# LC Duplex to SC Duplex Multimode Fiber Optic Cable Assemblies

## 1. INTRODUCTION

### 1.1. Purpose

Testing was performed on Tyco Electronics LC Duplex to SC Duplex multimode fiber optic cable assemblies to determine their conformance to tests that were excerpted from Telcordia GR-1435-CORE, Issue 1.

### 1.2. Scope

This report covers the optical, environmental, and mechanical performance of the LC Duplex to SC Duplex, 3.0 mm Zipcord, 50/125 multimode fiber optic cable assemblies, manufactured by Tyco Electronics, Fiber Optic Business Unit. Testing was performed between April 2003 and June 2003. The test file number for this testing is B045216-001.

### 1.3. Product Description

The cable assemblies are 50/125 micron multimode fiber optic cable assemblies with an LC duplex connector on one end and SC duplex connector on the other end of 3.0 mm jacketed Zipcord cable. These cables assemblies are used in data communication and telecommunications networks and equipment.

### 1.4. Test Specimens

The test specimens were produced in Shanghai (Waigaiqiao) using normal manufacturing means. Specimens consisted of the LC Duplex to SC Duplex cable assemblies and the following supplies shown in Figure 1.

| Component Description | Test Group | |
|---|---|---|
| | 1 | 2 |
| Fiber size (µm/µm) | 50/125 | |
| Cable type (see Note a) | Plenum | Riser |
| Cable assembly PN | 1693172-2 | 1693173-2 |
| Test specimen cable length (m) | 7 | 7 |
| LC coupling bushing PN (see Note b) | 1457567-5, 1374352-1 | |
| SC coupling bushing PN | 1278049-4 | |
| Launch and receive test leads | 1693220-1, 1693225-1 | |
| Test specimens required (see Note c) | 20 | 20 |
| Control cable required | Yes | No |

**NOTE**

*(a) 3.0 mm Zipcord.*
*(b) Flangeless adapter used for tension tests.*
*(c) See paragraph 3 for any exceptions to specimen size.*

Figure 1



* Trademark
| Indicates change

1.5. Test Sequence

| Test or Examination | Test Groups (a) | |
|---|---|---|
| | 1 | 2 |
| | Test Sequence (b) | |
| Examination of product | 1 | 1 |
| Attenuation | 2,4,6,8,15 | 2,4,11 |
| Ship shock | 3 | 3 |
| Heat age | 5 | |
| Vibration | 7 | |
| Twist | 9 | 5 |
| Proof, 0 degree pull | 10 | 6 |
| Proof, 90 degree pull | 11 | 7 |
| Straight pull | 12 | 8 |
| Side pull | 13 | 9 |
| Stability (flex) | 14 | 10 |

**NOTE**

*a. See paragraph 1.4.*
*b. Numbers indicate sequence in which tests are performed.*

Figure 2

## 2. SUMMARY OF TESTING

2.1. Examination of Product - All Test Groups

All specimens submitted for testing were manufactured using normal manufacturing methods, and were inspected by the Product Assurance Department of the Fiber Optic Business Unit.

2.2. Attenuation - All Test Groups

All initial attenuation measurements were less than 0.3 dB. Attenuation was measured at 850 and 1300 nm for 50/125 micron fiber size.

| Test Group | Maximum Attenuation (Single Specimen) | | | | Maximum Attenuation (Group Average) | | | |
|---|---|---|---|---|---|---|---|---|
| | 850 nm | | 1300 nm | | 850 nm | | 1300 nm | |
| | LC | SC | LC | SC | LC | SC | LC | SC |
| 1 | 0.28 | 0.18 | 0.20 | 0.16 | 0.09 | 0.07 | 0.06 | 0.04 |
| 2 | 0.20 | 0.16 | 0.14 | 0.12 | 0.08 | 0.06 | 0.05 | 0.04 |

Figure 3
Attenuation - Actual for New Product (dB)

2.3. Attenuation and Attenuation Increase – All Test Groups

All attenuation and attenuation increase measurements were recorded at 850 and 1300nm for 50/125 µm fiber size.

| Test Group | Condition | Actual (End of Test) | | | |
|---|---|---|---|---|---|
| | | 850 nm | | 1300 nm | |
| | | LC | SC | LC | SC |
| 1 | Ship shock | 0.58 (M)<br>0.29 (A)<br>0.4 (I) | 0.43 (M)<br>0.24 (A)<br>0.3 (I) | 0.51 (M)<br>0.22 (A)<br>0.4 (I) | 0.40 (M)<br>0.18 (A)<br>0.3 (I) |
| 1 | Heat age | 0.42 (M)<br>0.19 (A)<br>0.1 (I) | 0.45 (M)<br>0.17 (A)<br>0.1 (I) | 0.37 (M)<br>0.15 (A)<br>0.2 (I) | 0.40 (M)<br>0.14 (A)<br>0.1 (I) |
| 1 | Vibration | 0.42 (M)<br>0.21 (A)<br>0.1 (I) | 0.35 (M)<br>0.18 (A)<br>0.2 (I) | 0.35 (M)<br>0.14 (A)<br>0.1 (I) | 0.28 (M)<br>0.14 (A)<br>0.2 (I) |
| 1 | Tension tests | 0.38 (M)<br>0.18 (A)<br>0.1 (I) | 0.34 (M)<br>0.14 (A)<br>0.2 (I) | 0.32 (M)<br>0.13 (A)<br>0.0 (I) | 0.27 (M)<br>0.09 (A)<br>0.1 (I) |
| 2 | Ship shock | 0.31 (M)<br>0.14 (A)<br>0.1 (I) | 0.30 (M)<br>0.12 (A)<br>0.2 (I) | 0.24 (M)<br>0.09 (A)<br>0.1 (I) | 0.24 (M)<br>0.09 (A)<br>0.2 (I) |
| 2 | Tension tests | 0.32 (M)<br>0.11 (A)<br>0.0 (I) | 0.26 (M)<br>0.05 (A)<br>0.0 (I) | 0.23 (M)<br>0.07 (A)<br>0.0 (I) | 0.26 (M)<br>0.05 (A)<br>0.1 (I) |

**NOTE**

*(M) - Single specimen maximum attenuation*
*(A) - Group average attenuation*
*(I) - Attenuation Increase*

Figure 4
Attenuation and Attenuation Increase Results (dB)

## 3. TEST METHODS

3.1. Examination of Product

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

3.2. Attenuation

All attenuation readings were measured in accordance with FOTP-171, Method D1, processes, using reference-quality launch cables. The initial optical power through each of the launch connectors was measured. The specimen cable assembly was then mated to the launch connector and final optical power was recorded from the specimen. The connector attenuation was calculated by taking the difference between the initial measurement and the final measurement. Each specimen connector was mated and unmated a total of 3 times, and optical transmittance was measured after each cycle. Both connector ends of each cable assembly were tested. Optical power readings were compensated by changes in a source monitor cable. Attenuation was initially measured on new product and repeated after each test in the sequence.

3.3. Attenuation Increase

The initial attenuation was recorded before the test using an optical source and detector. Final attenuation was recorded at the completion of each test. Change in attenuation was calculated for each test specimen by taking the difference between the initial and final attenuation measurements. Attenuation increase was determined to be the greatest difference that was a decrease in optical power. Optical power readings were compensated by changes in the source monitor cable.

3.4. Ship Shock

All specimen cable assemblies as well as test lead assemblies were mated to adapters and exposed to thermal shock. Testing consisted of 5 cycles between 60 and -40˚C with 1-hour dwells at each temperature extreme. Attenuation was measured after test.

3.5. Heat Age

Mated specimens from Test Group 1 were subjected to 85˚C with an uncontrolled standard ambient humidity for a period of 10 days. Attenuation was measured at ambient conditions before and after test.

3.6. Vibration

Ten mated specimens from Test Group 1 were subjected to sinusoidal vibration from 10 to 55 Hz for 2 hours in each of 3 mutually perpendicular axes. Both the SC and LC connector ends were fixtured to the vibration test equipment. Optical performance was observed before and after vibration in each axis. Following the test, attenuation was recorded for each specimen.

3.7. Tension Tests

Half of the specimen quantities for each connector type were subjected to the series of tension tests per Telcordia GR-1435-CORE, Issue 1, Section 5.6.4.2. Level 1 loads were used per Table 4-5 in GR-1435-CORE. Specimens were subjected to the following tests: Twist, Proof (0 degrees), Proof (90 degrees), Straight Pull, Side Pull, and Stability (Flex). For all tests, optical transmittance was recorded before and after test. In addition, optical performance was observed during test for Straight Pull, Side Pull and Stability (Flex) tests. Following the completion of the series of tension tests, final attenuation was recorded for each specimen.