LC, Singlemode, One-Piece Housing, Fiber Optic Connector

1. INTRODUCTION

1.1. Purpose

Testing was performed on Tyco Electronics LC singlemode, one-piece housing, fiber optic connectors and adapters to determine their conformance to the requirements of Section 3, General Requirements, and Section 4, Connector Tests and Criteria, of Telcordia Technologies, GR-326-CORE, Issue 3, September 1999.

1.2. Scope

This report covers the performance of LC singlemode, one-piece housing, fiber optic connectors terminated to 1.6 mm simplex, matched-cladding, OFNR, singlemode cable. Cable assemblies were manufactured by Tyco Electronics, Fiber Optics Business Unit. Product was tested to the General Requirements and Connector Tests and Criteria of Telcordia Technologies GR-326-CORE, Issue 3, September 1999. Product was tested at 1490 and 1625 nm wavelengths in addition to the 1310 and 1550 nm wavelengths required by Telcordia Technologies, GR-326-CORE, Issue 3. Testing was performed by Intertek Testing Services (ITS) NA, Inc., 3933 US Route 11, Cortland, NY 13045. Testing was performed from 12Dec05 through 08Jan07. The test file number for this testing is B066497-005. This documentation is on file at and available from the Tyco Electronics Fiber Optics Business Unit.

1.3. Conclusion

Tyco Electronics LC singlemode, one-piece housing, fiber optic connectors and adapters conform to Telcordia Technologies GR-326-CORE, Issue 3 Requirements and Objectives except as noted in the attached Report #3081121 from ITS. Apex Offset measurements were reported to be non-conforming on three of the samples measured for endface geometry at ITS after the samples were tested per the qualification plan. Endface geometry measurements were taken at ITS prior to the qualification testing and were passing for all samples. The samples were measured for end face geometry by Tyco Electronics, Fiber Optics Business Unit Test Laboratory before and after qualification testing was performed at ITS, and all Apex Offset measurements were determined to be conforming to the requirements stated in GR-326-CORE, Issue 3. The test file number for this testing is B066497-005. This documentation is on file at and available from the Tyco Electronics Fiber Optics Business Unit.

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Report Format
☑ Client Customized
Test Location: Cortland, NY

FINAL REPORT FOR:

Tyco Electronics
2900 Fulling Mill Road
Middletown, PA 17057

Product: Single Mode LC Connector

Tested to Telcordia Technologies' GR-326-CORE, Issue 3, September 1999

Date: January 26, 2007
Project: 3081121
Report: 3081121

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Criteria Conformance Summary (GR-326-CORE)

Evaluation For: Tyco Electronics
Product: Single Mode LC Connector

CRITERIA CONFORMANCE SUMMARY[1]

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS[2]	Comments
3	**General Requirements**						
3.1	**Documentation**						
R3-1 (3.1)	Test Reports Test Reports issued under the terms of this document shall include the following information: 1. The ordering information for the items being tested. This is to include as appropriate: the part number and model number for the adapter, connector plug, cable assembly, etc. 2. The specification for the media type. 3. The manufacturer and type of fiber being used. 4. The base materials being used in the connector plug and adapter. 5. A list of the metallic materials which come into contact with each other, used in the adapter and the plug. 6. The operating instructions included with the product, for example, the cleaning instructions. 7. A description of the training material the supplier recommends for training operators in the use of the product.	√				C	
R3-2 (3.1)	Product Documentation A complete set of documentation in accordance with GR-454-CORE, *Generic Requirements for Supplier Provided Documentation*, shall be available from the manufacturer upon request and shall provide all related information, as applicable to the particular connector, alignment sleeve, or jumper assembly product, to describe: 1. Use and application 2. Cleaning procedures 3. Bend radius limits at 1310 nm and 1550 nm 4. Operational limits (temperature, humidity, etc.) 5. Testing operations 6. Materials used for ferrule, sleeve, plug body, housing, etc. 7. Traceability information for critical components obtained from third party sources, e.g., ferrules and alignment elements 8. Safety instructions 9. Auxiliary equipment required and usage 10. Storage and transportation instructions 11. Packaging list of all items included in the shipping container. The documentation may require preparation in accordance with instructions from the individual customers.	√				C	

[1] Not part of GR-326-CORE.
[2] Each criterion will be addressed with a compliant, noncompliant, not applicable, or evaluation not requested.

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Section (Para.)	**GR-326-CORE** Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS[2]	Comments
3.2	**Packaging and Shipping**						
R3-3 (3.2)	Packaging The packaging shall be adequate to ensure that the product will not be damaged under normal handling , shipping, and storage. Jumper cables shall be packaged individually.		√	√		C	
3.3	**Design Features**						
3.3.1	**Materials**						
R3-4 (3.3.1)	Metallic elements shall be corrosion resistant. Dissimilar metals shall not be used in contact with each other unless they are suitably finished to prevent electrolytic corrosion.	√		√		C	Documentation Review
R3-5 (3.3.1)	The connector product shall not incorporate an index matching fluid or gel which is designed to prevent glass-to-air contact or glass-to-glass contact nor require application of such material use.	√		√		C	
R3-6 (3.3.1)	Polymeric materials that are used shall not support fungus growth per ASTM-G21-70. A rating of 0 (zero) is required.				√	ENR	Not Evaluated
R3-7 (3.3.1)	Polymeric materials that are used shall have a rating of V-1 or better as determined by Underwriters Laboratories (UL) Standard 94, and an oxygen index of 28 percent or greater as determined by ASTM D-2863-87.				√	C	Documentation Review
R3-8 (3.3.1)	The media on which the connector plugs are mounted shall meet the criteria in either GR-409-CORE, *Generic Requirements for Premises Fiber Optical Cable*, or GR-20-CORE, *Generic Requirements for Optical Fiber and Optical Fiber Cable*. Cable media types shall be defined as follows: Type I Media: Reinforced jacketed cable of any diameter used as jumper cordage.[3] Type II Media: Cable with 900 µm buffer coating that may or may not be reinforced. Type III Media: Connectors mounted on fiber with a 250 µm coating.	√		√		C	Documentation Review
3.3.2	**Cleanability**						
O3-9 (3.3.2)	The connector structure should allow the area of the ferrule that engages the alignment sleeve to be cleaned by means of the cleaning procedures in Section 4.3.	√		√		C	

[3] Type I media may include simplex, duplex, or quad cable products.

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		VERIFY	ANALYZE	INSPECT	TEST	RESULTS[2]	Comments
3.4	**Intermateability**						
CR3-10 (3.4)	The product (connectors, adapters) shall meet the requirements of the applicable FOCIS-n (ANSI/TIA/EIA-604-n), where "n" is a number designation assigned to a specific connector type. The requirements should be met on both new product and after the completion of the Service Life Tests.				√	C	Documentation Review
CR3-11 (3.4)	The ferrule extension distance and the spring loading force shall meet the conditional limits specified by TIA/EIA FOCIS documents.				√	ENR	Not Evaluated
CR3-12 (3.4)	The distance between the mechanical reference planes for the connector adapters shall be with in the limits specified by the TIA/EIA FOCIS documents.				√	C	
CR3-13 (3.4)	The force required to remove a gauge pin from the adapter sleeve shall meet the requirements specified in the TIA/EIA FOCIS documents.				√	ENR	Not Evaluated
CR3-14 (3.4)	The latch spacing for the connector adapters sleeve shall meet the requirements specified in the TIA/EIA FOCIS documents.				√	NA	Not Applicable
CR3-15 (3.4)	The glass transition temperature of the latches in the connector adapters shall be > 100°C.				√	NA	Not Applicable
3.4.1	**Latching Intermateability Requirements for Push-Pull Type Connectors**						
CO3-16 (3.4.1)	No more than 30% of the connectors (a total of 43 connectors) shall fail the latchability test.				√	NA	Not Applicable
3.5	**Product Marking and Packaging**						
R3-17 (3.5)	Connector plugs and adapters shall be marked to identify the supplier, the model or series of the parts, and a code that identifies the vintage of the parts. Vintage markings shall allow for the identification by date of the adapters to within 6 months and the plugs to within 3 months.	√		√		C	
O3-18 (3.5)	Connector plugs, of non-angled polished connectors, should be color-coded on the basis of their typical maximum reflectance when mated to themselves, using the color code indicated in Table 3-1 in GR-326.	√		√		C	
CR3-19 (3.5)	Angled polished connectors (APC) shall have green plug body or green boots.	√		√		NA	Not Applicable
3.5.1	**Keying**						
O3-20 (3.5.1)	The connector plug shall be keyed such that a particular angular orientation is required for insertion of the plug adapter.	√		√		C	
O3-21 (3.5.1)	The key orientation should be clearly visible either through the design of the connector plug and adapter or by means of marking on the plug and adapter.	√		√		C	

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3.6	**Safety**						
R3-22 (3.6)	The instructions that describe the procedures for cleaning the adapters and plugs shall indicate the possible hazard due to the presence of invisible (infrared) radiation when examining connectors with the naked eye or using a microscope. The instructions shall also contain ordering information for an IR indicator card (Edmund Scientific Part #53-031 or equivalent) to allow visualization of invisible light.	√		√		C	
R3-23 (3.6)	The instructions that describe the procedures for cleaning the adapters and plugs shall contain the following information regarding any materials that are used for cleaning that may be considered hazardous to health or to the environment: 1. Warning as to the toxicity hazard 2. Instructions for handling and use 3. Instructions for disposal.	√		√		C	

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Section (Para.)	**GR-326-CORE** Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
4.4	**Statement of Criteria**						
4.4.1	**Performance of New Product**						
R4-2 **(4.4.1)**	New Product Maximum Loss Requirement All connections in the population shall meet the New Product Loss Requirement of 0.40 dB stated in Table 4-2 of GR-326-CORE.				√	C	
O4-3 **(4.4.1)**	New Product Maximum Loss Objective All connections in the population should meet the New Product Loss Objective of 0.20 dB stated in Table 4-2 of GR-326-CORE.				√	C	
R4-4 **(4.4.1)**	New Product Mean Loss Requirement The mean of the losses for the population of connections shall meet the New Product Mean Loss Requirement of 0.20 dB stated in Table 4-2 of GR-326-CORE.				√	C	
O4-5 **(4.4.1)**	New Product Mean Loss Objective The mean of the losses for the population of connections should meet the New Product Mean Loss Objective of 0.15 dB stated in Table 4-2 of GR-326-CORE.				√	C	
R4-6 **(4.4.1)**	New Product Reflectance (Digital) All connections in the population shall meet the New Product Reflectance Requirement of -40 dB stated in Table 4-3 of GR-326-CORE.				√	C	
CR4-7 **(4.4.1)**	New Product Reflectance (Analog) Connectors intended for use in AM-VSB (analog video) systems shall meet the Conditional Requirement of -55 dB stated in Table 4-3 of GR-326-CORE.				√	C	
CO4-8 **(4.4.1)**	New Product Reflectance (Analog) Connectors intended for use in AM-VSB (analog video) systems should meet the Conditional Objective of -60 dB stated in Table 4-3 of GR-326-CORE.				√	NA	Not Applicable
4.4.2	**Temperature, Humidity, Condensation Tests**						
4.4.2.1	**Thermal Age Test**						
R4-9 **(4.4.2.1)**	Thermal Age Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	

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O4-10 (4.4.2.1)	Thermal Age Test Objectives The product should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
4.4.2.2	**Thermal Cycle Test**						
R4-11 (4.4.2.2)	Thermal Cycle Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
O4-12 (4.4.2.2)	Thermal Cycle Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
4.4.2.3	**Humidity Aging Test**						
R4-13 (4.4.2.3)	Humidity Aging Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
O4-14 (4.4.2.3)	Humidity Aging Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	N C[4]	
4.4.2.4	**Humidity / Condensation Cycling Test**						
R4-15 (4.4.2.4)	Humidity / Condensation Cycling Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
O4-16 (4.4.2.4)	Humidity / Condensation Cycling Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	N C[4]	
4.4.2.5	**Dry-Out Step**				√	C	
4.4.2.6	**Post-Condensation Thermal Cycle Test**						
R4-17 (4.4.2.6)	Post-Condensation Thermal Cycle Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	N C[5]	

[4] One connector assembly was noncompliant with the maximum reflectance objective at 1310 nm.
[5] One connector assembly was noncompliant with the maximum reflectance increase objective at 1550 nm and 1625 nm.

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		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	
O4-18 (4.4.2.6)	Post-Condensation Thermal Cycle Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	N C[6]	
4.4.3	**Mechanical Tests**						
4.4.3.1	**Vibration Test**						
R4-19 (4.4.3.1)	Vibration Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
O4-20 (4.4.3.1)	Vibration Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	N C[7]	
4.4.3.2	**Flex Test**						
R4-21 (4.4.3.2)	Flex Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
O4-22 (4.4.3.2)	Flex Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	N C[8]	
CO4-23 (4.4.3.2)	Flex Test Objective for Small Form Factor Connectors When applying a 0.9 kgf (2.0 lbf) load to Small Form Factor Connectors, the product shall not become uncoupled under this load and should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load."				√	E N R	
4.4.3.3	**Twist Test**						
R4-24 (4.4.3.3)	Twist Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
O4-25 (4.4.3.3)	Twist Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	N C[8]	

[6] One connector assembly was noncompliant with the maximum reflectance objective at 1310 nm wavelength. One connector assembly was noncompliant with the maximum reflectance objective at 1310 nm, 1550 nm, and 1625 nm, and the maximum reflectance increase objective at all wavelengths.
[7] One connector assembly was noncompliant with the maximum reflectance objective at 1310 nm.
[8] Five connector assemblies were noncompliant with the maximum reflectance objective at 1310 nm. One connector assembly was noncompliant with the maximum reflectance objective at 1310 nm and 1550 nm.

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Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
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4.4.3.4	**Proof Test**						
R4-26 **(4.4.3.4)**	Proof Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
O4-27 **(4.4.3.4)**	Proof Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	N C[9]	
CO4-28 **(4.4.3.4)**	90° Side Pull Proof Test Objectives for Small Form Factor Connectors The Small Form Factor Connectors shall not become uncoupled under this load and it should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" when subjected to the higher loading level in Step 'g'.				√	N C[9]	
4.4.3.5	**Transmission with Applied Tensile Load**						
R4-29 **(4.4.3.5)**	Transmission with Applied Load at 0° Requirements The product shall not become uncoupled under this load and shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 0° in Table 4-9 (GR-326-CORE), for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest which was supported shall be reported.				√	C	
R4-30 **(4.4.3.5)**	Transmission with Applied Load at 90° Requirements The product shall not become uncoupled under this load and shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 90° in Table 4-9 (GR-326-CORE) or for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.				√	C	
O4-31 **(4.4.3.5)**	Transmission with Applied Load at 0° Objectives The product shall not become uncoupled under this load and should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 0° in Table 4-9 (GR-326-CORE) or for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.				√	C	

[9] Six connector assemblies were noncompliant with the maximum reflectance objective at 1310 nm. Two connector assemblies were noncompliant with the maximum reflectance objective at 1310 nm and 1550 nm.

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O4-32 **(4.4.3.5)**	Transmission with Applied Load at 90° Objectives The product shall not become uncoupled under this load and should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 90° in Table 4-9 (GR-326-CORE) or for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.				√	C	
CO4-33 **(4.4.3.5)**	Transmission with Applied Load at 90° Objectives for Small Form Factor Connectors Small Form Factor Connectors shall not become uncoupled under this load and should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 90° in Table 4-9 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.				√	C	
R4-34 **(4.4.3.5)**	Use in High Density Environments The supplier of a connector or jumper assembly product shall state if that product is intended for use in a "high density" environment. See Section 4.1.1 of GR-326-CORE for definition.				√	C	
CR4-35 **(4.4.3.5)**	Transmission with Applied Load at 135° If the product is intended for use in "high density" environments, then it should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 135° in Table 4-9 (GR-326-CORE) or for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.				√	C	
CO4-36 **(4.4.3.5)**	Transmission with Applied Load at 135° for Small Form Factor Connectors If the Small Form Factor Connector is intended for use in "high density" environments, then it should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 135° in Table 4-9 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.				√	C	

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4.4.3.6	**Equilibrium Tensile Load**					NA	Not Applicable
4.4.3.7	**Impact Test**						
R4-37 (4.4.3.7)	Impact Test Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	C	
O4-38 (4.4.3.7)	Impact Test Objectives The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".				√	NC[10]	
4.4.3.8	**Durability**						
R4-39 (4.4.3.8)	Remateability Requirement Of the entire body of measurements taken after either one-sided or two-sided cleaning (at insertion 25, 50…), 95% shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load."				√	C	
O4-40 (4.4.3.8)	Remateability with Cleaning Objective Of the entire body of measurements taken after either one-sided or two-sided cleaning (at insertion 25, 50…), 95% shall meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load."				√	NC[11]	
O4-41 (4.4.3.8)	Remateability without Cleaning Objective Of the entire body of measurements taken without cleaning (at insertions 24, 49…), 90% shall meet the loss and reflectance Requirements (not Objectives) listed in tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load."				√	C	

[10] Five connector assemblies were noncompliant with the maximum reflectance objective at 1310 nm. One connector assembly was noncompliant with the maximum reflectance objective at 1310 nm, 1490 nm, and 1550 nm.
[11] Less than 95% of the samples met the maximum reflectance objective at 1310 and 1550 nm.

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Section (Para.)	**GR-326-CORE** Requirement and Objective Summary	Method of Conformance					
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R4-42 **(4.4.3.8)**	Durability Requirement After having been subjected to the complete set of 200 insertions, the product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load." Up to two re-cleanings may be performed for each connection.				√	NC[12]	
O4-43 **(4.4.3.8)**	Durability Objective After having been subjected to the complete set of 200 insertions, the product shall meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load." Up to two re-cleanings may be performed for each connection.				√	NC[13]	
O4-44 **(4.4.3.8)**	Cleanability Objective The criterion is not met if connectors which are nonconforming after 200 insertions and the subsequent two-sided cleaning are brought back into conformance by one or two re-cleanings.				√	NC[14]	

[12] One connector had noncompliant loss readings after 100 durability cycles, which was attributed to fiber breakage upon Tyco/Electronics inspection. This sample was noncompliant with the maximum loss requirement, maximum loss increase requirement, and the maximum reflectance increase requirement at all wavelengths. In addition, the entire sample population was noncompliant with the mean loss requirement at all wavelengths

[13] The connector assembly that had high loss readings after 100 durability cycles was noncompliant with the maximum loss objective, maximum loss increase objective, maximum reflectance objective, and the maximum reflectance increase objective at all wavelengths. Seven connector assemblies were noncompliant with the maximum reflectance objective at 1310 nm. Two connector assemblies were noncompliant with the maximum reflectance objective at 1310 nm and 1550 nm. In addition, the entire sample population was noncompliant with the mean loss requirement at all wavelengths.

[14] The connector assembly that had high loss readings after 100 durability cycles was noncompliant with the maximum loss objective, maximum loss increase objective, maximum reflectance objective, and the maximum reflectance increase objective at all wavelengths. The remainder of the population was not subject to the one or two re-cleanings.

Intertek
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Criteria Conformance Summary (GR-326-CORE)

Evaluation For: Tyco Electronics
Product: Single Mode LC Connector

Section (Para.)	**GR-326-CORE** Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
4.4.3.9	**End of Test Criteria**						
R4-45 **(4.4.3.9)**	Optical Requirements The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "End of Test."				√	C	
O4-46 **(4.4.3.9)**	Optical Objectives The product shall meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "End of Test."				√	NC[15]	
R4-47 **(4.4.3.9)**	Ferrule Endface Geometry The product shall meet the Ferrule Endface Geometry Requirement criteria stated in Section 4.4.5.1 of GR-326-CORE.				√	NC[16]	
R4-48 **(4.4.3.9)**	Damage At the completion of the tests there shall be no damage that would impair the performance of either the connector plug or the adapter, as described in Section 4.2.3 of GR-326-CORE.				√	C	
4.4.4	**Materials and Environmental Tests**						
4.4.4.1	**Dust Test**						
R4-49 **(4.4.4.1)**	Dust Test Requirements: Set "A" The product of Set "A" (Group I) shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" during the first measurement (before cleaning).				√	ENR	Not Evaluated
R4-50 **(4.4.4.1)**	Dust Test Requirements: Set "A" and "B" The product of both Sets "A" and "B" (Groups II and III) should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" after the last cleaning in Step "1".				√	ENR	Not Evaluated

[15] Two connector assemblies were noncompliant with the maximum reflectance objective at 1310 nm. Two connector assemblies were noncompliant with the maximum reflectance objective at all wavelengths.
[16] Three samples exceeded the Apex Offset requirement of 50um.

Intertek
ETL Semko
Criteria Conformance Summary (GR-326-CORE)

Evaluation For: Tyco Electronics
Product: Single Mode LC Connector

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
O4-51 (4.4.4.1)	Dust Test Objectives The product of both Sets "A" and "B" (Groups II and III) should meet the loss and reflectance Requirements (not Objectives) criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" after the last cleaning in Step "i".				√	ENR	Not Evaluated
O4-52 (4.4.4.1)	Dust Test Cleanability Objective The criterion is not met if connectors which are nonconforming to the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, after the first cleaning in Step "G" or Step "J" are brought back into conformance during the subsequent two cleanings.				√	ENR	Not Evaluated
O4-53 (4.4.4.1)	Dust Resistance Objective The criterion is not met if product which is conforming after the first cleaning becomes nonconforming after a subsequent cleaning.				√	ENR	Not Evaluated
4.4.4.2	**Adhesive Test**						
R4-54 (4.4.4.2)	Adhesive Test After subjecting the specimens to loading with a ceramic blank for 7 days at 65°C with uncontrolled humidity, the endface geometry shall still be within the tolerances allowed by the Fiber Undercut and Protrusion Requirement [80] (4.4.5.1 or Section 4.4.5.2).				√	C	
4.4.4.3	**Airborne Contaminants**						
R4-55 (4.4.4.3)	Airborne Contaminants Requirements: Set "A" The product of Set "A" (Group I) shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" during the first measurement (before cleaning).				√	ENR	Not Evaluated
R4-56 (4.4.4.3)	Airborne Contaminants Requirements: Set "A" and "B" The product of both Sets "A" and "B" (Groups II and III) shall meet the loss and reflectance Requirements criteria listed in tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" after the last cleaning in Step "1".				√	ENR	Not Evaluated
O4-57 (4.4.4.3)	Airborne Contaminants Objectives The product of both Sets "A" and "B" (Groups II and III) should meet the loss and reflectance Requirements (not Objectives) criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" after the last cleaning in Step "i".				√	ENR	Not Evaluated
R4-58 (4.4.4.3)	Airborne Contaminants Corrosion Requirement There shall be no visual evidence of the formation of corrosion under visual inspection.				√	ENR	Not Evaluated

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Evaluation For: Tyco Electronics
Product: Single Mode LC Connector

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					Comments
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	
4.4.4.4	**Salt Spray**						
R4-59 **(4.4.4.4)**	Salt Spray Requirements: Set "A" The product of Set "A" (Group I) shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" during the first measurement (before cleaning).				√	ENR	Not Evaluated
R4-60 **(4.4.4.4)**	Salt Spray Requirements: Set "A" and "B" The product of both Sets "A" and "B" (Groups II and III) shall meet the loss and reflectance Requirements criteria listed in tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" after the last cleaning in Step "1".				√	ENR	Not Evaluated
O4-61 **(4.4.4.4)**	Salt Spray Objectives The product of both Sets "A" and "B" (Groups II and III) should meet the loss and reflectance Requirements (not Objectives) criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" after the last cleaning in Step "i".				√	ENR	Not Evaluated
R4-62 **(4.4.4.4)**	Salt Spray Corrosion Requirement There shall be no visual evidence of the formation of corrosion under visual inspection.				√	ENR	Not Evaluated
4.4.4.5	**Immersion/Corrosion Test**						
R4-63 **(4.4.4.5)**	Immersion/Corrosion Requirement for Ferrule Deformation The degradation factor shall be less than 0.015 after two weeks of aging in 85°C de-ionized water. The Degradation Factor = (Rfinal-Rinitial)/(Rinitial*Rfina), where Rinitial and Rfina are the initial and final radii of curvature, respectively.				√	ENR	Not Evaluated
O4-64 **(4.4.4.5)**	Immersion/Corrosion Objective for Fiber Disolution The fiber core recess shall not increase by more than 10 nm with respect to the cladding during the two week aging test.				√	ENR	Not Evaluated

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Criteria Conformance Summary (GR-326-CORE)

Evaluation For: Tyco Electronics
Product: Single Mode LC Connector

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					Comments
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	
4.4.4.6	**Groundwater Immersion**						
CR4-65 (4.4.4.6)	Groundwater Immersion Test (Underground) Product intended for deployment underground shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" after groundwater exposure.				√	ENR	Not Evaluated
CR4-66 (4.4.4.6)	Organism Exposure Test (Free-breathing) Product intended for deployment in free-breathing closures in the above-ground or aerial plant shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" after Organism Exposure.				√	ENR	Not Evaluated

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Criteria Conformance Summary (GR-326-CORE)

Evaluation For: Tyco Electronics
Product: Single Mode LC Connector

Section (Para.)	**GR-326-CORE** Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
4.4.5	**Geometry Requirements**						
4.4.5.1	**Ferrule Endface Geometry for Non-Angled Physical Contact Connectors**						
R4-67 **(4.4.5.1)**	Fiber Undercut and Protrusion The Fiber Undercut (x) as shown in figure 4-6 (GR-326-CORE) shall meet the requirements stated in IEC 60874-14-n, where "n" is any of the applicable (single-mode, single fiber, physical contact) released connector detailed specifications in the IEC 60874-14-n series. In those detailed specifications, the radius of curvature of the ferrule is between 1 mm and 25 mm. That is, the value of the fiber undercut (in units of nanometers) shall be no larger than $-0.02R^3+1.3R^2-31R+325$, where R is the radius of curvature, expressed in millimeters. When the radius of curvature is between 7 mm and 10 mm, the value of the fiber undercut shall be no larger than 125 nm. The Fiber Protrusion (y) as shown in figure 4-6 (GR-326-CORE) shall be ≤ 50 nm for all radii of curvature.				√	C	
R4-68 **(4.4.5.1)**	Ferrule Endface Radius The Radius of Curvature of the ferrule shall be between 7 mm and 25 mm.				√	C	
R4-69 **(4.4.5.1)**	Apex Offset The Apex Offset of the spherical endface to the axis of the ferrule shall be less than 50 µm.				√	C	
4.4.5.2	**Endface Geometry Requirements for Angled Physical Contact (APC) Connectors**						
R4-70 **(4.4.5.2)**	The endface geometry parameters for angled physical contact connectors must meet the requirements of IEC 60874-14-6 for an angle of 9° for untuned connectors, IEC 60874/-14-7 for an angle of 9° for tuned connectors.				√	NA	Not Applicable
4.4.5.3	**Endface Geometry Measurement Areas**						
R4-71 **(4.4.5.2)**	Endface Geometry Measurement Areas The endface geometry measurement areas shall meet the requirements of IEC 61300-3-23 for measuring the radius of curvature and fiber undercut/protrusion.				√	C	
4.4.6	**Connector Installation**						
R4-72 **(4.4.6.1)**	Loss Increase Requirement The increase in loss, the difference between the loss in Steps 3 and 5, shall be ≤0.20 dB. No increase in loss is permitted for products with right angle boots.				√	C	

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Criteria Conformance Summary (GR-326-CORE)

Evaluation For: Tyco Electronics
Product: Single Mode LC Connector

Section (Para.)	**GR-326-CORE** Requirement and Objective Summary	Method of Conformance					
		VERIFY	**ANALYZE**	**INSPECT**	**TEST**	**RESULTS**	**Comments**
O4-73 **(4.4.6.1)**	Loss Increase Objective The increase in loss, the difference between the loss in Steps 3 and 5, shall be ≤0.10 dB.				√	NC[17]	
CR4-74 **(4.4.6.1)**	Right Angle Boot Requirement No portion of a right angle boot shall come in contact with the panel parallel to the mounting surface.				√	NA	Not Applicable
O4-75 **(4.4.6.1)**	Maximum Length Objective The maximum length of the installed connector including the boot should not exceed 75 mm (2.95 in), dimension y as shown in figure 4-10 (GR-326-CORE). This objective does not apply to right angle boots.				√	C	

[17] Two connector assemblies were noncompliant with the maximum loss increase objective at 1625 nm.

Intertek ETL SEMKO

FINAL REPORT FOR:

Tyco Electronics
2900 Fulling Mill Road
Middletown, PA 17057

Product: Single Mode LC Connector

Tested to Section 3, General Requirements, of Telcordia
GR-326-CORE, Issue 3, September 1999
Test Plan Control Number: COR-WE-WAC-087
Test Plan Revision #: 5

Date: January 26, 2007
Project: 3081121
Report: 3081121
Part: 2

Prepared By:_____**Date:** 1/26/07

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INTRODUCTION

PROJECT OBJECTIVE

An analysis was performed to determine if the Single Mode LC Connector meets the requirements for Section 3, *General Requirements*, of GR-326-CORE, Issue 3, September 1999. No testing was performed during this analysis; compliance was determined by evaluating product drawings, specifications and documentation only.

PRODUCT DESCRIPTION

The devices analyzed were Single Mode LC/PC Fiber Optic Connectors and Adapters manufactured by Tyco Electronics. The LC/PC Fiber Optic Connectors and Adapters utilized 1.6 mm simplex cordage that consisted of a riser-rated jacket and contained 900μm, matched clad, buffered fiber. The manufacturer of this Type I cable was OFS (Manufacturer Product Code MC-001C-VRX). The adapters were duplex, constructed of nickel-plated die cast zinc. Tyco part numbers for the devices analyzed were as follows:

Pigtail Samples: Part Number 1-1828883-5, Rev. 1; 15 meter jumper; LC / LC

Jumper Samples: Part Number 1828883-3, Rev. 1; 3 meter jumper; LC / LC

Adapters: Part Number 1754683-1, Rev 2; Adapter, Duplex, Die-Cast

PRODUCT CONFIGURATION

No configuration was necessary for the Single Mode LC Connector for the analysis to Section 3. Product packaging and documentation only were analyzed for this section.

REFERENCE TO EXHIBITS

All references to Exhibits pertain to corresponding charts, tables, and figures within this report, except for references within the **Criteria** section. Each **Criteria** section contains a direct quotation from GR-326-CORE; therefore, all references to charts, tables, and figures pertain to GR-326-CORE.

Intertek
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Section 3, General Requirements (GR-326-CORE)

Evaluation For: Tyco Electronics
Product: Single Mode LC Connector
Revision 5

LIST OF EVALUATION EQUIPMENT

Note: No equipment was used. Compliance was determined by evaluating product drawings and specifications only.

FAILURE HISTORY SUMMARY

There were no failures during this evaluation.

GENERAL REQUIREMENTS (GR-326, SECTION 3)

GENERAL INFORMATION

The following evaluation was performed by Ken Riedl at Intertek ETL SEMKO in Cortland, NY.

GENERAL REQUIREMENTS (3.)

DOCUMENTATION (3.1)

Criteria:

R3-1 [1] Test Reports

Test Reports issued under the terms of this document shall include the following information:

1. The ordering information for the items being tested. This is to include as appropriate: the part number and model number for the adapter, connector plug, cable assembly, etc.
2. The specification for the media type.
3. The manufacturer and type of fiber being used.
4. The base materials being used in the connector plug and adapter.
5. A list of the metallic materials which come into contact with each other, used in the adapter and the plug.
6. The operating instructions included with the product, for example, the cleaning instructions.
7. A description of the training material the supplier recommends for training operators in the use of the product.

R3-2 [2] Product Documentation

A complete set of documentation in accordance with GR-454-CORE, *Generic Requirements for Supplier Provided Documentation*, shall be available from the manufacturer upon request and shall provide all related information, as applicable to the particular connector, alignment sleeve, or jumper assembly product, to describe:

1. Use and application
2. Cleaning procedures
3. Bend radius limits at 1310 nm and 1550 nm
4. Operational limits (temperature, humidity, etc.)
5. Testing operations
6. Materials used for ferrule, sleeve, plug body, housing, etc.
7. Traceability information for critical components obtained from third party sources, e.g., ferrules and alignment elements
8. Safety instructions
9. Auxiliary device(s) required and usage
10. Storage and transportation instructions
11. Packaging list of all items included in the shipping container.

The documentation may require preparation in accordance with instructions from the individual customers.

Test Method:

All documentation, which includes catalogs, sales brochures, manuals, product data, and instruction sheets will be reviewed for content. The documentation shall include all of the information as described in Requirements **R3-1 [1]** and **R3-2 [2]**. This documentation will be provided by the customer.

Configuration and Conditions:

Only documentation will be addressed in this section. No configuration will be needed for the Single Mode LC Connector.

Test Results:

The Single Mode LC Connector was **compliant** with Requirement **R3-1 [1]**.

1. Please refer to Tyco-provided packet for ordering information.
2. Media type tested was Type I.
3. The cable type was 1.6 mm, simplex cordage that consisted of a riser-rated jacket and contained 900 um, matched clad, buffered fiber. The manufacturer of this Type I cable was OFS (Manufacturer Product Code MC-001C-VRX).
4. Refer to Tyco provided packet for materials used in the plug; the adapter is constructed of nickel-plated die cast zinc.
5. No dissimilar metals come into contact with each other.
6. Cleaning instructions were provided via Tyco document 408-8675 Section 8.
7. Refer to the Tyco-provided packet for operation and product use documentation.

The Single Mode LC Connector was **compliant** with Requirement **R3-2 [2]**. Tyco Electronics provided documentation that met the requirements of R3-2.

Failure History: None

PACKAGING AND SHIPPING (3.2)

Criteria:

R3-3 [3] The packaging shall be adequate to ensure that the product will not be damaged under normal handling, shipping, and storage. Jumper cables shall be packaged individually.

Test Method:

The Single Mode LC Connector and all shipping materials will be inspected for packaging and shipping as described in Requirement **R3-3 [3]**.

Configuration and Conditions:

The Single Mode LC Connector and all shipping materials will be visually inspected for packaging and shipping.

Test Results:

The Single Mode LC Connector was **compliant** with Requirement **R3-3 [3]**. Packaging was adequate. All of the samples were packaged to prevent damage under normal handling, shipping, and storage.

Failure History: None

DESIGN FEATURES (3.3)

MATERIALS (3.3.1)

Criteria:

R3-4 [4] Metallic elements shall be corrosion resistant. Dissimilar metals shall not be used in contact with each other unless they are suitably finished to prevent electrolytic corrosion.

R3-5 [5] The connector product shall not incorporate an index matching fluid or gel which is designed to prevent glass-to-air contact or glass-to-glass contact nor require application of such material use.

R3-6 [6] Polymeric materials that are used shall not support fungus growth per ASTM-G21-70. A rating of 0 (zero) is required.

R3-7 [7] Polymeric materials that are used shall have a rating of V-1 or better as determined by Underwriters Laboratories (UL) Standard 94, and an oxygen index of 28 percent or greater as determined by ASTM D-2863-87.

R3-8 [8] The media on which the connector plugs are mounted shall meet the criteria in either GR-409-CORE, *Generic Requirements for Premises Fiber Optical Cable*, or GR-20-CORE, *Generic Requirements for Optical Fiber and Optical Fiber Cable*.

Cable media types shall be defined as follows:

Type I Media: Reinforced jacketed cable of any diameter used as jumper cordage.[1]
Type II Media: Cable with 900 µm buffer coating that may or may not be reinforced.
Type III Media: Connectors mounted on fiber with a 250 µm coating.

Test Method:

The optical connectors/adapters and documentation will be examined for compliance with Requirements **R3-4 [4]**, **R3-5 [5]**, **R3-6 [6]**, **R3-7 [7]**, and **R3-8 [8]**.

1. Obtain a list of metallic elements used and determine form the tables of electrochemical potentials if these metals promote corrosion.
2. If the metals do not promote corrosion note a compliance on the datasheet for Requirement **R3-4 [4]**
3. Determine if the DUT incorporates or requires the use of index matching fluid or gel to be applied. **R3-5 [5]**.
4. The fungus growth test per ASTM-G21-70 is to be tested in the Intertek Chemical Lab located in Columbus, OH. **R3-6 [6]** The sample requirement is 5 jumpers and 5 adaptors.

[1] Type I media may include simplex, duplex, or quad cable products.

5. The Polymeric materials used shall be tested to UL-94 following Intertek procedure ITL-COR-OE-GPT-007 UL 94. **R3-7 [7]** The sample requirement is 20 specimens 125mm ± 5mm long x 13.0 ±0.5mm wide and provided in the minimum and maximum thicknesses. The maximum thickness is not to exceed 13mm. Specimens in intermediate thicknesses are also to be provided and shall be tested if the results obtained on the minimum or maximum thicknesses indicate inconsistent test results. Intermediate thicknesses are not to exceed increments of 3.2mm. The edges are to be smooth and the radius on the corners are not to exceed 1.3mm. Material ranges – if a material is to be considered in a range of colors, densities, melt flows or reinforcement, specimens representing these ranges are also to be provided. The Cortland Retail/Home Appliance/Electronics Test Lab performs this testing.
6. Oxygen index shall be determined by ASTM D-2863-87 following the Intertek index test procedure CORE-OE-WAC-091. **R3-7 [7]** The Cortland Fire Lab performs this testing.

Configuration and Conditions:

The optical connectors/adapters will be visually inspected for compliance. No configuration will be needed for the Single Mode LC Connector. All documentation will be reviewed.

Test Results:

The Single Mode LC Connector was **compliant** with Requirement **R3-4 [4]**. Based on manufacturer's documentation, all metallic surfaces were corrosion resistant.

The Single Mode LC Connector was **compliant** with Requirement **R3-5 [5]**. The connectors and plugs did not incorporate index matching gel.

The Single Mode LC Connector was **not evaluated** for compliance with Requirement **R3-6 [6]**. The evaluation to determine compliance to ASTM-G21-70 was not requested by Tyco Electronics.

The Single Mode LC Connector was **compliant** with Requirement **R3-7 [7]**. Documentation supplied by Tyco Electronics was reviewed and the connectors were found to have a flame class of V-0 under UL 94.

The Single Mode LC Connector was **compliant** with Requirement **R3-8 [8]**. Tyco Electronics provided documentation detailing the requirements of this section.

Failure History: None

CLEANABILITY (3.3.2)

Criteria:

O3-9 [9] The connector structure should allow the area of the ferrule that engages the alignment sleeve to be cleaned by means of the cleaning procedures in Section 4.3.

Test Method:

Compliance will be determined by examining the connector structure and the cleaning procedures in Section 4.3. The connectors will be examined with a Westover 400X Fiber Microscope to verify cleanliness after performing Cleaning Procedure A of Section 4.3.1 or Cleaning Procedure B of Section 4.3.2. Also, the cleanability will be evaluated throughout the evaluation.

Configuration and Conditions:

The connector structure will be examined in order to determine compliance. There will be no configuration needed for the Single Mode LC Connector.

Test Results:

The Single Mode LC Connector was **compliant** with Objective **O3-9 [9]**. The connectors tested were type LC; cleanability was evaluated throughout the project and found to meet O3-9 [9].

Failure History: None

INTERMATEABILITY (3.4)

Criteria:

CR3-10 [10] The product (connectors, adapters) shall meet the requirements of the applicable FOCIS-n (ANSI/TIA/EIA-604-n), where "n" is a number designation assigned to a specific connector type. The requirements should be met on both new product and after the completion of the Service Life Tests.

CR3-11 [11] The ferrule extension distance and the spring loading force shall meet the conditional limits specified by TIA/EIA FOCIS documents.

CR3-12 [212] The distance between the mechanical reference planes for the connector adapters shall be with in the limits specified by the TIA/EIA FOCIS documents.

CR3-13 [213] The force required to remove a gauge pin from the adapter sleeve shall meet the requirements specified in the TIA/EIA FOCIS documents.

CR3-14 [214] The latch spacing for the connector adapters sleeve shall meet the requirements specified in the TIA/EIA FOCIS documents.

CR3-15 [215] The glass transition temperature of the latched in the connector adapters shall be > 100°C.

Test Method:

Test Procedure for FOCIS physical dimensions:

1. Obtain the FOCIS document for the type of connector under evaluation, e.g., SC-FOCIS 3.
2. Measure all physical dimensions using the Intertek comparator and compare them to the FOCIS document.
3. Record the results.

Test Procedure for Ferrule Extension Contact Force: *CR3-11 [11] (TIA/EIA 604-3a Sec. 3.2.2*)

1. Obtain the FOCIS document for the type of connector under evaluation, e.g., SC – FOCIS 3.
2. Measure the distance from the end of the ferrule to the mechanical reference plane of the connector using a precision digital caliper. (Distance A in GR-326-CORE. See Exhibit 7 - 1.)

SC Connector

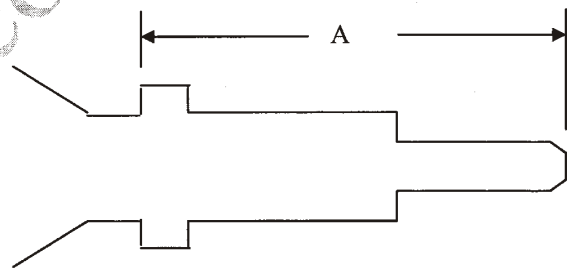

Exhibit 7 - 1

3. Attach the Intertek ferrule extension contact force adapter to the Instron. (TML # 2490)

4. Attach the 200 pound load cell to the Instron.
5. Power the Instron and allow 30 minutes for it to stabilize.
6. Calibrate the Instron and load cell combination by pressing IEEE to turn off the red indicator light then "cal button" and "enter".
7. Attach the connector into the fixture with the ferrule facing upward in the adapter. Do not over tighten the grip screws.
8. Position the magnetic anvil over the center of the connector.
9. Reset the Gage Length by pressing the GL reset button. This should zero out the display.
10. Jog the Instron until it just touches the connector. (You can visually watch for physical contact between the ferrule and magnetic anvil while monitoring the load to determine when contact occurs.) The anvil should be making contact with the ferrule but not showing any applied force.
11. Consult the FOCIS document to determine the ferrule end to mechanical reference plane distance under load. $B_l = 6.9$, $B_u = 7.1$ mm for SC connector and $B_l = 3.6$, $B_u = 3.7$ mm for FC connector.
12. Subtract the lowest value of this range (B_l) from the dimension A determined in step 2 above.
13. Set up the Instron to stop on extension at (A - B_l mm) (On the Instron control panel, under crosshead action press stop, under extension press max) Program the Instron "max" extension to be (A - B_l mm).
14. Open the Instron Software. The pass words are Instron, Instron. Press the Test Icon then enter a file name.
15. Choose test Method 13 "GR-326 Ferrule Extension Contact Force and press OK. Then press OK to Environmental Parameters.
16. Enter in the Job #, Client Name, Sample Description, and press OK.
17. Click on the Start Test at the top of the screen and OK to specimen Information, which does not apply.
18. Click on the OK button to "The Test will now Start"
19. Record the peak load and convert the lfb to Newtons.
20. Repeat steps 10 through 18 for the upper range of the ferrule end to mechanical reference plane distance under load. (B_u)
21. Compare the peak force results to the criteria of CR3-11or FOCIS document as appropriate.
22. Compare the mechanical and optical reference plane distance measured in step 2 to the criteria of CR3-12 as given in Figure 3-1 and 3-1 of GR-326-CORE or the appropriate FOCIS document.

Conversion Factors
Kg to Newtons – 9.80665, 1 kg = 9.80665 N
Lbf to Newtons – 4.44822, 1 lbf = 4.44822 N

Test Procedure for Adapter Sleeve Ferrule Frictional Forces: CR3-113 [213], (TIA/EIA 604-3a Sec. 3.2.2)

1. Obtain the FOCIS document for the type of connector under evaluation, e.g., SC – FOCIS 3.
2. Select the connector guide pins for the connector under test (or have them fabricated).
3. Measure the distance between the center of the connector adapter and the end of the adapter using a digital micrometer.
4. Insert the gauge pins into the adapter to a depth as determined by the distance measured in step 3.

5. Install the 10 lb load cell on the Instron.
6. Clamp the polystyrene attachment line on the gauge pin to in the upper clamp on the Instron.
7. Using the lower clamp on the Instron, clamp the connector into place so that it will remain stationary during the test.
8. Set the Instron so that the pull rate is 25 mm (1 in) per minute.
9. Record the peak force required to remove the gauge pin from the adapter.

Test Procedure for Measuring the Adapter Mechanical Reference Plane Distance:

1. Consult the appropriate FOCIS document for the device under test and measure the distance from the end of the ferrule to the mechanical reference plane of the adapter using a precision digital caliper. (Distance E in GR-326-CORE. See Exhibit 7 - 2.)

Example of an SC Connector Reference Plane

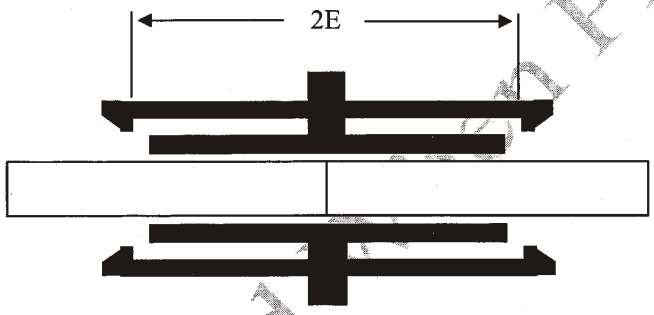

Exhibit 7 - 2

2. It may be necessary to disassemble the adapter to reveal the adapter latches for measuring the mechanical reference plane.
3. Record the value and compare to the value shown in GR-326-CORE or the appropriate FOCIS document.

SC Latch Spacing Example

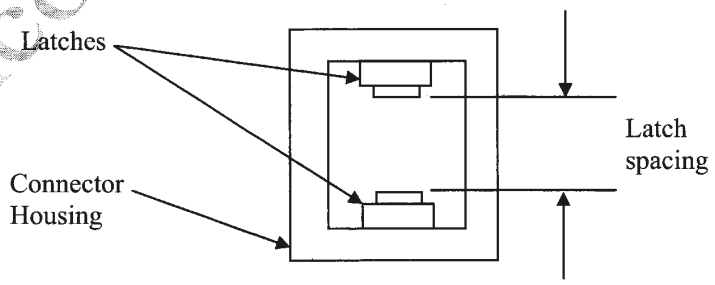

Exhibit 7 - 3

4. For those connectors that contain latches, measure the latch spacing using a digital micrometer. See Exhibit 7 - 3.
5. Other mechanical dimensions that could impact the ability of the device under test to properly latch or meet the requirements of GR-326-CORE are measured following the guidelines and descriptions given in the appropriate FOCIS document.
6. Compare the results to the requirements of GR-326-CORE or the appropriate FOCIS document.

Glass Transition Temperature:

Connectors constructed of materials with an inadequate glass transition temperature could experience material deformations that produce intermateability issues after exposure to environmental aging.

1. The glass transition temperature shall be tested using a differential scanning calorimeter in order to determine conformance to CR3-15. This test is performed at Intertek Lexington.

Configuration and Conditions:

The connectors and adapters will be in a non-operational state during the course of this evaluation. There will be no configuration needed for the Single Mode LC Connector.

Test Results:

The Single Mode LC Connector was **compliant** with Conditional Requirement **CR3-10 [10]**.

The Single Mode LC Connector was **not evaluated** for compliance with Conditional Requirement **CR3-11 [11]**. Ferrule extension contact force was not measured for the LC connector.

The Single Mode LC Connector was **compliant** with Conditional Requirement **CR3-12 [212]**. The distance between mechanical reference planes was determined to be within the limits of FOCIS 10 based on the documentation supplied by Tyco Electronics.

The Single Mode LC Connector was **not evaluated** for compliance with Conditional Requirement **CR3-13 [213]**. The force required to remove a gauge pin from the adapter sleeve was not measured.

Conditional Requirement **CR3-14 [214]** is **not applicable** to LC connectors and adapters.

Conditional Requirement **CR3-15 [215]** is **not applicable** to LC connectors and adapters.

Failure History: None. Some parameters were not evaluated during this investigation.

LATCHING INTERMATEABILITY REQUIREMENTS FOR PUSH-PULL TYPE CONNECTORS (3.4.1)

Criteria:

CO3-16 [216] No more than 30% of the connectors (a total of 43 connectors) shall fail the latchability test.

Test Method:

1. A sample set of 144 connectors shall be tested to determine the ability of the plugs to latch properly into the adapters.
2. The connectors shall be mounted in a typical termination shelf configuration (12 rows and 12 columns, with a vertical center spacing of approximately 12.7 mm (0.5 in) and a horizontal center spacing of approximately 29.4 mm (1.156 in)).
3. Insert the connectors into the back-side of the adapters initially.
4. Using only the boots, randomly insert the mating connector plugs using an insertion force between 2.2 kgf and 2.7 kgf (5 lbf to 6 lbf).
5. After the connectors have been properly inserted, they are to be tested by pulling them out of the adapters using the jumper behind the boot on the connector. The operator's fingers are not to come into contact with boot at any time during the course of testing.
6. Wrap the fiber (located directly behind the boot of the connector) at least three times around the mandrel.
7. Zero the Force Gauge.
8. Using the hook side of the Force Gauge, hook onto the loop that extends form the mandrel.
9. Pull on the mandrel until the connector uncouples from the adapter.
10. Record the force that is measured on the Force Gauge. Record all data on the datasheet provided in Appendix A. If a connector plug pulls out at a force of less than 2.2 kgf (5 lbf), the connector fails the test.
11. Repeat this process on 35 additional connectors for a total of 36 connectors.
12. Four different operators must perform this test with each operator performing the test on 36 connectors.

Configuration and Conditions:

The connectors and adapters will be in a non-operational state during the course of this evaluation. There will be no configuration needed for the Single Mode LC Connector.

Test Results:

Conditional Objective **CO3-16 [216]** is not applicable to LC connectors.

Failure History: None

PRODUCT MARKING AND PACKAGING (3.5)

Criteria:

R3-17 [12] Connector plugs and adapters shall be marked to identify the supplier, the model or series of the parts, and a code that identifies the vintage of the parts. Vintage markings shall allow for the identification by date of the adapters to within 6 months and the plugs to within 3 months.

O3-18 [13] Connector plugs, of non-angled polished connectors, should be color-coded on the basis of their typical maximum reflectance when mated to themselves, using the color code indicated in Table 3-1 in GR-326.

The color code shall be applied to the connector boot.

CR3-19 [14] Angled polished connectors (APC) shall have green plug body or green boots.

Test Method:

The product marking and packaging will be examined in order to determine compliance.

The connectors' plugs and adapters will be examined to see if the following information is identified: the supplier's name, the model or series of the parts, and the vintage code of the parts. Vintage markings shall allow for the identification by date of the adapters to within 6 months and the plugs to within 3 months. The markings may be on the plugs, the boot, or the cable. If on the cable, determine if the markings are within 20 cm (8 inches) of the boot. The medium on which the markings are made shall not be loose or dangling from the cable. The medium shall also not interfere with the use of the connector.

The connector plugs, of non-angled polished connectors, will be examined to determine if they are color-coded on the basis of their typical maximum reflectance when mated to themselves and compared to the table shown in Exhibit 7 - 4. The color code is to be applied to the connector boot.

Reflectance Color Code per GR-326-CORE

Color	Typical Maximum Reflectance
Red	< -30 dB
White	< -40 db
Dark-Blue	< -55 db
Green	Angled (APC)

Exhibit 7 - 4

Angled polished (APC) connectors will be inspected for a green plug body or green boots.

Intertek Evaluation For: Tyco Electronics
ETL Semko Product: Single Mode LC Connector
Section 3, General Requirements (GR-326-CORE) Revision 5

Configuration and Conditions:

The connector assemblies will be in a non-operational state during the course of this evaluation.

Test Results:

The Single Mode LC Connector was **compliant** with Requirement **R3-17 [12]**. Samples were marked as required by R3-17.

The Single Mode LC Connector was **compliant** with Objective **O3-18 [13]**. Connector plugs were molded in dark blue to show their typical maximum reflectance.

Conditional Requirement **CR3-19[14]** is **not applicable** to the LC connectors under test, as they were not APC connectors.

Failure History: None

KEYING (3.5.1)

Criteria:

O3-20 [15] The connector plug shall be keyed such that a particular angular orientation is required for insertion of the plug adapter.

O3-21 [16] The key orientation should be clearly visible either through the design of the connector plug and adapter or by means of marking on the plug and adapter.

Test Method:

The connector will be inspected in order to determine compliance.

Configuration and Conditions:

The connector assemblies will be in a non-operational state during the course of this evaluation.

Test Results:

The Single Mode LC Connector was **compliant** with Objective **O3-20 [15]**. The connector was keyed to fit into the adapter in a specific angular orientation.

The Single Mode LC Connector was **compliant** with Objective **O3-21 [16]**. The key orientation was clearly visible on both the connector and the adapter.

Failure History: None

SPECIALTY FIBER (3.5.2)

Criteria:

There are no criteria for this section.

Test Method:

Not Applicable

Configuration and Conditions:

Not Applicable

Test Results:

There are no criteria for this section.

SAFETY (3.6)

Criteria:

R3-22 [17] The instructions that describe the procedures for cleaning the adapters and plugs shall indicate the possible hazard due to the presence of invisible (infrared) radiation when examining connectors with the naked eye or using a microscope. The instructions shall also contain ordering information for an IR indicator card (Edmund Scientific Part #53-031 or equivalent) to allow visualization of invisible light.

R3-23 [18] The instructions that describe the procedures for cleaning the adapters and plugs shall contain the following information regarding any materials that are used for cleaning that may be considered hazardous to health or to the environment:

1. Warning as to the toxicity hazard
2. Instructions for handling and use
3. Instructions for disposal.

Test Method:

1. The sample and its documentation shall be inspected in order to determine compliance.

2. Determine if the documentation contains a warning about the possible hazards due to the presence of invisible (infrared) radiation when examining with the naked eye or using a microscope.

3. Determine if the instructions contain ordering information for an IR indicator card, (Edmund Scientific, Part #53-031 or its equivalent. This card will allow the visualization of the invisible light.

4. Determine if the instructions for cleaning adapters and plugs contain information regarding any material used for cleaning that may be hazardous, such as toxicity hazard warning, instructions for handling and use, and instructions for disposal.

Documentation should contain laser safety warnings because lasers are biological hazards. Lasers are classified into four broad areas depending on the potential for causing biological damage. When you see a laser, it should be labeled with one of these four class designations:

- **Class I** – This type of laser cannot emit laser radiation at known hazard levels.
- **Class IA** - This is classification applies only to lasers that are "not intended for viewing," such as a supermarket laser scanner. The upper power limit of Class I.A. laser is 4.0 mW.
- **Class II** – This classification is for a low-power visible laser that emits above Class I levels but at a radiant power not above 1 mW.
- **Class IIIA** – This classification is for intermediate-power lasers (cw: 1-5 mW), which are hazardous only for intrabeam viewing. Most pen-like pointing lasers are in this class.
- **Class IIIB** - These are moderate-power lasers.
- **Class IV** - These are high-power lasers (cw: 500 mW, pulsed: 10 J/cm^2 or the diffuse reflection limit), which are hazardous to view under any condition (directly or diffusely scattered), and are a potential fire hazard and a skin hazard. Significant controls are required of Class IV laser facilities.

Configuration and Conditions:

There will be no configuration needed for the Single Mode LC Connector.

Test Results:

The Single Mode LC Connector was **compliant** with Requirement **R3-22 [17]**. Tyco Electronics' instruction sheet 408-8675, Rev D, 26 October 04, contained the appropriate safety instructions and radiation warnings.

The Single Mode LC Connector was **compliant** with Requirement **R3-23 [18]**. Tyco Electronics' instruction sheet 408-8675, Rev D, 26 October 04, contained the appropriate instructions and warnings.

Failure History: None

Intertek ETL SEMKO

FINAL REPORT FOR:

Tyco Electronics
2900 Fulling Mill Road
Middletown, PA 17057

Product: Single Mode LC Connector

Tested to Section 4, Connector Tests and Criteria,
of Telcordia GR-326-CORE, Issue 3, September 1999
Test Plan Control Number: COR-WE-WAC-087
Test Plan Revision #: 5

Date: January 26, 2007
Project: 3081121
Report: 3081121
Part: 3

Prepared By: _____Date: 1/26/07_____
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INTRODUCTION

PROJECT OBJECTIVE

Testing will be performed to determine if the Single Mode LC Connector meet the requirements for Section 4, *Connector Tests and Criteria*, of GR-326-CORE, Issue 3, September 1999.

PRODUCT DESCRIPTION

The device tested was a Single Mode LC Connector, manufactured by Tyco Electronics. For further details, see the **PRODUCT DESCRIPTION** section in Part 2.

PRODUCT CONFIGURATION

The Single Mode LC Connector was configured and verified for functionality as described in the **CONFIGURATION AND CONDITIONS** section for each test on the pages that follow.

REFERENCE TO EXHIBITS

All references to Exhibits pertain to corresponding charts, tables, and figures within this report, except for references within the **Criteria** section. Each **Criteria** section contains a direct quotation from GR-326-CORE; therefore, all references to charts, tables, and figures pertain to GR-326-CORE.

LIST OF EVALUATION EQUIPMENT FOR GR-326-CORE

Component	Model Number	Serial Number	Calibration Date	TML No. / Control No.	Rental (Y or N)
JDS RX3 Multichannel Backreflection Meter	RX3	KK00247	3/27/06	O111	N
JDS RX3 Multichannel Backreflection Meter	RX3	KK000304	3/27/06	O110	N
JDS Fitel SC Series Fiber Optic Switch	EB036642	N/A	N/A	Note 2	Y
JDS Uniphase SC Series Fiber Optic Switch	D084006	N/A	N/A	Note 2	Y
JDS Fitel Optical Fiber Switch (100 Ch Switch)	SAZ451A	CD158359	Scheduled Maintenance	2223	N
JDS Fitel Optical Fiber Switch (100 Ch Switch)	SAZ451A	CD158358	Scheduled Maintenance	2224	N
JDS Uniphase Optical Fiber Switch SC Series 1x10	SC2D10201+2 7XF000FP	JE02755FP	Scheduled Maintenance	3070	N
Photon Kinetics OTDR	88402-ZO/88201-10	80000268	3/11/05	O090	N
Laser Source 1625nm, DFB	81663A	DE41701296	2/25/2005	O080	N
Laser Source 1490nm DFB	81662A	DE40402061	2/25/2005	O079	N
Laser Source, Dual, 1310/1550nm	HP81554SM	2949G01809	3/18/2005	O089	N
Power Sensor	HP 81532 A	2948G00196	7/20/2005	1513/O097	N
Lightwave Measurement System	8164A	DE40707053	2/25/2005	O078	N
Optical Head 800-1650nm	HP81623B	DE41100102	1/9/2006	O107	N
Optical Head Interface	81618A	---	1/9/2006	O074	N
Agilent Lightwave Management System	8163A	DE38706843	1/9/2006	O074	N
Envirotronics 27 ft^3 Environmental Chamber	AirCraft	116	8/22/05	Note 2	Y
Large Walk-In Chamber	Bally	-	10/11/05	3002	N
Norland Interferometer	AC3000	14020	Scheduled Maintenance	3003	N
Vibration Table	H560B.16	425	Scheduled Maintenance	3016	-
Vibration Controller	UDC	-	9/16/05	V254	N

Intertek
ETL Semko
Section 4, Connector Tests and Criteria (GR-326-CORE)

Evaluation For: Tyco Electronics
Product: Single Mode LC Connector
Revision 5

Component	Model Number	Serial Number	Calibration Date	TML No. / Control No.	Rental (Y or N)
Signal Conditioner	CVA-4	-	11/9/05	V272	N
Accelerometer	10B10T	-	6/20/05	V253	N
Torque Wrench	DM70NM	-	8/19/05	N861	N
Arc Fusion Splicer	FSM-20CSII	2054	Scheduled Maintenance	1052	N
High Precision Fiber Cleaver	CT-04	14742	Scheduled Maintenance	1593	N
Siecor Fusion Splicer	M90	6759	Scheduled Maintenance	3007	N
Siecor High Precision Fiber Cleaver	FBC-005	8590	Scheduled Maintenance	3008	N
Westover 400X Fiber Microscope	FV-400	WS02-105C-3033	-	2466	N
Westover 400X Fiber Microscope	FV-400	WS00-105C-2121	-	3013	N
Mechanical Test Fixture	-	-	-	3009	N
Impact Test Fixture	-	-	-	2501	N
Durability Test Fixture	-	-	-	2515	N
JDS Fitel Mandrel	BR 1503-FA	016	-	3022	N
Ceramic Blank/Guide Sleeve	-	-	-	Note 1	-
Bulk Head Adapter	-	-	N/A		N
Bare Fiber Adapter	H4125-SM	-	N/A	3040	N
Airborne Chamber	NA	NA	Scheduled Maintenance		N
Salt Fog Chamber	-	-	-		-
Dust Chamber	-	-	-	2506	-
Immersion Box	-	-	-		-
Kimwipes	EX-L	-	-	Note 1	N
CLETOP	-	-	-	Note 1	N
2-Propanol	9334-03	-	-	Note 1	N
NO-NIK Fiber Optic Stripper	-	-	-	Note 1	N
Clauss Fiber Optic Stripper	CFS-2	-	-	Note 1	N
Ripley Co./Miller Fiber Optic Stripper	FO103-85	-	-	Note 1	N
Clauss No-NIK	FJS-2	-	-	Note 1	N
Ceramic Scissors	CEMIC-124	-	-	Note 1	N
Test Jumper	TBD	TBD	-	-	N

Note 1: These evaluation components are expendable and replaceable items that do not have a predetermined useful lifespan and are replaced as needed without negatively impacting evaluation results. Therefore, they are not tracked within the equipment database using TML tracking numbers.
Note 2: Rental equipment and not tracked within the TML equipment database.

Calibration dates shown are the dates of latest calibration for the listed equipment at the start of this test program (December 2005). Equipment calibration is done on a yearly basis and it is understood that most of the equipment on this list has gone through a yearly calibration cycle during the course of this test program and thus calibration dates in effect at the time of this report release do not match those in effect at the beginning of the test program.

FAILURE HISTORY SUMMARY

HUMIDITY AGING TEST (4.4.2.3)

Sample 16 (Tyco ID --01) was **noncompliant** with the maximum Reflectance Objective Criteria **O4-14 [31]** at 1310nm.

HUMIDITY/CONDENSATION CYCLING TEST (4.4.2.4)

Sample 16 (Tyco Id –01) was **noncompliant** with maximum Reflectance Objective **O4-16 [33]** at 1310nm.

POST-CONDENSATION THERMAL CYCLING (4.4.2.6)

Sample 16 (Tyco Id –01) was **noncompliant** with maximum Reflectance Objective **O4-18 [35]** at 1310nm. Sample 18 (Tyco Id –08) was **noncompliant** with maximum Reflectance Increase Requirement **R4-17 [34]** at 1550nm and 1625nm, maximum Reflectance Objective **O4-18 [35]** at 1310nm, 1550nm, and 1625nm, and maximum reflectance increase objective **O4-18 [35]** at 1310nm, 1490nm, 1550nm, and 1625nm.

VIBRATION TEST (4.4.3.1)

Sample 1 (Tyco Id --10) was **noncompliant** with maximum Reflectance Objective **O4-20 [37]** at 1310nm.

FLEX TEST (4.4.3.2)

A pre-flex test measurement scan showed samples 9,11,14,15,18, and 20 (Tyco IDs –26, --05, --23, --02, --08, and –03) had noncompliant IL readings. These samples were removed from the test population before the start of the flex test and were replaced with "hot spares" 27,29,31,33, 21,23; the noncompliant samples were returned to Tyco Electronics for failure analysis. Samples 3,13,17,21,31,33 (Tyco IDs –01,--23,--04,--06,--18,--30) were **noncompliant** with maximum Reflectance Objective **O4-22 [39]** at 1310nm. Sample 21 (Tyco ID –06) was **noncompliant** with maximum Reflectance Objective **O4-22 [39]** at 1550nm.

TWIST TEST (4.4.3.3)

Samples 3,13,17,21,31, and 33 (Tyco IDs –01,--33,--04,--06,--18, and --30) were **noncompliant** with maximum Reflectance Objective **O4-25 [41]** at 1310nm. Sample 21 (Tyco ID –06) was noncompliant with maximum Reflectance Objective **O4-25 [41]** at 1550nm.

PROOF TEST (4.4.3.4)

Samples 1,3,7,13,17,21,31, and 33 (Tyco IDs –10,--01,--15,--33,--04,--06,--18 and –30) were **noncompliant** with maximum Reflectance Objective **O4-27 [43]** at 1310nm. Samples 17 and 21 (Tyco IDs –04 and –06) were **noncompliant** with maximum Reflectance Objective **O4-27 [43]** at 1550nm.

IMPACT TEST (4.4.3.7)

Samples 1,6,10,13,28, and 33 (Tyco IDs –10,--27,--28,--33,--16,--30) were **noncompliant** with maximum Reflectance Objective **O4-38 [51]** at 1310nm. Sample 28 (Tyco ID –16) was **noncompliant** with maximum Reflectance Objective **O4-38 [51]** at 1490nm. Sample 28 (Tyco ID – -16) was **noncompliant** with maximum Reflectance Objective **O4-38 [51]** at 1550nm. A pre-impact measurement scan showed Sample 25 (Tyco ID – 21) had noncompliant IL. This sample was removed from the test population before the start of the impact test and replaced with "hot spare" 28 (Tyco ID – 16).

DURABILITY TEST (4.4.3.8)

Sample 3 (Tyco ID—01) showed noncompliant insertion loss readings at all wavelengths after 100 durability insertions. Hot spare 30 (Tyco ID—13) was brought in to replace sample 3; it was subjected to 100 durability cycles and then the entire sample population was subjected to the remainder of the durability test.

Sample 3 (Tyco ID—01) was **noncompliant** with maximum Loss Requirement and maximum Loss Increase requirement **R4-42 [55]** at 1310, 1490, 1550, and 1625nm. Sample 3 was **noncompliant** with maximum Reflectance Increase requirement **R4-42 [55]** at 1310, 1490, 1550 and 1625nm.

Sample 3 was **noncompliant** with maximum Loss Objective and maximum Loss Increase Objective **O4-43 [56]** at 1310, 1490, 1550, and 1625nm.

The entire sample population was noncompliant with mean Loss requirement **R4-42 [55]** at 1310, 1490, 1550, and 1625nm. The entire sample population was noncompliant with mean Loss objective **O4-43 [56]** at 1310, 1490, 1550, and 1625nm.

Samples 1,3,5,6,8,10,13,17,31, and 33 (Tyco IDs –10,--01,--31,--27,--03,--28,--33,--04,--18, and –30) were **noncompliant** with maximum Reflectance Objective **O4-43 [56]** at 1310nm; sample 3 was **noncompliant** with maximum Reflectance Increase Objective **O4-43 [56]** at 1310nm.

Sample 3 was **noncompliant** with maximum Reflectance Objective **O4-43 [56]** and maximum Reflectance Increase Objective **O4-43 [56] at 1490nm.**

Samples 3,8 and 33 (Tyco IDs –01,--03, and –30) were **noncompliant** with maximum Reflectance Objective **O4-43 [56]** at 1550nm. Sample 3 was **noncompliant** with maximum Reflectance Increase Objective **O4-43 [56]** at 1550nm.

Sample 3 was **noncompliant** with maximum Reflectance Objective **O4-43 [56]**and maximum Reflectance Increase objective **O4-43 [56]** at 1625nm.

The entire sample population was **noncompliant** with Rematebility with Cleaning objective **O4-40 [53]** for maximum reflectance at 1310nm and 1550nm.

Sample 3 was **non-compliant** with Cleanability Objective **O4-44 [57].**

CONNECTOR INSTALLATION (4.4.6)

Samples 16 and 24 (Tyco IDs –01 and --25) were **noncompliant** with Loss Increase Objective **O4-73 [83]** at 1625nm.

END OF TEST CRITERIA (4.4.3.9)

Samples 1,8,10, and 23 (Tyco IDs –10,--03,--28 and –12) were **noncompliant** with maximum Reflectance Objective **O4-46 [59]** at 1310nm. Samples 1 and 10 (Tyco IDs –10 and –28) were **noncompliant** with Maximum Reflectance Objective O4-46 [59] at 1490nm. Samples 1 and 10 (Tyco IDs –10 and –28) were **noncompliant** with Maximum Reflectance Objective O4-46 [59] at 1550nm. Samples 1 and 10 (Tyco IDs –10 and –28) were **noncompliant** with Maximum Reflectance Objective O4-46 [59] at 1625nm.

CONNECTOR TESTS AND CRITERIA (GR-326-CORE, SECTION 4)

GENERAL INFORMATION

The following evaluation was performed by Ken Riedl at Intertek ETL SEMKO's Laboratories in Cortland, NY.

TEST SAMPLES (4.1)

DEFINITIONS (4.1.1)

Pigtail Assembly Sample – consists of two connector plugs mated with an adapter with unterminated leads. Each of the unterminated leads should be 3 ± 0.5 meters (9.8 ± 1.6 ft) long so that the splices may be located outside of the environmental test chamber.

Jumper Cable Assembly Sample – consists of a jumper cable terminated with plugs on each end connected with adapters to two additional connector plugs with unterminated leads on either end. The jumper cable shall be 3 ± 0.5 meters (9.8 ± 1.6 ft). Each of the unterminated leads should also be 3 ± 0.5 meters (9.8 ± 1.6 ft) long so that the splices may be located outside of the environmental test chamber.

Pigtail Assembly

Exhibit 8 - 1

Jumper Assembly

Exhibit 8 - 2

POPULATION (4.1.2)

Fifteen pigtail assemblies and five jumper assemblies shall be tested sequentially to all the environmental and mechanical tests described in Section 6.1, *Service Life Tests.*

CRITERIA (4.2)

The generalized optical performance criteria is summarized in this section. The criteria for specific tests are included with the respective tests.

OVERVIEW OF OPTICAL PERFORMANCE CRITERIA (4.2.1)

This section describes the optical performance criteria for loss and reflectance. The criteria is described in Exhibit 8 - 3 and Exhibit 8 - 4. Measurements shall be taken at 1310 nm, 1490 nm, 1550 nm and 1625 nm.

Summary of Optical Performance Criteria: Loss

Test	Maximum Loss (dB)		Mean Loss (dB)		Loss Increase (dB)	
	(R)	(O)	(R)	(O)	(R)	(O)
New Product	0.40	0.20	0.20	015	---	---
During Test, Not Under Load	0.50	0.30	0.30	0.20	0.30	0.20
During Test, Under Load	---	---	---	---	0.50	0.30
End of Test	0.50	0.30	0.30	0.20	---	---

Exhibit 8 - 3

Summary of Optical Performance Criteria: Reflectance

Test	Reflectance			Increase in Reflectance	
	(R)	(CR)	(CO)	(R)	(O)
New Product	-40	-55	-60	---	---
During Test, Not Under Load	-40	-55	-60	5	2
During Test, Under Load	-40	-55	-60	5	2
End of Test	-40	-55	-60	5	2

Exhibit 8 - 4

MODIFICATIONS AND CONDITIONS (4.2.2)

MEASURMENT ERROR (4.2.2.1)

This section states that Telcordia will allow a measurement error of 2 dB for reflectance and 0.05 dB for loss measurements.

JUMPER CABLE ASSEMBLY MEASUREMENTS (4.2.2.2)

This section describes how to measure jumper cable assemblies for the Service Life Tests. This specification states the following:

- Loss, Loss Increase – Divide the measured values by 2 and apply the appropriate criteria from Table 4-2.
- Reflectance – Subtract 3.0 dB from each measurement and apply the respective criteria from Table 4-3.

These modifications do not apply during the mechanical testing of a single fiber optic connection at the end of a jumper assembly.

REFLECTANCE INCREASE CRITERIA APPLICABILITY (4.2.2.3)

This section states that the Reflectance Increase in Criteria, as defined in Table 4-3, do not apply to connections with reflectance(s) less than –64 dB due to measurement uncertainty at the low reflected power levels involved.

REFLECTANCE CRITERIA APPLICABILITY (4.2.2.4)

This section explains how the reflectance criteria will be applied.
For example, connectors intended for use in digital systems shall meet the Requirement criterion of reflectance not exceeding –40 dB. Connectors intended for use in AM-VSB (analog video) systems shall meet the Conditional Requirement criterion of reflectance not exceeding –55 dB. Connectors intended for use in AM-VSB (analog video) systems should meet the Conditional Objective criterion of reflectance not exceeding –60 dB.

HANDLING OF NONCONFORMANCE (4.2.2.5)

Criteria:

R4-1 [217] If a connector assembly becomes nonconforming in the course of a test then the criteria for that test are a priori not met. However, rather than consider this specimen nonconforming for all subsequent tests (as was the case in Issue 1 of GR-326-CORE), it is permissible to substitute for the failed product to replenish the test group with product from the same production lot to its original size, with the condition that substitute product has also been subjected to the conditions of the previous tests. It is therefore desirable to maintain a supply of unmonitored "hot spares" in the environmental chamber. Any product substitutions shall be noted clearly within any report issued under this document. "Hot spares" do not need to be monitored until they are substituted for failed product. No more than ten (10) initial test samples may be replaced by "hot spares". This criteria does not apply to samples that are pre-screened to New Product criteria, see Section 4.4.1.

Test Method:

This section states that if a connector assembly becomes nonconforming in the course of a test, then the criteria for that test are not met. GR-326-CORE, Issue 3, allows a failing sample to be replaced with a "hot spare" during the course of testing as long as the "hot spare" is from the same production lot and has been subjected to the conditions of all previous tests. If a sample has to be replaced, it shall be clearly noted so that it can be reported.

Configuration and Conditions:

Not Applicable

Test Results:

Not Applicable

DAMAGE CRITERIA (4.2.3)

This section describes different types of damage to look for when inspecting connectors at the completion of various tests. The connectors shall be inspected for the following:

- Distortion of housing parts, as indicated by the difficulty in insertion, improper snap-fits, etc.
- Distortion of ferrules and sleeves, as indicated by change in mating force, changes in endface geometry, etc.
- Cracks
- Presence of debris, shavings, etc.
- Corrosion or residue
- Other potentially service-affecting damage
- Permanent Loss Increase of more than 0.5 dB from the New Product Measurement
- Permanent Reflectance Increase of more than 5 dB from the New Product Measurement.

Permanent is defined as having the specified level of increase in loss or reflectance at the end of all tests performed on the samples. In order to bring the samples below the criteria level, the samples may be cleaned up to two times using Cleaning Procedure A or Cleaning Procedure B.

The polished end of the ferrule shall be inspected under magnification of 100 power for cracks, chips, or scratches.

CLEANING PROCEDURES (4.3)

CLEANING PROCEDURE A (4.3.1)

Criteria:

This section does not contain criteria.

Test Method:

1. If both plugs have been removed from the adapter, blow compressed gas through the adapter. If both plugs are not removed, blow compressed gas into the open end of the adapter.
2. Wipe completely around the ferrule of the plug twice with a lint-free wiping material that has been moistened with alcohol. Then wipe across the end of the ferrule.
3. Repeat step 2 with a dry wipe.
4. Blow compressed gas across the end of the ferrule. This is the final step before inserting the plug. Do not wipe the ferrule or allow it to touch anything after completion of this step and before the ferrule is inserted into the sleeve.
5. Insert the plug into the adapter.
6. If both plugs have been removed, repeat Steps 2 through 5 with the second plug.

In order to view the connector's endface for cleanliness, use a Westover 400X Fiber Microscope.

Configuration and Conditions:

Not Applicable

Test Results:

Not Applicable

CLEANING PROCEDURE B (4.3.2)

Criteria:

This section does not contain criteria.

Test Method:

1. Blow compressed air through adapter opening.
2. Inspect launch fiber endface prior to cleaning using the Westover 400x microscope.
3. Clean the outside surface of the ferrule with an alcohol-soaked Texwipe, repeat with a dry Texwipe, blow compressed air over ferrule.
4. Wipe endface with a dry Texwipe and inspect with the Westover microscope.
5. If further cleaning is needed use Cletop and reinspect.
6. Install launch connector into adapter.
7. Repeat steps 2-6 for the receive cable assembly.
8. Install receive assembly into adapter.

Procedure for using Cletop:

1. Cleaning Procedure B utilizes the Cletop.
2. Hold the Cletop firmly and open the protective cover exposing the cleaning strip.
3. Place the endface of the plug on the top right-hand side of the cleaning. The twist the connector clockwise and pull down across the strip.
4. Next, place the endface of the plug on the top left-hand side of the cleaning. The twist the connector counter-clockwise and pull down across the strip.
5. Verify the cleanliness of the connector by placing it Westover 400X Fiber Microscope.

Configuration and Conditions:

Not Applicable

Test Results:

Not Applicable

STATEMENT OF CRITERIA (4.4)

PERFORMANCE OF NEW PRODUCT (4.4.1)

Criteria:

R4-2 [19]	All connections in the population shall meet the New Product Loss Requirement of 0.40 dB stated in Table 4-2 of GR-326-CORE.
O4-3 [20]	All connections in the population should meet the New Product Loss Objective of 0.20 dB stated in Table 4-2 of GR-326-CORE.
R4-4 [21]	The mean of the losses for the population of connections shall meet the New Product Mean Loss Requirement of 0.20 dB stated in Table 4-2 of GR-326-CORE.
O4-5 [22]	The mean of the losses for the population of connections should meet the New Product Mean Loss Objective of 0.15 dB stated in Table 4-2 of GR-326-CORE.
R4-6 [23]	All connections in the population shall meet the New Product Reflectance Requirement of -40 dB stated in Table 4-3 of GR-326-CORE.
CR4-7 [24]	Connectors intended for use in AM-VSB (analog video) systems shall meet the Conditional Requirement of -55 dB stated in Table 4-3 of GR-326-CORE.
CO4-8 [25]	Connectors intended for use in AM-VSB (analog video) systems should meet the Conditional Objective of -60 dB stated in Table 4-3 of GR-326-CORE.

Test Conditions:

23 ± 2°C, ~50% RH
Sample Group: (15) 7 meter pigtail assemblies and (5) 14m jumper assemblies were used as test samples. (10) additional pigtail assemblies and (3) additional jumper assemblies were used as hot spares.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

Insertion Loss measurements were made using a build-out process as illustrated in Exhibits 8-5a and 8-5b. Insertion loss for pigtail assemblies was the difference in power measured at P0 and P1. Insertion loss for jumper assemblies was the sum of P0 minus P1 and P1 minus P2, with the sum divided by two. Return Loss measurements were made using an OTDR-based measurement system as illustrated in Exhibit 8-5c.

Configuration and Conditions:

The connector assemblies were in an operational state during the course of this evaluation. See Exhibits 8-5a to 8-5c for details.

New Product Test Configuration (Insertion Loss - Pigtail Assemblies)

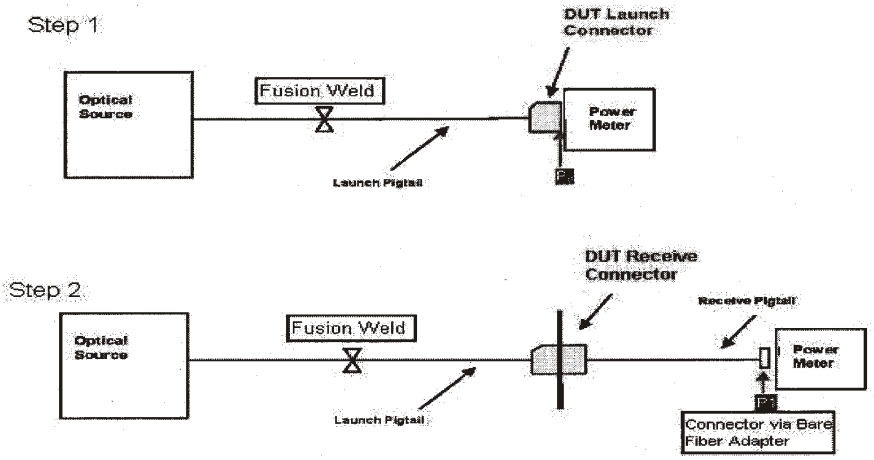


Exhibit 8-5a

New Product Test Configuration (Insertion Loss - Jumper Assemblies)

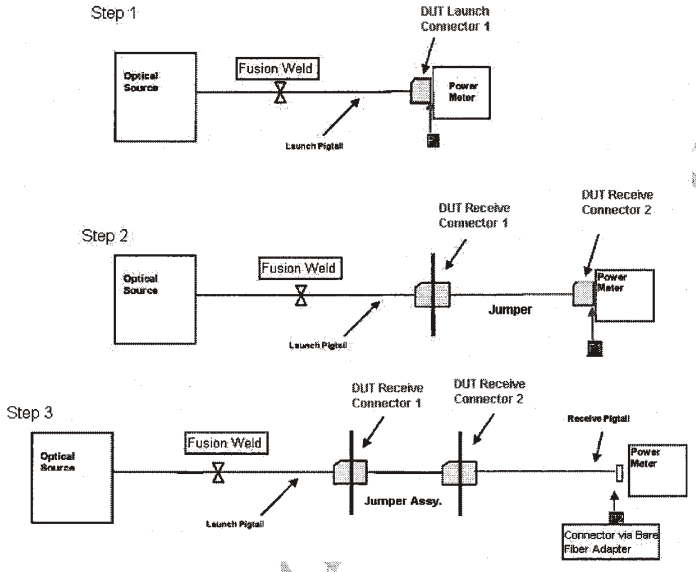


Exhibit 8-5b

New Product Test Configuration (Return Loss)

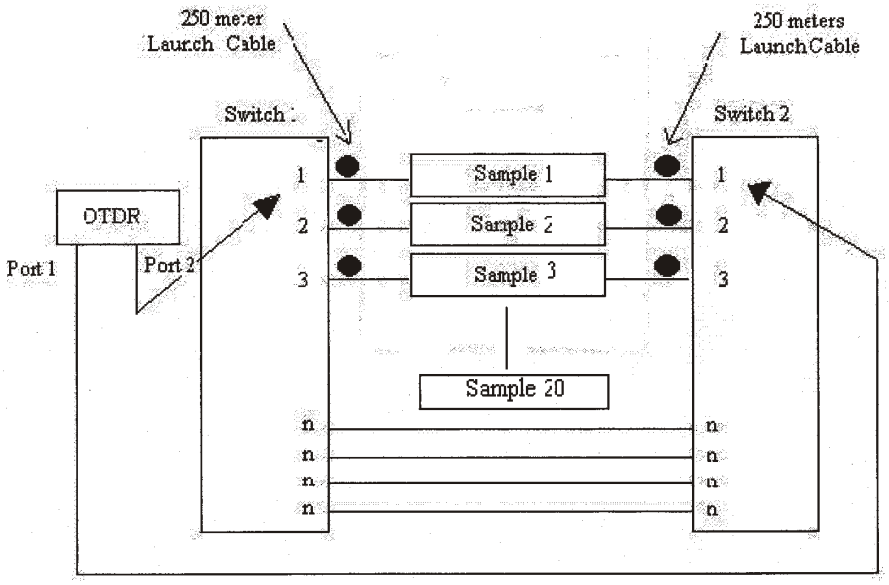


Exhibit 8 – 5c

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirements **R4-2, R4-4, R4-6, Conditional Requirement CR4-7, and Objective O4-3 and O4-5.**

The Conditional Objective **CO4-8** was **not applicable** to the LC/PC fiber Optic Connectors and Adapters. The LC/PC Fiber Optic Connectors and Adapters were not designed to meet these criteria.

See Exhibit 8 - 6 (1310nm), Exhibit 8 - 7 (1490nm), Exhibit 8 - 8 (1550nm), Exhibit 8 - 9 (1625 nm) for the maximum values measured during the evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss (**R4-2, O4-3**)	0.18	0.40	Yes (25Y, 0N)	0.20	Yes(25Y, 0N)
Mean Loss (**R4-4, O4-5**)	0.05	0.20	Yes	0.15	Yes
Max Reflectance (**R4-6, CR4-7**)	-54	-40	Yes (25 Y, 0N)	-55	Yes(25Y, 0N)

Exhibit 8 - 6

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss (**R4-2, O4-3**)	0.18	0.40	Yes (25Y, 0N)	0.20	Yes (25Y, 0N)
Mean Loss (**R4-4, O4-5**)	0.07	0.20	Yes	0.15	Yes
Max Reflectance (**R4-6, CR4-7**)	-56	-40	Yes (25Y, 0N)	-55	Yes (25Y, 0N)

Exhibit 8 - 7

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss (**R4-2, O4-3**)	0.19	0.40	Yes (25Y, 0N)	0.20	Yes (25Y, 0N)
Mean Loss (**R4-4, O4-5**)	0.06	0.20	Yes	0.15	Yes
Max Reflectance (**R4-6, CR4-7**)	-54	-40	Yes (25Y, 0N)	-55	Yes (25Y, 0N)

Exhibit 8 - 8

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss (**R4-2, O4-3**)	0.20	0.40	Yes (25Y, 0N)	0.20	Yes (25Y, 0N)
Mean Loss (**R4-4, O4-5**)	0.08	0.20	Yes	0.15	Yes
Max Reflectance (**R4-6, CR4-7**)	-55	-40	Yes (25Y, 0N)	-55	Yes (25Y, 0N)

Exhibit 8 - 9

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

There were no failures during the course of this evaluation.

TEMPERATURE, HUMIDITY, AND CONDENSATION TESTS (4.4.2)

THERMAL AGE TEST (4.4.2.1)

Criteria:

R4-9 [26] The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-10 [27] The product should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

Test Conditions:

Temperature: 85°C ± 2°C for 168 hours
Humidity: Uncontrolled

Sample Group: Use samples from the New Product Test.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After the New Product measurements have been made, take all of the connector assemblies and route them in the environmental area. Pay close attention to the fiber cables so that sharp bends are not created leading to high loss measurements. Once the connector assemblies have been routed to the environmental area, place the connector assemblies into the environmental chamber. Pay close attention to the routing of the fibers in the chamber; be sure that the fibers are not under any stress whatsoever. After the connector assemblies have been placed in the chamber, place the hot spares into the chamber.
2. Place a thin port plug on the back side of the fibers and a thin port plug on the front side of the fibers on the exact location where the fibers will enter the chamber. By surrounding the fiber with the port plug, this will act as a buffer so that the fibers are not pinched and bends are not induced when being routed into the chamber. Place the port plug into the appropriate slot on the chamber and close the door. Be extremely careful not to pinch any of the fibers with the door.
3. Insertion Loss and Reflectance measurements shall be made once the connectors have been placed in the environmental chamber.
4. After the test is completed, verify the connectors, using excel to pull in the raw data from the ATOC database, to ensure that the loss values have not changed due to moving the samples.
5. If some of the connectors have exceeded the loss requirements, verify the cleanliness and the cable routing of the connector in question. Once this has been taken care of, take a new set of loss measurements and verify once again. Repeat this process until all of the connectors are within the requirements.
6. Once all of the connectors have been verified and all are within the requirements, allow 2 hours for the connectors to stabilize before starting the test.
7. After the connectors have stabilized for 2 hours, take the initial measurements for the Thermal

Age Test. The initial measurement for Thermal Age Test is taken at 23°C.

8. Once the initial measurements have been made, program the environmental chamber to increase in temperature to 85°C with uncontrolled humidity. Have the chamber hold at this temperature for 168 hours (7 days). Refer to for the temperature profile in Exhibit 8 - 10.
9. Verify that the actual environmental profile for the chamber is accurate and within tolerance on a daily basis.
10. Following the 168-hour at 85°C, decrease the chamber temperature to 23°C and allow the samples to stabilize for at least one hour.
11. After the samples have stabilized at room temperature, take the final insertion loss and reflectance measurements for the Thermal Age Test.
12. Verify the data by pulling it into excel from the ATOC database, to ensure that the connectors met the requirements for the Thermal Age Test. If some of the samples are not within the requirements notify the customer.

Thermal Age Test Profile

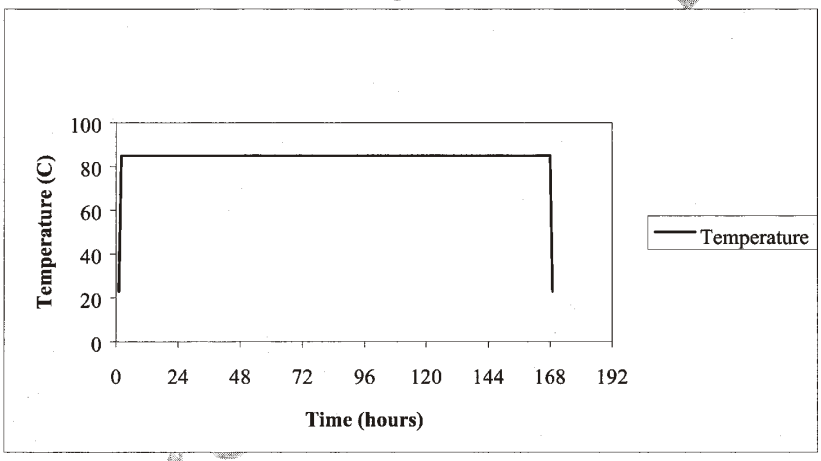


Exhibit 8 - 10

Configuration and Conditions:

The connector assemblies will be placed in an environmental chamber and remain operational during the course of this evaluation. See Exhibit 8 - 11 for a diagram of the test setup.

Environmental Test Configuration

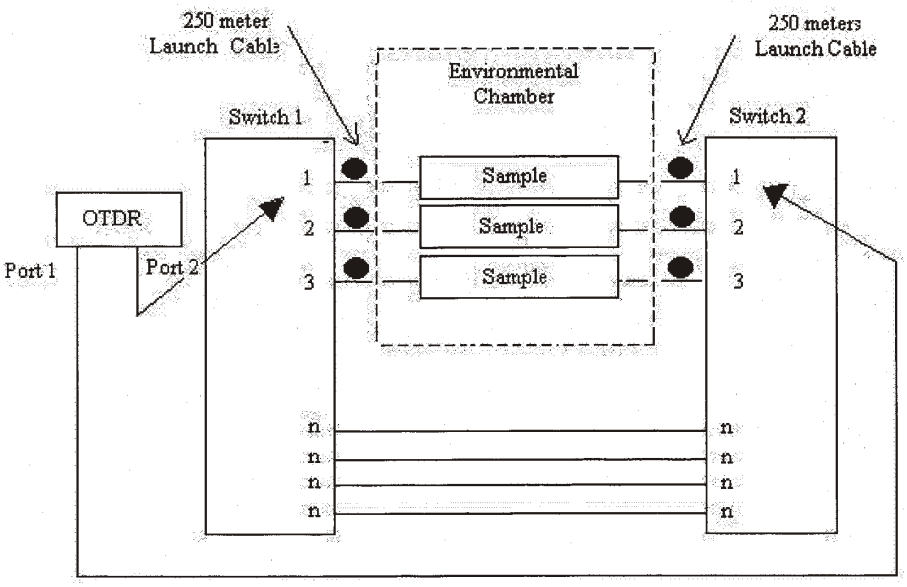


Exhibit 8 - 11

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-9 and Objective O4-10.**

See Exhibits 8-12 through 8-15 for the maximum values measured during the evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.19	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.19	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	0	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 12

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.20	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.10	0.30	Yes	0.20	Yes
Loss Increase	0.20	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 13

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.16	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 14

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.16	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.06	0.30	Yes	0.20	Yes
Loss Increase	0.16	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-57	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 15

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

There were no failures during the course of this evaluation.

THERMAL CYCLE TEST (4.4.2.2)

Criteria:

R4-11 [28] The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-12 [29] The product should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

Test Conditions:

Temperature: -40°C ± 2°C to 75°C ± 2°C
Humidity: Uncontrolled

Sample Group: Use the same sample group from the Thermal Age Test.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After finishing the Thermal Age Test, the Thermal Cycle Test shall be conducted on the same set of connectors and in the same environmental chamber.
2. Verify the data taken from the previous test using excel to pull the data in from ATOC database. If the connectors are within the requirements, proceed with Step 3. If the connectors are not within the requirements, hold off on testing until the customer has been notified and a resolution has been reached. If some of the samples are not within the requirements, it may be necessary to clean the connectors, check the fiber cable for bends, or even splice in hot spares, these alternatives should only be done at the discretion of the customer.
3. The measurements need to be set up by using ATOC Software. The measurement sequence is set up so that the measurements will be made approximately 30 minutes after the start of each temperature plateau at 2 hour intervals. Verify that the measurements are being made at the correct times on a daily basis.
4. Once the initial measurements have been made, program the environmental chamber in accordance with the temperature profile as shown in Exhibit 8 - 16. The temperature extremes are -40°C and 75°C. The chamber shall be programmed so that the temperature profile in will be performed for 21 cycles, lasting 168 hours.
5. Verify that the actual environmental profile for the chamber is accurate and within tolerance on a daily basis.
6. Once the environmental run has finished a, verify the data using excel to pull in the data form the ATOC database, to ensure that the connectors met the requirements for the Thermal Cycle Test. If the connectors met the requirements, proceed to the next test. If some of the connectors failed to meet the requirements, notify the customer. Once a resolution has been reached, proceed with testing.

Thermal Cycle Profile

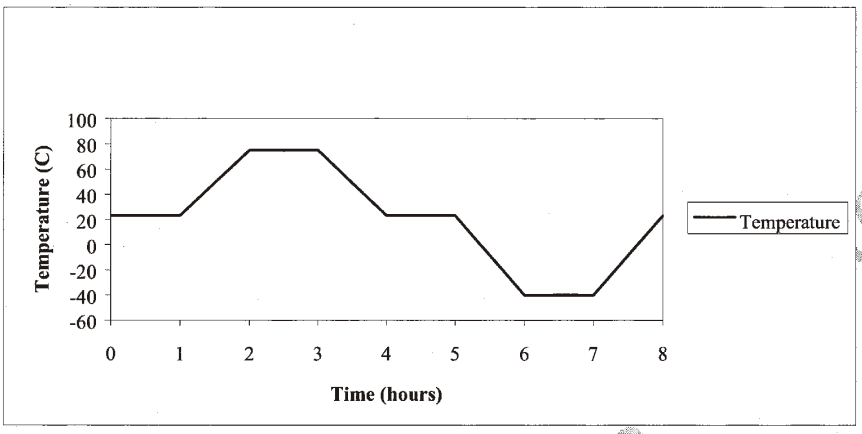


Exhibit 8 - 16

Configuration and Conditions:

The connector assemblies will remain in an environmental chamber and will be operational during the course of this evaluation. See Exhibit 8 - 17 for a diagram of the test setup.

Environmental Test Configuration

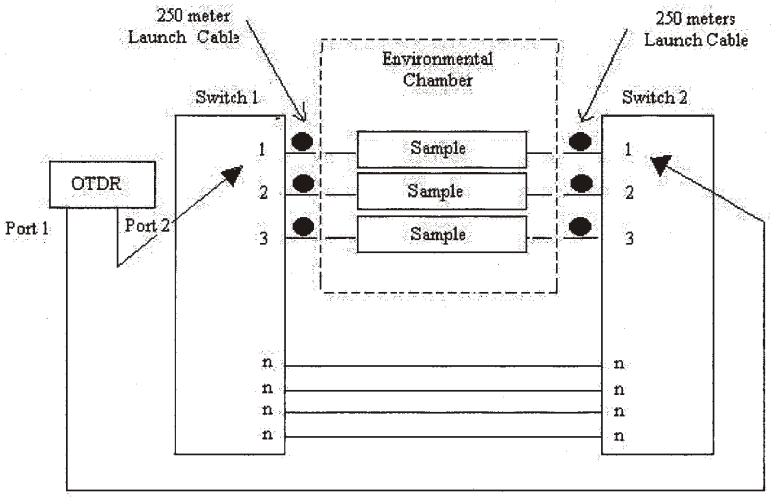


Exhibit 8 - 17

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirements **R4-11 [28].**

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-12 [29].**

See Exhibit 8 - 18 (1310 nm), Exhibit 8 - 19 (1490nm), Exhibit 8 - 20 (1550nm), and Exhibit 8 - 21 (1625nm) for maximum values measured during this evaluation.

At the request of Tyco Electronics "hot spare" jumper sample 16 was substituted for jumper sample 19; sample 19 was compliant and was retained as a "hot spare."

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.29	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.09	0.30	Yes	0.20	Yes
Loss Increase	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-54	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 18

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.27	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.14	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 19

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.19	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.08	0.30	Yes	0.20	Yes
Loss Increase	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-54	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 20

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.12	0.30	Yes	0.20	Yes
Loss Increase	0.03	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 21

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

There were no failures during the course of this evaluation.

HUMIDITY AGING TEST (4.4.2.3)

Criteria:

R4-13 [30] The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-14 [31] The product should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

Test Conditions:

Temperature: 75°C ± 2°C for 168 hours
Humidity: 95%

Sample Group: The same sample group from the Thermal Cycle Test shall be used.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After finishing the Thermal Cycle Test, the Humidity Aging Test shall be conducted on the same set of connectors and in the same environmental chamber.
2. Verify the data taken from the previous test using excel to pull in the data from the ATOC database. If the connectors are within the requirements, proceed with Step 3. If the connectors are not within the requirements, hold off on testing until the customer has been notified and a resolution has been reached. If some of the samples are not within the requirements, it may be necessary to clean the connectors, check the fiber cable for bends, or even splice in hot spares, these alternatives should only be done at the discretion of the customer.
3. The measurements need to be set up by using the ATOC software. The measurement sequence is set up so that the measurements will be made at the beginning of the test, every six hours during the test, and at the end of the test. Verify that the measurements are being made at the correct times on a daily basis.
4. Once the initial measurements have been made, program the environmental chamber in accordance with the temperature profile as shown in Exhibit 8 - 22.
5. The chamber shall be programmed so that it will hold a temperature of 75°C and a humidity of 95% for 168 hours.
6. Verify that the actual environmental profile for the chamber is accurate and within tolerance on a daily basis.
7. Once the environmental run has finished, verify the data by using excel to pull in the data from the ATOC database to ensure that the connectors met the requirements for the Thermal Cycle Test. If the connectors met the requirements, proceed to the next test. If some of the connectors failed to meet the requirements, notify the customer. Once a resolution has been reached, proceed with testing.

Humidity Aging Profile

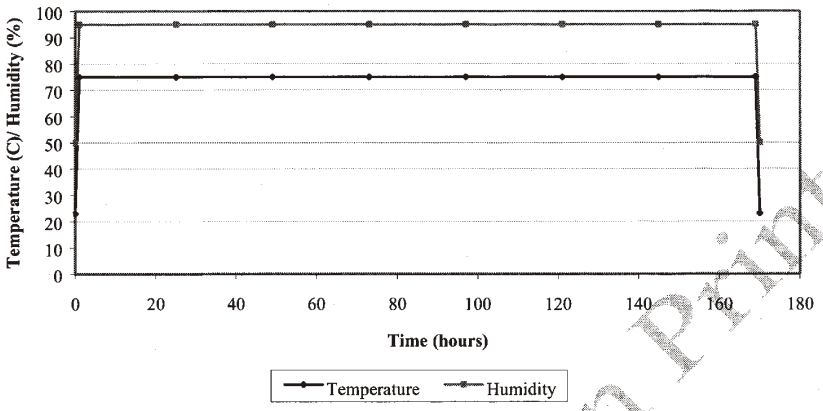


Exhibit 8 - 22

The environmental plot shown in Exhibit 8 - 22 depicts both the temperature and humidity requirements in the same plot.

Configuration and Conditions:

The connector assemblies will remain in an environmental chamber and will be operational during the course of this evaluation. See Exhibit 8 - 23 for a diagram of the test setup.

Environmental Test Configuration

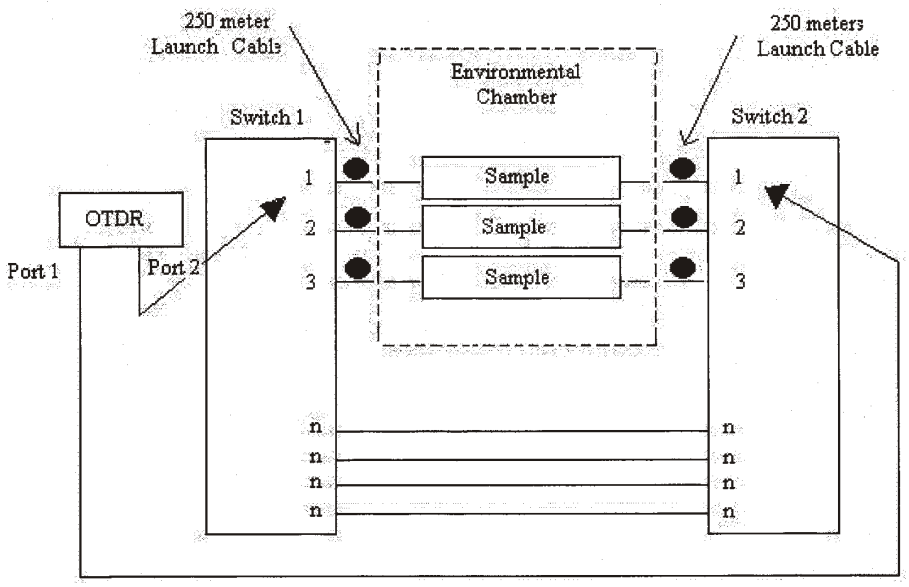


Exhibit 8 - 23

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-13[30].** The connector assemblies met the criteria.

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Objective **O4-14 [31]** at 1310nm.

See Exhibit 8 - 24 (1310nm), Exhibit 8 - 25 (1490nm), Exhibit 8 - 26 (1550nm), and Exhibit 8 - 27 (1625nm) for the maximum values measured during this evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.06	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-52	-40	Yes (25 Y, 0 N)	-55	Yes (23 Y, 2 N)
Reflectance Increase	3.5	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 24

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.11	0.30	Yes	0.20	Yes
Loss Increase	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-54	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	4	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 25

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.17	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.04	0.30	Yes	0.20	Yes
Loss Increase	0.03	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	4	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 26

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.15	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.06	0.30	Yes	0.20	Yes
Loss Increase	0.03	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	4	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 27

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Sample 16 (Tyco ID --01) was **noncompliant** with the maximum Reflectance Objective Criteria **O4-14 [31]** at 1310nm.

HUMIDITY/CONDENSATION CYCLING TEST (4.4.2.4)

Criteria:

R4-15 [32] The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-16 [33] The product should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

Test Conditions:

Temperature: -10°C ± 2°C to 65°C ± 2°C
Humidity: 90% to 100 % at points shown in Exhibit 8 - 28.

Sample Group: The same sample group from the Humidity Age Test will be used.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After finishing the Humidity Aging Test, the Humidity/Condensation Cycling Test shall be conducted on the same set of connectors and in the same environmental chamber.
2. Verify the data taken from the previous test using excel to pull in the data from the ATOC database. If the connectors are within the requirements, proceed with Step 3. If the connectors are not within the requirements, hold off on testing until the customer has been notified and a resolution has been reached. If some of the samples are not within the requirements, it may be necessary to clean the connectors, check the fiber cable for bends, or even splice in hot spares, these alternatives should only be done at the discretion of the customer.
3. The measurements need to be set up by using the ATOC software. The measurement sequence is set up so that the measurements will be made at the beginning of the test, every hour during the test, and at the end of the test. Verify that the measurements are being made at the correct times on a daily basis.
4. Taking measurements every hour throughout the duration of this test will yield more data than necessary. By using excel pull in the data form the ATOC database. The data that needs to be used is only the measurement that was made thirty minutes after the start of each temperature plateau.
5. Once the initial measurements have been made, program the environmental chamber in accordance with the temperature profile as shown in Exhibit 8 - 28. Pay close attention to the ramp step from -10°C to 65°C, this should be completed in no more than 20 minutes so that the maximum amount of condensation is created. The chamber shall be programmed so that the temperature profile will be performed for 14 cycles, lasting 168 hours.
6. Verify that the actual environmental profile for the chamber is accurate and within tolerance on a daily basis.

7. Once the environmental run has finished and the software on the computer shows that the test is complete, verify the data using ATOC software to ensure that the connectors met the requirements for the Thermal Cycle Test. Compare the data taken in this test to the initial measurement made at the beginning of the Thermal Cycle Test. If the connectors met the requirements, proceed to the next test. If some of the connectors failed to meet the requirements, notify the customer. Once a resolution has been reached, proceed with testing.

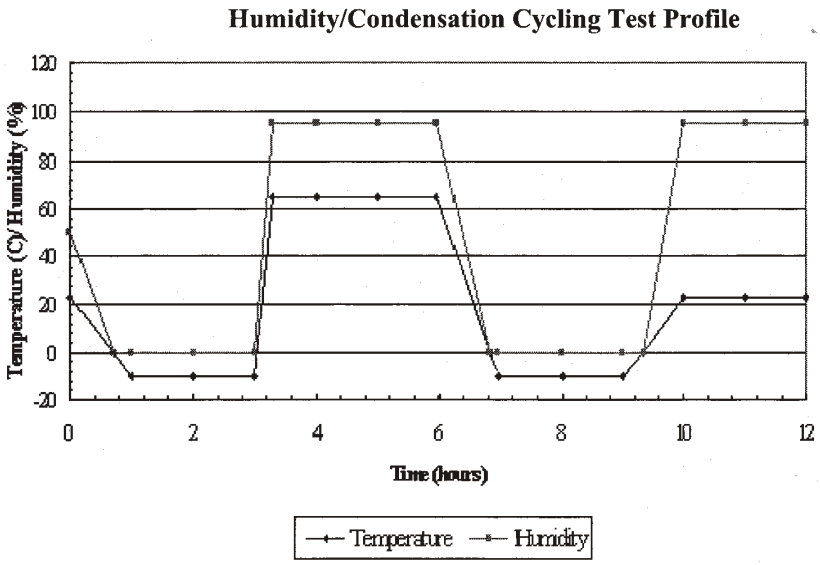


Exhibit 8 - 28

The environmental plot shown in Exhibit 8 - 28 depicts both the temperature and humidity requirements in the same plot.

Configuration and Conditions:

The connector assemblies will remain in an environmental chamber and will be operational during the course of this evaluation. See Exhibit 8 - 29 for a diagram of the test setup.

Environmental Test Configuration

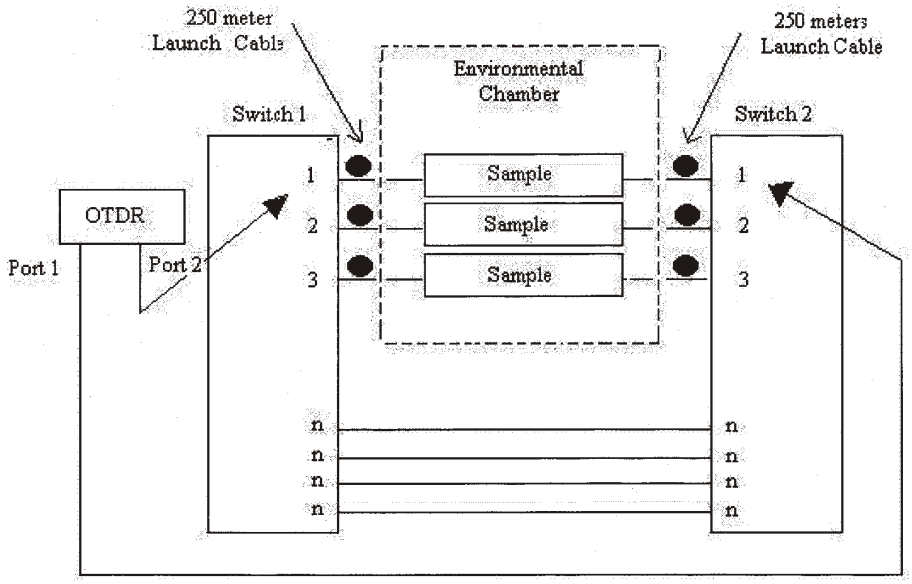


Exhibit 8 - 29

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-15[32].**

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Maximum Reflectance Objective **O4-16 [33]** at 1310nm.

See Exhibit 8 - 30 (1310nm), Exhibit 8 - 31 (1490nm), Exhibit 8 - 32 (1550nm), and Exhibit 8 - 33 (1625nm) for the maximum values measured during this evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.25	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.07	0.30	Yes	0.20	Yes
Loss Increase	0.03	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-52	-40	Yes (25 Y, 0 N)	-55	No (23 Y, 2 N)
Reflectance Increase	3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 30

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.24	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.12	0.30	Yes	0.20	Yes
Loss Increase	0.03	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 31

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.19	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.04	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-54	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 32

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.16	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.07	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 33

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Sample 16 (Tyco Id –01) was **noncompliant** with maximum Reflectance Objective **O4-16 [33]** at 1310nm.

DRY-OUT STEP (4.4.2.5)

Criteria: There are no criteria for this step.

Test Conditions:

Temperature: 75°C ± 2°C
Humidity: Uncontrolled

Sample Group: The same samples from the Humidity/Condensation Cycling Test will be used. All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After finishing the Humidity/Condensation Cycling Test, the Dry-Out Step shall be conducted on the same set of connectors and in the same environmental chamber.
2. Verify the data taken from the previous test using excel to pull in the data from the ATOC database. If the connectors are not within the requirements, hold off on testing until the customer has been notified and a resolution has been reached. If some of the samples are not within the requirements, it may be necessary to clean the connectors, check the fiber cable for bends, or even splice in hot spares, these alternatives should only be done at the discretion of the customer.
3. Once the data from the previous test has been verified, program the environmental chamber in accordance with the temperature profile sown in Exhibit 8 - 34. The chamber shall be programmed so that the temperature profile will be performed for 24 hours.
4. Once the 24-hour dry-out exposure is complete, proceed with the Post-Condensation Thermal Cycle Test.

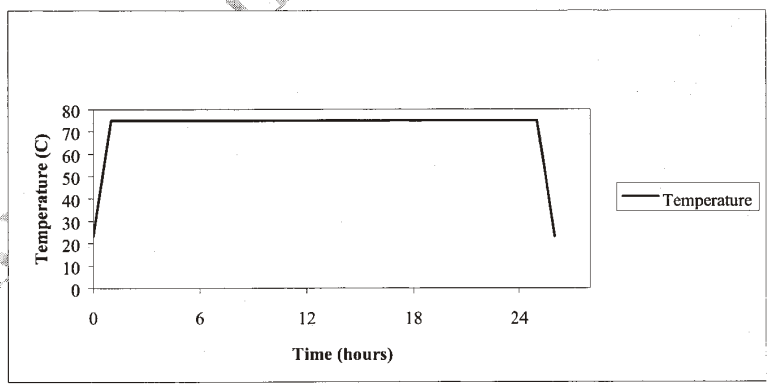


Exhibit 8 - 34

Configuration and Conditions:

The connector assemblies will remain in an environmental chamber and will be operational during the course of this evaluation. See Exhibit 8 - 35 for a diagram of the test setup.

Environmental Test Configuration

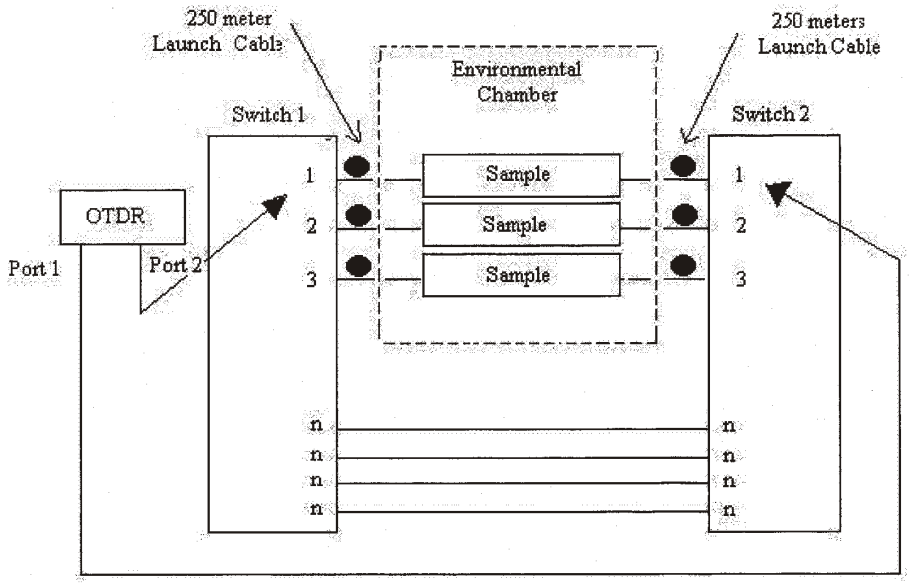


Exhibit 8 - 35

Test Results:

There are no criteria for this section.

POST-CONDENSATION THERMAL CYCLING (4.4.2.6)

Criteria:

R4-17 [34] The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-18 [35] The product should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

Test Conditions:

Temperature: -40°C ± 2°C to 75°C ± 2°C
Humidity: Uncontrolled

Sample Group: The same sample group from the Dry-Step will be used for the test.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After completing the Dry-Out Step, the Post-Condensation Thermal Cycle Test shall be conducted on the same set of connectors and in the same environmental chamber.
2. Verify the data taken from the previous test using excel to pull in the data from the ATOC database. If the connectors are within the requirements, proceed with Step 3. If the connectors are not within the requirements, hold off on testing until the customer has been notified and a resolution has been reached. If some of the samples are not within the requirements, it may be necessary to clean the connectors, check the fiber cable for bends, or even splice in hot spares, these alternatives should only be done at the discretion of the customer.
3. The measurements need to be set up by using the ATOC software. The measurement sequence is set up so that the measurements will be made approximately 30 minutes after the start of each temperature plateau. Verify that the measurements are being made at the correct times on a daily basis.
4. Once the initial measurements have been made, program the environmental chamber in accordance with the temperature profile. The temperature extremes are -40°C and 75°C. The chamber shall be programmed so that the temperature profile will be performed for 21 cycles, lasting 168 hours. See Exhibit 8 - 36 for the environmental profile.
5. Verify that the actual environmental profile for the chamber is accurate and within tolerance on a daily basis.
6. Once the environmental run has finished, verify the data using excel to pull in the data form the ATOC database to ensure that the connectors met the requirements for the Thermal Cycle Test. If the connectors met the requirements, proceed to the next test. If some of the connectors failed to meet the requirements, notify the customer. Once a resolution has been reached, proceed with testing.

Post-Condensation Thermal Cycling Profile

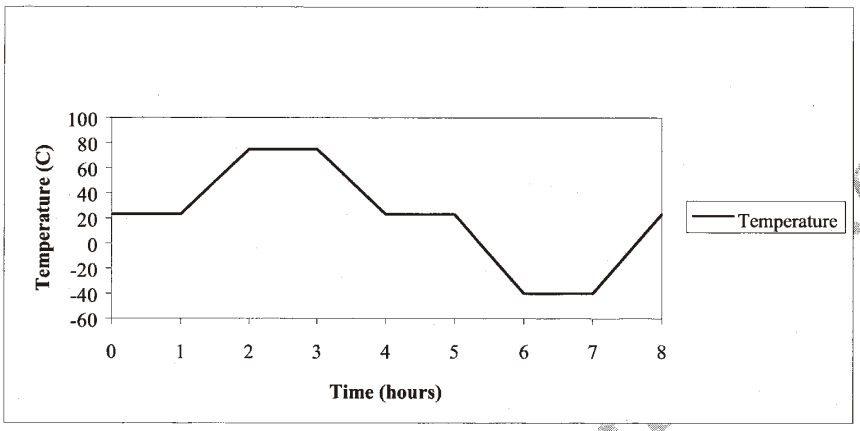


Exhibit 8 - 36

Configuration and Conditions:

The connector assemblies will remain in an environmental chamber and will be operational during the course of this evaluation. See Exhibit 8 - 37 for a diagram of the test setup.

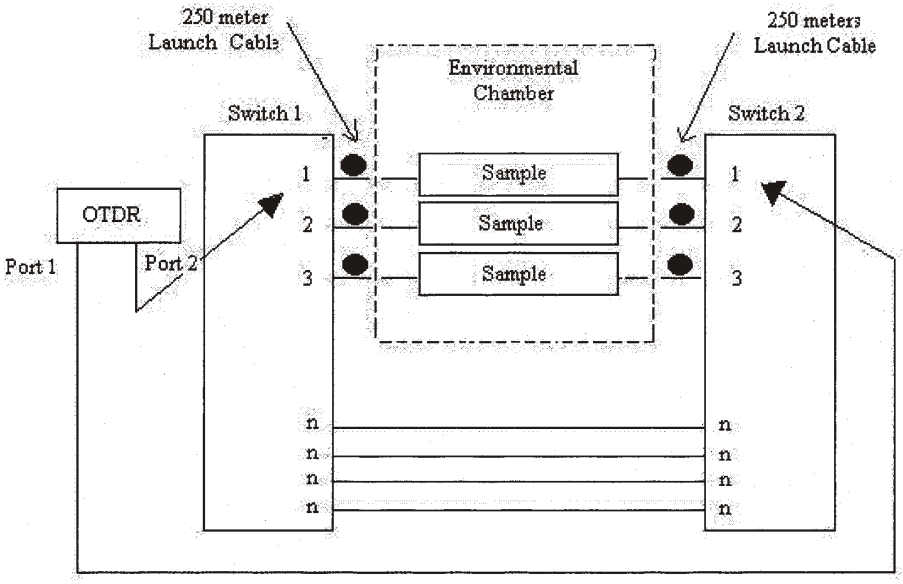


Exhibit 8 - 37

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Requirement **R4-17[34].**

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Objective **O4-18 [35]**.

See Exhibit 8 - 38 (1310 nm) Exhibit 8 - 39 (1490 nm) Exhibit 8 - 40 (1550 nm) Exhibit 8 - 41 (1625 nm) for the maximum values measured during the course of this evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.25	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.08	0.30	Yes	0.20	Yes
Loss Increase	0.06	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-52	-40	Yes (25 Y, 0 N)	-55	Yes (21 Y, 4 N)
Reflectance Increase	6	5	Yes (25 Y, 0 N)	2	Yes (23 Y, 2 N)

Exhibit 8 - 38

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.26	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.15	0.30	Yes	0.20	Yes
Loss Increase	0.10	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	7	5	Yes (25 Y, 0 N)	2	Yes (23 Y, 2 N)

Exhibit 8 - 39

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.08	0.30	Yes	0.20	Yes
Loss Increase	0.17	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51	-40	Yes (25 Y, 0 N)	-55	Yes (23 Y, 2 N)
Reflectance Increase	8	5	Yes (23 Y, 2 N)	2	Yes (22 Y, 3 N)

Exhibit 8 – 40

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.11	0.30	Yes	0.20	Yes
Loss Increase	0.24	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-52	-40	Yes (25 Y, 0 N)	-55	Yes (23 Y, 2 N)
Reflectance Increase	8	5	Yes (23 Y, 2 N)	2	Yes (22 Y, 3 N)

Exhibit 8 - 41

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Sample 16 (Tyco Id –01) was **noncompliant** with maximum Reflectance Objective **O4-18 [35]** at 1310nm. Sample 18 (Tyco Id –08) was **noncompliant** with maximum Reflectance Increase Requirement **R4-17 [34]** at 1550nm and 1625nm, maximum Reflectance Objective **O4-18 [35]** at 1310nm, 1550nm, and 1625nm, and maximum reflectance increase objective **O4-18 [35]** at 1310nm, 1490nm, 1550nm, and 1625nm.

MECHANICAL TESTS (4.4.3)

Note: Mechanical tests were performed on pigtail assemblies and jumper assemblies.

VIBRATION TEST (4.4.3.1)

Criteria:

R4-19 [36] The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-20 [37] The product should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

Test Conditions:

Temperature:	Room Ambient (~23°C)
Humidity:	Room Ambient (~50%)
Duration of Test:	2 hours
Amplitude (peak to peak):	1.5 mm
Frequency:	10 to 55 Hz
Frequency Sweep Rate:	45 Hz per minute

Sample Group: The same sample group from the environmental testing shall be used.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. The Vibration Test is to be performed on the same set of connector assemblies that went through the Temperature, Humidity, and Condensation Tests.
2. After completing the Post-Condensation Thermal Cycle Test, take loss measurements on the connectors. Verify these measurements. If all of the measurements meet the requirements, proceed to Step 3. If some of the connectors do not meet the requirements, try cleaning the connectors and adapters or straightening out the fiber cables. If this does not bring the connector assemblies back into conformance, notify the customer and determine the corrective course of action. Once all of the connectors are within the requirements, proceed to Step 3.
3. Carefully remove the samples from the environmental chamber. If the connectors are not currently mounted in the Vibration Bulk Head Adapter, place them in the bulk head adapter at this time using the customer provided mounting hardware. Be careful not to bind any of the fibers.
4. Once the connectors have been placed into the bulk head adapter, mount the bulk head adapter on to the Vibration Mounting Plate. Be careful not to bind any of the fibers.
5. Once the connector assemblies are secured in the bulk head adapter and the bulk head adapter is secured to the mounting plate, route the connectors behind the environmental chambers and place them on the vibration table. Be very careful with the fibers, place them neatly into the routing trays that are attached to the wall. Make sure that none of the fibers are bent or pinched as this would create excess loss.

6. Mount the mounting plate to the vibration table with the table rotated so that the vertical axis will be the axis of vibration.
7. Once the mounting plate has been mounted to the vibration table, check the fibers to ensure that they are not in a bind of any type.
8. Take loss and reflectance measurements on the connectors by selecting on the option button that is beside Standard Operation. Verify these measurements are the same as the ones taken initially while the connector assemblies were in the environmental chamber. If some of the connectors do not meet the requirement criteria, check the fibers to ensure that they are straight and that not tightly bent. Once all of the connectors are within the requirements, proceed with the next step.
9. Take the initial loss measurements for the Vibration Test by selecting the vibration option button on the switch software. Once the measurements are complete, proceed with the next step.
10. Load the software for the vibration table. Select the "GR-326" option in the VWIN application on the vibration computer. The vibration controller has already been programmed to run a vibration with the following parameters:

    Duration of Test – 2 hours
    Amplitude (peak to peak) – 1.5 mm
    Frequency – 10 to 55 Hz
    Frequency Sweep Rate – 45 Hz per minute

11. Verify that the parameters on the program match those above. If the parameters are correct, proceed. If the parameters are incorrect, make the necessary changes and save the file.
12. Once the program has been verified, turn on the vibration table power amplifier and the charge amplifier. Be sure that the charge amplifier is connected to the accelerometer, which is bolted to the vibration table.
13. Once both of the amplifiers have been turned on, select the "Start" button on the vibration software.
14. Once the first axis is complete and the vibration table has stopped, take another set of loss and reflectance measurements. Verify that the connectors meet the requirements. If the connectors do not meet the requirements, notify the customer and discontinue testing until a resolution has been reached. After the issue has been resolved, proceed to the next step.
15. Remove the vibration mounting plate, with the connectors still attached, from the vibration table. Remove the accelerometer from the vibration head expander and remove the vibration head expander from the vibration table. Rotate the vibration table 90° so that it will be lined up with the slip table that is located directly in front of the vibration table. Using the adapter, bolt the slip table to the vibration table. Use a feeler gage to determine of the edges of the slip table. Have an adequate amount space in order to allow the slip table to move freely, if there is not enough space, adjust accordingly.
16. Once the slip table is bolted in place, mount the vibration mounting plate (with the connectors still attached) to the slip table so that the axis of vibration will be along one of the horizontal axes.
17. Once the vibration plate has been secured, verify that the fibers have been properly routed and are not under any stress.
18. Take loss measurements to ensure that the connectors are still the same as the last set of data that was taken. If the measurements are the same, proceed with the Vibration Test. If the connector

measurements are different, verify that the fibers are not under stress and retake the loss measurements. Once the measurements are the same, proceed with the Vibration Test.

19. At this point, bolt the accelerometer to the vibration table so that it will be moving in the same direction as the exciter.
20. The power amplifier and the charge amplifier should still be on at this point. Select the "Start" button on the vibration software to start the vibration.
21. Once the first horizontal axis is complete and the vibration table has stopped, take another set of loss measurements. Verify that the connectors meet the requirements. If the connectors do not meet the requirements, notify the customer and discontinue testing until a resolution has been reached. After the issue has been resolved, proceed to the next step.
22. Unbolt the vibration mounting plate and mount the vibration mounting plate (with the connectors still attached) to the slip table so that the axis of vibration will be along the second of the horizontal axes.
23. Once the vibration plate has been secured, verify that the fibers have been properly routed and are not under any stress.
24. Take loss and reflectance measurements to ensure that the connectors are still the same as the last set of data that was taken. If the measurements are the same, proceed with the vibration test. If the connector measurements are different, verify that the fibers are not under stress and retake the loss measurements. Once the measurements are the same, proceed with the Vibration Test.
25. The power amplifier and the charge amplifier should still be on at this point. Select the "Start" button on the vibration software to start the vibration.
26. Once the second horizontal axis is complete and the vibration table has stopped, take another set of loss and reflectance measurements. Verify that the connectors meet the requirements. If the connectors do not meet the requirements, notify the customer and discontinue testing until a resolution has been reached. After the issue has been resolved, proceed to the next test.

Diagram of Vibration Fixture

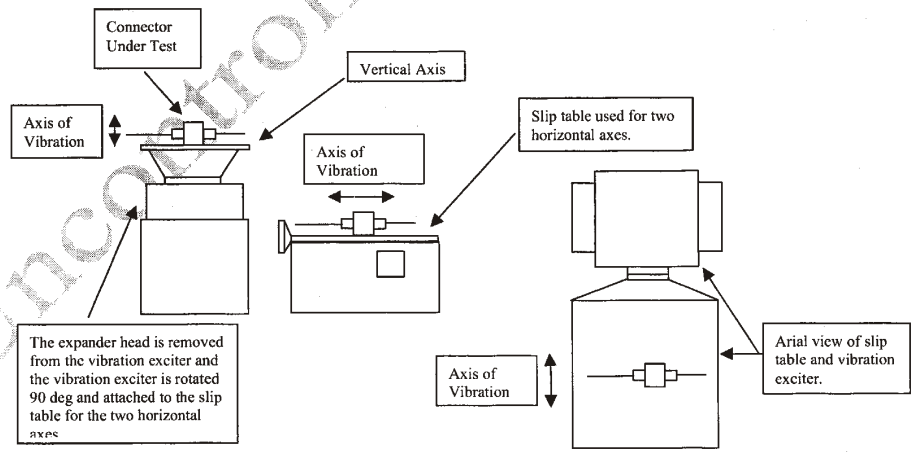


Exhibit 8 - 42

Configuration and Conditions:

The connector assemblies will be placed on the vibration table and will be operational during the course of this evaluation. See Exhibit 8 - 43 for a diagram of the test setup.

Vibration Test Configuration

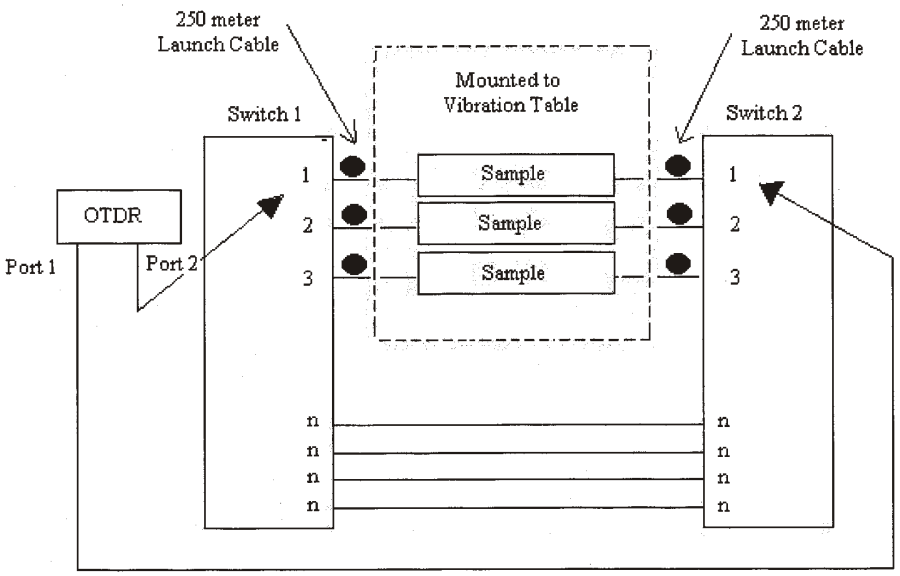


Exhibit 8 - 43

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-19[36].**

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Objective **O4-20 [37]**.

See Exhibit 8 - 44 (1310 nm), Exhibit 8 - 45 (1490 nm), Exhibit 8 - 46 (1550 nm), Exhibit 8 - 47 (1625 nm) for the maximum values measured during the course of this evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.20	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.04	0.30	Yes	0.20	Yes
Loss Increase	0.01	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-52	-40	Yes (25 Y, 0 N)	-55	Yes (24 Y, 1 N)
Reflectance Increase	1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 44

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement*	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.10	0.30	Yes	0.20	Yes
Loss Increase	0.01	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	0	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 45

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.15	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.03	0.30	Yes	0.20	Yes
Loss Increase	0.03	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-54	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	0	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 46

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement*	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.14	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 47

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Sample 1 (Tyco Id --10) was **noncompliant** with maximum Reflectance Objective **O4-20 [37]** at 1310nm.

FLEX TEST (4.4.3.2)

Criteria:

R4-21 [38] The product shall not become uncoupled under this load and shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-22 [39] The product should not become uncoupled under this load and should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

CO4-23 [218] When applying a 0.9 kgf (2.0 lbf) load to Small Form Factor Connectors, the product shall not become uncoupled under this load and should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load."

Test Conditions:

Temperature:	Room Ambient (~23°C)
Humidity:	Room Ambient (~50%)
Duration of Test:	100 Flexes
Load:	2 pounds (0.9 kgf) for regular connectors/1.3 pounds (0.6 kgf) for small form factor connectors

Sample Group: The same set of connectors that were used in the Vibration Test will be used for this test.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. Once the Vibration Test is complete, the Flex Test shall be conducted on the same set of connectors that were subjected to the Vibration Test. The Flex Test only applies to Type I Media only. Refer to Section 2 for a description of Type I Media.
2. Route the connector assemblies into the fiber lab very carefully, be sure not to create any bends in the fiber while moving the samples. Coil the excess fiber up on the bench located in the fiber lab.
3. After moving the connectors, measure the loss of the connectors. Verify the data. If the connectors are not within the requirements, cleaning the connectors and/or straightening the fibers may be necessary.
4. Once all of the connector assemblies are within the requirements, disconnect the first connector and place it in the Mechanical Test Fixture. The bracket in which the adapter is mounted has the provision for mounting the adapter in angular increments of 45° from 0°- 315°. Start out at 0° for the first connector and increment 45° for each connector afterwards. Secure the connector with the hardware that was provided by the customer.[1]

[1] For adapters that have provisions for mounting different ways (springs or screws), half of the connectors shall be tested using only springs and the half of the connectors shall be tested using screws.

Diagram of the Mechanical Test Fixture

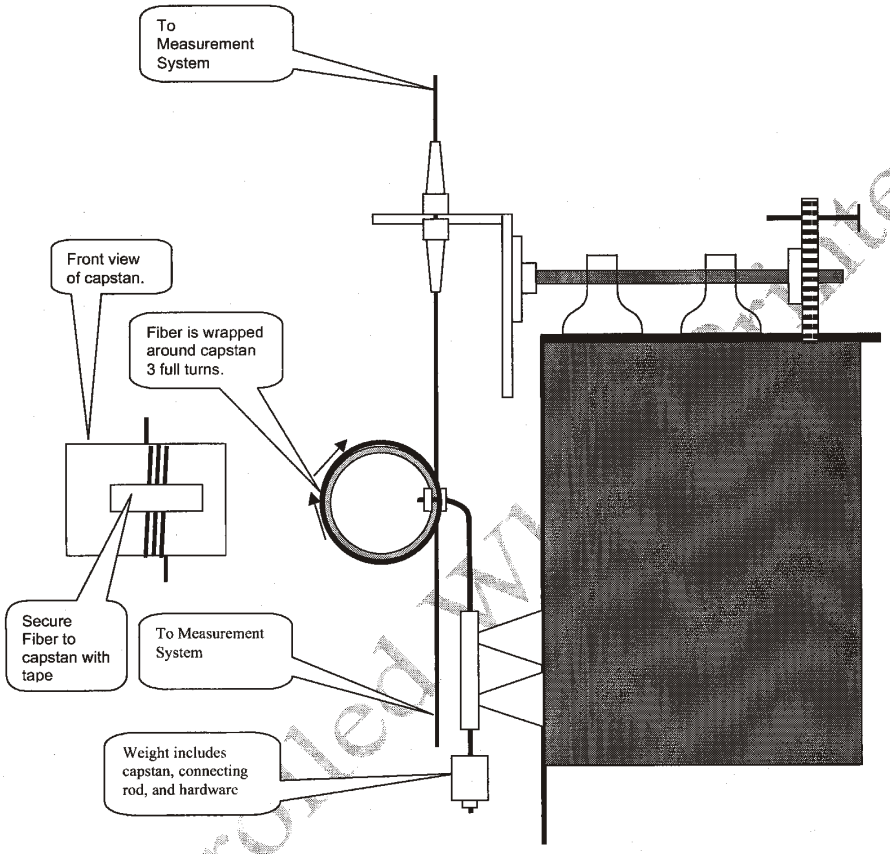


Exhibit 8 - 48

Diagram of the Mechanical Fixture's Rotation Plate

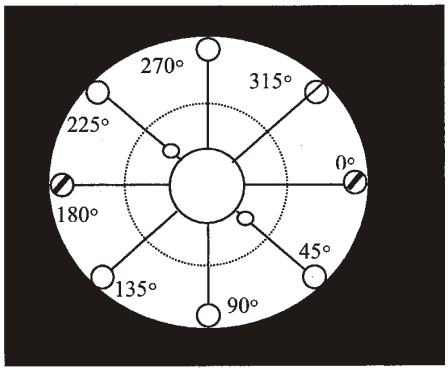


Exhibit 8 - 49

Isometric Drawing of the Mechanical Fixture's Rotating Arm

Exhibit 8 - 50

5. Starting at approximately 8 inches behind the boot of the connector, wrap the fiber at least three times around the capstan (3 inches in diameter) and secure with duct tape. Using the wire that is attached to the mechanical test fixture, take it through the capstan and hook it on the bolt on top of the fixture on the opposing side or use the "L" shaped rod attached to the table. This will relieve the stress that is imposed by the weight of the capstan and the rod that is connected to it.
6. Make an adjustment to the Mechanical Fixture's Rotating Arm, (Exhibit 8 - 50) and (Exhibit 8 - 54), each time a different weight mass is applied so that the cable bend is exactly in the vertical alignment with the capstan when bent at a 90° angle.
7. Measure the loss on the connector that is in the mechanical fixture to ensure that the connector is within the requirements. If the connector is not within the requirements, clean if necessary and/or straighten the fibers if necessary. If the connector is within the requirements, proceed with the next step.
8. Once a connector is placed into the mechanical fixture, it will remain in the fixture and continue to the next mechanical test until the Transmission with Applied Load Test is completed. It is done this way in order to conserve as much time as possible and to help with the flow of testing.

Loads Needed for Tensile Tests

Test Mass (lbs)	Shaft, Nut & Washer (kg)	Mass (kg)	Total (kg)	Total (lbs)
15	0.248	6.55	6.798	14.9870
10	0.248	4.29	4.538	10.0004
7.5	0.248	3.15	3.398	7.4912
5.0	0.248	2.02	2.268	5.0000
4.4	0.248	1.75	1.998	4.4048
3.3	0.248	1.25	1.498	3.3025
3.0	0.248	1.11	1.358	2.9938
2.0	0.248	0.66	0.908	2.0017
1.65	0.248	0.5	0.748	1.6490
1.54	0.248	0.45	0.698	1.5388
1.3	0.248	0.34	0.588	1.2963
1.1	0.248	0.25	0.498	1.0979
1.0	0.248	0.205	0.453	0.9986
0.55	0.248		0.248	0.5467
0.37		0.17	0.17	0.3747

Exhibit 8 - 51

9. Based on the chart in Exhibit 8 - 51, mount the appropriate load at the base of the capstan bolt. Use a load of 0.9 kgf (2.0 lbf) when testing regular style connectors and a load of 0.6 kgf (1.3 lbs) when testing small form factor connectors. Keep in mind, the Flex Test does not apply to Type II Media.

10. Load the ATOC Software (shortcut is located on the desktop). Select the Job Id and the Test Id (GR326Flex). The first form in the program will appear and will allow you to select options. Pay close attention to the tests, loads, and angles that are selected since these are the labels that will identify the test data with the test that is being performed.
11. After the laser stabilizes, the software will show you the insertion loss measurements in real time mode. Select the "Initial" button. Be sure not to disturb the connector under test. The loss and reflectance measurements will be performed at this time.
12. Once the measurements have been performed, the program will automatically return to the first form that was originally displayed. If the readings are not with in the requirement you would like to see reclean and visually check the fiber for tight bends. Select the "Cancel" button and select "Initial" again.
13. At this point, remove the wire or the "L" shaped rod that is relieving the load from the connector and gradually apply the load to the connector under test.
14. Once the load has been applied, using the mechanical fixture, flex the sample with the load applied from 0° to +90° back to 0° and then to -90° and back to 0°. Perform a total of 100 cycles.
15. Once the flexing portion of the Flex Test is complete, remove the load by using the wire or the "L" shaped rod and select the "Final" button. Be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time. Once the measurements have been made, select the "data" button to review the data. Then select the "Accept" Button.
16. During the course of the mechanical tests, the insertion loss measurements are displayed in real time to allow the user or customer to witness firsthand if there are any problems during testing.. Pay close attention to the real time measurements, if a particular connector does meet the requirements, notify the customer and determine the appropriate course of action. Once a resolution has been agreed upon, proceed with testing.
17. Be sure to verify the real time data as the tests are being done so that any problems can be caught and can be discussed with the customer.
18. Refer to Exhibit 8 - 52 for diagram of Tension Test Fixture.

Tension Test Fixture

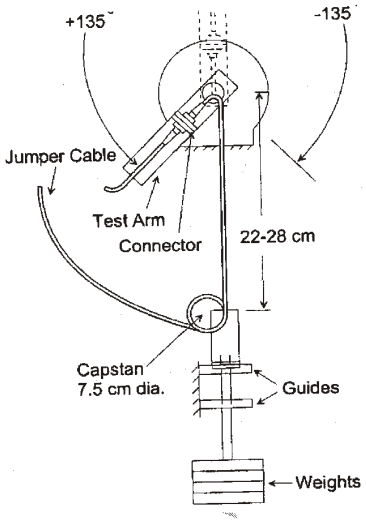


Exhibit 8 - 52

Definitions:

Type I Media: Reinforced jacketed cable of any diameter used as jumper cordage. Type I Media may include simplex, duplex, or quad cable products.

Type II Media: Cable with 900 µm buffer coating that may or may not be reinforced.

Type III Media: Connectors mounted on fiber with a 250 µm coating.

Configuration and Conditions:

The connector assemblies will be placed in the mechanical test fixture and will be operational during the course of this evaluation. See Exhibit 8 - 53 for a diagram of the test setup. See **Exhibit 8-54** for a mechanical diagram of the Flex Test.

Mechanical Test Setup

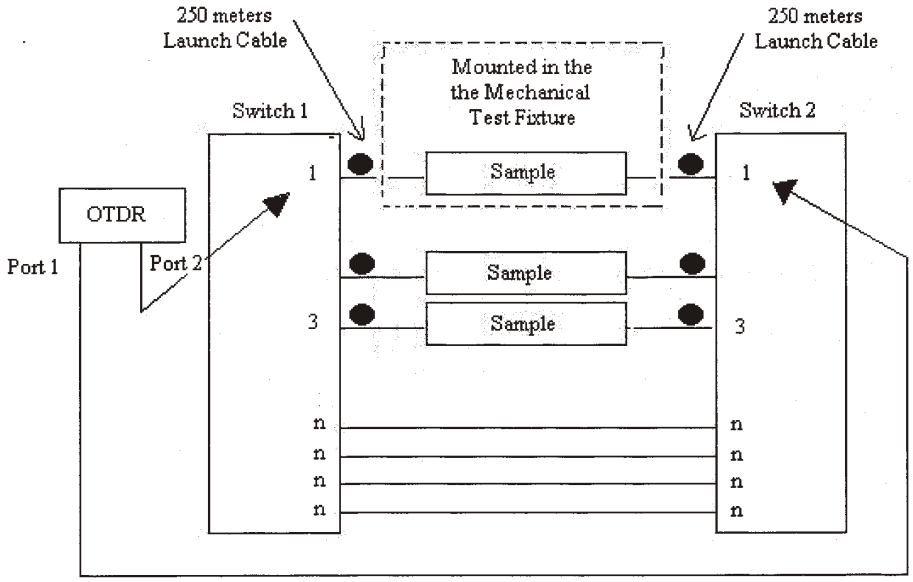


Exhibit 8 - 53

Diagram of Flex Test

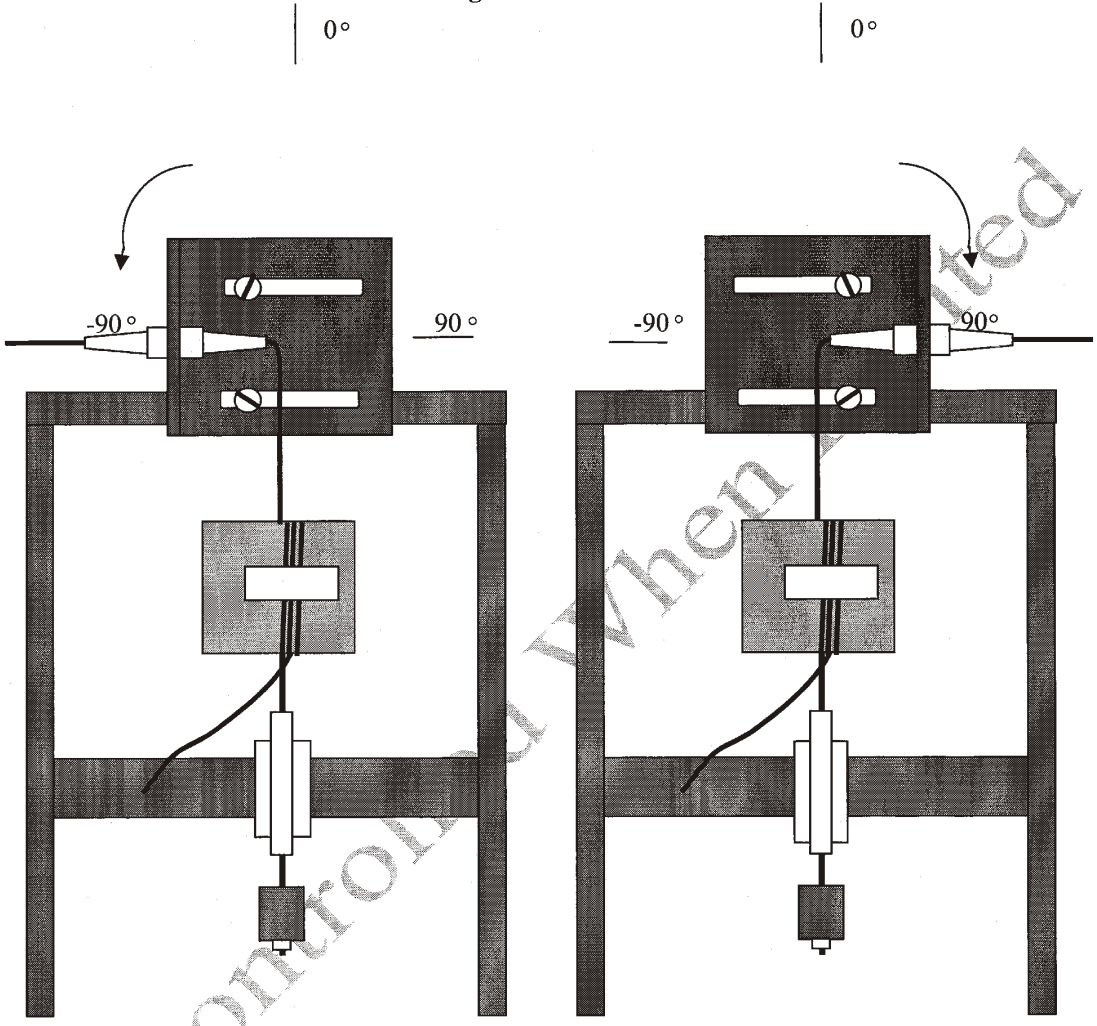


Exhibit 8 - 54

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-21[38].**

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Objective **O4-22 [39]**.

See Exhibit 8 - 55 (1310 nm), Exhibit 8 - 56 (1490 nm), Exhibit 8 - 57 (1550 nm), and Exhibit 8 - 58 (1625) for the maximum values measured during the course of this evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.06	0.30	Yes	0.20	Yes
Loss Increase	0.03	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51	-40	Yes (25 Y, 0 N)	-55	No (17 Y, 8 N)
Reflectance Increase	1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 55

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.10	0.30	Yes	0.20	Yes
Loss Increase	0.03	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 56

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.15	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.00	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51	-40	Yes (25 Y, 0 N)	-55	No (23 Y, 2 N)
Reflectance Increase	1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 57

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.14	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 58

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Samples 3,13,17,21,31,33 (Tyco IDs –01,--23,--04,--06,--18,--30) were **noncompliant** with maximum Reflectance Objective **O4-22 [39]** at 1310nm. Sample 21 (Tyco ID –06) was **noncompliant** with maximum Reflectance Objective **O4-22 [39]** at 1550nm.

TWIST TEST (4.4.3.3)

Criteria:

R4-24 [40] The product shall not become uncoupled under this load and shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-25 [41] The product should not become uncoupled under this load and should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

Test Conditions:

Temperature:	Room Ambient (~23°C)
Humidity:	Room Ambient (~50%)
Duration of Test:	10 Cycles
Load:	3 pounds (1.35 kgf) for Media Type I; 1.65 pounds (0.75 kgf) for Media Type II; and 1.1 pounds (0.5 kgf) for Media Type III

Sample Group: The same set of connectors that were used in the Flex Test will be used for this test. All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After completing the measurements for the Flex Test, perform the Twist Test on the same exact connector that is already in the mechanical test fixture. By leaving the same connector in the fixture, it enables the use of the Flex Test final measurements to be used as the Twist Test initial measurements.
2. Remove the load that was used during the Flex Test and place the appropriate load for the Twist Test on the test fixture. Use the appropriate load for the media type being tested. For Media Type I, use a 1.35 kgf (3.0 lbf) load, for Media Type II, use a 0.75 kgf (1.65 lbf) load, and for Media Type III, use a 0.5 kgf (1.1 lbf) load.
3. After placing the appropriate load on the fixture, select the Test Id GR326Twist, the No Load, and 3.0 lb option. Again, verify that the appropriate Job Id Number.
4. Select the "Initial" button. You can choose to rerun the Initial by selecting the "Cancel" button
5. Gradually apply the load to the connector under test.
6. If the connector under test has Type I Media fiber, begin the rotation about the axis of the fiber by rotating the capstan two and a half turns and stop. Proceed by reversing the direction of the rotation and rotating the capstan five full turns in the opposite direction and stop. Proceed by reversing the direction of the rotation and rotating the capstan five full turns in the opposite direction and stop. Continue the cycle of rotating the capstan five turns and reversing the directions and rotating five full turns an additional eight times, for a total of nine times. After stopping on the tenth cycle of five full turns, reverse direction and rotate the capstan two and a half turns back to where it originally started.
7. If the connector under test has Type II or III Media fiber, begin the rotation about the axis of the fiber by rotating the capstan one and a half turns and stop. Proceed by reversing the direction of the rotation and rotating the capstan three full turns in the opposite direction and stop. Proceed

by reversing the direction of the rotation and rotating the capstan three full turns in the opposite direction and stop. Continue the cycle of rotating the capstan three turns and reversing directions an additional eight times for a total of nine times. After stopping on the tenth cycle of five full turns, reverse direction and rotate the capstan two and a half turns back to where it originally started.

8. Using the wire or the "L" shaped rod, relieve the connector of the load. Allow the connector to stabilize for approximately twenty seconds and select "Final". Be sure not to disturb the connector under test, the loss measurements will be performed at this time.
9. Be sure to verify the real time data, or view the table by selection of the "Data" button as the tests are being done so that any problems can be caught and can be discussed with the customer.
10. Refer to Exhibit 8 - 59 for diagram of Tension Test Fixture.

Tension Test Fixture

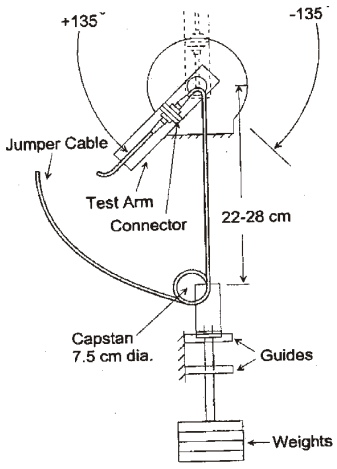


Exhibit 8 - 59

Configuration and Conditions:

The connector assemblies will be placed in the mechanical test fixture and will be operational during the course of this evaluation. See Exhibit 8 - 60 for a diagram of the Mechanical Test setup. See Exhibit 8 - 61 for a mechanical diagram of the Twist Test.

Mechanical Test Setup

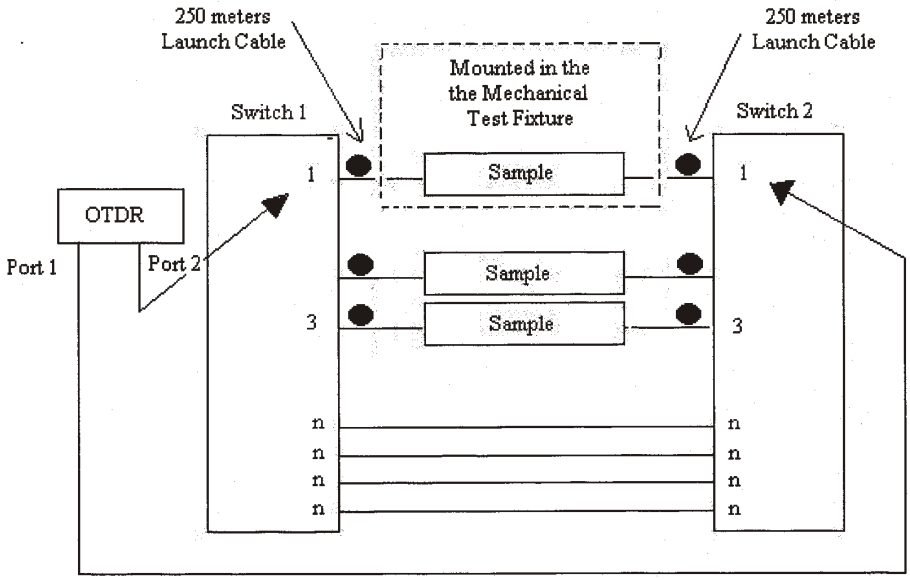


Exhibit 8 - 60

Diagram of Twist Test

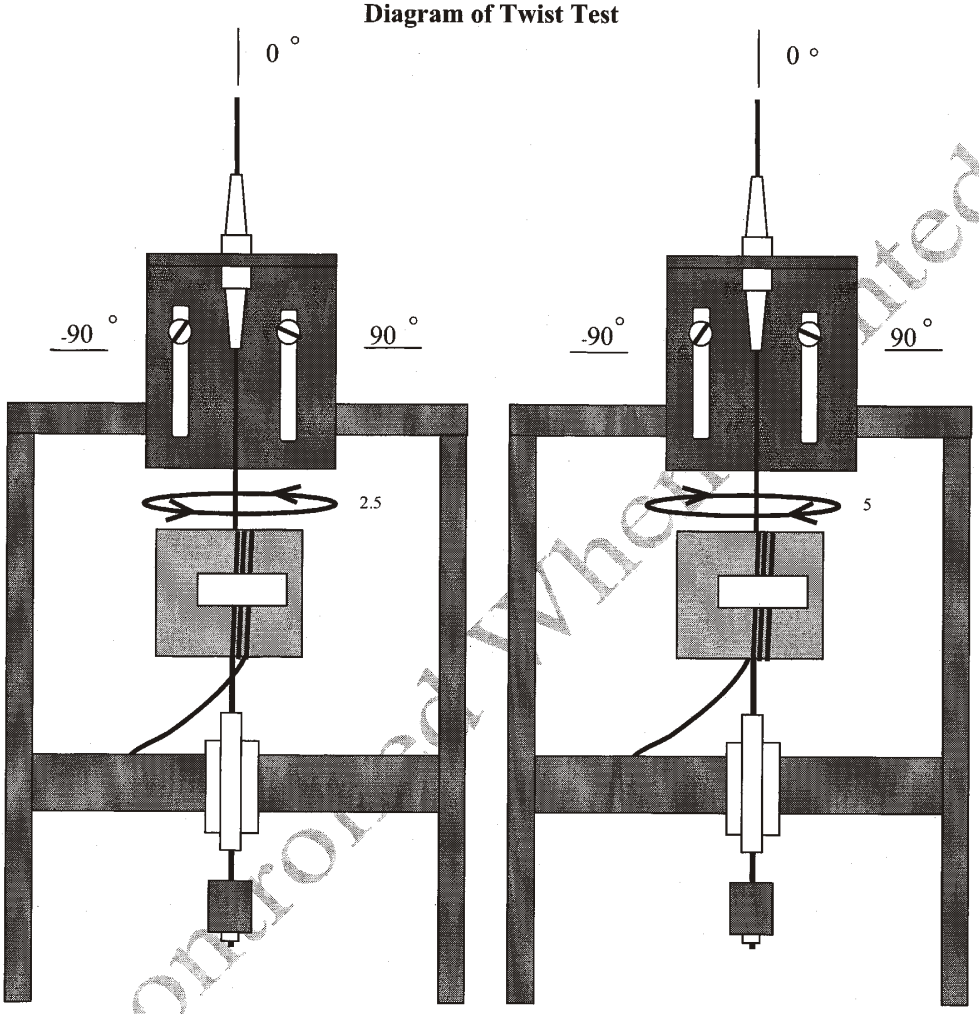


Exhibit 8 - 61

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-24[40].** The connector assemblies met the requirement criteria.

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Objective **O4-25 [41]**. Failures occurred for maximum reflectance at 1310nm and 1550nm.

See Exhibit 8 - 62 (1310 nm), Exhibit 8 - 63 (1490 nm), Exhibit 8 - 64 (1550 nm), Exhibit 8 - 65 (1625 nm) for the maximum values measured during the course of this evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.20	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.07	0.30	Yes	0.20	Yes
Loss Increase	0.06	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51	-40	Yes (25 Y, 0 N)	-55	No (17 Y, 8 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 62

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.10	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 63

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.15	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.00	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51	-40	Yes (25 Y, 0 N)	-55	No (23 Y, 2 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 64

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.13	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 65

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Samples 3,13,17,21,31, and 33 (Tyco IDs –01,--33,--04,--06,--18, and --30) were **noncompliant** with maximum Reflectance Objective **O4-25 [41]** at 1310nm. Sample 21 (Tyco ID –06) was noncompliant with maximum Reflectance Objective **O4-25 [41]** at 1550nm.

PROOF TEST (4.4.3.4)

Criteria:

R4-26 [42] The product shall not become uncoupled under this load and shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" when subjected to the lower loading level in Steps 'c' and 'g'.

O4-27 [43] The product should not become uncoupled under this load and should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" when subjected to the higher loading level in Steps 'e' and 'i'.

CO4-28 [219] The Small Form Factor Connectors shall not become uncoupled under this load and it should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load" when subjected to the higher loading level in Step 'g'.

Test Conditions:

Temperature:	Room Ambient (~23°C)
Humidity:	Room Ambient (~50%)
Load:	See Flowchart

Sample Group: The same set of connectors that were used in the Twist Test will be used for this test. All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After completing the measurements for the Twist Test, perform the Proof Test on the same exact connector that is already in the mechanical test fixture. By leaving the same connector in the fixture, it enables the use of the Twist Test final measurements to be used as the Proof Test initial measurements. The Proof Test only applies to samples of Media Type I.
2. Remove the load that was used during the Twist Test and place the appropriate load for the Proof Test on the mechanical fixture. Place the appropriate loads on the bolt that is attached to the capstan.
3. Make sure that the mechanical test fixture is at 0° so that the axis of the fiber perpendicular to the floor. After placing the 10 lbf load on the fixture, select the Test Id "GR326Proof", No Load, 10.0 lb, and 0 deg option buttons.
4. Select the "Initial" button. You may view the readings in the table view.
5. Gradually apply the load to the connector under test. Once the load is applied, wait at least five seconds before removing the load. Allow the connector to stabilize for at least 10 seconds and select the "Multi" button. Be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time.
6. Once the measurements are finished, place the appropriate weights on the bolt attached to the capstan so that the load is 15 lbf.
7. Make sure that the mechanical test fixture is at 0° so that the axis of the fiber is perpendicular to the floor. After placing the 15-lbf load on the fixture, select the "Multi" button, No Load, 15.0

lb, and 0-deg option buttons. Select the "Multi" button.

8. Gradually apply the load to the connector under test. Once the load is applied, wait at least five seconds before removing the load. Allow the connector to stabilize for at least 10 seconds and select "Multi" button. Be sure not to disturb the connector under test, the loss measurements will be performed at this time. Again, be sure not to disturb the connector under test while the loss and reflectance measurements are performed.
9. Once the measurements are finished, place the appropriate weights on the bolt attached to the capstan so that the load is 5 lbf (the load may be reduced to 3.3 lbf for small form factor connectors).
10. Make sure that the mechanical test fixture is at 90° so that the axis of the fiber is parallel to the floor. Placing the 5 lbf (or 3.3 lbf for small form factor) load on the fixture. Make an adjustment to the Mechanical Fixture's Rotating Arm, (Exhibit 8 - 50), and (Exhibit 8 - 54), each time a different weight mass is applied so that the cable bend is exactly in the vertical alignment with the capstan when bent at a 90° angle.
11. Select the "Multi" button, No Load, 5.0 lb (or 3.3 lbf for small form factor), and 90-deg option buttons. You may view the results in the table view.
12. Gradually apply the load to the connector under test. Once the load is applied, wait at least five seconds before removing the load. Allow the connector to stabilize for at least 20 seconds and select the "Multi" button. Be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time.
13. Once the measurements are finished, place the appropriate weights on the bolt attached to the capstan so that the load is 7.5 lbf (the load may be reduced to 5.0 lbf for small form factor connectors).
14. Make sure that the mechanical test fixture is at 90° so that the axis of the fiber is parallel to the floor. After placing the 7.5 lbf (or 5.0 lbf for small form factor) load on the fixture, select the Proof Test, No Load, 7.5 lb (or 5.0 lbf for small form factor), and 90-deg option buttons. Select Begin Reading.
15. Once the laser has stabilized and the real time measurements are being displayed on the screen, proceed with the Proof Test.
16. Gradually apply the load to the connector under test. Once the load is applied, wait at least five seconds before removing the load. Allow the connector to stabilize for at least 20 seconds and select Take Reading. Be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time. Once the 1310 nm measurements have been made, the "Take Reading" button will appear again to allow you to take measurements at the next wavelength which is 1490 nm. Select "Take Reading". Again, be sure not to disturb the connector under test while the loss and reflectance measurements are performed. Repeat this process for wavelengths of 1550 nm and 1625 nm. Be sure that the loss measurements are made a both wavelengths.
17. Be sure to verify the real time data as the tests are being done so that any problems can be caught and can be discussed with the customer.
18. Refer to Exhibit 8 - 66 for diagram of Tension Test Fixture.

Tension Test Fixture

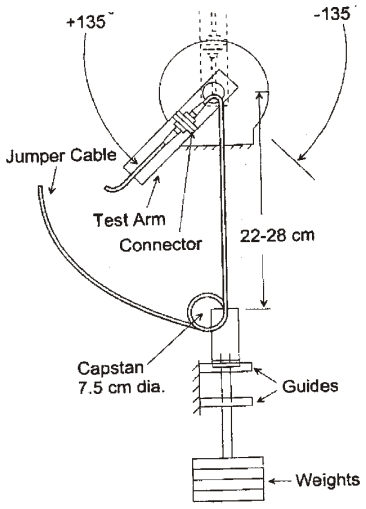


Exhibit 8 - 66

Configuration and Conditions:

The connector assemblies will be placed in the mechanical test fixture and will be operational during the course of this evaluation. See Exhibit 8 - 67 for a diagram of the Mechanical Test setup.

Mechanical Test Setup

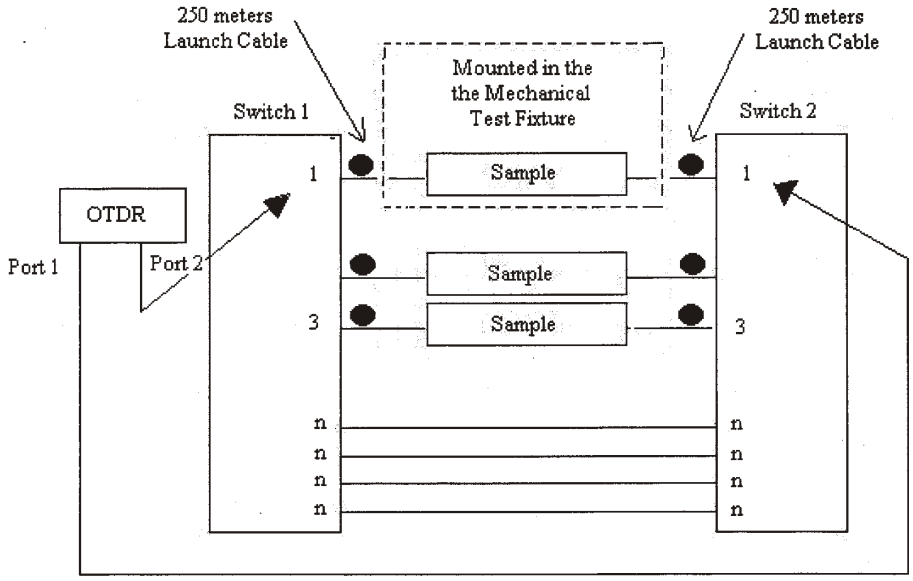


Exhibit 8 - 67

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-26[42].** The connector assemblies met the requirement criteria.

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Objective **O4-27 [43]**. Failures occurred for maximum reflectance at 1310nm, and 1550nm.

See Exhibit 8 - 68 (1310 nm), Exhibit 8 - 69 (1490 nm), Exhibit 8 - 70 (1550 nm), Exhibit 8 - 71 (1625nm) for the maximum values measured during the course of this evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.20	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.07	0.30	Yes	0.20	Yes
Loss Increase	0.01	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51	-40	Yes (25 Y, 0 N)	-55	No (15 Y, 10 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 68

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.10	0.30	Yes	0.20	Yes
Loss Increase	0.01	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 69

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.15	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51	-40	Yes (25 Y, 0 N)	-55	No (21 Y, 4 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 70

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.13	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.01	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 71

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Samples 1,3,7,13,17,21,31, and 33 (Tyco IDs –10,--01,--15,--33,--04,--06,--18 and –30) were **noncompliant** with maximum Reflectance Objective **O4-27 [43]** at 1310nm. Samples 17 and 21 (Tyco IDs –04 and –06) were **noncompliant** with maximum Reflectance Objective **O4-27 [43]** at 1550nm.

TRANSMISSION WITH APPLIED LOAD (4.4.3.5)

Criteria:

R4-29 [44] The product shall not become uncoupled under this load and shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 0° in Table 4-9 (GR-326-CORE), for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest which was supported shall be reported.

R4-30 [45] The product shall not become uncoupled under this load and shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 90° in Table 4-9 (GR-326-CORE) or for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.

O4-31 [46] The product shall not become uncoupled under this load and should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 0° in Table 4-9 (GR-326-CORE) or for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.

O4-32 [47] The product shall not become uncoupled under this load and should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 90° in Table 4-9 (GR-326-CORE) or for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.

CO4-33 [220] Small Form Factor Connectors shall not become uncoupled under this load and should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 90° in Table 4-9 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.

R4-34 [48] The supplier of a connector or jumper assembly product shall state if that product is intended for use in a "high density" environment. See Section 4.1.1 of GR-326-CORE for definition.

CR4-35 [49] If the product is intended for use in "high density" environments, then it should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 135° in Table 4-9 (GR-326-CORE) or for Small Form Factor Connectors in Table 4-10 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.

CO4-36 [221] If the Small Form Factor Connector is intended for use in "high density" environments, then it should meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Under Load", when subjected to all of the loading levels at an angle of 135° in Table 4-9 (GR-326-CORE). If the product fails to do so, then the highest load which was supported shall be reported.

Test Conditons:

Temperature:	Room Ambient (~23°C)
Humidity:	Room Ambient (~50%)
Load:	See Exhibit 8 - 72 and Exhibit 8 - 73.

Sample Group: The same set of connectors that were used in the Proof Test will be used for this test. All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. With sample spliced (or coupled) to the OTDR system, mount sample into mechanical test fixture – mount sample with receive side positioned for exposure.
2. Record manually the averaged OTDR performance IL/RL (free run).
3. Without disturbing fixtured sample, cut sample out of OTDR system
   Note: Maintain 4 meter pigtails on both receive and launch side.
4. Splice sample onto benchtop system.
5. With sample spliced to benchtop system, record initial optical performance as indicated in the following steps:

   - Initially set RX meters to 1310 and 1490, respectively. Set switches to Channel 2.
   - When signaled, record data in order of transmission power (1310, 1550, 1490, 1625) followed by reflectance in the same order.
   - Transmission for 1310 / 1550 = **Switch 1** & **Switch 2** are **set to Channel 2.**
   - Transmission for 1490 / 1625 = **Switch 1 is set to Channel** 1 and **Switch 2** is set to **Channel 2**.
   - Reflectance for 1310 / 1550 = **Switch 1** is set to **Channel 2** & **Switch 2** are **set to Channel 0.**
   - Reflectance for 1490 / 1625 = **Switch 1** is set to **Channel 1** & **Switch 2** are **set to Channel 0.**
     Note: Manipulation of wavelength source is performed by toggling the RX meter wavelength source button. This is done at the appropriate point in the measurement process.

6. Proceed with transmission with applied load testing – two operators are needed at this point.

   Operator 1: Bench Top System Operator (Switches / RX Meter)
   - This operator also monitors the clock for proper loading time.
   - Operator also calls out sample performance to Operator 2.

   Operator 2: Applies / Removes Loads and Scribe
   This operator also records data manually on datasheet (the data is verbally called out by operator 1).

7. Refer to Exhibit 8 - 72 for the loads and angles at which they are to be applied at for each media type.

Tensile Loads Vs. Applied Angle for Each Media Type

Media Type I			
Load	**0°**	**90°**	**135°**
0.25 kgf (0.55 lbf)	X	X	X
0.7 kgf (1.54 lbf)	X	X	
1.5 kgf (3.3 lbf)	X	X	
2.0 kgf (4.4 lbf)	X	X	
Media Type II			
Load	**0°**	**90°**	**135°**
0.25 kgf (0.55 lbf)	X	X	X
0.7 kgf (1.54 lbf)	X	X	
Media Type III			
Load	**0°**	**90°**	**135°**
0.25 kgf (0.55 lbf)	X	X	
0.5 kgf (1.1 lbf)	X	X	

Exhibit 8 - 72

8. Refer to Exhibit 8 - 73 for the loads and angles at which they are to be applied at for each media type for Small Form Factor Connectors.

Tensile Loads Vs. Applied Angle for Each Media Type for Small Form Factor Connectors

Media Type I			
Load	**0°**	**90°**	**135°**
0.25 kgf (0.55 lbf)	R	O	O
0.17 kgf (0.37 lbf)		R	R
0.7 kgf (1.54 lbf)	R	O	
0.47 kgf (1.00 lbf)		R	
1.5 kgf (3.3 lbf)	R	O	
1.0 kgf (2.2 lbf)		R	
2.0 kgf (4.4 lbf)	R	O	
1.3 kgf (2.9 lbf)		R	
Media Type II			
Load	**0°**	**90°**	**135°**
0.25 kgf (0.55 lbf)	R	O	O
0.17 kgf (0.37 lbf)		R	R
0.7 kgf (1.54 lbf)	R	O	
0.47 kgf (1.00 lbf)		R	
Media Type III			
Load	**0°**	**90°**	**135°**
0.25 kgf (0.55 lbf)	R	O	
0.17 kgf (0.37 lbf)		R	
0.5 kgf (1.1 lbf)	R	O	
0.33 kgf (0.73 lbf)		R	

Exhibit 8 - 73

9. Refer to the data sheets for order of tests.
10. Place the appropriate load for the Transmission with Applied Load Test on the mechanical fixture. Place the appropriate loads on the bolt that is attached to the capstan.
11. Make an adjustment to the Mechanical Fixture's Rotating Arm, (Exhibit 8 - 50), and (Exhibit 8 - 54), each time a different weight mass is applied so that the cable bend is exactly in the vertical alignment with the capstan when bent at any angle.
12. Be sure that the appropriate load is selected, angle, test, project number, and channel number are selected on the form.
13. Gradually apply the load to the connector under test. Allow at least 20 seconds for the measurements to stabilize before making measurements. Be sure not to disturb the connector under test.
14. Following the procedures given in Step (5), measure and record the IL and RL readings for the

load and angle under test.

15. Repeat steps 10-14 for all required loads and angles.
16. Once all of the applicable loads have been tested at all applicable angles for the first connector, perform one last measurement that will serve as a final measurement for the TWAL test. Remove the connector assembly from the setup, increment the fixture 45° and start over again with a new sample.
17. Refer to Exhibit 8 - 74 for diagram of Tension Test Fixture.

Tension Test Fixture

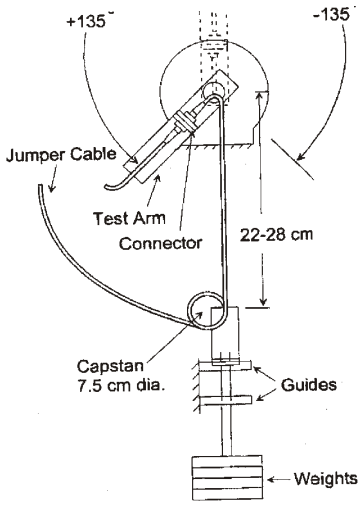


Exhibit 8 - 74

Configuration and Conditions:

The connector assemblies will be placed in the mechanical test fixture and will be operational during the course of this evaluation. See Exhibit 8 - 75 for a diagram of the Mechanical Test setup.

Mechanical Test Setup

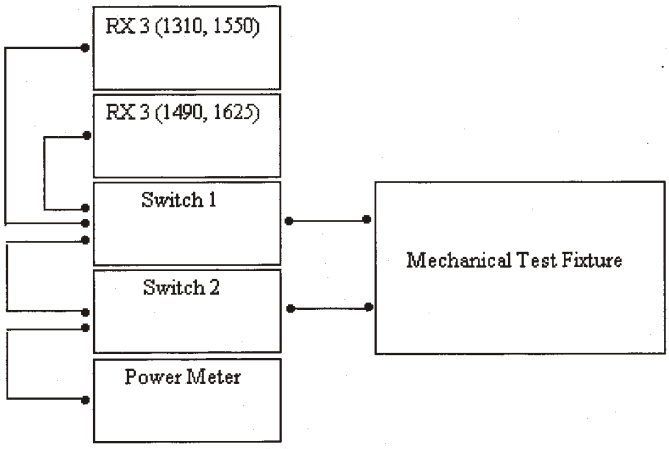


Exhibit 8 - 75

Test Results:

The Single Mode LC Connector was **compliant** with Requirements **R4-29 [44]** and **R4-30 [45]**. The connector assemblies **met** the requirement criteria.

The Single Mode LC Connector was **compliant** with Objectives **O4-31 [46]** and **O4-32 [47]**. The connector assemblies **met** the objective criteria.

The Single Mode LC Connector was **compliant** with Conditional Objectives **CO4-33 [220]** and **CO4-36 [221]**. The connector assemblies **met** the objective criteria.

The Single Mode LC Connector was **compliant** with Requirement **R4-34 [48]**. The Single Mode LC Connector can be used in a high-density environment.

The Single Mode LC Connector were **compliant** with Conditional Requirement **CR4-35 [49]**. The connector assemblies **met** the requirement criteria. See Exhibit 8-76 through Exhibit 8-87 for the maximum values measured during the course of this evaluation.

Maximum Values Measured For Requirement R4-29 and Objective O4-31 at 1310 nm

Criteria Category			Max	Requirement (R4-29)		Objective/Conditional Requirement (O4-31)	
Measurement Type	Load (kg.)	Angle (Degree)	Values (dB)	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	0	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	0	0.2	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	No Load	0	0.0	0.3	Yes (25 Y, 0 N)	0.2	Yes (25 Y, 0 N)
Reflectance	0.25	0	-60	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	0.7	0	-60	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	1.5	0	-60	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	2	0	-61	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	No Load	0	-60	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Increase in Reflectance	0.25	0	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	0.7	0	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	1.5	0	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	2	0	0.0	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	No Load	0	0.4	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 76

Maximum Values Measured For Requirement R4-29 and Objective O4-31 at 1490 nm

Criteria Category			Max	Requirement (R4-29)		Objective/Conditional Requirement (O4-31)	
Measurement Type	Load (kg.)	Angle (Degree)	Values (dB)	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	0	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	No Load	0	0.0	0.3	Yes (25 Y, 0 N)	0.2	Yes (25 Y, 0 N)
Reflectance	0.25	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	0.7	0	-62	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	1.5	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	2	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	No Load	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Increase in Reflectance	0.25	0	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	0.7	0	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	1.5	0	0.0	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	2	0	0.0	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	No Load	0	0.3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 77

Maximum Values Measured For Requirement R4-29 and Objective O4-31 at 1550 nm

Criteria Category			Max	Requirement (R4-29)		Objective/Conditional Requirement (O4-31)	
Measurement Type	Load (kg.)	Angle (Degree)	Values (dB)	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	0	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	No Load	0	0.0	0.3	Yes (25 Y, 0 N)	0.2	Yes (25 Y, 0 N)
Reflectance	0.25	0	-61	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	0.7	0	-62	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	1.5	0	-62	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	2	0	-62	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	No Load	0	-62	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Increase in Reflectance	0.25	0	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	0.7	0	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	1.5	0	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	2	0	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	No Load	0	0.4	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 78

Maximum Values Measured For Requirement R4-29 and Objective O4-31 at 1625 nm

Criteria Category			Max	Requirement (R4-29)		Objective/Conditional Requirement (O4-31)	
Measurement Type	Load (kg.)	Angle (Degree)	Values (dB)	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	0	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	0	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2	0	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	No Load	0	0.0	0.3	Yes (25 Y, 0 N)	0.2	Yes (25 Y, 0 N)
Reflectance	0.25	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	0.7	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	1.5	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	2	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	No Load	0	-63	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Increase in Reflectance	0.25	0	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	0.7	0	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	1.5	0	0.0	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	2	0	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	No Load	0	0.3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 79

Maximum Values Measured For Requirement R4-30 and Objective O4-32 at 1310 nm

Criteria Category			Max	Requirement (R4-30)		Objective/Conditional Requirement (O4-32)	
Measurement Type	**Load (kg.)**	**Angle (Degree)**	**Values (dB)**	**Criteria (dB)**	**Criteria Met?**	**Criteria (dB)**	**Criteria Met?**
Loss Increase	0.25	90	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	90	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	90	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2	90	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Reflectance	0.25	90	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	0.7	90	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	1.5	90	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	2	90	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Increase in Reflectance	0.25	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	0.7	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	1.5	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	2	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 80

Maximum Values Measured For Requirement R4-30 and Objective O4-32 at 1490 nm

Criteria Category			Max	Requirement (R4-30)		Objective/Conditional Requirement (O4-32)	
Measurement Type	**Load (kg.)**	**Angle (Degree)**	**Values (dB)**	**Criteria (dB)**	**Criteria Met?**	**Criteria (dB)**	**Criteria Met?**
Loss Increase	0.25	90	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	90	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	90	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2	90	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Reflectance	0.25	90	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	0.7	90	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	1.5	90	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	2	90	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Increase in Reflectance	0.25	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	0.7	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	1.5	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	2	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 81

Maximum Values Measured For Requirement R4-30 and Objective O4-32 at 1550 nm

Criteria Category			Max	Requirement (R4-30)		Objective/Conditional Requirement (O4-32)	
Measurement Type	**Load (kg.)**	**Angle (Degree)**	**Values (dB)**	**Criteria (dB)**	**Criteria Met?**	**Criteria (dB)**	**Criteria Met?**
Loss Increase	0.25	90	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	90	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	90	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2	90	0.2	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Reflectance	0.25	90	-54	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	0.7	90	-54	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	1.5	90	-55	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	2	90	-54	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Increase in Reflectance	0.25	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	0.7	90	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	1.5	90	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	2	90	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 82

Maximum Values Measured For Requirement R4-30 and Objective O4-32 at 1625 nm

Criteria Category			Max	Requirement (R4-30)		Objective/Conditional Requirement (O4-32)	
Measurement Type	Load (kg.)	Angle (Degree)	Values (dB)	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	90	0.3	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	90	0.0	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	90	0.1	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2	90	0.3	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Reflectance	0.25	90	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	0.7	90	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	1.5	90	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance	2	90	-56	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Increase in Reflectance	0.25	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	0.7	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	1.5	90	0.2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in Reflectance	2	90	0.1	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 – 83

Maximum Values Measured For Conditional Requirement CR4-35 at 1310 nm

Criteria Category				Requirement (CR4-35)		Objective/Conditional Requirement	
Measurement Type	Load (kg.)	Angle (Degree)	Max Values (dB)	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	135	0.04	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Reflectance	0.25	135	-53	-40	Yes	-55	Yes
Increase in Reflectance	0.25	135	0.20	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 84

Maximum Values Measured for Conditional Requirement CR4-35 at 1490 nm

Criteria Category			Max Values (dB)	Requirement (CR4-35)		Objective/Conditional Requirement	
Measurement Type	Load (kg.)	Angle (Degree)		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	135	0.07	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Reflectance	0.25	135	-56	-40	Yes	-55	Yes
Increase in Reflectance	0.25	135	0.20	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 85

Maximum Values Measured for Conditional Requirement CR4-35 at 1550 nm

Criteria Category			Max Values (dB)	Requirement (CR4-35)		Objective/Conditional Requirement	
Measurement Type	Load (kg.)	Angle (Degree)		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	135	0.20	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Reflectance	0.25	135	-55	-40	Yes	-55	Yes
Increase in Reflectance	0.25	135	0.10	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 86

Maximum Values Measured for Conditional Requirement CR4-35 at 1625 nm

Criteria Category			Max Values (dB)	Requirement (CR4-35)		Objective/Conditional Requirement	
Measurement Type	Load (kg.)	Angle (Degree)		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.25	135	0.32	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Reflectance	0.25	135	-57	-40	Yes	-55	Yes
Increase in Reflectance	0.25	135	0.10	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 87

Failure History: None

Sample 25 (Tyco ID –21) showed very high IL after TWAL testing, indicating a performance issue with this connector assembly. Results for sample 25 were compliant for the requirements and objectives of Section 4.4.3.5, but sample 25 was replaced with hot spare 28 for tests following TWAL.

EQUILIBRIUM TENSILE LOADING (4.4.3.6)

This section was removed from Issue 2 because of overlap with Section 4.4.3.5. The section was left as a place holder so that the numbering scheme will remain consistent between the issues.

IMPACT TEST (4.4.3.7)

Criteria:

R4-37 [50] The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

O4-38 [51] The product should meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load".

Test Conditions:

Temperature:	Room Ambient (~23°C)
Humidity:	Room Ambient (~50%)
Impacts:	8 impacts

Sample Group: The same set of connectors that were used in the Transmission With Applied Load will be used for this test.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After completing the Transmission with Applied Load Test on the last connector assembly, the Impact Test shall be conducted on the same set of connectors.
2. Take the loss and reflectance measurements using the ATOC switch software.
3. Once the measurement has finished, verify that the connector meets the requirements before starting the test.
4. Place a concrete block adjacent to the base of either a seven- or eight-foot equipment rack. Attach an extension (a piece of flat metal ¼ in. x 1 in. x 6 in. is sufficient) to the rack at a height of 1.5 meters above the center of the concrete block (Refer to Exhibit 8 - 88).
5. Disconnect the receive plug from the assembly and place a dust cap over the end of the ferrule so that only the ferrule is protected by the dust cap. The dust cap is used to prevent the endface of the connector from being scratched.

Impact Test Setup

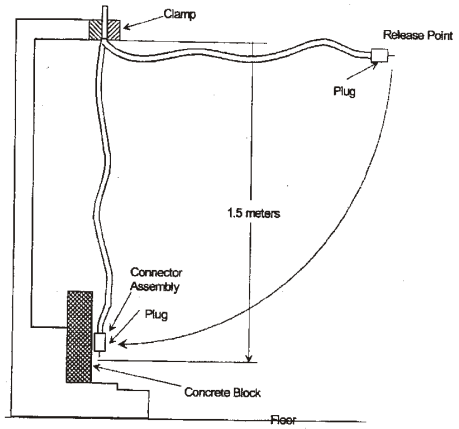


Exhibit 8 - 88

6. Secure the fiber patchcord to the extension arm using duct tape. Be sure that the connector is hanging such that the connector is lined up with the center of the concrete block.
7. Hold the connector; raise it to a horizontal position so that the fiber cable is parallel to the floor and in line with the concrete block.
8. Release the connector so that it will strike the center of the concrete block.
9. Perform the procedure in Steps 7 and 8 an additional 7 times for a total of 8 impacts.
10. Clean the connector as outlined in Section 4.3.1, Cleaning Procedure A, or as outlined in Section 4.3.2, Cleaning Procedure B, at the customer's option.
11. Once the connector has been cleaned, plug the connector back into the adapter from which it was unplugged and take a final reading.
12. Perform the procedure outlined in Steps 5 through 11 until all of the connectors have been tested and cleaned. (one plug on each pigtail assembly-receive side, and one plug on the source side of the jumper assembly).
13. Using the switch software, take a final reading for loss and reflectance
14. When all the measurements have finished, open Excel and verify that all of the connectors meet the requirements after completing the test. The final insertion loss measurements shall be subtracted from the initial insertion loss measurements, yielding the change in loss.
15. If all the connector assemblies meet the requirements, proceed to the next test. If some of the connector assemblies are not within the requirements, notify the customer. Once a resolution has been reached, proceed with testing.

Configuration and Conditions:

The connector assemblies will be placed in the impact test fixture and will remain operational during the course of this evaluation. See Exhibit 8 - 89 for a diagram of the functional configuration.

Impact Test Setup (Functional Configuration)

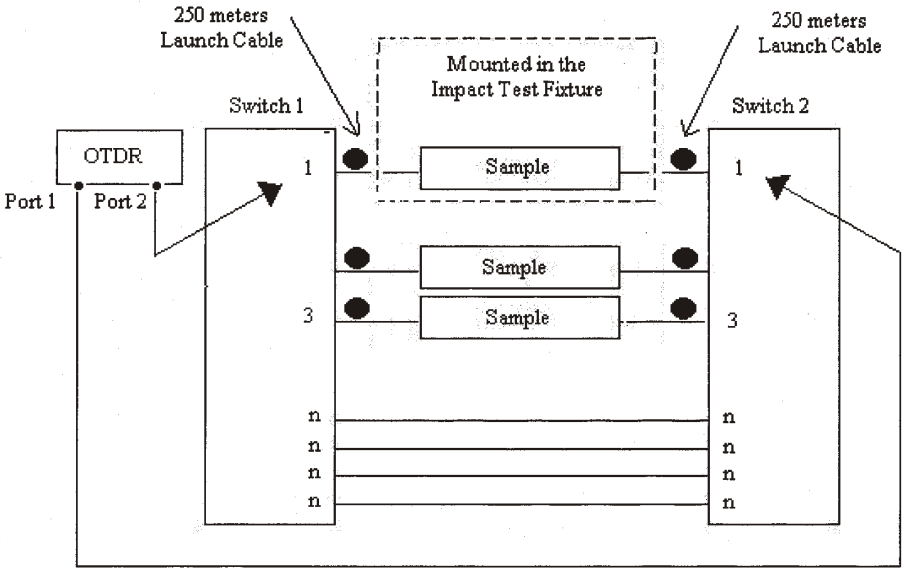


Exhibit 8 - 89

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-37[50].**

The LC/PC Fiber Optic Connectors and Adapters were **noncompliant** with Objective **O4-38 [51]**. Failures occurred for Maximum Reflection at 1310 nm, 1490 nm, and 1550 nm.

See Exhibit 8 - 90 through Exhibit 8 - 93 for maximum values measured during this evaluation.

Maximum Value Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.18	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.06	0.30	Yes	0.20	Yes
Loss Increase	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-50	-40	Yes (25 Y, 0 N)	-55	No (19 Y, 6 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 – 90

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.22	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.10	0.30	Yes	0.20	Yes
Loss Increase	0.01	0.3	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-52	-40	Yes (25 Y, 0 N)	-55	No (24 Y, 1 N)
Reflectance Increase	3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 – 91

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.16	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.04	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51	-40	Yes (25 Y, 0 N)	-55	No (24 Y, 1 N)
Reflectance Increase	3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 92

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.15	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.04	0.30	Yes	0.20	Yes
Loss Increase	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53	-40	Yes (25 Y, 0 N)	-55	Yes (25 Y, 0 N)
Reflectance Increase	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 93

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Samples 1,6,10,13,28, and 33 (Tyco IDs –10,--27,--28,--33,--16,--30) were **noncompliant** with maximum Reflectance Objective **O4-38 [51]** at 1310nm. Sample 28 (Tyco ID –16) was **noncompliant** with maximum Reflectance Objective **O4-38 [51]** at 1490nm. Sample 28 (Tyco ID –-16) was **noncompliant** with maximum Reflectance Objective **O4-38 [51]** at 1550nm.

DURABILITY TEST (4.4.3.8)

Criteria:

R4-39 [52] Of the entire body of measurements taken after either one-sided or two-sided cleaning (at insertion 25, 50…), 90% shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load."

O4-40 [53] Of the entire body of measurements taken after either one-sided or two-sided cleaning (at insertion 25, 50…), 95% shall meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load."

O4-41 [54] Of the entire body of measurements taken without cleaning (at insertions 24, 49…), 90% shall meet the loss and reflectance Requirements (not Objectives) listed in tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load."

R4-42 [55] After having been subjected to the complete set of 200 insertions, the product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load." Up to two re-cleanings may be performed for each connection.

O4-43 [56] After having been subjected to the complete set of 200 insertions, the product shall meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "During Test, Not Under Load." Up to two re-cleanings may be performed for each connection.

O4-44 [57] The criterion is not met if connectors which are nonconforming after 200 insertions and the subsequent two-sided cleaning are brought back into conformance by one or two re-cleanings.

Test Conditions:

Temperature:	Room Ambient (~23°C)
Humidity:	Room Ambient (~50%)
Insertions:	200

Sample Group: The same set of connectors that were used in the Impact Test will be used for this test. All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After completing the Impact Test, the Durability Test shall be conducted on the same set of connectors.
2. Using the same rack that was used in the Impact Test setup, mount boards (preferably 2" x 2") on the equipment rack at heights of 0.9 meters (3 ft.), 1.4 meters (4.5 ft), and 1.8 meters (6 ft.) above the floor.
3. Mount the connectors, in the bulk head adapters, with an equal amount of connectors at each of the height in Step 2. Mount the connector adapters in the face plate so as to maximize the distance from the end of the connector to the enclosure front panel (testing performed in sec. 4.4.6 Connector Installation).
4. Be sure that none of the connectors or adapters are under any stress due to the hanging fibers. If necessary, relieve the stress of the fibers by securing them to the rack next to their associated connector assemblies.

5. Take the loss and reflectance measurements using the switch software. Use the Standard option button to name the test something else. Open Excel and verify the data. If all of the connectors meet the requirements, proceed. If some of the connectors are not within the requirements, clean the connectors or adapter and straighten the fibers if necessary. Take another set of measurements to ensure that all of the connector assemblies are within the requirements. Once all of the connector assemblies are within the requirements, proceed to the next step.
6. Take the loss measurements again.
7. Once the measurements are finished, you may proceed with the test.
8. The connector assemblies must be disconnected and reconnected as follows:
9. Disconnect and reconnect a sample at the 6-ft height.
10. Disconnect and reconnect a sample at the 4.5-ft height.
11. Disconnect and reconnect a sample at the 3-ft height.
12. Disconnect and reconnect a sample at the 3-ft height.
13. Disconnect and reconnect a sample at the 4.5-ft height.
14. Disconnect and reconnect a sample at the 6-ft height.
15. Repeat Steps 9 through 13 until all of the connector assemblies have been disconnected and reconnected.
16. This sequence counts as a single insertion.
17. When testing jumper assemblies, disconnect and reconnect both connections in the assembly. Loss measurements are made on the assembly after both connections are unmated/remated.
18. Measurements and cleanings shall be made as follows:
19. After insertions 24, 49, 74, 99, 124, 149, 174, and 199, take measurements (after inserting the connectors on this cycle but before cleaning them.
20. During insertions 25, 75, 125, and 175, a one-sided cleaning needs to be performed (per Cleaning Procedure A, Section 4.3.1 of Cleaning Procedure B, Section 4.3.2) before reconnecting the connector. Take loss and reflectance measurements after all of the connectors have gone through a one-sided cleaning at these insertions.
21. During insertions 50, 100, 150, and 200, a two-sided cleaning needs to be performed (per Cleaning Procedure A, Section 4.3.1 of Cleaning Procedure B, Section 4.3.2) before reconnecting the connector. Take loss and reflectance measurements after all of the connectors have gone through a two-sided cleaning at these insertions.
22. If the optical criteria are not met by all of the connections after the two-sided cleaning during the 200th insertion then up to two re-cleanings may be performed.
23. After completion of the Durability Test, open Excel and verify that all of the connectors met the requirement criteria. If all of the connectors met the requirements, proceed to the next test. If some of the connectors failed to meet the requirements, notify the customer. Once a resolution has been reached, proceed with testing.

Configuration and Conditions:

The connector assemblies will be placed in the durability test fixture and will be operational during the course of this evaluation. See Exhibit 8 - 94 for a diagram of the functional configuration. See Exhibit 8 - 95 for a diagram of the Durability setup.

Test Setup for the Durability Test (Functional Configuration)

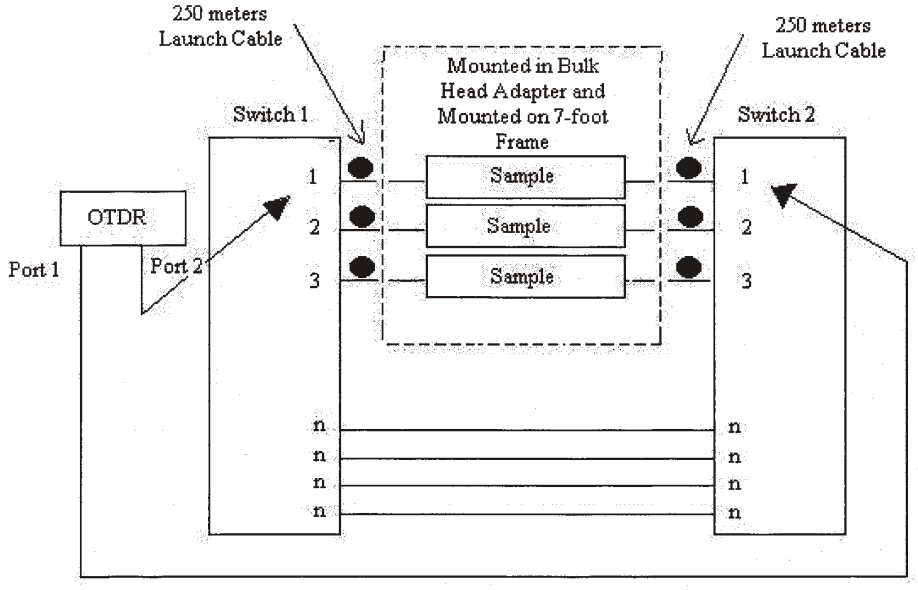


Exhibit 8 - 94

Setup Diagram for the Durability Test

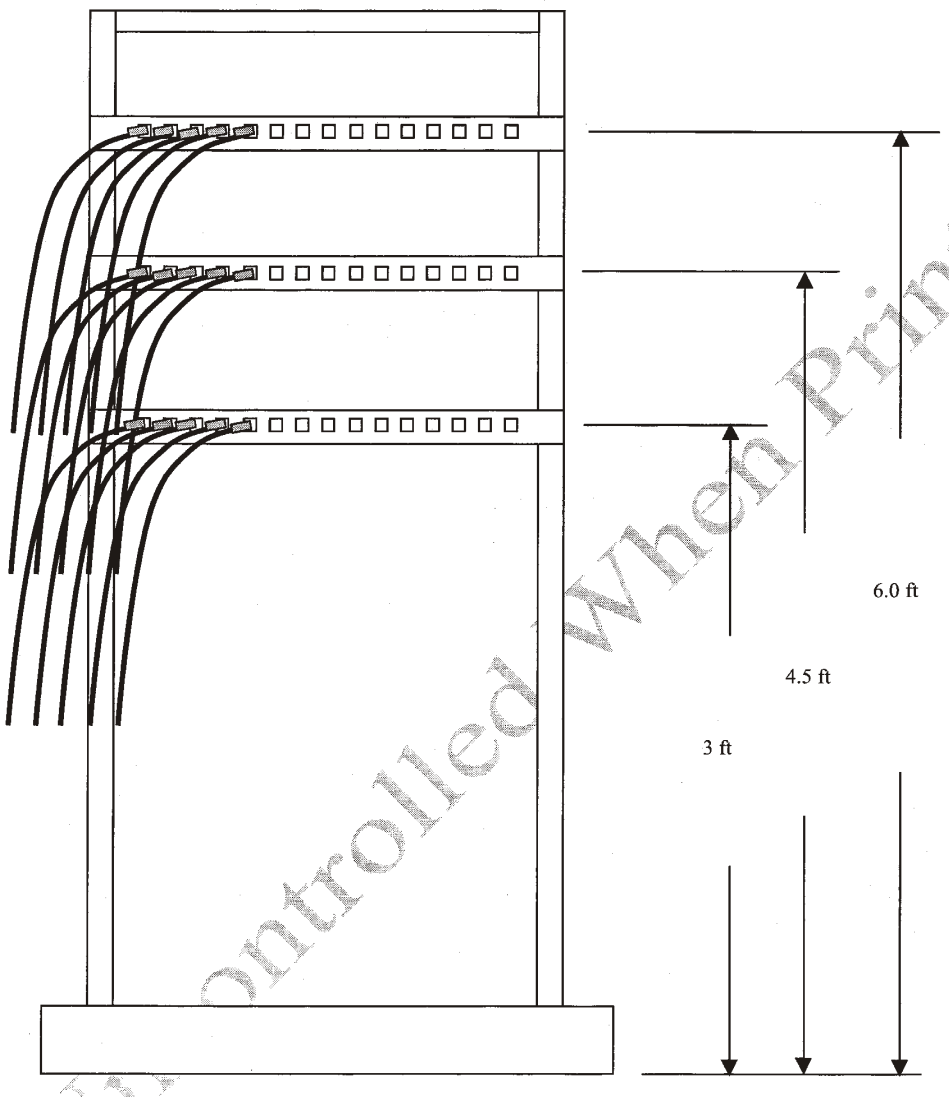


Exhibit 8 - 95

Test Results:

The Single Mode LC Connectors were **noncompliant** with Objective **O4-40 [53].** Failures occurred for Maximum Reflectance at 1310 nm and 1550 nm.

The Single Mode LC Connectors were **noncompliant** with Requirement **R4-42 [55].** Failures occurred for Maximum Loss, Loss Increase and Reflectance Change at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

The Single Mode LC Connectors were **noncompliant** with Objective **O4-43 [56].** Failures occurred for Maximum Loss, Mean Loss, Loss Increase, Maximum Reflectance, and Reflectance Change at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

The Single Mode LC Connectors were **noncompliant** with Objective **O4-44 [57].** Failures occurred for Maximum Loss, Mean Loss, Loss Increase, Maximum Reflectance, and Reflectance Change at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

See Exhibits 8 - 96 through Exhibit 8 - 103 for the maximum values measured during this evaluation. Note that the two automatic cleanings and the two optional cleanings were not completed following the 200th cycle.

Maximum Values Measured from Sample Group at 1310 nm During Test

Criteria Category	Requirement, 90% Of Measurements After Cleaning (R4-39)		Objective/Conditional Requirement, 95% Of Measurements After Cleaning (O4-40)		Objective, 90% Of Measurements Before Cleaning (O4-41)	
	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.5	Yes, 97%	0.3	Yes, 97%	0.5	Yes, 98%
Mean Loss	0.3	No	0.2	No	0.3	No
Loss Increase	0.3	Yes, 97%	0.2	Yes, 97%	0.3	Yes, 98%
Max Reflectance	-40	Yes, 99%	-55	No, 49%	-40	Yes, 98%
Reflectance Change	5	Yes, 96%	2	Yes, 96%	5	Yes, 95%

Exhibit 8 - 96

Maximum Values Measured from Sample Group at 1490 nm During Test

Criteria Category	Requirement, 90% Of Measurements After Cleaning (R4-39)		Objective/Conditional Requirement, 95% Of Measurements After Cleaning (O4-40)		Objective, 90% Of Measurements Before Cleaning (O4-41)	
	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.5	Yes, 97%	0.3	Yes, 97%	0.5	Yes, 98%
Mean Loss	0.3	No	0.2	No	0.3	No
Loss Increase	0.3	Yes, 97%	0.2	Yes, 97%	0.3	Yes, 98%
Max Reflectance	-40	Yes, 99%	-55	Yes, 95%	-40	Yes, 99%
Reflectance Change	5	Yes, 95%	2	Yes, 95%	5	Yes, 94%

Exhibit 8 - 97

Maximum Values Measured from Sample Group at 1550 nm During Test

Criteria Category	Requirement, 90% Of Measurements After Cleaning (R4-39)		Objective/Conditional Requirement, 95% Of Measurements After Cleaning (O4-40)		Objective, 90% Of Measurements Before Cleaning (O4-41)	
	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.5	Yes, 97%	0.3	Yes, 97%	0.5	Yes, 98%
Mean Loss	0.3	No	0.2	No	0.3	No
Loss Increase	0.3	Yes, 97%	0.2	Yes, 97%	0.3	Yes, 98%
Max Reflectance	-40	Yes, 98%	-55	No, 87%	-40	Yes, 96%
Reflectance Change	5	Yes, 96%	2	Yes, 96%	5	Yes, 94%

Exhibit 8 - 98

Maximum Values Measured from Sample Group at 1625 nm During Test

Criteria Category	Requirement, 90% Of Measurements After Cleaning (R4-39)		Objective/Conditional Requirement, 95% Of Measurements After Cleaning (O4-40)		Objective, 90% Of Measurements Before Cleaning (O4-41)	
	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.5	Yes, 97%	0.3	Yes, 97%	0.5	Yes, 98%
Mean Loss	0.3	No	0.2	No	0.3	No
Loss Increase	0.3	Yes, 97%	0.2	Yes, 97%	0.3	Yes, 98%
Max Reflectance	-40	Yes, 98%	-55	Yes, 95%	-40	Yes, 97%
Reflectance Change	5	Yes, 95%	2	Yes, 95%	5	Yes, 95%

Exhibit 8 - 99

Maximum Values Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective /Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.21[2]	0.50	No (24 Y, 1 N)	0.30	No (24 Y, 1 N)
Mean Loss	0.07[2]	0.3	No	0.20	No
Loss Increase	0.09[2]	0.30	No (24 Y, 1 N)	0.20	No (24 Y, 1 N)
Max Reflectance	-50.00[2]	-40	Yes (25 Y, 0 N)	-55	No (14 Y, 11 N)
Reflectance Change	4[2]	5	No (24 Y, 1 N)	2	No (24 Y, 1 N)

Exhibit 8 - 100

Maximum Values Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective /Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.21[2]	0.50	No (24 Y, 1 N)	0.30	No (24 Y, 1 N)
Mean Loss	0.11[2]	0.3	No	0.20	No
Loss Increase	0.07[2]	0.30	No (24 Y, 1 N)	0.20	No (24 Y, 1 N)
Max Reflectance	-53.00[2]	-40	Yes (25 Y, 0 N)	-55	No (24 Y, 1 N)
Reflectance Change	3[2]	5	No (24 Y, 1 N)	2	No (24 Y, 1 N)

Exhibit 8 - 101

Maximum Values Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective /Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.18[2]	0.50	No (24 Y, 1 N)	0.30	No (24 Y, 1 N)
Mean Loss	0.06[2]	0.3	No	0.20	No
Loss Increase	0.06[2]	0.30	No (24 Y, 1 N)	0.20	No (24 Y, 1 N)
Max Reflectance	-52[2]	-40	Yes (25 Y, 0 N)	-55	No (22 Y, 3 N)
Reflectance Change	3[2]	5	No (24 Y, 1 N)	2	No (24 Y, 1 N)

Exhibit 8 - 102

[2] Sample 3, which had excessive loss after 100 durability insertions, has been excluded from the maximum value statistics. For further information on this sample refer to Appendix A.

Maximum Values Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective /Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.20[3]	0.50	No (24 Y, 1 N)	0.30	No (24 Y, 1 N)
Mean Loss	0.04[3]	0.3	No	0.20	No
Loss Increase	0.05[3]	0.30	No (24 Y, 1 N)	0.20	No (24 Y, 1 N)
Max Reflectance	-54[3]	-40	Yes (25 Y, 0 N)	-55	No (24 Y, 1 N)
Reflectance Change	3[3]	5	No (24 Y, 1 N)	2	No (24 Y, 1 N)

Exhibit 8 - 103

The loss and reflectance measurements, for each sample, are reported in Appendix A.

Failure History:

Sample 3 (Tyco ID—01) showed noncompliant insertion loss readings at all wavelengths after 100 durability insertions. Hot spare 30 (Tyco ID—13) was brought in to replace sample 3; it was subjected to 100 durability cycles and then the entire sample population was subjected to the remainder of the durability test.

Sample 3 (Tyco ID—01) was was **noncompliant** with maximum Loss Requirement and maximum Loss Increase requirement **R4-39 [52]** at 1310, 1490, 1550, and 1625nm.

Sample 3 (Tyco ID—01) was **noncompliant** with maximum Loss Requirement and maximum Loss Increase requirement **R4-42 [55]** at 1310, 1490, 1550, and 1625nm. Sample 3 was **noncompliant** with maximum Reflectance Increase requirement **R4-42 [55]** at 1310, 1490, 1550 and 1625nm.

Sample 3 was **noncompliant** with maximum Loss Objective and maximum Loss Increase Objective **O4-43 [56]** at 1310, 1490, 1550, and 1625nm.

The entire sample population was noncompliant with mean Loss requirement **R4-42 [55]** at 1310, 1490, 1550, and 1625nm. The entire sample population was noncompliant with mean Loss objective **O4-43 [56]** at 1310, 1490, 1550, and 1625nm.

Samples 1,3,5,6,8,10,13,17,31, and 33 (Tyco IDs –10,--01,--31,--27,--03,--28,--33,--04,--18, and –30) were **noncompliant** with maximum Reflectance Objective **O4-43 [56]** at 1310nm; sample 3 was **noncompliant** with maximum Reflectance Increase Objective **O4-43 [56]** at 1310nm.

Sample 3 was **noncompliant** with maximum Reflectance Objective **O4-43 [56]** and maximum Reflectance Increase Objective **O4-43 [56]** at 1490nm.

[3] Sample 3, which had excessive loss after 100 durability insertions, has been excluded from the maximum value statistics. For further information on this sample refer to Appendix A.

Samples 3,8 and 33 (Tyco IDs –01,--03, and –30) were **noncompliant** with maximum Reflectance Objective **O4-43 [56]** at 1550nm. Sample 3 was **noncompliant** with maximum Reflectance Increase Objective **O4-43 [56]** at 1550nm.

Sample 3 was **noncompliant** with maximum Reflectance Objective **O4-43 [56]**and maximum Reflectance Increase objective **O4-43 [56]** at 1625nm.

The entire sample population was **noncompliant** with Rematebility with Cleaning objective **O4-40 [53]** for maximum reflectance at 1310nm and 1550nm.

Sample 3 was **non-compliant** with Cleanability Objective **O4-44 [57].**

END OF TEST CRITERIA (4.4.3.9)

Criteria:

R4-45 [58] The product shall meet the loss and reflectance Requirements criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "End of Test."

O4-46 [59] The product shall meet the loss and reflectance Objectives criteria listed in Tables 4-2 and 4-3, of GR-326-CORE, in the row marked "End of Test."

R4-47 [60] The product shall meet the Ferrule Endface Geometry Requirement criteria stated in Section 4.4.5.1 of GR-326-CORE.

R4-48 [61] At the completion of the tests there shall be no damage that would impair the performance of either the connector plug or the adapter, as described in Section 4.2.3 of GR-326-CORE.

Test Conditions:

Temperature: Room Ambient (~23°C)
Humidity: Room Ambient (~50%)

Sample Group: The same set of connectors that were used in the Durabilty Test will be used for this test.
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. After completing the Connector Installation Test, the End of Test Criteria shall be conducted on the same set of connectors.
2. Verify the data taken in the previous test.
3. If the data for the connectors is within the requirements, proceed. If not, be sure that the customer has been notified.
4. Take the loss and reflectance measurements using the switch software.
5. Once the loss and reflectance measurements have been performed.
6. Check the data to see if all of the connectors were compliant with optical requirements. If some of the connectors do not meet the requirements, clean the connectors or straighten the fibers as necessary and take another set of measurements. If some of the connectors are still not within the requirements, notify the customer to determine the proper course of action.
7. Cutback measurements will be performed on the jumper assemblies at the End of Criteria Test.
8. The Ferrule Endface Geometry will now be taken on the connectors.

Configuration and Conditions:

The connector assemblies will be visually inspected. The endface geometry measurements will be performed, and optical measurements will be taken. See Exhibit 8 - 104 for a diagram of the setup for the End of Test Criteria.

Test Setup for the End of Test Criteria

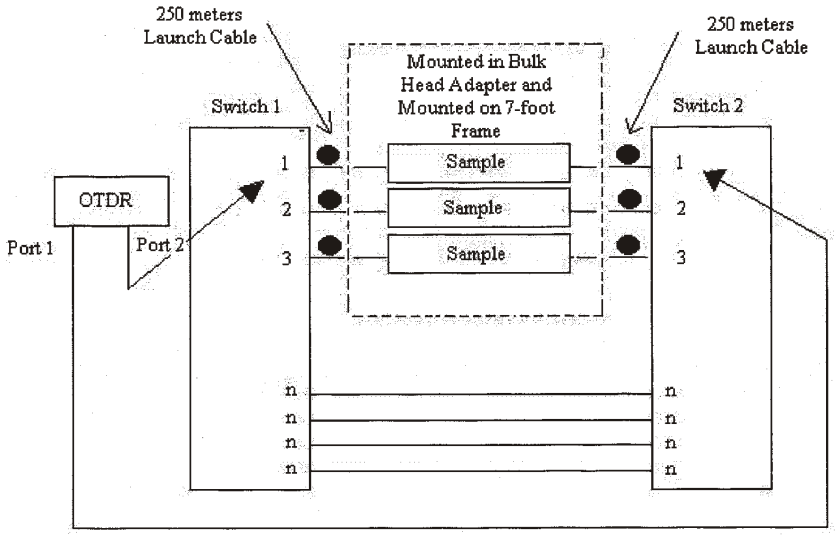


Exhibit 8 - 104

Test Results:

The Single Mode LC Connector was **compliant** with Requirement **R4-45 [58].**

The Single Mode LC Connector was **noncompliant** with Requirement **O4-46 [59].** Failures occurred for Maximum Reflectance at 1310, 1490, 1550 and 1625nm and for Reflectance Increase at 1625nm.

The Single Mode LC Connector was **noncompliant** with Requirement **R4-47 [60].** Failures occurred for Apex Offset.

The Single Mode LC Connector was **compliant** with Requirement **R4-48 [61].**

See Exhibit 8 – 105 through Exhibit 8 - 109 for the maximum values measured during this evaluation.

Maximum Values Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB)	Requirement		Objective /Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.06	0.3	Yes	0.20	Yes
Loss Increase	0.08	NA	NA	NA	NA
Max Reflectance	-49	-40	Yes (25 Y, 0 N)	-55	No (20 Y, 5 N)
Reflectance Change	2	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 105

Maximum Value Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.23	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.07	0.30	Yes	0.20	Yes
Loss Increase	0.08	NA	NA	NA	NA
Max Reflectance	-50	-40	Yes (25 Y, 0 N)	-55	No (23 Y, 2 N)
Reflectance Increase	4	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 106

Maximum Value Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.19	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.07	0.30	Yes	0.20	Yes
Loss Increase	0.16	NA	NA	NA	NA
Max Reflectance	-50	-40	Yes (25 Y, 0 N)	-55	No (23 Y, 2 N)
Reflectance Increase	3	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 8 - 107

Maximum Value Measured from Sample Group at 1625 nm

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.20	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.18	NA	NA	NA	NA
Max Reflectance	-50	-40	Yes (25 Y, 0 N)	-55	No (23 Y, 2 N)
Reflectance Increase	5	5	Yes (25 Y, 0 N)	2	No (24 Y, 1 N)

Exhibit 8 - 108

Maximum Values Measured From Sample Group

Criteria Category	Max/Min Values	Requirement	
		Criteria	Criteria Met?
Fiber Extension (**R4-67**)	86nm/-48nm	-125 to 50 nm	Yes
Ferrule Endface Radius (**R4-68**)	17.2mm/7.3mm	7 to 25 mm	Yes
Apex Offset (**R4-69**)	61	< 50 µm	No

*(+) indicates undercut
*(-) indicates protrusion

Exhibit 8 – 109

The loss, reflectance, and endface geometry measurements, for each sample, are reported in Appendix A.

Failure History:

Samples 1,8,10, and 23 (Tyco IDs –10,--03,--28 and –12) were **noncompliant** with maximum Reflectance Objective **O4-46 [59]** at 1310nm. Samples 1 and 10 (Tyco IDs –10 and –28) were **noncompliant** with Maximum Reflectance Objective **O4-46 [59]** at 1490nm. Samples 1 and 10 (Tyco IDs –10 and –28) were **noncompliant** with Maximum Reflectance Objective **O4-46 [59]** at 1550nm. Samples 1 and 10 (Tyco IDs –10 and –28) were **noncompliant** with Maximum Reflectance Objective **O4-46 [59]** at 1625nm. Sample 10 (Tyco ID –28) was noncompliant with maximum Reflectance Increase Objective **O4-46 [59]** at 1625nm.

Samples 28R, 33L and 16L (Tyco IDs –16R, --30L, and –01L) were noncompliant with Apex Offset requirement **R4-47 [60]**.

GEOMETRY REQUIREMENTS (4.4.5)

FERRULE ENDFACE GEOMETRY FOR NON-ANGLED PHYSICAL CONTACT CONNECTORS (4.4.5.1)

Criteria:

R4-67 [80] The Fiber Undercut (x) as shown in figure 4-6 (GR-326-CORE) shall meet the requirements stated in IEC 60874-14-n, where "n" is any of the applicable (single-mode, single fiber, physical contact) released connector detailed specifications in the IEC 60874-14-n series. In those detailed specifications, the radius of curvature of the ferrule is between 1 mm and 25 mm. That is, the value of the fiber undercut (in units of nanometers) shall be no larger than $-0.02R^3+1.3R^2-31R+325$, where R is the radius of curvature, expressed in millimeters. When the radius of curvature is between 7 mm and 10 mm, the value of the fiber undercut shall be no larger than 125 nm.

The Fiber Protrusion (y) as shown in figure 4-6 (GR-326-CORE) shall be ≤ 50 nm for all radii of curvature.

R4-68 [81] The Radius of Curvature of the ferrule shall be between 7 mm and 25 mm.

R4-69 [82] The Apex Offset of the spherical endface to the axis of the ferrule shall be less than 50 µm.

Test Conditions:

Radius of Curvature:	Between 7 mm and 25 mm
Dome Offset:	less than 50 µm
Maximum Fiber Undercut (x) or Protrusion (y):	Between -125 nm and 50 nm

Test Method:

1. The Ferrule Endface Geometry for Non-Angled Physical Contact Connectors is to be performed at the beginning of the test, before splicing the samples to the switch, and at the end of the testing, during the End of Test Criteria tests.
2. To start using the interferometer, the instrument must be set up as follows:
3. Wipe all oils/dire/dust off the surface of the tilt stage with alcohol.
4. Clean the bottom of the mount with alcohol.
5. Verify that the lock collar is in the unlocked position by turning the lock collar counter clockwise.
6. Set the micrometer to 0.0. The micrometer should always be turned in a clockwise direction. Turn the lock collar clockwise to lock into position.
7. Clean the 25mm ROC with the connector cleaner.
8. Make sure the mount is in the unlocked position with the lever to the left. Insert the 25mm ROC side of the calibration standard into the mount. Push the connector all the way down into the mount. Lock the connector into place.
9. Change to Red Light mode if not already in it.
10. Go into the Set-Up screen by pressing the "F2 Setup" button on the Tool bar, click "Default" and change Scan Type to Calibration. Click "OK" to save the parameters and exit the set up

screen.

11. Go into the Configuration – Option screen and click on the General Tab. Enter the Group Name and select any of the configuration options desired. Click "OK" to exit the screen and return to the program.
12. Adjust the focus knob to bring the fringe pattern into focus. Center the high point of the polish near the center of the scan. (Exhibit 8 - 110)
13. Beginning the measurement process. Click on F4 to take a measurement and be able to change the connector ID during the measurement process or Click on F12 for a Quick Scan. The interferometer will automatically scan the connector as is in the live image screen.
14. Upon the completion of the scan, the results will appear on the screen. The Radius of Curvature measurement should be between 24.9mm and 25.1mm. The Fiber Height should be < 0.005µm. If the measurements are with in spec, the Magnification Calibration is fine.
15. If the measurement is off after the above attempts have been made. Go into Action-Magnification Calibration and click on "Auto" in the calibration dialog box to start the auto-calibration. The system will proceed through a series of scans until a calibration factor is obtained. A message will appear indicating when the auto-calibration is done. Click "OK" to exit.
16. Making a measurement. Select the Set-UP Parameters for the connector being measured and the mount being used.
17. Select Configuration Settings and click on Configuration-Option-General Tab. Enter the Group Name data is to be stored under. Select Auto Export, Auto Increment, Auto Save in Database and/or Auto Print if desired. Click "OK" when done.
18. If measuring PC Connectors, verify that the lock collar is in the unlocked position by turning the lock collar counterclockwise. Set the micrometer to 0.0 then lock the micrometer position by turning the lock collar clockwise.
19. If measuring APC connector`, verify that the lock collar is in the unlocked position by turning the lock collar in a counter clockwise direction. Turn the micrometer clockwise to the degree of the polish indicated by the mount angle in the Set-UP menu. Lock the micrometer position by turning the lock collar clockwise.
20. Clean the connector/bar ferrule with the connector cleaner.
21. Make sure the lever arm is in the unlocked position and insert the connector into the mount. Lock the connector into place.
22. Center the fiber over the crosshairs on the live image using the X and Y knobs.
23. Adjust the focus knob to bring the fringe pattern into focus Exhibit 8 - 110
24. Click on F4 to take a measurement or F12 for a Quick Scan.
25. Upon completion of the scan, the results will appear on the screen. Remove the connector from the mount and insert the next connector to be tested.

Diagram of High Contrast Fringes

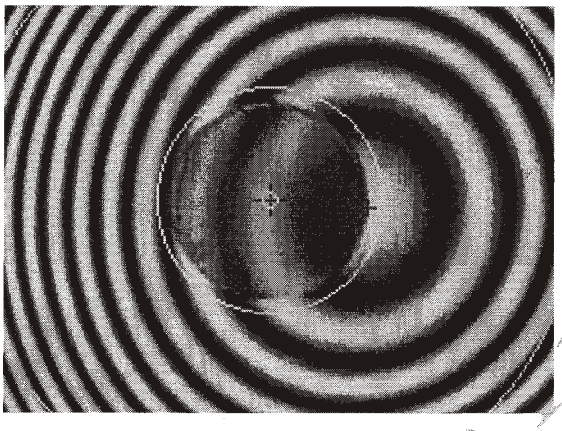


Exhibit 8 - 110

Configuration and Conditions:

The connectors will be individually mounted on the interferometer for these measurements.

Test Results:

The Single Mode LC Connector was **compliant** with Requirement **R4-67 [80].**

The Single Mode LC Connector was **compliant** with Requirement **R4-68 [81].**

The Single Mode LC Connector was **compliant** with Requirement **R4-69 [82].**

See Exhibit 8 - 111 for the maximum values measured during this evaluation.

Maximum Values Measured From Sample Group

Criteria Category	Max/Min Values	Requirement	
		Criteria	Criteria Met?
Fiber Extension (**R4-67**)	-49/+80nm	-125 to 50 nm	Yes
Ferrule Endface Radius (**R4-68**)	17.1/7.3	7 to 25 mm	Yes
Apex Offset (**R4-69**)	49.9	< 50 µm	Yes

*(+) indicates undercut
*(-) indicates protrusion

Exhibit 8 - 111

The endface geometry measurements, for each sample, are reported in Appendix A.

Failure History:

None.

ENDFACE GEOMETRY REQUIREMENTS FOR ANGLED PHYSICAL CONTACT (APC) CONNECTORS (4.4.5.2)

Criteria:

R4-70 [222] The endface geometry parameters for angled physical contact connectors must meet the requirements of IEC 60874-14-6 for an angle of 9° for untuned connectors, IEC 60874/-14-7 for an angle of 9° for tuned connectors.

Test Conditions:

Radius of Curvature:	Between 5 mm and 12 mm
Dome Offset:	less than 50 µm
Maximum Fiber Undercut (x) or Protrusion (y):	≤ 100 nm

Test Method:

26. The Ferrule Endface Geometry for Non-Angled Physical Contact Connectors is to be performed at the beginning of the test, before splicing the samples to the switch, and at the end of the testing, during the End of Test Criteria tests.
27. To start using the interferometer, the instrument must be set up as follows.
28. Wipe all oils/dire/dust off the surface of the tilt stage with alcohol.
29. Clean the bottom of the mount with alcohol.
30. Verify that the lock collar is in the unlocked position by turning the lock collar counter clockwise.
31. Set the micrometer to 0.0. The micrometer should always be turned in a clockwise direction. Turn the lock collar clockwise to lock into position.
32. Clean the 25mm ROC with the connector cleaner.
33. Make sure the mount is in the unlocked position with the lever to the left. Insert the 25mm ROC side of the calibration standard into the mount. Push the connector all the way down into the mount. Lock the connector into place.
34. Change to Red Light mode if not already in it.
35. Go into the Set-Up screen by pressing the "F2 Setup" button on the Tool bar, click "Default" and change Scan Type to Calibration. Click "OK" to save the parameters and exit the set up screen.
36. Go into the Configuration – Option screen and click on the General Tab. Enter the Group Name and select any of the configuration options desired. Click "OK" to exit the screen and return to the program.
37. Adjust the focus knob to bring the fringe pattern into focus. Center the high point of the polish near the center of the scan. (Exhibit 8 - 110)
38. Beginning the measurement process. Click on F4 to take a measurement and be able to change the connector ID during the measurement process or Click on F12 for a Quick Scan. The interferometer will automatically scan the connector as is in the live image screen.
39. Upon the completion of the scan, the results will appear on the screen. The Radius of Curvature measurement should be between 24.9mm and 25.1mm. The Fiber Height should be < 0.005µm.

If the measurements are with in spec, the Magnification Calibration is fine.

40. If the measurement is off after the above attempts have been made. Go into Action-Magnification Calibration and click on "Auto" in the calibration dialog box to start the auto-calibration. The system will proceed through a series of scans until a calibration factor is obtained. A message will appear indicating when the auto-calibration is done. Click "OK" to exit.
41. Making a measurement. Select the Set-UP Parameters for the connector being measured and the mount being used.
42. Select Configuration Settings and click on Configuration-Option-General Tab. Enter the Group Name data that it is to be stored under. Select Auto Export, Auto Increment, Auto Save in Database and/or Auto Print if desired. Click "OK" when done.
43. If measuring **PC** Connectors, verify that the lock collar is in the unlocked position by turning the lock collar counterclockwise. Set the micrometer to 0.0 then lock the micrometer position by turning the lock collar clockwise.
44. If measuring **APC** connector`, verify that the lock collar is in the unlocked position by turning the lock collar in a counter clockwise direction. Turn the micrometer clockwise to the degree of the polish indicated by the mount angle in the Set-UP menu. Lock the micrometer position by turning the lock collar clockwise.
45. Clean the connector/bar ferrule with the connector cleaner.
46. Make sure the lever arm is in the unlocked position and insert the connector into the mount. Lock the connector into place.
47. Center the fiber over the crosshairs on the live image using the X and Y knobs.
48. Adjust the focus knob to bring the fringe pattern into focus Exhibit 8 - 110
49. Click on F4 to take a measurement or F12 for a Quick Scan.
50. Upon completion of the scan, the results will appear on the screen. Remove the connector from the mount and insert the next connector to be tested.

Configuration and Conditions:

The connectors will be individually mounted on the interferometer for these measurements.

Test Results:

The section is not applicable as the connectors under test do not have an angled physical contact (APC) endface polish.

Failure History:

None.

ENDFACE GEOMETRY MEASUREMENT AREAS (4.4.5.3)

Criteria:

R4-71 [223] The endface geometry measurement areas shall meet the requirements of IEC 61300-3-23 for measuring the radius of curvature and fiber undercut/protrusion.

Test Conditions:

Organization	"D" Fitting Region	"E" Extracting Region	"F" Averaging Region
IEC (PC & APC)	250 microns	140 microns	50 microns

These measurements verified on 12/13/06 and again on 8/7/06.

The annular region bounded by "D" and "E" is the fitting region on the connector ferrule over which the radius of curvature is measured. The annular region bounded by "E" and "F" is the extraction region, at the interface between the fiber and the ferrule, which is excluded from any measurement. Finally, the "F" averaging region is over the center of the fiber, and used to estimate the fiber position.

Test Method:

1. Before making any of the geometrical measurements, be sure that the fitting regions being used are correct.
2. Go to www.Dorc.com (Direct Optical Research home page) and look up Standards Watch. They will have the latest measurement area values (Fitting Region D, E, and F) in compliance with IEC 61300-3-23.
3. Once these values have been found, print them out. Double check that the correct Fitting Regions are being used by selecting the "Setup" icon.
4. The Fitting Regions will appear on the far right. Verify that they are correct. If they are not, change accordingly and select "Apply." Then, select "OK."
5. Refer to Exhibit 8 - 112 for a diagram of the fitting regions.

Fitting Regions

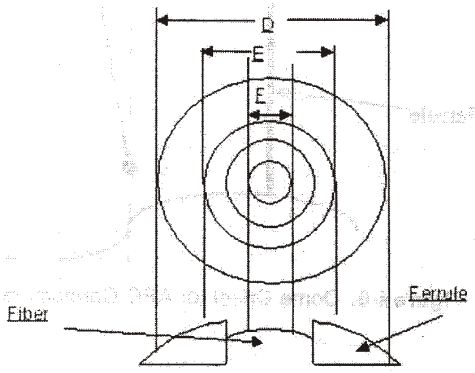


Exhibit 8 - 112

Configuration and Conditions:

Not Applicable

Test Results:

The LC/PC Fiber Optic Connectors and Adapters were compliant with Requirements R4-71. The endface geometry areas were verified via the Internet and found to be D=250µm, E=140 µm, and F=50 µm.

Failure History:

There were no failures during the course of this evaluation.

CONNECTOR INSTALLATION (4.4.6)

Criteria:

R4-72 [224] The increase in loss, the difference between the loss in Steps 3 and 5, shall be ≤0.20 dB. No increase in loss is permitted for products with right angle boots.

O4-73 [83] The increase in loss, the difference between the loss in Steps 3 and 5, shall be ≤0.10 dB.

CR4-74 [225] No portion of a right angle boot shall come in contact with the panel parallel to the mounting surface.

O4-75 [226] The maximum length of the installed connector including the boot should not exceed 57 mm (2.25 in), dimension y as shown in figure 4-10 (GR-326-CORE). This objective does not apply to right angle boots.

Test Conditions:

Temperature: 23 ± 2°C
Humidity: 50% RH
All optical measurements shall be performed at 1310 nm, 1490 nm, 1550 nm, and 1625 nm.

Test Method:

1. Mount the adapter on a vertical mounting surface. The same equipment rack that was used for the Durability Test and the Impact Test should be used for this.
2. If there is more than one way to mount the adapter, it should be mounted so as to maximize the distance from the end of the connector to the movable panel.

Diagram of Connector Installation Test

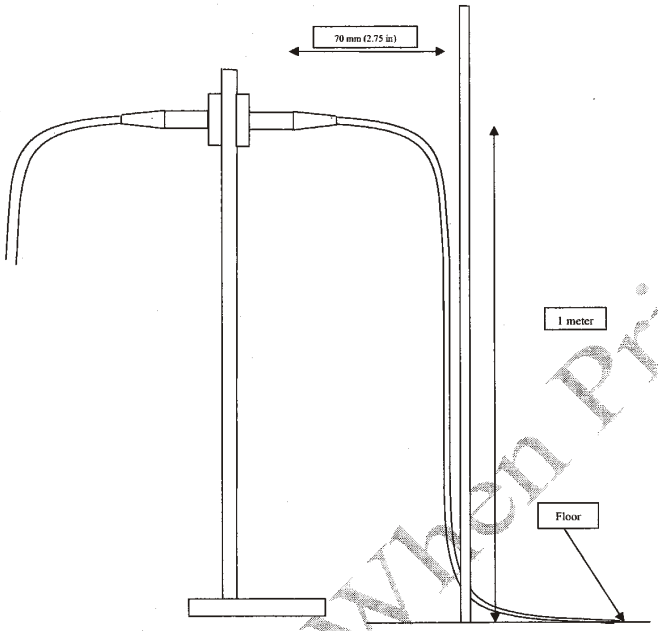


Exhibit 8 - 113

3. At this point, the connector assemblies should still be coupled together. Be sure that the plug is dressed so that approximately one meter of cable is supported by the end of the connector boot.
4. Using the ATOC switch software, select the proper Job Number and the Test ID (GR326ConnInstal) and take the Initial measurements.
5. After the measurements have been made, mount a panel at a distance of x = 70 mm (2.75 in).
6. Make sure that the panel is the exact distance from each of the connectors.
7. Once again, using the switch software, select Final option button.
8. Once the measurements have finished, open the EvalShell located in the FiberLab Reports folder and import the data, evaluate the data and then save the data in the job folder under wire&cable.
9. If the loss increase exceeds the requirement, notify the customer. Once a resolution has been resolved, proceed with testing.
10. If the connectors under test are right angle connectors, while the panel is mounted, verify that none of the connector boots are touching the panel.
11. When calculating the loss increase in Step 9 for right angle boots, keep in mind that Requirement **R4-72** states that no increase in loss is permitted for products with right angle boots.
12. Measure the length of the installed connector in order to determine compliance with Objective **O4-75**.
13. Notify the customer immediately if some of the connectors fail to meet the requirements.

Configuration and Conditions:

The connector assemblies will be placed in the connector installation test fixture and will remain operational during the course of this evaluation.

Test Results:

The Single Mode LC Connector was **compliant** with Requirement **R4-72 [224]**

The Single Mode LC Connector was **noncompliant** with Objective **O4-73 [83]**. The connectors failed the Loss Increase Objective at 1625nm.

Conditional Requirement **CR4-74 [225]** was **not applicable** to the Single Mode LC Connector. The Single Mode LC Connector did not have right angle boots.

The Single Mode LC Connector were **compliant** with Objective **O4-75 [226]**. The maximum boot length was 52.0 mm.

See Exhibit 8 - 114 for the maximum values measured during this evaluation.

Maximum Values Measured from Sample

Criteria Category	Max Values (dB)	Requirement R4-72		Objective O4-73	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase 1310 nm	0.05	0.20	Yes (25 Y, 0 N)	0.10	Yes (25 Y, 0 N)
Loss Increase 1490 nm	0.08	0.20	Yes (25 Y, 0 N)	0.10	Yes (25 Y, 0 N)
Loss Increase 1550 nm	0.14	0.20	Yes (25 Y, 0 N)	0.10	Yes (25 Y, 0 N)
Loss Increase 1625 nm	0.19	0.20	Yes (25 Y, 0 N)	0.10	No (22 Y, 3 N)

Exhibit 8 - 114

The loss and reflectance measurements, for each sample, are reported in Appendix A.

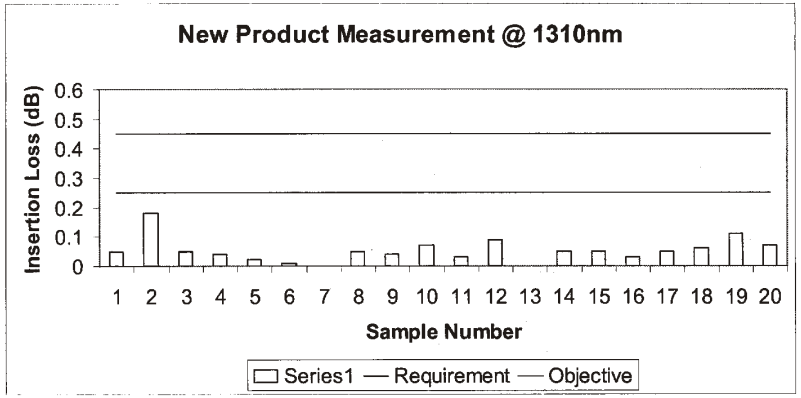
Failure History:

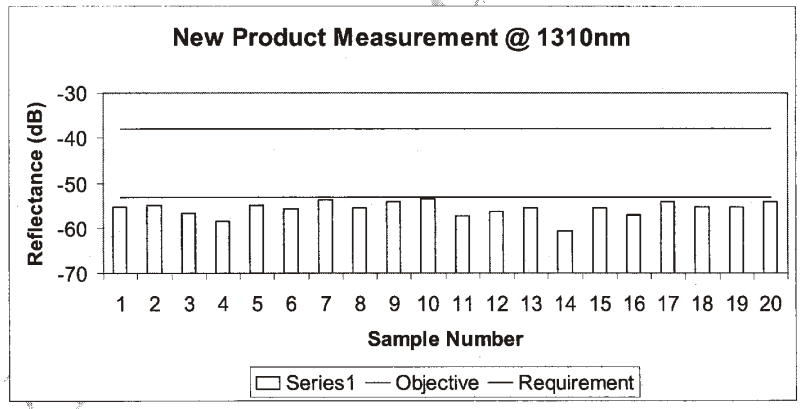
Samples 16 and 24 (Tyco IDs –01 and --25) were **noncompliant** with Loss Increase Objective **O4-73 [83]** at 1625nm.

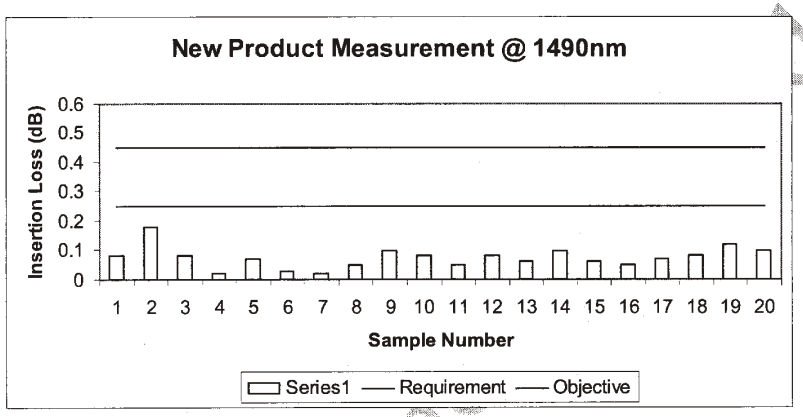
Appendix A – Test Data

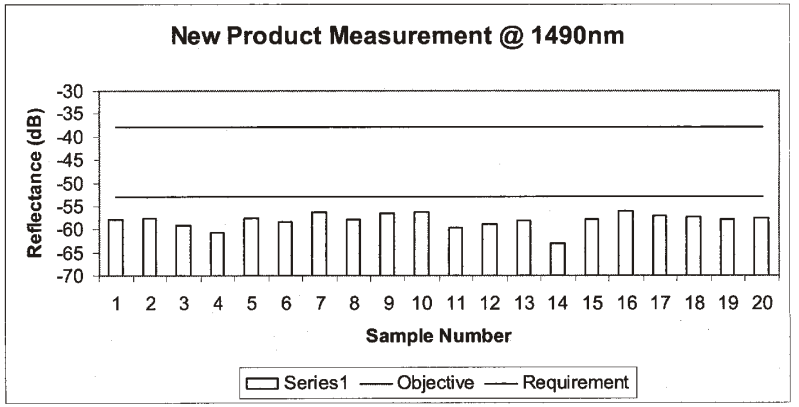
GRAPHICAL DATA BY TEST

Section 4.4.1 Performance of New Product

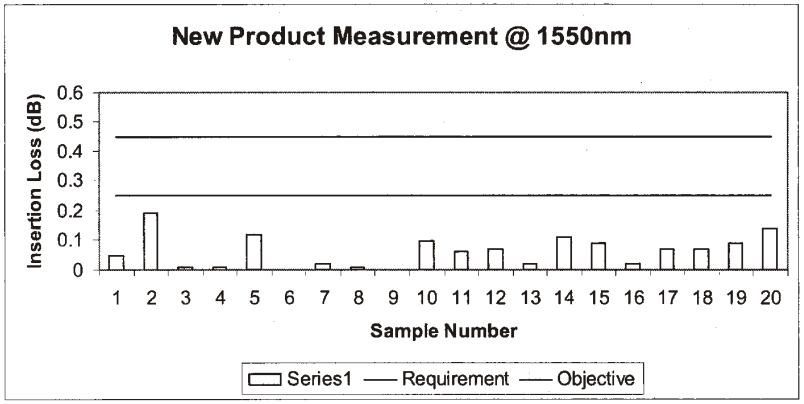


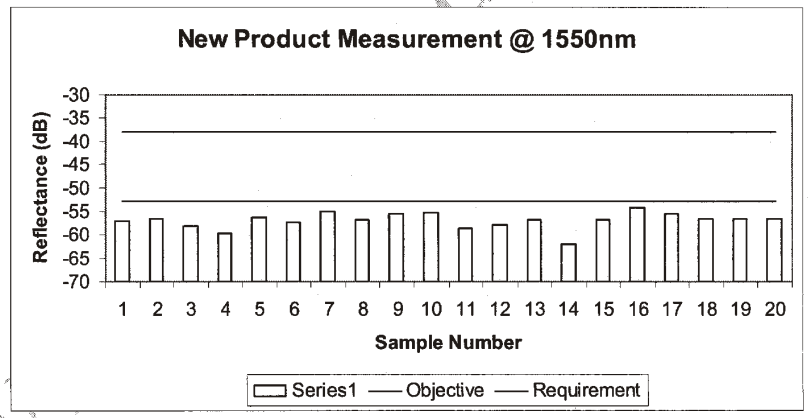


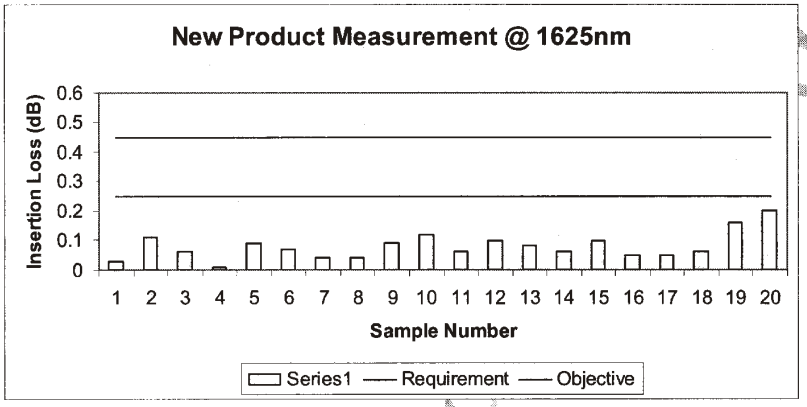


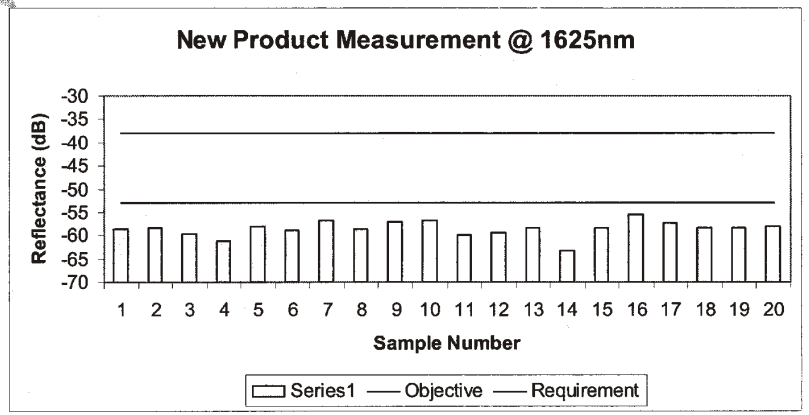


Section 4.4.1 Performance of New Product (Cont)

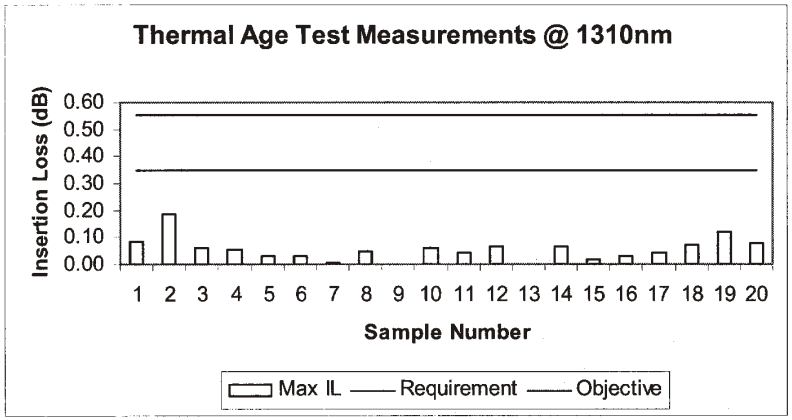


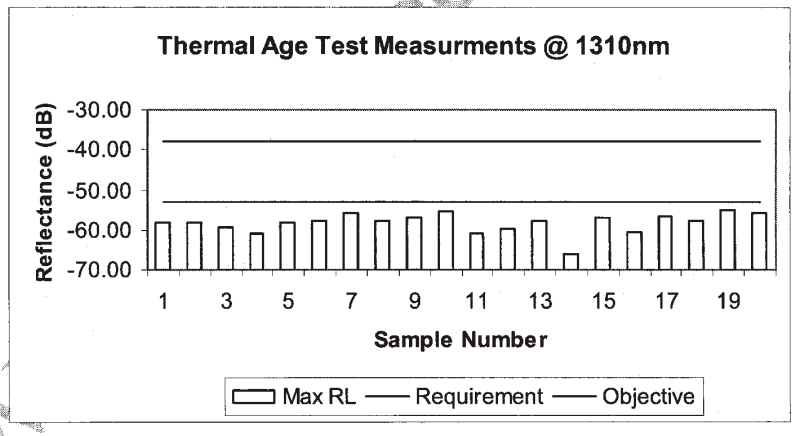


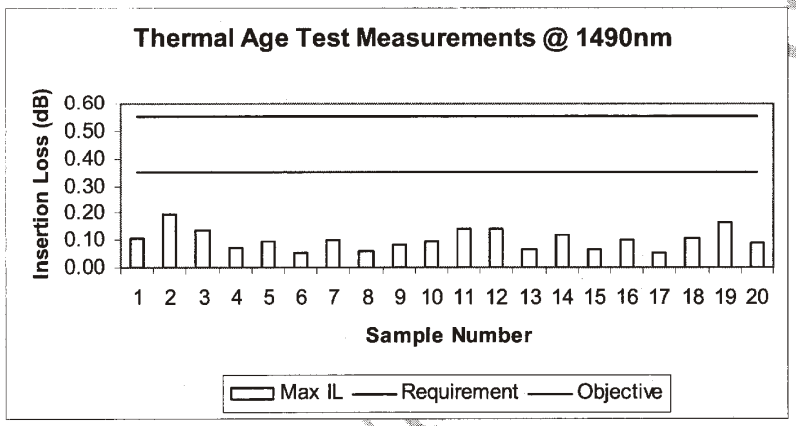


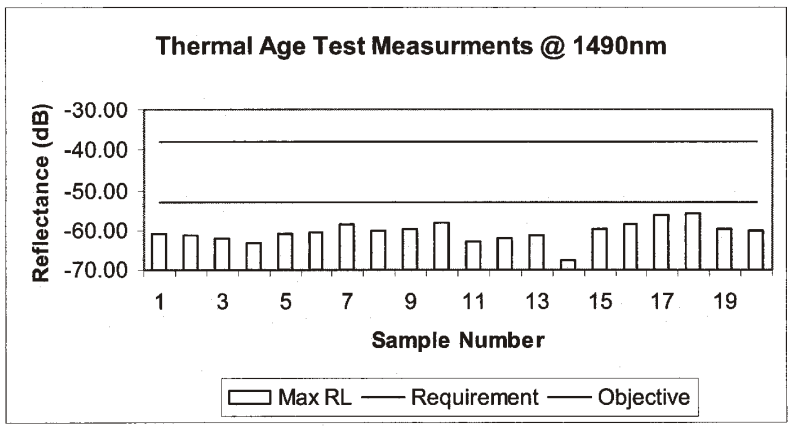


Section 4.4.2.1 Thermal Age Test

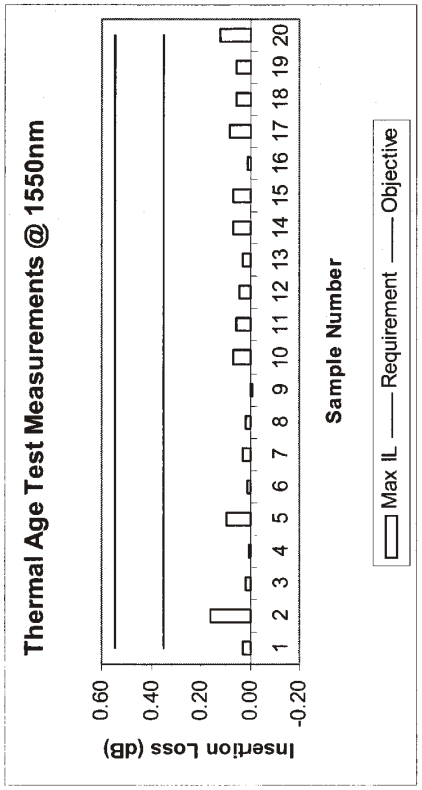


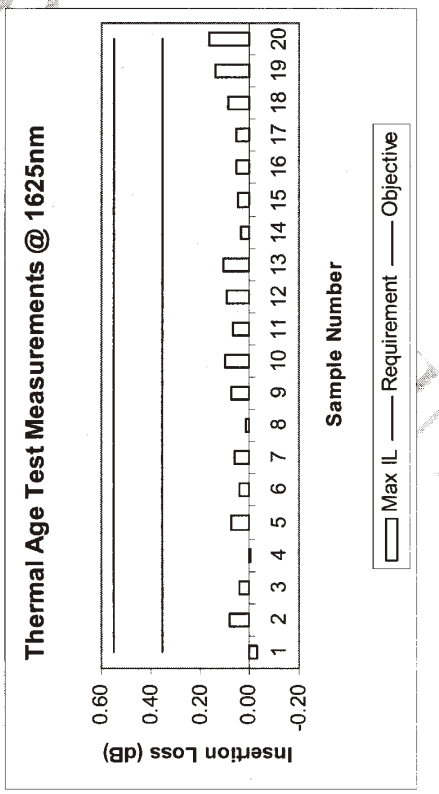


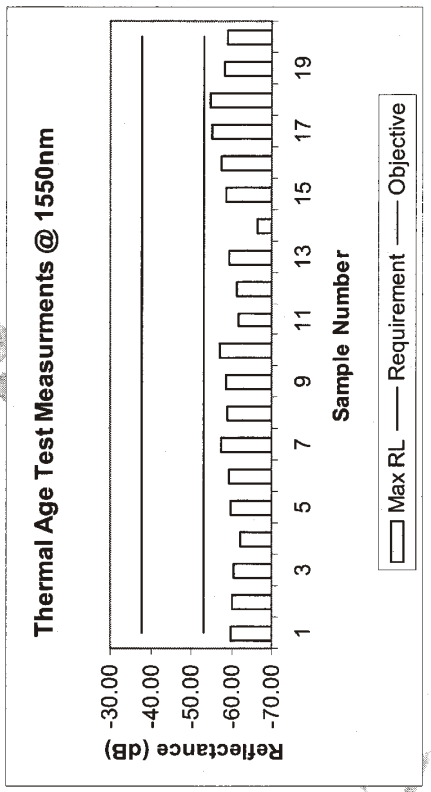


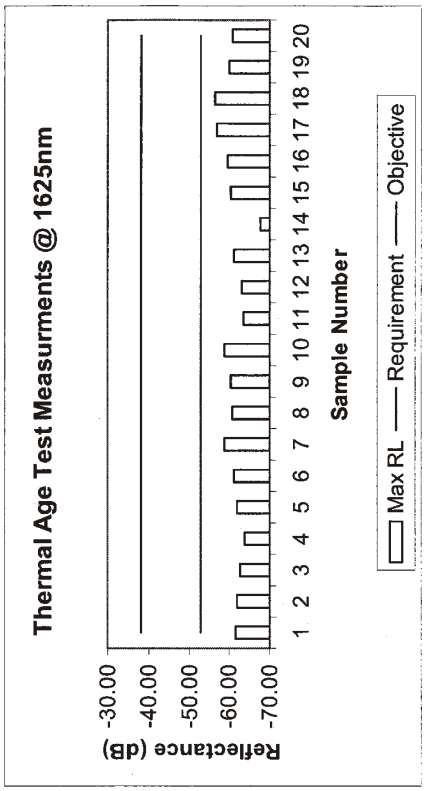


Section 4.4.2.1 Thermal Age Test (continued)

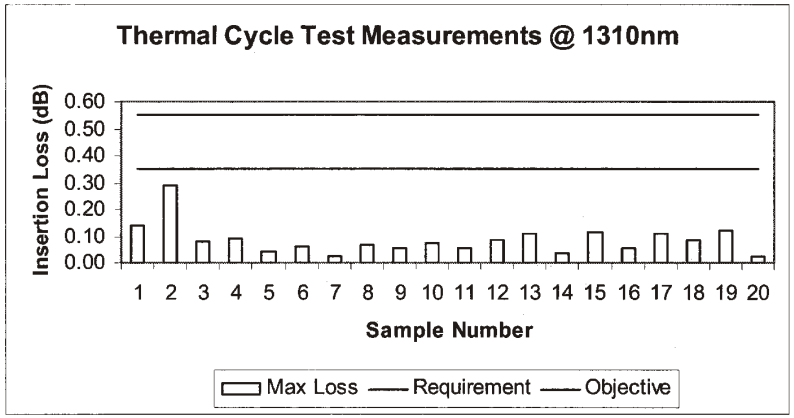


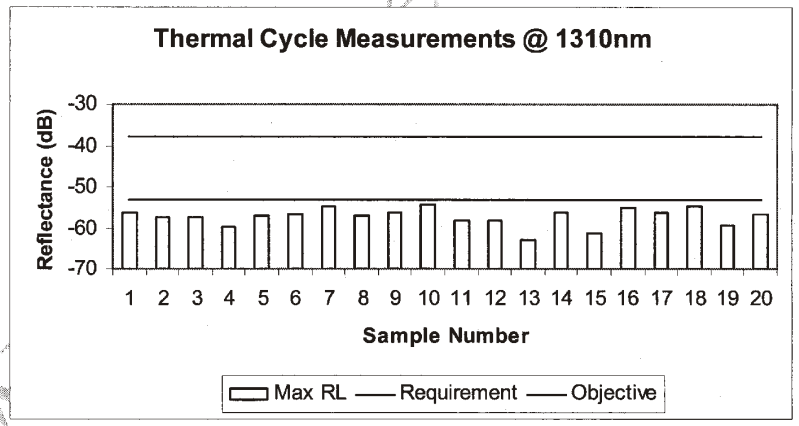


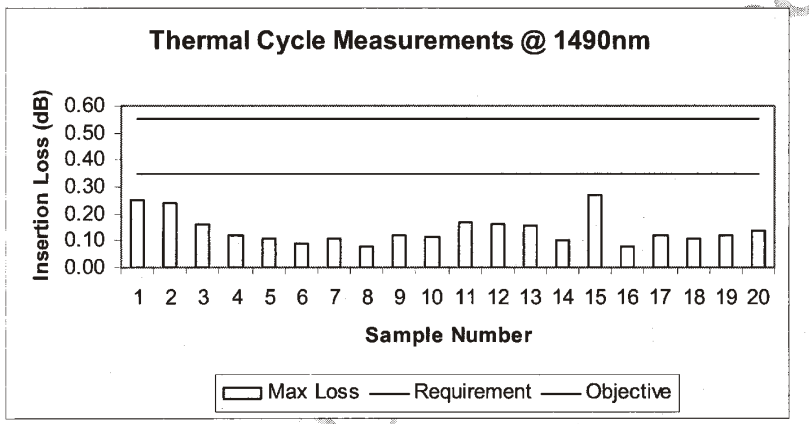


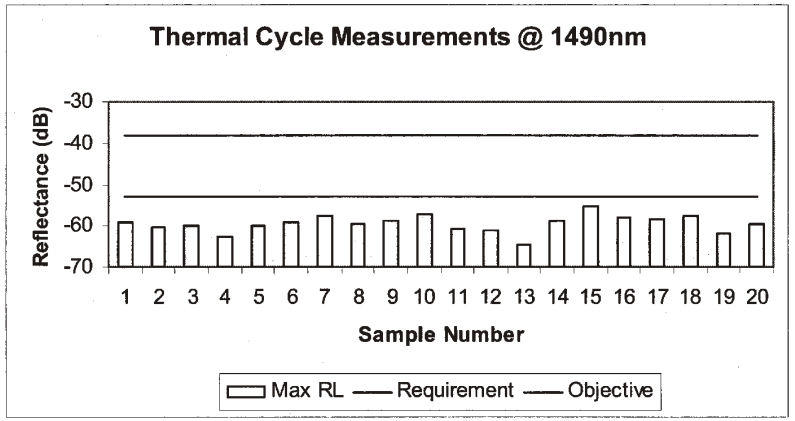


Section 4.4.2.2 Thermal Cycle Test

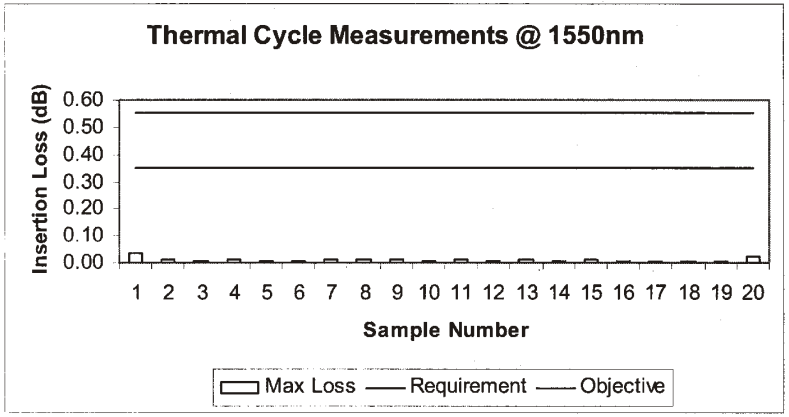


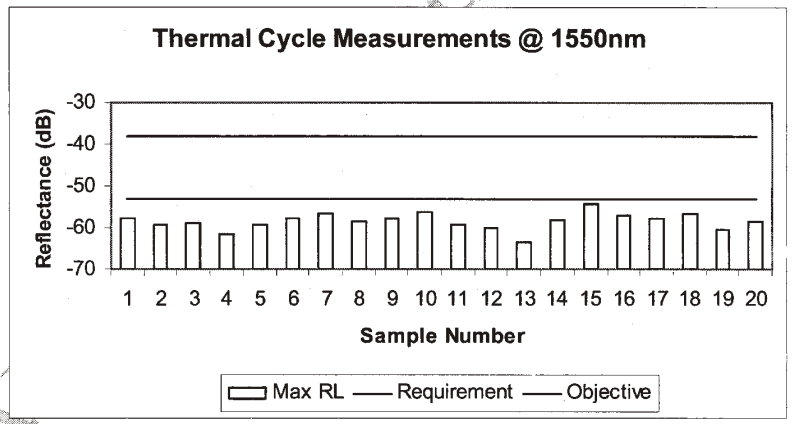


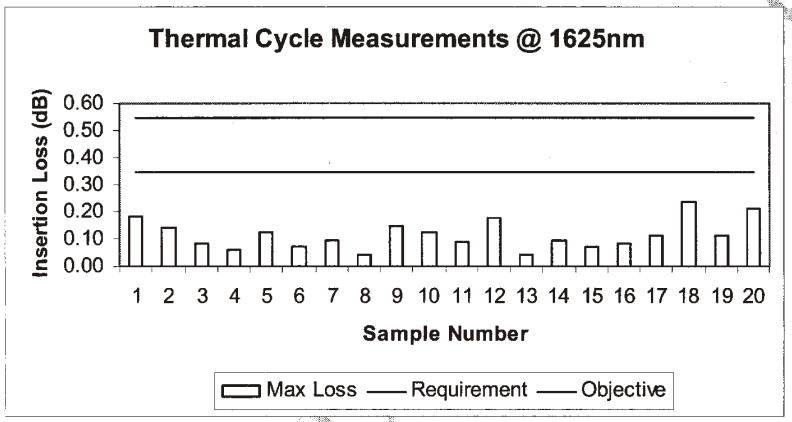


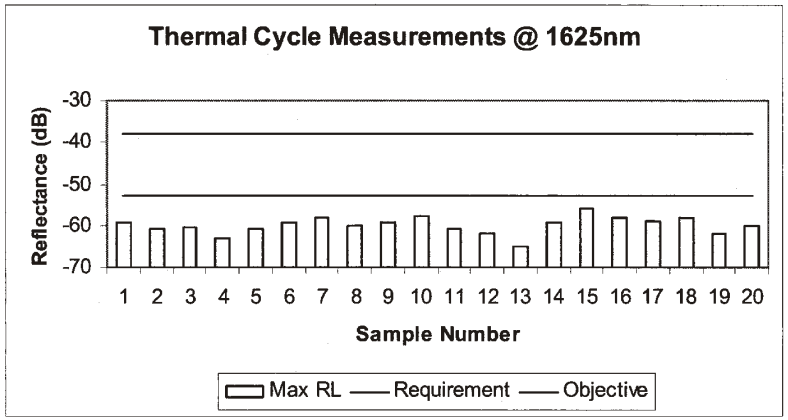


Section 4.4.2.2 Thermal Cycle Test (Cont)

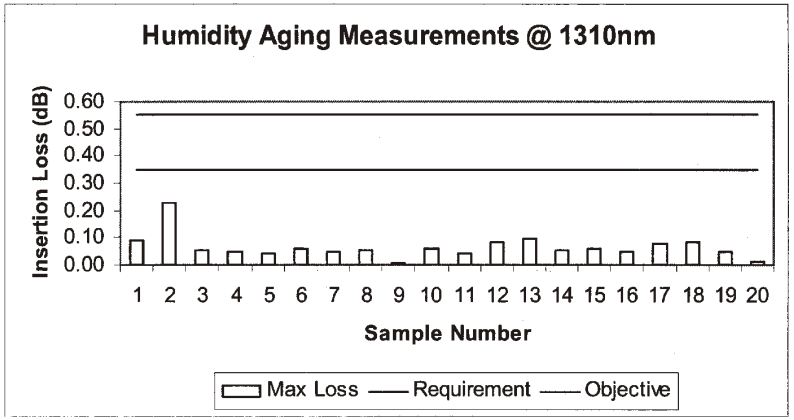


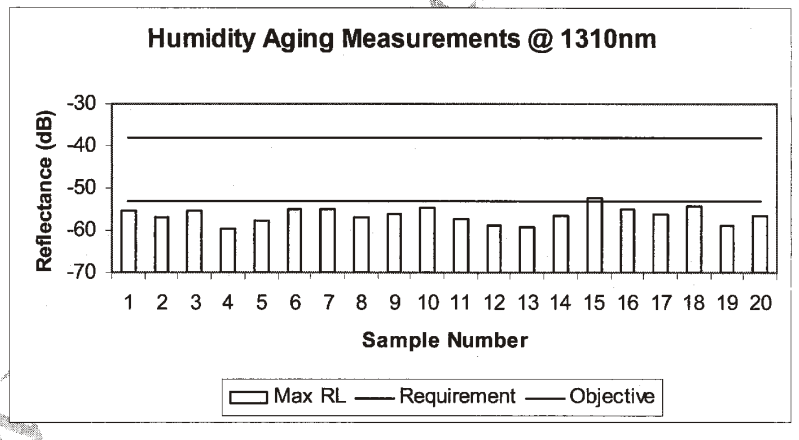


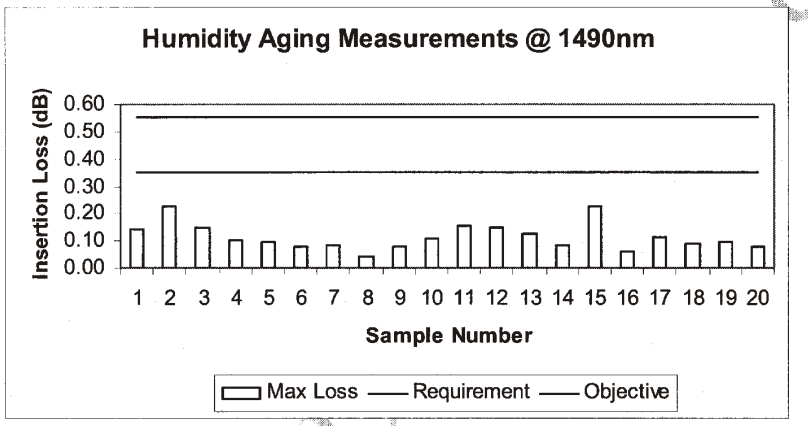


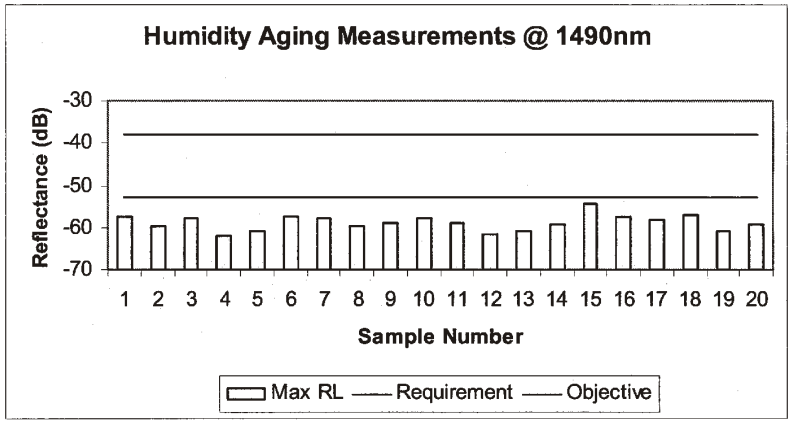


Section 4.4.2.3 Humidity Aging Test

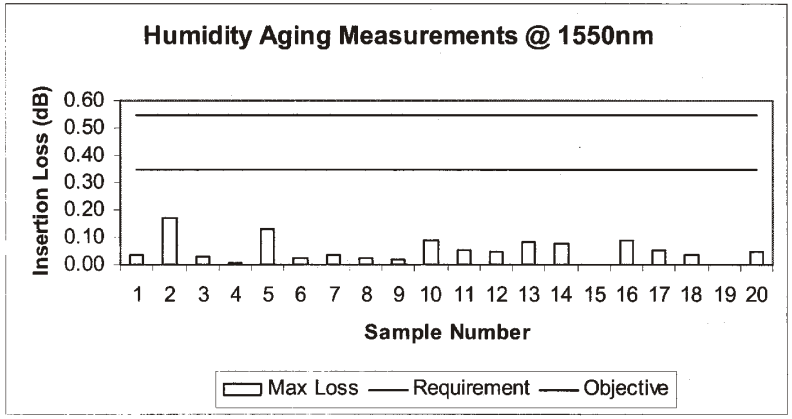


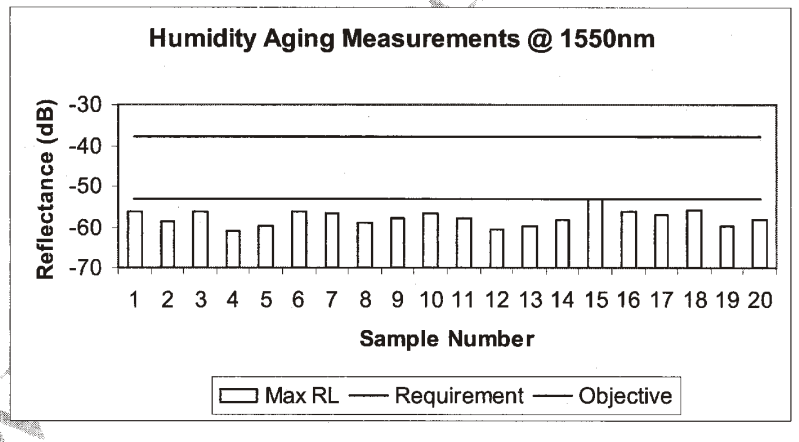


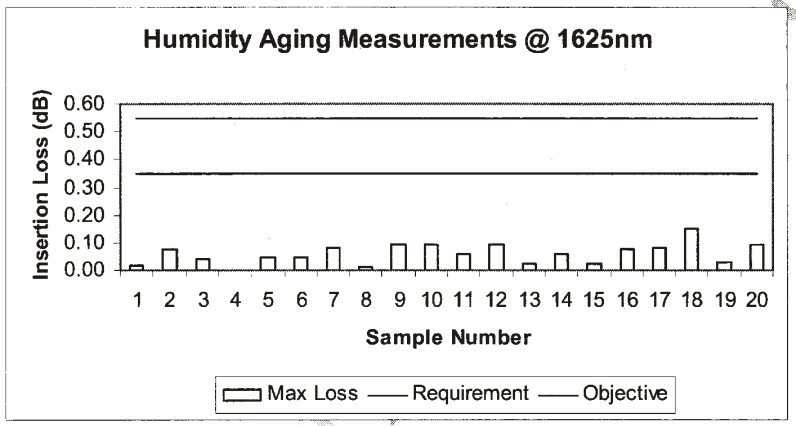


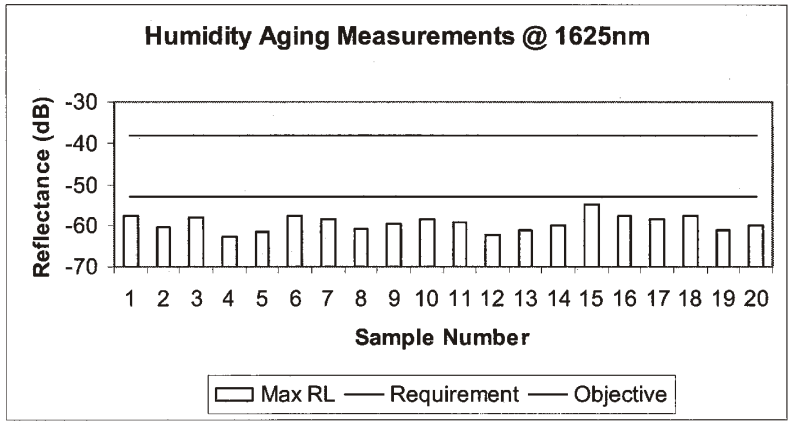


Section 4.4.2.3 Humidity Aging Test (Cont)

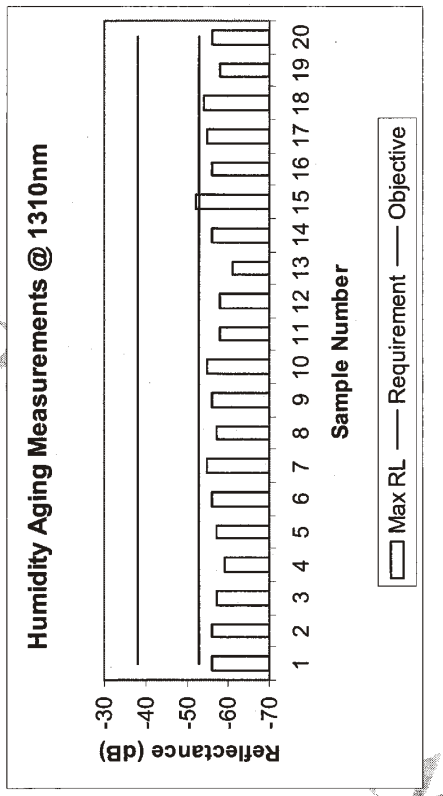


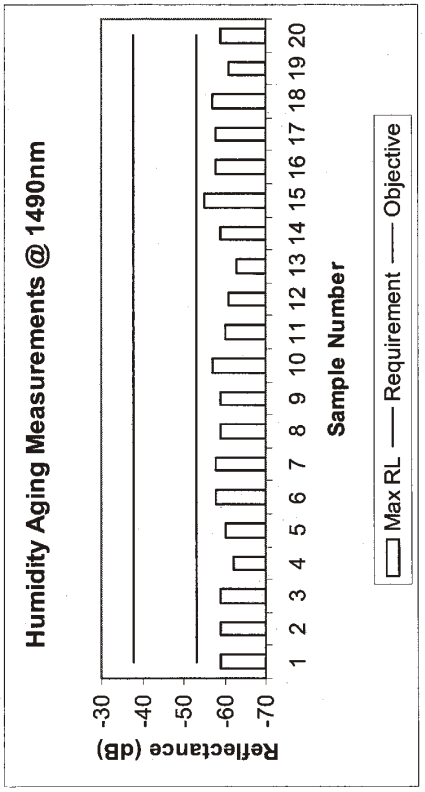


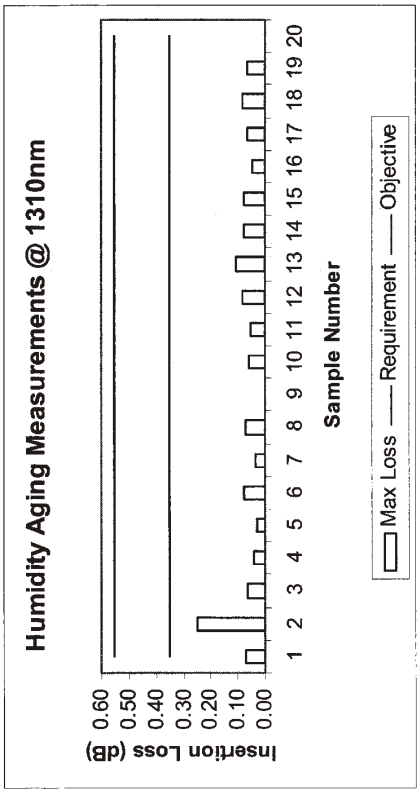


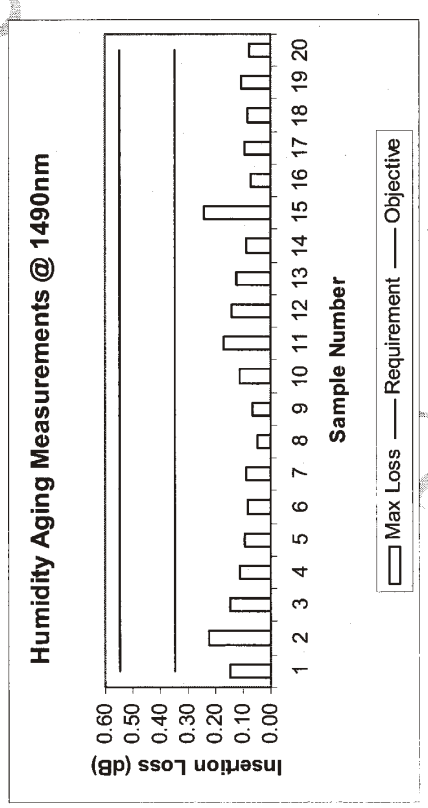


Section 4.4.2.4 Humidity /Condensation Test

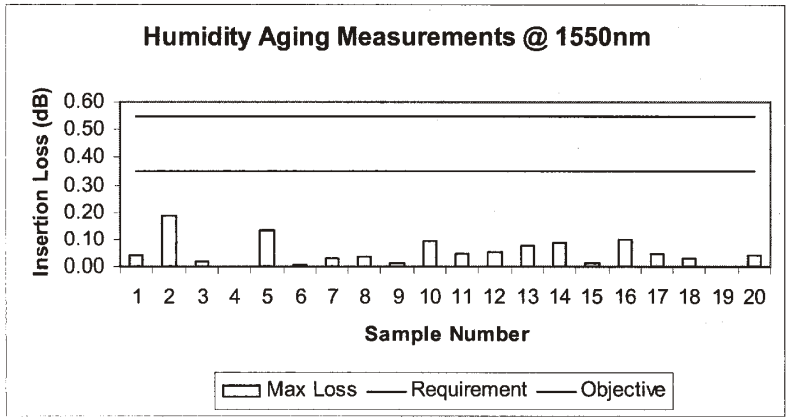


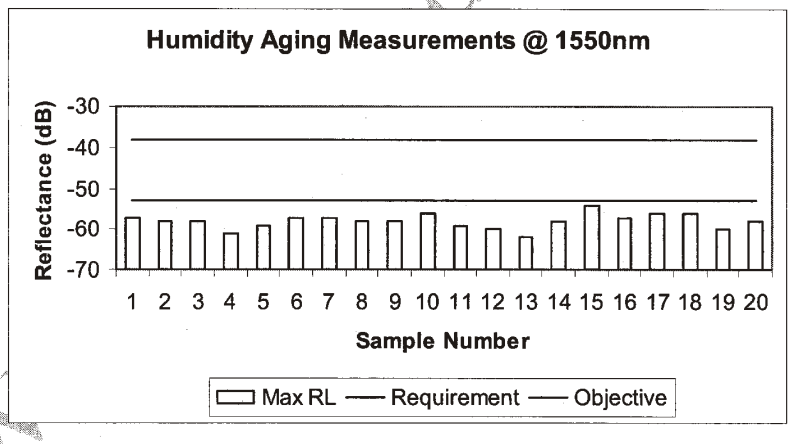


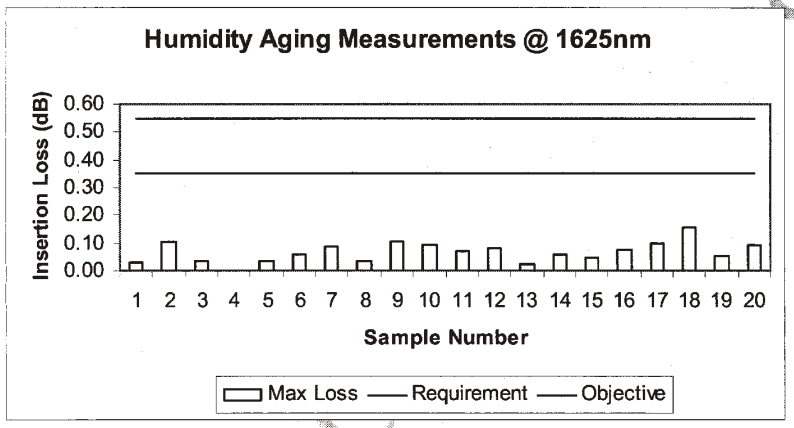


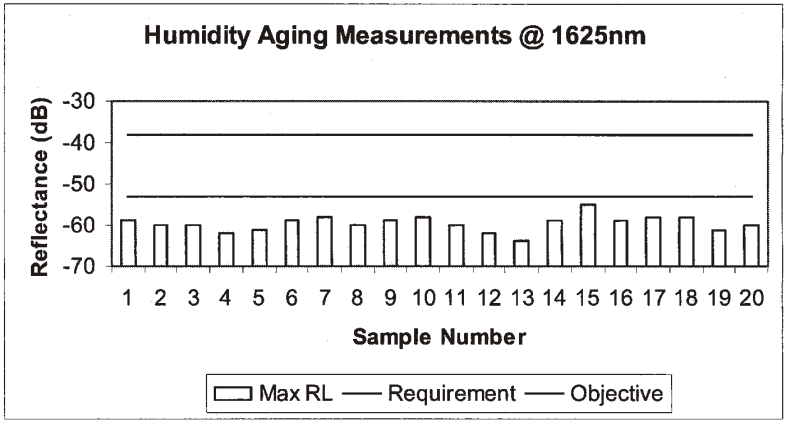


Section 4.4.2.4 Humidity /Condensation Test (Cont)

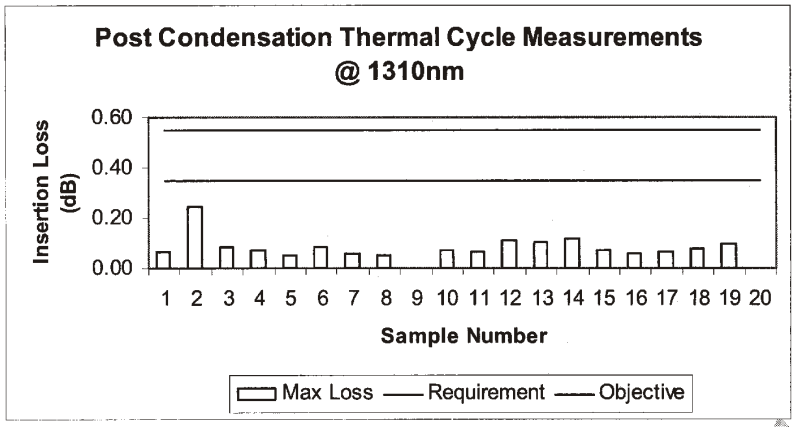


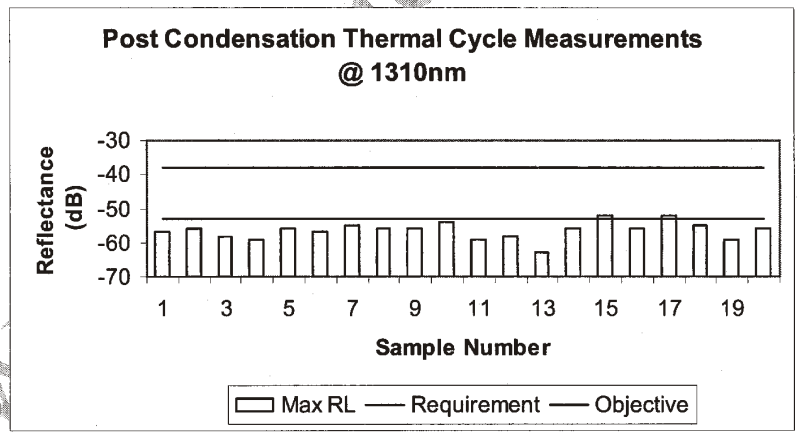


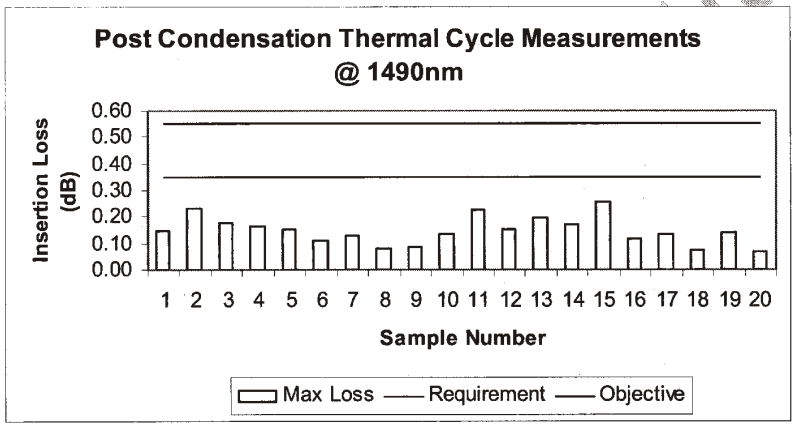


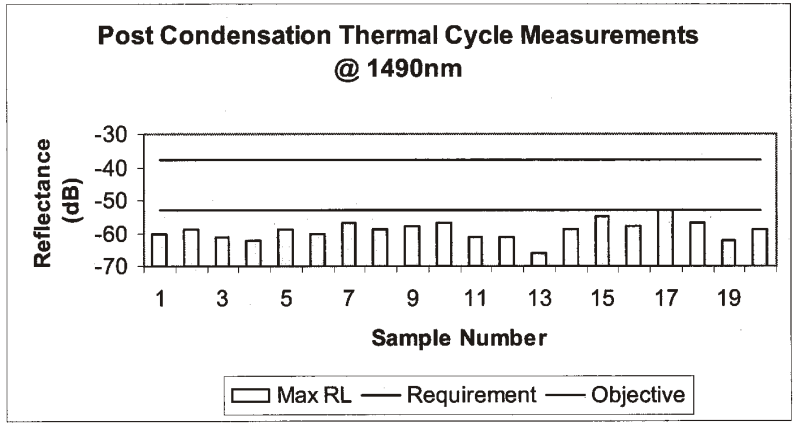


Section 4.4.2.6 Post Condensation Thermal Cycle Test

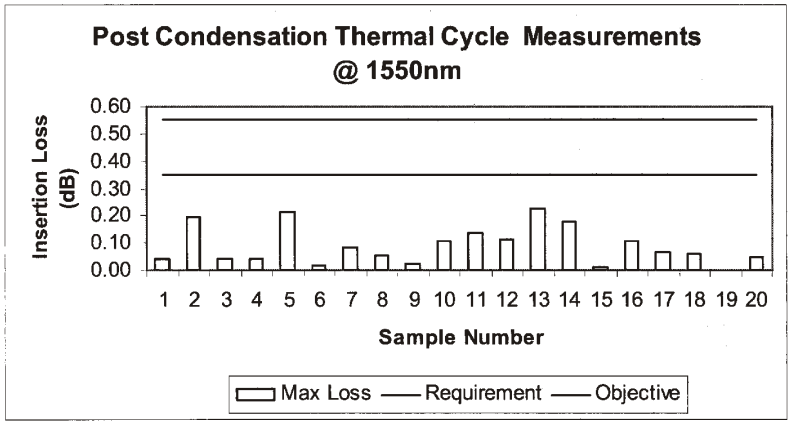


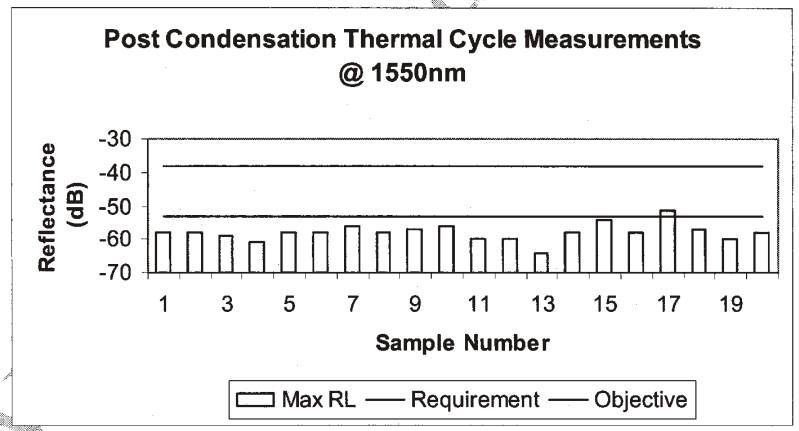


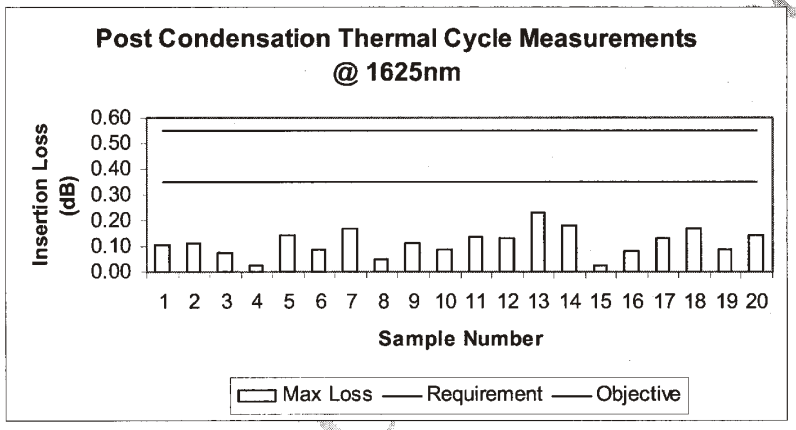


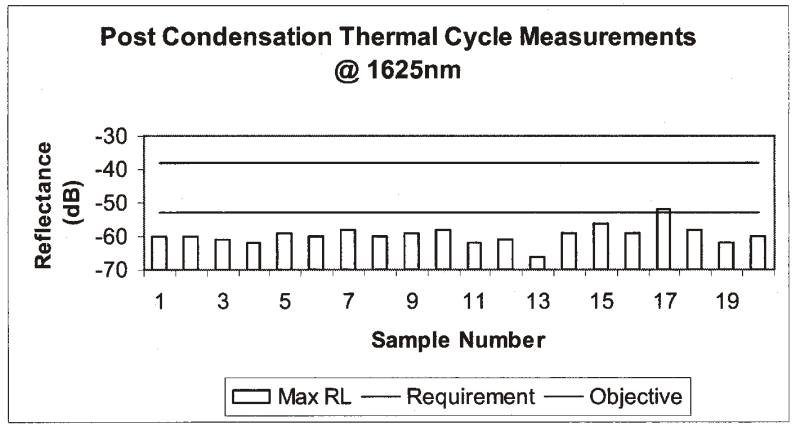


Section 4.4.2.6 Post Condensation Thermal Cycle Test (Cont)

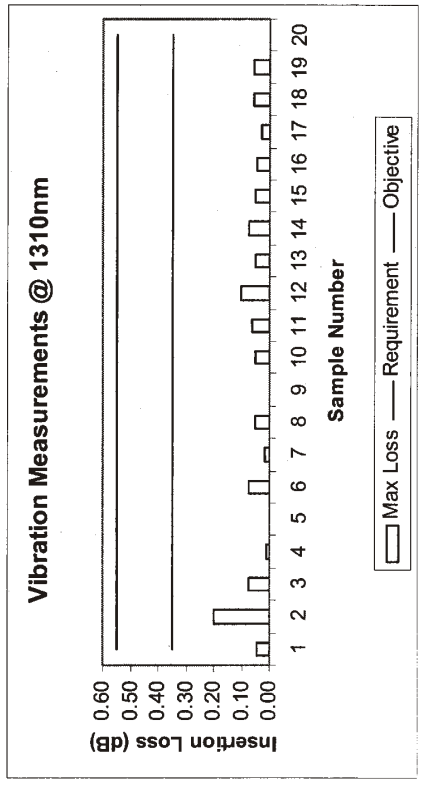


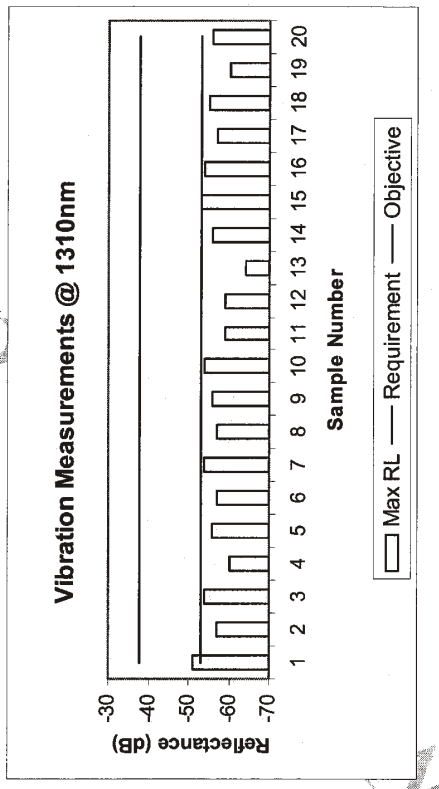


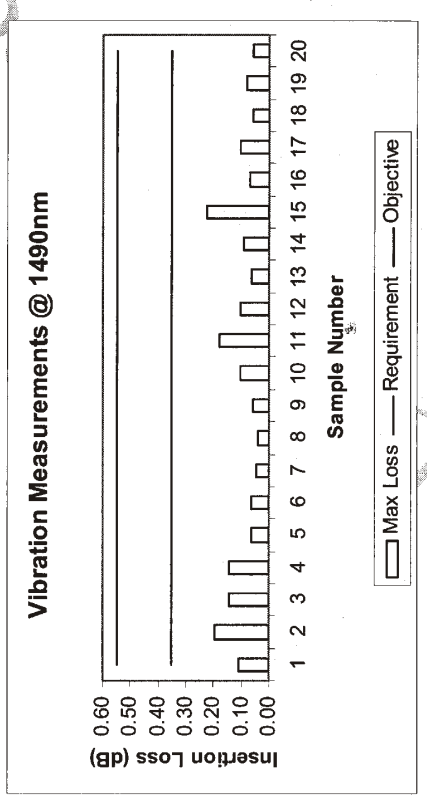


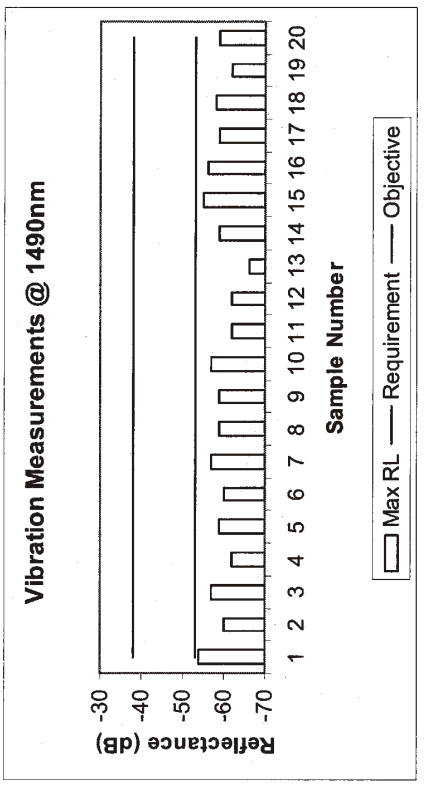


Section 4.4.3.1 Vibration Test

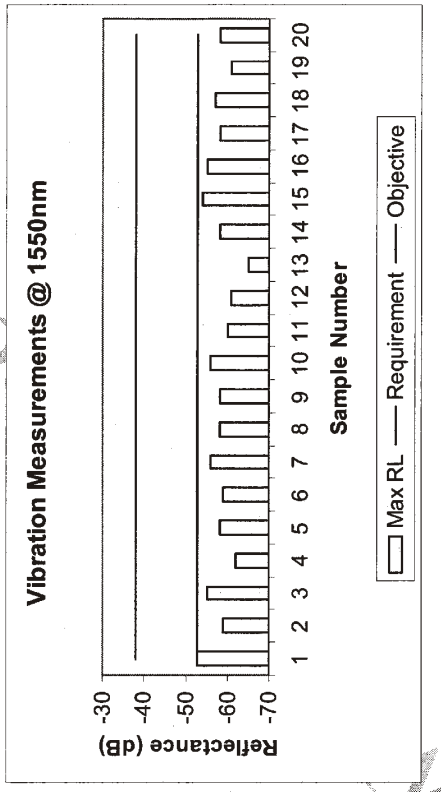


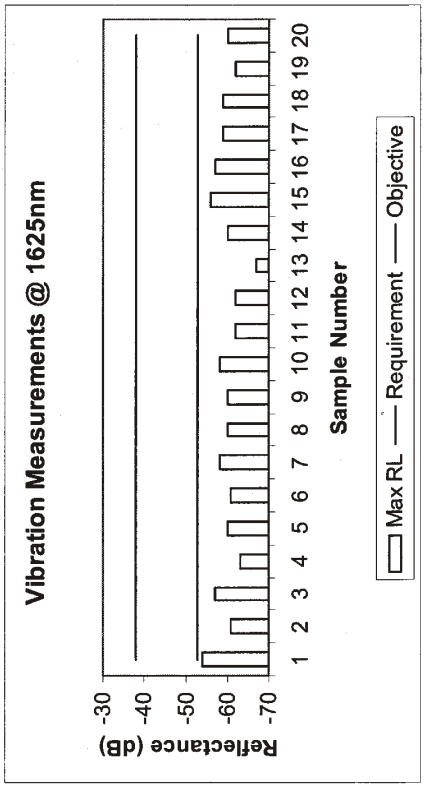


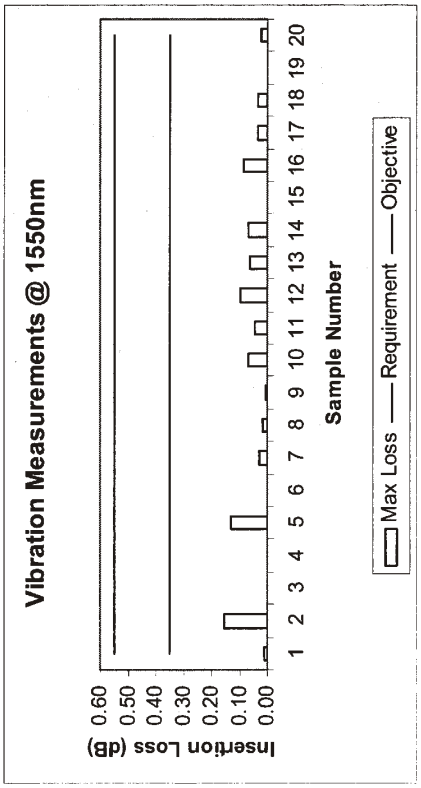


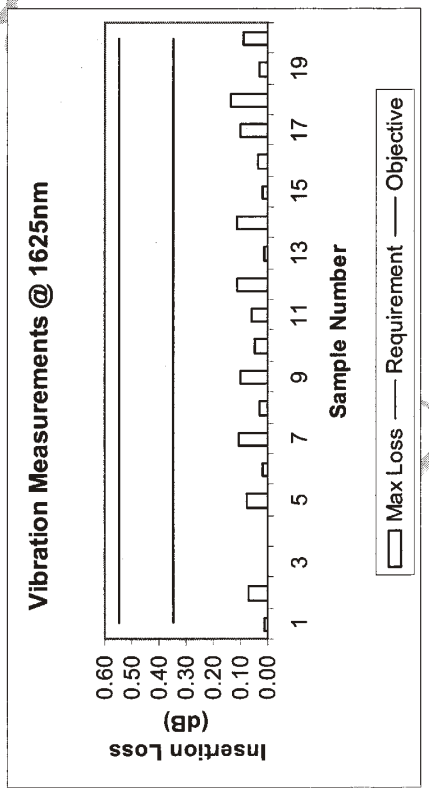


Section 4.4.3.1 Vibration Test (Cont)

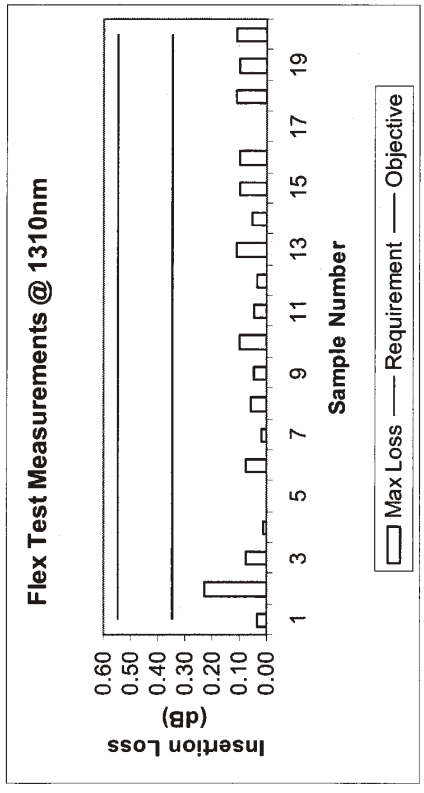


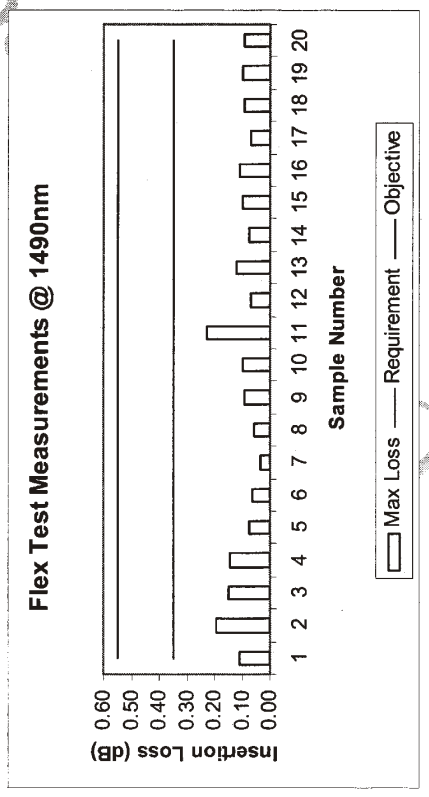


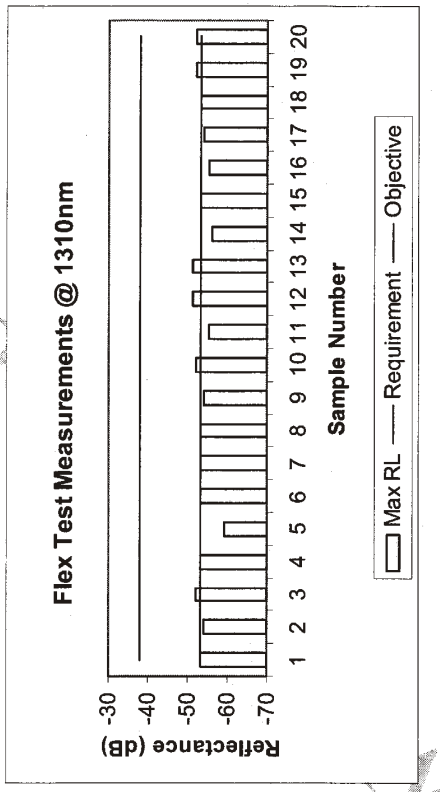


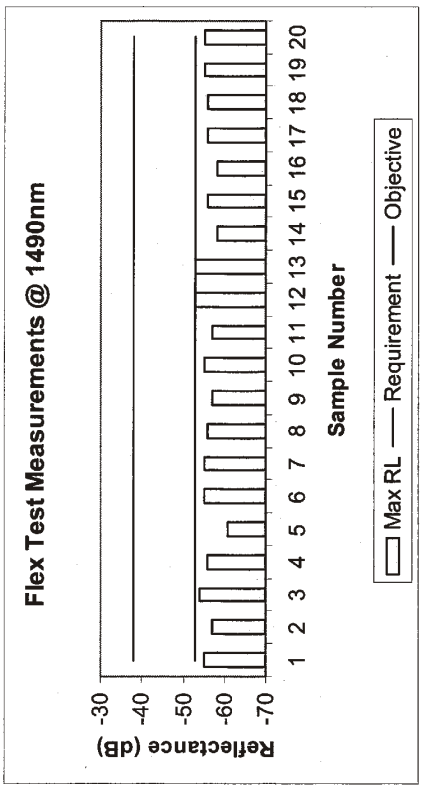


Section 4.4.3.2 Flex Test

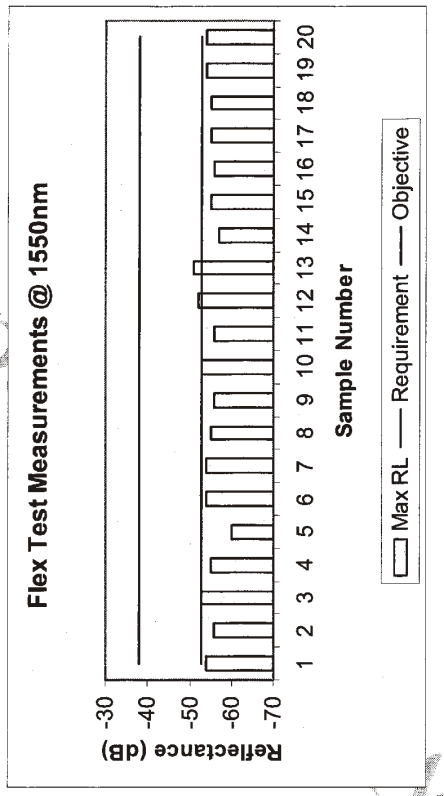


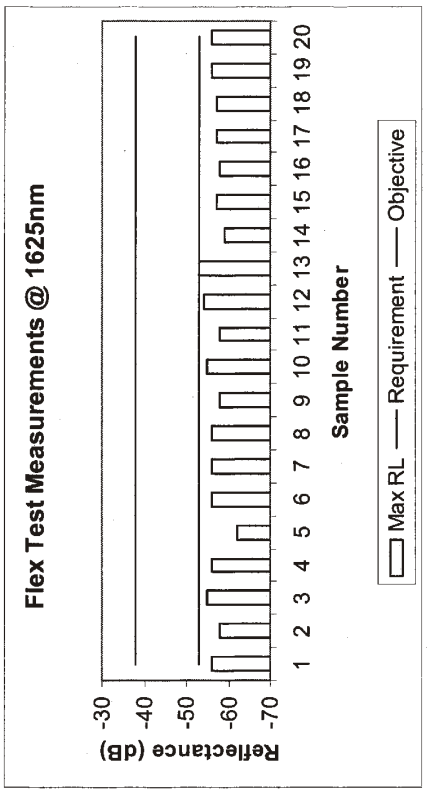


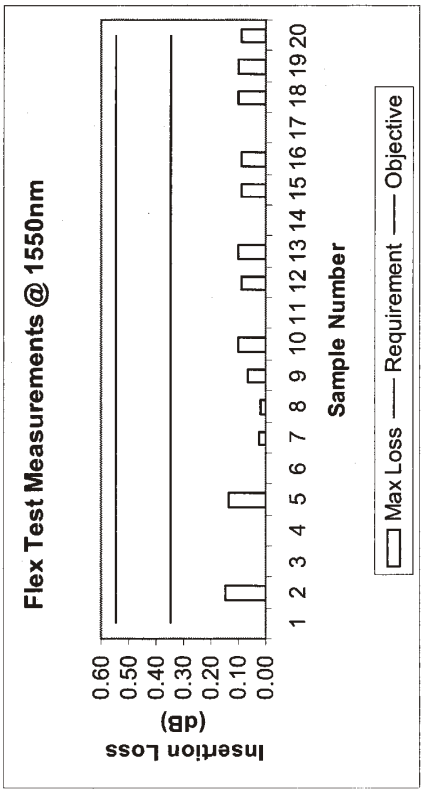


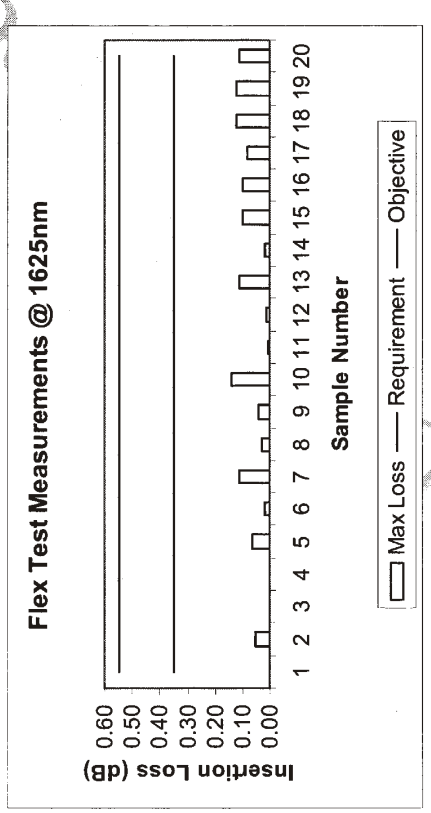


Section 4.4.3.2 Flex Test (Cont)

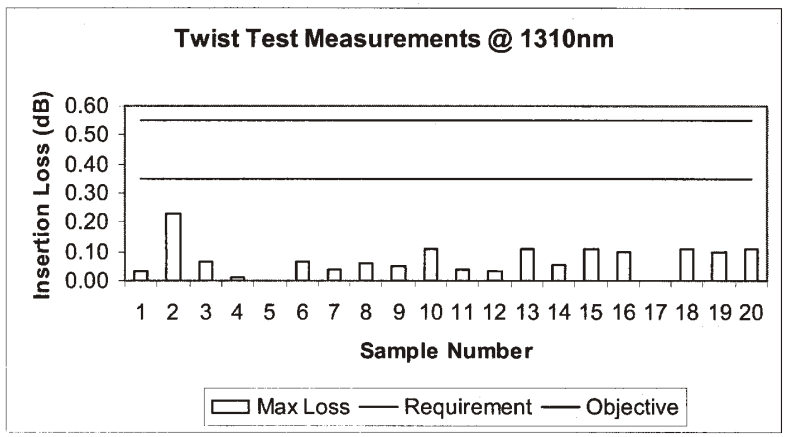


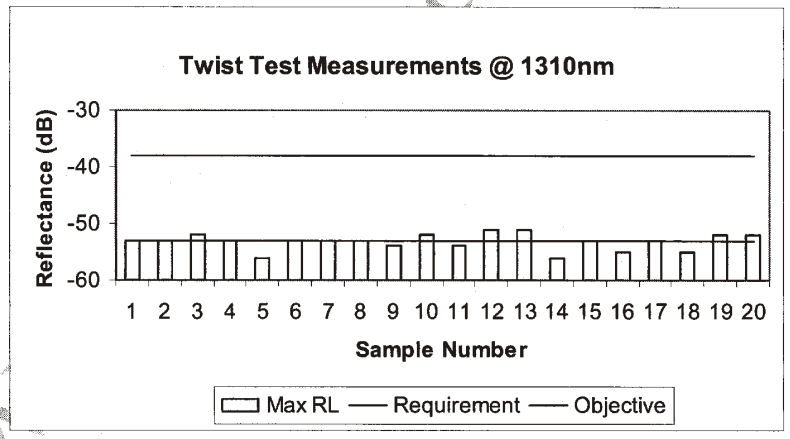


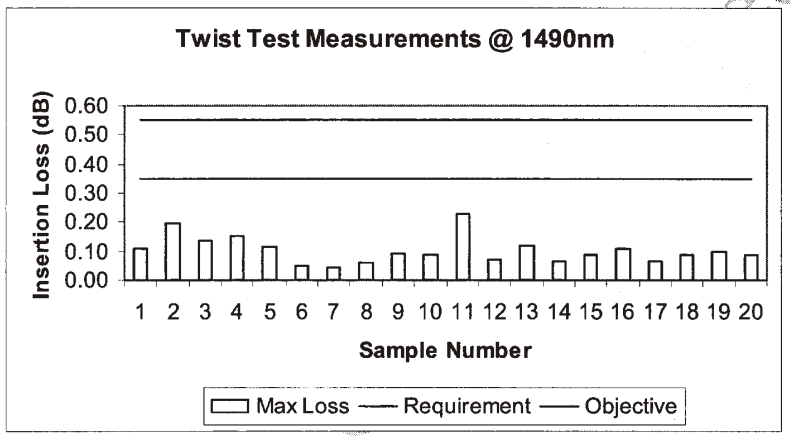


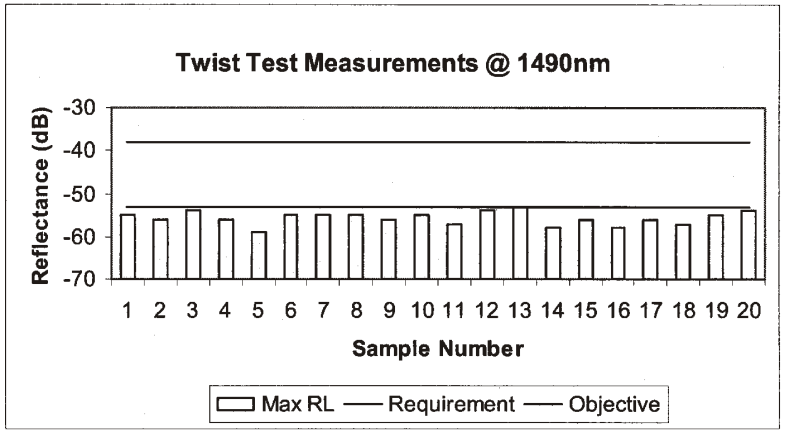


Section 4.4.3.3 Twist Test

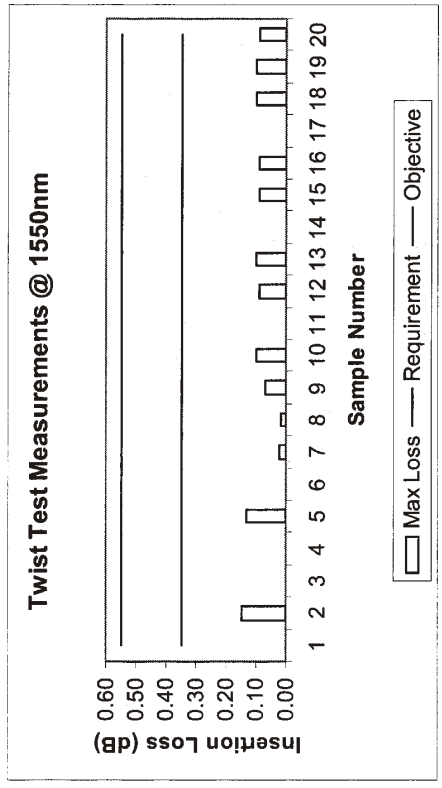


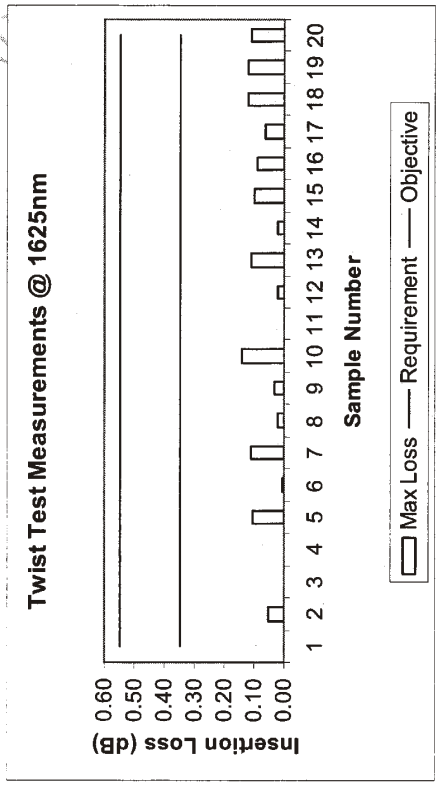


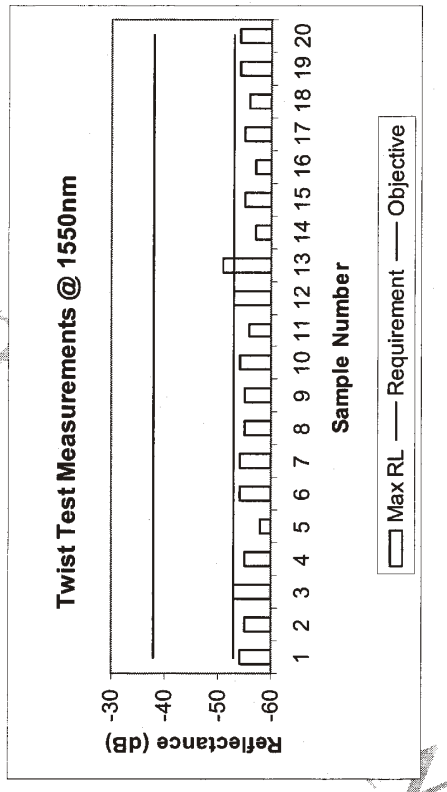


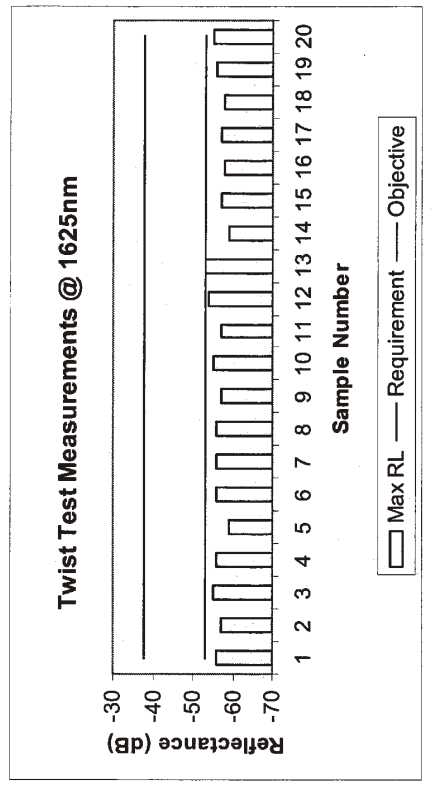


Section 4.4.3.3 Twist Test (Cont)

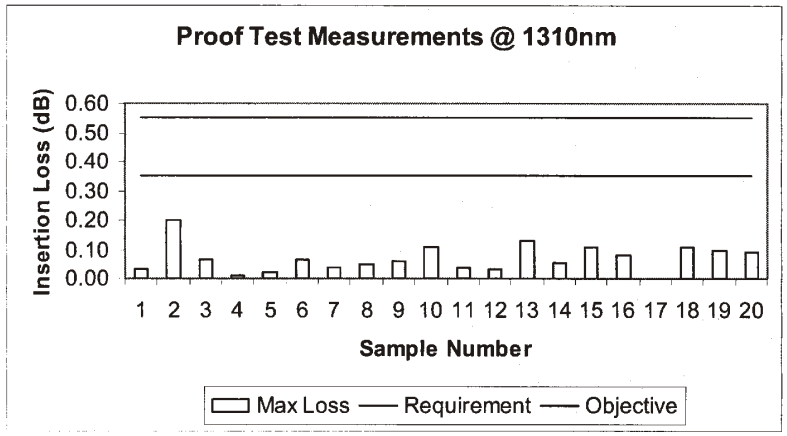


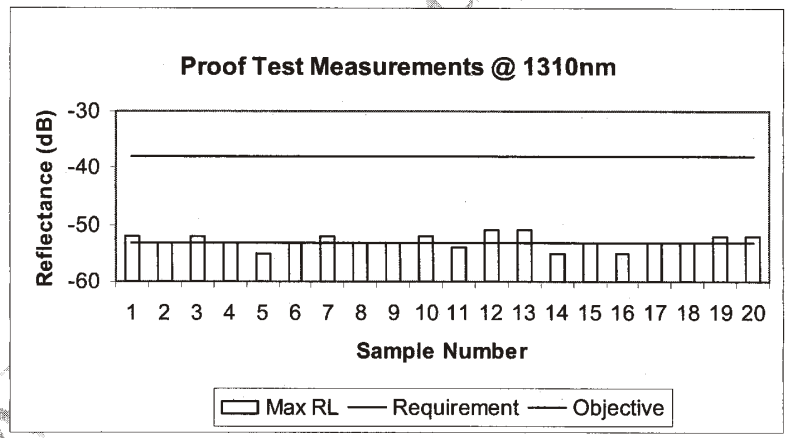


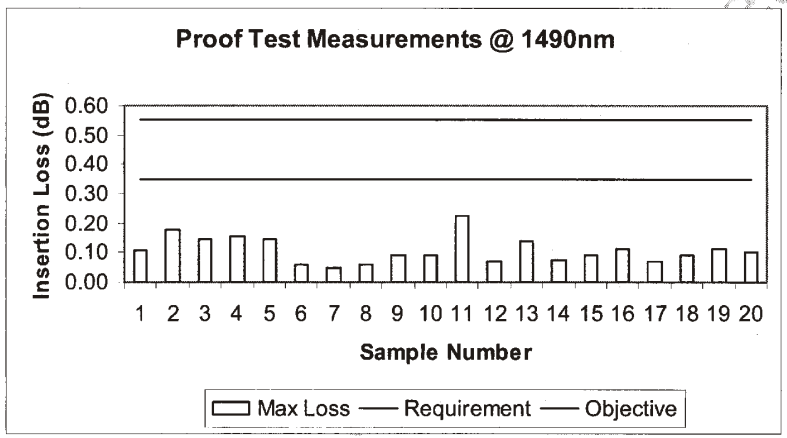


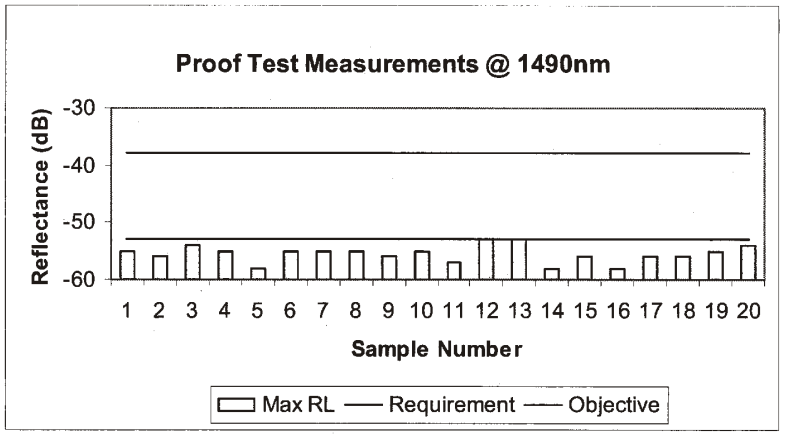


Section 4.4.3.4 Proof Test

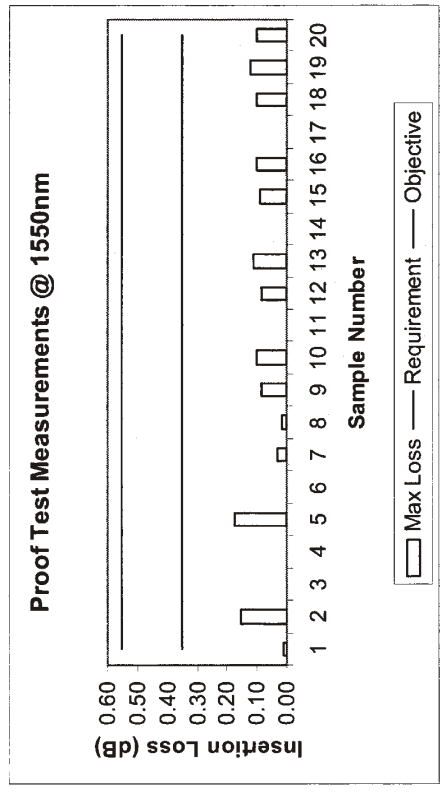


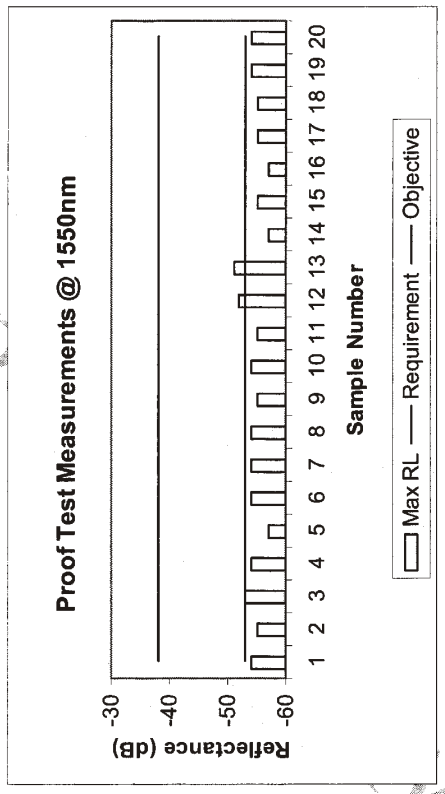


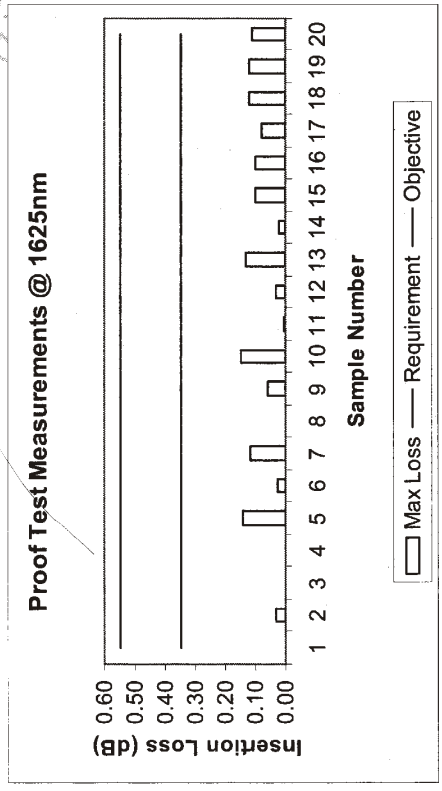


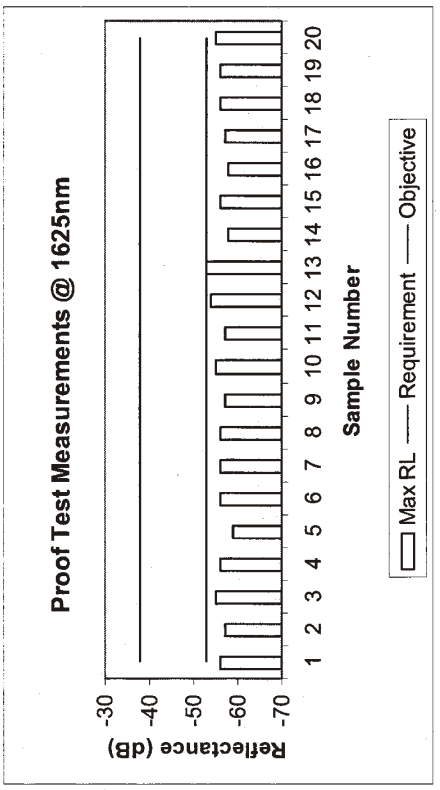


Section 4.4.3.4 Proof Test (Cont)

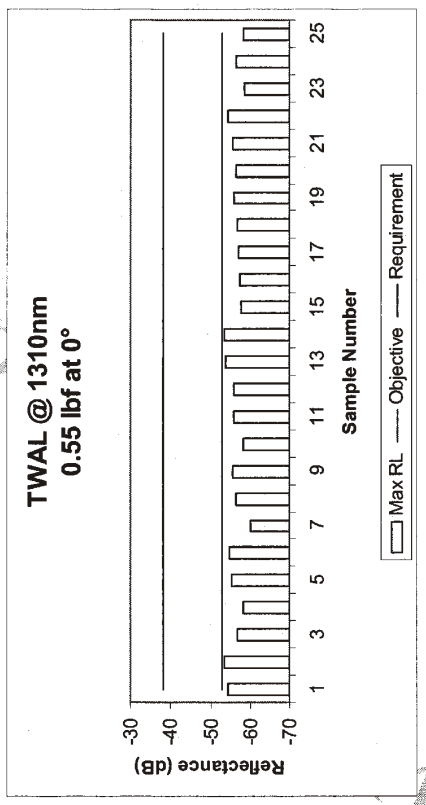


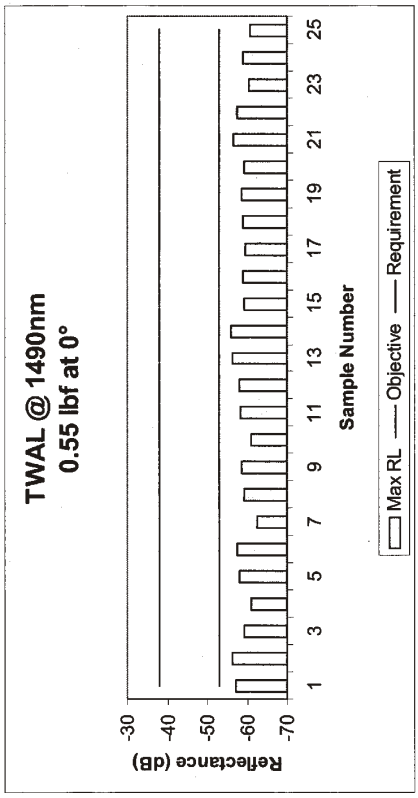


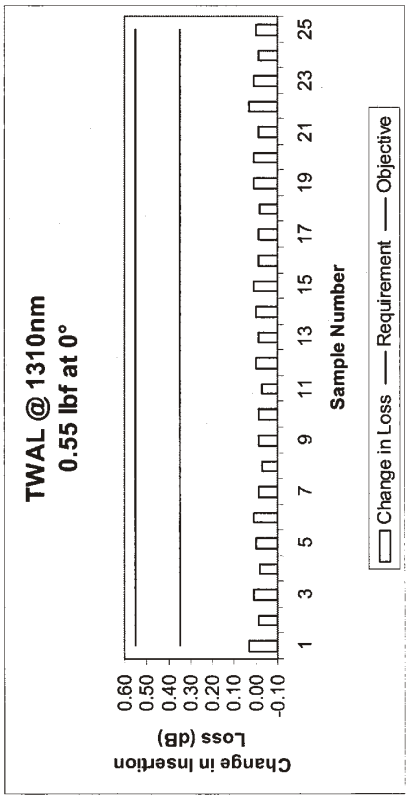


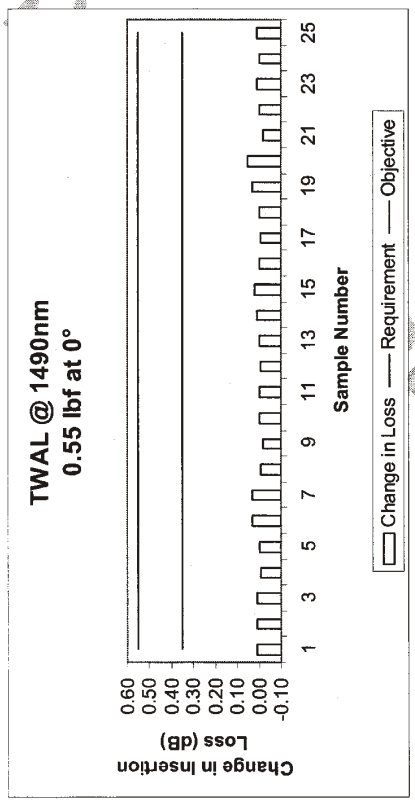


Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 0°

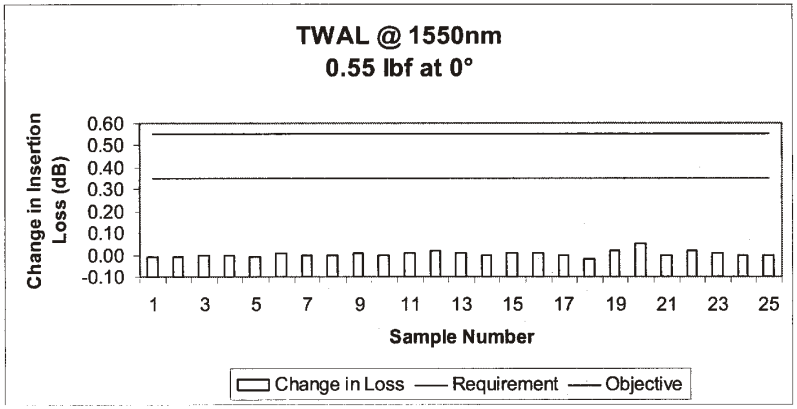


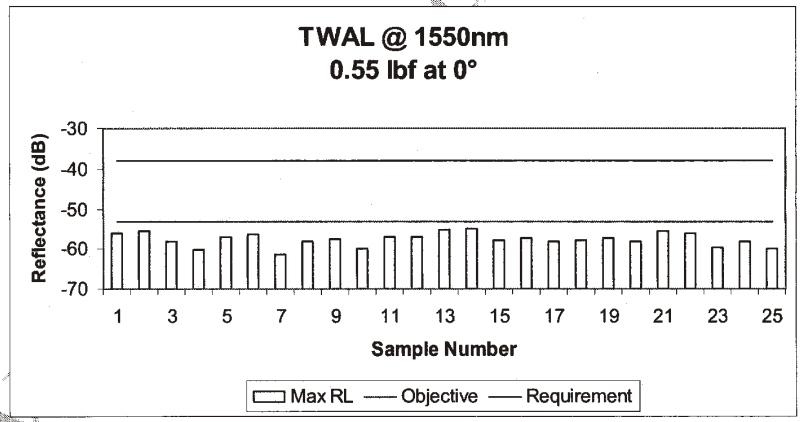


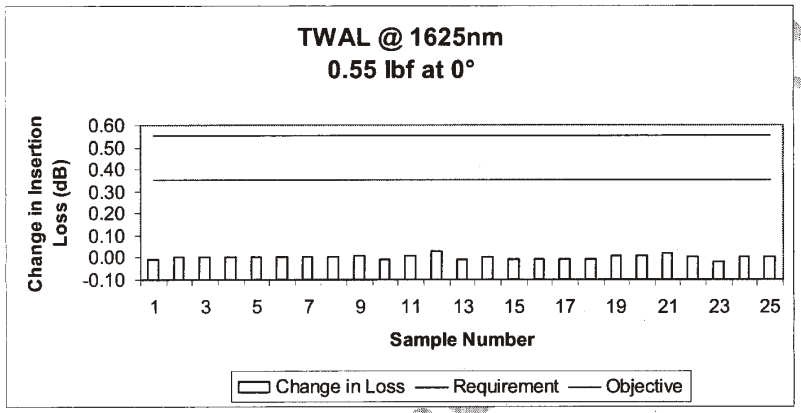


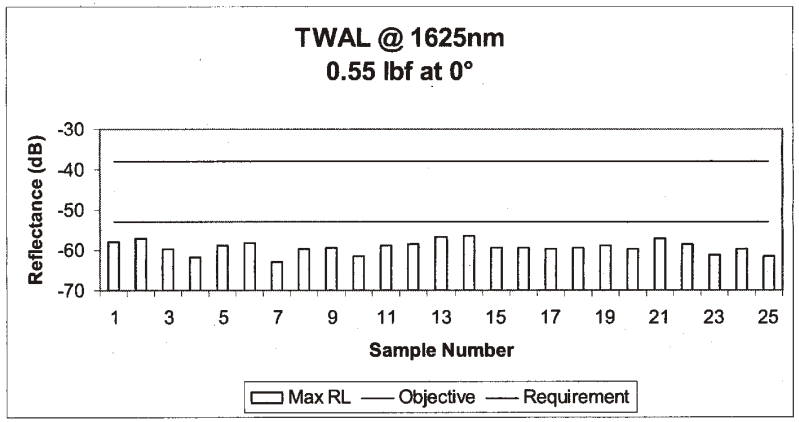


Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 0° (Cont)

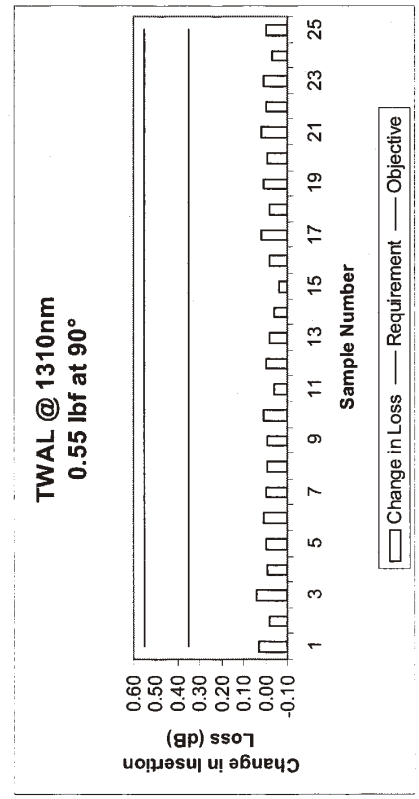


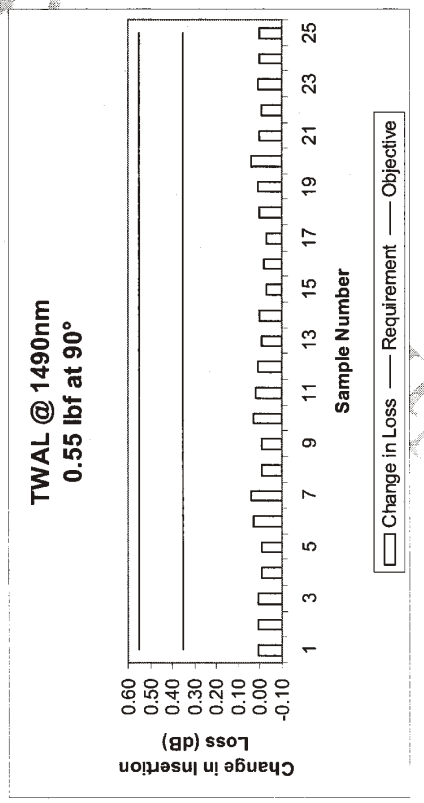


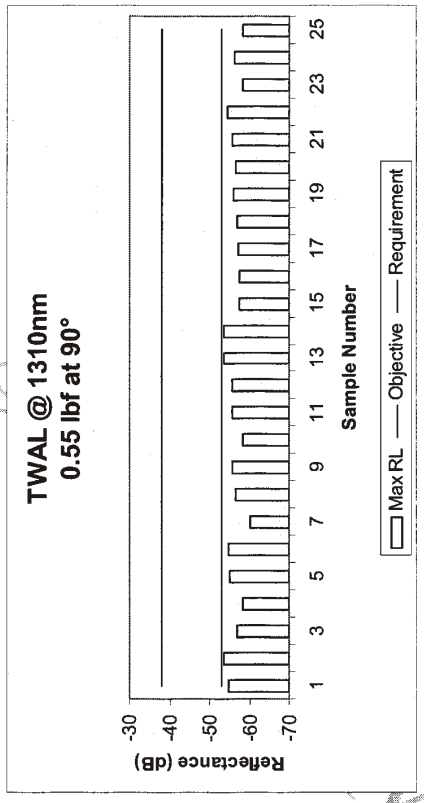


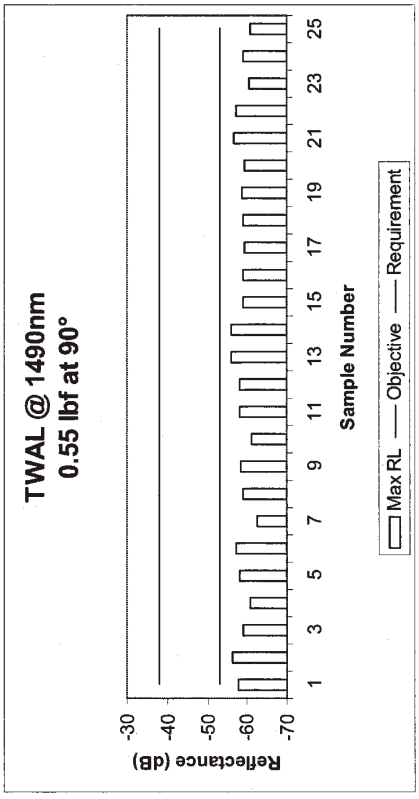


Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 90°

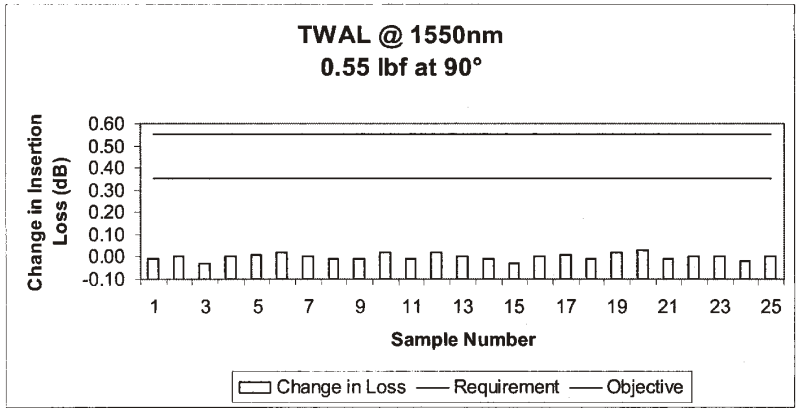


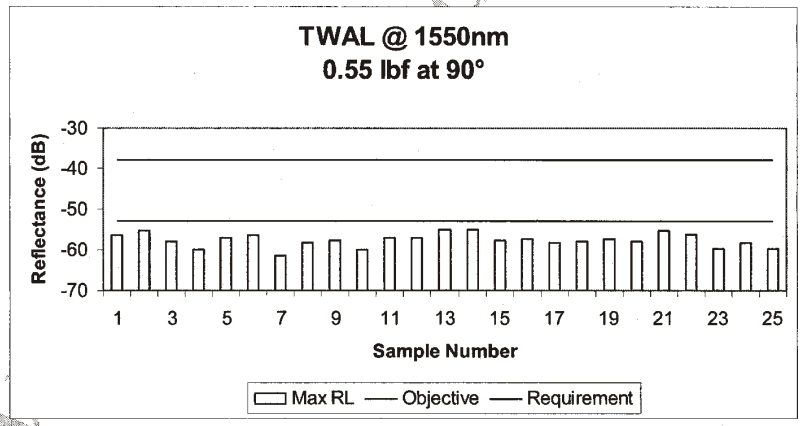


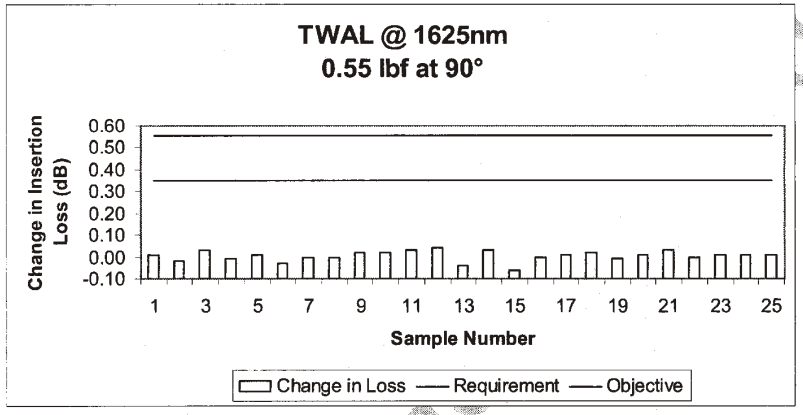


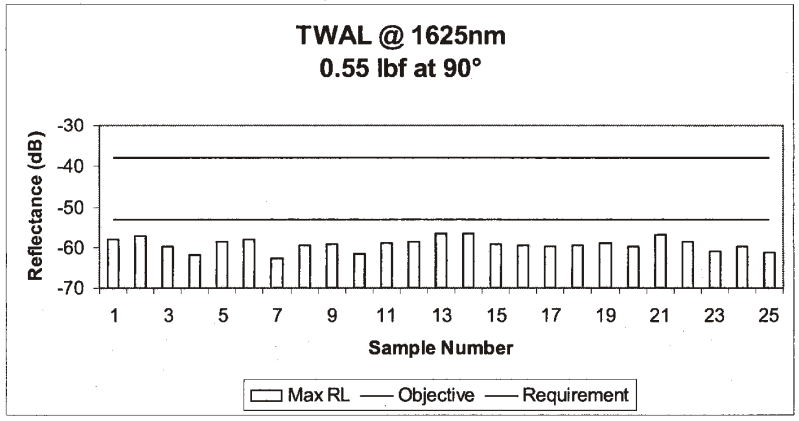


Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 90°(Cont)

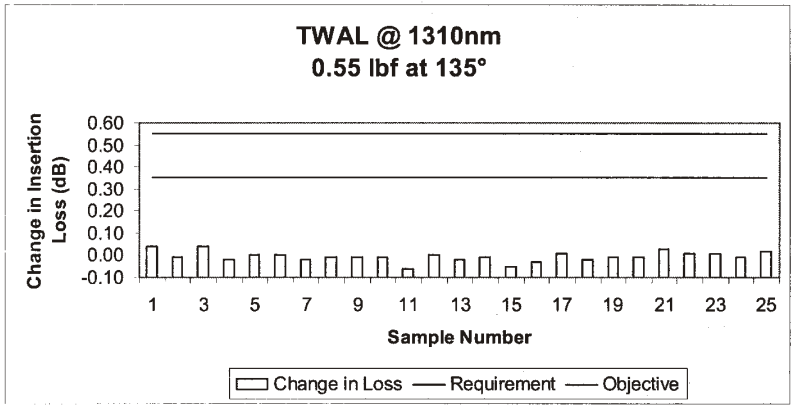


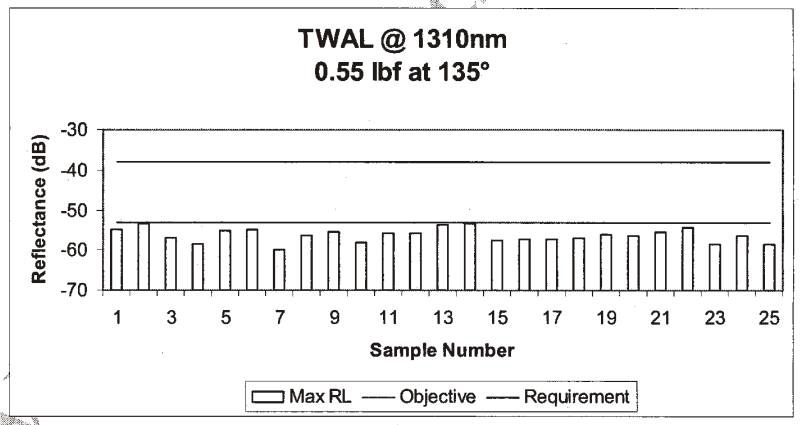


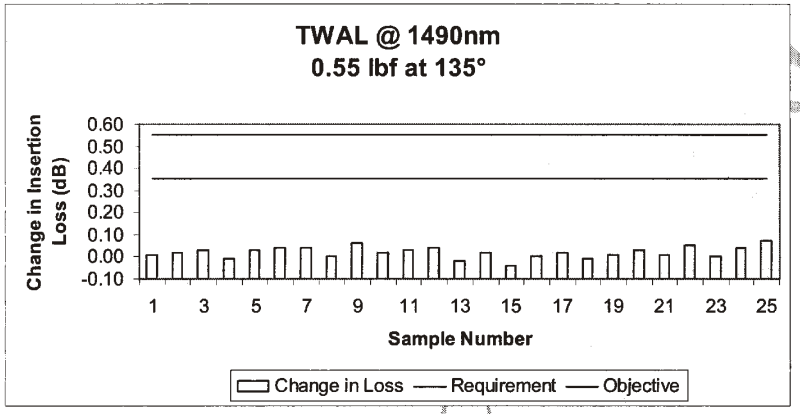


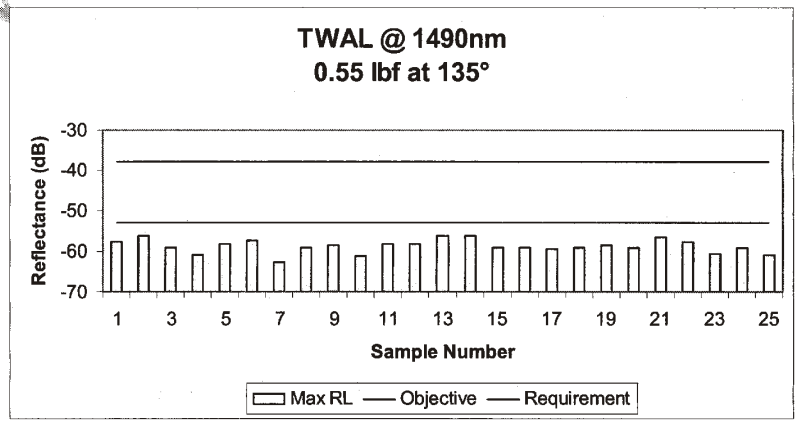


Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 135°

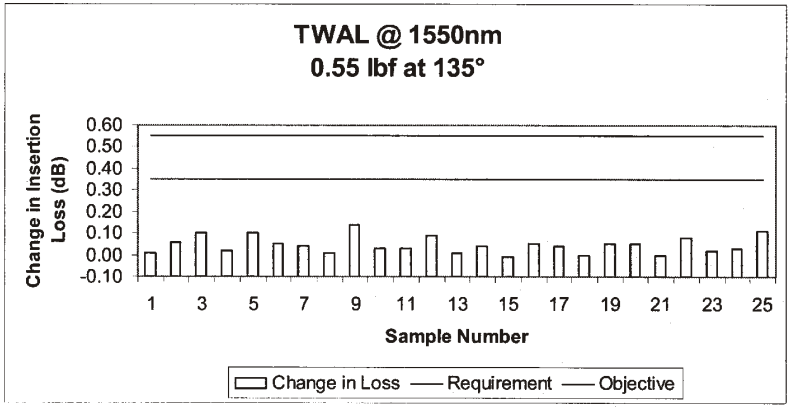


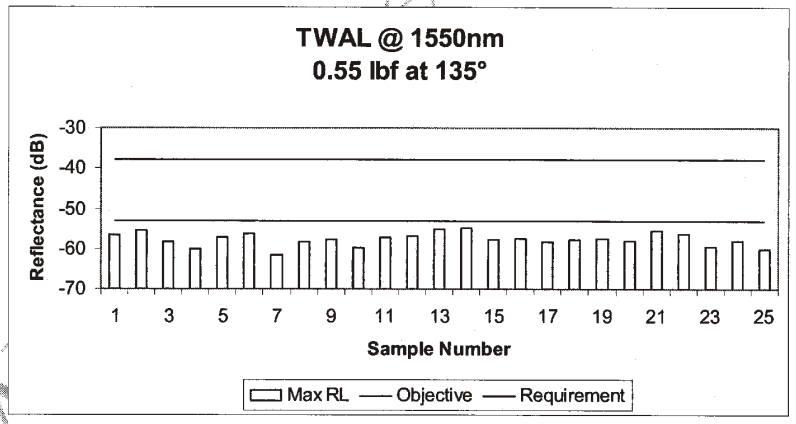


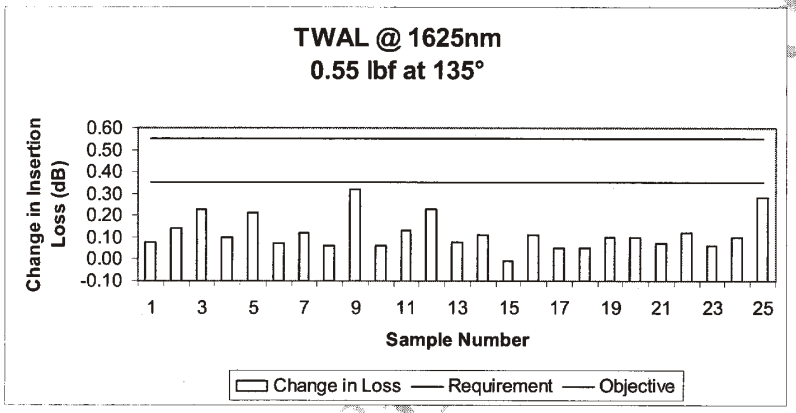


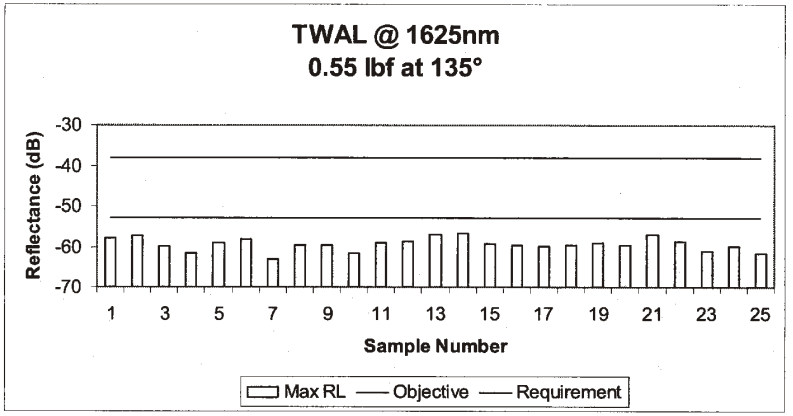


Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 135° (Cont)

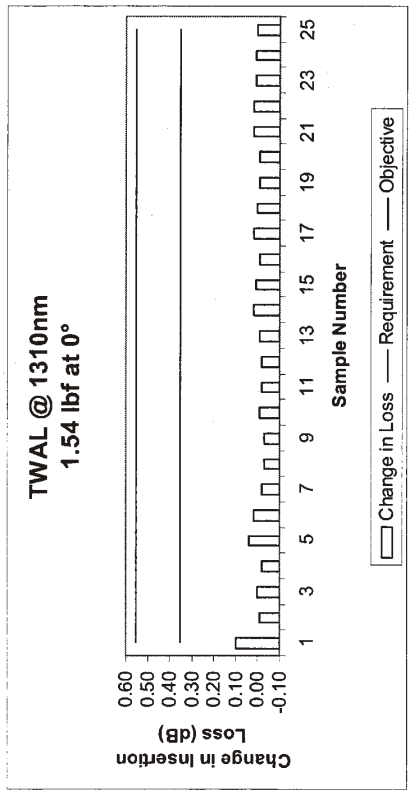


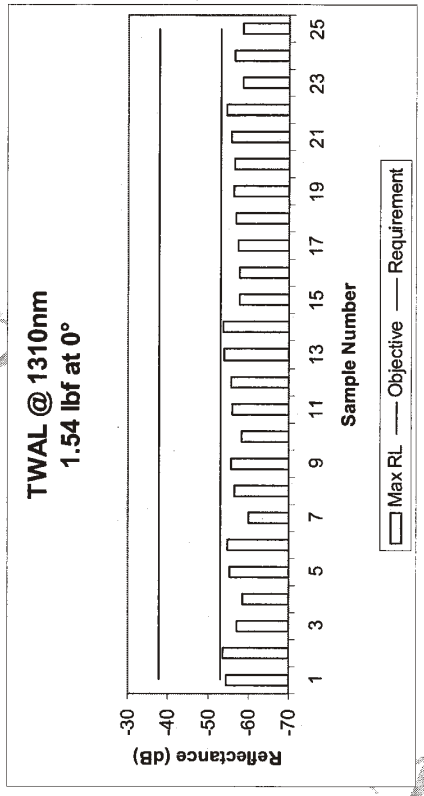


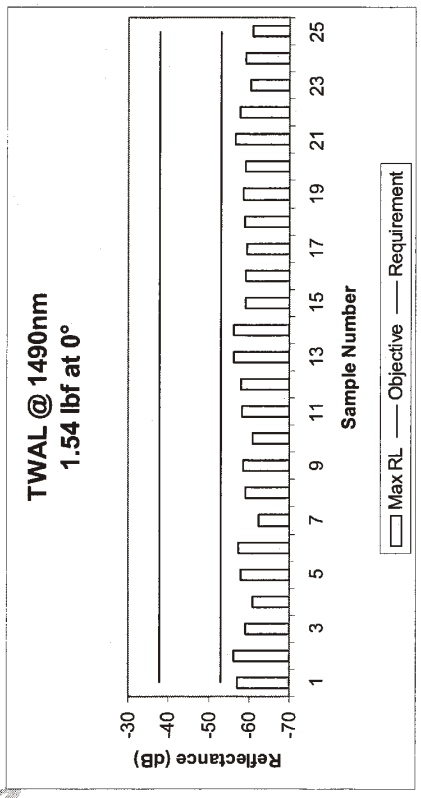




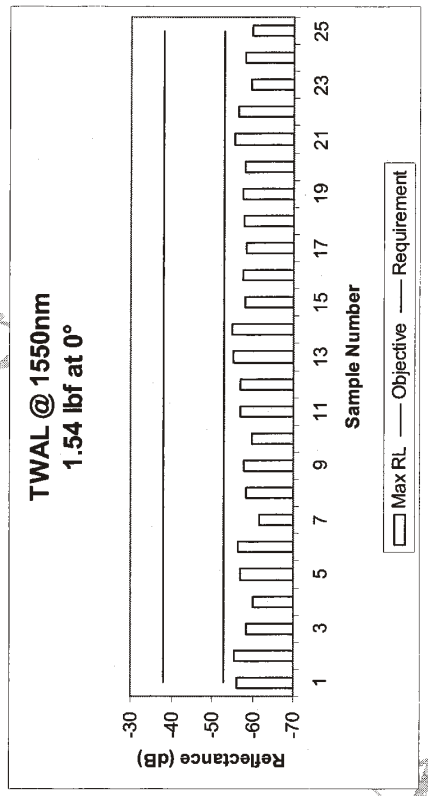
Section 4.4.3.5 Transmission With Applied Load 1.54 lbf at 0°



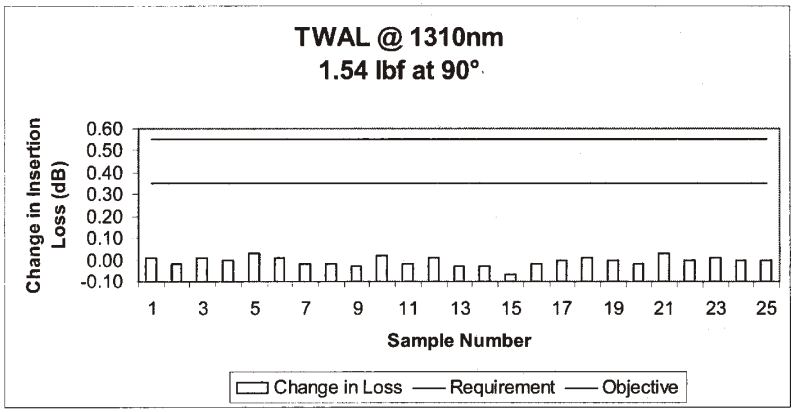


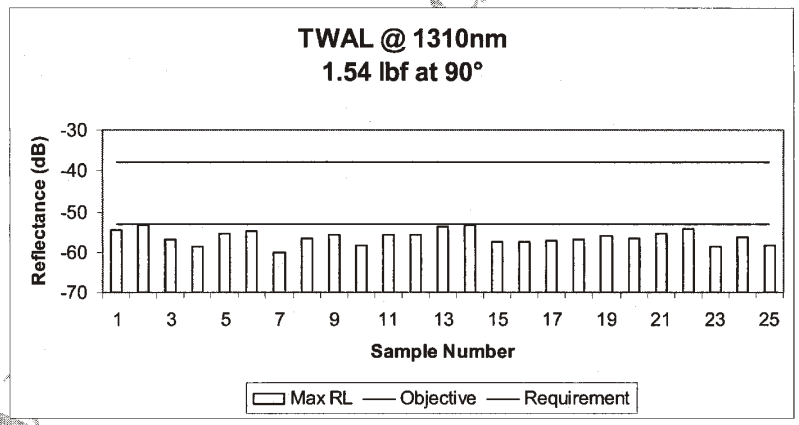


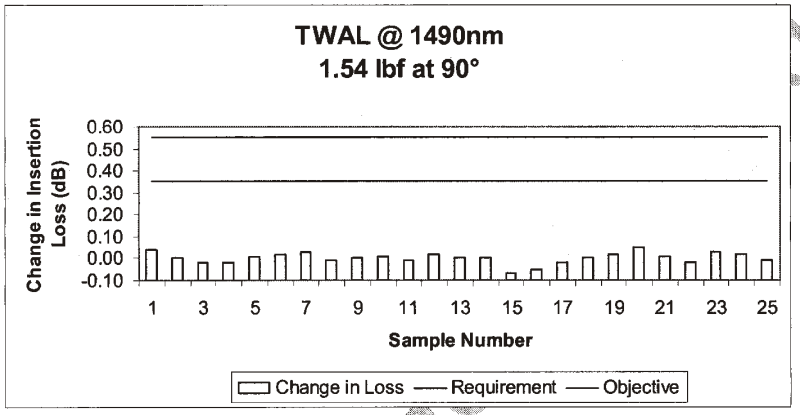
Section 4.4.3.5 Transmission With Applied Load 1.54 lbf at 0° (Cont)

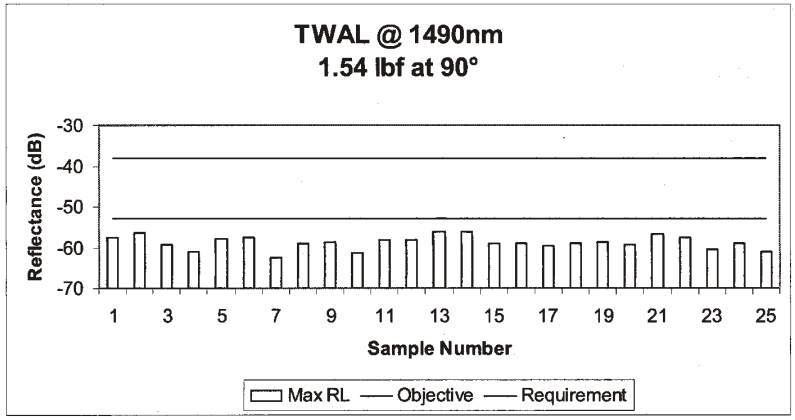


Section 4.4.3.5 Transmission With Applied Load 1.54 lbf at 90°

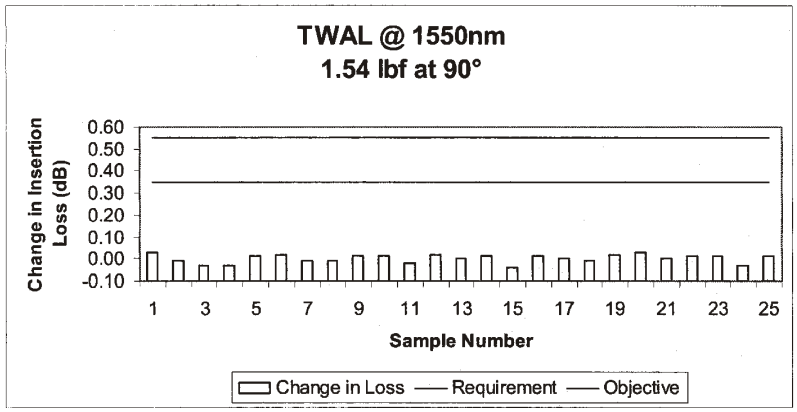


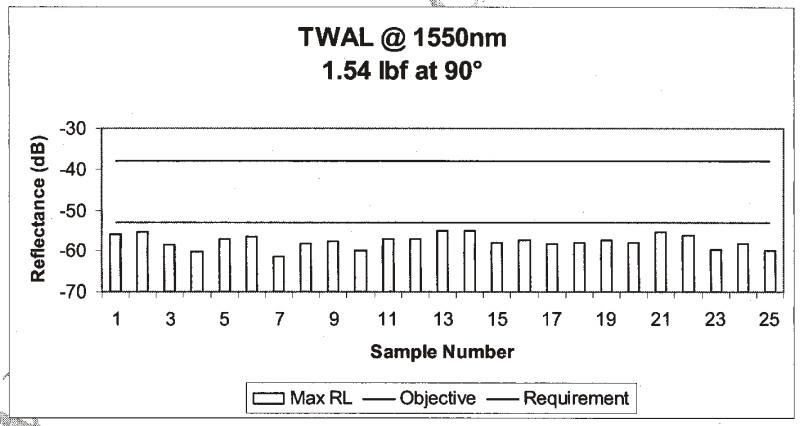


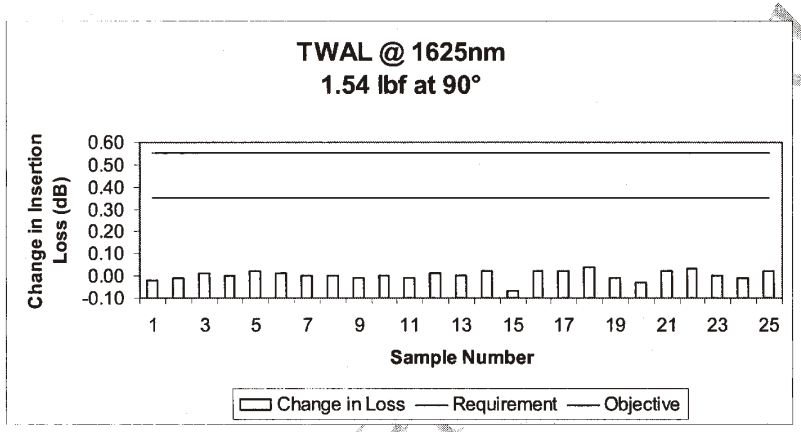


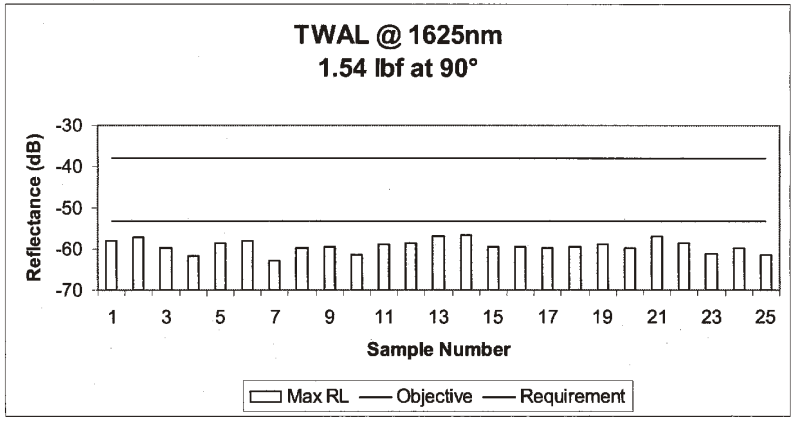


Section 4.4.3.5 Transmission With Applied Load 1.54 lbf at 90°(Cont)

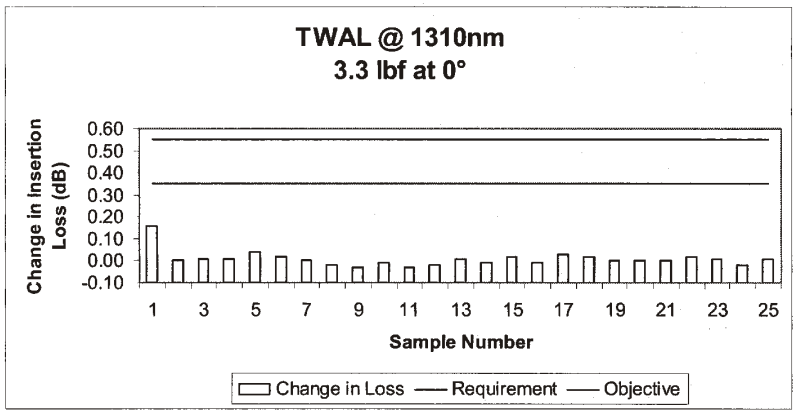


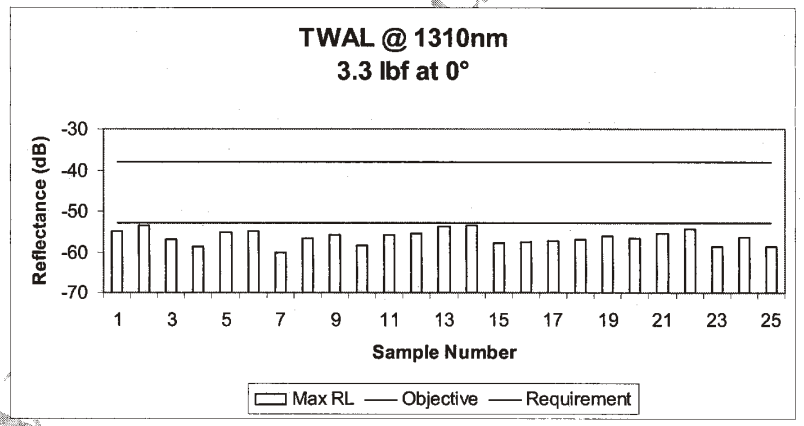


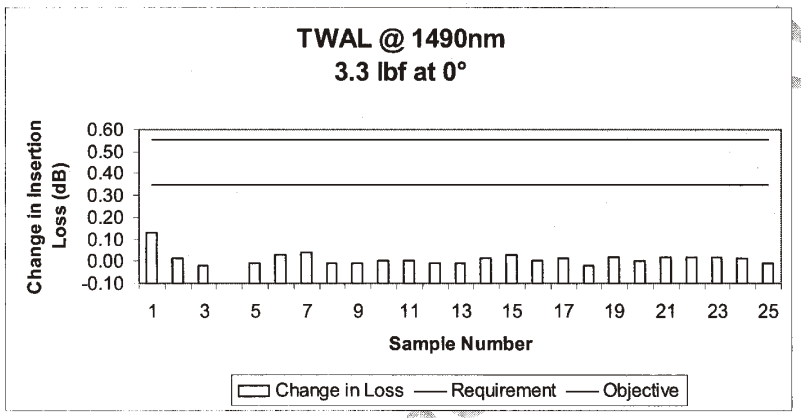


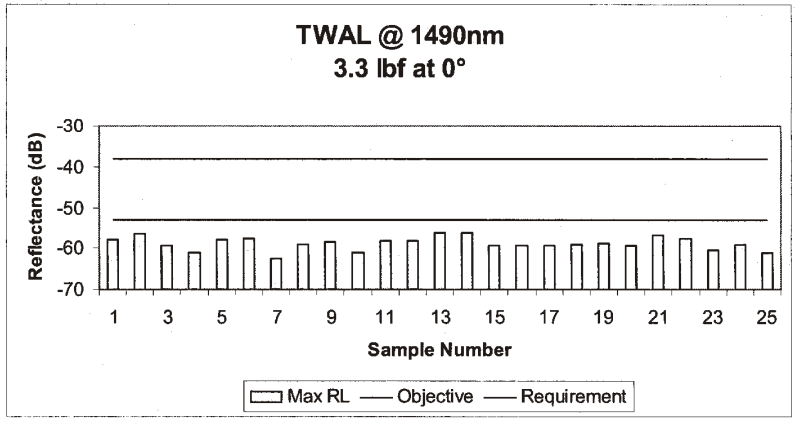


Section 4.4.3.5 Transmission With Applied Load 3.3 lbf at 0°

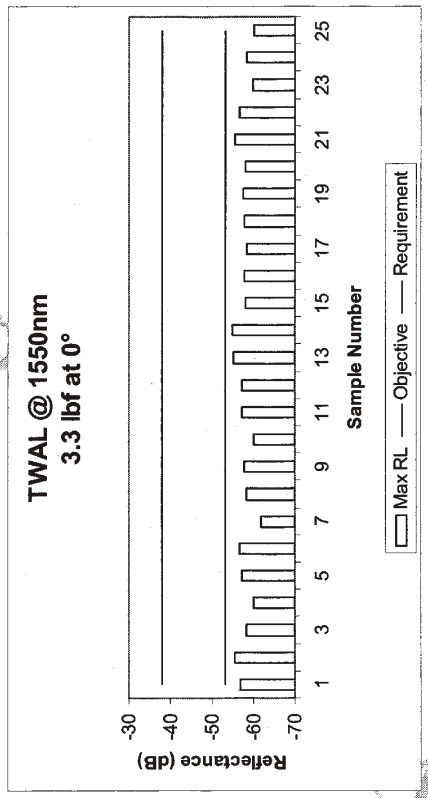


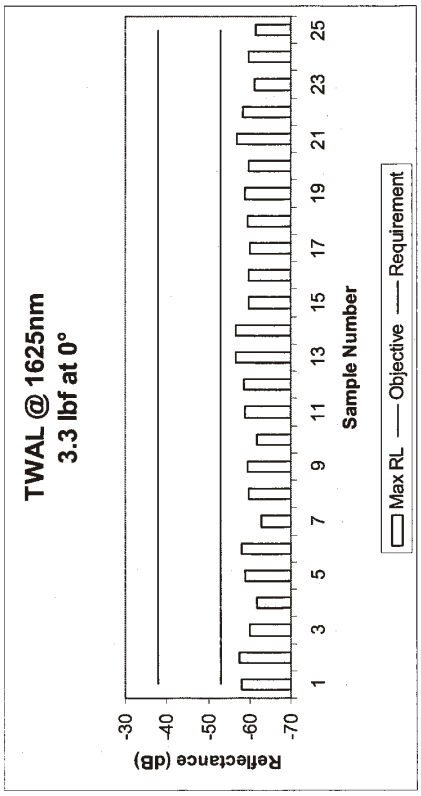


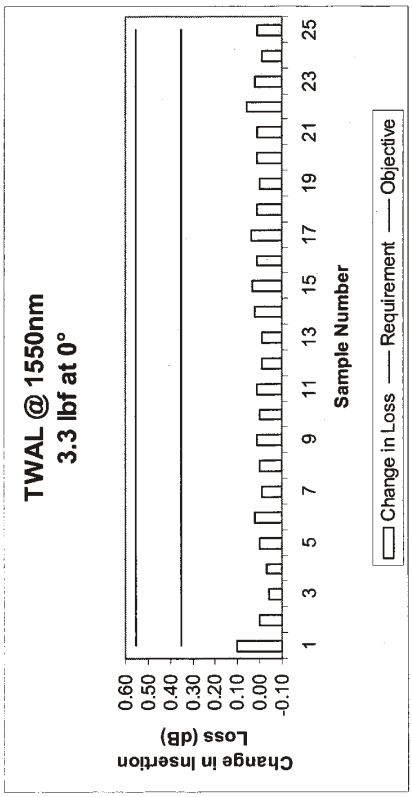


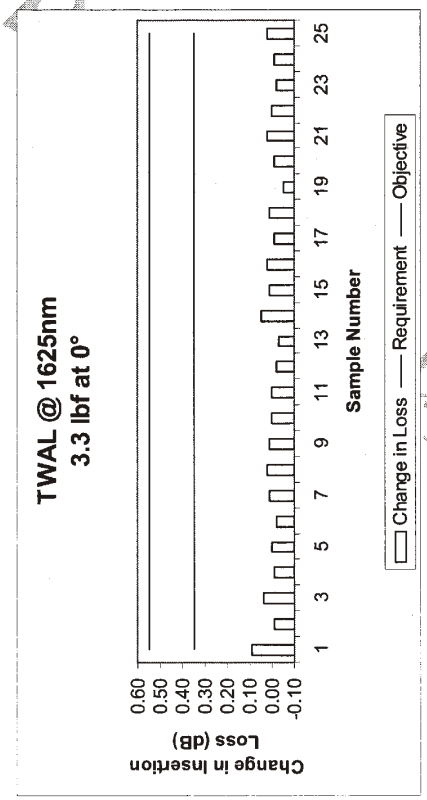


Section 4.4.3.5 Transmission With Applied Load 3.3 lbf at 0° (Cont)

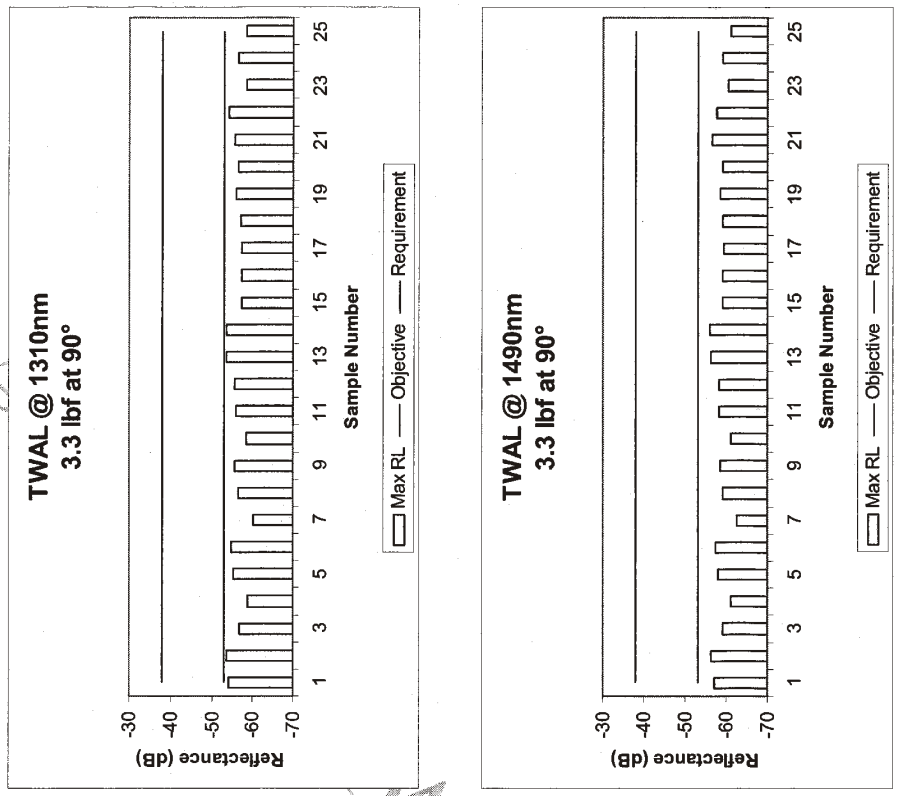


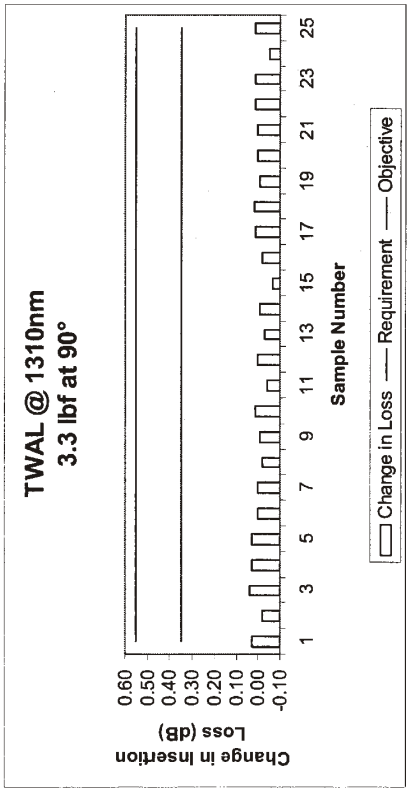


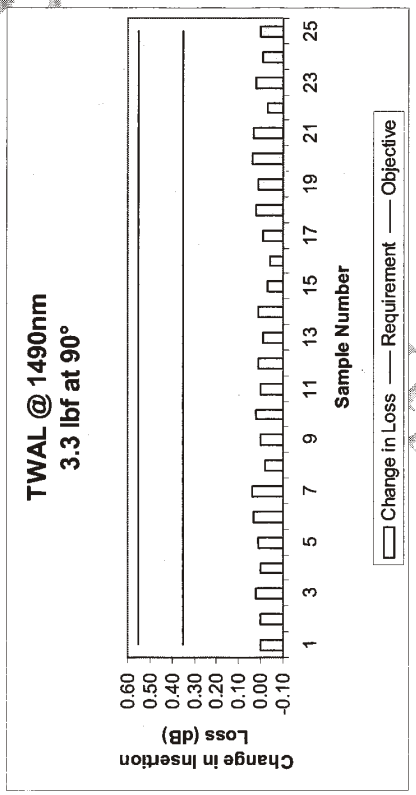




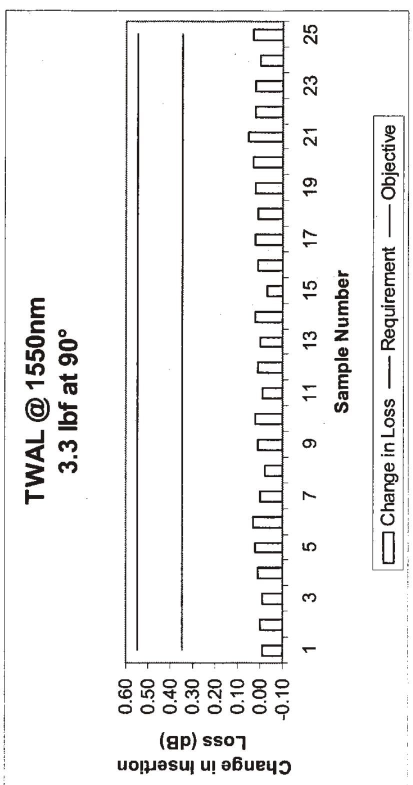
Section 4.4.3.5 Transmission With Applied Load 3.3 lbf at 90°

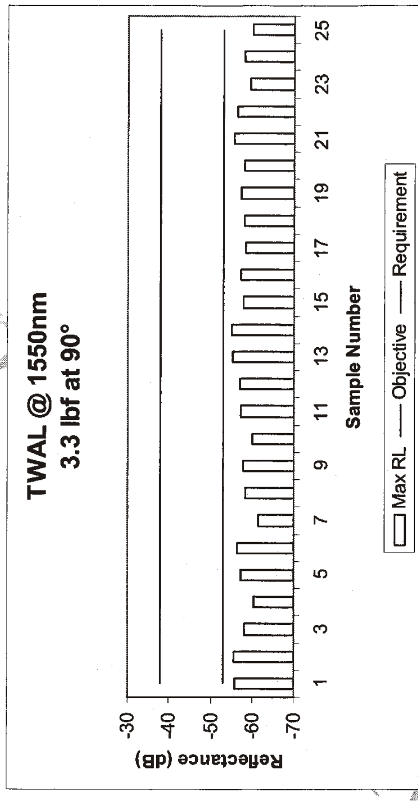


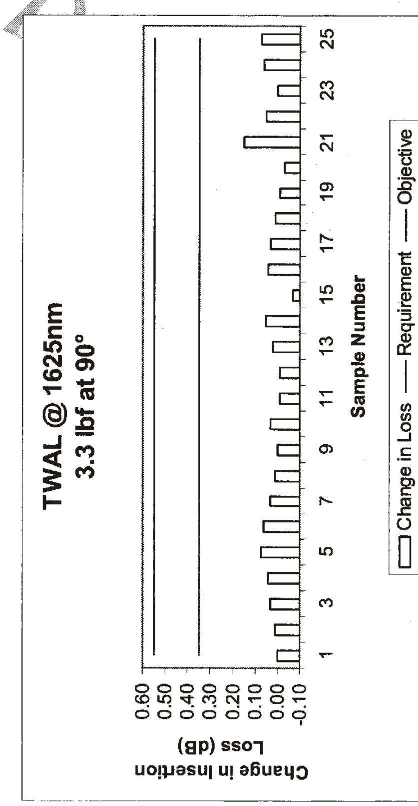


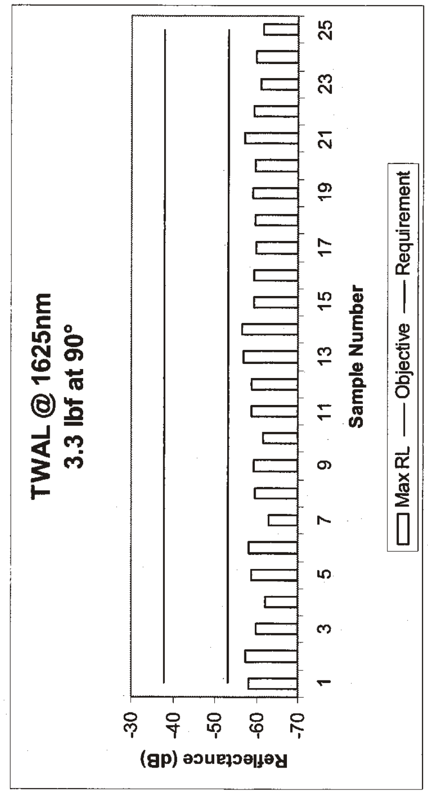


Section 4.4.3.5 Transmission With Applied Load 3.3 lbf at 90°(Cont)

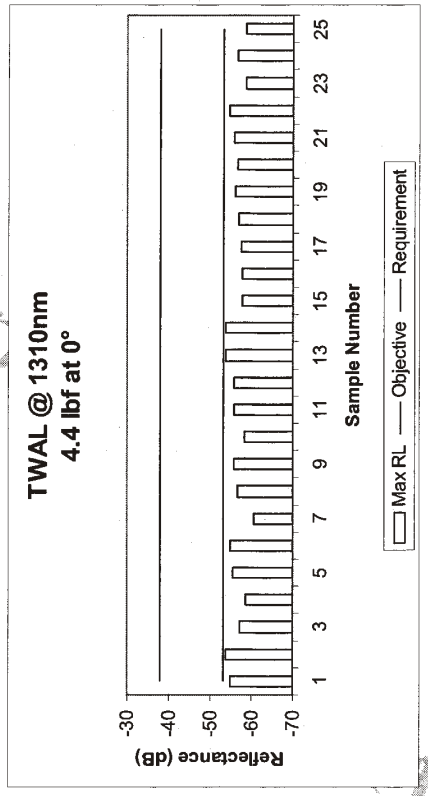


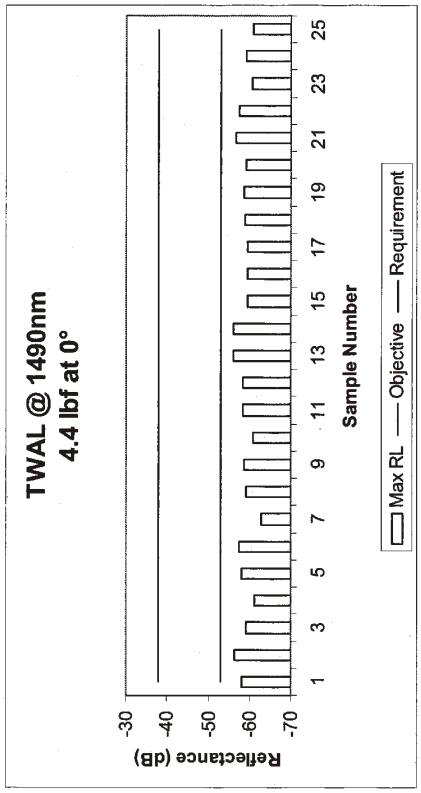


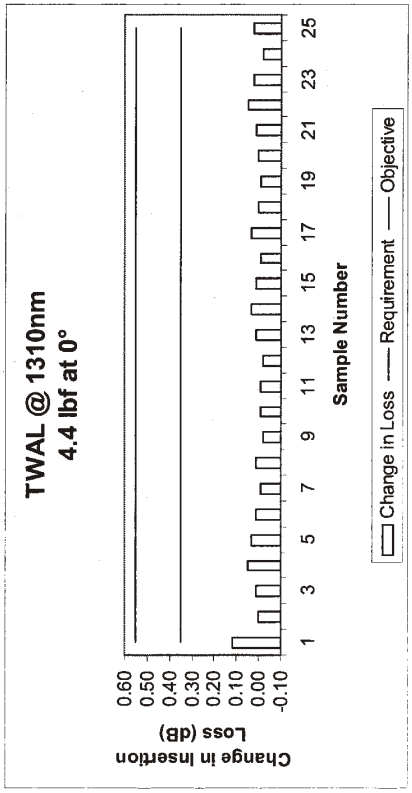


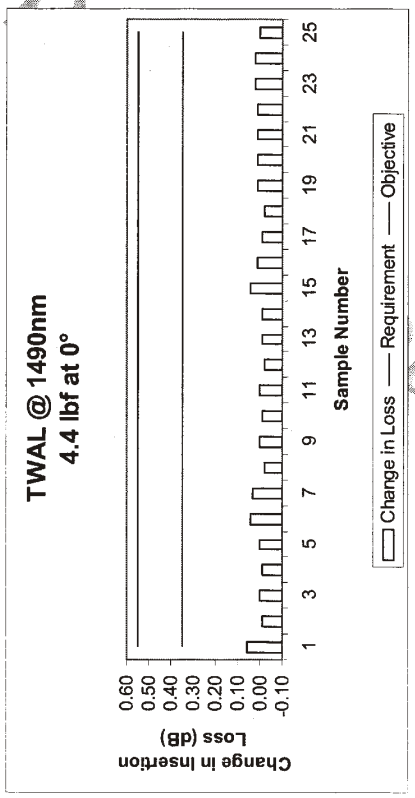


Section 4.4.3.5 Transmission With Applied Load 4.4 lbf at 0°

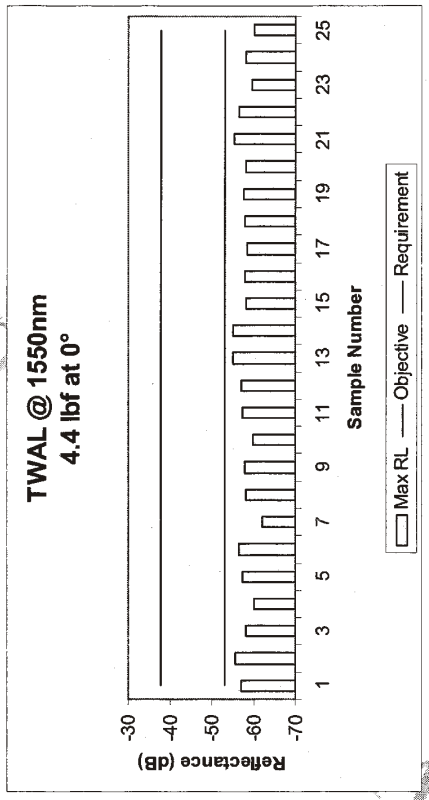


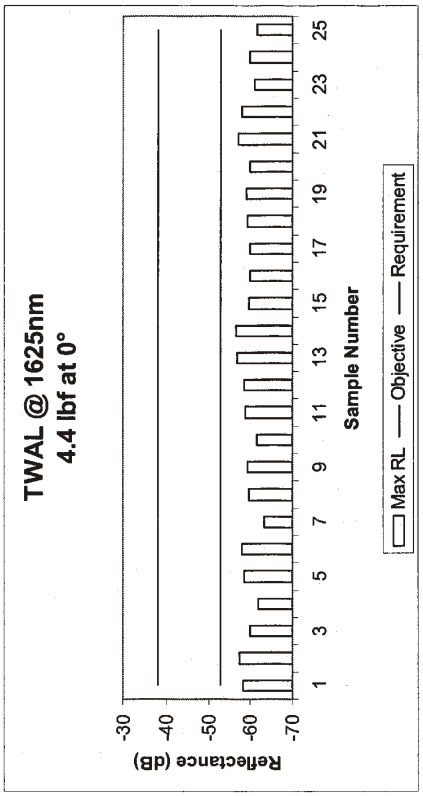


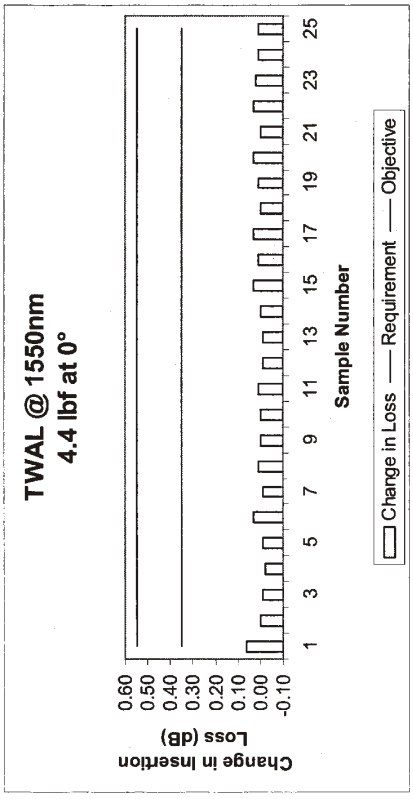


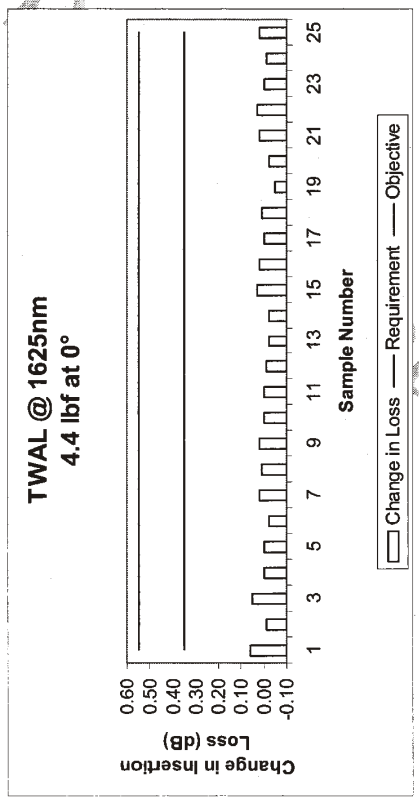


Section 4.4.3.5 Transmission With Applied Load 4.4 lbf at 0° (Cont)

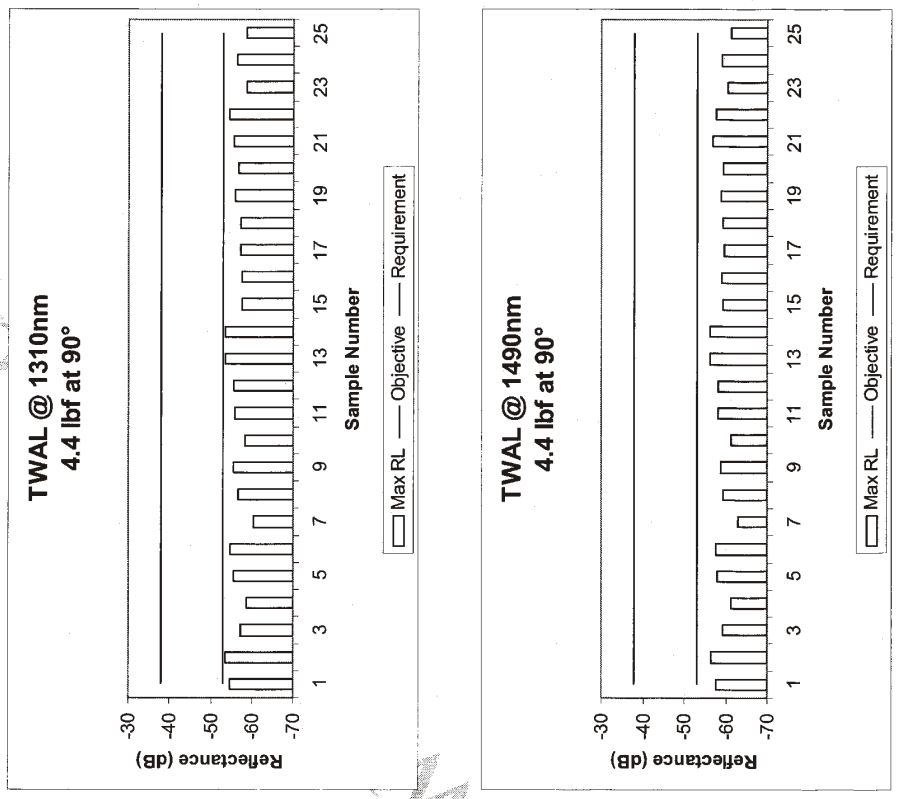


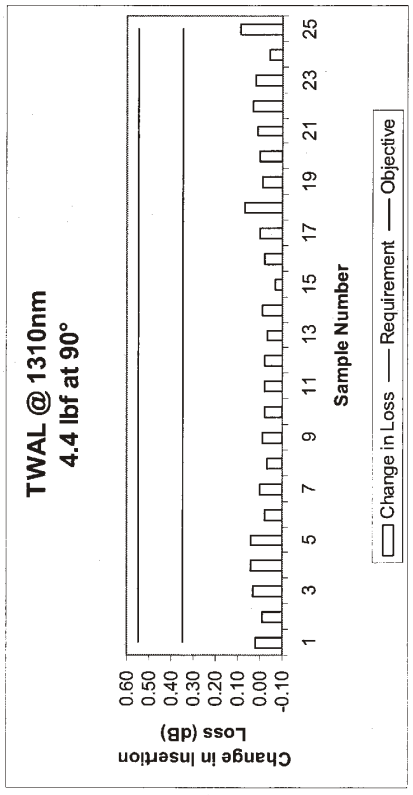


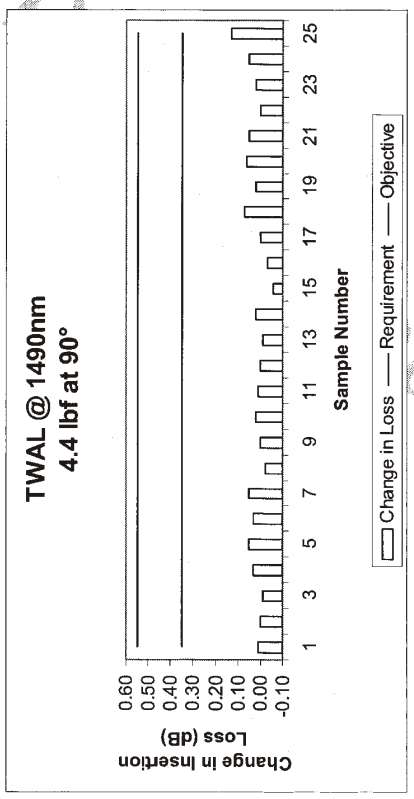




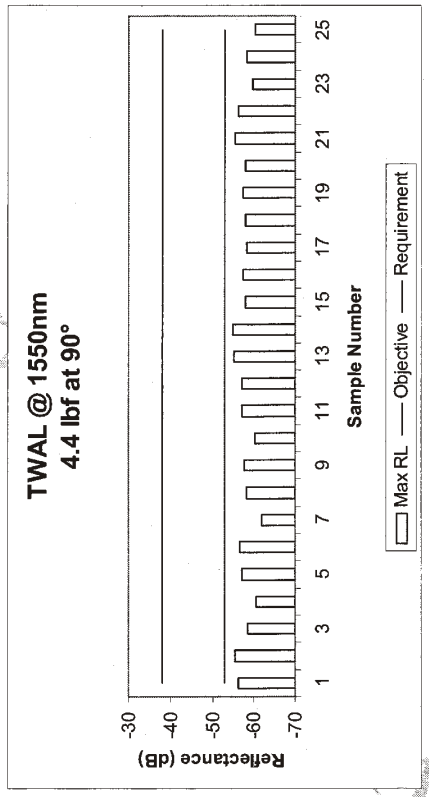
Section 4.4.3.5 Transmission With Applied Load 4.4 lbf at 90°

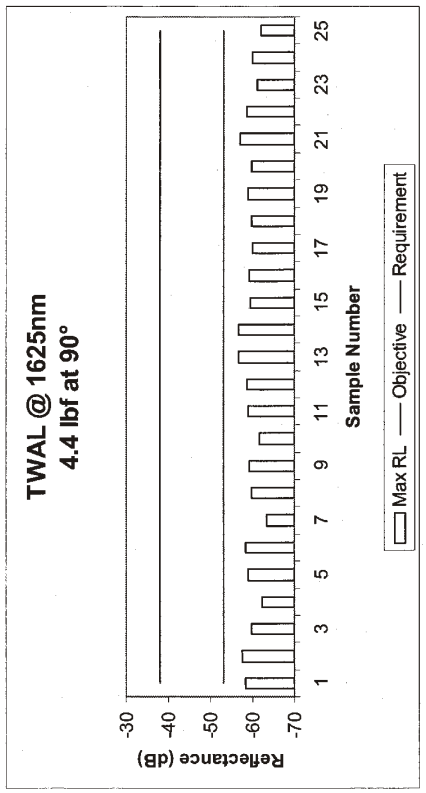


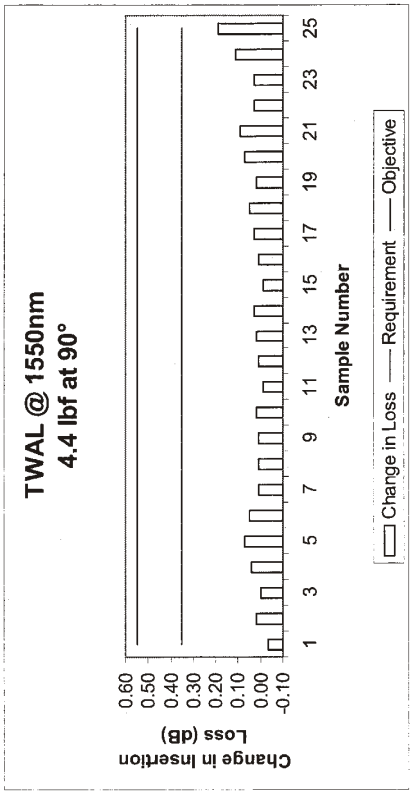


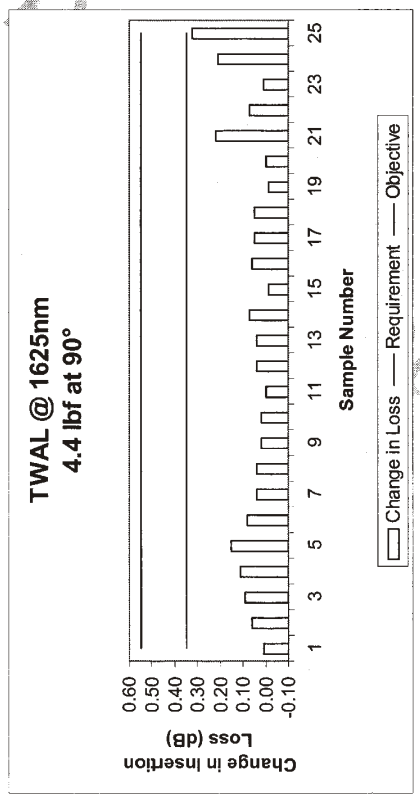


Section 4.4.3.5 Transmission With Applied Load 4.4 lbf at 90°(Cont)

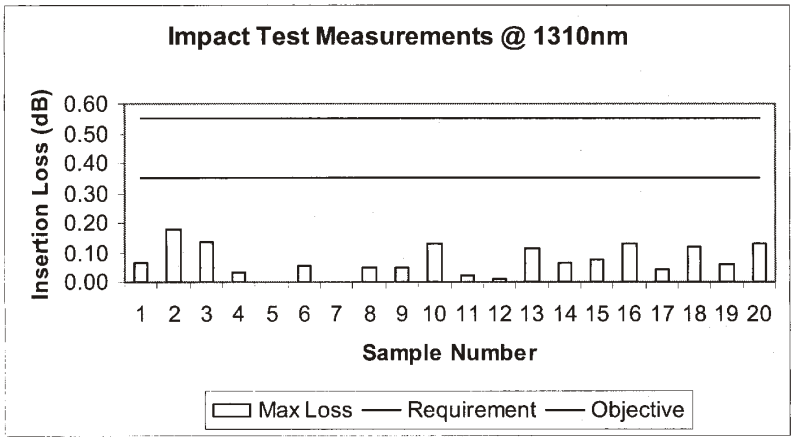


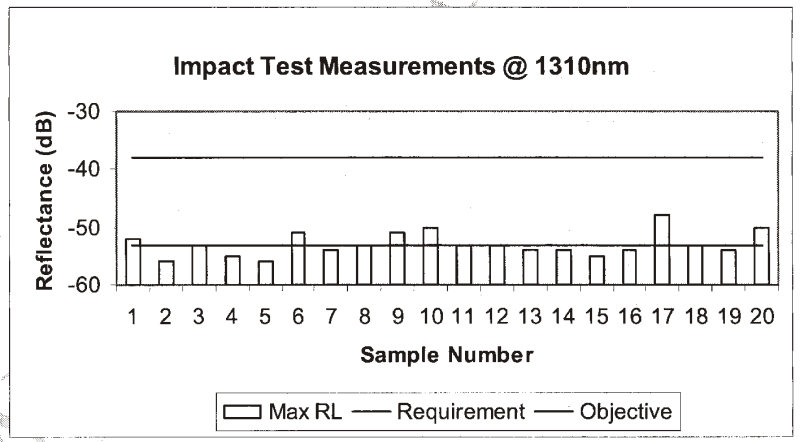


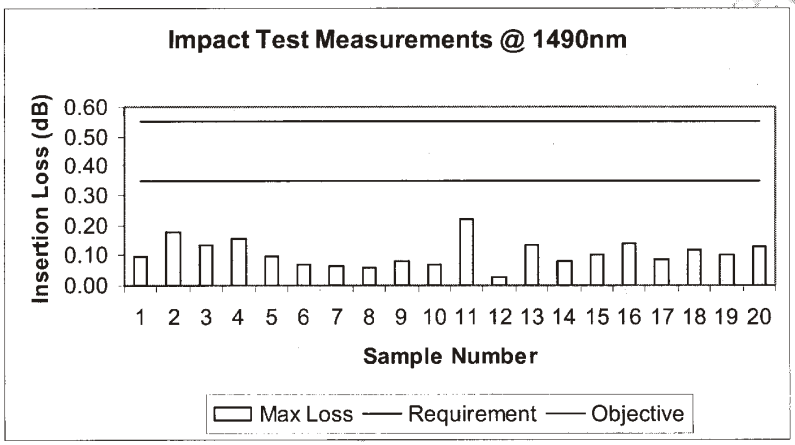


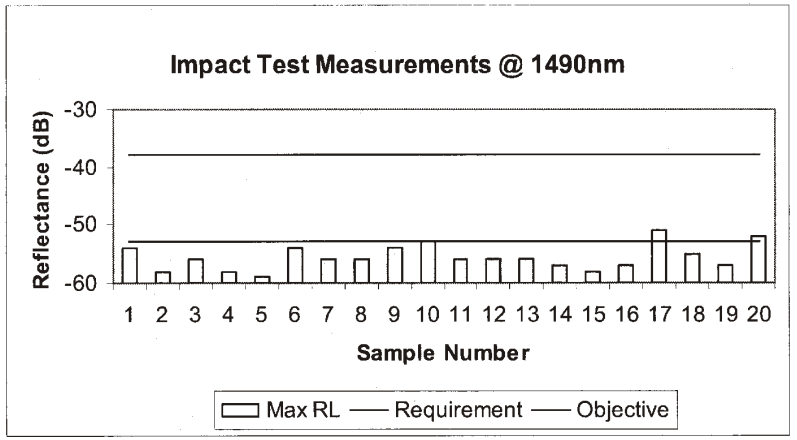


Section 4.4.3.7 Impact Test

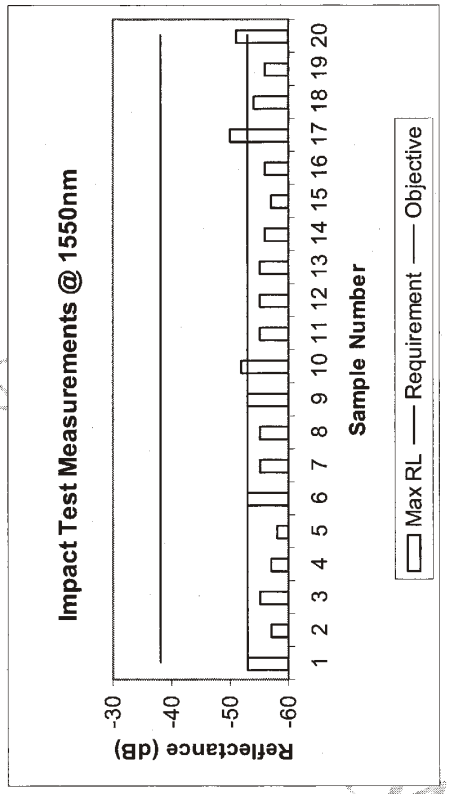


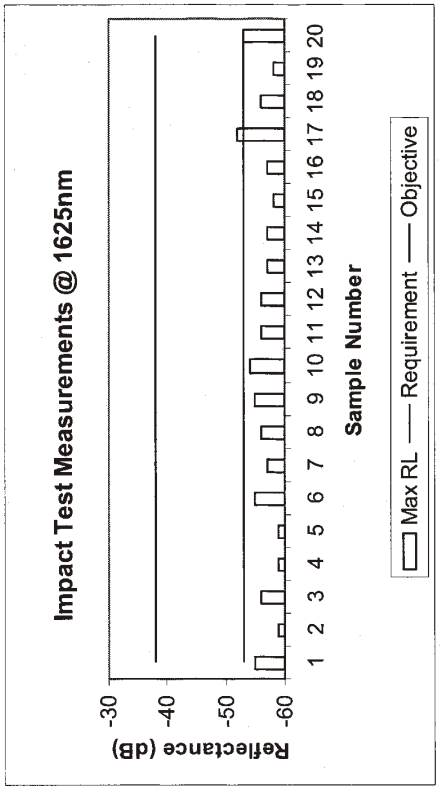


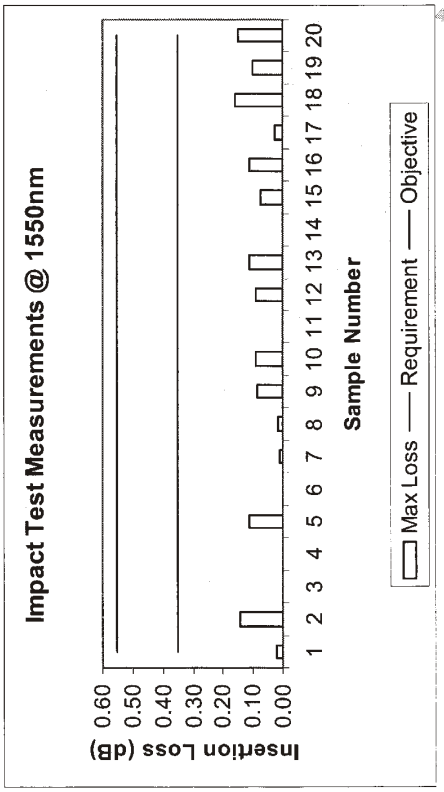


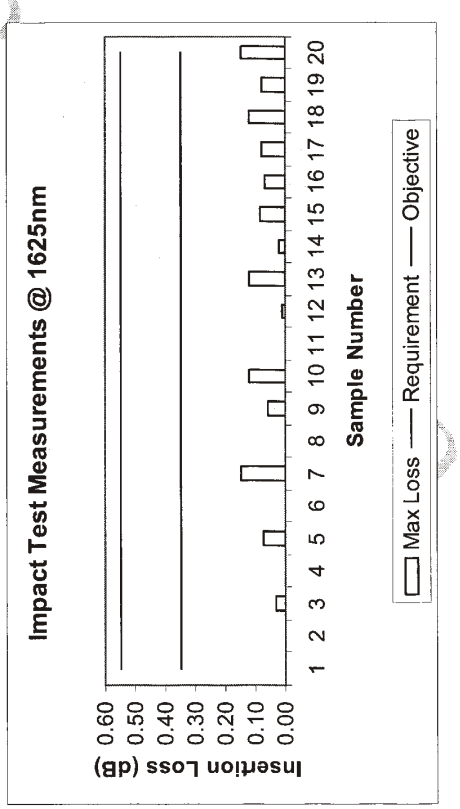


Section 4.4.3.7 Impact Test (Cont)

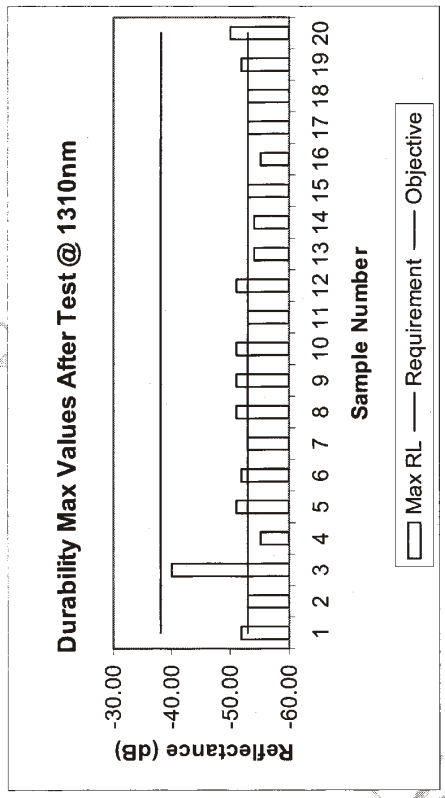


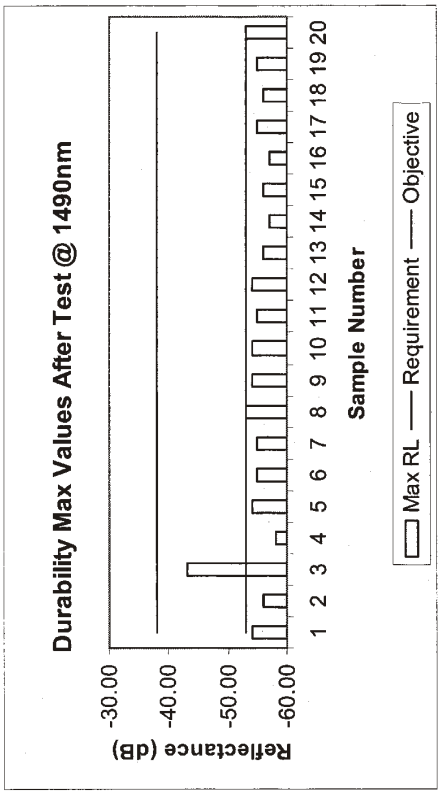


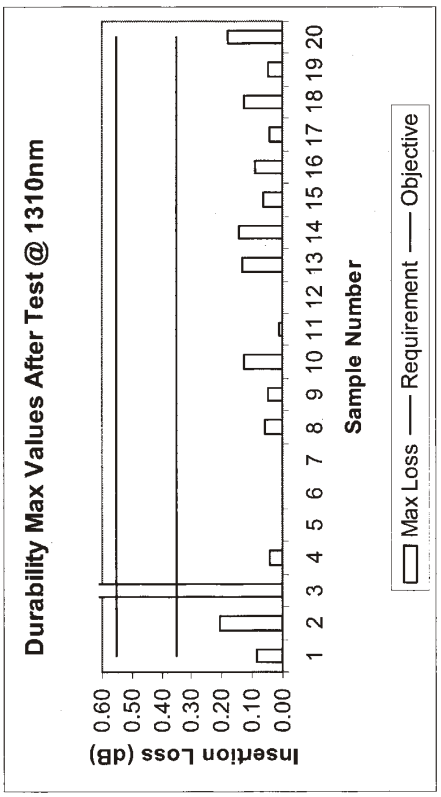


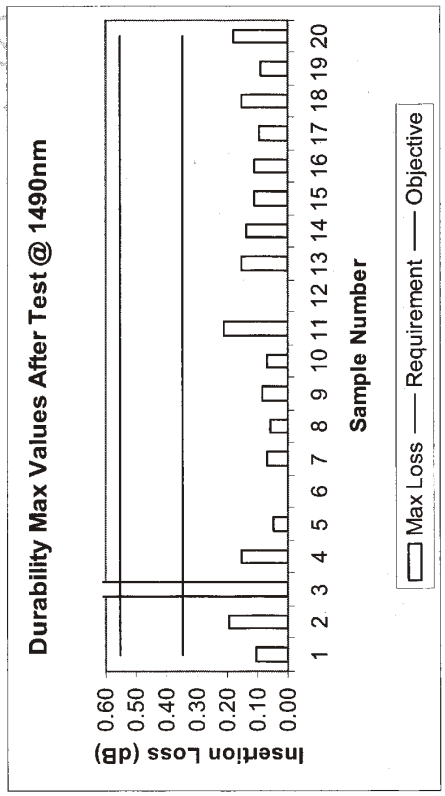


Section 4.4.3.8 Durability

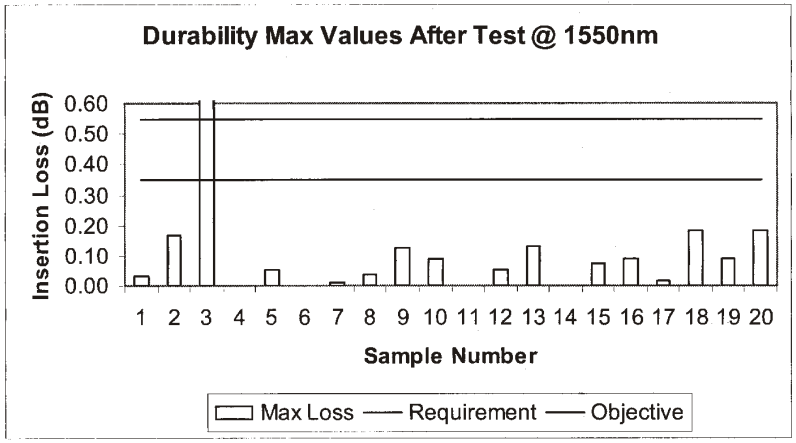


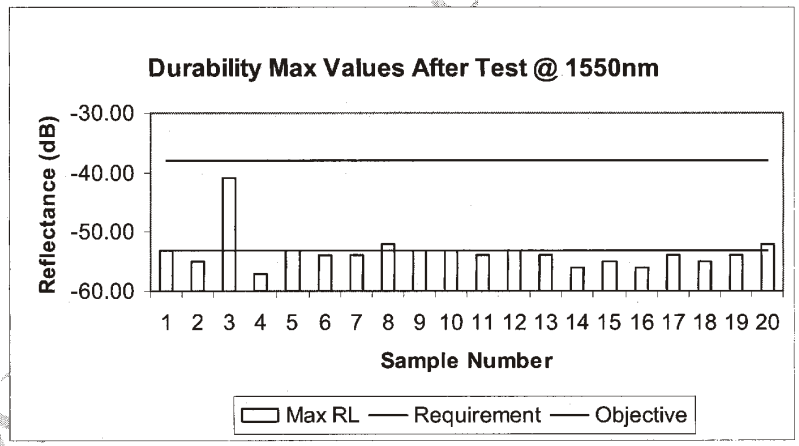


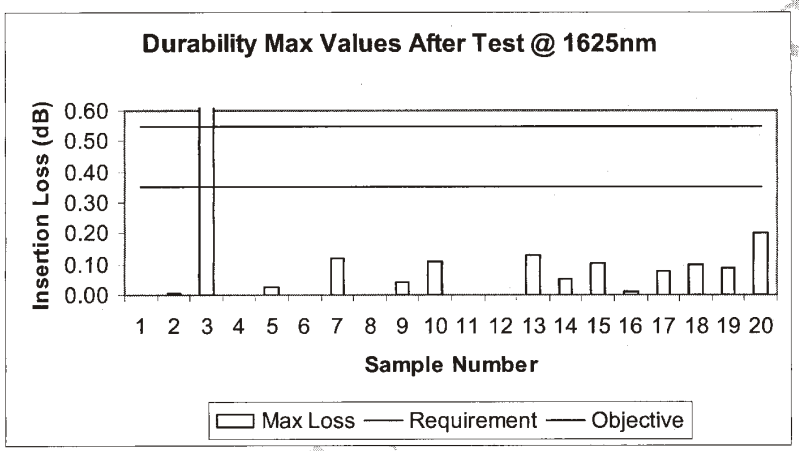


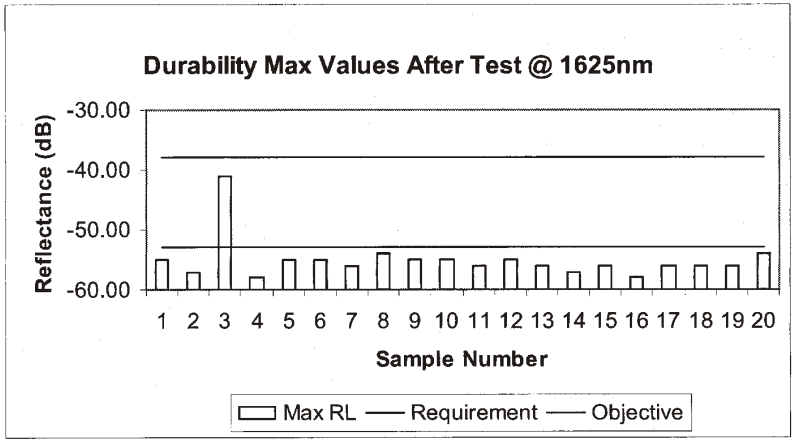


Section 4.4.3.8 Durability (Cont)

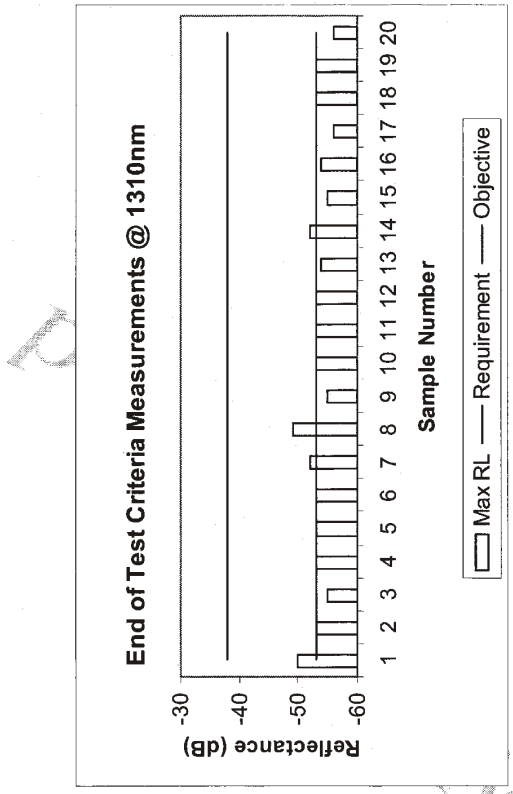


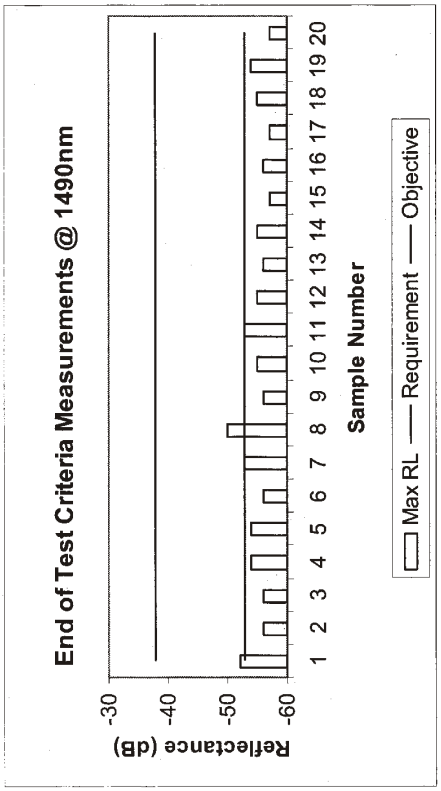


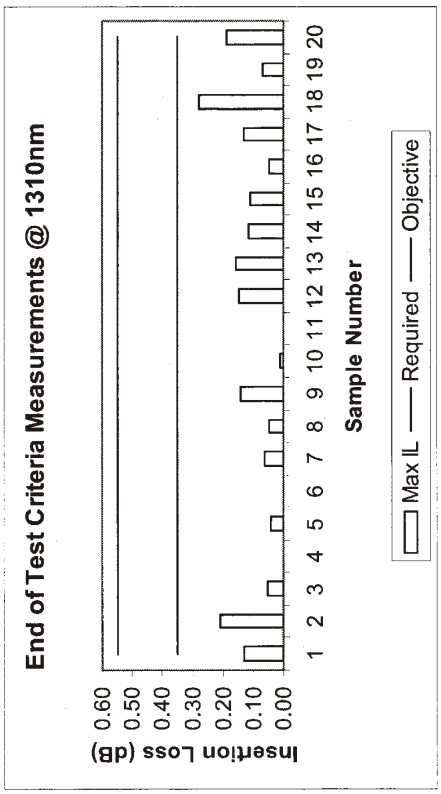


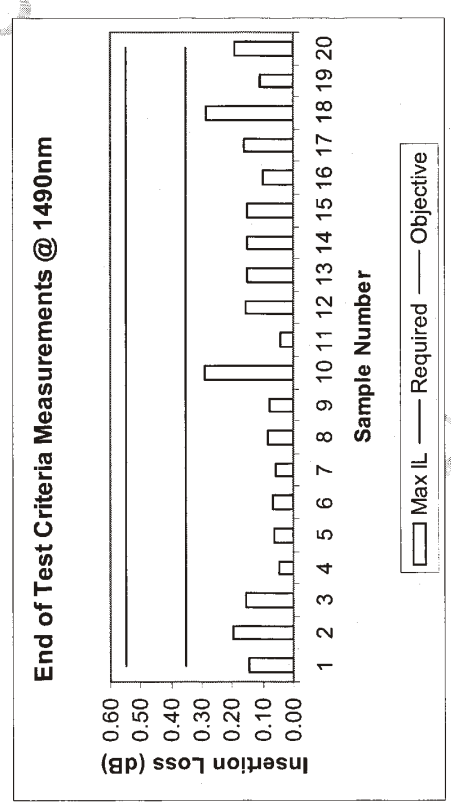


Section 4.4.3.9 End of Test Criteria

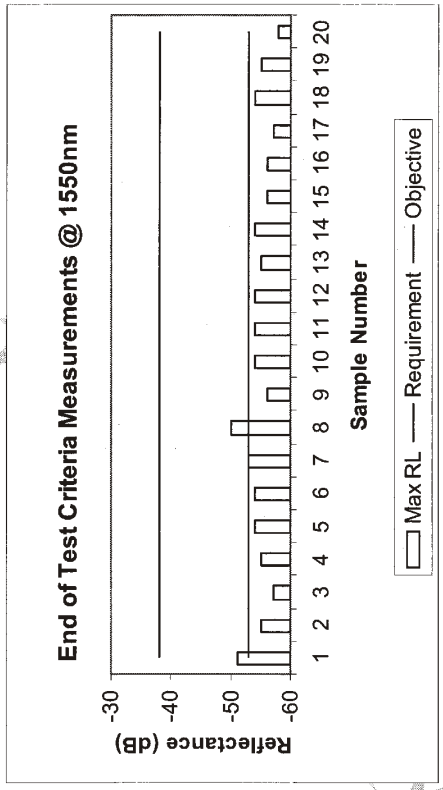


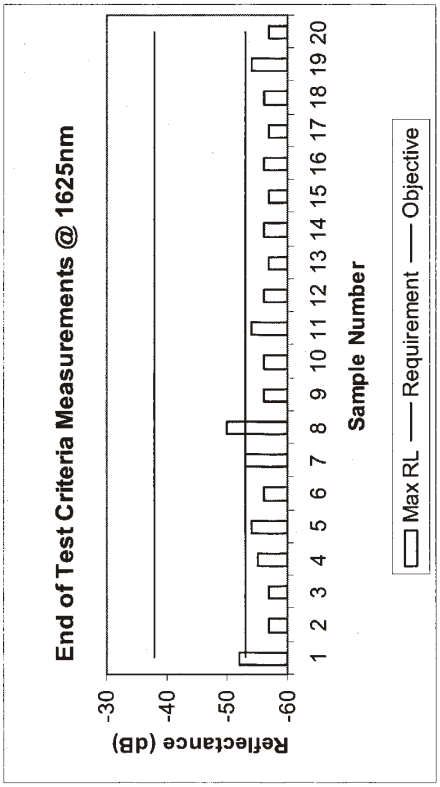


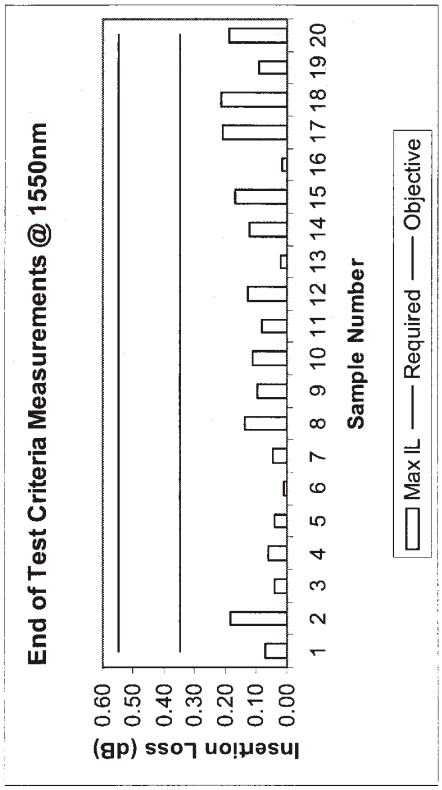


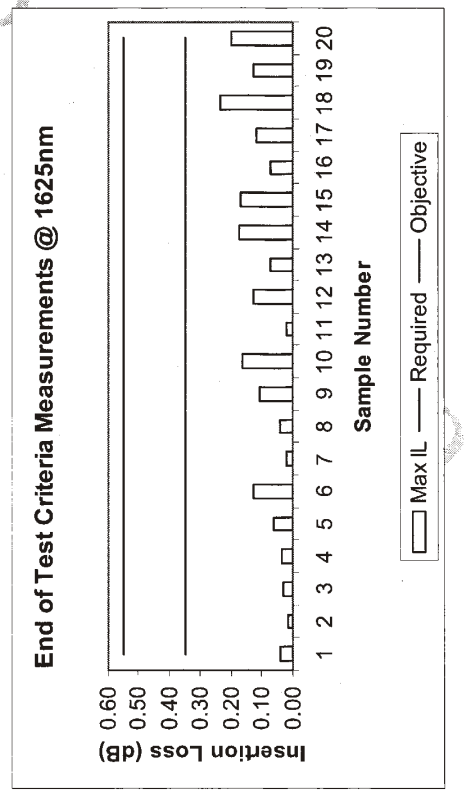


Section 4.4.3.9 End of Test Criteria (Cont)

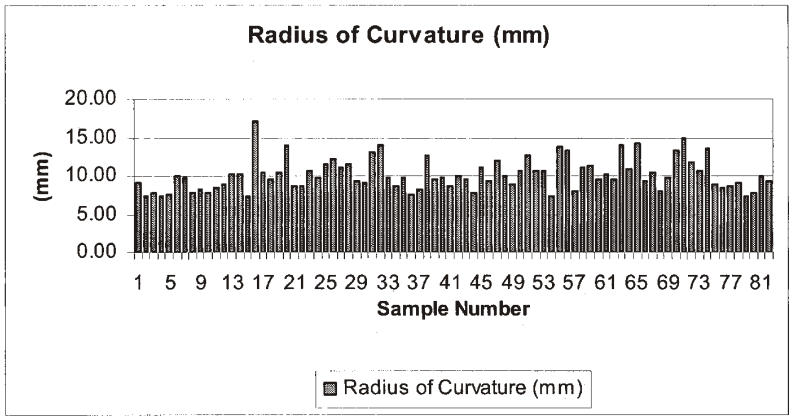


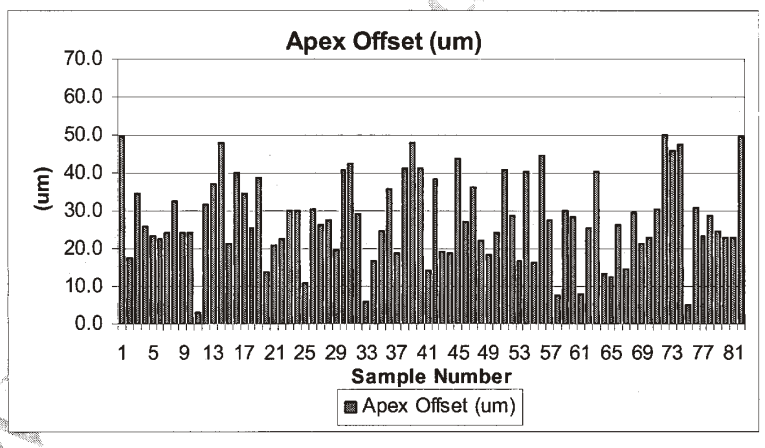


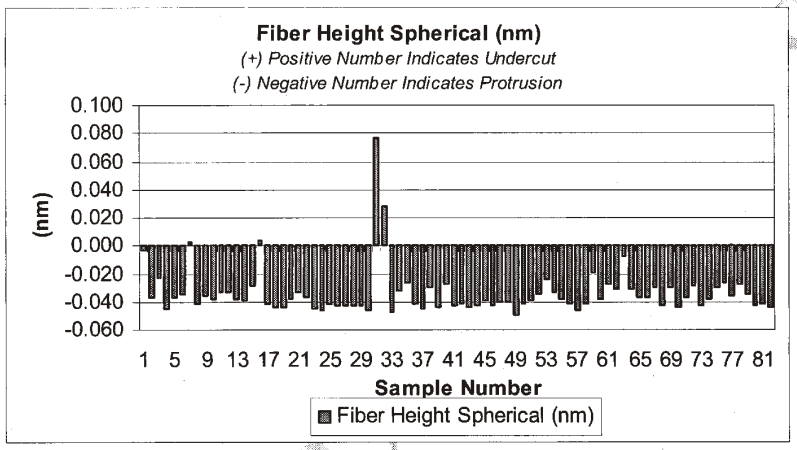




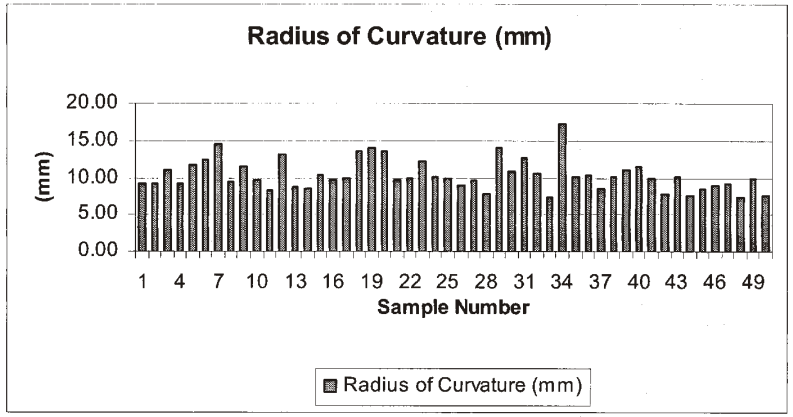
Section 4.4.5.1 Ferrule Endface Geometry –Initial

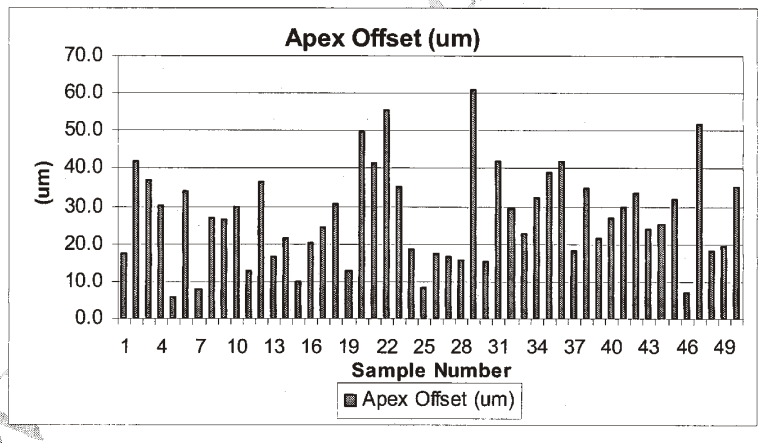


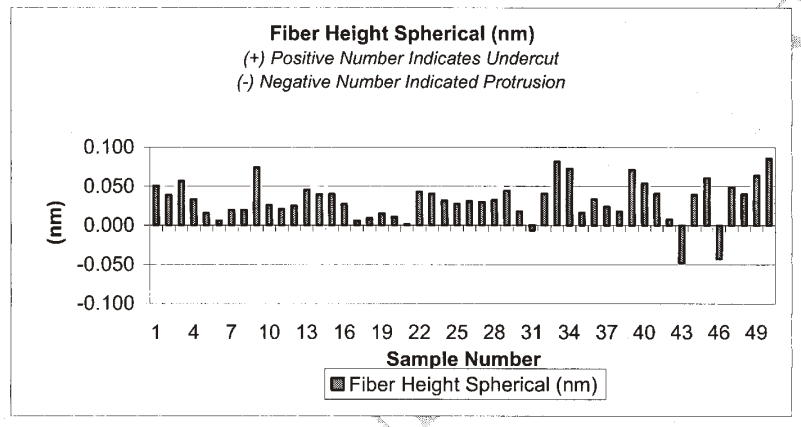




Section 4.4.3.9 End of Test Criteria







Section 4.4.6 Connector Installation