



# GT-19-230

## VersaLink Micro-D

### High Speed Characterization Report for Differential Applications



## Revision History

Rev	Date	Approved	Description
A	2/7/2023	L. Blackwell / B. Samowitz	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 VersaLink Micro-D in differential signaling applications. This report outlines frequency domain performance metrics such as insertion loss (IL) and return loss (RL) as well as time-domain performance metrics including impedance and eye diagrams.

## 2. Product Overview

The Glenair VersaLink delivers outstanding impedance matching and crosstalk isolation at both the cable-to-connector interface, as well as between connector and board. VersaLink is a highly engineered differential Twinax contact module that may be packaged in a wide range of both circular and rectangular connector formats such as the MIL-DTL-83513 Micro-D. This high-density package solution provides mating reliability, ruggedness, signal integrity, and deployment simplicity.

## 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 E5071C 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

Test fixture PCB sets utilizing edge-launch SMA connectors were designed for the high-speed tests. Each set consisted of a VersaLink Micro-D to SMA board and a calibration board. Calibration board performance data is included in Appendix A. One test set used straight VersaLink Micro-D PCB-mount connectors, part numbers GVLM2L-4-0PBSPN-.080 and GVLM2L-4-0SBSPN-.080. The other set used right-angle VersaLink Micro-D PCB-mount connectors, part numbers GVLM2L-4-0-PBRLT-.080 and GVLM2L-4-0SBRPT-.080. Photographs of the test boards are seen in the following two figures.

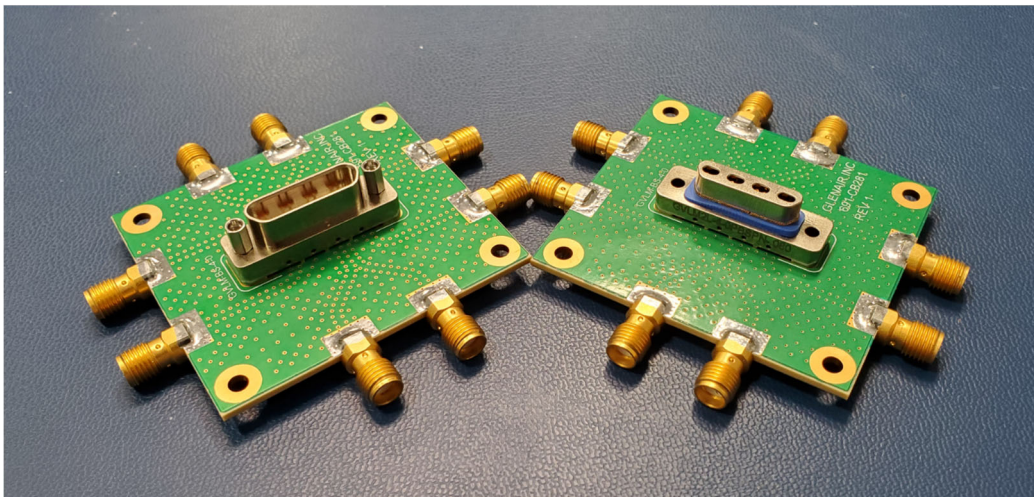


Figure 1. VersaLink Micro-D Straight Test PCB

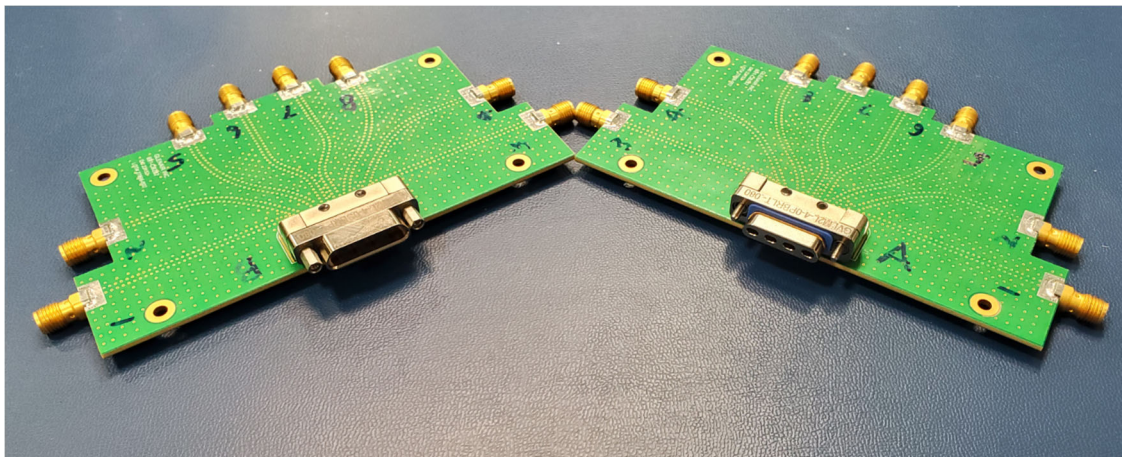


Figure 2. VersaLink Micro-D Right-Angle Test PCB



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

In addition to the test PCBs, an experimental VersaLink Micro-D cable assembly was tested. The assembly is presented in Figure 3.

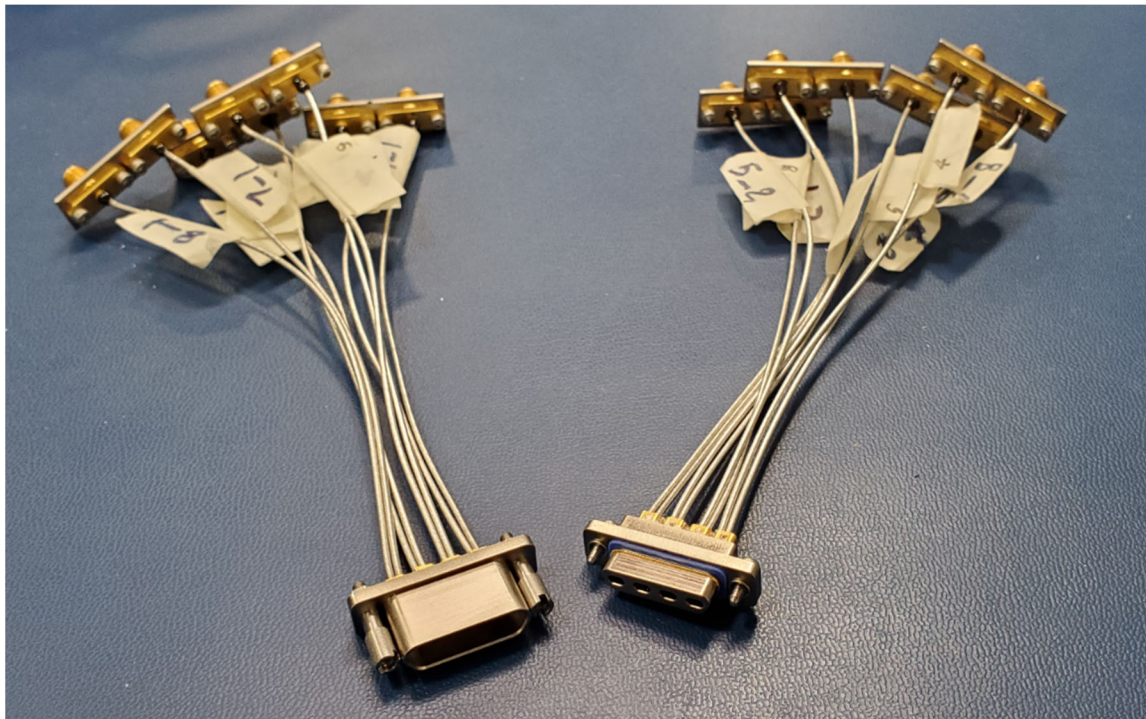


Figure 3. VersaLink Micro-D Test Cable Assembly

## 4. Straight VersaLink Micro-D Performance

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

### 4.1. Frequency Domain Analysis

#### 4.1.1. Straight VersaLink Micro-D Insertion Loss

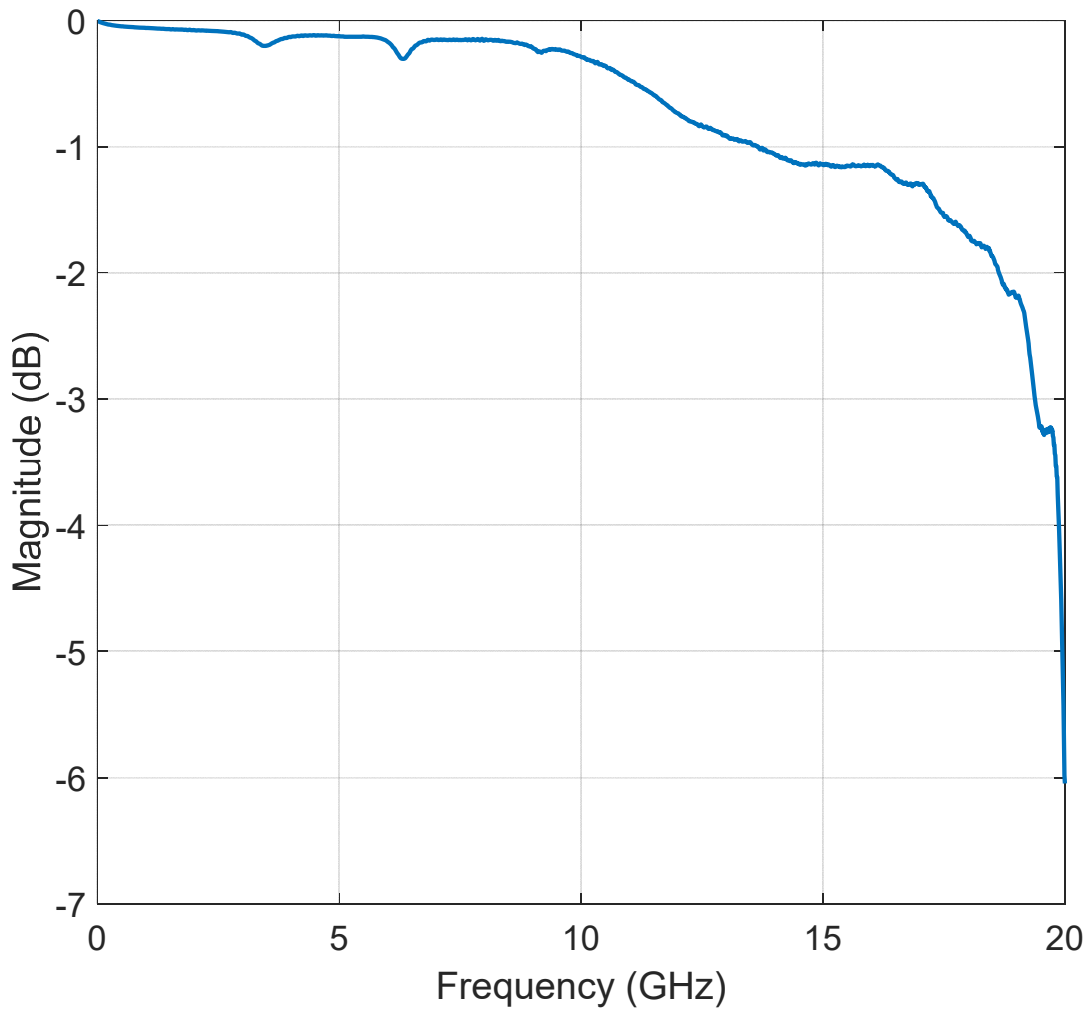


Figure 4. Straight VersaLink Micro-D Insertion Loss



### 4.1.2. Straight VersaLink Micro-D Return Loss

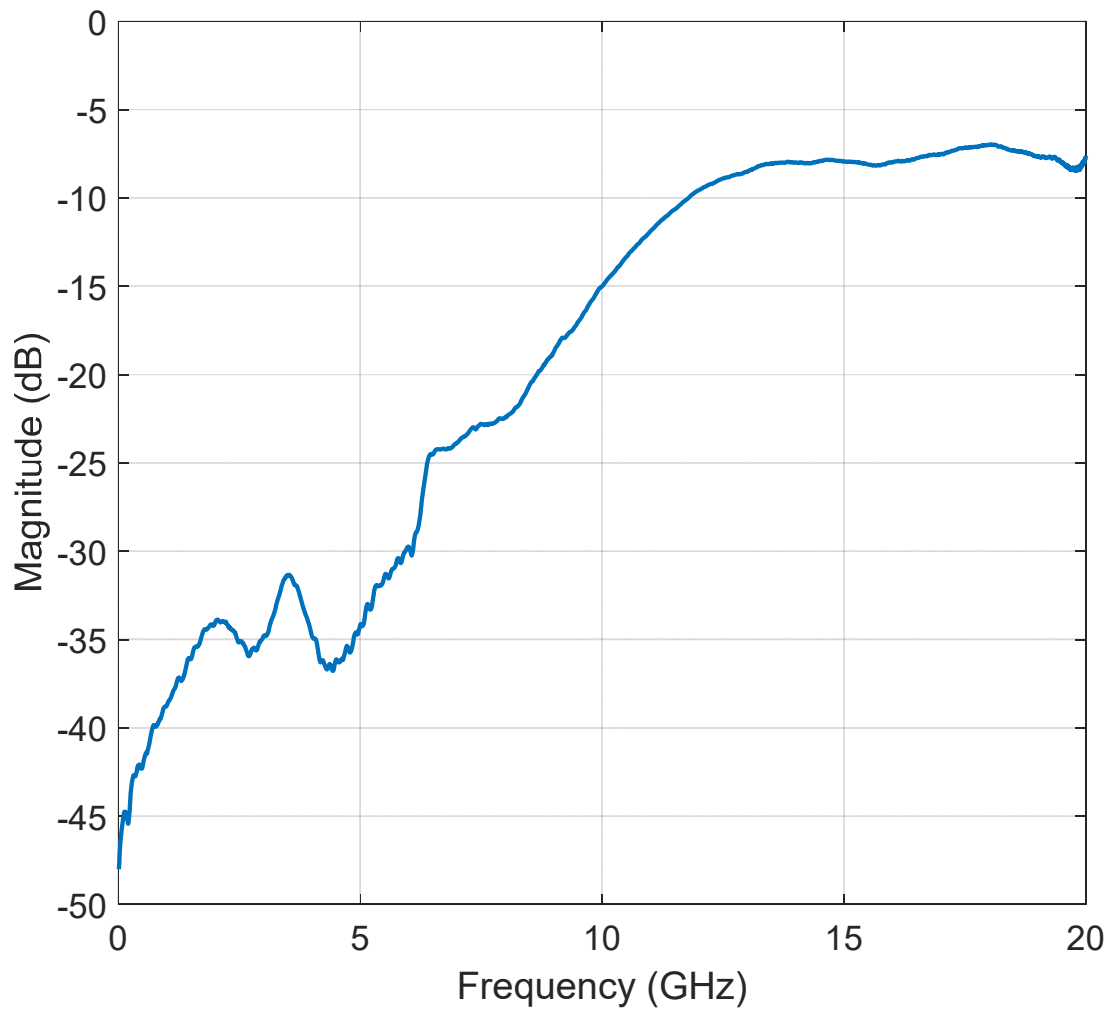


Figure 5. Straight VersaLink Micro-D Return Loss

### 4.1.3. Straight VersaLink Micro-D Bandwidth

The bandwidth of the Straight VersaLink Micro-D can be drawn from Figure 6 by noting the frequency where the difference between the insertion loss and return loss is 3dB.

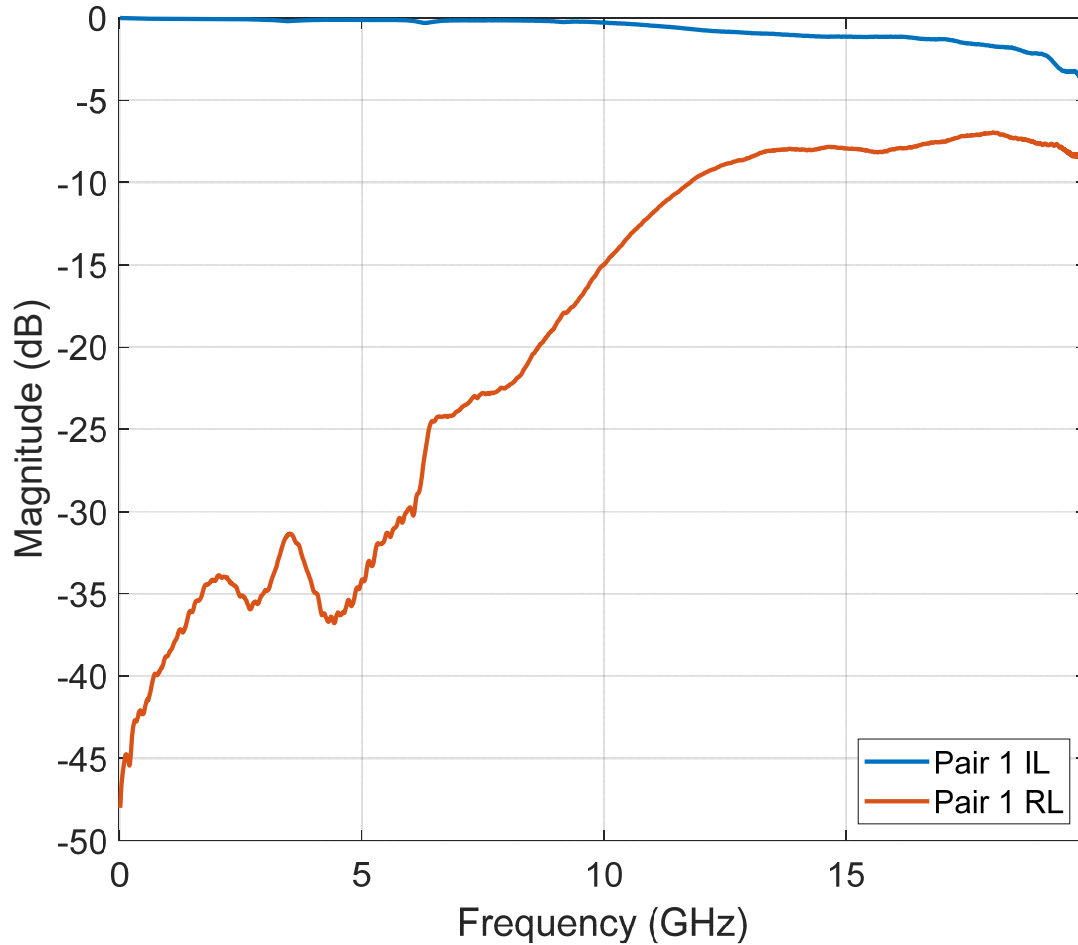


Figure 6. Straight VersaLink Micro-D Bandwidth

In this manner, the bandwidth is found to be approximately 20Ghz.

#### 4.1.4. Straight VersaLink Micro-D VSWR

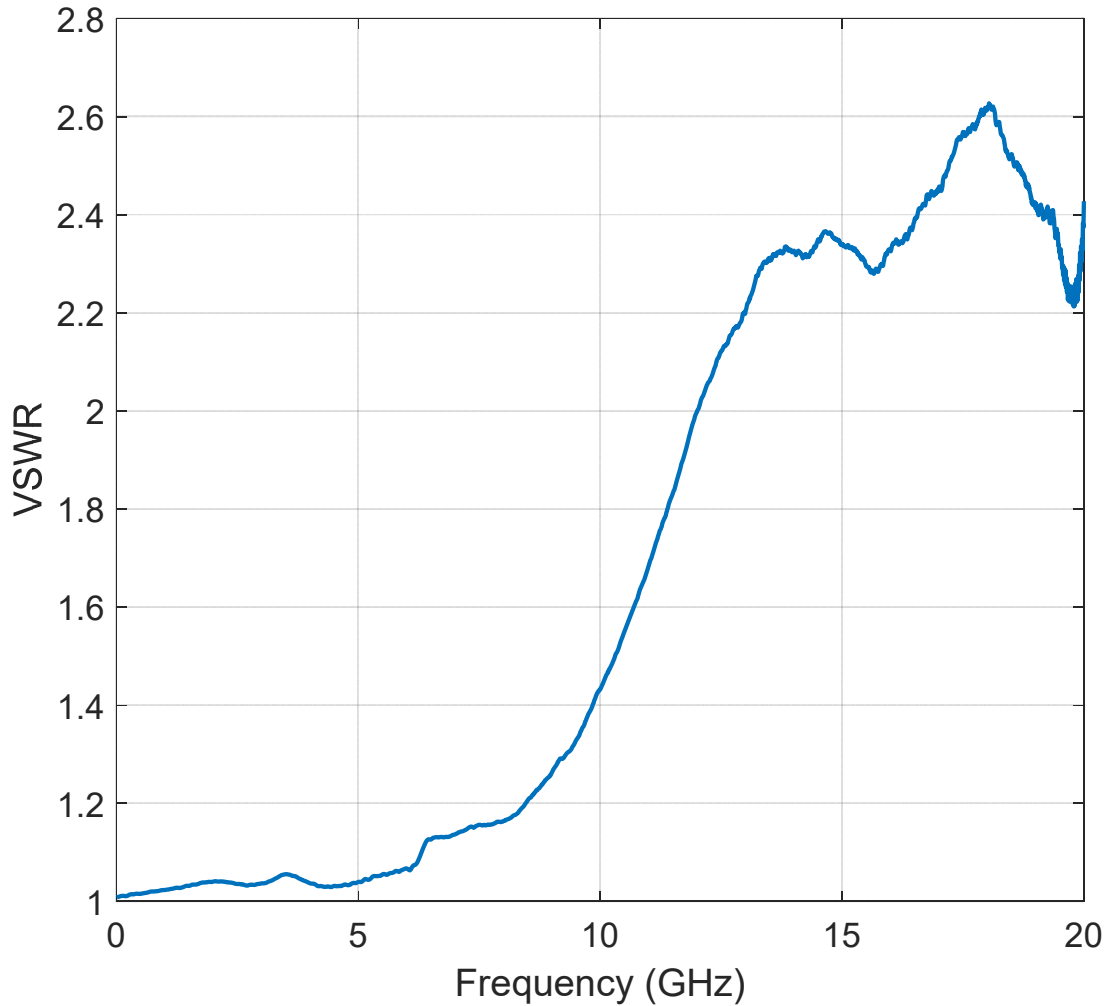


Figure 7. Straight VersaLink Micro-D VSWR

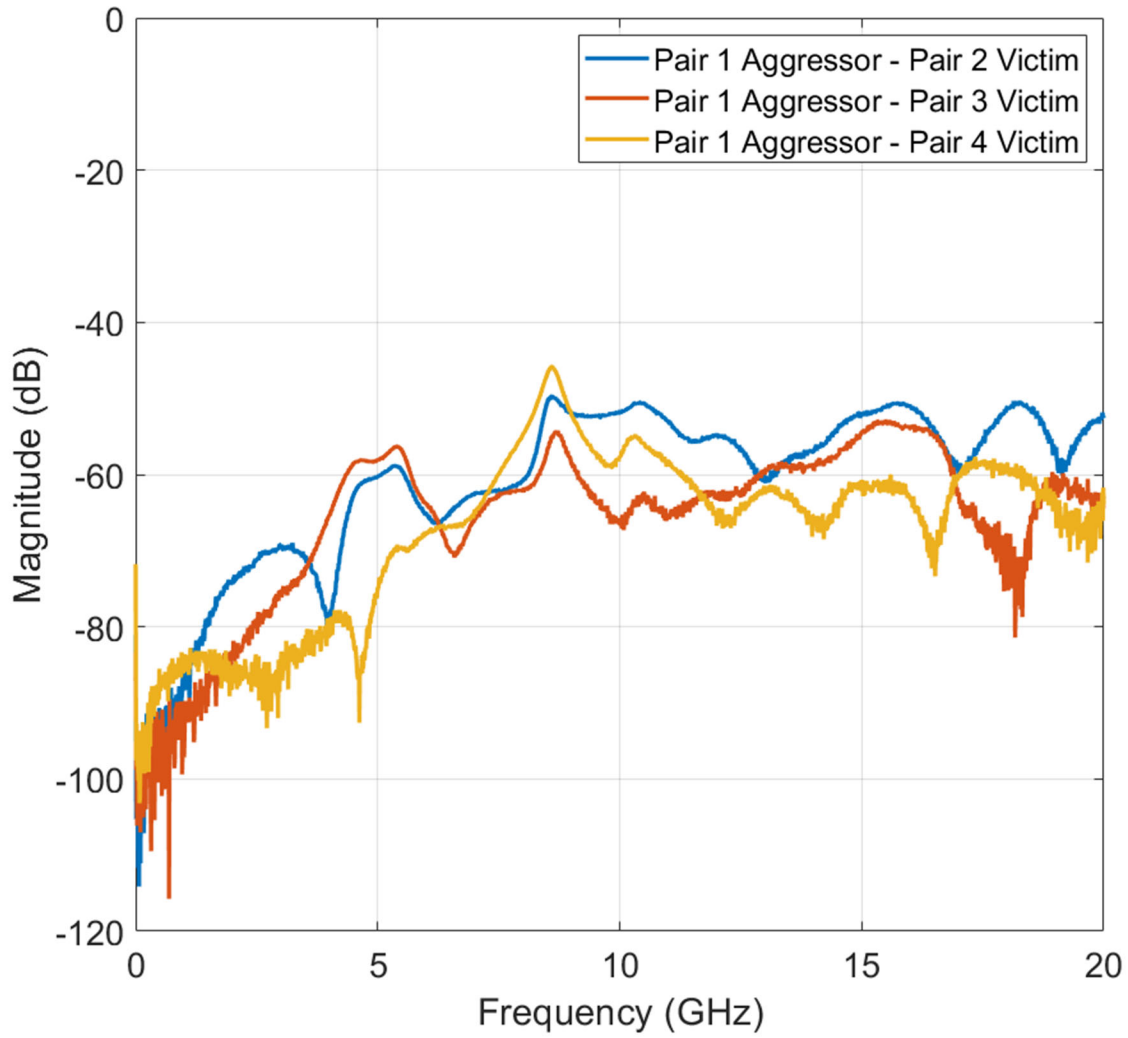


Figure 8. Straight VersaLink NEXT



## 4.2. Straight VersaLink Micro-D Time Domain Analysis

### 4.2.1. Straight VersaLink Micro-D TDR

Time domain data was generated in real time using a Tektronix DSA8300 Digital Serial Analyzer. Graphs for each test cable and pair configuration are shown below for various rise times. Rise time is defined at 20% to 80% of the signal's rising edge. Rise times of 25ps, 35ps, 50ps, and 100ps 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)
25	14
35	10
50	7
100	3.5

Table 1. Bandwidth to Rise Time Relationship

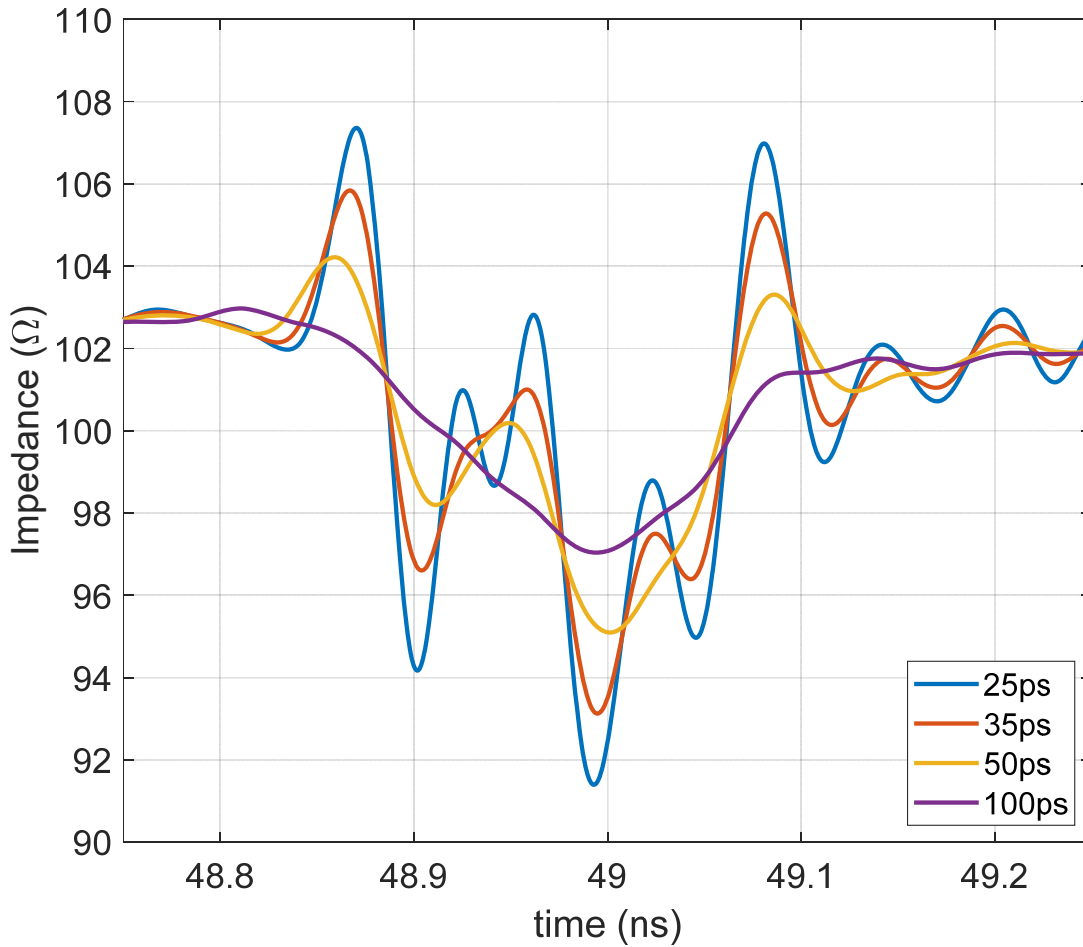


Figure 9. TDR – Straight VersaLink Micro-D



### 4.2.2. Straight VersaLink Micro-D Eye Diagram

The S-parameter data for Pair 1 obtained from the Keysight N5227B PNA measurements was used to generate a statistical eye diagram for a bit rate of 28Gbps and is presented in Figure 10

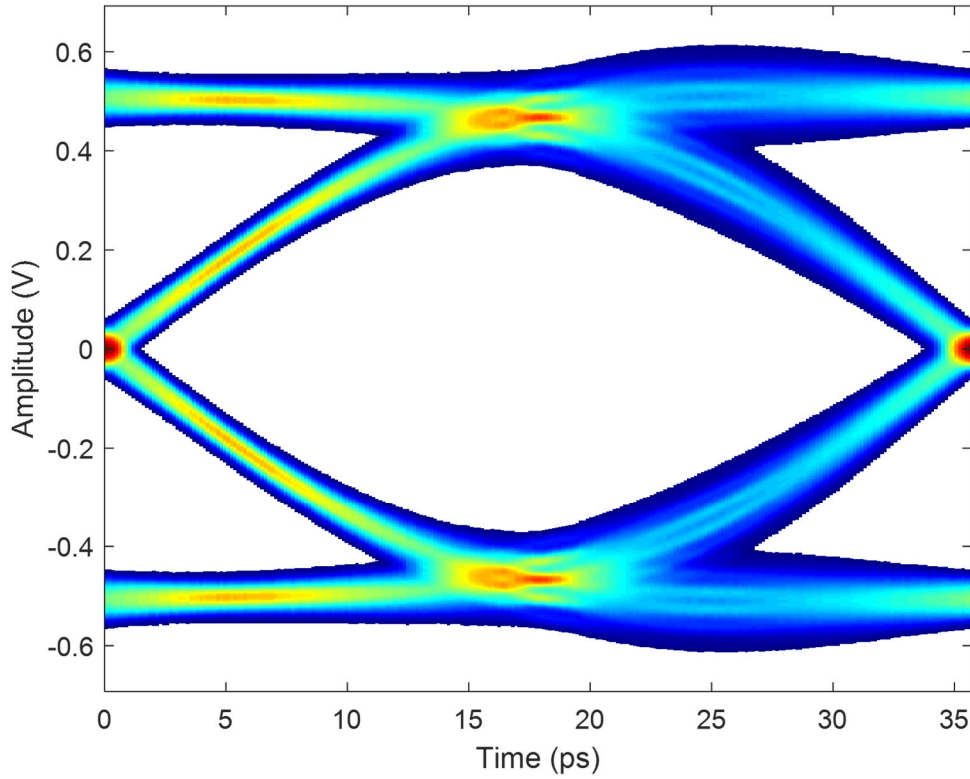


Figure 10. Eye diagram of Straight VersaLink Micro-D at 28Gbps

## 5. Right-Angle VersaLink Micro-D Performance Summary

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

### 5.1. Frequency Domain Analysis

#### 5.1.1. Right-Angle VersaLink Micro-D Insertion Loss

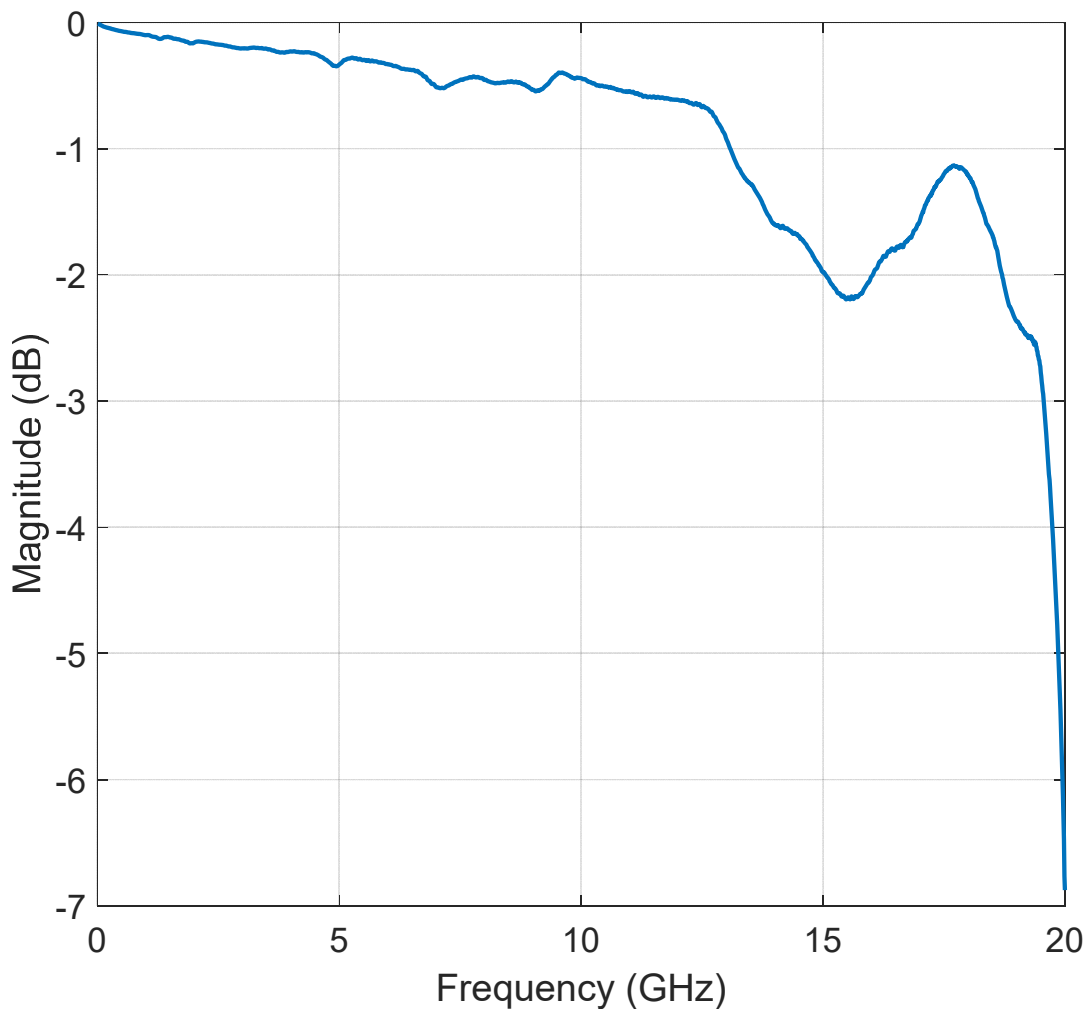


Figure 11. Right-Angle VersaLink Micro-D Insertion Loss

### 5.1.2. Right-Angle VersaLink Micro-D Return Loss

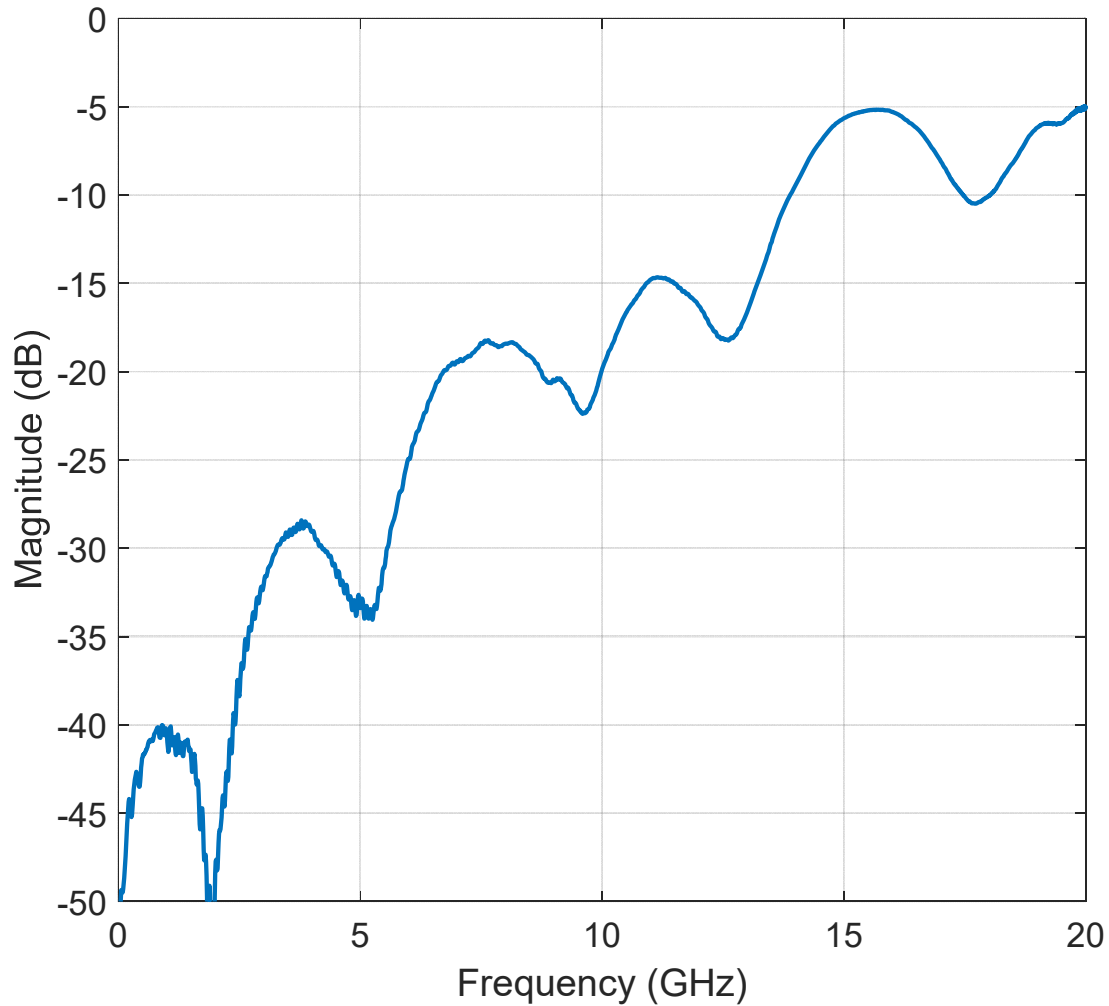


Figure 12. Right-Angle VersaLink Micro-D Return Loss

### 5.1.3. Right-Angle VersaLink Micro-D Bandwidth

The bandwidth of the Right-Angle VersaLink Micro-D can be drawn from Figure 13 by noting the frequency where the difference between the insertion loss and return loss is 3dB.

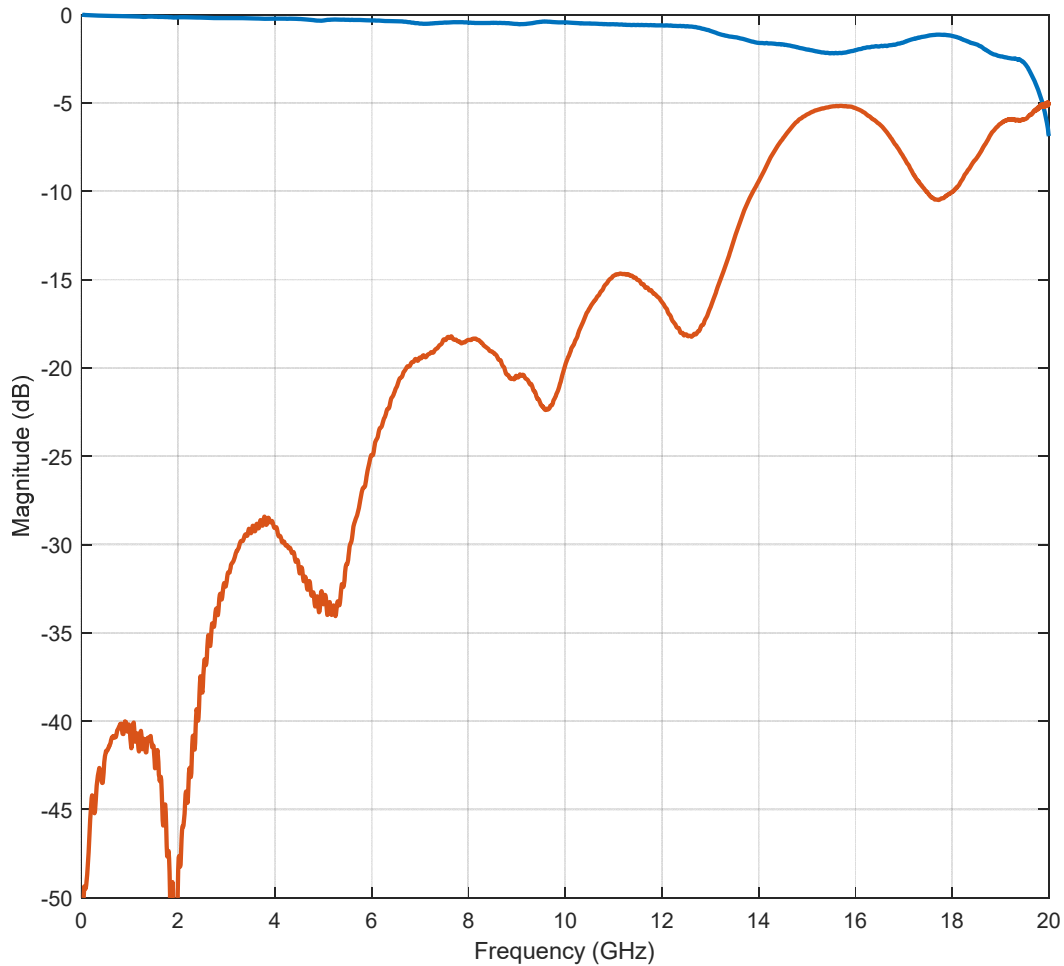


Figure 13. Right-Angle VersaLink Micro-D Bandwidth

In this manner, the bandwidth is found to be approximately 15GHz.

### 5.1.4. Right-Angle VersaLink Micro-D VSWR

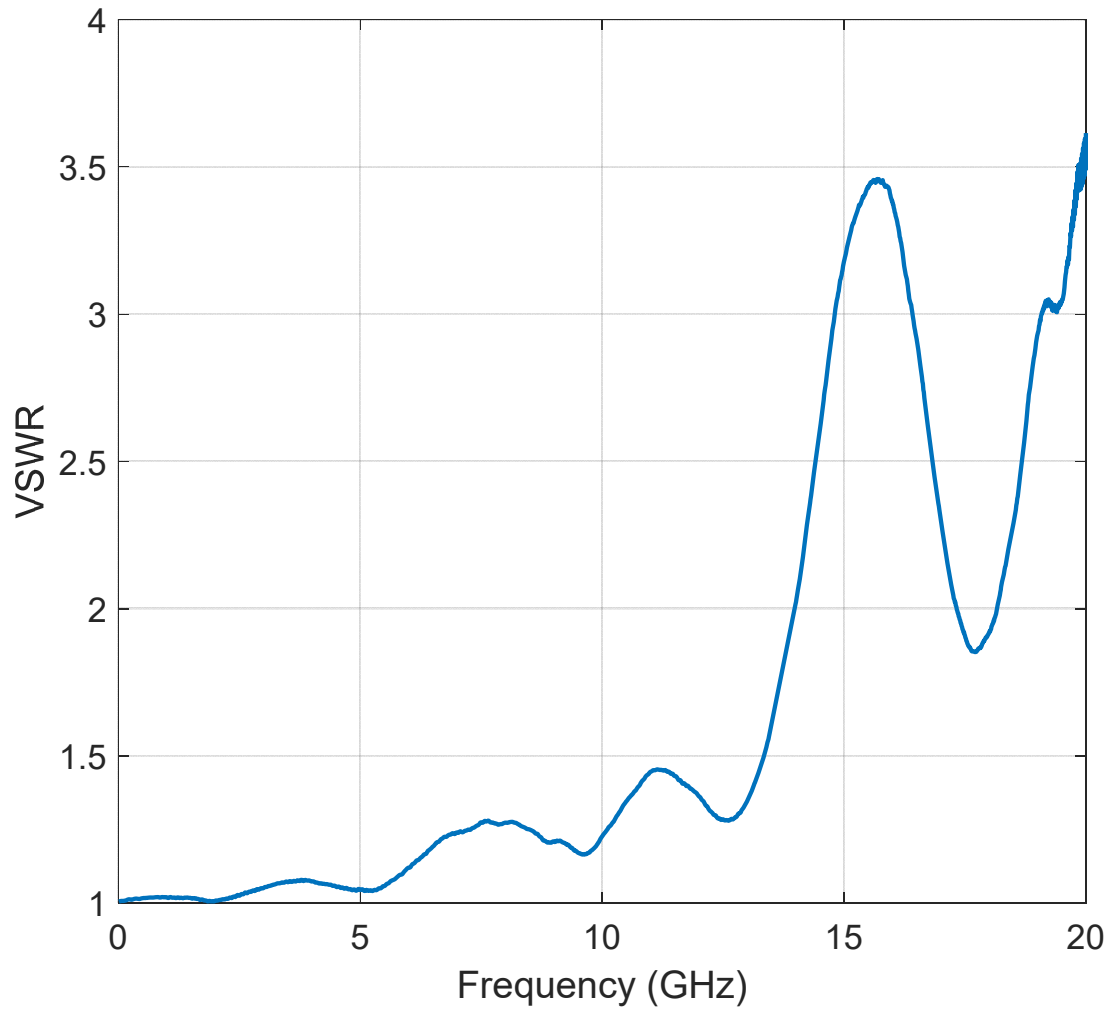


Figure 14. Right-Angle VersaLink Micro-D VSWR

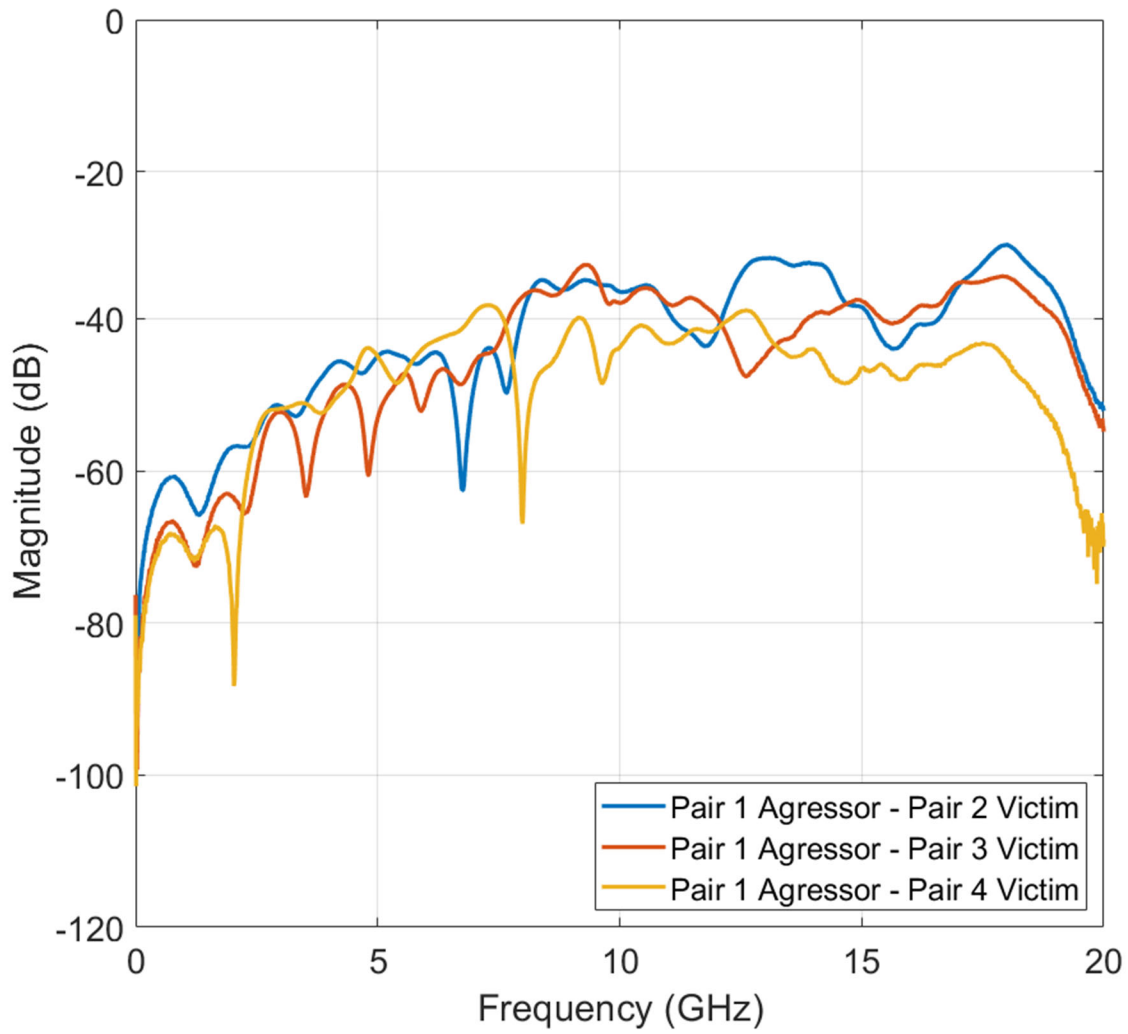


Figure 15. Right-Angle VersaLink NEXT





## 5.2. Time Domain Analysis

### 5.2.1. Right-Angle VersaLink Micro-D TDR

Time domain data was generated in real time using a Tektronix DSA8300 Digital Serial Analyzer. Graphs for each test cable and pair configuration are shown below for various rise times. Rise time is defined at 20% to 80% of the signal's rising edge. Rise times of 25ps, 35ps, 50ps, and 100ps 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)
25	14
35	10
50	7
100	3.5

Table 1. Bandwidth to Rise Time Relationship

The assembly's physical features and resulting impedance discontinuities are labeled in each plot.

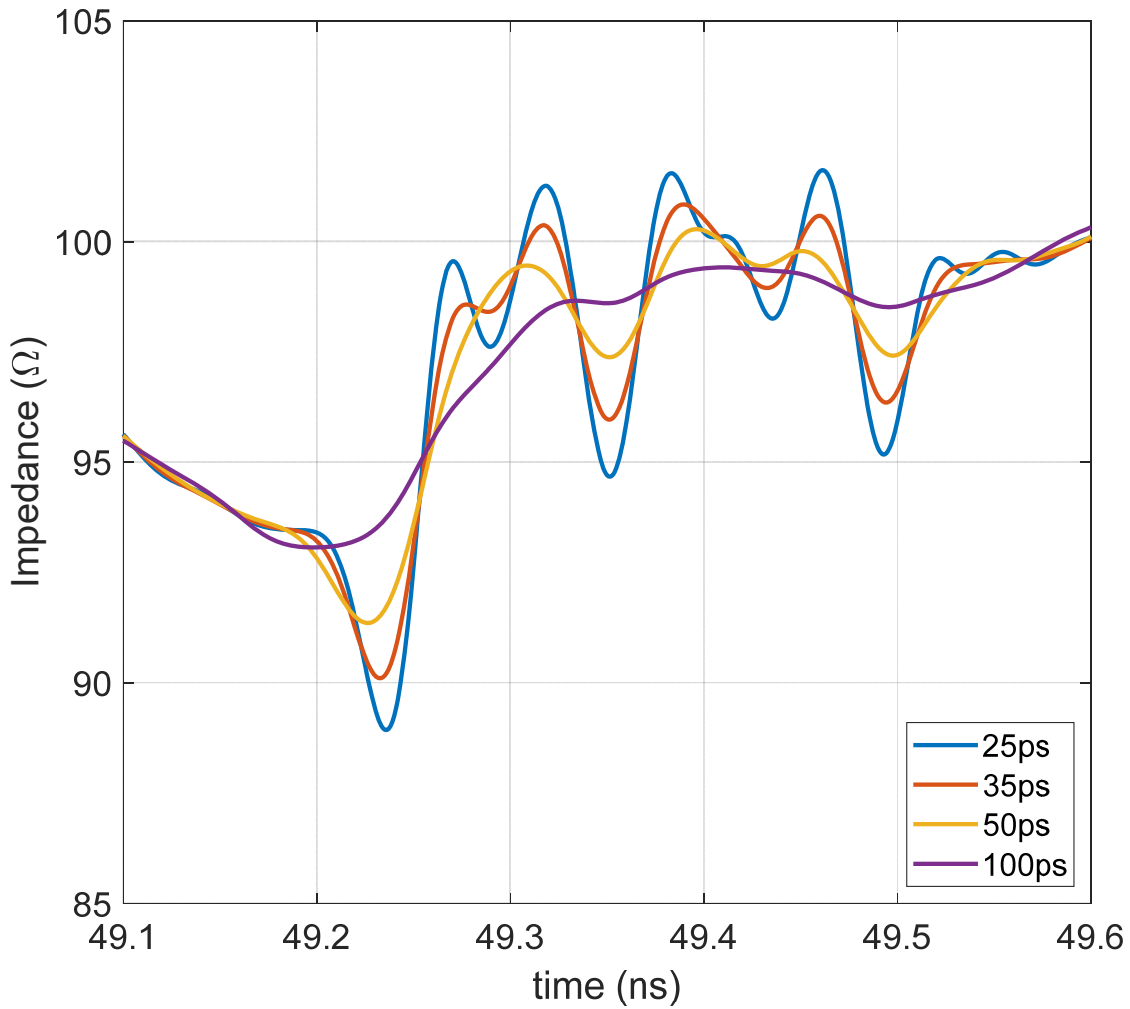


Figure 16. TDR – Right-Angle VersaLink Micro-D

### 5.2.2. Right-Angle VersaLink Micro-D Eye Diagrams

The S-parameter data for Pair 1 obtained from the Keysight N5227B PNA measurements was used to generate a statistical eye diagram for a bit rate of 28Gbps and is presented in Figure 17.

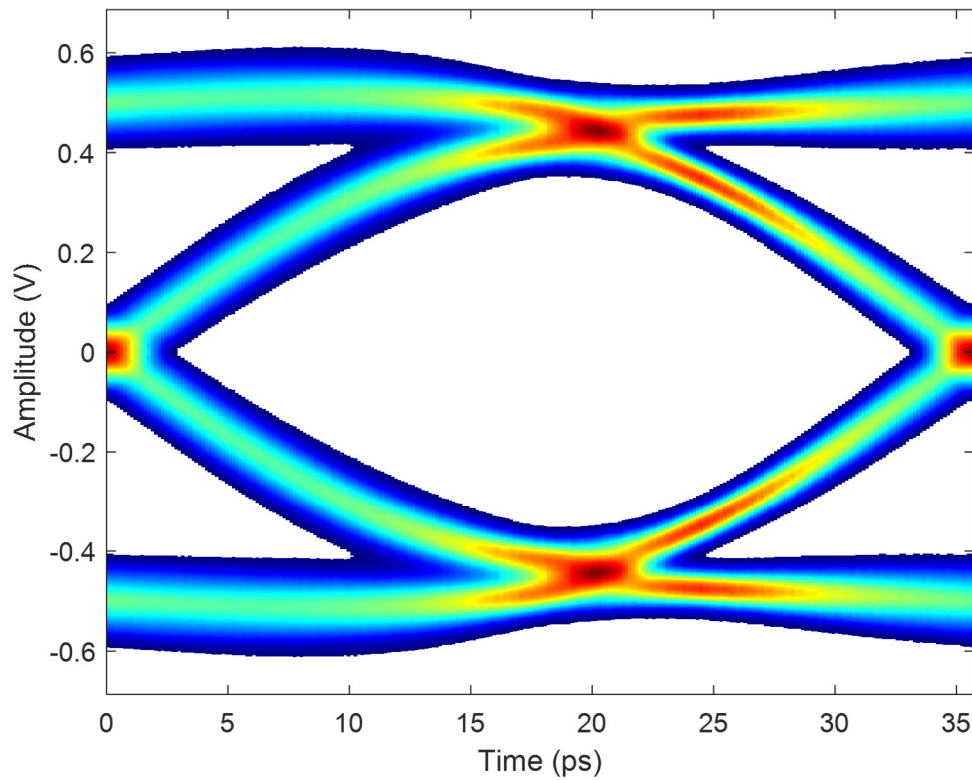


Figure 17. Eye diagram of Right-Angle VersaLink Micro-D at 28Gbps

## 6. VersaLink Micro-D Cable Assembly Performance

### 6.1. VersaLink Micro-D Cable Assembly Frequency Domain Analysis

#### 6.1.1. VersaLink Micro-D Cable Assembly Insertion Loss

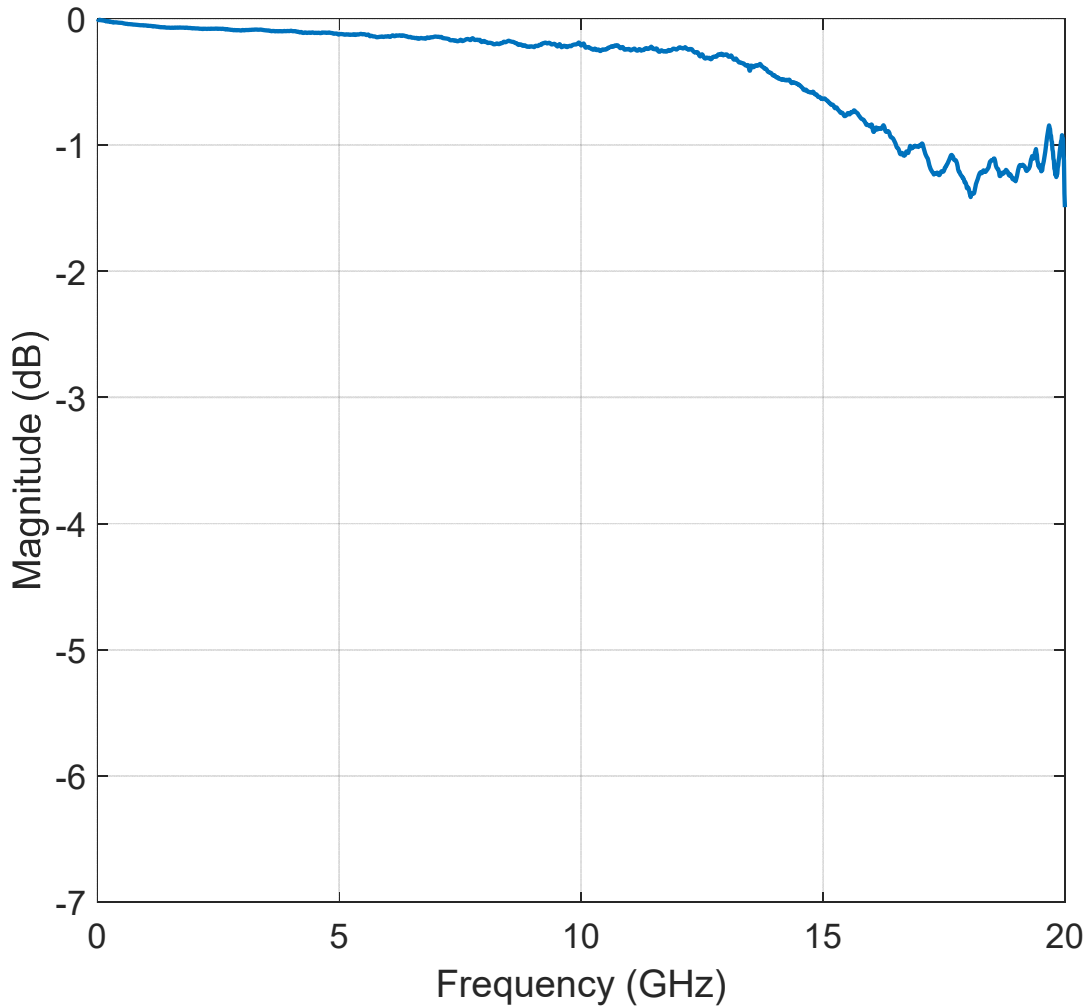


Figure 18. VersaLink Micro-D Cable Assembly Insertion Loss

### 6.1.2. VersaLink Micro-D Cable Assembly Return Loss

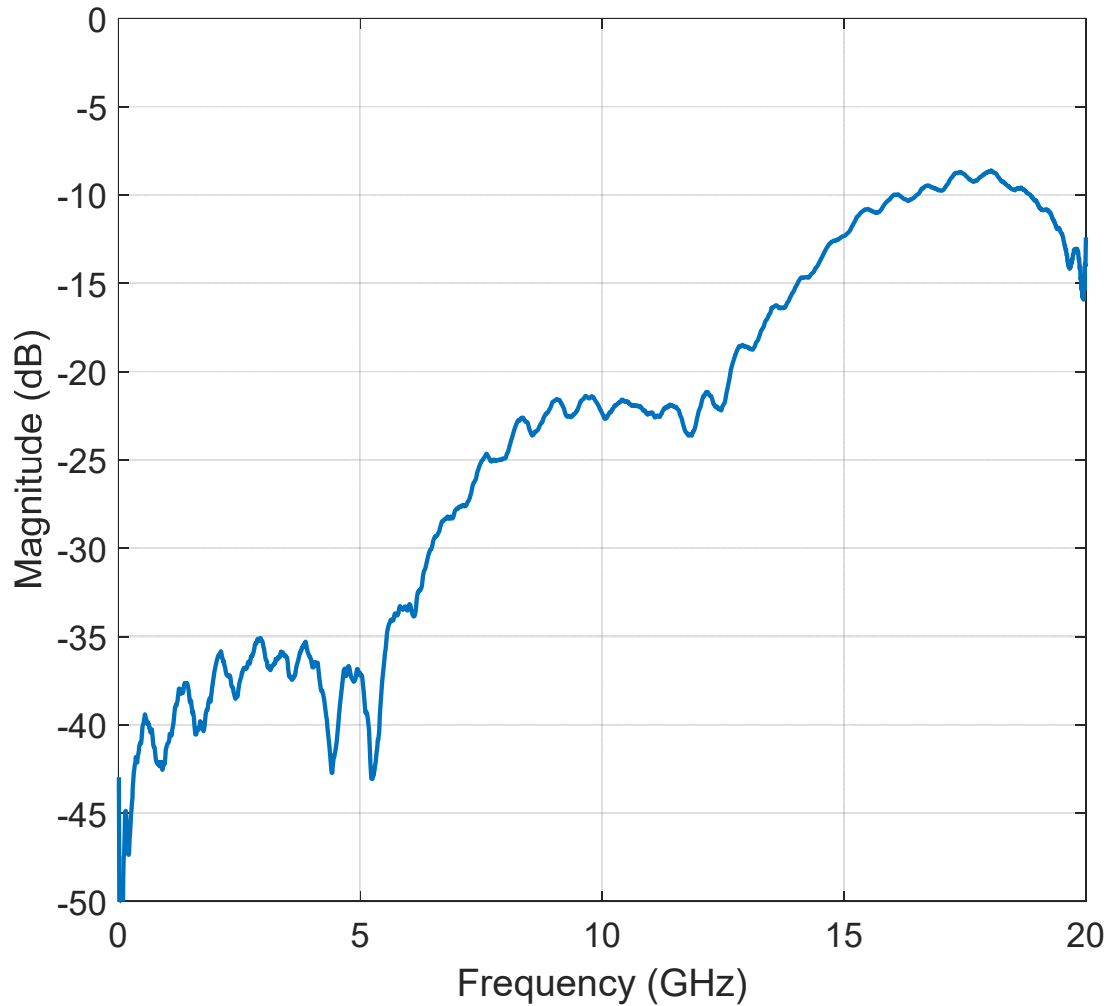


Figure 19. VersaLink Micro-D Cable Assembly Return Loss

### 6.1.3. VersaLink Micro-D Cable Assembly Bandwidth

The bandwidth of the Right-Angle VersaLink Micro-D can be drawn from Figure 20 by noting the frequency where the difference between the insertion loss and return loss is 3dB.

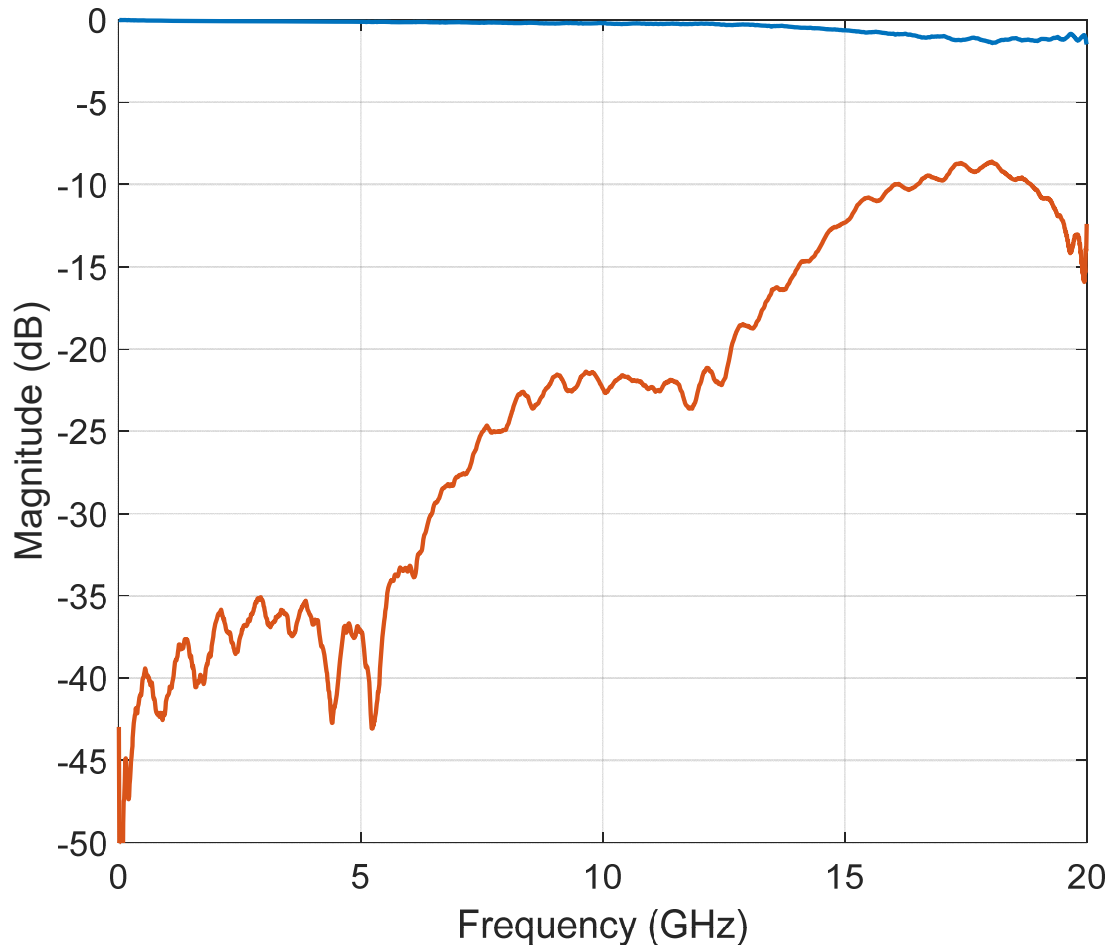


Figure 20. VersaLink Micro-D Cable Assembly Bandwidth

In this manner, the bandwidth is found to be greater than 20GHz.



### 6.1.4. VersaLink Micro-D Cable Assembly VSWR

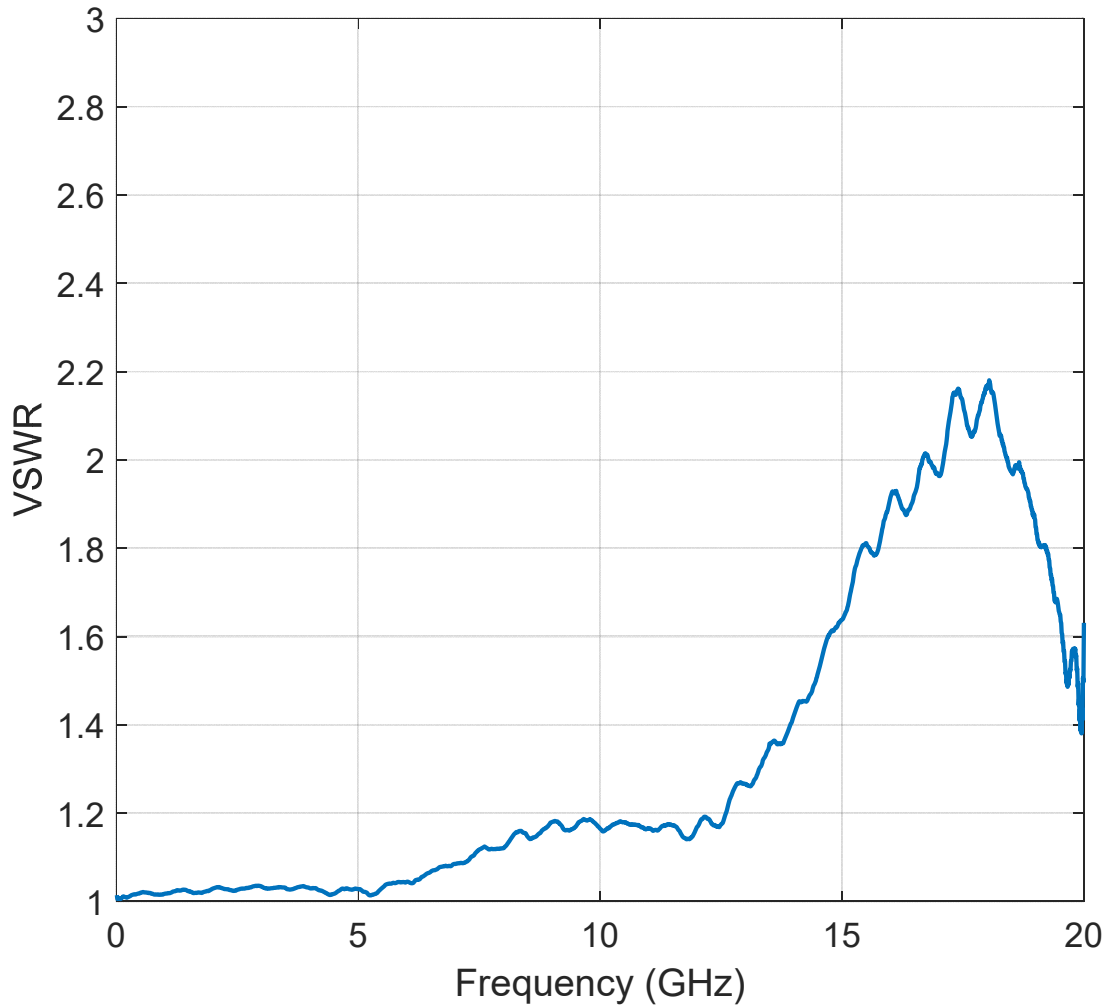


Figure 21. VersaLink Micro-D Cable Assembly VSWR

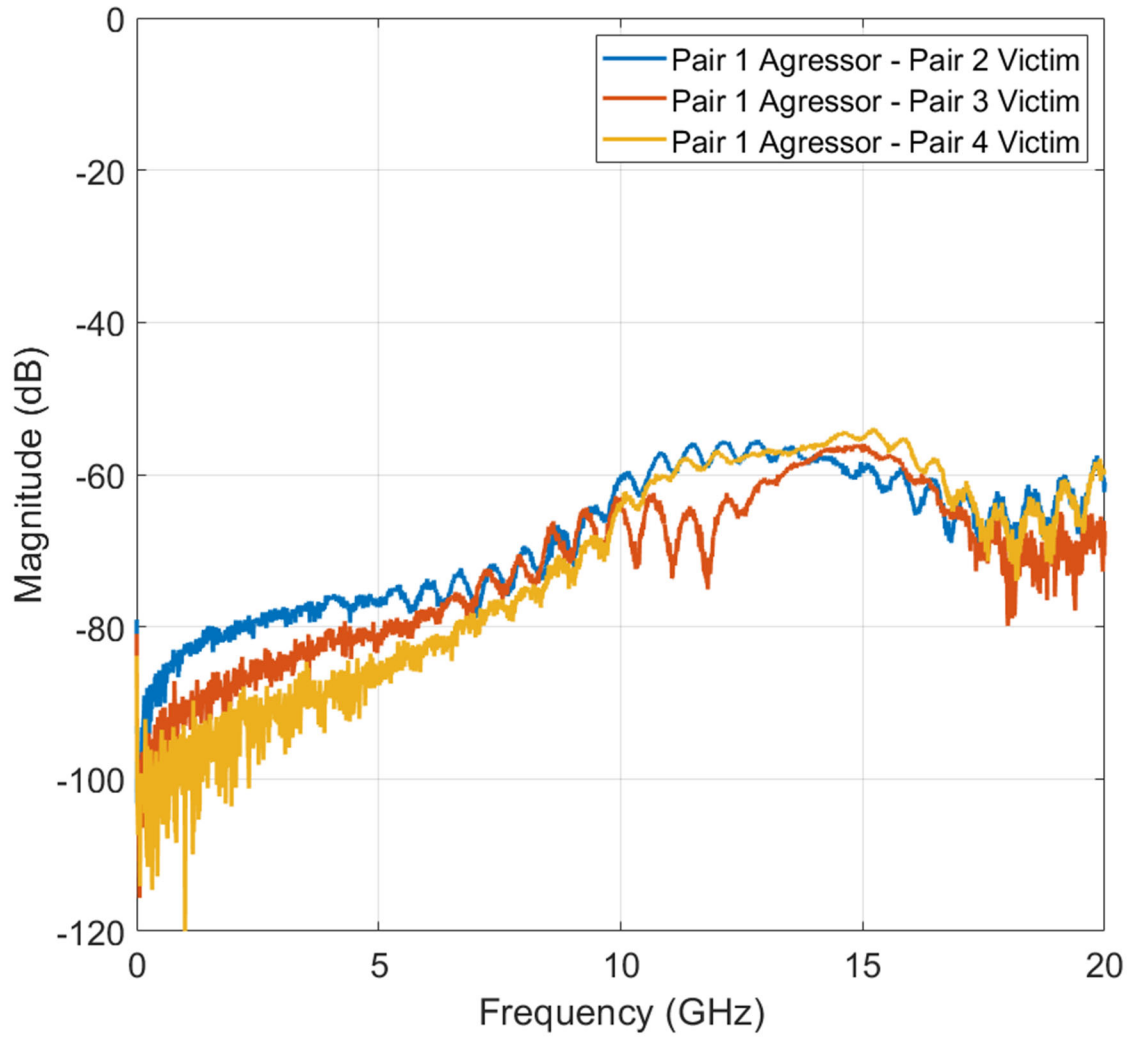


Figure 22. VersaLink Micro-D Cable Assembly NEXT

## 6.2. VersaLink Micro-D Cable Assembly Time Domain Analysis

### 6.2.1. VersaLink Micro-D Cable Assembly TDR

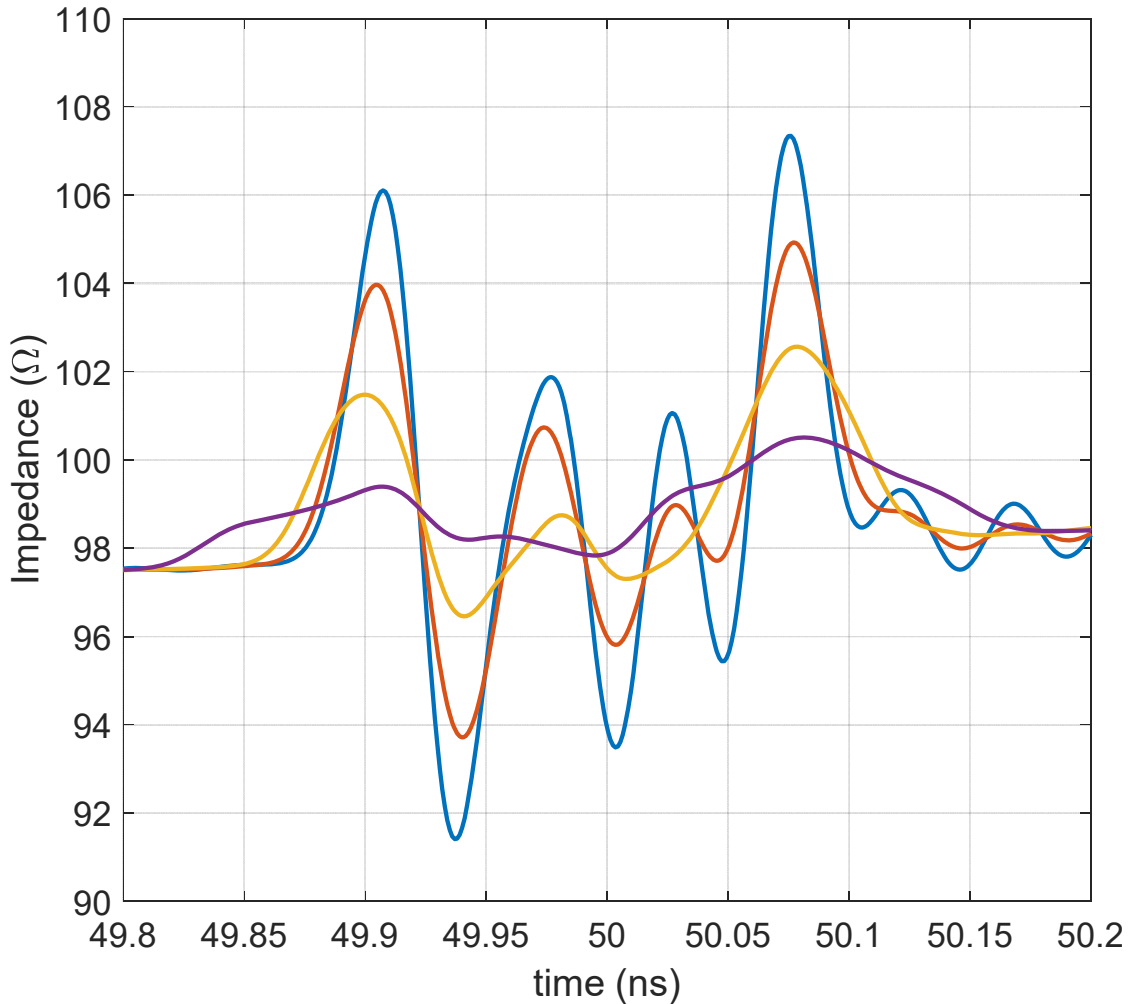


Figure 23. VersaLink Micro-D Cable Assembly TDR

### 6.2.2. VersaLink Micro-D Cable Assembly Eye Diagram

The S-parameter data for Pair 1 obtained from the Keysight N5227B PNA measurements was used to generate a statistical eye diagram for a bit rate of 28Gbps and is presented in Figure 24.

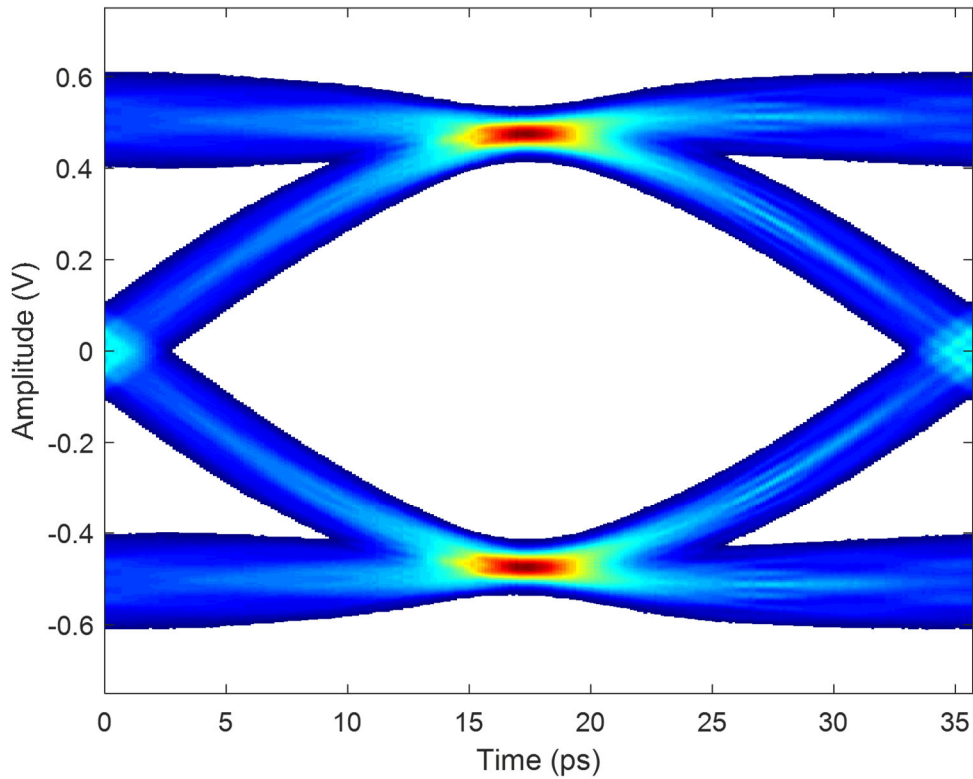


Figure 24. Eye diagram of VersaLink Micro-D Cable Assembly at 28Gbps

## Appendix A. 2x-Thru Fixture Performance

This section includes frequency domain results of the 2x-thru PCBs and cable assembly used to extract the VersaLink Micro-D electrical characteristics from the overall measured DUT/fixtures data.

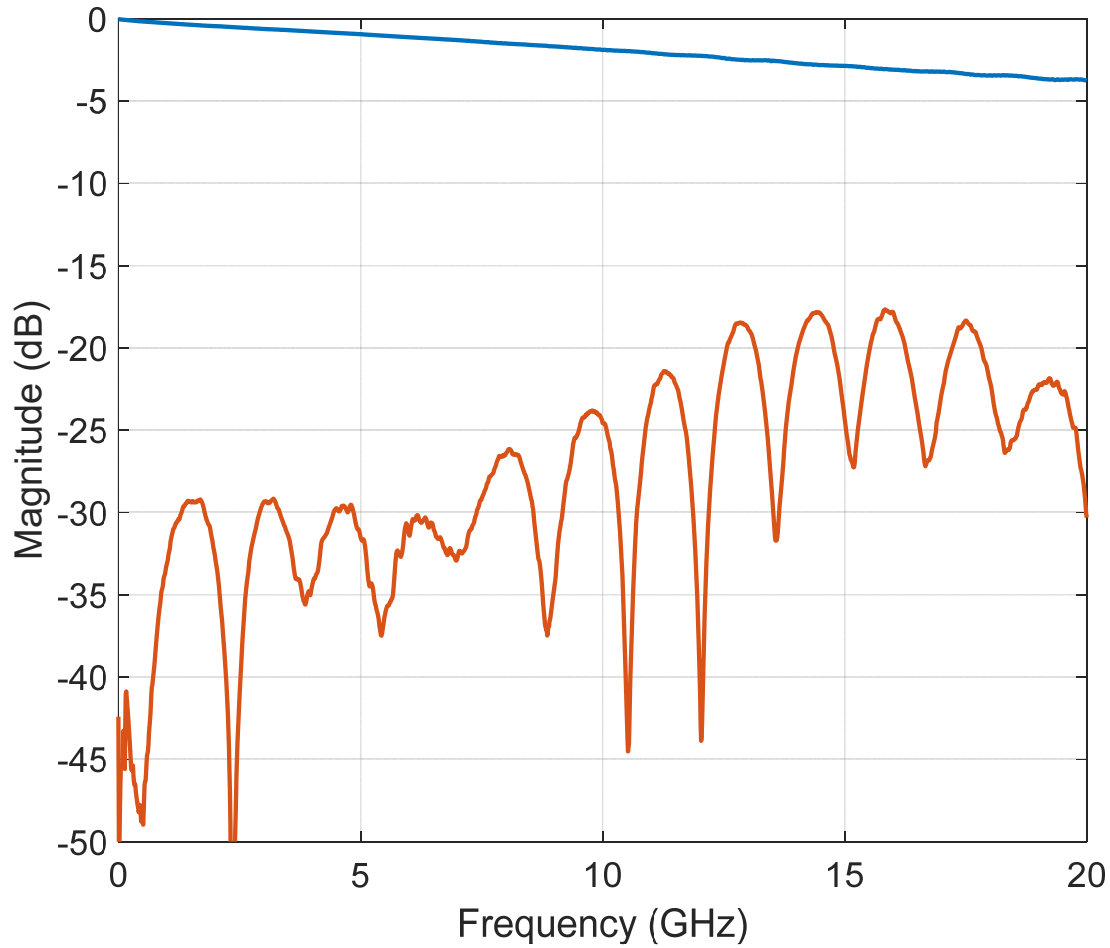


Figure 25. Straight VersaLink Micro-D 2x-Thru PCB Response

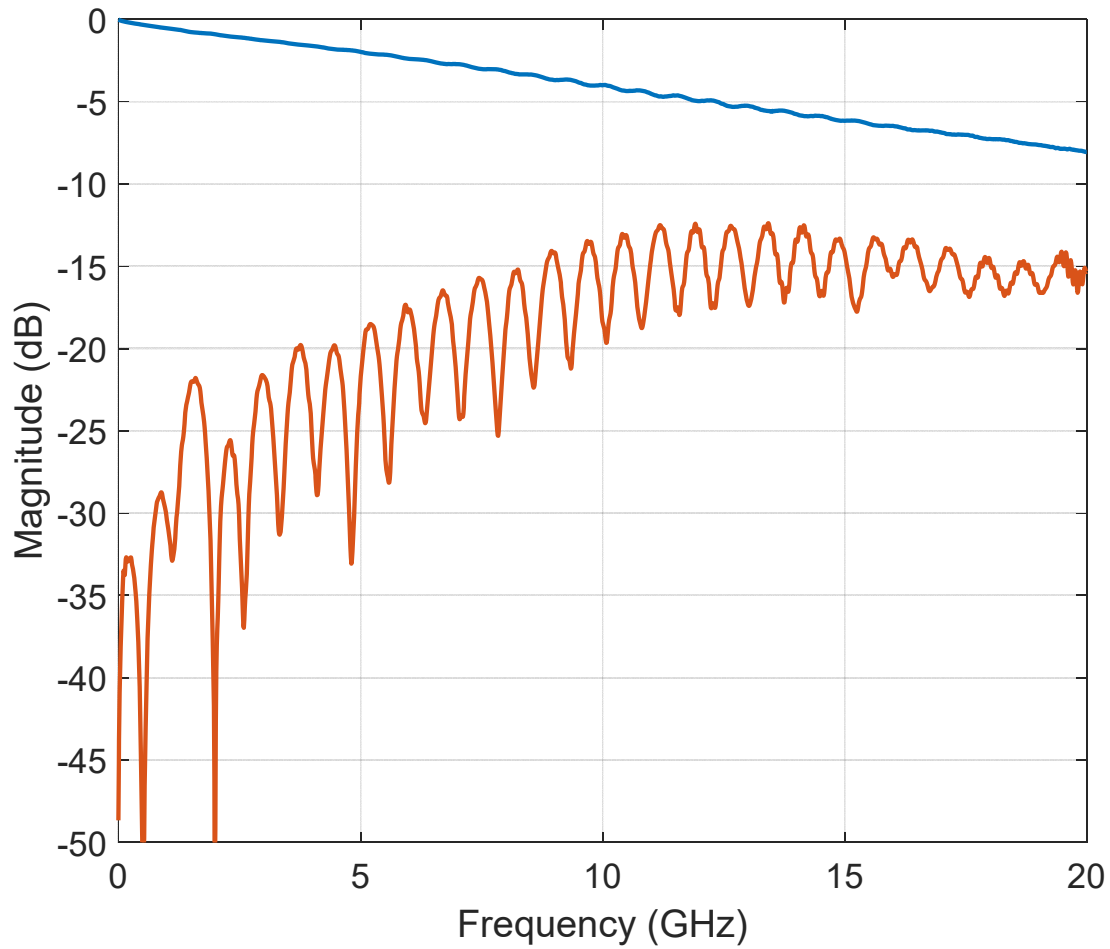


Figure 26. Right Angle VersaLink Micro-D 2x-Thru PCB Response



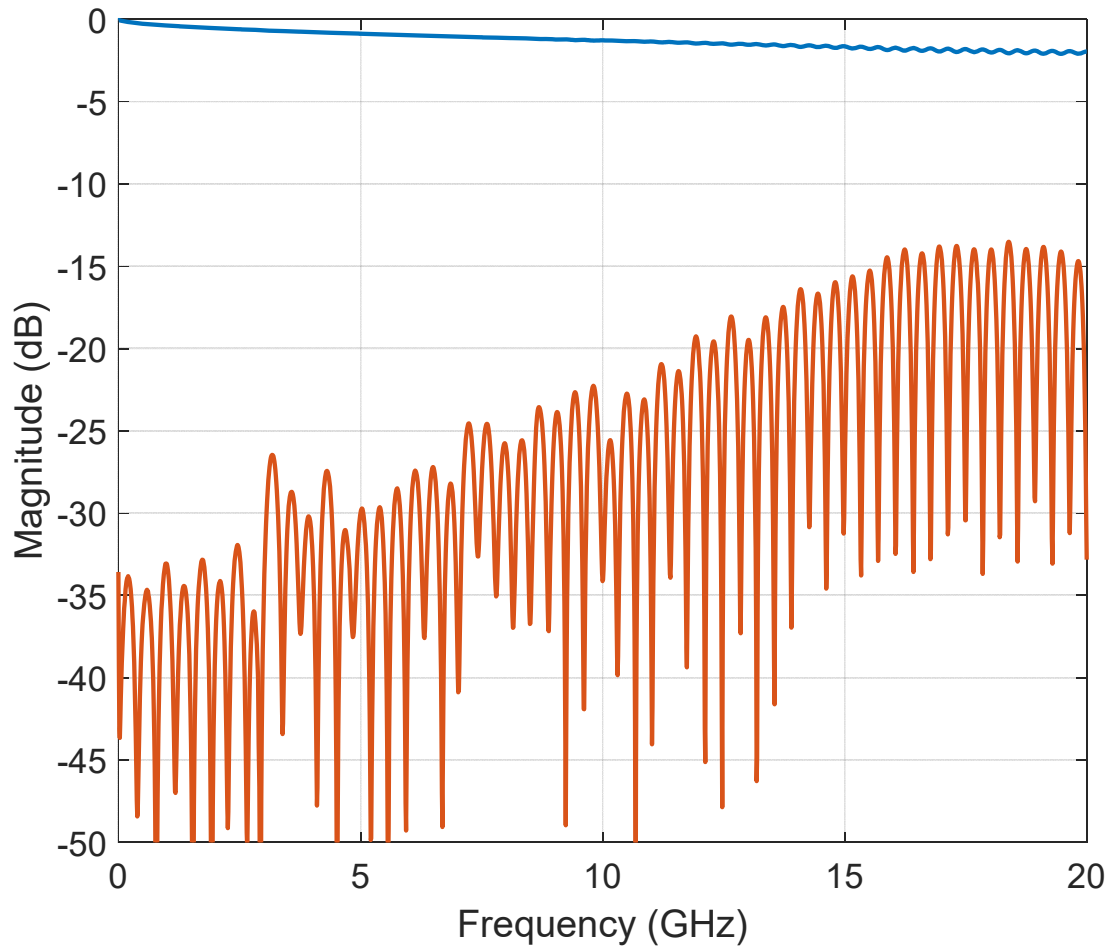


Figure 27. VersaLink Micro-D Cable Assembly 2x-Thru Response