



GT-23-169

Glenair El Ochito White High Speed Characterization Report for Differential Applications

Revision History

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

Table of Contents

1. Introduction	7
2. Product Overview	7
3. Test Setup	7
3.1. Test Fixtures	8
3.1.1. Test PCBs	8
3.1.2. Test Cable Assemblies	9
3.2. Test Pairs	9
4. Straight PCB Mount EI Ochito White Performance.....	10
4.1. Frequency Domain Analysis	10
4.1.1. Insertion Loss / Return Loss	10
4.1.2. Straight PCB Mount EI Ochito White Crosstalk	12
4.2. Straight PCB Mount EI Ochito White Time Domain Analysis	14
4.2.1. Straight PCB Mount EI Ochito White TDR.....	14
5. Right-Angle PCB Mount EI Ochito White Performance Summary	15
5.1. Frequency Domain Analysis	15
5.1.1. Insertion Loss/Return Loss	15
5.1.2. Right-Angle PCB Mount EI Ochito White Crosstalk.....	17
5.2. Right-Angle PCB Mount EI Ochito White Time Domain Analysis.....	19
5.2.1. Right-Angle PCB Mount EI Ochito White TDR	19
6. Cable Assembly EI Ochito White Performance	21
6.1. Frequency Domain Analysis	21
6.1.1. Insertion Loss / Return Loss	21
6.1.2. Cable Assembly EI Ochito White Crosstalk.....	23
6.2. Cable Assembly EI Ochito White Time Domain Analysis.....	25
6.2.1. Cable Assembly EI Ochito White TDR.....	25
7. Straight PCB Mount to Right-Angle PCB Mount EI Ochito White Performance.....	26
7.1. Frequency Domain Analysis	26
7.1.1. Insertion Loss / Return Loss	26
7.1.2. Straight PCB Mount to Right-Angle PCB Mount EI Ochito White Crosstalk.....	28

7.2.	Straight PCB Mount to Right-Angle PCB Mount EI Ochito White Time Domain Analysis	30
8.	Straight PCB Mount to Cable Assembly EI Ochito White Performance.....	32
8.1.	Frequency Domain Analysis	32
8.1.1.	Insertion Loss / Return Loss	32
8.1.2.	Straight PCB Mount to Cable Assembly EI Ochito White Crosstalk	34
8.2.	Straight PCB Mount to Cable Assembly EI Ochito White Time Domain Analysis	36
9.	Right-Angle PCB Mount to Cable Assembly EI Ochito White Performance	37
9.1.	Frequency Domain Analysis	37
9.1.1.	Insertion Loss / Return Loss	37
9.1.2.	Right-Angle PCB Mount to Cable Assembly EI Ochito White Crosstalk.....	39
9.2.	Right-Angle PCB Mount to Cable Assembly EI Ochito White Time Domain Analysis.....	41
10.	Appendix A - 2x-Thru Fixture Performance.....	43

Table of Figures

Figure 1. Straight EI Ochito Test PCB Set	8
Figure 2. Right-Angle EI Ochito Test PCB Set.....	8
Figure 3. EI Ochito Test Cable Assembly Set.....	9
Figure 4. EI Ochito White Test Pairs	9
Figure 5. Straight PCB Mount EI Ochito White Insertion Loss	10
Figure 6. Straight PCB Mount EI Ochito White Return Loss	11
Figure 7. Straight PCB Mount EI Ochito White NEXT	12
Figure 8. Straight PCB Mount EI Ochito White FEXT	13
Figure 9. TDR – Straight PCB Mount EI Ochito White	14
Figure 10. Right-Angle PCB Mount EI Ochito White Insertion Loss	15
Figure 11. Right-Angle PCB Mount EI Ochito White Return Loss	16
Figure 12. Right-Angle PCB Mount EI Ochito White NEXT	17
Figure 13. Right-Angle PCB Mount EI Ochito White FEXT.....	18
Figure 14. TDR – Right-Angle PCB Mount EI Ochito White (Positions 3/4, 5/6)	19
Figure 15. TDR – Right-Angle PCB Mount EI Ochito White (Positions 1/2, 7/8)	20
Figure 16. Cable Assembly EI Ochito White Insertion Loss.....	21
Figure 17. Cable Assembly EI Ochito White Return Loss.....	22
Figure 18. Cable Assembly EI Ochito White NEXT	23
Figure 19. Cable Assembly EI Ochito White FEXT	24
Figure 20. TDR – Cable Assembly EI Ochito White.....	25
Figure 21. Straight PCB Mount to Right Angle PCB Mount EI Ochito White Insertion Loss	26
Figure 22. Straight PCB Mount to Right-Angle PCB Mount EI Ochito White Return Loss.....	27
Figure 23. Straight PCB Mount to Right-Angle PCB Mount EI Ochito White NEXT.....	28
Figure 24. Straight PCB Mount to Right-Angle PCB Mount EI Ochito White FEXT	29
Figure 25. TDR – Straight PCB Mount to Right-Angle Mount PCB EI Ochito White (Positions 1-2 and 7-8).....	30
Figure 26. TDR – Straight PCB Mount to Right-Angle PCB Mount EI Ochito White (Positions 3-4 and 5-6).....	31
Figure 27. Straight PCB Mount to Cable Assembly EI Ochito White Insertion Loss	32
Figure 28. Straight PCB Mount to Cable Assembly EI Ochito White Return Loss	33
Figure 29. Straight PCB Mount to Cable Assembly EI Ochito White NEXT	34
Figure 30. Straight PCB Mount to Cable Assembly EI Ochito White FEXT	35
Figure 31. TDR – Straight PCB Mount to Cable Assembly EI Ochito White	36
Figure 32. Right-Angle PCB Mount to Cable Assembly EI Ochito White Insertion Loss.....	37
Figure 33. Right-Angle PCB Mount to Cable Assembly EI Ochito White Return Loss.....	38
Figure 34. Right-Angle PCB Mount to Cable Assembly EI Ochito White NEXT	39
Figure 35. Right-Angle PCB Mount to Cable Assembly EI Ochito White FEXT	40
Figure 36. TDR – Right-Angle PCB Mount to Cable Assembly EI Ochito White (Positions 1-2 and 7-8).....	41

Figure 37. TDR – Right-Angle PCB Mount to Cable Assembly EI Ochito White (Positions 3-4 and 5-6).....42
Figure 38. Straight EI Ochito White 2x-Thru PCB Response.....43
Figure 39. Right Angle EI Ochito White 2x-Thru PCB Response44
Figure 40. Cable Assembly EI Ochito White 2x-Thru PCB Response45

1. Introduction

This document contains results from testing that was performed to evaluate the high-frequency electrical performance of the Glenair El Ochito White 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 El Ochito® octaxial contacts save size and weight. Suitable for aircraft avionics, weapons systems, satellites, radars, communications equipment and other aerospace/defense gear, El 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 792-005 and 792-006. The other set used right-angle, Series 792, PCB-mount connectors, part numbers 792-009 and 792-010. Photographs of the test boards are seen in the following two figures.

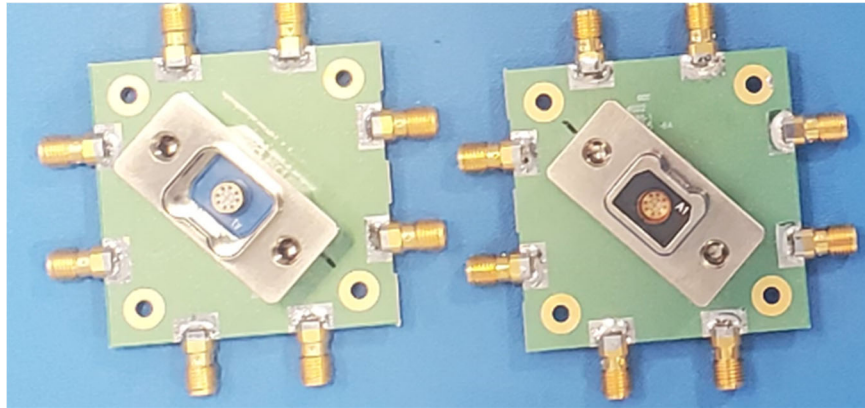


Figure 1. Straight El Ochito Test PCB Set

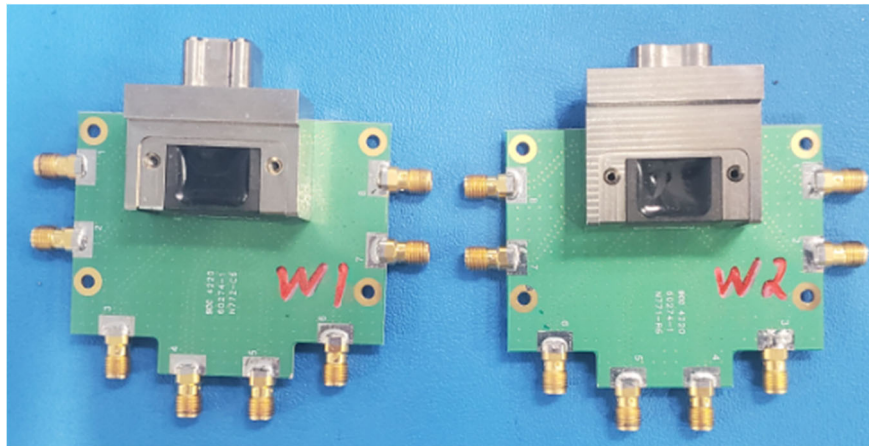


Figure 2. Right-Angle El Ochito Test PCB Set

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 792-001, with 858-046 contacts, and a Series 792 receptacle connector, part number 792-002, with 858-045 contacts. The test cable assemblies are shown in Figure 3.

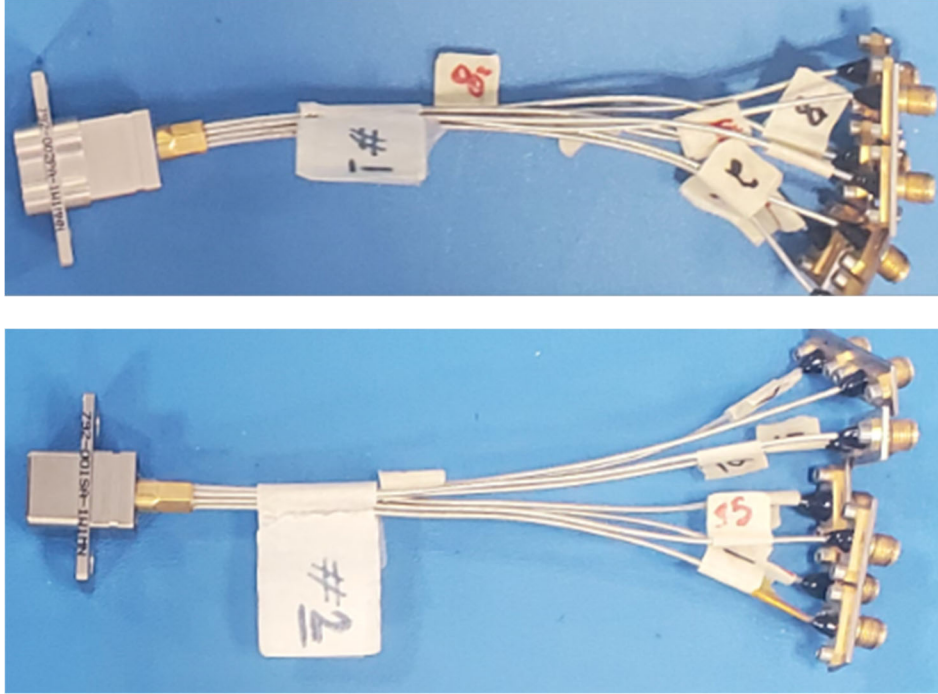


Figure 3. El Ochito Test Cable Assembly Set

3.2. Test Pairs

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

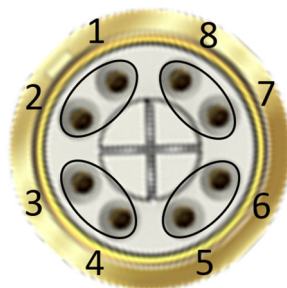


Figure 4. El Ochito White Test Pairs

4. Straight PCB Mount El Ochito White 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

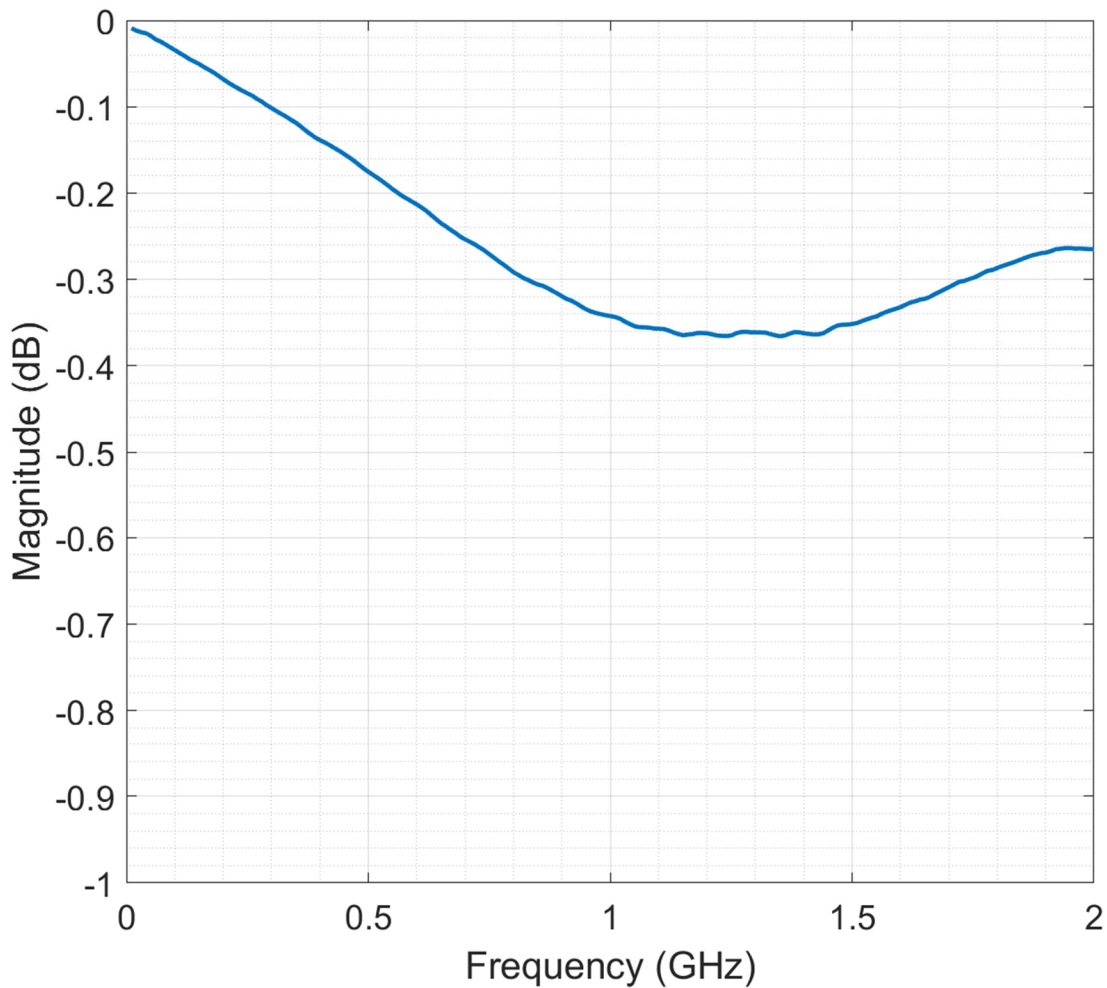


Figure 5. Straight PCB Mount El Ochito White Insertion Loss

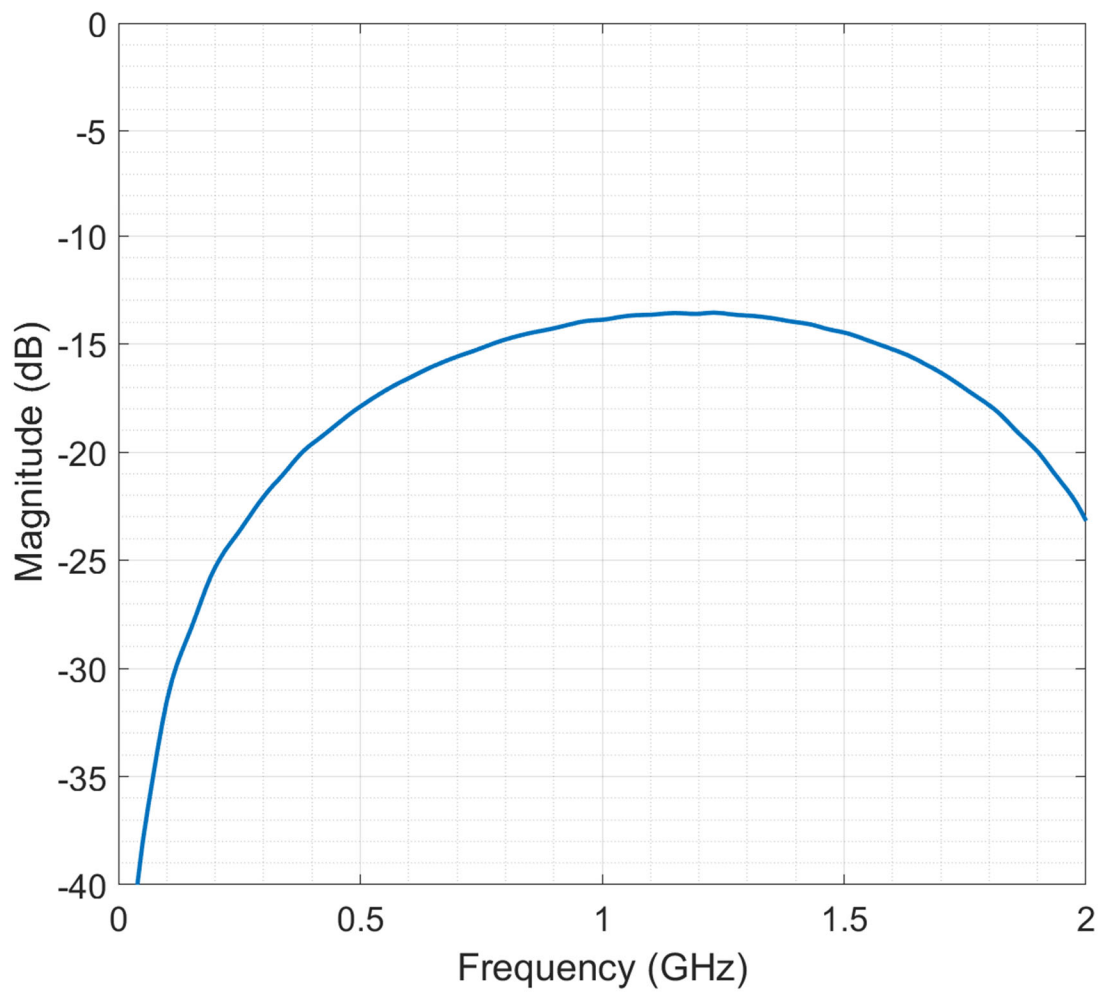


Figure 6. Straight PCB Mount EI Ochito White Return Loss

4.1.2. Straight PCB Mount El Ochito White Crosstalk

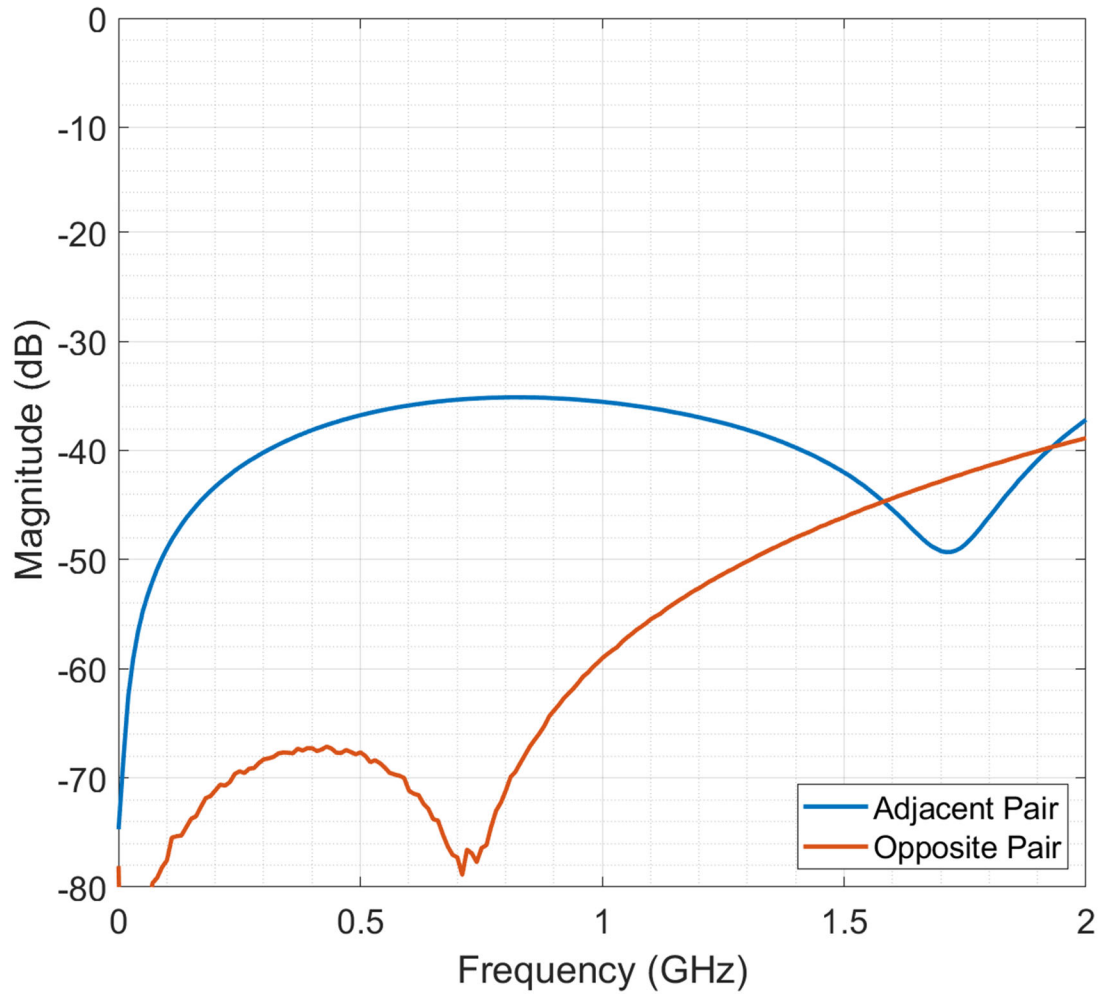


Figure 7. Straight PCB Mount El Ochito White NEXT

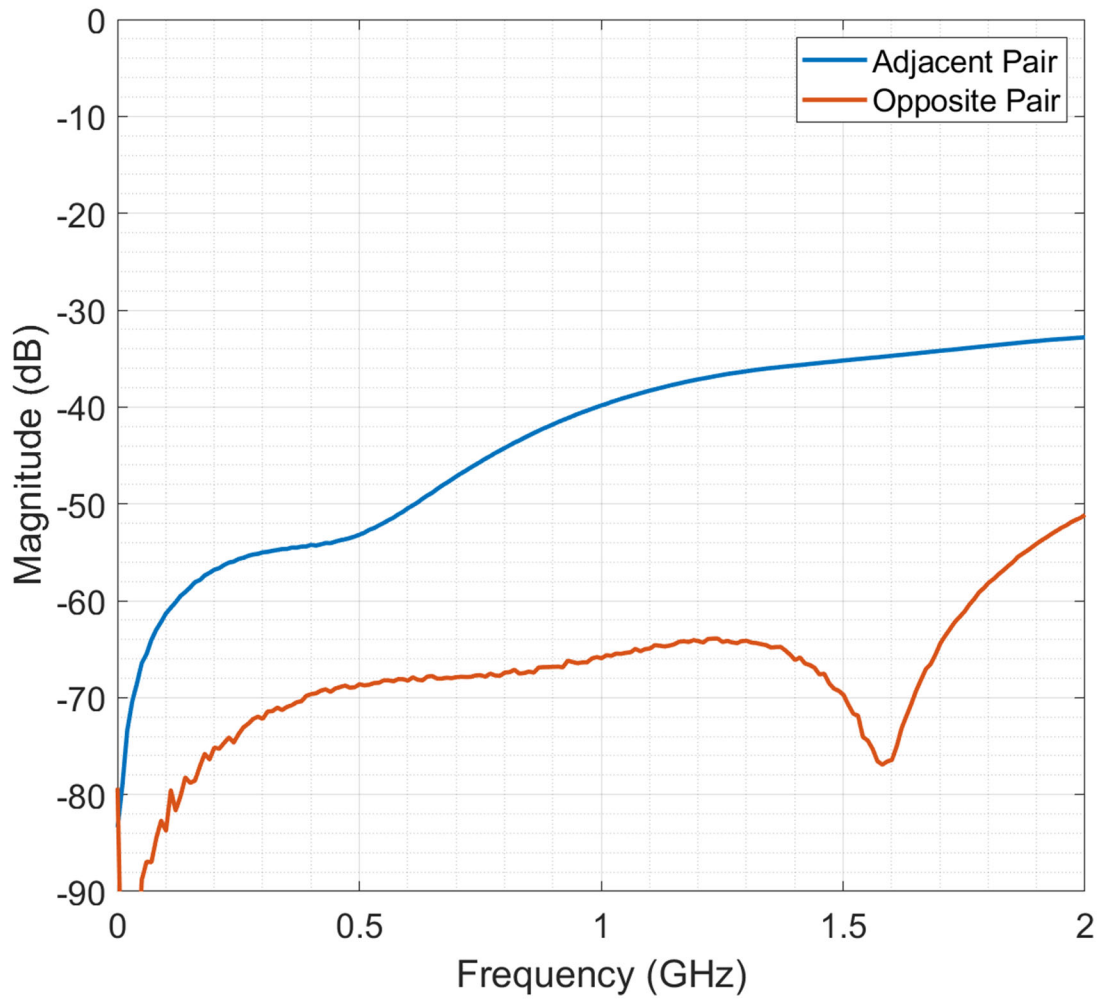


Figure 8. Straight PCB Mount EI Ochito White FEXT

4.2. Straight PCB Mount El Ochito White Time Domain Analysis

4.2.1. Straight PCB Mount El Ochito White TDR

Rise time is defined at 10% to 90% of the signal's rising edge. A rise time of 200 ps was used. This corresponds to a bandwidth of 1.75 GHz.

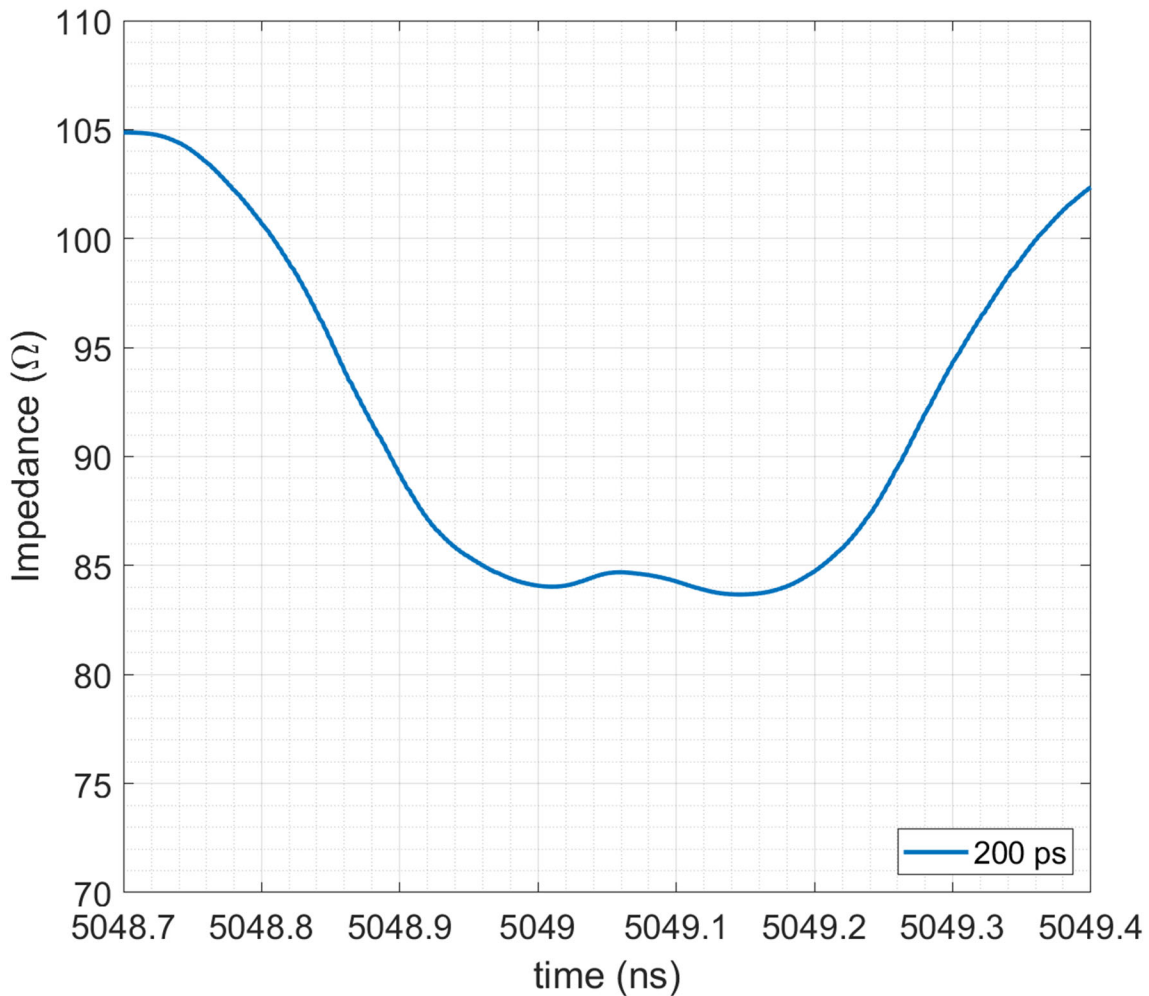


Figure 9. TDR – Straight PCB Mount El Ochito White

5. Right-Angle PCB Mount El Ochito White 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

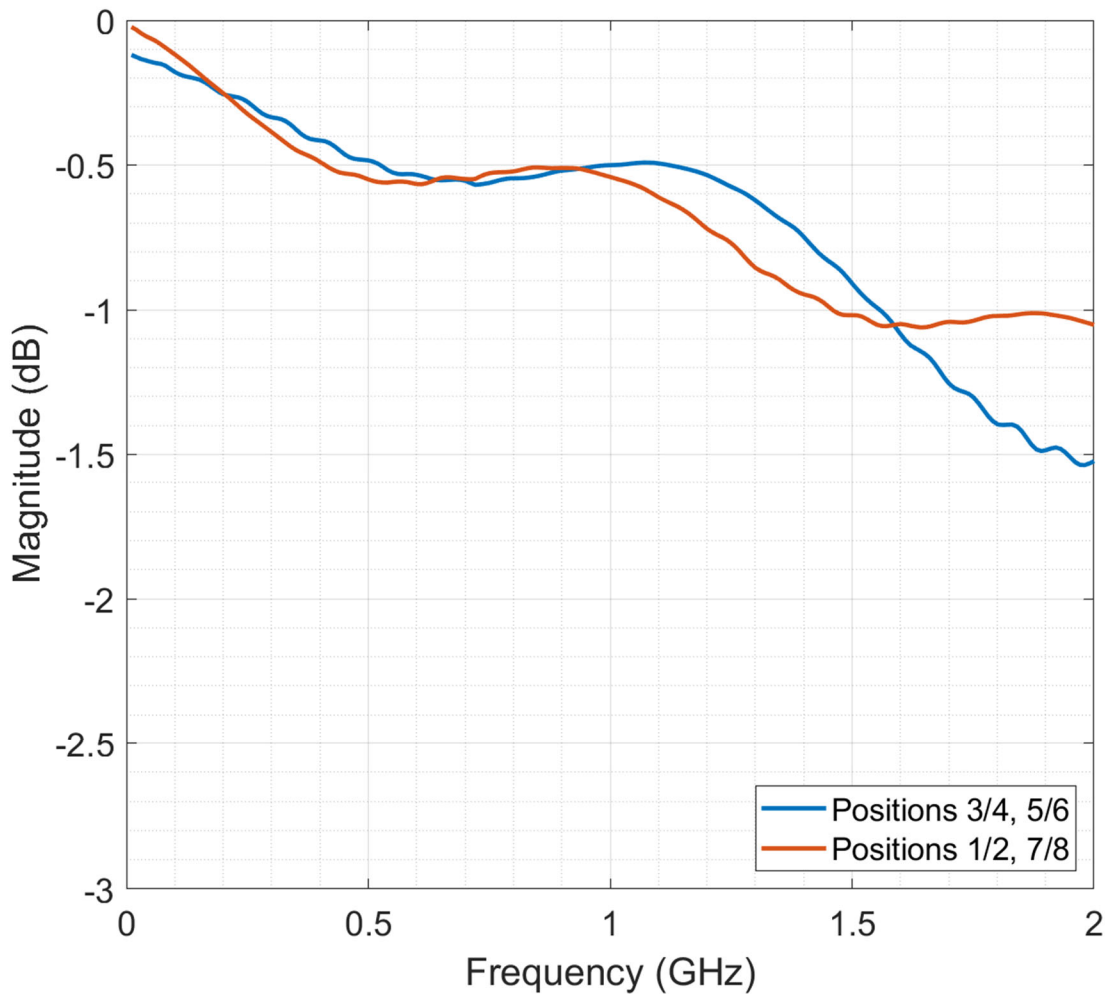


Figure 10. Right-Angle PCB Mount El Ochito White Insertion Loss

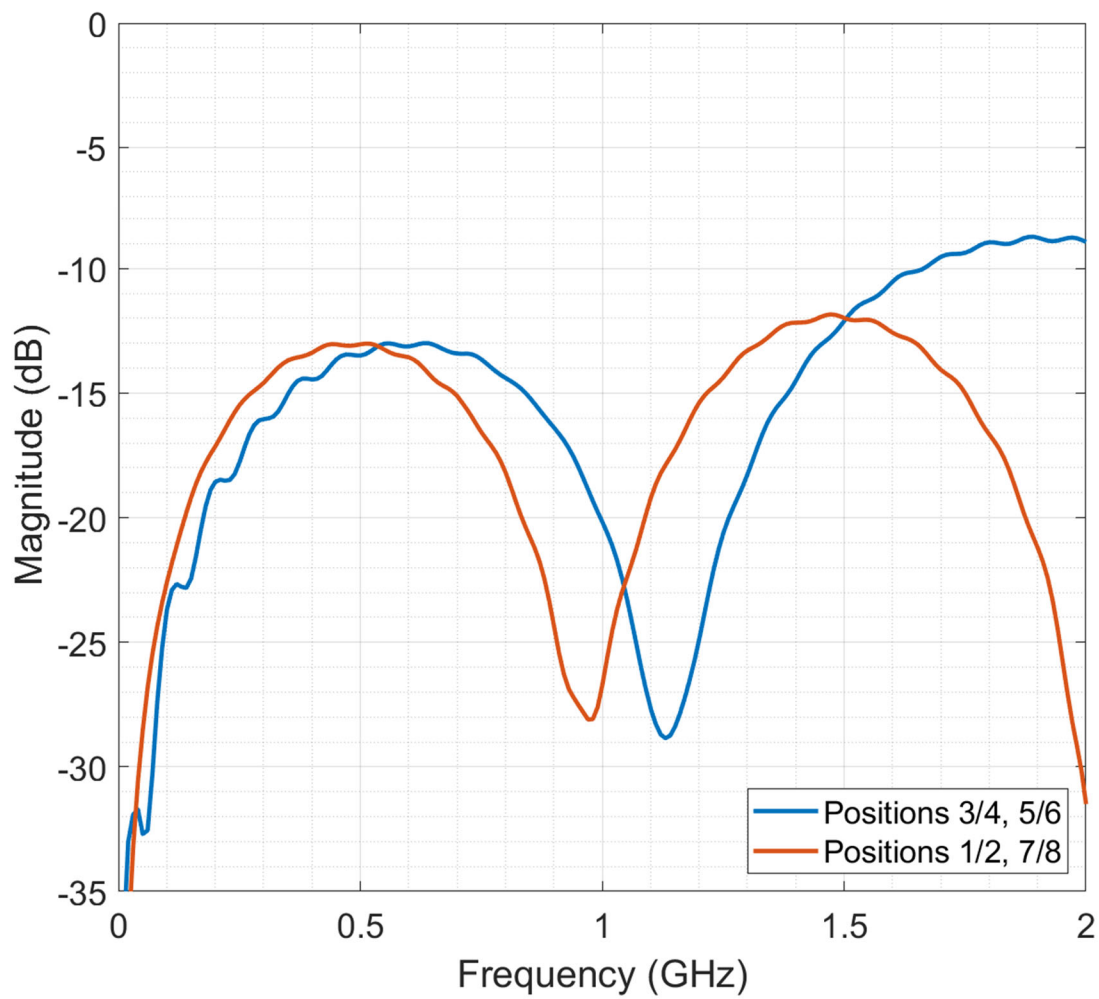


Figure 11. Right-Angle PCB Mount EI Ochito White Return Loss

5.1.2. Right-Angle PCB Mount El Ochito White Crosstalk

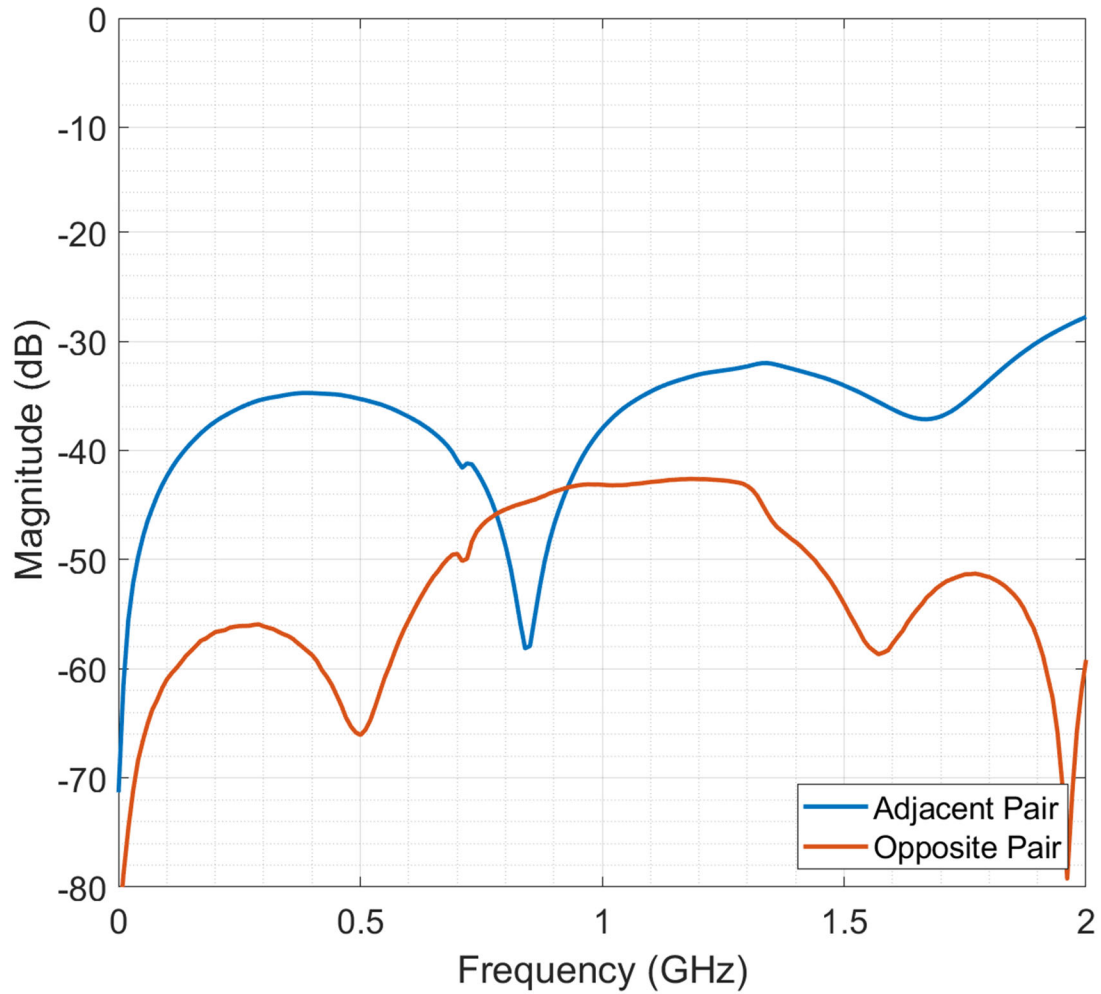


Figure 12. Right-Angle PCB Mount El Ochito White NEXT

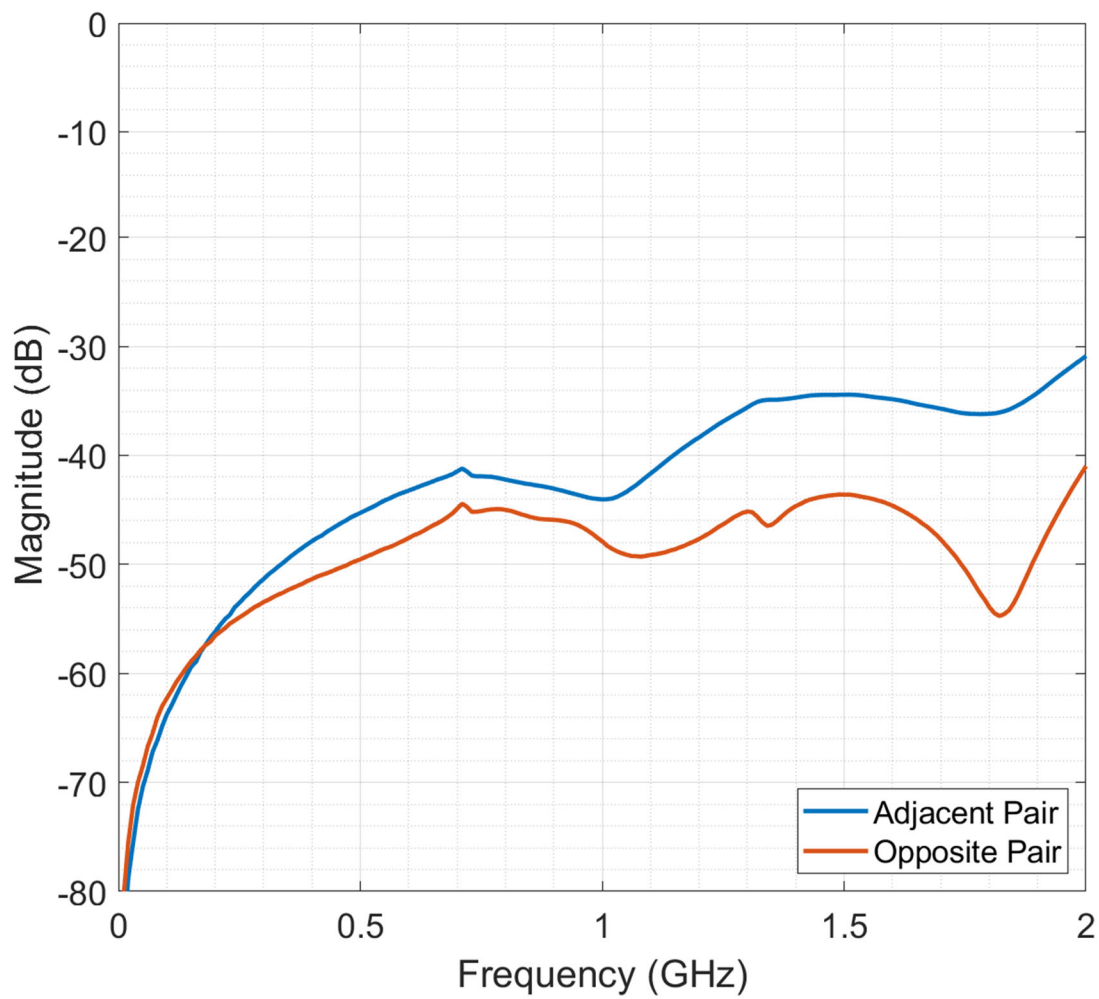


Figure 13. Right-Angle PCB Mount El Ochito White FEXT

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

5.2.1. Right-Angle PCB Mount El Ochito White TDR

Rise time is defined at 10% to 90% of the signal's rising edge. A rise time of 200 ps was used. This corresponds to a bandwidth of 1.75 Ghz.

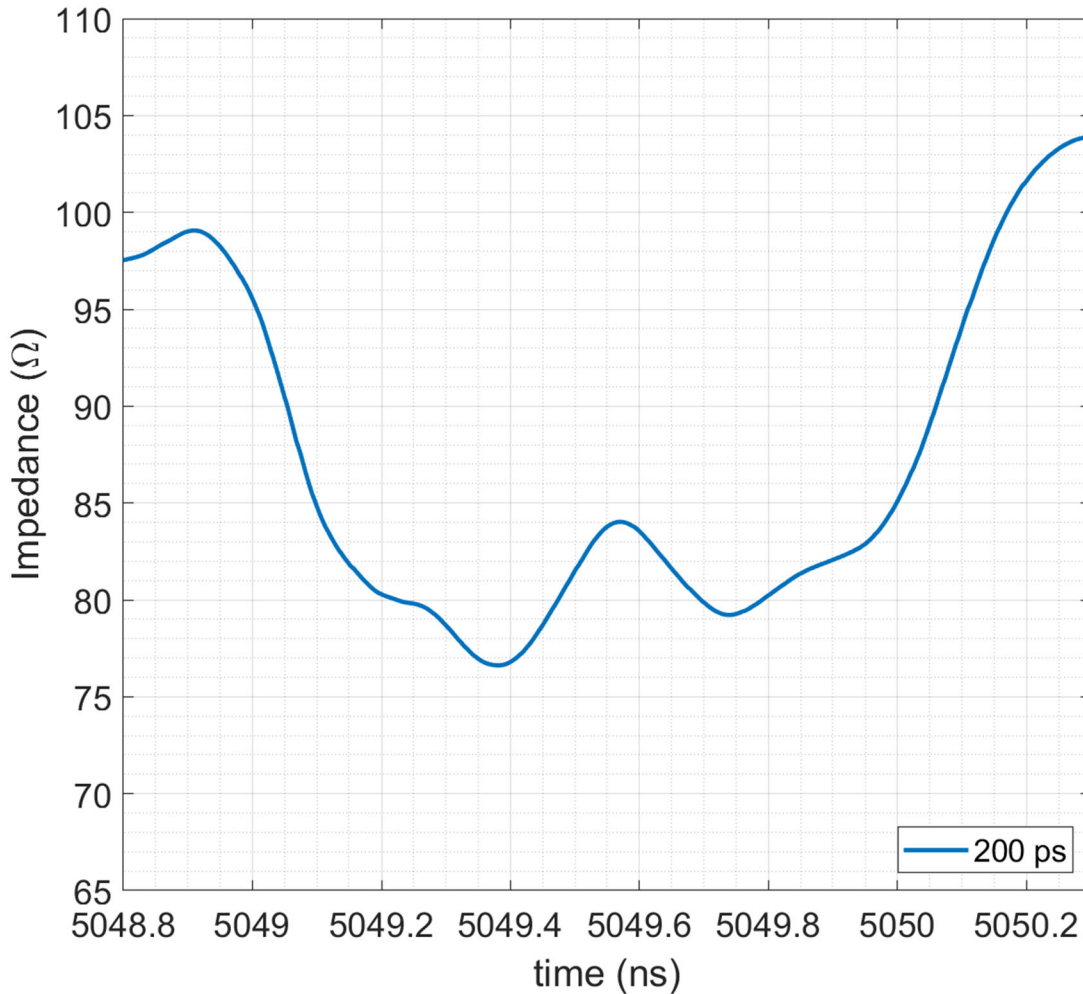


Figure 14. TDR – Right-Angle PCB Mount El Ochito White (Positions 3/4, 5/6)

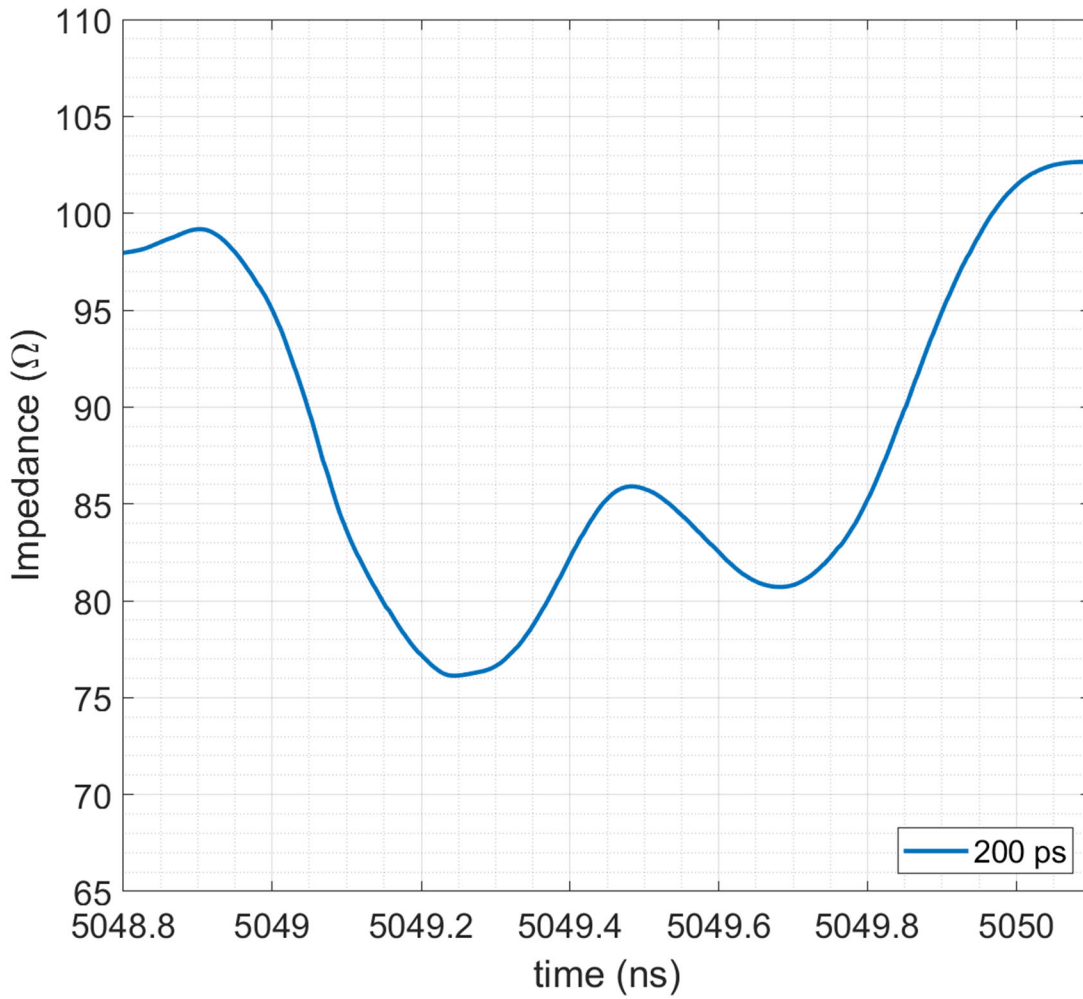


Figure 15. TDR – Right-Angle PCB Mount EI Ochito White (Positions 1/2, 7/8)

6. Cable Assembly El Ochito White 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

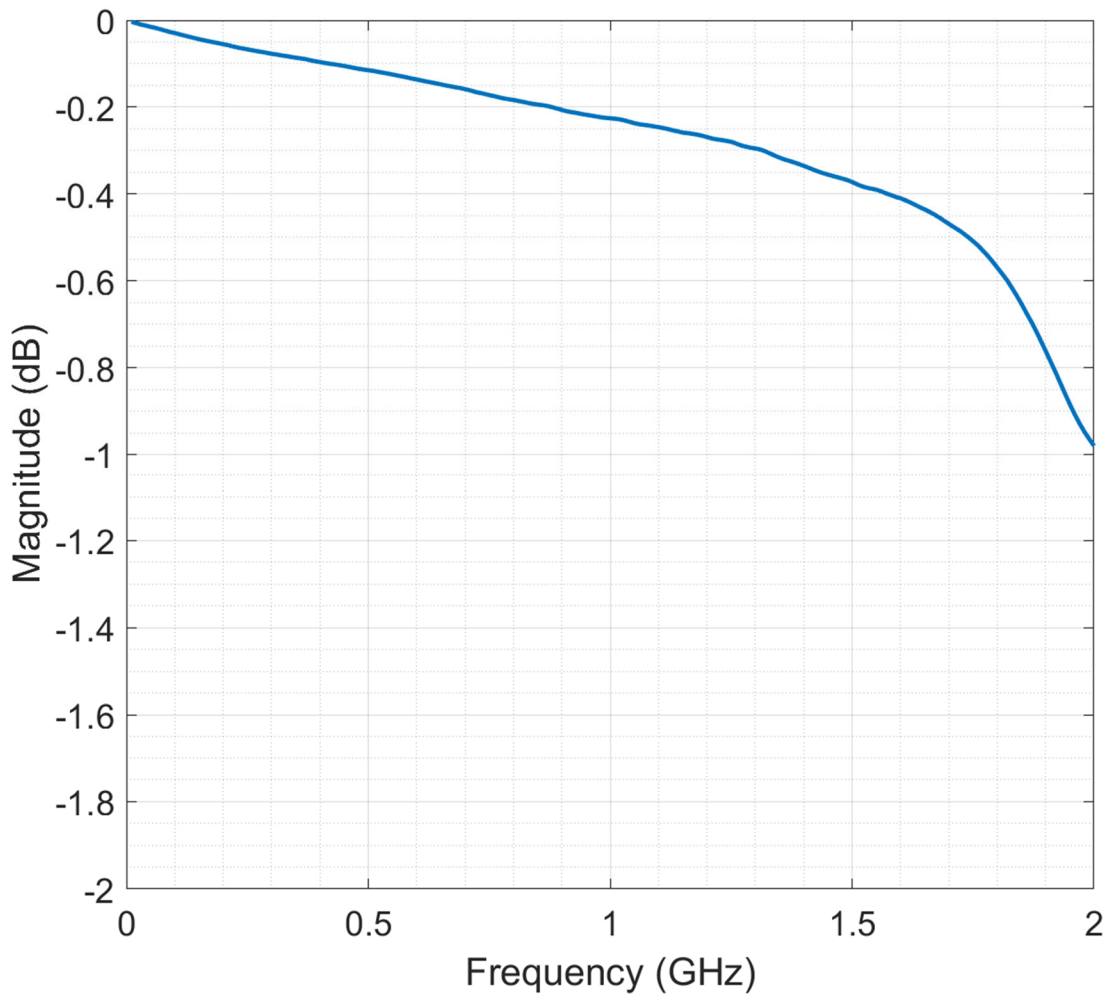


Figure 16. Cable Assembly El Ochito White Insertion Loss

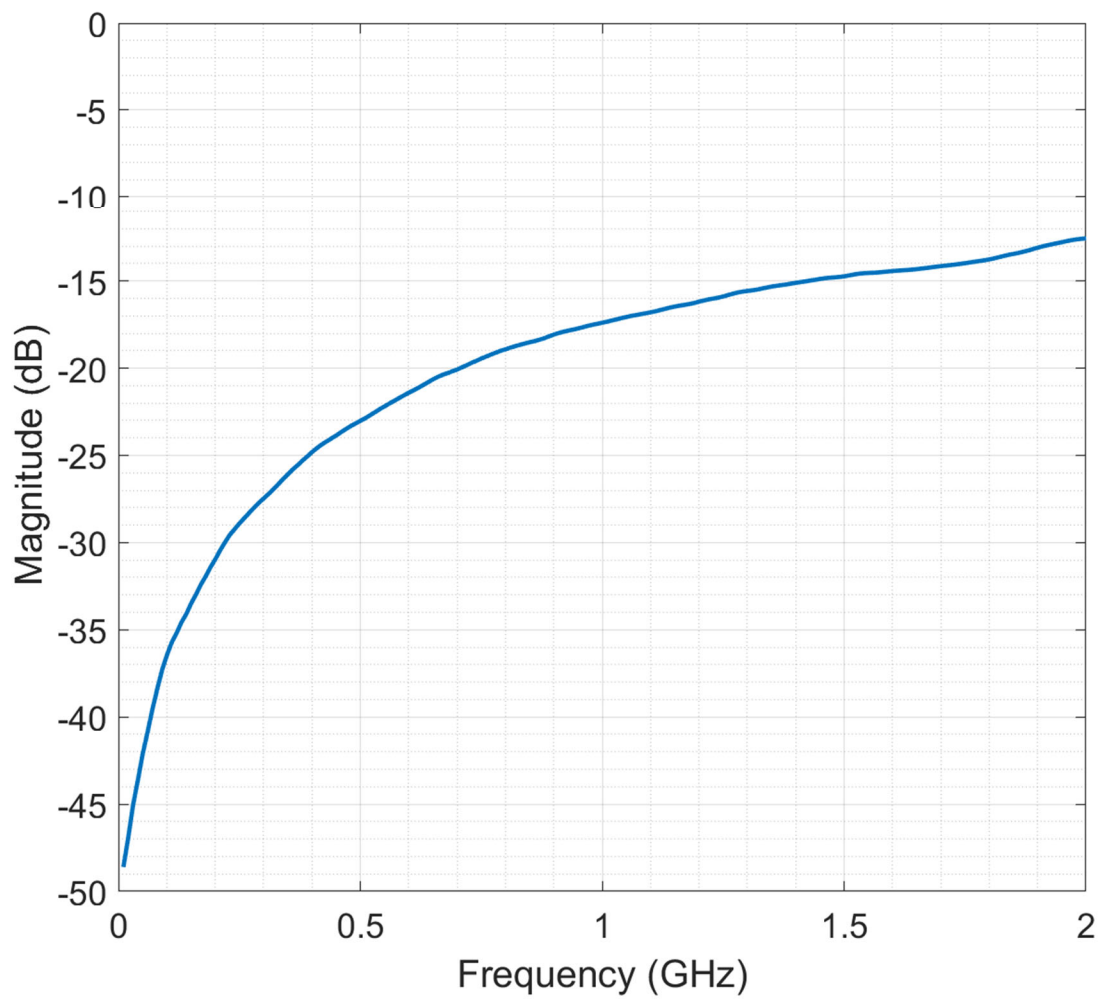


Figure 17. Cable Assembly EI Ochito White Return Loss

6.1.2. Cable Assembly El Ochito White Crosstalk

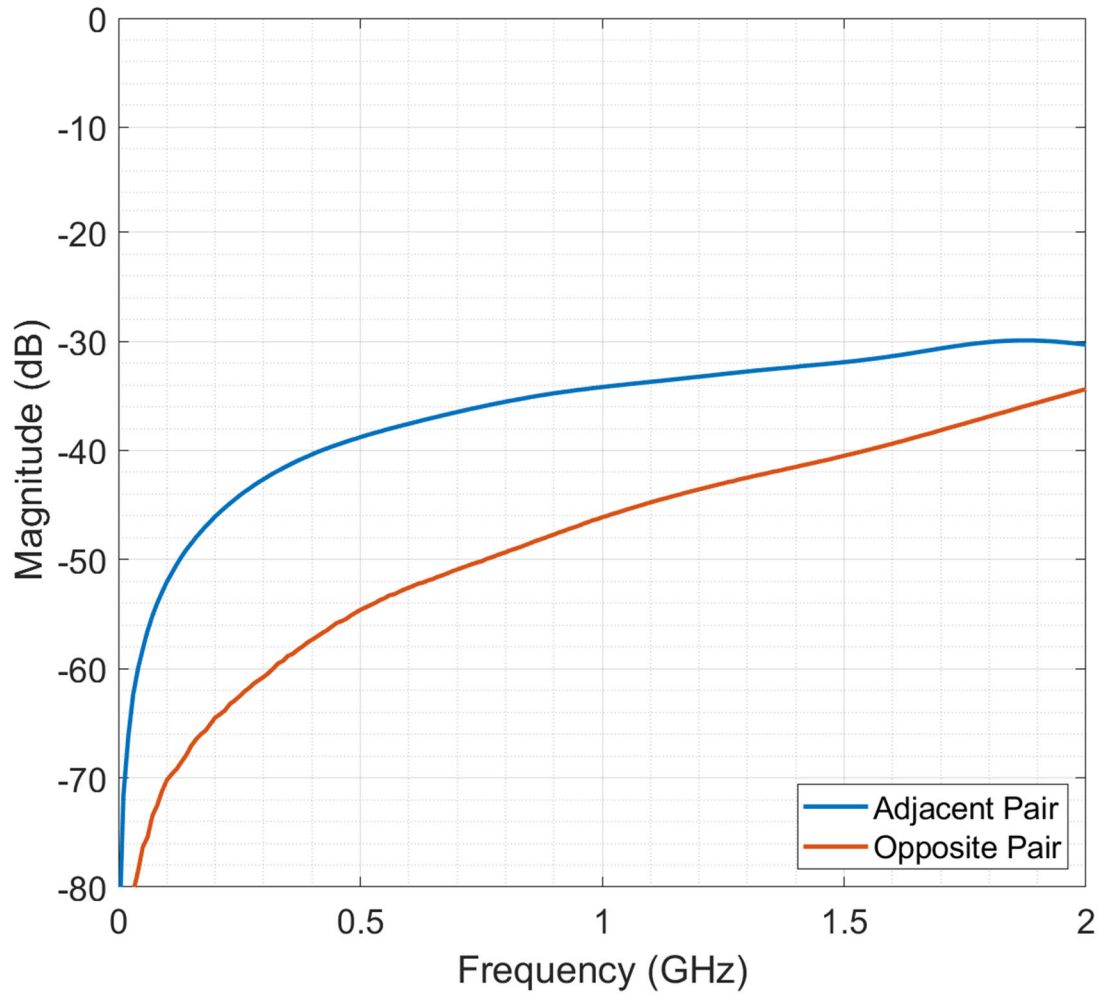


Figure 18. Cable Assembly El Ochito White NEXT

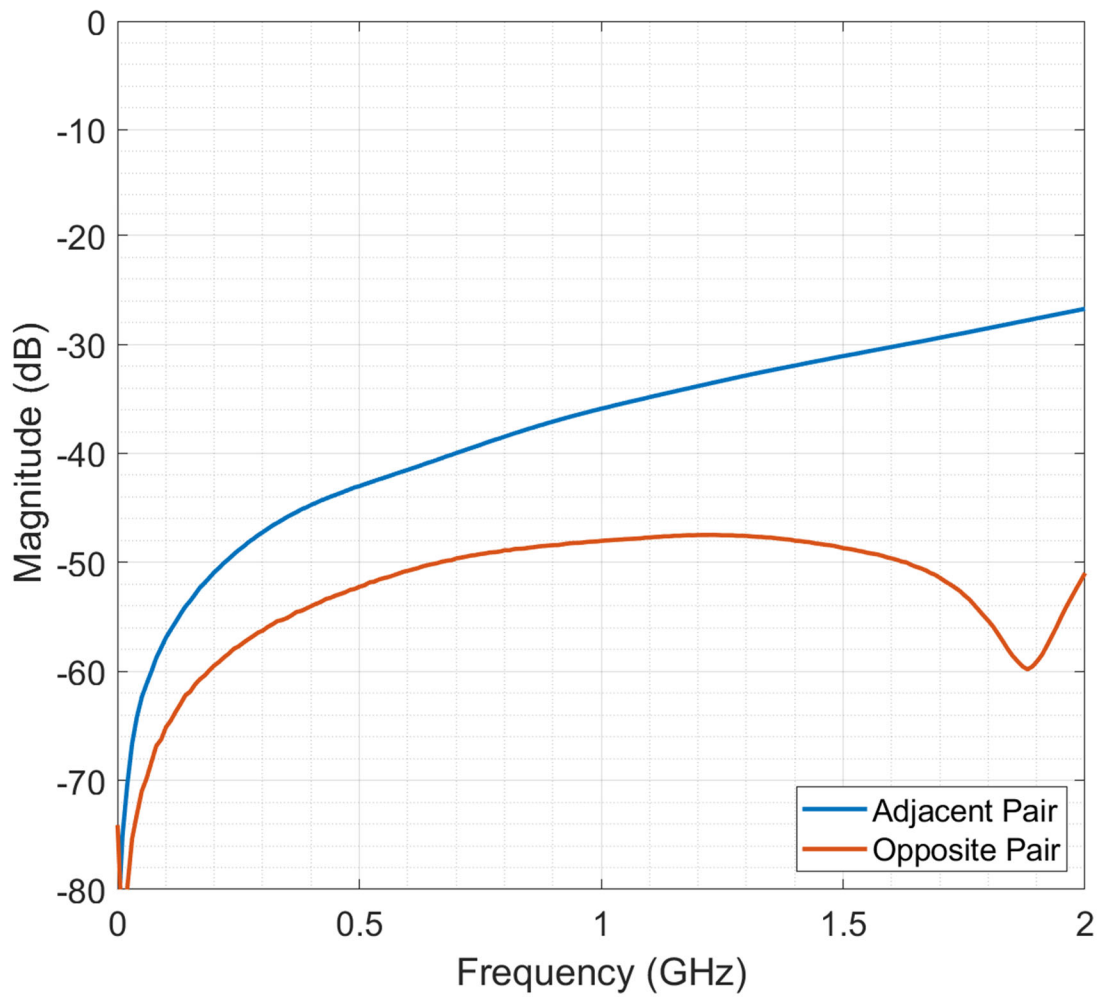


Figure 19. Cable Assembly EI Ochito White FEXT

6.2.Cable Assembly El Ochito White Time Domain Analysis

6.2.1. Cable Assembly El Ochito White TDR

Rise time is defined at 10% to 90% of the signal's rising edge. A rise time of 200 ps was used. This corresponds to a bandwidth of 1.75 GHz.

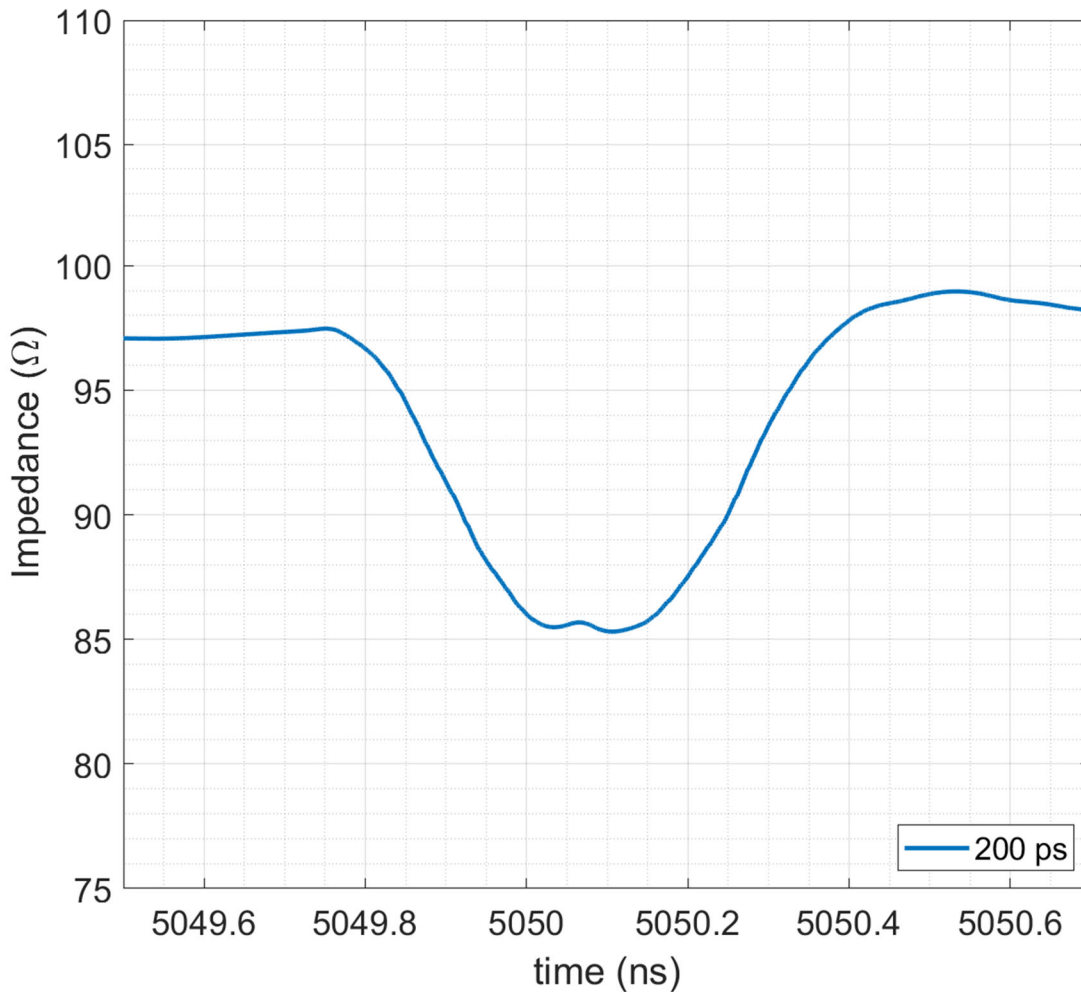


Figure 20. TDR – Cable Assembly El Ochito White

7. Straight PCB Mount to Right-Angle PCB Mount El Ochito White 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

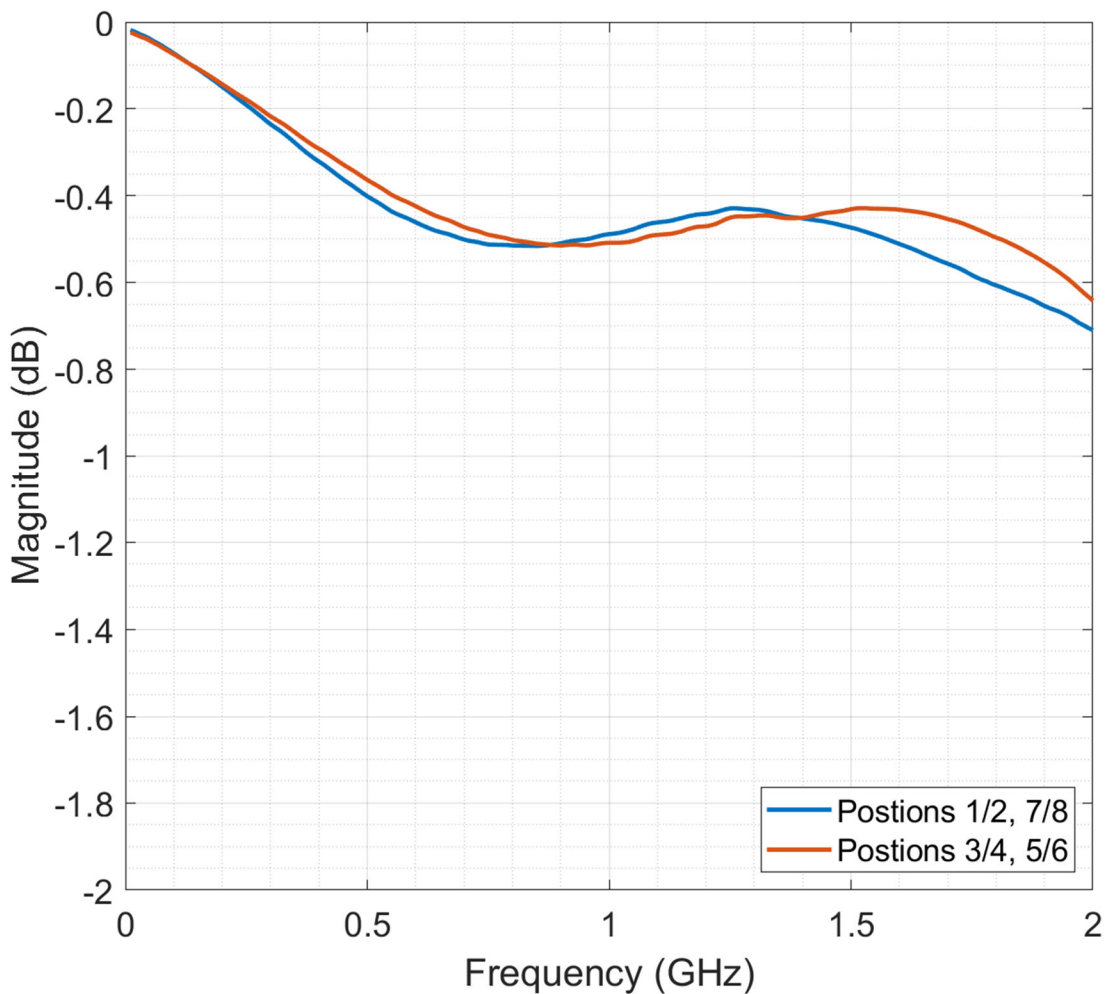


Figure 21. Straight PCB Mount to Right Angle PCB Mount El Ochito White Insertion Loss

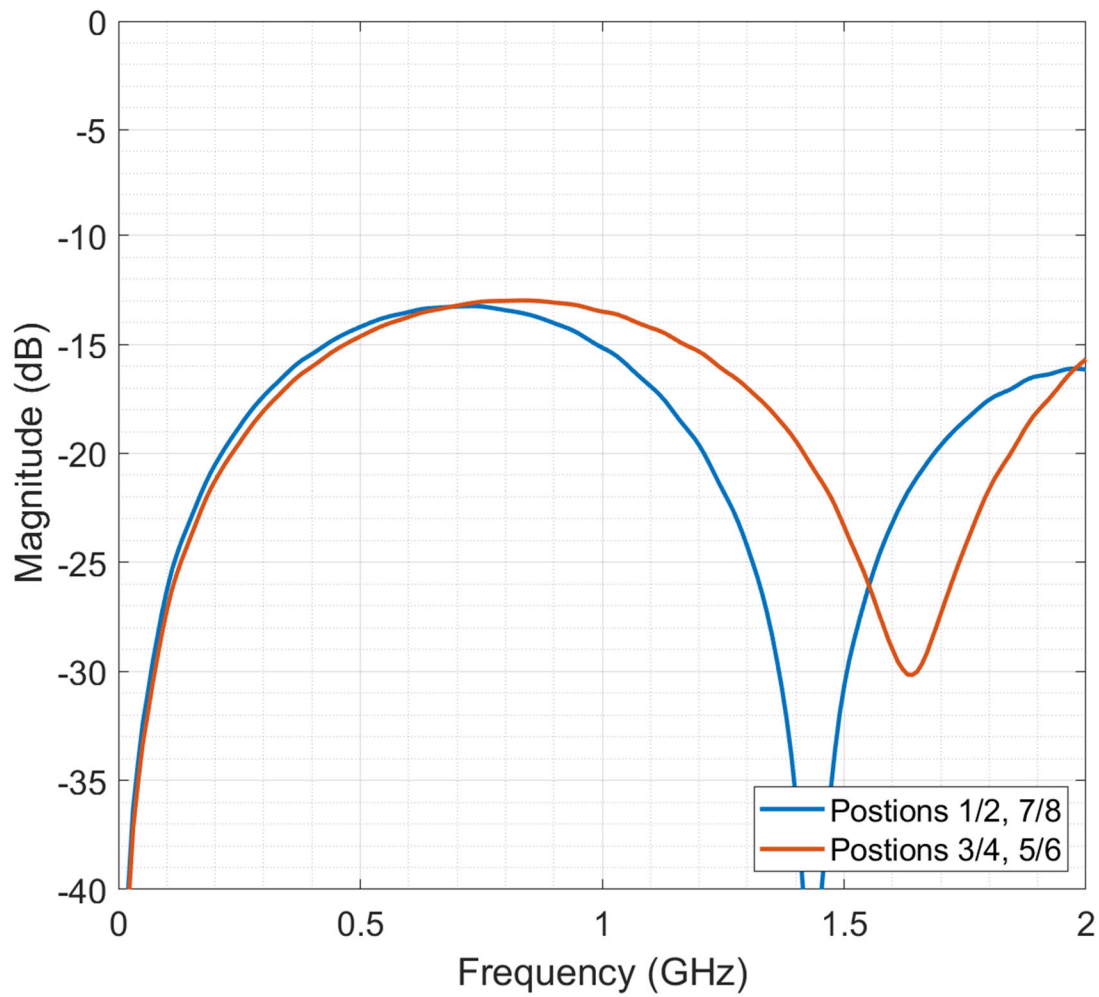


Figure 22. Straight PCB Mount to Right-Angle PCB Mount El Ochito White Return Loss

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

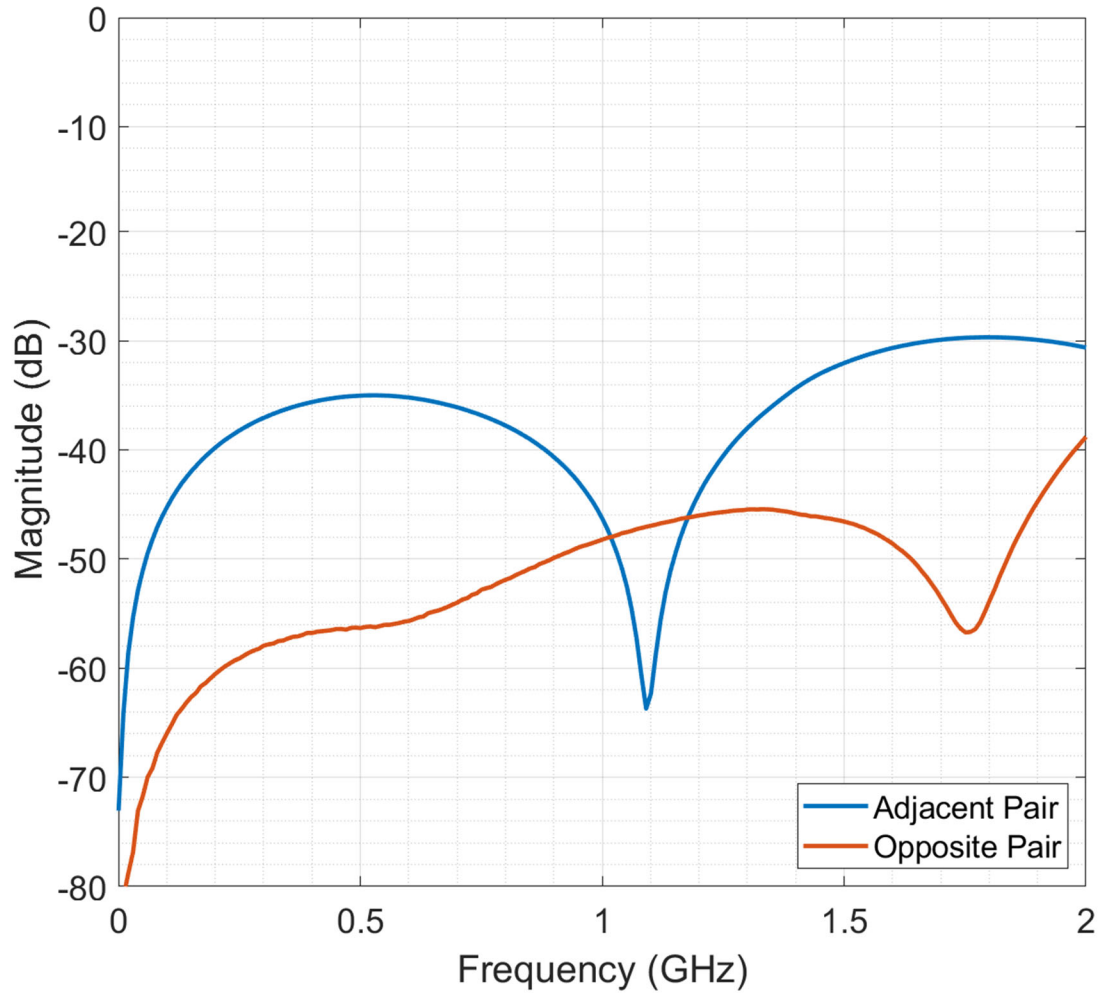


Figure 23. Straight PCB Mount to Right-Angle PCB Mount El Ochito White NEXT

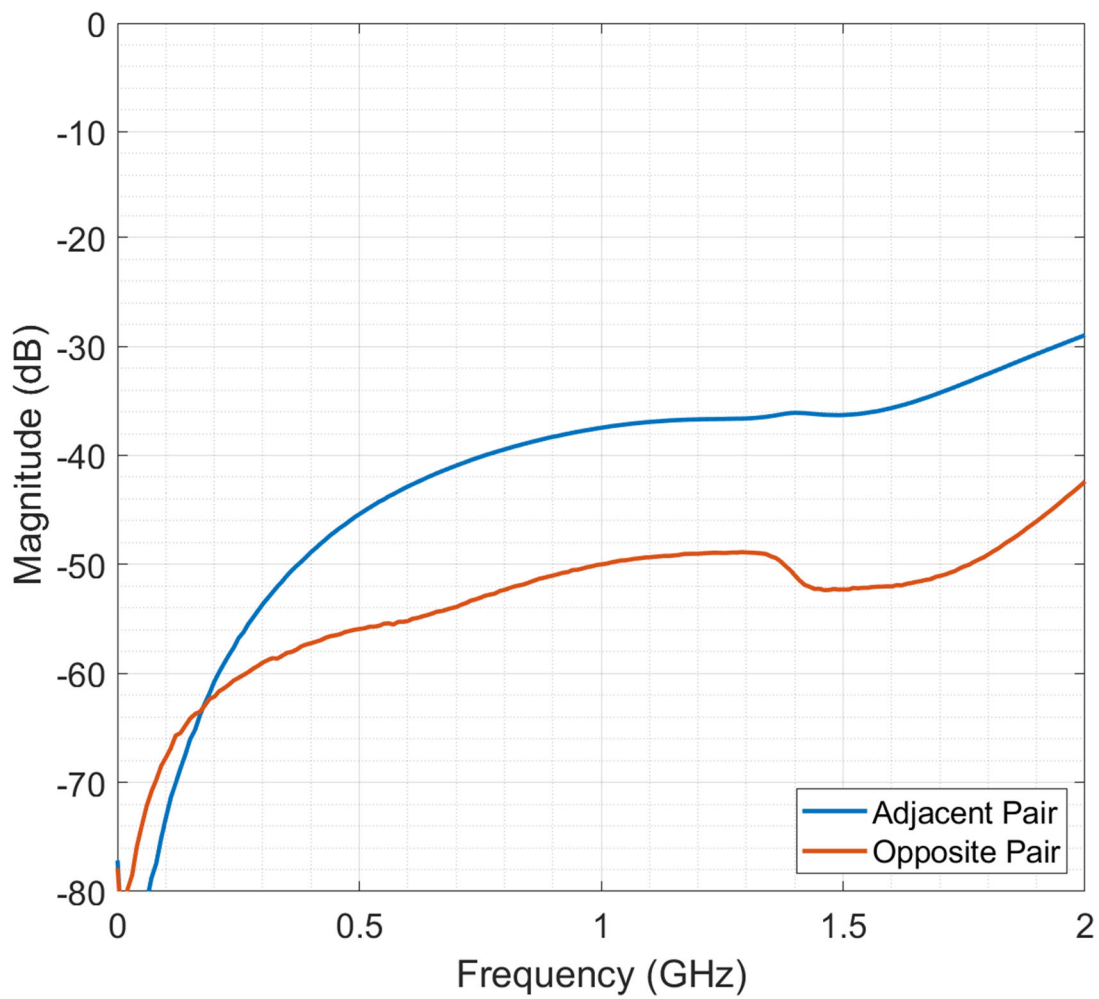


Figure 24. Straight PCB Mount to Right-Angle PCB Mount EI Ochito White FEXT

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

Rise time is defined at 10% to 90% of the signal's rising edge. A rise time of 200 ps was used. This corresponds to a bandwidth of 1.75 GHz.

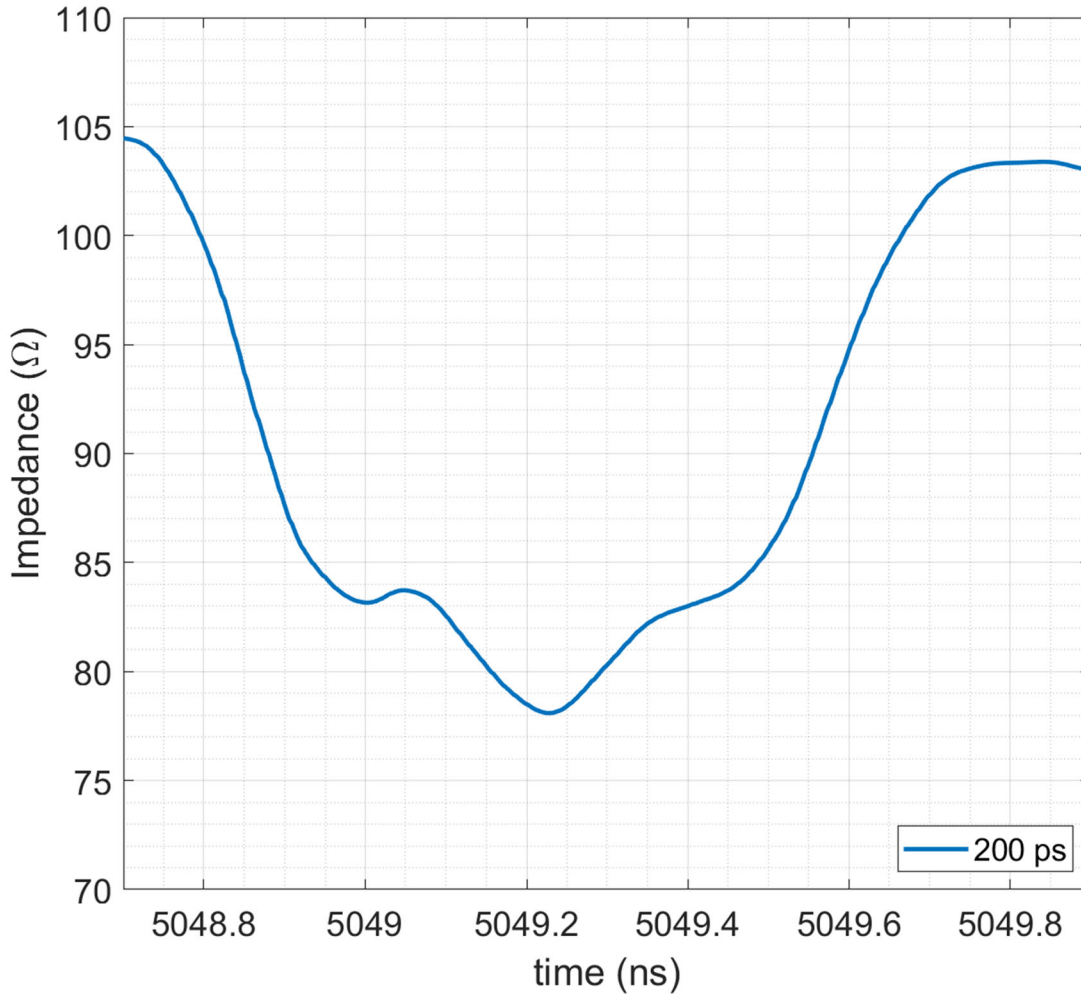


Figure 25. TDR – Straight PCB Mount to Right-Angle Mount PCB El Ochito White (Positions 1-2 and 7-8)

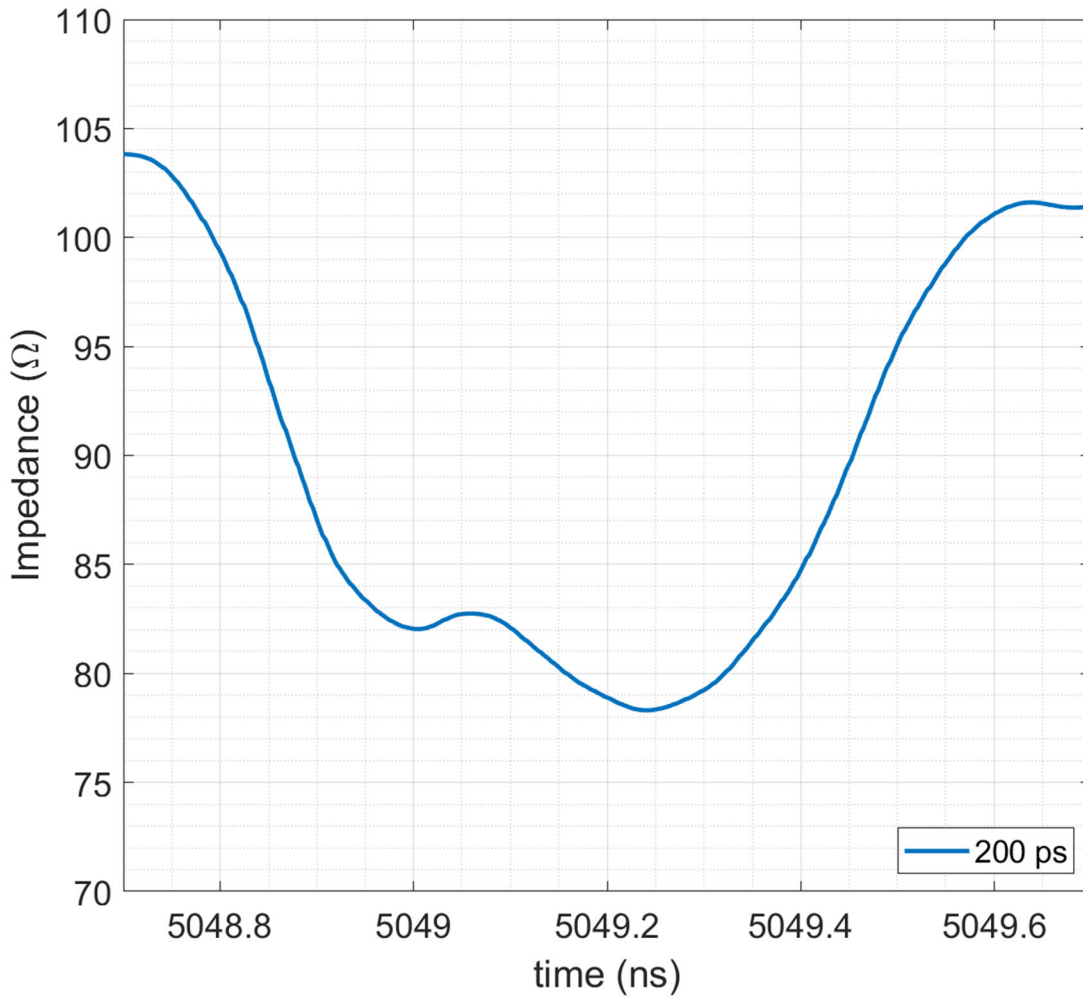


Figure 26. TDR – Straight PCB Mount to Right-Angle PCB Mount EI Ochito White (Positions 3-4 and 5-6)

8. Straight PCB Mount to Cable Assembly El Ochito White 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

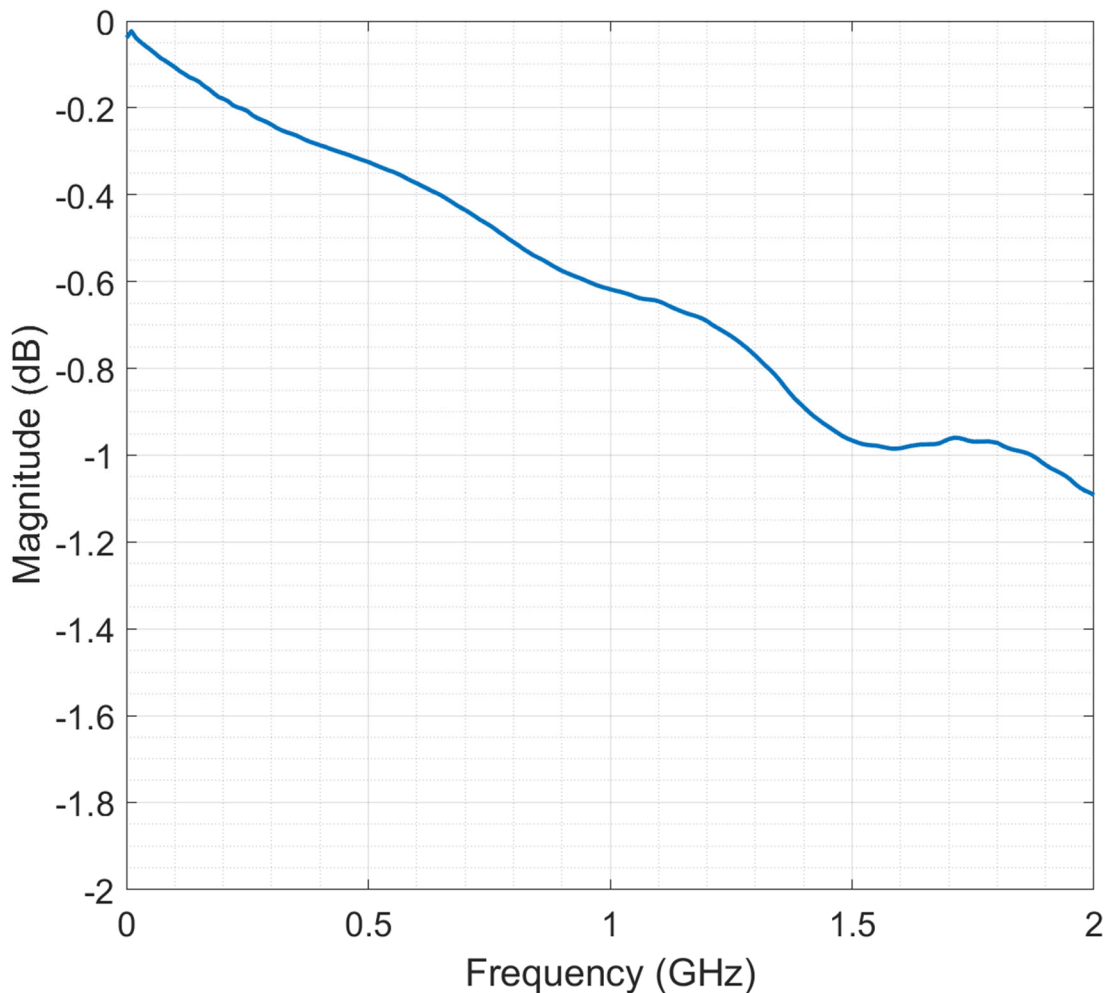


Figure 27. Straight PCB Mount to Cable Assembly El Ochito White Insertion Loss

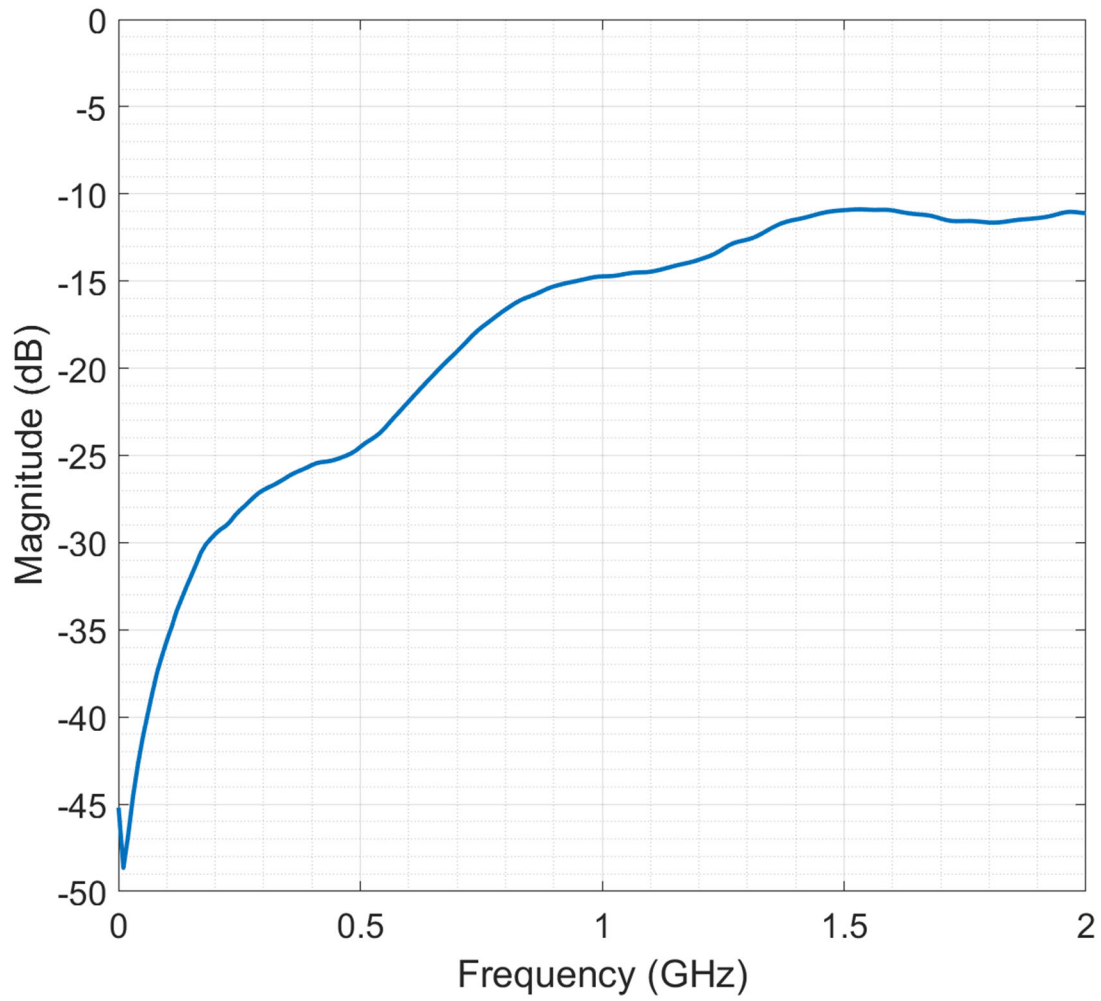


Figure 28. Straight PCB Mount to Cable Assembly EI Ochito White Return Loss

8.1.2. Straight PCB Mount to Cable Assembly El Ochito White Crosstalk

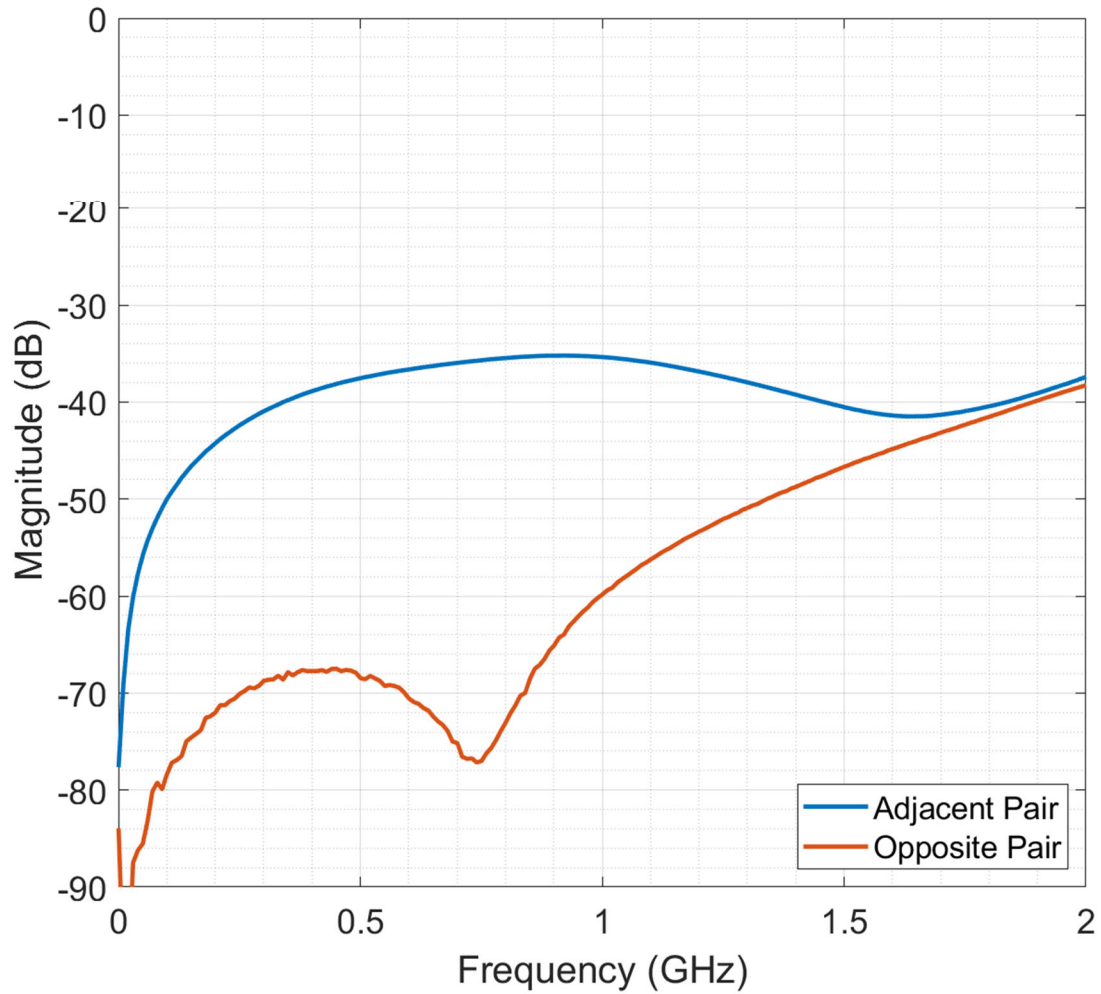


Figure 29. Straight PCB Mount to Cable Assembly El Ochito White NEXT

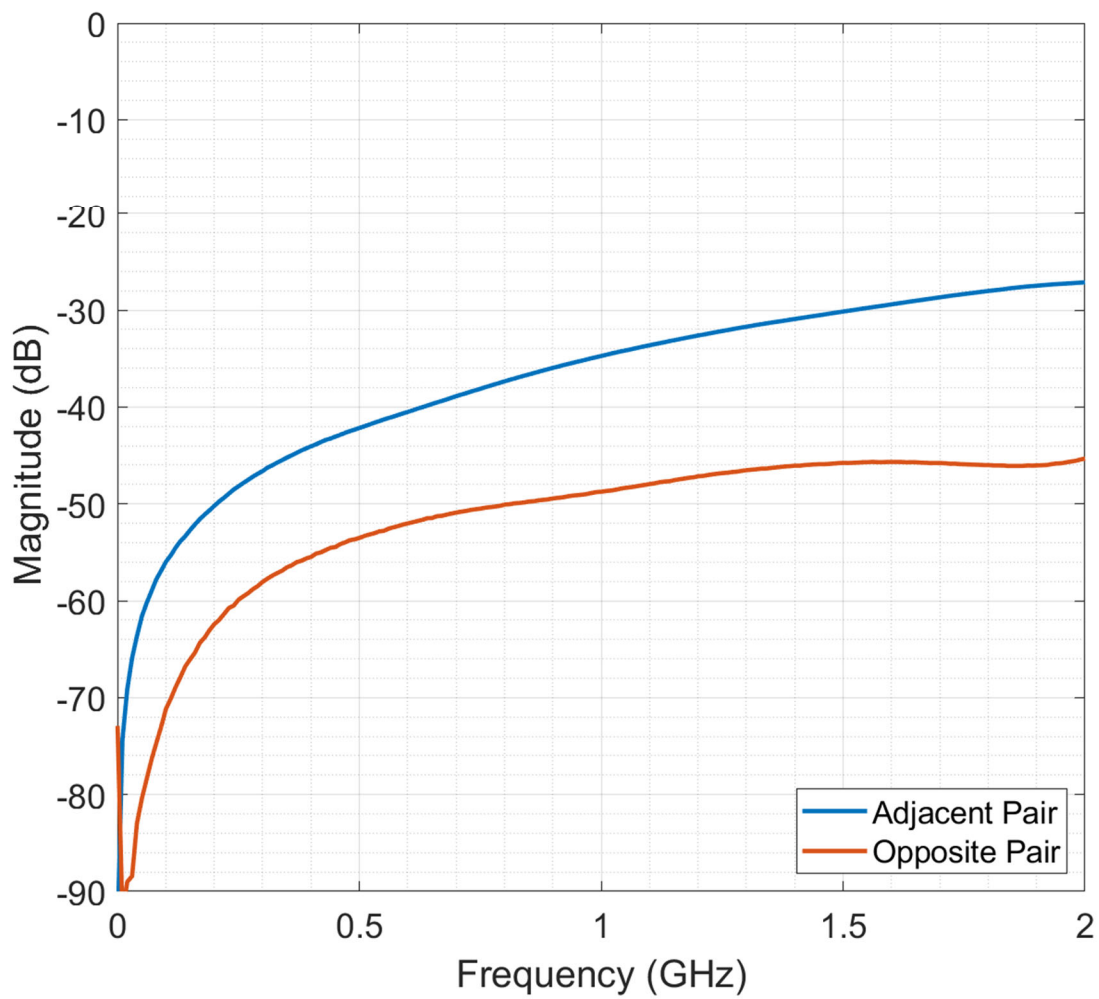


Figure 30. Straight PCB Mount to Cable Assembly EI Ochito White FEXT

8.2. Straight PCB Mount to Cable Assembly El Ochito White Time Domain Analysis

Rise time is defined at 10% to 90% of the signal's rising edge. A rise time of 200 ps was used. This corresponds to a bandwidth of 1.75 GHz.

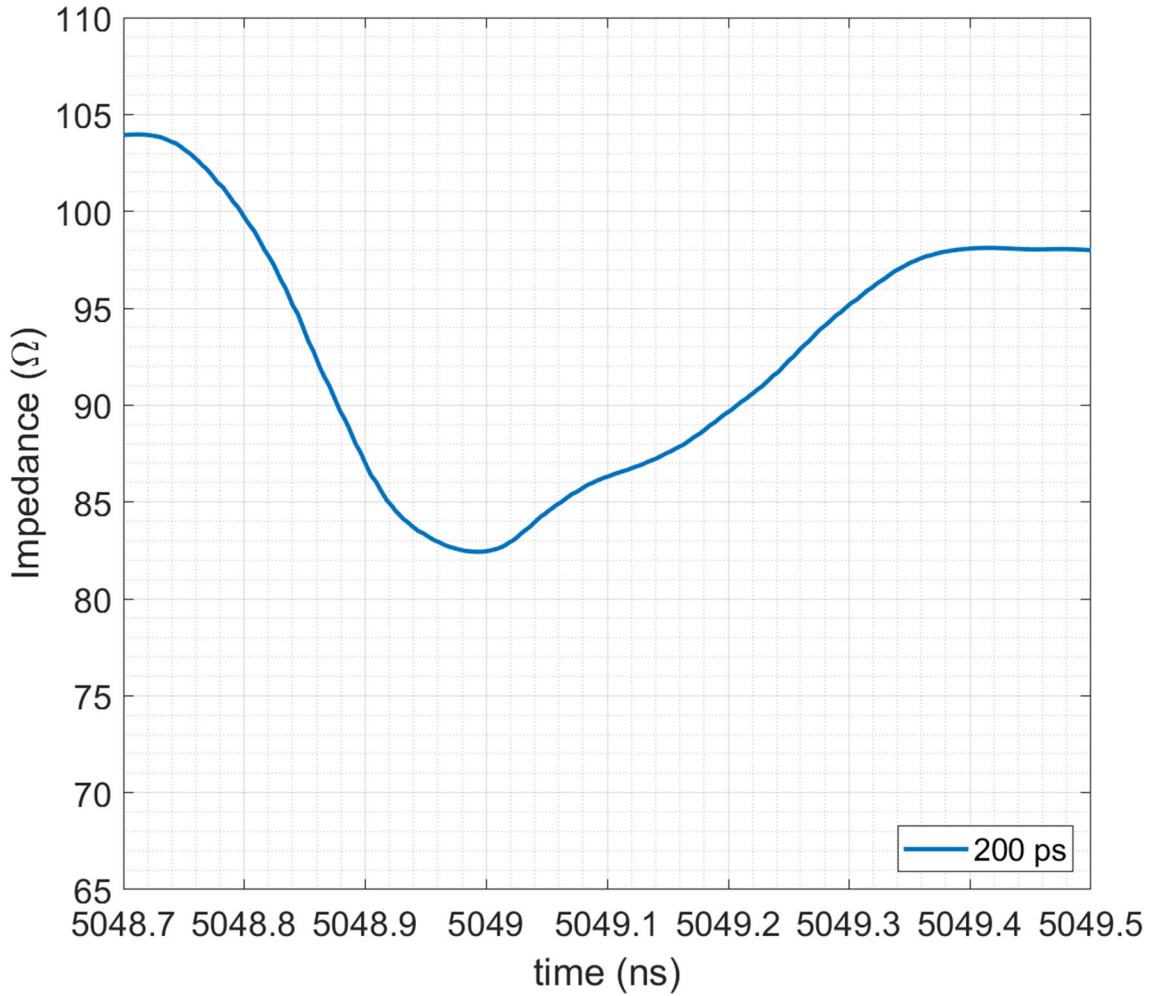


Figure 31. TDR – Straight PCB Mount to Cable Assembly El Ochito White

9. Right-Angle PCB Mount to Cable Assembly El Ochito White 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

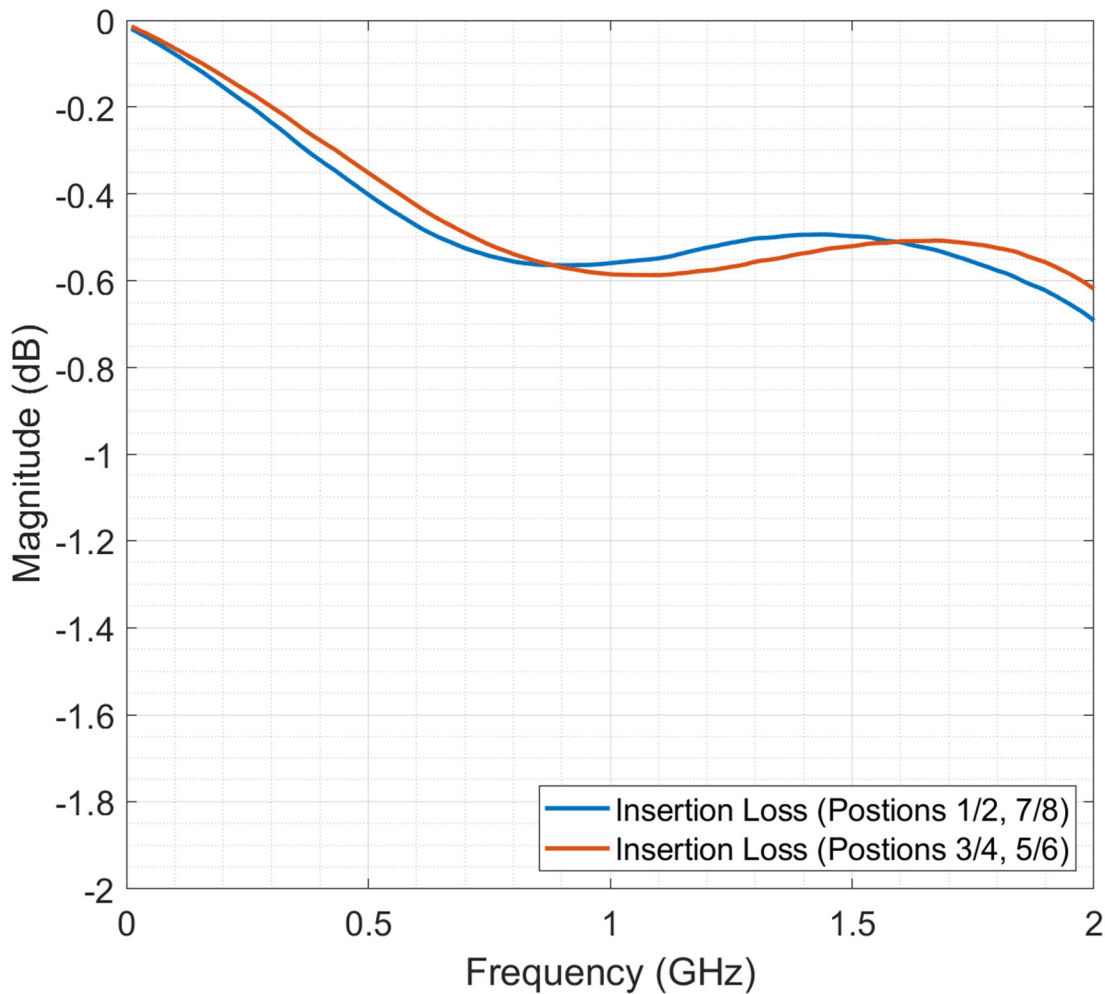


Figure 32. Right-Angle PCB Mount to Cable Assembly El Ochito White Insertion Loss

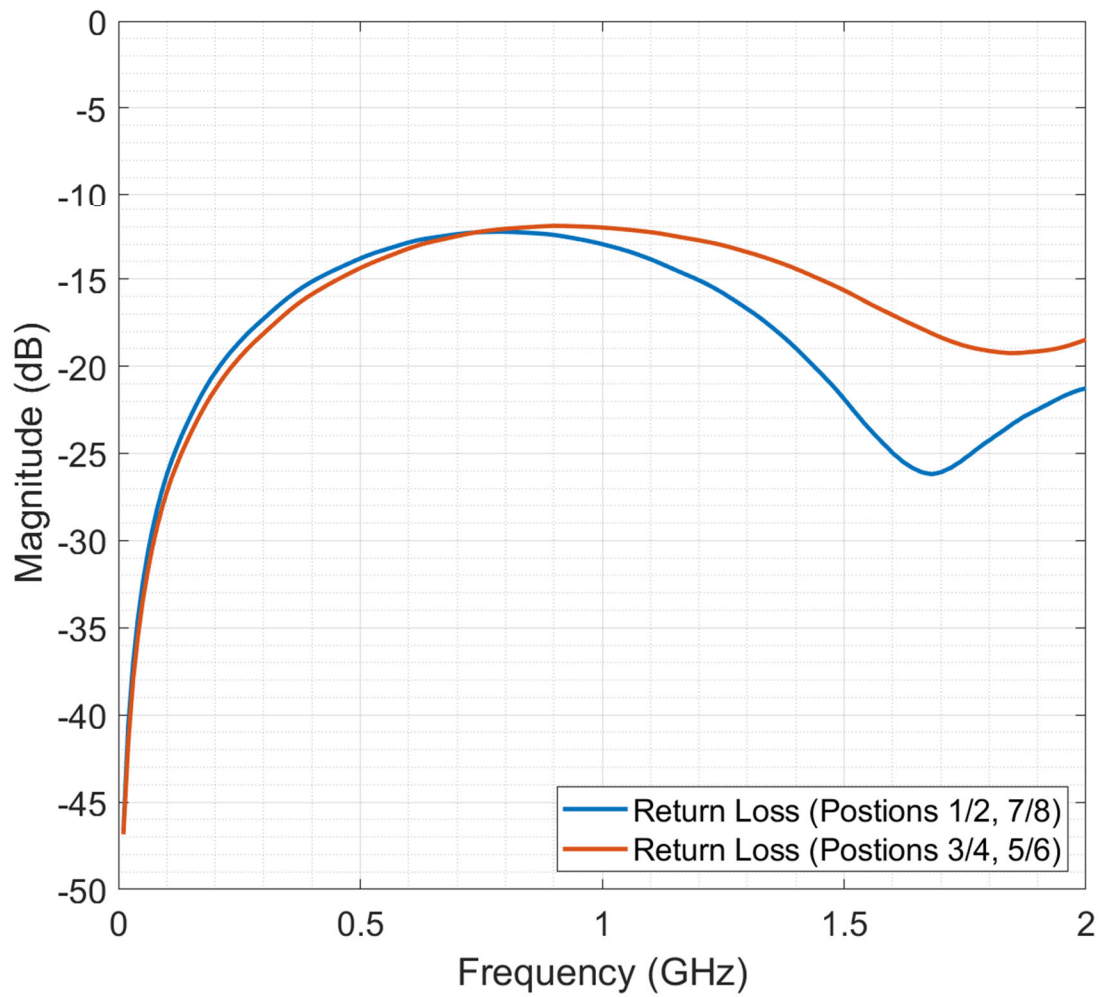


Figure 33. Right-Angle PCB Mount to Cable Assembly El Ochito White Return Loss

9.1.2. Right-Angle PCB Mount to Cable Assembly El Ochito White Crosstalk

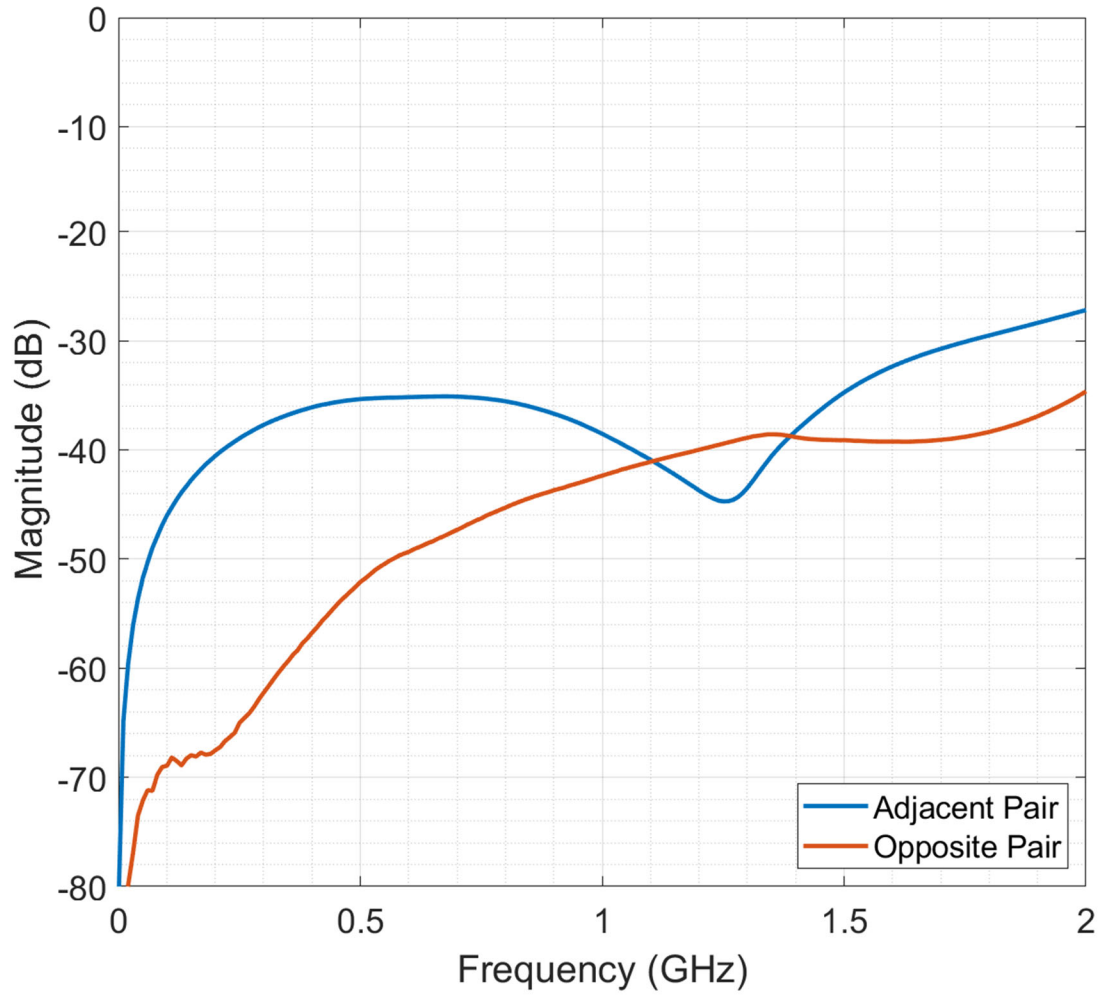


Figure 34. Right-Angle PCB Mount to Cable Assembly El Ochito White NEXT

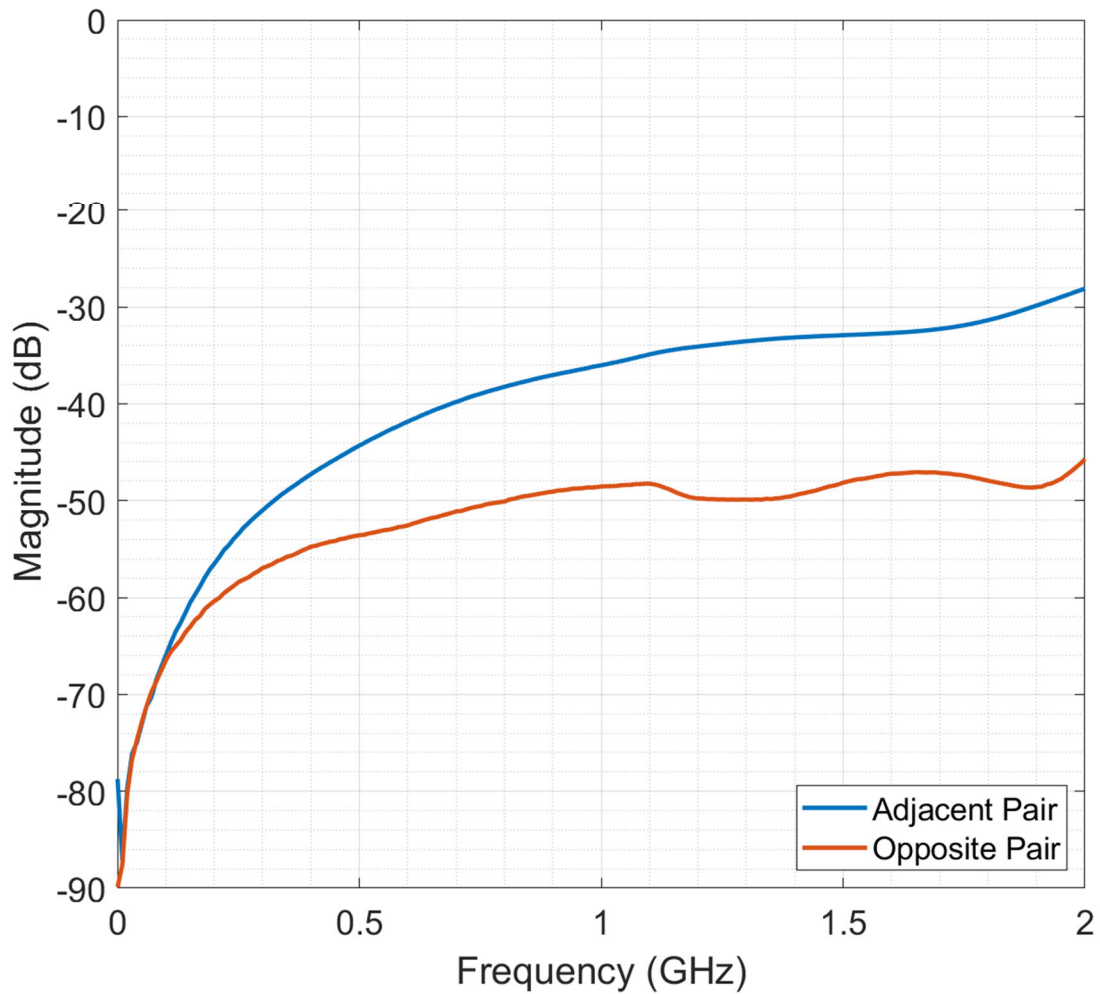


Figure 35. Right-Angle PCB Mount to Cable Assembly EI Ochito White FEXT

9.2.Right-Angle PCB Mount to Cable Assembly El Ochito White Time Domain Analysis

Rise time is defined at 10% to 90% of the signal's rising edge. A rise time of 200 ps was used. This corresponds to a bandwidth of 1.75 GHz.

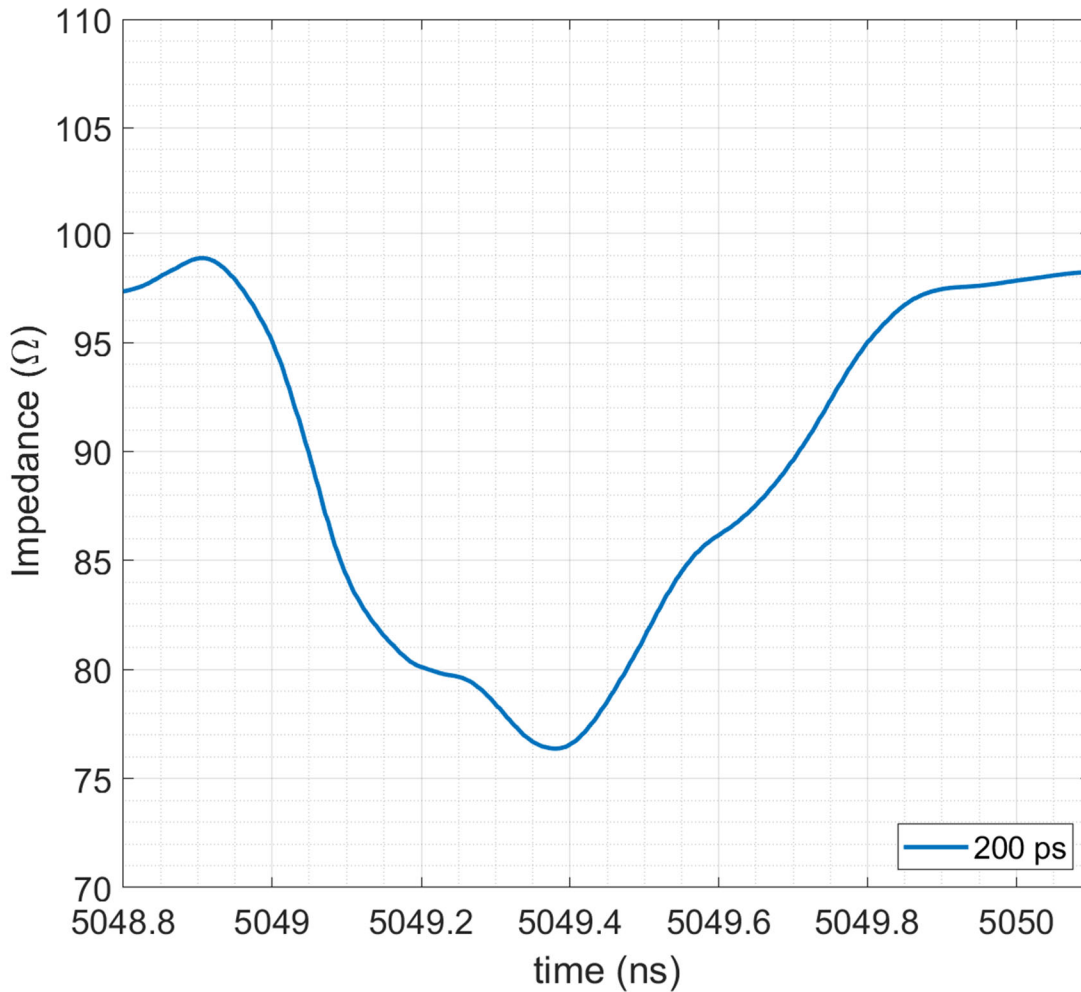


Figure 36. TDR – Right-Angle PCB Mount to Cable Assembly El Ochito White (Positions 1-2 and 7-8)

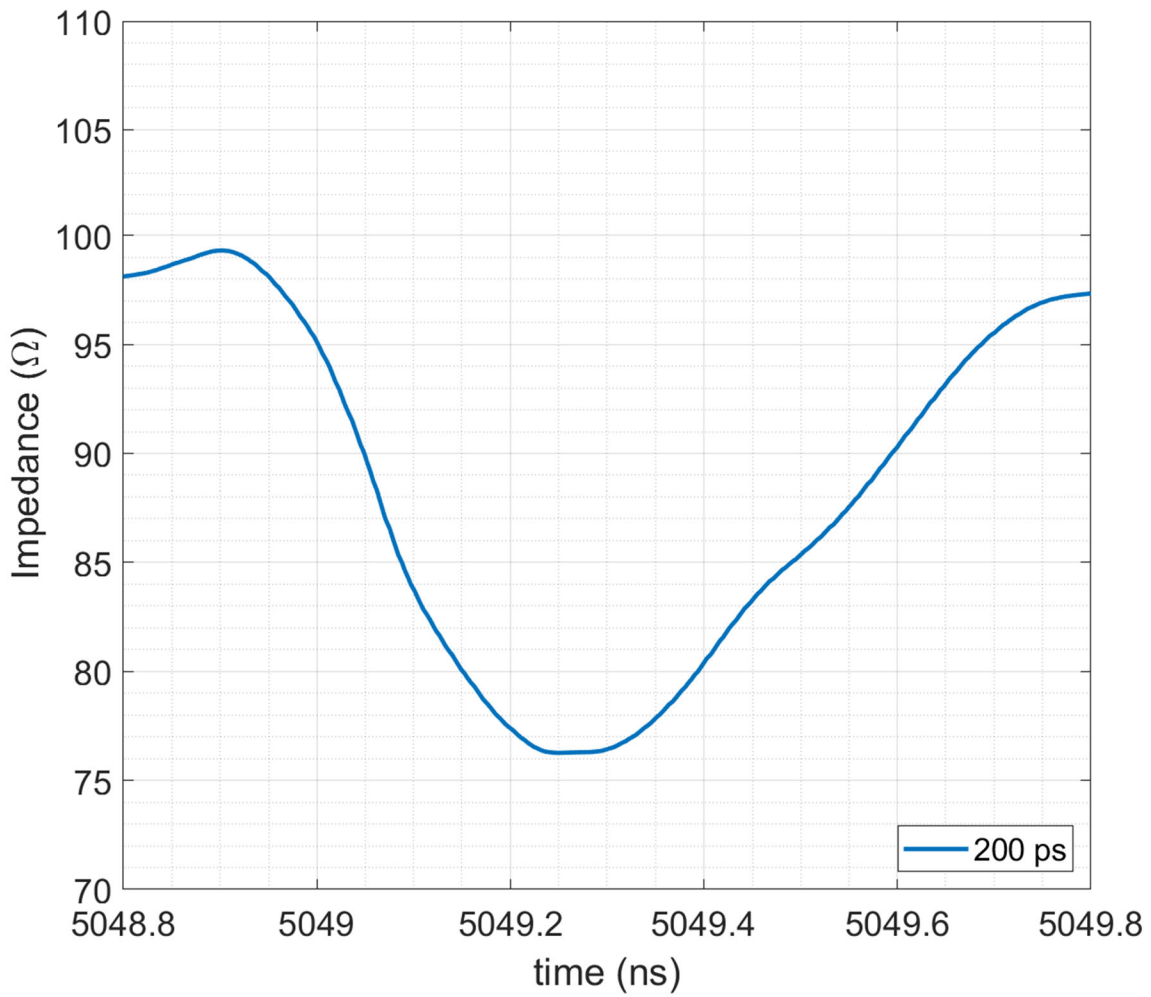


Figure 37. TDR – Right-Angle PCB Mount to Cable Assembly EI Ochito White (Positions 3-4 and 5-6)

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.

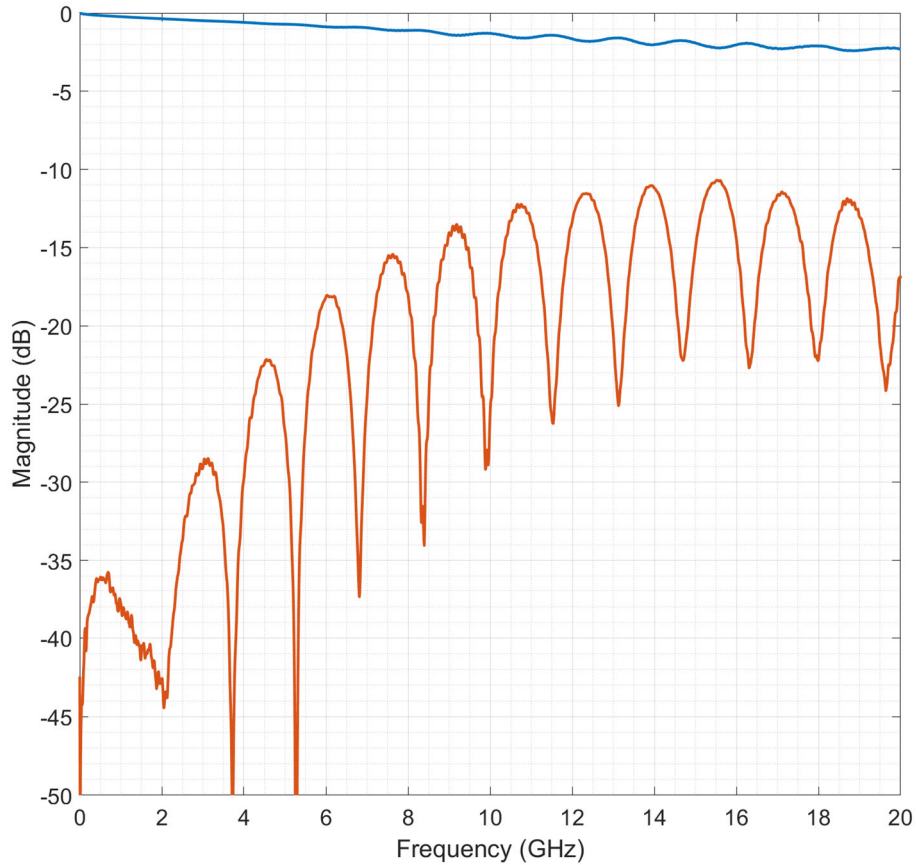


Figure 38. Straight EI Ochito White 2x-Thru PCB Response

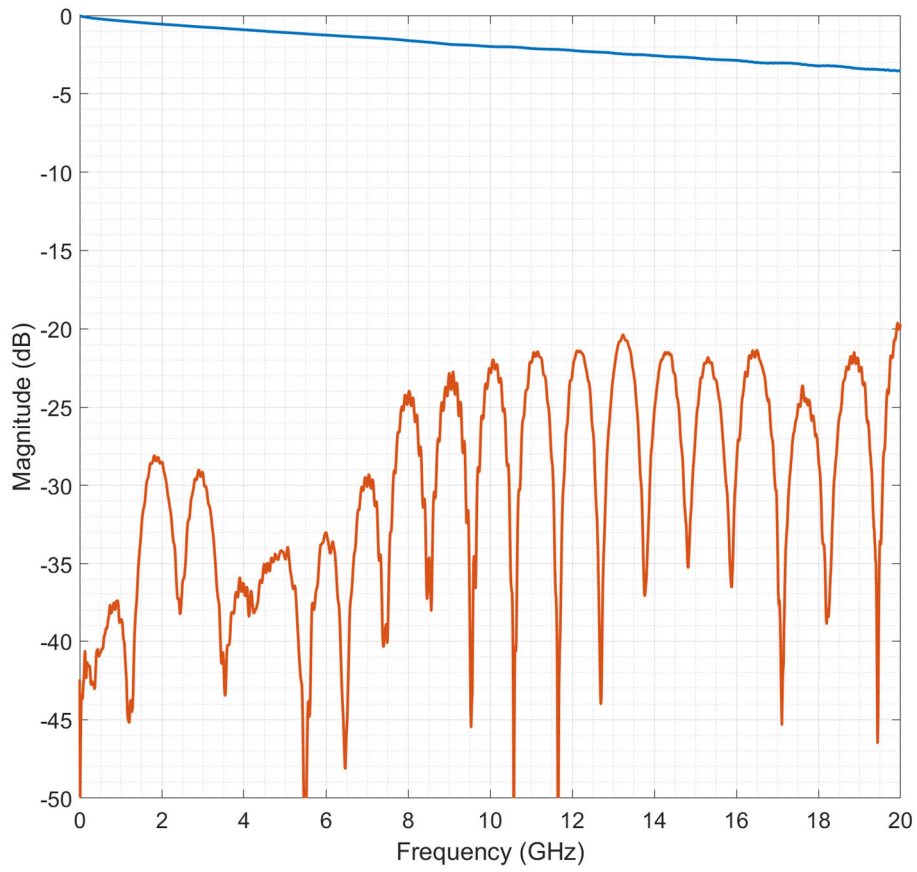


Figure 39. Right Angle EI Ochito White 2x-Thru PCB Response

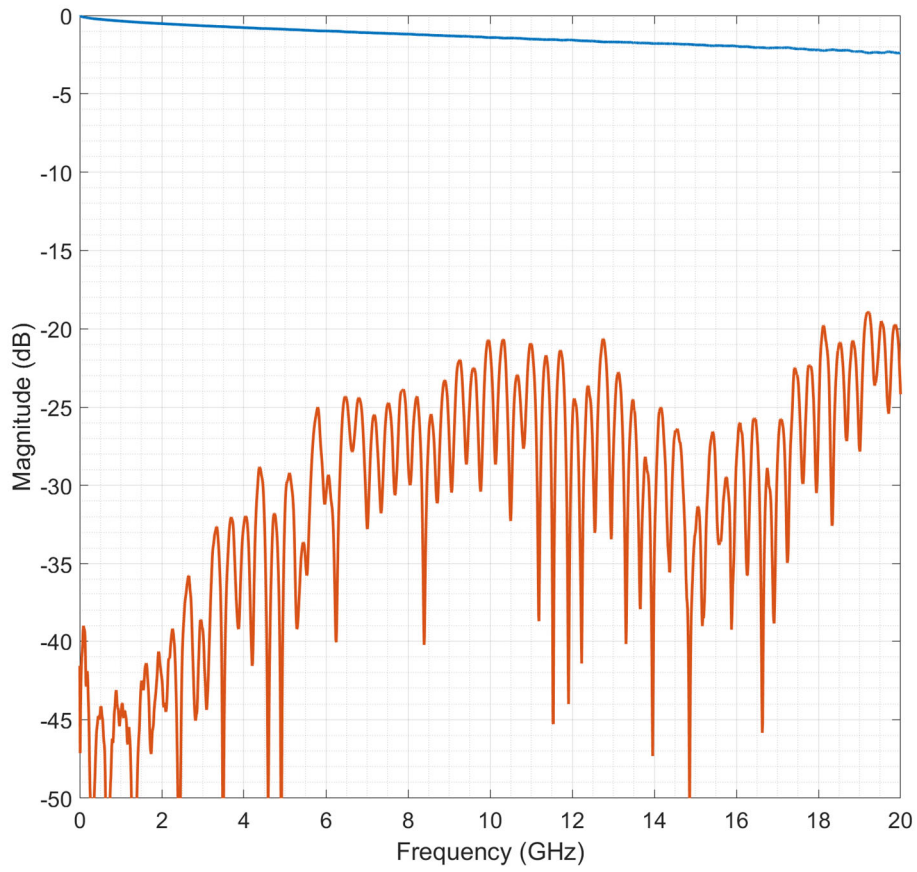


Figure 40. Cable Assembly EI Ochito White 2x-Thru PCB Response