LC Multimode Fiber Optic Connectors Terminated To 1.8 mm Simplex Cable With 62.5/125 µm Fiber

1. INTRODUCTION

1.1. Purpose

Testing was performed on LC multimode fiber optic connectors terminated to 1.8 mm simplex cable with 62.5/125 µm fiber to determine their conformance to the requirements stated in this document.

1.2. Scope

This report covers the optical and mechanical performance of cable assemblies, which consist of LC multimode connectors with 1.8 mm simplex cable and 62.5/125 µm fiber, manufactured by the Communications and Industrial Solutions Manufacturing Unit of Tyco Electronics. Testing was performed on 15Dec09.

1.3. Conclusion

LC simplex fiber optic cable assemblies, listed in section 1.5, meet the optical and mechanical performance requirements stated in this document. One sample failed to meet the stated mechanical requirement, see paragraph 2.3.

1.4. Product Description

Tyco Electronics LC multimode fiber optic connectors and cable assemblies are used in telephone company central offices, CATV headends, interbuilding backbones and customer premise applications. In particular, the small form factor of the LC connector is ideal for applications that require high-density utilization of space.

1.5. Test Samples

Samples were constructed using normal manufacturing means. Multimode 62.5/125 µm optical fiber was used in the following tests. The following sample quantities were used for the test group.

Test Group	1
Connector Type	Simplex LC Multimode
Connector Part Number	1918267-1
Fiber Type	Multimode 62.5/125 µm
Cable Type	1.8 mm Simplex MIL.TACT.
Cable PN	6828453-1
Coupling Receptacle PN	19185150-3
Test Cable Length (m)	3.2 m
Test Samples Required	8
Source Wavelength	850 and 1300 nm

* Trademark
| Indicates change

1.6. Design Verification Test Sequence

Test or Examination	Test Sequence
Examination of Product	1
Initial Optical Performance	2
Cable Retention, 0 Degree Pull	3

NOTE *Numbers indicate sequence in which tests are performed.*

2. SUMMARY OF TESTING

2.1. Examination of Product

Tyco Electronics Communications and Industrial Solutions Manufacturing Unit, using normal manufacturing processes, built all samples submitted for testing. The samples were inspected for conformance to the applicable production drawings.

2.2. Initial Optical Performance

All measurements met the stated performance goal. The maximum permitted loss is 0.75 dB. The minimum permitted return loss is 20 dB. Attenuation and return loss were measured at 850 and 1300 nm. The test results are tabularized below.

Test Group (N = 8)	Initial Attenuation (dB)			Initial Return Loss (dB)		
	Average	Minimum	Maximum	Average	Minimum	Maximum
850 nm	0.07	0.02	0.17	30.15	29.50	30.90
1300 nm	0.05	0.01	0.15	32.23	31.80	32.90

2.3. Cable Retention, 0 Degree Pull

All measurements met the stated performance goal. For the initial and final measurements, the maximum permitted loss is 0.75 dB. The minimum permitted return loss is 20 dB. Attenuation and return loss were measured at 850 and 1300 nm. The test results are tabularized below with graphs located in the Appendix.

NOTE *Sample number 7 met the stated optical requirements but did not meet the stated mechanical requirements. The sample failed per FOTPO-6, Failure Mode C, cable clamp failure. On sample number 7, the heat shrink tubing strain relief tore close behind the back side of the crimp eyelet, and some aramid strength members pulled loose from underneath the crimp eyelet. All other samples met the stated mechanical requirements.*

Test Group (N = 8)	Attenuation After Test (dB)			Return Loss After Test (dB)		
	Average	Minimum	Maximum	Average	Minimum	Maximum
850 nm	0.08	0.02	0.18	30.20	29.40	31.00
1300 nm	0.05	0.01	0.16	32.30	31.70	32.90

Test Group (N = 8)	Change In Attenuation Before/After Test (dB)	
	Average	Maximum
850 nm	0.01	0.01
1300 nm	0.00	0.01

3. TEST METHODS

All optical measurements were performed with the utilization of a multimode test system. This measurement facility is compliant with ANSI/TIA-568-C.3, Annex A. Loss and reflectance is measured at 850 and 1300 nm. Following the installation of the samples, sequential testing was performed. Changes in transmission were calculated from the difference between initial optical power at the start of the test and final optical power at a specified point later in the test. A negative change in transmission value indicates a decrease in optical power.

3.1. Examination of Product

Product drawings and quality inspection plans were used to examine the samples. They were examined visually and functionally.

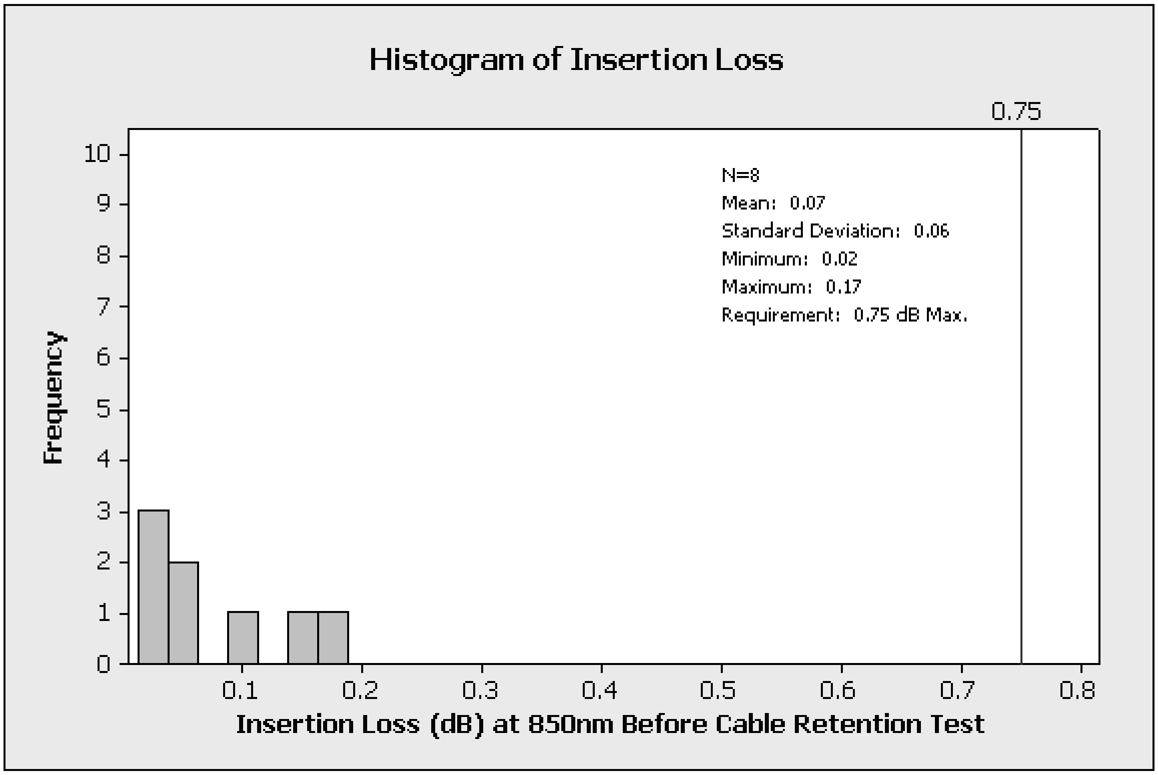
3.2. Initial Optical Performance

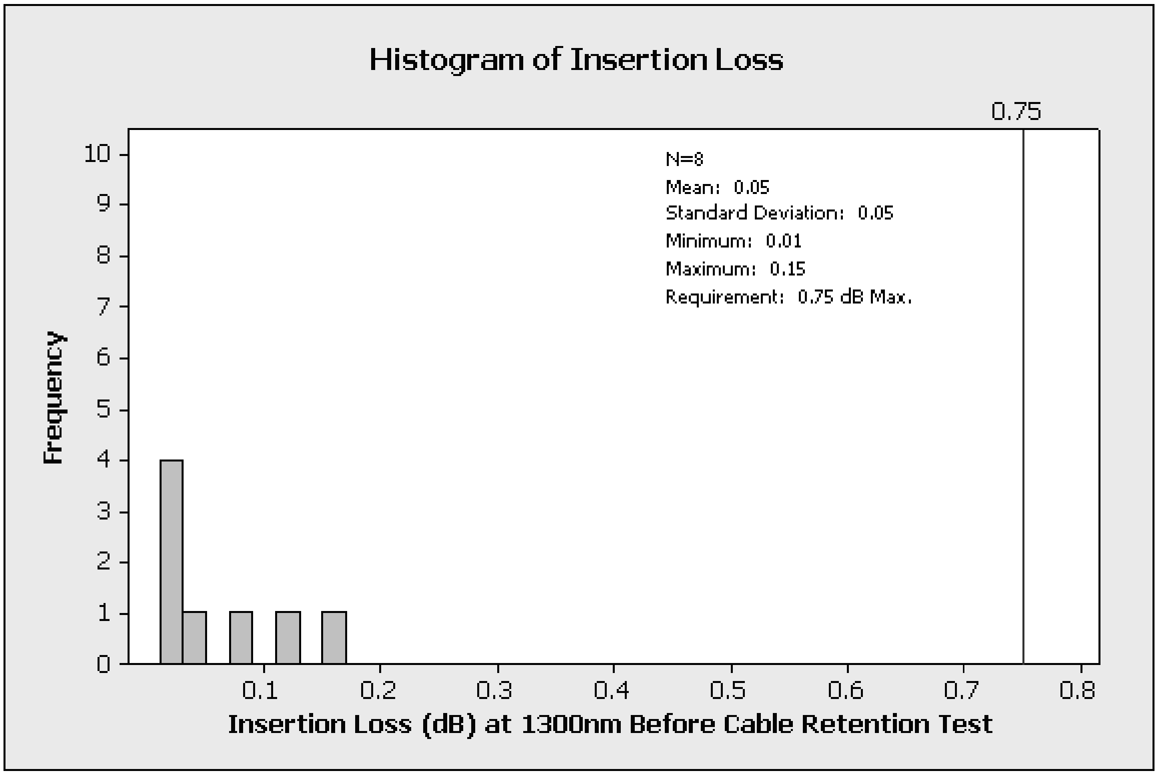
Initial optical power, through the selected launch connector fiber, was measured. The connector assembly was then mated and final optical power measured from the receive-side cable assembly. Cable assembly attenuation was calculated by taking the difference between the initial measurement and the final measurement. Return loss was performed using reflectance discrimination methodology.

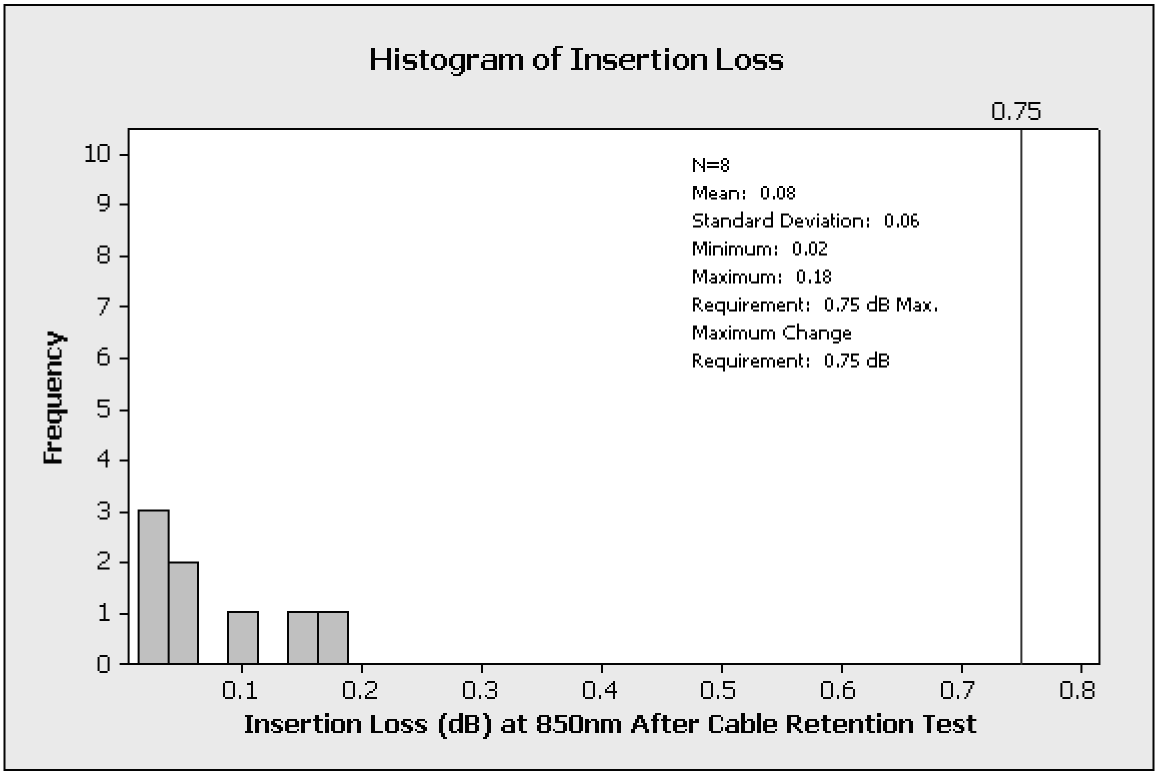
3.3. Cable Retention, 0 Degree Pull

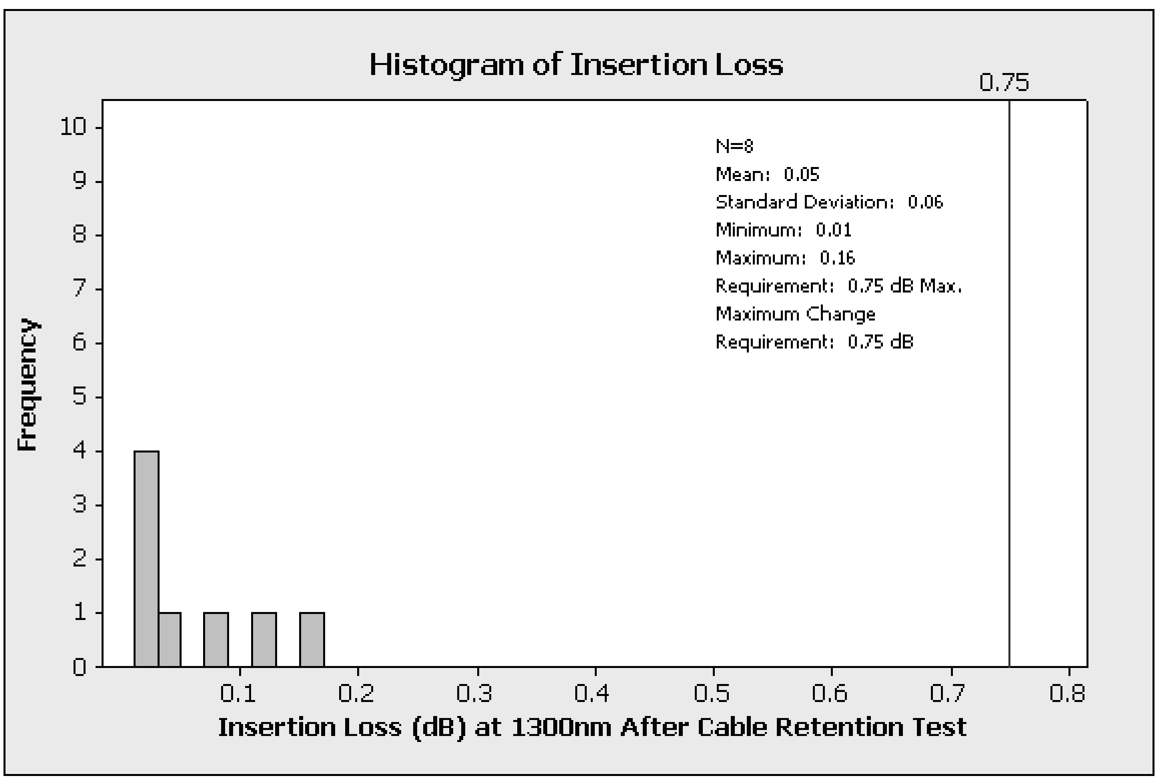
Using a 7.6 cm [3 in] mandrel, the receive sides of the simplex cable assemblies were wrapped 22 to 28 cm [10 in] behind the strain relief. With a load application rate of 5 N [1.12 lbf] per second, the simplex cable assemblies were subjected to a 66.72 N [15 lbf] axial load for a minimum of 5 seconds. Attenuation and return loss were measured before and after the load application.

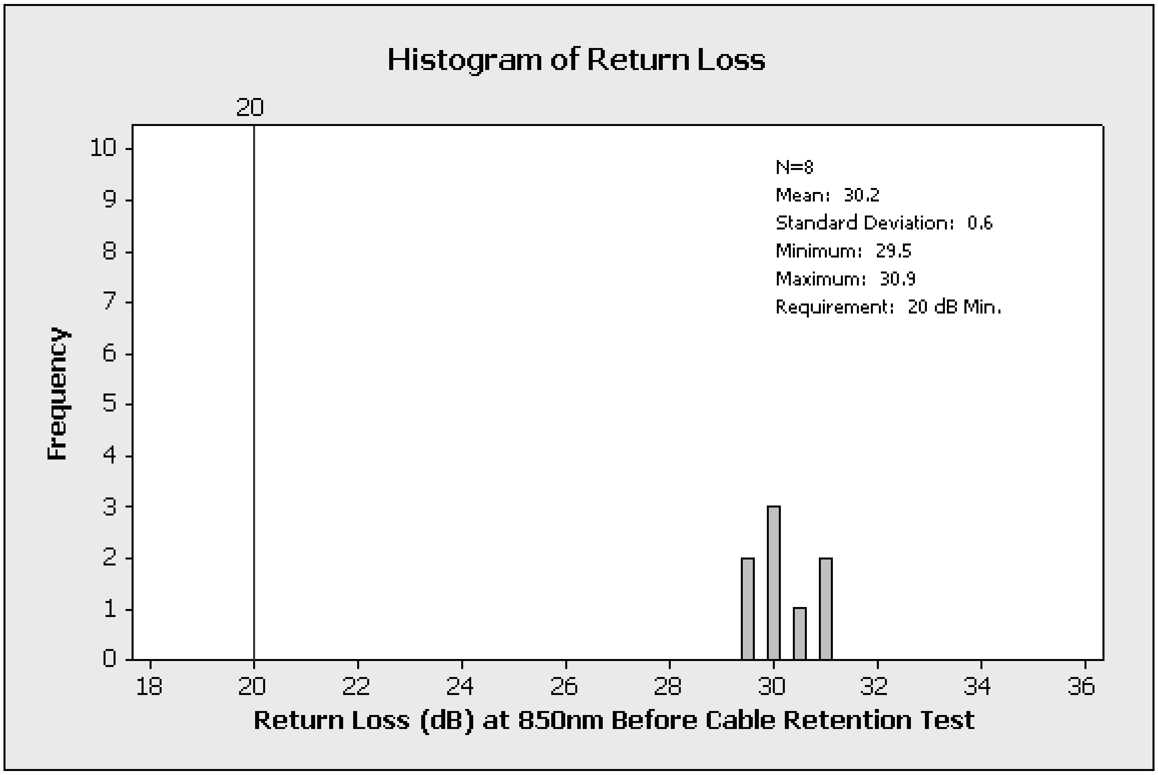
APPENDIX

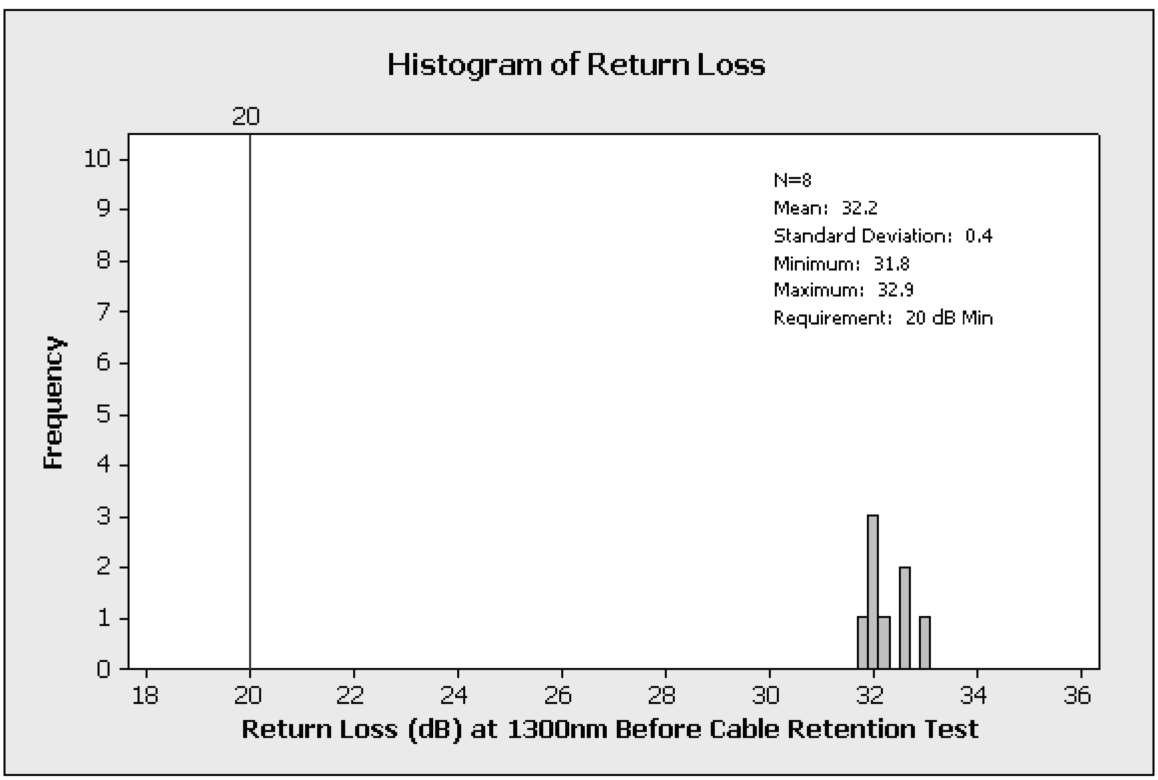

Histogram of Insertion Loss
0.75
N=8
Mean: 0.07
Standard Deviation: 0.06
Minimum: 0.02
Maximum: 0.17
Requirement: 0.75 dB Max.
Frequency
0
1
2
3
4
5
6
7
8
9
10
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Insertion Loss (dB) at 850nm Before Cable Retention Test

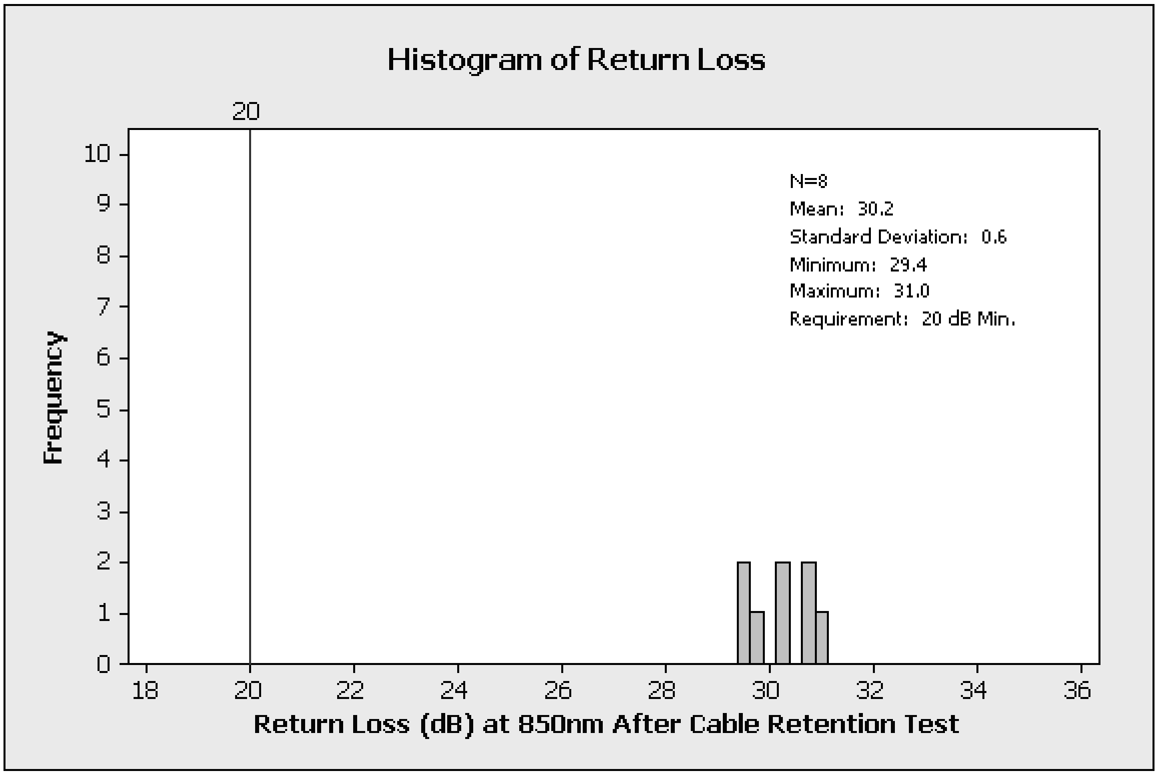

Histogram of Insertion Loss
0.75
N=8
Mean: 0.05
Standard Deviation: 0.05
Minimum: 0.01
Maximum: 0.15
Requirement: 0.75 dB Max.
Frequency
0
1
2
3
4
5
6
7
8
9
10
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Insertion Loss (dB) at 1300nm Before Cable Retention Test

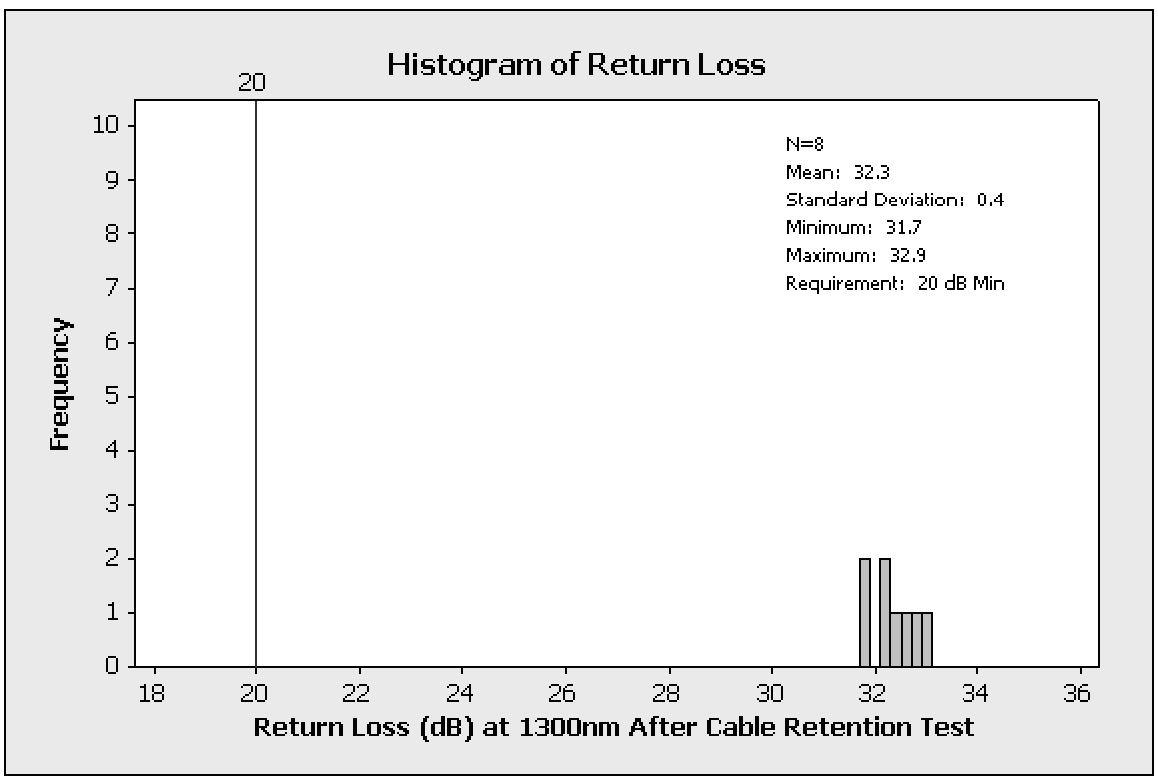

Histogram of Insertion Loss
0.75
N=8
Mean: 0.08
Standard Deviation: 0.06
Minimum: 0.02
Maximum: 0.18
Requirement: 0.75 dB Max.
Maximum Change
Requirement: 0.75 dB
Frequency
0
1
2
3
4
5
6
7
8
9
10
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Insertion Loss (dB) at 850nm After Cable Retention Test

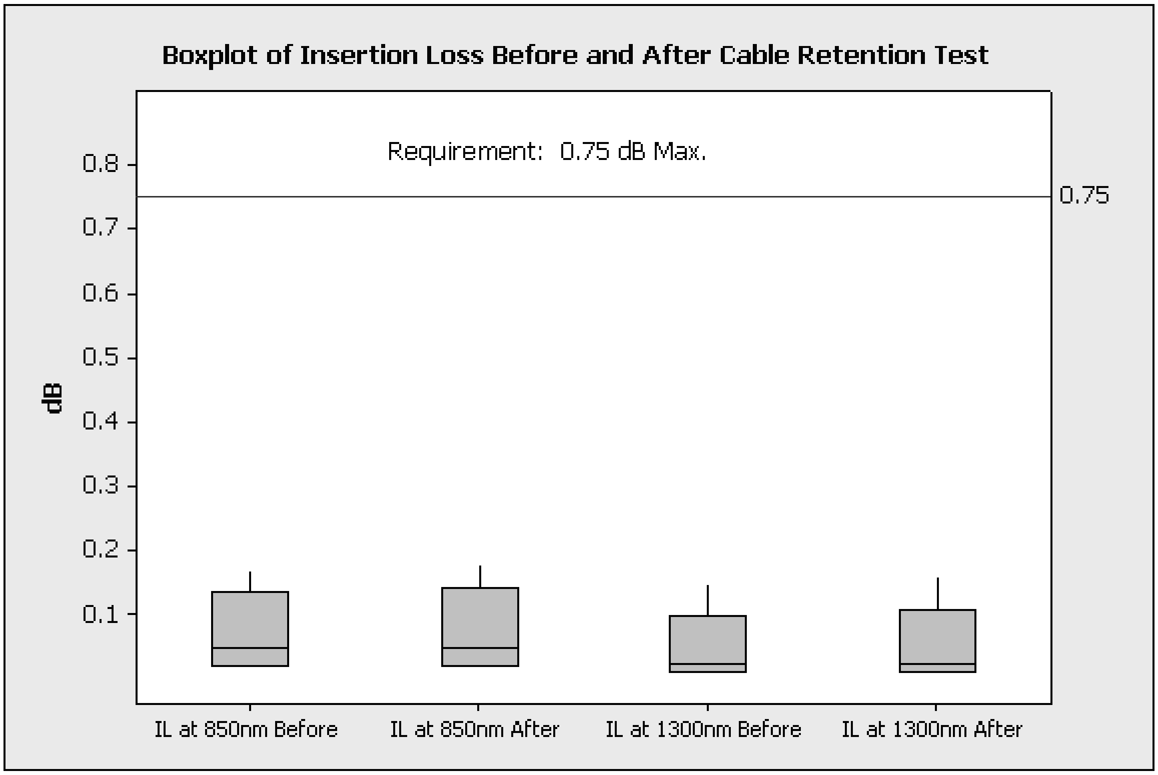

Histogram of Insertion Loss
0.75
N=8
Mean: 0.05
Standard Deviation: 0.06
Minimum: 0.01
Maximum: 0.16
Requirement: 0.75 dB Max.
Maximum Change
Requirement: 0.75 dB
Frequency
0
1
2
3
4
5
6
7
8
9
10
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Insertion Loss (dB) at 1300nm After Cable Retention Test

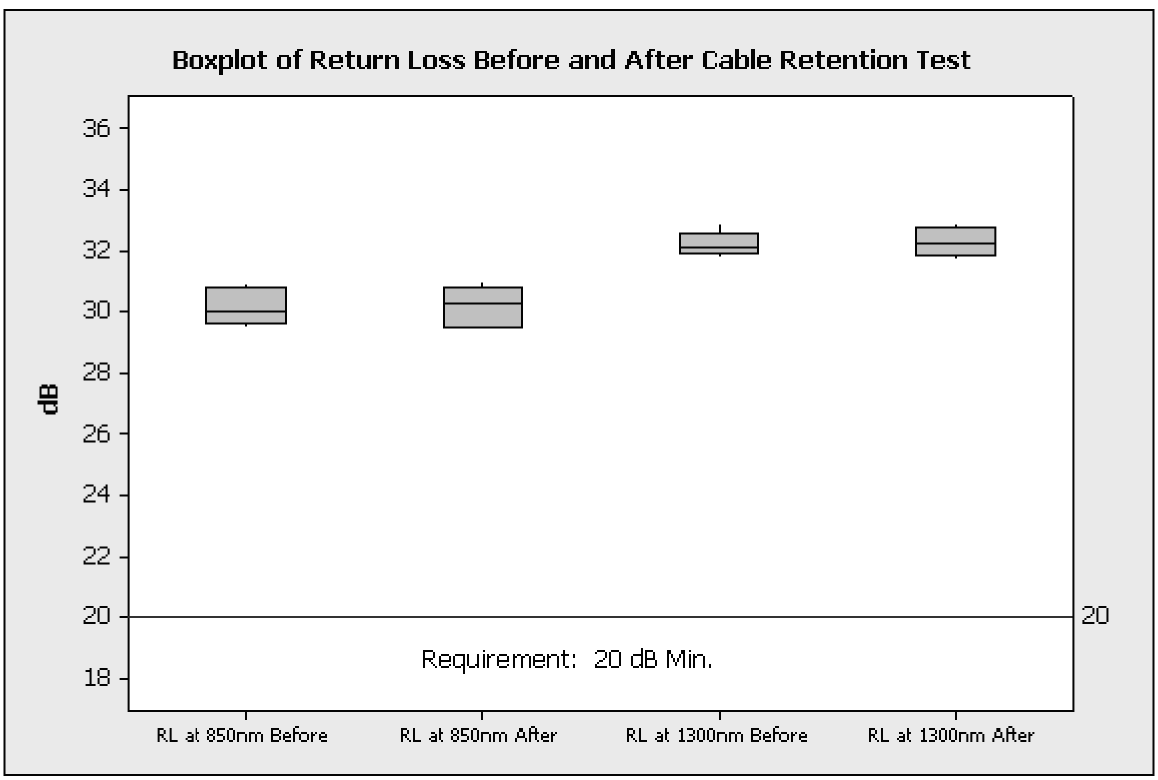

Histogram of Return Loss
20
N=8
Mean: 30.2
Standard Deviation: 0.6
Minimum: 29.5
Maximum: 30.9
Requirement: 20 dB Min.
Frequency
0
1
2
3
4
5
6
7
8
9
10
18
20
22
24
26
28
30
32
34
36
Return Loss (dB) at 850nm Before Cable Retention Test


Histogram of Return Loss
20
N=8
Mean: 32.2
Standard Deviation: 0.4
Minimum: 31.8
Maximum: 32.9
Requirement: 20 dB Min
Frequency
0
1
2
3
4
5
6
7
8
9
10
18
20
22
24
26
28
30
32
34
36
Return Loss (dB) at 1300nm Before Cable Retention Test


Histogram of Return Loss
20
N=8
Mean: 30.2
Standard Deviation: 0.6
Minimum: 29.4
Maximum: 31.0
Requirement: 20 dB Min.
Frequency
0
1
2
3
4
5
6
7
8
9
10
18
20
22
24
26
28
30
32
34
36
Return Loss (dB) at 850nm After Cable Retention Test


Histogram of Return Loss
20
N=8
Mean: 32.3
Standard Deviation: 0.4
Minimum: 31.7
Maximum: 32.9
Requirement: 20 dB Min
Frequency
0
1
2
3
4
5
6
7
8
9
10
18
20
22
24
26
28
30
32
34
36
Return Loss (dB) at 1300nm After Cable Retention Test


Boxplot of Insertion Loss Before and After Cable Retention Test
Requirement: 0.75 dB Max.
0.75
dB
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
IL at 850nm Before
IL at 850nm After
IL at 1300nm Before
IL at 1300nm After


Boxplot of Return Loss Before and After Cable Retention Test
dB
36
34
32
30
28
26
24
22
20
18
20
Requirement: 20 dB Min.
RL at 850nm Before
RL at 850nm After
RL at 1300nm Before
RL at 1300nm After