LC Singlemode Duplex Adapters With Zirconia Alignment Sleeves

1. INTRODUCTION

1.1. Purpose

Testing was performed on Tyco Electronics LC singlemode duplex adapters, with zirconia alignment sleeves, to determine their conformance to the requirements stated in this report.

1.2. Scope

This report covers the optical and mechanical performance of LC singlemode duplex adapters, manufactured by the Fiber Optic Business Unit of Tyco Electronics. Testing was performed between February 2002 and May 2002.

1.3. Conclusion

LC duplex adapters, listed in paragraph 1.5, meet the optical and mechanical performance requirements stated in this report.

1.4. Product Description

Tyco Electronics LC singlemode fiber optic adapters, connectors and cable assemblies are used in telephone company central offices, CATV headends, interbuilding backbones and customer premise applications.

1.5. Test Samples

Samples were constructed using normal manufacturing means. The following sample quantities were used for the test group.

Test Group	1
Coupling Receptacle PN	1457567-1
Alignment Sleeve Material	Zirconia
Adapter Form	SC Simplex Mounting Envelope
Connector Style	LC Jumper
Test samples required	24

NOTE *Singlemode, jumper-type LC connectors, terminated to 1.6mm jacketed cable, were used to test the adapter samples.*

Figure 1

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1.6. Design Verification Test Sequence

Test or Examination	Test Group (a)
	1
	Test Sequence (b)
Examination of Product	1
Initial Attenuation	2
Initial Return Loss	3
Mating Durability – 200 Cycles	4
Tensile Proof Strength – 15.0 lbf	5

NOTE
(a) See paragraph 1.5.
(b) Numbers indicate sequence in which tests are performed.

Figure 2

2. SUMMARY OF TESTING

2.1. Examination of Product

Tyco Electronics Fiber Optic Business Unit, using normal manufacturing processes, built all samples submitted for testing. The samples were inspected for conformance to the production print.

2.2. Attenuation

All attenuation measurements met the stated performance goal. The maximum permitted attenuation is 0.50 dB. Attenuation was measured at 1310 nm and 1550 nm wavelengths.

Test Group	1310 nm Attenuation Actual (dB)				1550 nm Attenuation Actual (dB)			
	Mean	Minimum	Maximum	Std. Dev.	Mean	Minimum	Maximum	Std. Dev.
1	0.09	0.01	0.23	0.061	0.09	0.03	0.22	0.051

Figure 3

2.3. Return Loss

All back reflection measurements met the stated performance goal. The minimum permitted return loss is 50 dB. Return loss was measured at 1310 nm and 1550 nm wavelengths.

Test Group	1310 nm Return Loss Actual (dB)				1550 nm Return Loss Actual (dB)			
	Mean	Minimum	Maximum	Std. Dev.	Mean	Minimum	Maximum	Std. Dev.
1	60.6	55.6	64.0	2.26	59.4	55.0	62.2	1.89

Figure 4

2.4. Mating Durability

All samples met the stated performance goals. All change in optical transmittance measurements met the maximum allowed requirement. The maximum allowable Change in Optical Transmittance (CIT), during or after the test, is 0.3 dB. The minimum permitted return loss, during or after the test, is 50 dB. The test results are summarized below. In addition, attenuation and return losses, before and after the test, are characterized in the appendix.

Test Group	1310 nm CIT During Test (dB)				1550 nm CIT During Test (dB)			
	Mean	Minimum	Maximum	Std. Dev.	Mean	Minimum	Maximum	Std. Dev.
1	0.00	-0.14	0.14	0.041	0.00	-0.15	0.14	0.034

Test Group	1310 nm CIT After Test (dB)				1550 nm CIT After Test (dB)			
	Mean	Minimum	Maximum	Std. Dev.	Mean	Minimum	Maximum	Std. Dev.
1	0.01	-0.09	0.13	0.050	0.00	-0.07	0.10	0.041

Test Group	1310 nm Return Loss During Test (dB)				1550 nm Return Loss During Test (dB)			
	Mean	Minimum	Maximum	Std. Dev.	Mean	Minimum	Maximum	Std. Dev.
1	60.9	54.4	66.1	2.14	59.8	53.3	67.2	1.90

Test Group	1310 nm Return Loss After Test (dB)				1550 nm Return Loss After Test (dB)			
	Mean	Minimum	Maximum	Std. Dev.	Mean	Minimum	Maximum	Std. Dev.
1	60.7	56.0	66.0	2.45	59.7	55.0	64.4	2.27

Figure 5

2.5. Tensile Proof Strength

All samples met the stated performance goals. All change in optical transmittance measurements met the maximum allowed requirement. The maximum allowable change in optical transmittance, after the test, is 0.3 dB. The minimum permitted return loss, after the test, is 50 dB. The test results are summarized below.

Test Group	1310 nm CIT After Test (dB)				1550 nm CIT After Test (dB)			
	Mean	Minimum	Maximum	Std. Dev.	Mean	Minimum	Maximum	Std. Dev.
1	0.00	-0.10	0.06	0.024	0.00	-0.07	0.07	0.020

Test Group	1310 nm Return Loss After Test (dB)				1550 nm Return Loss After Test (dB)			
	Mean	Minimum	Maximum	Std. Dev.	Mean	Minimum	Maximum	Std. Dev.
1	59.2	54.4	65.1	2.52	58.1	52.9	63.8	2.45

Figure 6

3. TEST METHODS

All optical measurements were performed with the utilization of a singlemode test system. This measurement facility is compliant with Telcordia GR-326-CORE. Attenuation and return loss were measured at 1310 nm and 1550 nm wavelengths. Following the installation of the samples, sequential testing was performed.

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. Attenuation

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.

3.3. Return Loss

Return loss was performed using optical time domain reflectometry.

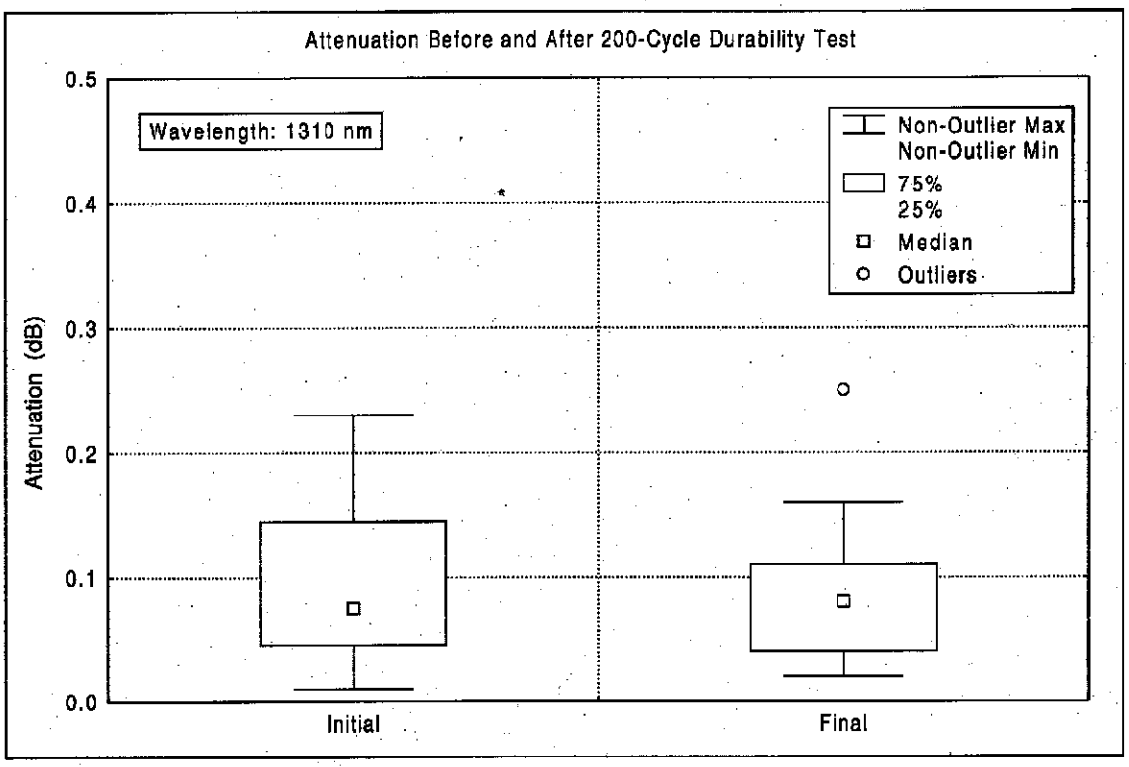
3.4. Mating Durability

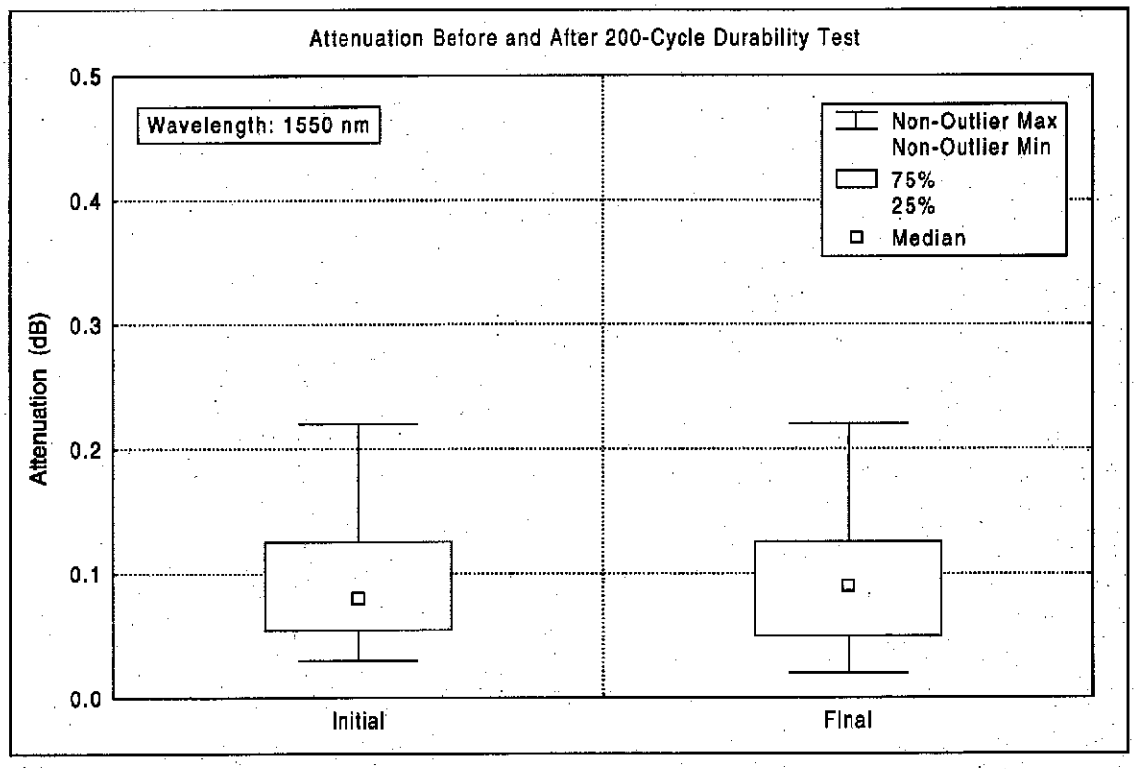
The connector, on one side of the mated pair, was subjected to 200 cycles. Samples were manually cycled at a rate not in excess of 300 cycles per hour. Attenuation and return loss were measured after every 10^{th} cycle. Prior to measurement, the samples were cleaned and inspected with a 400X microscope.

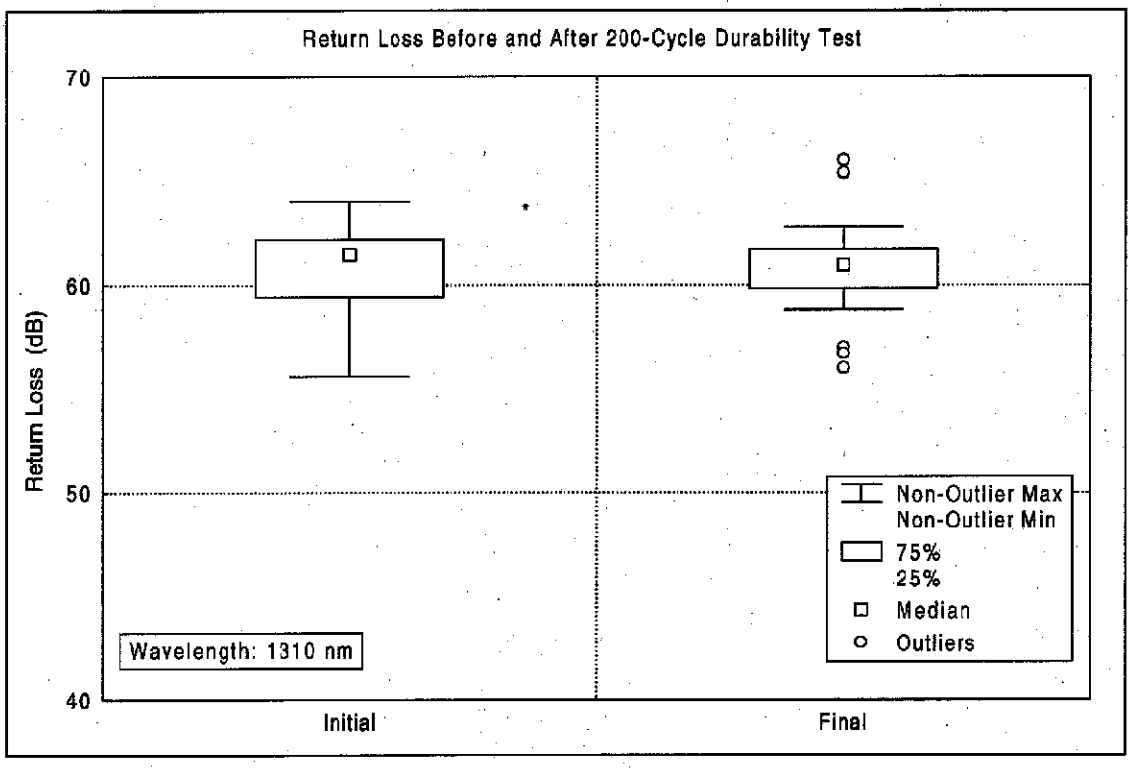
3.5. Tensile Proof Strength

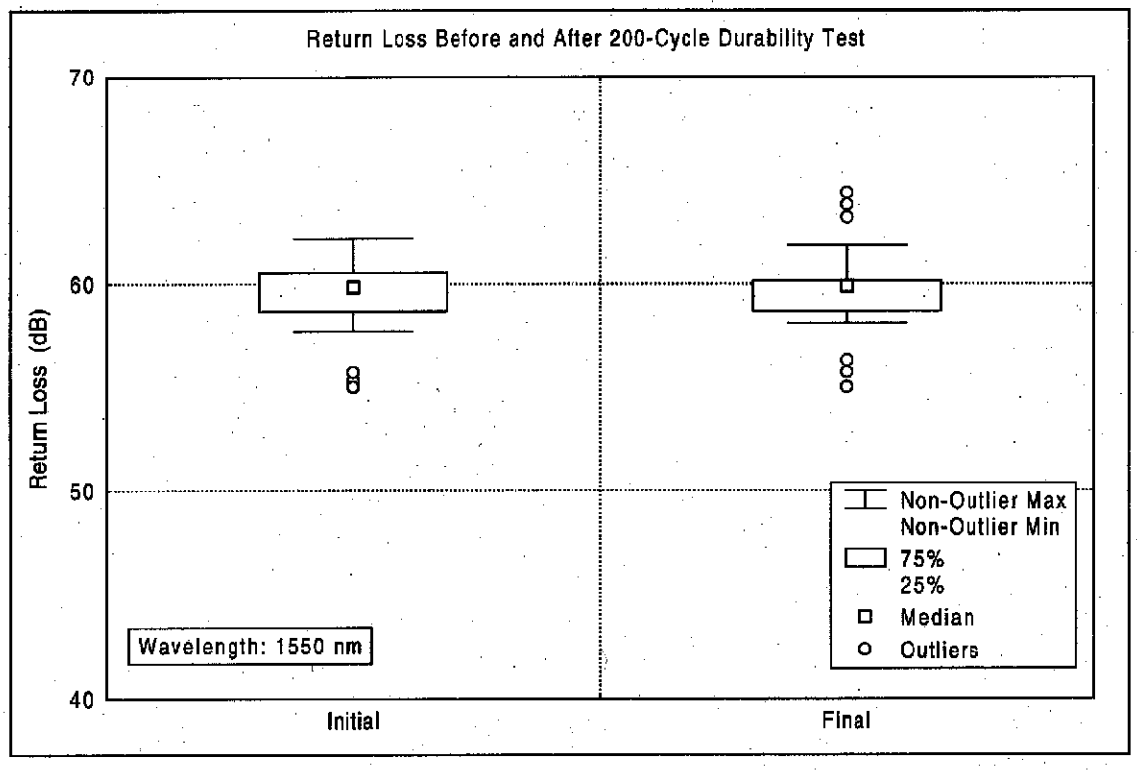
A 6.8 kg [15 lbf] load was applied to the receive side of the mated samples, using a 15.2 cm [6 in] diameter mandrel. The load was applied axially to the connector for a minimum of 5 seconds. Attenuation and return loss were measured at least 10 seconds after the load was removed.

APPENDIX


Attenuation Before and After 200-Cycle Durability Test
Wavelength: 1310 nm
Non-Outlier Max
Non-Outlier Min
75%
25%
Median
Outliers
Attenuation (dB)
0.5
0.4
0.3
0.2
0.1
0.0
Initial
Final


Attenuation Before and After 200-Cycle Durability Test
Wavelength: 1550 nm
Non-Outlier Max
Non-Outlier Min
75%
25%
Median
Attenuation (dB)
0.5
0.4
0.3
0.2
0.1
0.0
Initial
Final


Return Loss Before and After 200-Cycle Durability Test
70
60
50
40
Return Loss (dB)
Initial
Final
Non-Outlier Max
Non-Outlier Min
75%
25%
Median
Outliers
Wavelength: 1310 nm


Return Loss Before and After 200-Cycle Durability Test
70
60
50
40
Return Loss (dB)
Initial
Final
Non-Outlier Max
Non-Outlier Min
75%
25%
Median
Outliers
Wavelength: 1550 nm