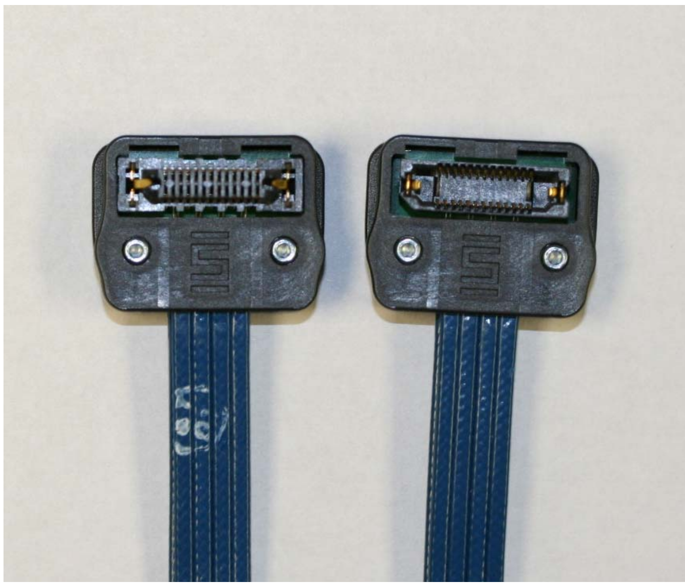
High Data Rate Characterization Report

ERDP-013-39.37-TTR-STL-1-D



Mated with:
ERF8-013-05.0-S-DV-DL-L and ERM8-013-05.0-S-DV-DS-L

Description:
Edge Rate Twin-Ax Cable Assembly, 0.8mm Pitch

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Report Revision: 2/27/2009

Series: ERDP
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Introduction

This testing was performed to evaluate the electrical performance of the ERDP series of 0.8-mm pitch Edge Rate Twin-Ax Cable Assemblies. Testing was performed in accordance to the High Performance Electrical Interconnect (HPEI) SFF-8416, Level 1[1] testing standards when applicable.

Time domain and frequency domain measurements were made. Time domain measurements included impedance, propagation delay, crosstalk and skew. Frequency domain measurements were preformed using Tektronix's IConnect® and Measurement XTractor™ software (Version 4.0.0) and included insertion loss (IL), return loss (RL), near end crosstalk (NEXT) and far end crosstalk (FEXT). All measurements were made utilizing test boards specifically designed for this project and are referred to as "test board" in this report. The test boards were identified as PCB-101517-TST-01 and PC-101517-TST-02.

Product Description

The test sample consists of two shielded #30 AWG twin-ax cables, which together provide for 8 signal pairs. At each end of the cable there is an edge rate connector that is terminated to a small transition PCB. Each connector is soldered to its respective PCB. The connector terminals are on 0.8-mm centers. Assembly length is 1 meter. The transition PCBs are wired to facilitate a Pin 1 to Pin 1 mapping between the cable ends.

The ERDP assembly was tested by mating it to an ERF8 socket at one end and to an ERM8 header at the other end. One sample of the assembly was tested. The actual part number that was tested is shown in Table 1, which also identifies End 1 and End 2 of the assembly; a relative sample picture is shown in Figure 1. Two signal paths, an inner pair and on outer pair, of the sample were tested.

Length	Part Number	End 1	End 2
1000 mm	ERDP-013-39.37-TTR-STL-1-D	TTR	STL

Table 1: Sample Description

[1] Measurement and Performance Requirements for HPEI Bulk Cable, Rev 15, June 27, 2005

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Figure 1: Test Sample Configuration

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Results Summary

Time Domain Data

Impedance

Impedance measurements were performed using a filtered risetime of 100 pS. Note that all measurements were performed with the assembly mated to the respective connector/test board. Data was measured at the cable connector and at 200 pS into the cable.

Assembly	Path	End Option				Cable	
		End 1		End 2		End 1	End 2
		Z_{Min} (Ω)	Z_{Max} (Ω)	Z_{Min} (Ω)	Z_{Max} (Ω)	Z_{max} (Ω)	Z_{max} (Ω)
TTR-STL-1-D	Inner	88.9	99.1	89.9	106.0	94.3	92.9
	Outer	90.0	101.4	91.7	105.1	93.5	93.2

Table 2: Impedance Measurements

Timing Measurements

Skew was calculated as the difference between the propagation delays of the longest and the shortest electrical paths. End 1 of the assembly was the source end for these measurements.

The results are tabulated below.

Assembly	Path	Propagation Delay (nS)	Skew (nS)
ERDP-013-39.37-TTR-STL-1-D	Inner	5.024	0.069
	Outer	4.955	

Table 3: Timing Measurements

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NEXT

The near end crosstalk was measured in the time domain and converted to a percentage and reported below in Table 4. The incident pulse amplitude from the TDR was 470 mV. The acquired data was measured using a filtered rise time of 100 pS. The End 1 heading in Table 4 represents the near-end of the assembly, i.e. the source end. All NEXT measurements were performed with the assembly mated to the respective connector/test board. Since most of the crosstalk occurs in the connectors, the values in Table 4 represent the crosstalk that occurs in the near-end mated assembly and the test board connectors.

Assembly	Path	END1		END 2	
		NEXT (mV)	NEXT (%)	NEXT (mV)	NEXT (%)
TTR-STL-1	Inner	1.52	0.32	1.36	0.29
	Outer	1.28	0.27	1.20	0.26

Table 4: % NEXT

FEXT

The far end crosstalk was measured in the time domain and converted to a percentage and reported below in Table 5. The incident pulse amplitude from the TDR was 470 mV. The acquired data was measured using a filtered rise time of 100 pS. The End 1 heading in Table 5 represents the near-end cable assembly connector, i.e. the source end. All FEXT measurements were performed with the cable assembly mated to the respective connector/test board. The values in Table 5 represent the crosstalk measured at the far end of the assembly.

Assembly	Path	END1		END 2	
		FEXT (mV)	FEXT (%)	FEXT (mV)	FEXT (%)
TTR-STL-1	Inner	2.24	0.48	1.84	0.39
	Outer	1.60	0.34	1.76	0.36

Table 5: % FEXT

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Frequency Domain Data

Insertion Loss

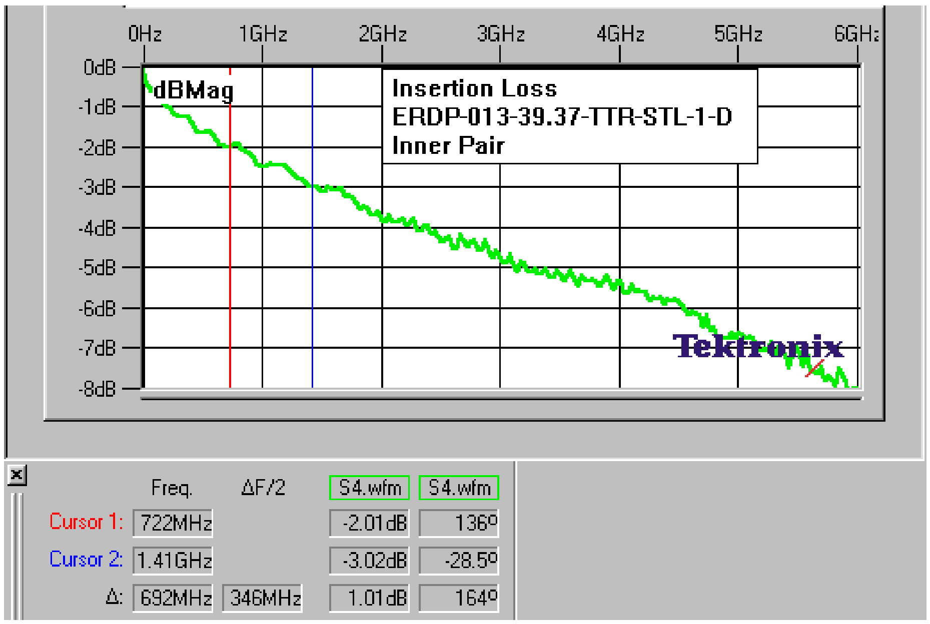

Figure 2: ERDP-013-39.37-TTR-STL-1-D Insertion Loss – Inner Path

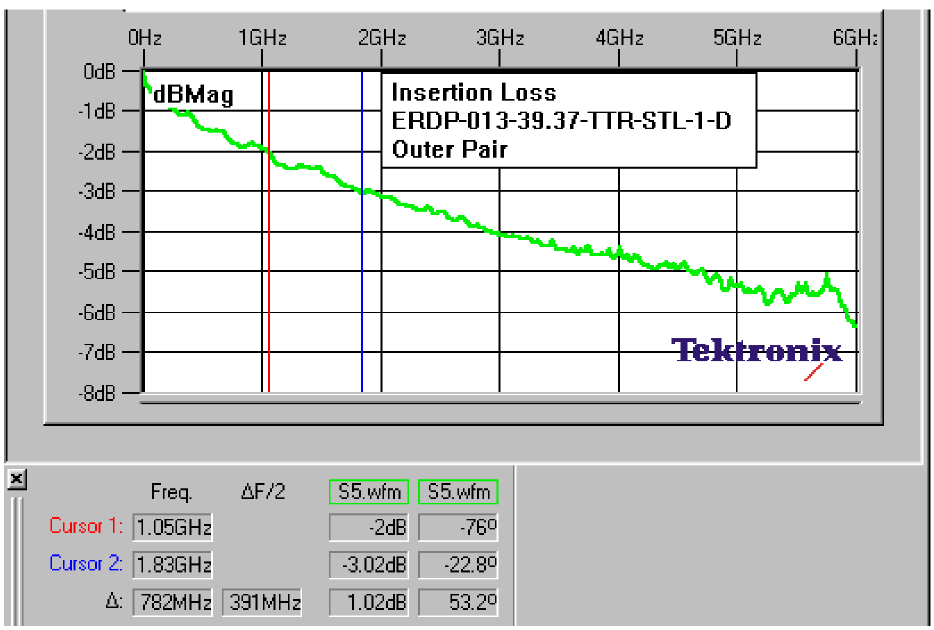

Figure 3: ERDP-013-39.37-TTR-STL-1-D Insertion Loss – Outer Path

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Return Loss

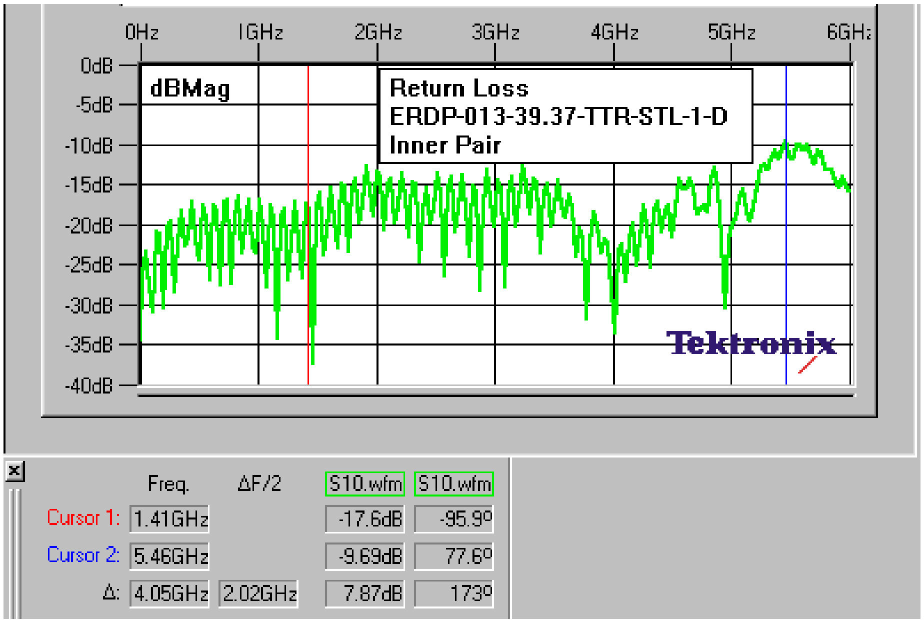

Figure 4: ERDP-013-39.37-TTR-STL-1-D Return Loss – Inner Path

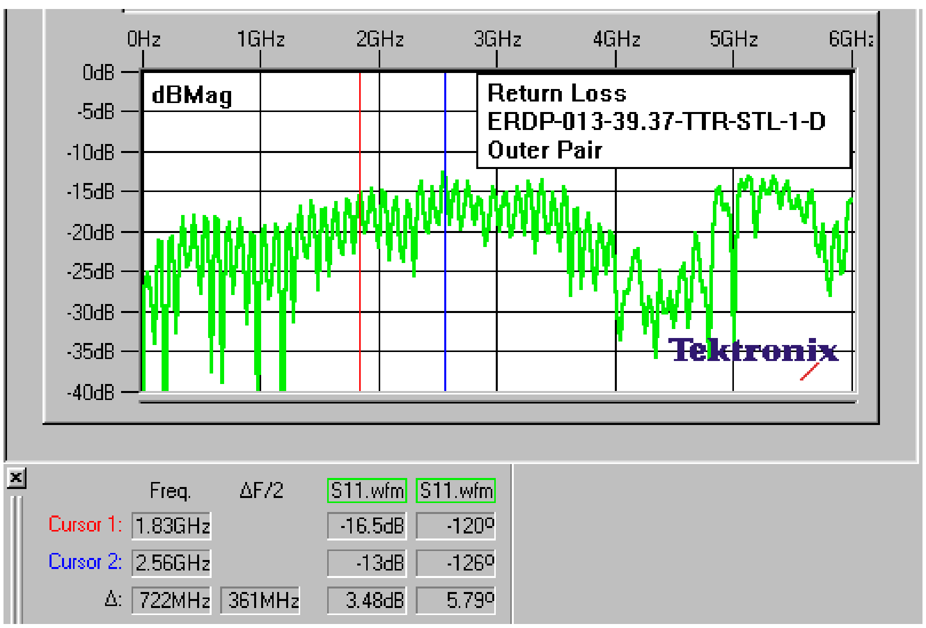

Figure 5: ERDP-013-39.37-TTR-STL-1-D Return Loss – Outer Path

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Near End Crosstalk

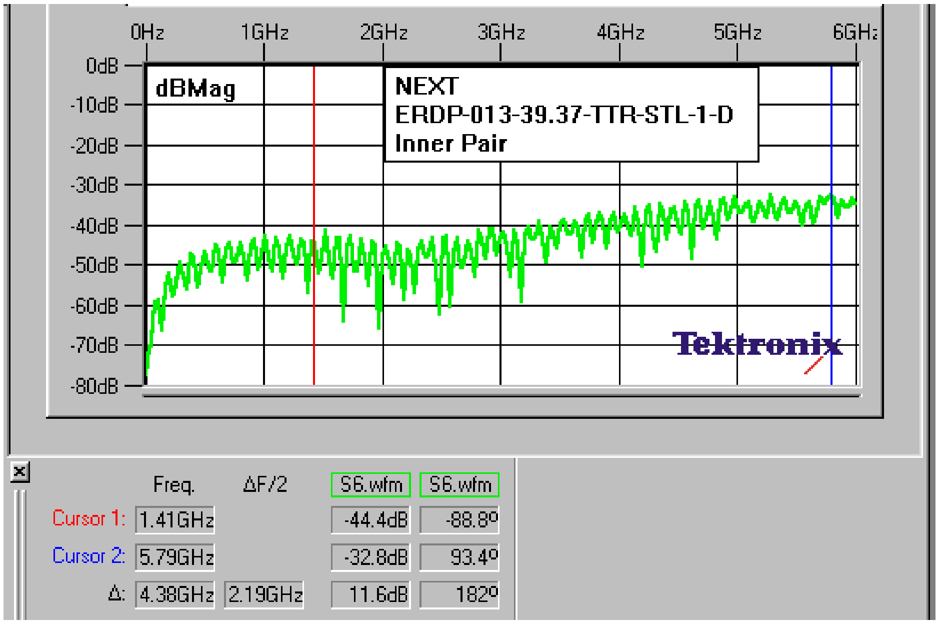

Figure 6: ERDP-013-39.37-TTR-STL-1-D NEXT – Inner Path

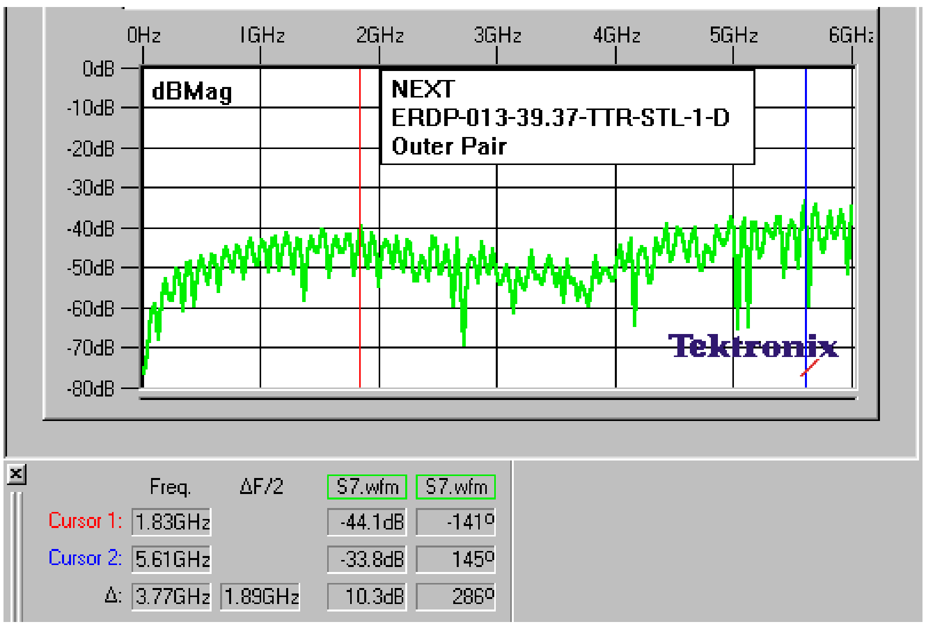

Figure 7: ERDP-013-39.37-TTR-STL-1-D NEXT – Outer Path

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Far End Crosstalk

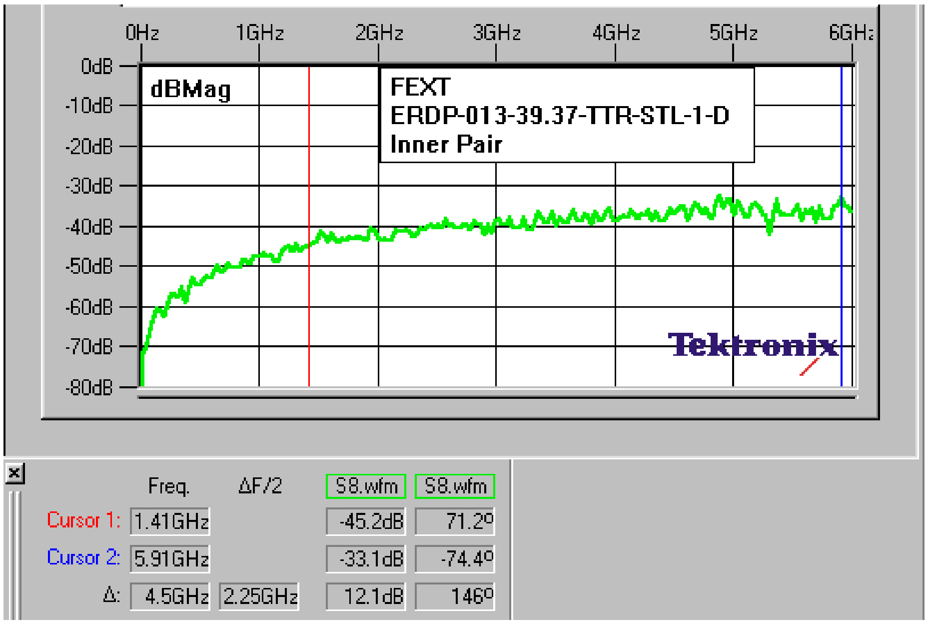

Figure 8: ERDP-013-39.37-TTR-STL-1-D FEXT – Inner Path

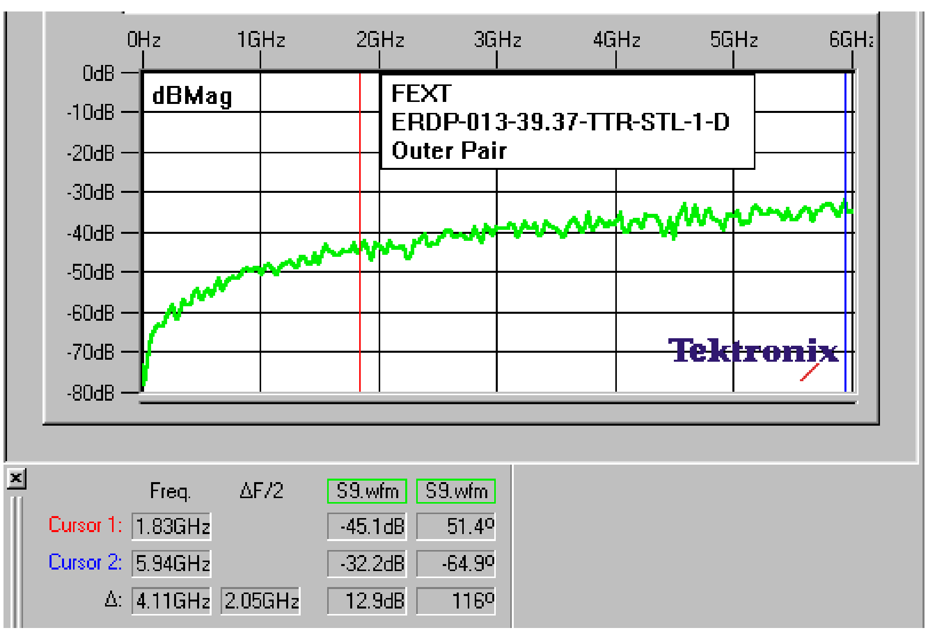

Figure 9: ERDP-013-39.37-TTR-STL-1-D FEXT – Outer Path

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Test Procedures

Fixturing:

All measurements were performed using the test boards that have signal line trace lengths of 2.500 inches and provide for the interconnection to the ERDP assembly by use of field replaceable SMA connectors. The test boards also provide THRU calibration traces that are 5.000 inches long. Figure 10 below shows how the THRU reference traces were utilized to compensate for the losses due to the coaxial test cables, SMA launches, and the test board traces during testing.

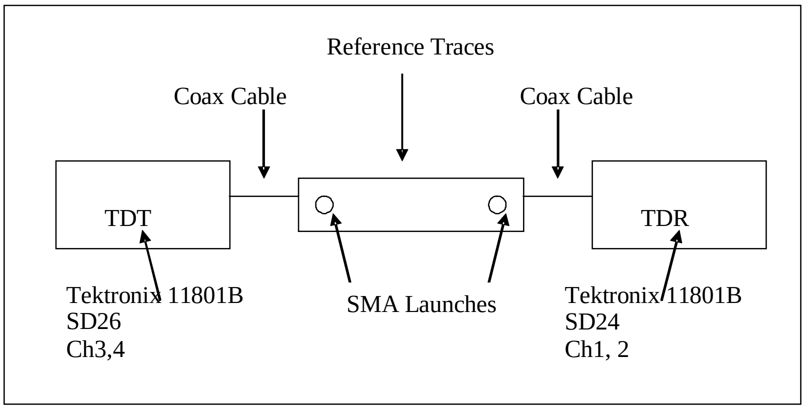

Figure 10: Test setup for Thru Reference Acquisition

Measurements were then performed using the test boards as shown in Figure 11. A picture of the test boards and cable is shown in Figure 12.

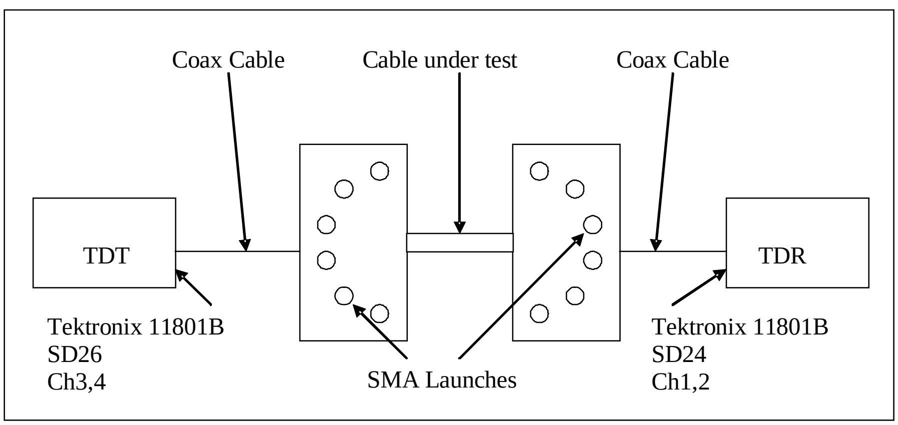

Figure 11: Characterization test setup

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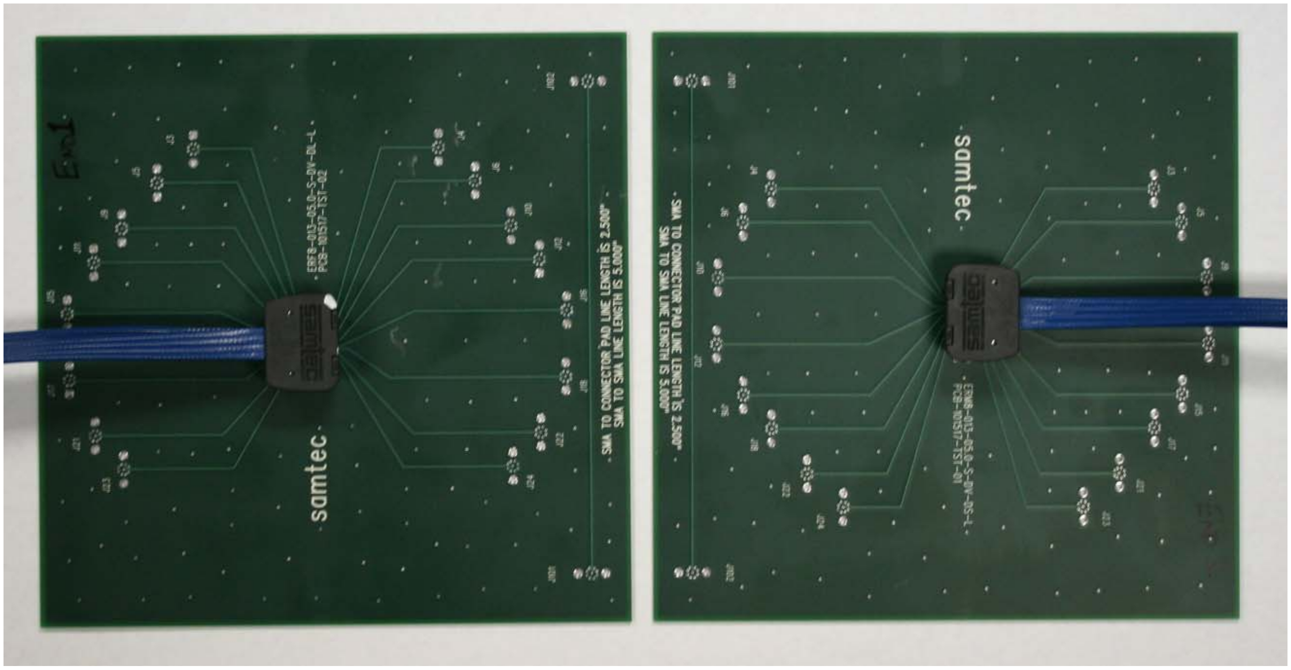

Figure 12: Test setup with Test PCBs and ERDP twin-ax cable assembly.

The twin-ax cable assembly terminations had a particular signal line configuration. The respective signal line numbers are shown in Table 6 below. There are a total of 13 positions per row. The SMA jack numbers on the test boards correspond to the assembly line numbers. All adjacent lines are terminated where applicable.

G	3	5	G	9	11	G	15	17	G	21	23	G
G	4	6	G	10	12	G	16	18	G	22	24	G

Table 6: Respective signal line numbers.

Table 7 below shows the signal line numbers corresponding to the inner and outer paths for the different configurations tested.

Assembly	Path	
	Inner	Outer
ERDP-013-39.37-TTR-STL-1-D	J4-J6	J15-J17

Table 7: Inner and Outer Path Signal Line Numbers

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Time Domain Testing

Impedance:

The Tektronix 11801B oscilloscope was set up in TDR (time domain reflectometry) mode using a 100-pS filtered risetime and 16 averages. The horizontal setup of the TDR used a 512 point record length and a horizontal scale of 200 pS/div to allow the near end connector and a portion of the cable to be displayed. All connector impedance measurements were made at the near-end connector. Cable impedance was measured 200 pS into the cable after the connector.

Propagation Delay:

The propagation delay was measured and skew calculated by first acquiring a thru reference pulse of the reference line. Using the delay function of the TDR, set at 50% amplitude of the reference pulse, the sample was inserted and the sample delay was measured. The TDR delay function calculates the sample delay by subtracting the delay measurement of the reference pulse from the delay measurement of the sample plus the test board traces.

Skew:

Skew is defined as the difference between of the propagation delays of the longest (maximum delay) and the shortest (minimum delay) electrical paths.

NEXT and FEXT:

Near end crosstalk (NEXT) and far end crosstalk (FEXT) measurements were made using the Tektronix 11801B oscilloscope. A thru reference of the coaxial test cables, SMAs, and reference board was performed to determine the pulse amplitude of the TDR generator (see Figure 10).

To acquire NEXT, a signal was applied using the oscilloscope pulse generator. NEXT was measured on an adjacent signal line at the near end (see Figure 13). To acquire FEXT, a trace was driven with the oscilloscope pulse generator. FEXT was measured on an adjacent trace at the far end (see Figure 14). All adjacent lines were terminated, at both ends, with 50Ω SMA loads; refer to Figures 13 and 14.

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Frequency Domain Testing

All frequency domain measurements were made using the Tektronix 11801B oscilloscope. Testing was performed using a risetime of 35 pS. The horizontal scale was set to 5 nS/div, the record length was set to 5120 points and the number of averages was set to 128. These values were selected to ensure the ratio between the number of points and the window length was long enough to capture the highest frequencies and still yield a small enough frequency step to gain adequate resolution. End 1 of the assembly was the source end for all frequency domain measurements. All adjacent lines were terminated at both ends with 50Ω SMA loads; refer to Figures 13 and 14.

Attenuation:
Insertion Loss test setup losses were compensated for by acquiring a thru measurement (reference output pulse) of the coaxial test cables, SMAs, and the reference trace (see Figure 10). A thru measurement of an assembly was taken and then post processed by using Tektronix IConnect® software. The result is the insertion loss of the cable assembly.

Return Loss:
An open circuit reference measurement was taken using signal traces on the test board. A matched reflection waveform of the cable assembly, i.e. with the assembly terminated in 50-Ω SMA loads on the far end test board, was acquired and then post processed by using Tektronix IConnect® software. The result is the return loss of the cable assembly.

Near and Far End Crosstalk:
NEXT and FEXT were measured in the time domain using the oscilloscope and then converted to frequency domain data using Tektronix IConnect® software. Initially a thru reference measurement of the coaxial test cables, SMAs, and calibration board trace was performed to compensate for the test setup losses (see Figure 10).

To acquire NEXT a trace was driven using the oscilloscope pulse generator. NEXT was measured, in the time domain, on an adjacent trace (see Figure 13). NEXT was then post processed using Tektronix's IConnect® software to generate the NEXT of the cable assembly in the frequency domain.

To acquire FEXT a trace was driven using the oscilloscope pulse generator. FEXT was measured in the time domain on an adjacent trace at the far end (see Figure 14). FEXT was then post processed using Tektronix's IConnect® software to generate the FEXT of the cable assembly in the frequency domain.

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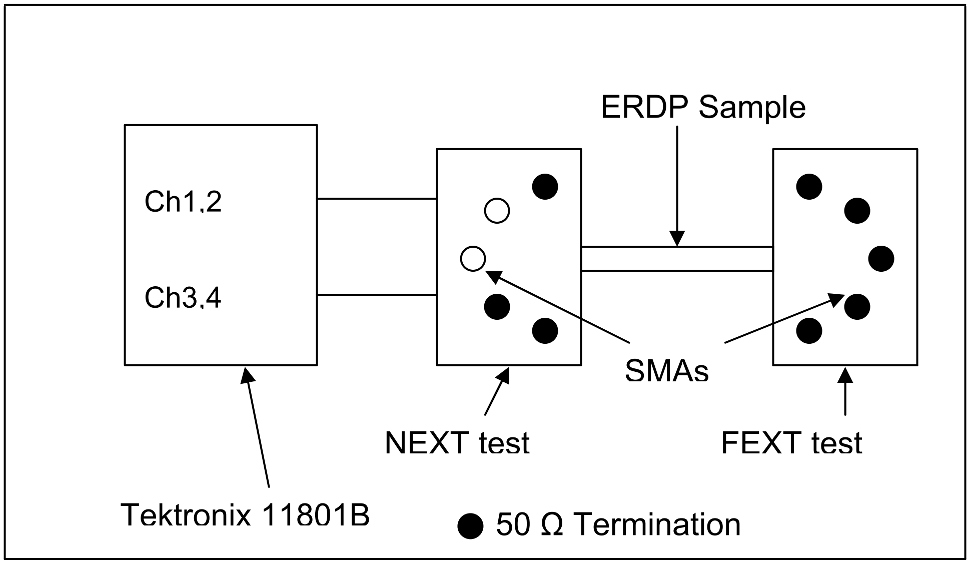

Figure 13: NEXT Measurement Setup.

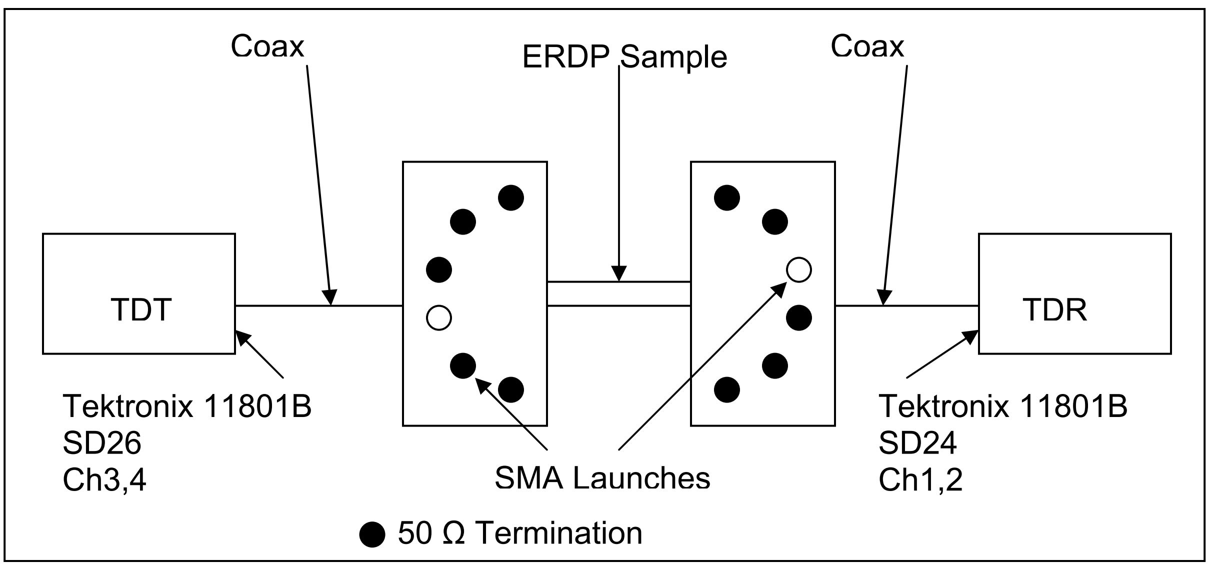

Figure 14: FEXT Measurement Setup

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Equipment

Time Domain Testing

Tektronix 11801B Oscilloscope
Tektronix SD24 TDR/Sampling Head
Tektronix SD26 Sampling Head