



U.S. Department of
Transportation

**Federal Railroad
Administration**

Railroad Test Track (RTT) Fiber Optic Acoustic Test Bed Expansion

Office of Research,
Development
and Technology
Washington, DC 20590



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13. ABSTRACT (Maximum 200 words) The Federal Railroad Administration (FRA) funded an expansion of the Railroad Test Track (RTT) Fiber Optic Acoustic Detection (FOAD) test bed. This test bed was designed for continued research of FOAD technology applications at the Transportation Technology Center (TTC). The FOAD test bed is installed at the toe of the ballast shoulder around the entire 13.5 mile RTT.				
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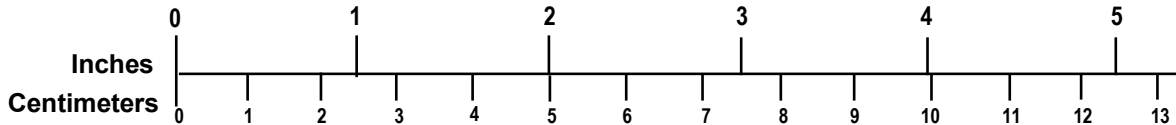
METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

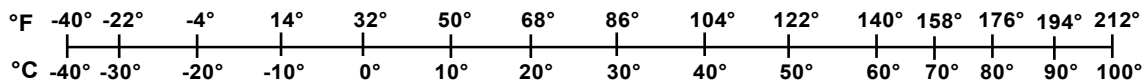
METRIC TO ENGLISH

<p style="text-align: center;">LENGTH (APPROXIMATE)</p> <p>1 inch (in) = 2.5 centimeters (cm) 1 foot (ft) = 30 centimeters (cm) 1 yard (yd) = 0.9 meter (m) 1 mile (mi) = 1.6 kilometers (km)</p>	<p style="text-align: center;">LENGTH (APPROXIMATE)</p> <p>1 millimeter (mm) = 0.04 inch (in) 1 centimeter (cm) = 0.4 inch (in) 1 meter (m) = 3.3 feet (ft) 1 meter (m) = 1.1 yards (yd) 1 kilometer (km) = 0.6 mile (mi)</p>
<p style="text-align: center;">AREA (APPROXIMATE)</p> <p>1 square inch (sq in, in²) = 6.5 square centimeters (cm²) 1 square foot (sq ft, ft²) = 0.09 square meter (m²) 1 square yard (sq yd, yd²) = 0.8 square meter (m²) 1 square mile (sq mi, mi²) = 2.6 square kilometers (km²) 1 acre = 0.4 hectare (he) = 4,000 square meters (m²)</p>	<p style="text-align: center;">AREA (APPROXIMATE)</p> <p>1 square centimeter (cm²) = 0.16 square inch (sq in, in²) 1 square meter (m²) = 1.2 square yards (sq yd, yd²) 1 square kilometer (km²) = 0.4 square mile (sq mi, mi²) 10,000 square meters (m²) = 1 hectare (ha) = 2.5 acres</p>
<p style="text-align: center;">MASS - WEIGHT (APPROXIMATE)</p> <p>1 ounce (oz) = 28 grams (gm) 1 pound (lb) = 0.45 kilogram (kg) 1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)</p>	<p style="text-align: center;">MASS - WEIGHT (APPROXIMATE)</p> <p>1 gram (gm) = 0.036 ounce (oz) 1 kilogram (kg) = 2.2 pounds (lb) 1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons</p>
<p style="text-align: center;">VOLUME (APPROXIMATE)</p> <p>1 teaspoon (tsp) = 5 milliliters (ml) 1 tablespoon (tbsp) = 15 milliliters (ml) 1 fluid ounce (fl oz) = 30 milliliters (ml) 1 cup (c) = 0.24 liter (l) 1 pint (pt) = 0.47 liter (l) 1 quart (qt) = 0.96 liter (l) 1 gallon (gal) = 3.8 liters (l) 1 cubic foot (cu ft, ft³) = 0.03 cubic meter (m³) 1 cubic yard (cu yd, yd³) = 0.76 cubic meter (m³)</p>	<p style="text-align: center;">VOLUME (APPROXIMATE)</p> <p>1 milliliter (ml) = 0.03 fluid ounce (fl oz) 1 liter (l) = 2.1 pints (pt) 1 liter (l) = 1.06 quarts (qt) 1 liter (l) = 0.26 gallon (gal) 1 cubic meter (m³) = 36 cubic feet (cu ft, ft³) 1 cubic meter (m³) = 1.3 cubic yards (cu yd, yd³)</p>
<p style="text-align: center;">TEMPERATURE (EXACT)</p> <p style="text-align: center;">[(x-32)(5/9)] °F = y °C</p>	<p style="text-align: center;">TEMPERATURE (EXACT)</p> <p style="text-align: center;">[(9/5) y + 32] °C = x °F</p>

QUICK INCH - CENTIMETER LENGTH CONVERSION



QUICK FAHRENHEIT - CELSIUS TEMPERATURE CONVERSION



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Updated 6/17/98

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Executive Summary

Fiber Optic Acoustic Detection (FOAD) is an emerging technology for use by North American railroads to track train movement as well as potentially detect a variety of wheel rail defects. Due to this, the Federal Railroad Administration (FRA) contracted Transportation Technology Center, Inc. (TTCI) to complete a partial installation of the Railroad Test Track (RTT) FOAD test bed installed in 2013 at the Transportation Technology Center (TTC). In 2017, FRA contracted TTCI to complete the remainder of the RTT FOAD test bed installation. The completed FOAD test bed now encompasses the entirety of the RTT allowing for expanded FOAD testing capabilities in the future. The work described in this report explains the details of the fiber optic installation from 2017.

1. Introduction

The scope of this project focused on the installation of fiber optic cable around the Railroad Test Track (RTT) between defined points on the track, R14 and R46, at the Transportation Technology Center (TTC). The fiber optic cable was installed to enhance the capabilities of the current RTT Fiber Optic Acoustic Detection (FOAD) test bed. The RTT FOAD test bed now encompasses fiber optic cable around the entire RTT. These enhancements will increase the capabilities of fiber optic testing on the RTT FOAD test bed.

1.1 Background

FOAD technology detects events of interest by sensing acoustic vibrations on fiber optic cable and by analyzing the response to signals received. The potential for the application of FOAD technology in the railroad industry has resulted in several industry-, supplier-, and government-funded research and testing programs in recent years. To support the development and evaluation of these potential applications, the Federal Railroad Administration (FRA) funded the implementation of a fiber optic test bed at the TTC. That test bed consists of fiber optic cable installed alongside certain test tracks and equipment to conduct FOAD railroad-related research. The fiber optic test beds include fiber optic cable installation that covers the High Tonnage Loop (HTL), and the RTT. Prior to the full fiber optic cable installation around the RTT, the test bed was limited in terms of being able to perform testing continuously around the entire RTT. Those limits included the speed and number of trains able to be tested while conducting FOAD railroad research.

1.2 Objectives

The objective of this project was to expand the existing fiber optic test bed to encompass the entire RTT. This expansion is designed to support FOAD technology testing at higher speeds and with multiple trains, both on the same track and on multiple tracks, and in areas where the RTT parallels other tracks.

1.3 Overall Approach

The overall approach to this project was to complete the RTT FOAD test bed by sub-contracting a professional fiber optic cable installation contractor to install and test the cable to installation specification's defined by Transportation Technology Center, Inc.'s (TTCI) engineers.

1.4 Scope

The following describes the scope of work performed to meet the project objectives:

- TTCI engineers developed a statement of work to identify the installation details of the RTT FOAD test bed expansion.
- Fiber optic installation contractors reviewed and submitted bids to perform the installation of the fiber optic cable.
- After the fiber optic cable was installed the installation sub-contractors tested all fiber optic cable the installed and provided test results.

- TTCI managed the project.

1.5 Organization of the Report

This report is organized into three sections and an appendix:

- [Section 1](#) introduces the work performed as well as providing a brief background, overall approach, and scope.
- [Section 2](#) summarizes the installation of the RTT FOAD test bed.
- [Section 3](#) provides the conclusion for this project.
- [Appendix A](#), provides the fiber test results.

2. Fiber Optic Cable Installation

A 34,500-foot direct bury, 12-core, single-mode fiber optic cable was installed on the south and west sides of the RTT from R14 to R46. From R15 to approximately R19, near the 501B switch, the fiber optic cable was placed on the south side of the access track. At R19, the fiber optic cable was pulled through a 2-inch conduit directly west of the 501B switch at a depth of 36 inches, using a directional bore machine, under the access track and then placed back into the trench located on the south and west sides of the RTT.

The fiber optic cable, except for the cable pulled through the bore, was installed utilizing a direct burial method at a depth of three feet below existing grade. The fiber optic cable was placed at a maximum of 20 feet from the center of the RTT track near the toe of the ballast. Following the placement of the fiber optic cable, the trench was water puddled, compacted in 12-inch lifts, and tamped to prevent future settling. A site overview of the installation can be seen below in [Figure 1](#). The fiber optic cable shown in yellow represents the installation of the fiber optic cable from R14 to R46. The fiber optic cable shown in green represents the previously installed fiber optic cable.

The fiber optic cable was not on a single reel because of limitations in reel size. Two separate reels were used. One reel contained 25,000 feet of fiber optic cable and the other reel contained 10,000 feet. Since the fiber was placed on two reels, there is one splice point, near mile marker R23. The splice was completed using a fusing technique to ensure the lowest loss of decibels (dB). The fiber splice was placed in a burial rated splice box and buried at a depth of 36 inches. There is no hand hole access at this point since previous testing has shown that hand hole boxes introduce interfering acoustic signal to the fiber optic cable.



Figure 1: Map of RTT fiber optic cable

2.1 TTC Site Plan Update

Detailed installation location information was added to the TTC site plans for future reference. A high-level example of the site plan update can be seen in red in [Figure 2](#).

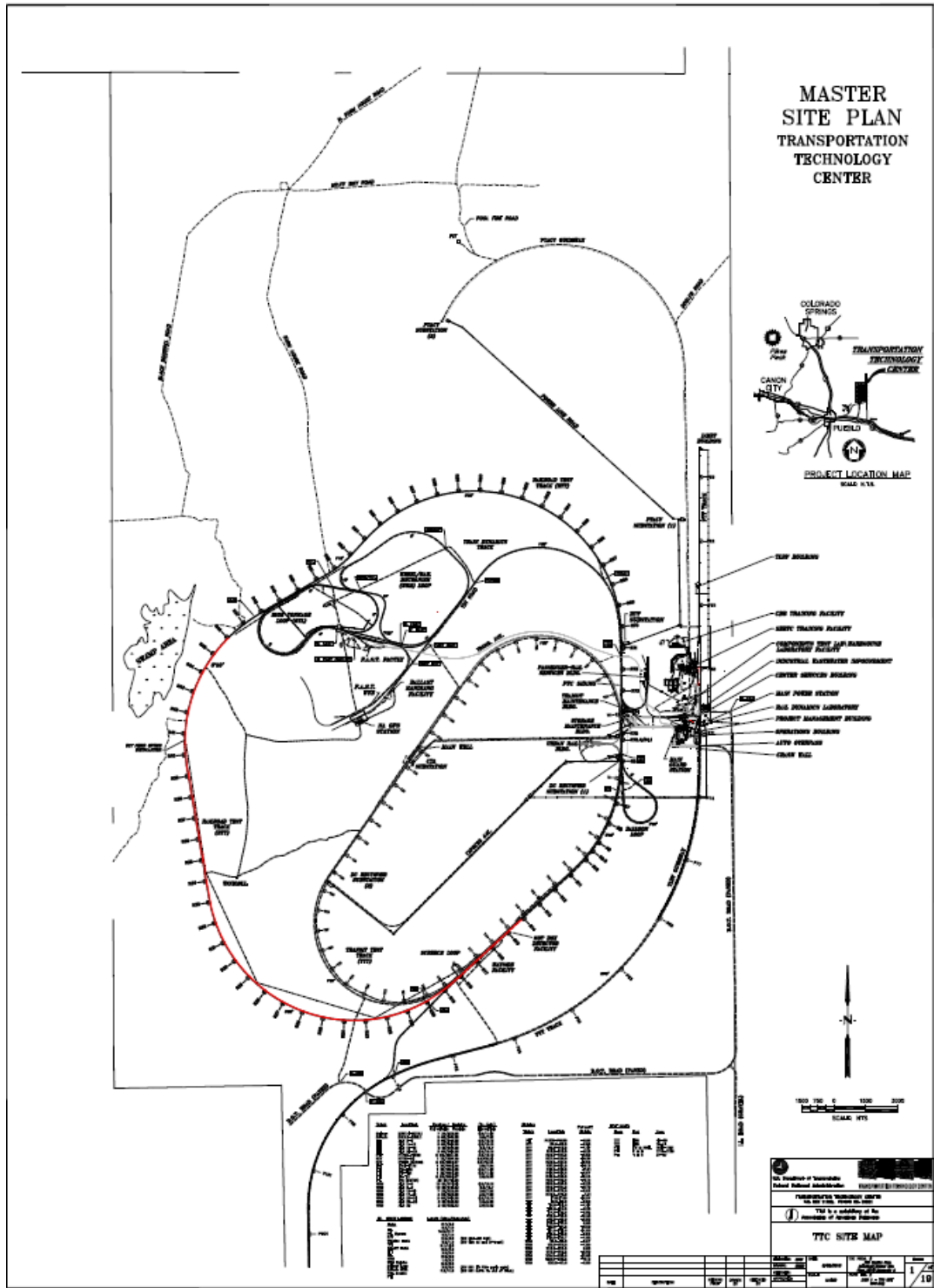


Figure 2: TTC site plan update

2.2 Fiber Optic Cable Testing

The fiber optic cable was tested post-installation via the use of an optical time domain reflectometer (OTDR) to ensure the integrity of each of the fibers. Each of the 12 fiber optic cables was tested individually from R46 counterclockwise to R14. The tested fibers showed less than 1 dB of loss at the splice point as recommended by FOAD suppliers. The test results are provided in [Appendix A](#).

3. Conclusion

Potential application of FOAD technology in the railroad industry has been, and will continue to be, evaluated using the fiber optic test bed at the TTC. The expansion of the fiber optic test bed conducted under this project will allow for additional testing capabilities, including testing at higher speeds continuously around the RTT, as well as testing with multiple trains.

Appendix A. Fiber Test Results

Appendix A. Fiber Test Results, raw data. Federal Railroad Administration.

Results

- A1
 - Backup
 - Backup1
 - Backup2
 - 001
 - 003

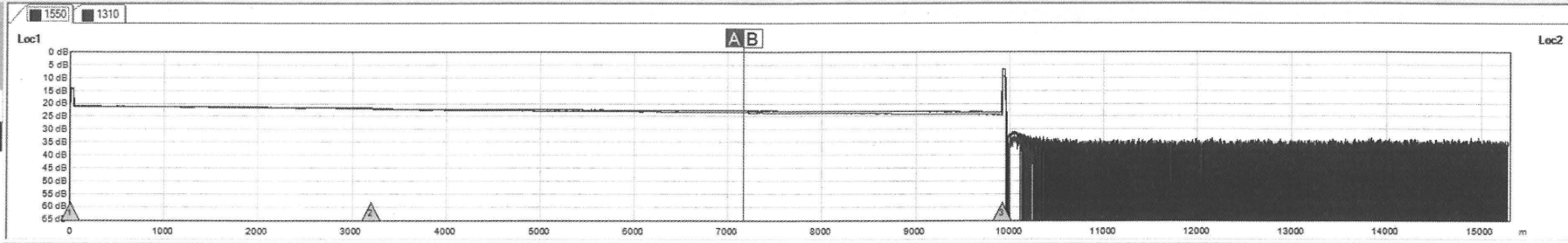
Press the button below to open the selected result.

Trace Viewer SM A-Z

Key to Result Icons

- OPM
- SingleMode Trace
- AutoTest
- MultiMode Trace

Job: TEST TRACK
 Route: Loc1_Loc2
 Cable: A1
 Fiber: 2
 OTDR @: Loc1



A: 7,169.4 m
 B: 7,167.3 m
 B-A: -2.1 m
 Two Point
 Insertion Loss B - A : 0.014 dB

Event Table

Number of Events	Link Loss (dB)	Link ORL (dB)	Link Length (m)	Link Atten (dB/km)
3	* 3.73 dB	* 26.72 dB	9,924.0 m	0.375 dB / km

#	Fiber Before	Attenuation (dB/km)	Loss (dB)	Source	Event Type	Link Events	Location (m)	Refli (dB)	Loss (dB)
1	Link Start			Auto	Reflective Start	0.0		-44.31	0.001
2		0.641	2.057	Auto	Single Non-Reflective	3,211.5		--	0.457
3		0.180	1.211	Auto	Reflective End	9,924.0		-23.859	--

Trace Info Text Info Unit Info

Date: 31-Jul-2018
 Time: 4:33 PM
 Module: M310
 Fiber: 2
 Cable ID: A1
 Wavelength: 1550 nm
 Pulse Width: 300 ns
 Range: 15,314.3 m
 Point Spacing: 0.5104762 m
 Averages: 6208
 GIR: 1.4682
 Backscatter: -82.00 dB
 Refl. Thresh: -65.00 dB
 Loss Thresh: 0.10 dB
 End Thresh: 3.00 dB

Edit Trace Info

Results

- A1
 - Backup
 - Backup1
 - Backup2
 - 001
 - 002

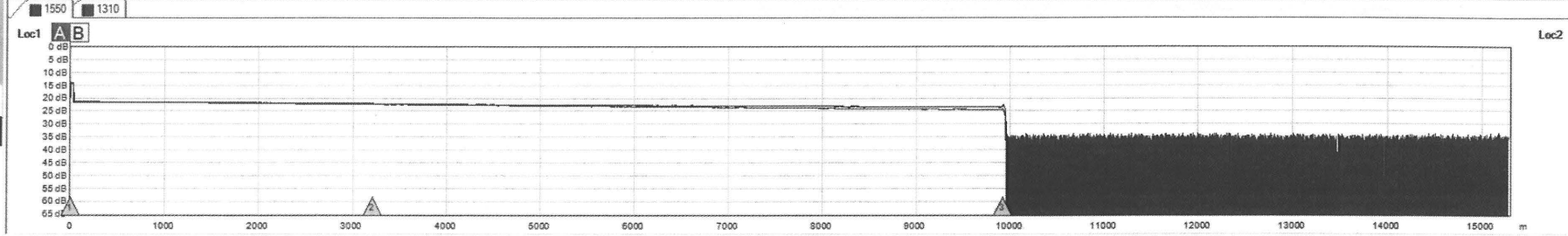
Press the button below to open the selected result.

Trace Viewer SM A-Z

Key to Result Icons
 OPM SingleMode Trace
 AutoTest MultiMode Trace

Job: TEST TRACK
 Route: Loc1_Loc2
 Cable: A1
 Fiber: 3
 OTDR @: Loc1

A: -161.4 m
 B: -161.4 m
 B-A: 0.0 m
 Two Point
 Insertion Loss B - A : 0.000 dB



Trace Info Text Info Unit Info

Date: 31-Jul-2018
 Time: 4:44 PM
 Module: M310
 Fiber: 3
 Cable ID: A1
 Wavelength: 1550 nm
 Pulse Width: 300 ns
 Range: 15,314.3 m
 Point Spacing: 0.5104762 m
 Averages: 6288
 GIR: 1.4682
 Backscatter: -82.00 dB
 Refl. Thresh: -65.00 dB
 Loss Thresh: 0.10 dB
 End Thresh: 3.00 dB

Edit Trace Info

Event Table

Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 4.90 dB		* 34.27 dB		9,927.6 m		0.494 dB / km	
#	Fiber Before	Atten. (dB/km)	Loss (dB)	Source	Event Type	Link Events	Location (m)	Refl (dB)	Loss (dB)
1	Link Start			Auto	Non-Reflective Start	0.0		--	0.000
2		0.731	3.427	Auto	Single Non-Reflective	3,214.6		--	0.331
3		0.112	1.147	Auto	Reflective End	9,927.6		-58.888	--

Test Results Manager

File Edit Tools Events View Help

Open Save Report Wizard Last Report Prev File Next File Horiz Zoom + Horiz Zoom - Vert Zoom + Vert Zoom - UnZoom ReZoom Prev Event Next Event Switch Cursor

Home **OTDR Trace Viewer** OLTS Viewer/Editor OTDR Trace Batch Editor

Results

A1

001
002
003
005
006

Job: TEST TRACK
Route: Loc1_Loc2
Cable: A1
Fiber: 4
OTDR @: Loc1

A: -10.2 m
B: -10.2 m
B-A: 0.0 m
Two Point
Insertion Loss B - A : 0.000 dB

Trace Info Text Info Unit Info

Date: 31-Jul-2018
Time: 4:49 PM
Module: M310
Fiber: 4
Cable ID: A1
Wavelength: 1310 nm
Pulse Width: 300 ns
Range: 15,318.8 m
Point Spacing: 0.5106257 m
Averages: 6304
GIR: 1.4678
Backscatter: -79.60 dB
Refl. Thresh: -65.00 dB
Loss Thresh: 0.10 dB
End Thresh: 3.00 dB

Edit Trace Info

Press the button below to open the selected result.

Trace Viewer SM A-Z

Key to Result Icons
OPM SingleMode Trace
Auto Test MultiMode Trace

Loc1 A B

0 dB
5 dB
10 dB
15 dB
20 dB
25 dB
30 dB
35 dB
40 dB
45 dB
50 dB
55 dB
60 dB
65 dB

0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000 15000 m

Loc2

Event Table

Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
4		* 6.26 dB		* 30.80 dB		9,926.4 m		0.631 dB / km	

#	Attenuation (dB/km)	Fiber Before Loss (dB)	Loss (dB)	Source	Event Type	Link Events Location (m)	Refl (dB)	Loss (dB)
1	--	--	--	Auto	Non-Reflective Start	0.0	--	0.000
2	1.328	5.086		Auto	Single Non-Reflective	3,213.5	--	0.172
3	--	0.629		Auto	Single Non-Reflective	5,427.1	--	0.293
4	0.038	0.172		Auto	Reflective End	9,926.4	-42.461	--

- Results
- 002
 - 003
 - 004
 - 005
 - 006
 - 007
 - 008

Press the button below to open the selected result.

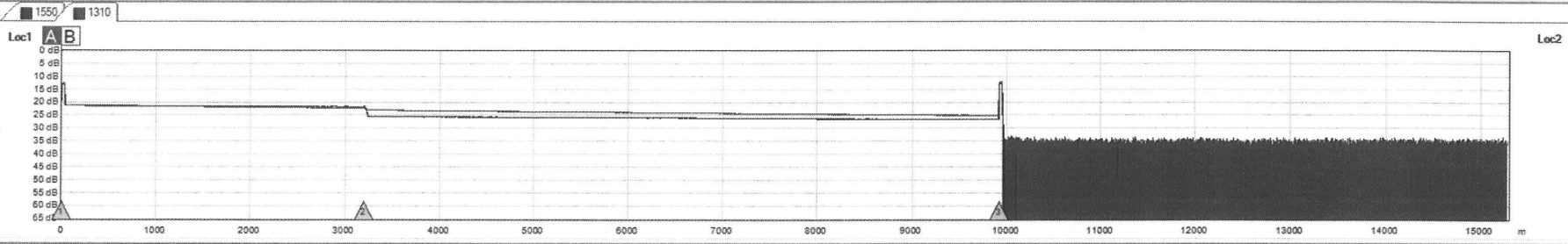
Trace Viewer SM A-Z

Key to Result Icons

- OPM
- SingleMode Trace
- Auto Test
- MultiMode Trace

Job: TEST TRACK
 Route: Loc1_Loc2
 Cable: A1
 Fiber: 5
 OTDR @: Loc1

A: -10.2 m
 B: -10.2 m
 B-A: 0.0 m
 Two Point
 Insertion Loss B - A : 0.000 dB



Trace Info Text Info Unit Info

Date:	31-Jul-2018
Time:	4:55 PM
Module:	M310
Fiber:	5
Cable ID:	A1
Wavelength:	1310 nm
Pulse Width:	300 ns
Range:	15,318.8 m
Point Spacing:	0.5106257 m
Averages:	6304
GIR:	1.4678
Backscatter:	-79.60 dB
Ref. Thresh:	-65.00 dB
Loss Thresh:	0.10 dB
End Thresh:	3.00 dB

Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 8.40 dB		* 30.98 dB		9,925.4 m		0.846 dB / km	
#	Fiber Before	Atten. (dB/km)	Loss (dB)	Source	Event Type	Link Events	Location (m)	Ref. (dB)	Loss (dB)
1	Link Start			Auto	Non-Reflective Start	0.0		--	0.000
2		1.365	5.533	Auto	Single Non-Reflective	3,210.4		--	0.809
3		0.306	2.058	Auto	Reflective End	9,925.4		-30.588	--

Edit Trace Info

- Results
- A1
 - 001
 - 002
 - 003
 - 004
 - 005

Press the button below to open the selected result.

Trace Viewer SM A->Z

Key to Result Icons

OPM SingleMode Trace

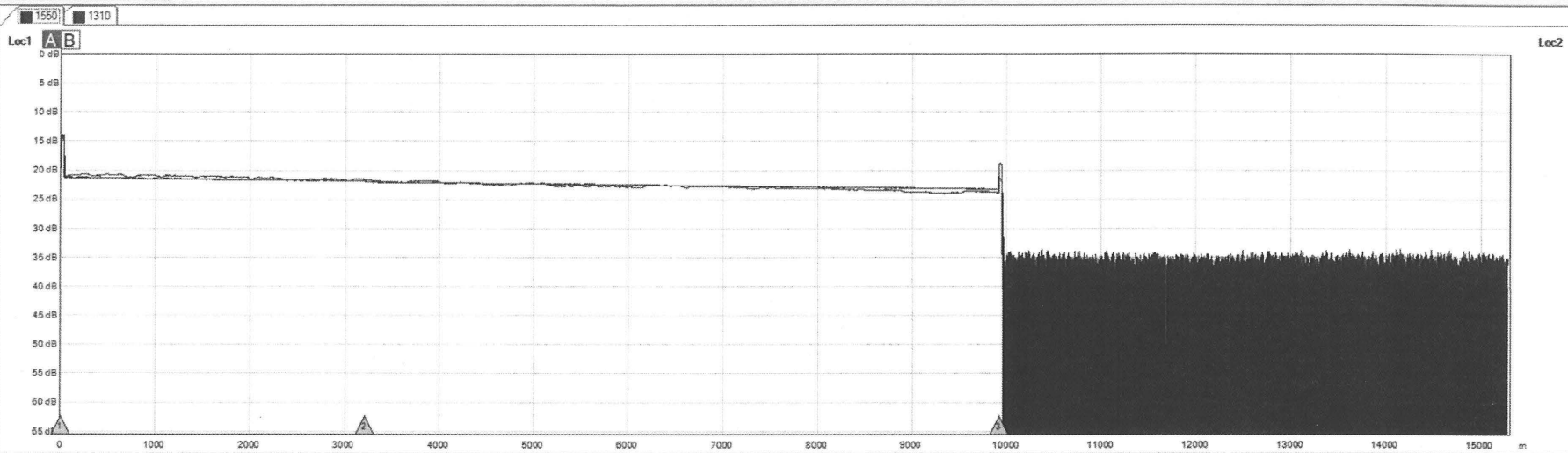
Auto Test MultiMode Trace

Job: TEST TRACK
 Route: Loc1_Loc2
 Cable: A1
 Fiber: 6
 OTDR @: Loc1

A: -10.2 m
 B: -10.2 m
 B-A: 0.0 m
 Two Point
 Insertion Loss B - A : 0.000 dB

Trace Info Text Info Unit Info

Date: 31-Jul-2018
 Time: 5:00 PM
 Module: M310
 Fiber: 6
 Cable ID: A1
 Wavelength: 1550 nm
 Pulse Width: 300 ns
 Range: 15,314.3 m
 Point Spacing: 0.5104762 m
 Averages: 6320
 GIR: 1.4682
 Backscatter: -82.00 dB
 Refl. Thresh: -65.00 dB
 Loss Thresh: 0.10 dB
 End Thresh: 3.00 dB



Event Table									
Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 3.59 dB		* 33.46 dB		9,926.5 m		0.362 dB / km	
#	Fiber Before	Loss (dB)	Source	Event Type	Link Events	Location (m)	Refl (dB)	Loss (dB)	
1			Auto	Reflective Start	0.0		-43.044	0.001	
2	0.203	2.230	Auto	Single Non-Reflective	3,212.0		--	0.208	
3	0.192	1.150	Auto	Reflective End	9,926.5		-48.979	--	

Edit Trace Info

Test Results Manager

File Edit Tools Events View Help

Open Save Report Wizard Last Report Prev File Next File Horiz Zoom + Horiz Zoom - Vert Zoom + Vert Zoom - UnZoom ReZoom Prev Event Next Event Switch Cursor

Home **OTDR Trace Viewer** OLTS Viewer/Editor OTDR Trace Batch Editor

Results

001
002
003
004
005
006

Press the button below to open the selected result.

Trace Viewer SM A->Z

Key to Result Icons
OPM SingleMode Trace
AutoTest MultiMode Trace

Job: TEST TRACK
Route: Loc1_Loc2
Cable: A1
Fiber: 7
OTDR @: Loc1

A: -10.2 m
B: -10.2 m
B-A: 0.0 m
Two Point
Insertion Loss B - A : 0.000 dB

Trace Info Text Info Unit Info

Date: 31-Jul-2018
Time: 5:03 PM
Module: M310
Fiber: 7
Cable ID: A1
Wavelength: 1550 nm
Pulse Width: 300 ns
Range: 15,314.3 m
Point Spacing: 0.5104762 m
Averages: 6304
GIR: 1.4682
Backscatter: -82.00 dB
Refl. Thresh: -65.00 dB
Loss Thresh: 0.10 dB
End Thresh: 3.00 dB

Edit Trace Info

1550 1310

Loc1 A B Loc2

0 dB
5 dB
10 dB
15 dB
20 dB
25 dB
30 dB
35 dB
40 dB
45 dB
50 dB
55 dB
60 dB
65 dB

0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000 15000 m

Event Table

Number of Events	Link Loss (dB)	Link ORL (dB)	Link Length (m)	Link Atten (dB/km)
2	* 2.79 dB	* 33.06 dB	9,932.7 m	0.281 dB / km

	Fiber Before	Loss (dB)	Source	Event Type	Link Events	Location (m)	Refl (dB)	Loss (dB)
1			Auto	Reflective Start	0.0		-42.305	0.001
2	0.281	2.792	Auto	Reflective End	9,932.7		-61.372	---

- 002
- 003
- 004
- 005
- 006
- 007

Press the button below to open the selected result.

Trace Viewer SM A-Z

Key to Result Icons

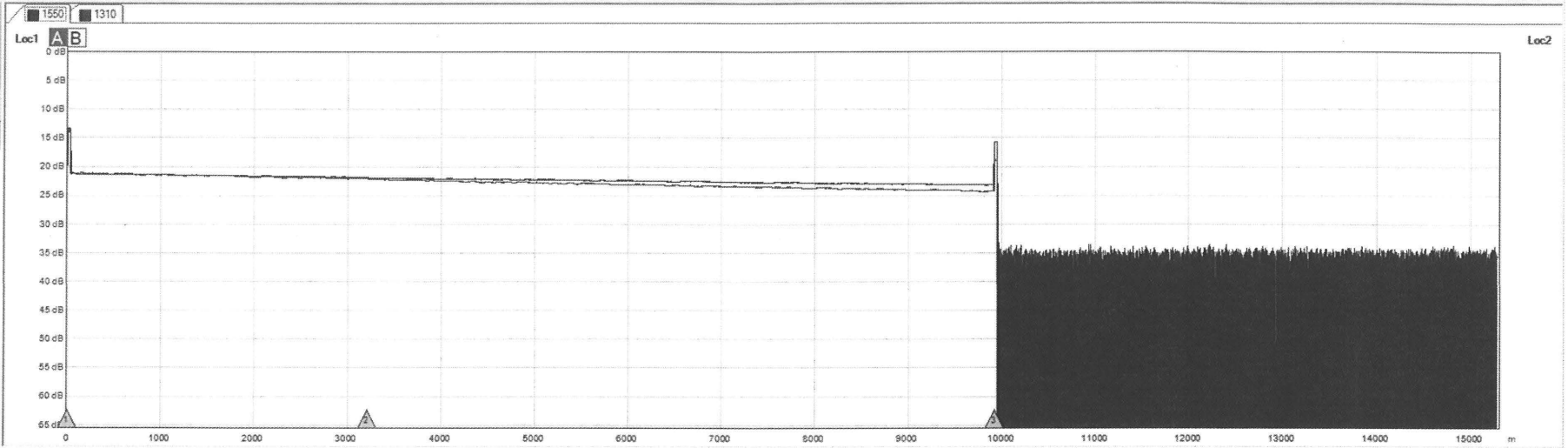
- OPM
- SingleMode Trace
- AutoTest
- MultiMode Trace

Job: TEST TRACK
 Router: Loc1_Loc2
 Cable: A1
 Fiber: 8
 OTRD @: Loc1

A: -10.2 m
 B: -10.2 m
 B-A: 0.0 m
 Two Point
 Insertion Loss B - A : 0.000 dB

Trace Info Text Info Unit Info

Date: 31-Jul-2018
 Time: 5:05 PM
 Module: M310
 Fiber: 8
 Cable ID: A1
 Wavelength: 1550 nm
 Pulse Width: 300 ns
 Range: 15,314.3 m
 Point Spacing: 0.5104762 m
 Averages: 6304
 GR: 1.4682
 Backscatter: -82.00 dB
 Refl. Thresh: -65.00 dB
 Loss Thresh: 0.10 dB
 End Thresh: 3.00 dB



Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 2.23 dB		* 33.62 dB		9,925.5 m		0.225 dB / km	
		Fiber Before		Link Events					
		Atten (dB/km)	Loss (dB)	Source	Event Type	Location (m)	Refl (dB)	Loss (dB)	
1	Link Start	--	--	Auto	Non-Reflective Start	0.0	--	0.000	
2		0.653	3.480	Auto	Single Non-Reflective	3,212.5	--	0.121	
3		--	-1.370	Auto	Reflective End	9,925.5	-42.605	--	

Edit Trace Info

- 003
- 004
- 005
- 006
- 007
- 008

Press the button below to open the selected result.

Trace Viewer SM A-Z

Key to Result Icons

OPM SingleMode Trace

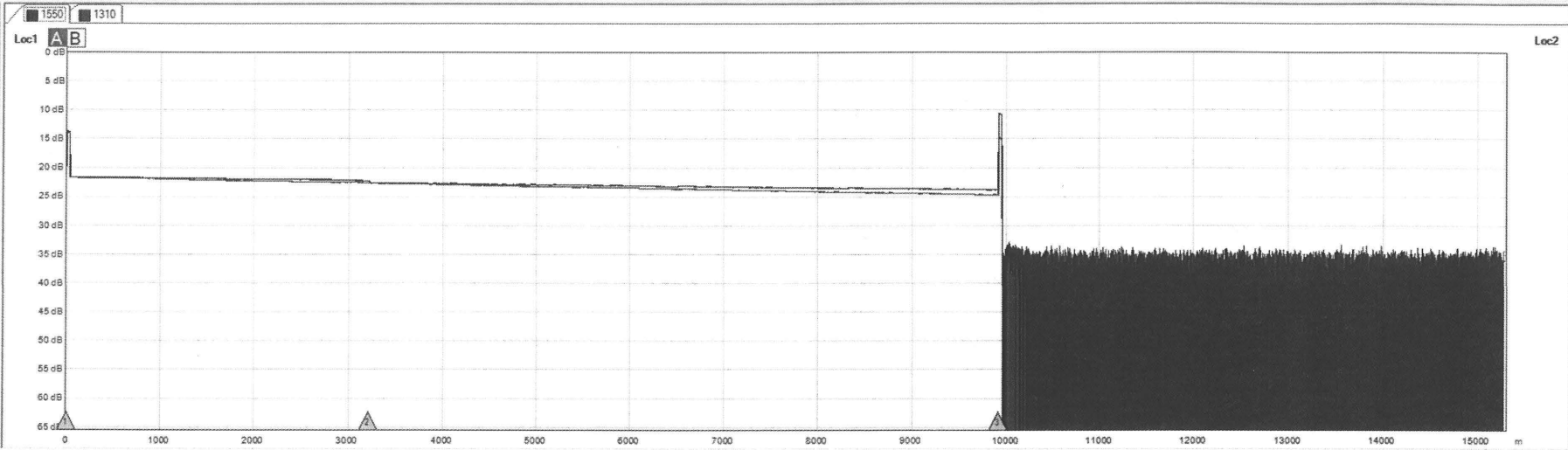
AutoTest MultiMode Trace

Job: TEST TRACK
 Route: Loc1_Loc2
 Cable: A1
 Fiber: 9
 OTRD @: Loc1

A: -10.2 m
 B: -10.2 m
 B-A: 0.0 m
 Two Point
 Insertion Loss B - A : 0.000 dB

Trace Info Text Info Unit Info

Date: 31-Jul-2018
 Time: 5:08 PM
 Module: M310
 Fiber: 9
 Cable ID: A1
 Wavelength: 1550 nm
 Pulse Width: 300 ns
 Range: 15,314.3 m
 Point Spacing: 0.5104762 m
 Averages: 6304
 GR: 1.4682
 Backscatter: -82.00 dB
 Refl. Thresh: -65.00 dB
 Loss Thresh: 0.10 dB
 End Thresh: 3.00 dB



Event Table									
Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 5.50 dB		* 32.28 dB		9,921.9 m		0.554 dB / km	
#	Fiber Before	Attenu (dB/km)	Loss (dB)	Source	Event Type	Link Events	Location (m)	Refl (dB)	Loss (dB)
1	Link Start			Auto	Non-Reflective Start	0.0		--	0.000
2		0.802	3.961	Auto	Single Non-Reflective	3.212.0		--	0.397
3		0.170	1.142	Auto	Reflective End	9.921.9		-30.91	--

Edit Trace Info

- 004
- 005
- 006
- 007
- 008
- 009
- 010

Press the button below to open the selected result.

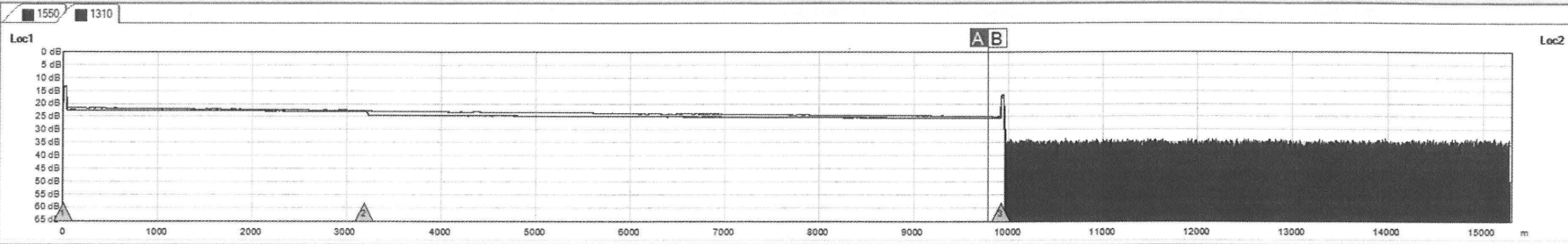
Trace Viewer SM A-Z

Key to Result Icons

- OPM
- SingleMode Trace
- AutoTest
- MultiMode Trace

Job: TEST TRACK
 Route: Loc1_Loc2
 Cable: A1
 Fiber: 10
 OTDR @: Loc1

A: 9,786.4 m
 B: 9,786.4 m
 B-A: 0.0 m
 Two Point
 Insertion Loss B - A : 0.000 dB



Trace Info	Text Info	Unit Info
Date:	31-Jul-2018	
Time:	5:11 PM	
Module:	M310	
Fiber:	10	
Cable ID:	A1	
Wavelength:	1310 nm	
Pulse Width:	300 ns	
Range:	15,318.8 m	
Point Spacing:	0.5106257 m	
Averages:	6288	
GIR:	1.4678	
Backscatter:	-79.60 dB	
Ref. Thresh:	-65.00 dB	
Loss Thresh:	0.10 dB	
End Thresh:	3.00 dB	

Event Table

Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 7.96 dB		* 30.46 dB		9,923.3 m		0.802 dB / km	
		Fiber Before				Link Events			
		Atten. (dB/km)	Loss (dB)	Source	Event Type	Location (m)	Ref. (dB)	Loss (dB)	
1	Link Start			Auto	Non-Reflective Start	0.0	--	0.000	
2		1.753	5.603	Auto	Single Reflective	3,197.1	-59.33	0.214	
3		0.319	2.145	Auto	Reflective End	9,923.3	-39.652	--	

Edit Trace Info

- Results
- 005
 - 006
 - 007
 - 008
 - 009
 - 010

Press the button below to open the selected result.

Trace Viewer SM A-Z

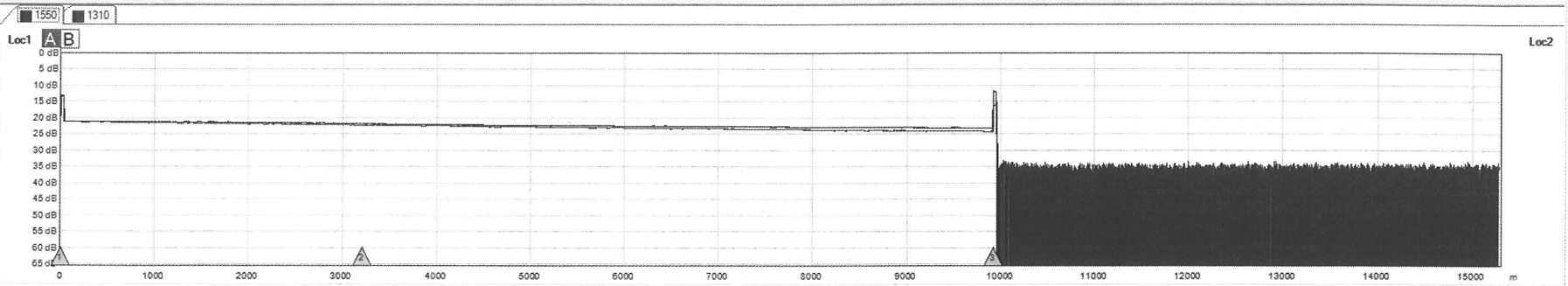
Key to Result Icons

OPM SingleMode Trace

AutoTest MultiMode Trace

Job: TEST TRACK
 Route: Loc1_Loc2
 Cable: A1
 Fiber: 11
 OTDR @: Loc1

A: -10.2 m
 B: -10.2 m
 B-A: 0.0 m
 Two Point
 Insertion Loss B - A : 0.000 dB



Trace Info Text Info Unit Info

Date: 31-Jul-2018
 Time: 5:14 PM
 Module: M310
 Fiber: 11
 Cable ID: A1
 Wavelength: 1550 nm
 Pulse Width: 300 ns
 Range: 15,314.3 m
 Point Spacing: 0.5104762 m
 Averages: 6320
 GR: 1.4682
 Backscatter: -82.00 dB
 Refl. Thresh: -65.00 dB
 Loss Thresh: 0.10 dB
 End Thresh: 3.00 dB

Edit Trace Info

Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 5.26 dB		* 33.02 dB		9,927.0 m		0.530 dB / km	
#	Fiber Before	Atten. (dB/km)	Loss (dB)	Source	Event Type	Location (m)	Refl (dB)	Loss (dB)	
1	Link Start			Auto	Non-Reflective Start	0.0	--	0.000	
2		0.200	3.680	Auto	Single Non-Reflective	3,213.6	--	0.227	
3		0.202	1.355	Auto	Reflective End	9,927.0	-34.438	--	

- Results
- 006
 - 007
 - 008
 - 009
 - 010
 - 011

Press the button below to open the selected result.

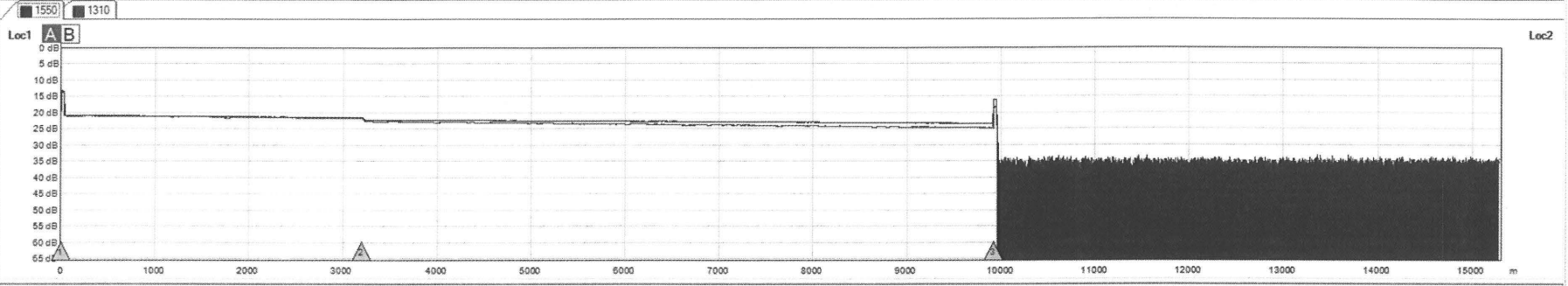
Trace Viewer SM A->Z

Key to Result Icons

- OPM
- SingleMode Trace
- Auto Test
- MultiMode Trace

Job: TEST TRACK
 Route: Loc1_Loc2
 Cable: A1
 Fiber: 12
 OTDR @: Loc1

A: -10.2 m
 B: -10.2 m
 B-A: 0.0 m
 Two Point
 Insertion Loss B - A : 0.000 dB



Trace Info Text Info Unit Info

Date: 31-Jul-2018
 Time: 5:16 PM
 Module: M310
 Fiber: 12
 Cable ID: A1
 Wavelength: 1550 nm
 Pulse Width: 300 ns
 Range: 15,314.3 m
 Point Spacing: 0.5104762 m
 Averages: 6288
 GIR: 1.4682
 Backscatter: -82.00 dB
 Refl. Thresh: -65.00 dB
 Loss Thresh: 0.10 dB
 End Thresh: 3.00 dB

Edit Trace Info

Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 3.87 dB		* 34.27 dB		9,927.6 m		0.390 dB / km	
#	Fiber Before	Atten (dB/km)	Loss (dB)	Source	Event Type	Location (m)	Refl (dB)	Loss (dB)	
1	Link Start			Auto	Reflective Start	0.0	-42.743	0.001	
2		0.184	1.943	Auto	Single Non-Reflective	3,211.0	--	0.713	
3		0.183	1.210	Auto	Reflective End	9,927.6	-47.626	--	

Results

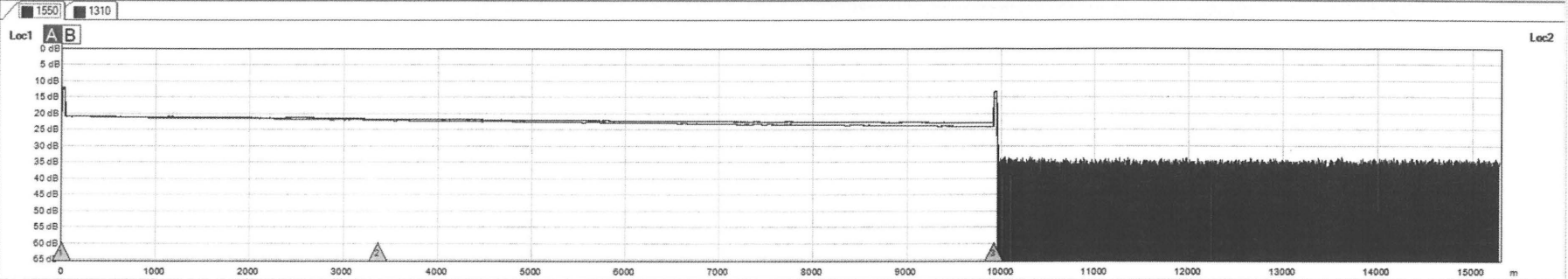
- Desktop
- My Documents
- C:
- D:
- IP Video System Design Tool
- IW2
- Shepherd

Expand the job tree on left to select an appropriate result icon.
Use the key on the right as a guide to result icons by type.
When an icon is selected, it can be opened with a double-click on the icon, or a single-click and then pressing the button below.

Key to Result Icons

- OPM
- SingleMode Trace
- AutoTest
- MultiMode Trace

Job: TEST TRACK
Route: Loc1_Loc2
Cable: A1
Fiber: 13
OTDR @: Loc1



A: -10.2 m
B: -10.2 m
B-A: 0.0 m
Two Point
Insertion Loss B - A : 0.000 dB

Trace Info Text Info Unit Info

Date: 31-Jul-2018
Time: 5:18 PM
Module: M310
Fiber: 13
Cable ID: A1
Wavelength: 1550 nm
Pulse Width: 300 ns
Range: 15,314.3 m
Point Spacing: 0.5104762 m
Averages: 6272
GIR: 1.4682
Backscatter: -82.00 dB
Ref. Thresh: -65.00 dB
Loss Thresh: 0.10 dB
End Thresh: 3.00 dB

Edit Trace Info

Number of Events		Link Loss (dB)		Link ORL (dB)		Link Length (m)		Link Atten (dB/km)	
3		* 5.39 dB		* 33.49 dB		9,926.5 m		0.543 dB / km	
#	Fiber Before	Atten (dB/km)	Loss (dB)	Source	Event Type	Location (m)	Ref (dB)	Loss (dB)	
1	Link Start			Auto	Non-Reflective Start	0.0	--	0.000	
2		0.620	4.124	Auto	Single Reflective	3,372.8	-61.793	0.208	
3		0.161	1.057	Auto	Reflective End	9,926.5	-37.482	--	

Abbreviations and Acronyms

Abbreviations & Acronyms	Definition
dB	Decibel
FRA	Federal Railroad Administration
FOAD	Fiber Optic Acoustic Detection
HTL	High Tonnage Loop
OTDR	Optical Time Domain Reflectometer
RTT	Railroad Test Track
TTC	Transportation Technology Center
TTCI	Transportation Technology Center, Inc.