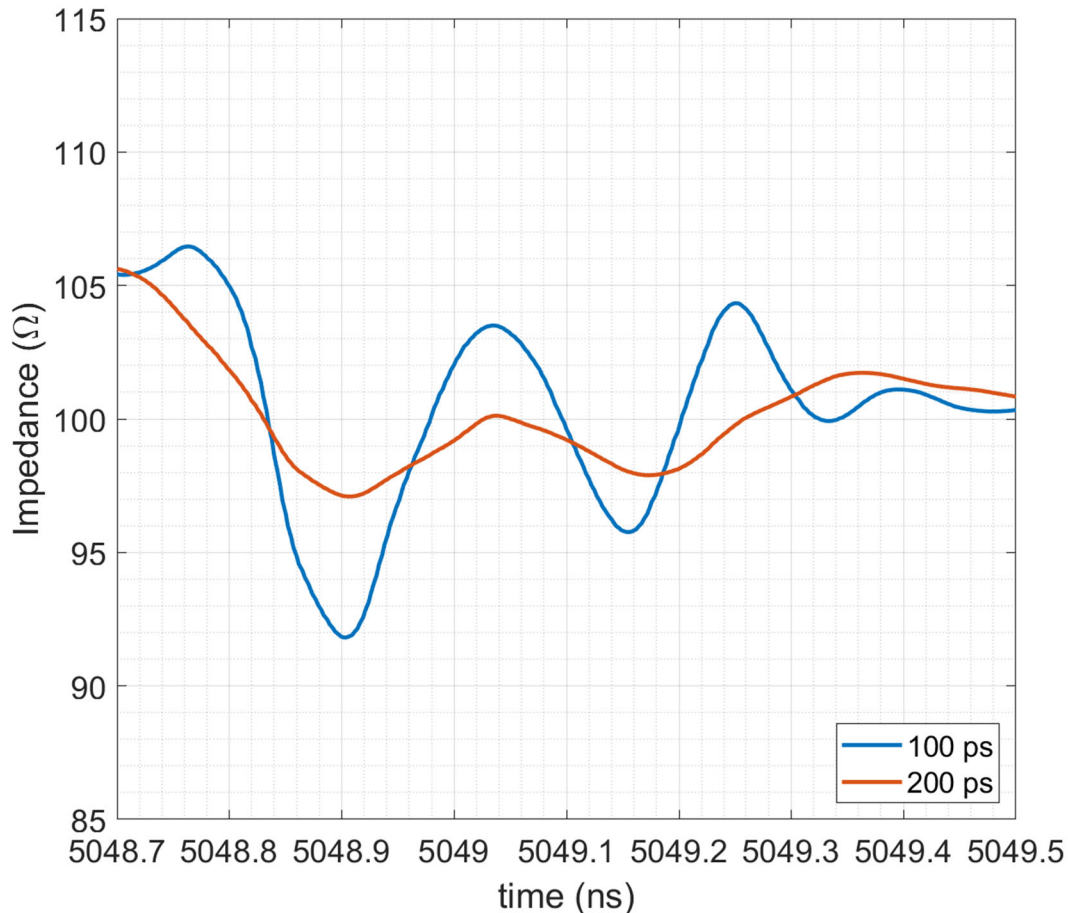


Figure 32. TDR – Straight PCB Mount PCB to Cable Assembly El Ochito Blue

10. Appendix A - 2x-Thru Fixture Performance

This section includes both frequency domain results of the 2x-thru PCBs used to extract the GHSM electrical characteristics from the overall measured DUT/fixturing data.

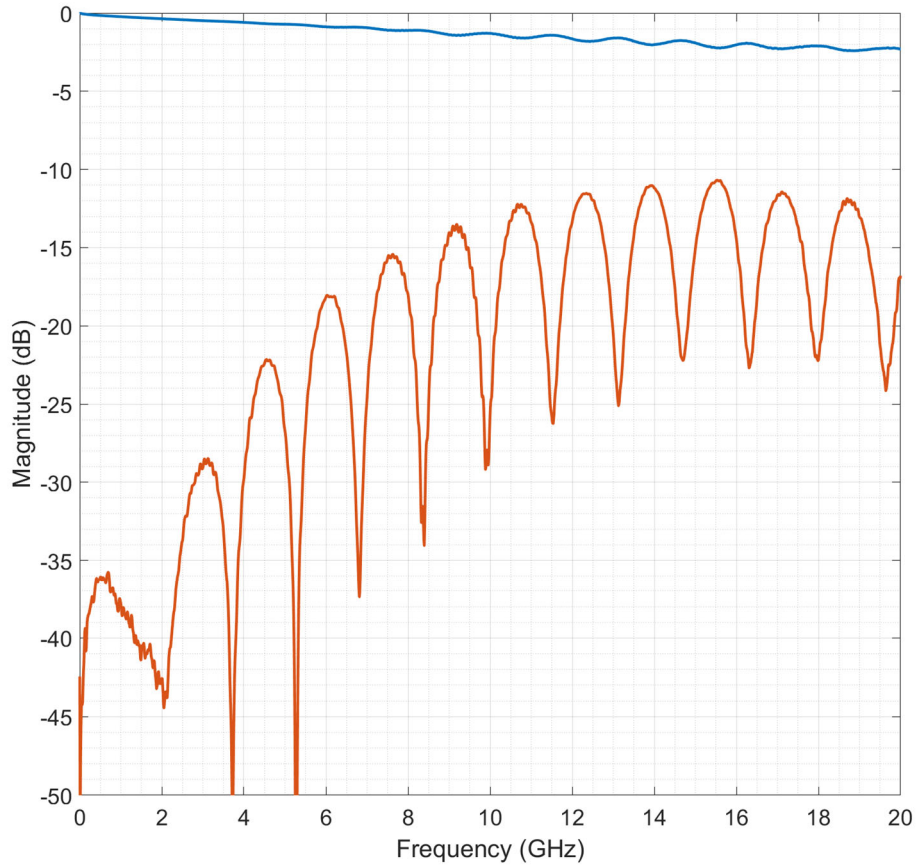


Figure 33. Straight PCB Mount EI Ochito Blue 2x-Thru PCB Response

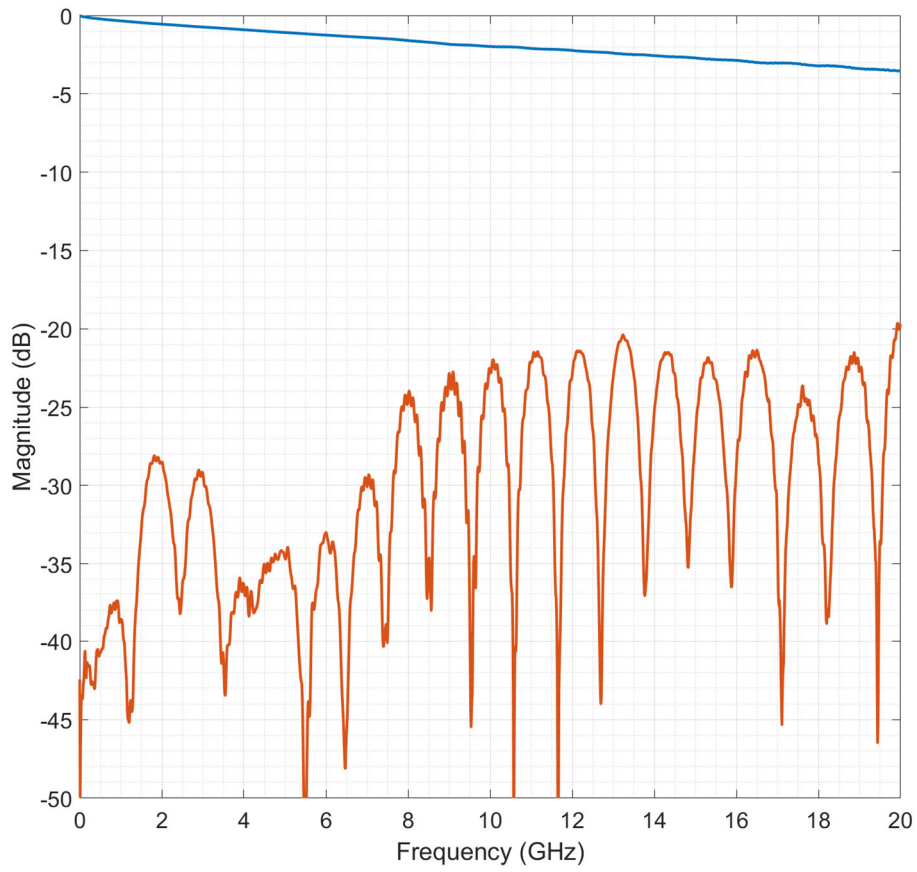


Figure 34. Right Angle EI Ochito Blue 2x-Thru PCB Response

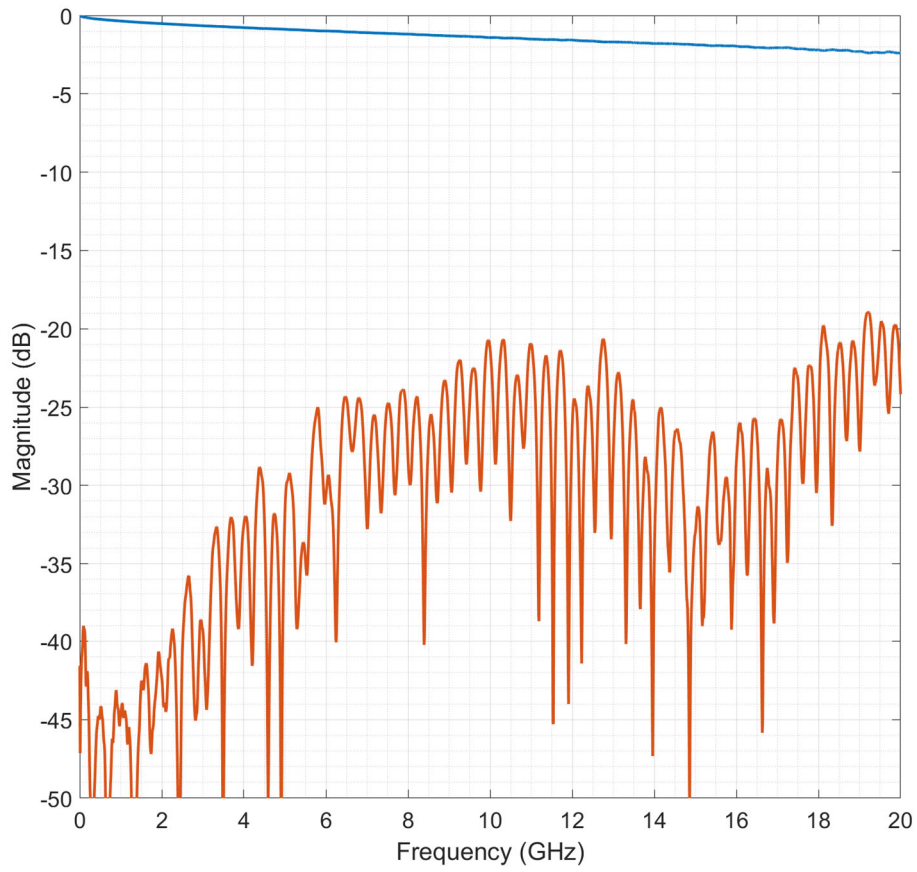


Figure 35. Cable Assembly El Ochito Blue 2x-Thru PCB Response