Singlemode SC Fiber Optic Connectors and Adapters

1. INTRODUCTION

1.1. Purpose

Testing was performed on Tyco Electronics Singlemode SC 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 Singlemode SC Fiber Optic Connectors terminated to 1.6 mm simplex, SM, riser-rated, jacketed cable, which 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 NA, Inc., 731 Enterprise Drive, Lexington, Kentucky 40510. Testing was performed between 08Jan04 and 28May04. The test file number for this testing is B044363-004. This documentation is on file at and available from the Tyco Electronics Fiber Optics Business Unit.

1.3. Conclusion

Tyco Electronics Singlemode SC Fiber Optic Connectors and Adapters conform to Telcordia Technologies GR-326-CORE, Issue 3, Requirements. Product also conforms to the Objectives of Telcordia Technologies GR-326-CORE, Issue 3, except as noted in the attached Report #3053315001 from Intertek Testing Services NA, Inc.

* Trademark
| Indicates change

Intertek ETL SEMKO

Report Format
☐ Verizon Format
☑ Client Customized
☐ Intertek Format
Test Location: Lexington, KY

FINAL REPORT FOR:

Tyco Electronics
2900 Fulling Mill Road
Middletown, PA 17057

Product: SC/PC Fiber Optic Connectors and Adapters

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

Date: July 8, 2004
Project: 305-33-15-001
Report: 3053315001

Prepared By: Justin Harbour **Date:** 7/8/2004

Justin Harbour, Project Engineer

Approved By: Robbie Payne **Date:** 7/8/2004

Robbie Payne, Team Leader - Engineering

This document is one part of a comprehensive evaluation report, and is not intended for stand-alone use.

Intertek Testing Services NA, Inc.
731 Enterprise Drive, Lexington, KY 40510
Telephone: 859-226-1000 Fax: 859-226-1040 Web: www.etlsemko.com

INTRODUCTION[1]

Overview:

The SC/PC Fiber Optic Connectors and Adapters, manufactured by Tyco Electronics, were tested to all applicable criteria of Telcordia Technologies'[2] GR-326-CORE, Issue 3, September 1999. Refer to the Executive Summary of this report for a synopsis of evaluation criteria and SC/PC Fiber Optic Connectors and Adapters testing.

This Report:

This report is comprised of several dependant parts, identified by labeled tabs. Each part is one component of the final, comprehensive, evaluation scheme, and is not intended for stand-alone use.

Tabbed parts correspond to individual sections of Telcordia Technologies' GR-326-CORE, Issue 3, September 1999. Parts are arranged in the order in which they are found in the Telcordia Technologies' documents.

Schedule:

The GR-326-CORE analysis and report is estimated to take approximately 12-14 weeks including any required tests. The analysis of the data generated can be expected to take an additional 2-4 weeks to complete. It is also estimated that it will take 4-6 weeks to complete the drafting of the report on the test results. Intertek will need an estimated 2-4 weeks to review the data analysis and the test report and to provide comments. To review and approve the final report, Intertek estimates will require approximately 1 week, assuming no further modification will be necessary. However, this schedule can be significantly condensed by careful scheduling of tests and by using additional personnel to permit testing, documentation reviews, data analysis and report writing activities to proceed in parallel. As soon as the documentation is provided and samples are set-up, test start dates can be scheduled.

Supplier Responsibilities:

1. The supplier shall supply all necessary documentation and specific information related to the products to be analyzed, including copies of referenced Telcordia Generic Requirements and other documents.
2. The supplier shall supply a list of all components used in the testing including their part numbers, manufacturer and their product specifications.
3. The supplier shall provide all samples and specialized tools for use with their products that may be necessary to perform the test.
4. All installation of ironwork, cabling and jumpers is to be done by the supplier's technicians.

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[1] Not in GR-326-CORE
[2] Formerly Bellcore

Revision History: First Issue: 7/7/2004

To Submit Comments:

When submitting comments, please include the document reference, citing any pertinent section and requirement number. In responding, please provide the name, address, phone number, fax number, and e-mail address of the contact person in your company for further discussion.

Send your comments to:

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TABLE OF CONTENTS[1]

[1] Not part of GR-326-CORE

EXECUTIVE SUMMARY[1]

DECLARATION OF COMPLIANCE

The SC/PC Fiber Optic Connectors and Adapters, as submitted, were **compliant** with all requested criteria of Sections 3, 4.2, 4.3, 4.4.1, 4.4.2, 4.4.3.1, 4.4.3.2, 4.4.3.3, 4.4.3.4, 4.4.3.5, 4.4.3.7, 4.4.3.9, 4.4.4.2, 4.4.5.1, and 4.4.6 of Telcordia Technologies' GR-326-CORE, Issue 3, September 1999. The SC/PC Fiber Optic Connectors and Adapters, as submitted, were **non-compliant** with Requirement **R4-39** and Objectives **O4-40**, **O4-41**, and **O4-44** of the criteria of Section 4.4.3.8. The results for each criterion can be found in the Summary of Test Results table, as listed in Part 4 of this report.

PRODUCT DESCRIPTION

The equipment tested were SC/PC Fiber Optic Connectors and Adapters, manufactured by Tyco Electronics. The SC/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 specific samples used for testing are described in Exhibit 3-1. A photograph of the SC/PC Fiber Optic Connectors and Adapters is shown in Exhibit 3-2.

[1] Not in GR-326-CORE.

Description of Samples Under Test

Component	Model Number	Serial Number	Description
10 Meter Jumper	0-1693918-2	B17HG0327900040	Sample 1
10 Meter Jumper	0-1693918-2	B17HG0327900041	Sample 2
10 Meter Jumper	0-1693918-2	B17HG0327900049	Sample 3
10 Meter Jumper	0-1693918-2	B17HG0327900050	Sample 4
10 Meter Jumper	0-1693918-2	B17HG0327900052	Sample 5
10 Meter Jumper	0-1693918-2	B17HG0327900055	Sample 6
10 Meter Jumper	0-1693918-2	B17HG0327900056	Sample 7
10 Meter Jumper	0-1693918-2	B17HG0327900061	Sample 8
10 Meter Jumper	0-1693918-2	B17HG0327900062	Sample 9
10 Meter Jumper	0-1693918-2	B17HG0327900075	Sample 10
10 Meter Jumper	0-1693918-2	B17HG0327900087	Sample 11
10 Meter Jumper	0-1693918-2	B17HG0327900088	Sample 12
10 Meter Jumper	0-1693918-2	B17HG0327900089	Sample 13
10 Meter Jumper	0-1693918-2	B17HG0327900090	Sample 14
10 Meter Jumper	0-1693918-2	B17HG0327900092	Sample 15
10 Meter Jumper	0-1693918-2	B17HG0327900099	Sample 16
10 Meter Jumper	0-1693918-2	B17HG0327900097	Sample 17
10 Meter Jumper	0-1693918-2	B17HG0327900096	Sample 18
10 Meter Jumper	0-1693918-2	B17HG0327900100	Sample 19
10 Meter Jumper	0-1693918-2	B17HG0327900094	Sample 20
3 Meter Jumper	0-1693918-1	B17HG0327900009	Sample 16 Jumper
3 Meter Jumper	0-1693918-1	B17HG0327900010	Sample 17 Jumper
3 Meter Jumper	0-1693918-1	B17HG0327900012	Sample 18 Jumper
3 Meter Jumper	0-1693918-1	B17HG0327900015	Sample 19 Jumper
3 Meter Jumper	0-1693918-1	B17HG0327900006	Sample 20 Jumper
20 Meter Jumper	0-1693918-2	B17HG0327900054	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900057	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900058	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900064	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900066	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900071	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900077	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900079	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900083	Hot Spare
20 Meter Jumper	0-1693918-2	B17HG0327900086	Hot Spare

Exhibit 3-1

Photograph of Samples Under Test

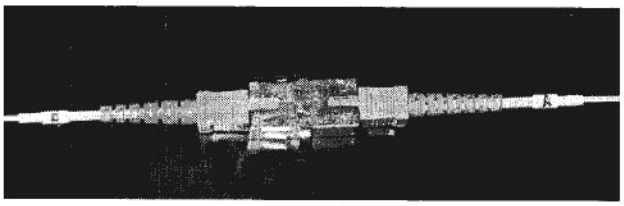

Exhibit 3-2

PRODUCT CONFIGURATION

During setup and throughout the testing, the connectors will be cleaned using a CLETOP, Kimwipes, and 99.9 percent pure alcohol. The cleaning procedure is described in more detail in Section 4.3.1 and Section 4.3.2 in Part 4 of this report.

The SC/PC Fiber Optic Connectors and Adapters were verified for functionality through insertion loss and reflectance measurements.

All measurements of insertion loss and reflectance were taken using an optical switching system as shown in Exhibit 3-3. The measurement instruments used in the system were three JDS Fitel 50 channel optical switches, an Agilent 8164A Lightwave Multimeter with an HP 81554SM dual wavelength (1310,1550 nm) laser source, an Agilent 81662A 1490 nm laser source, an Agilent 81663A 1625 nm laser source, and an HP 81532A power sensor.

Diagram of Test Setup

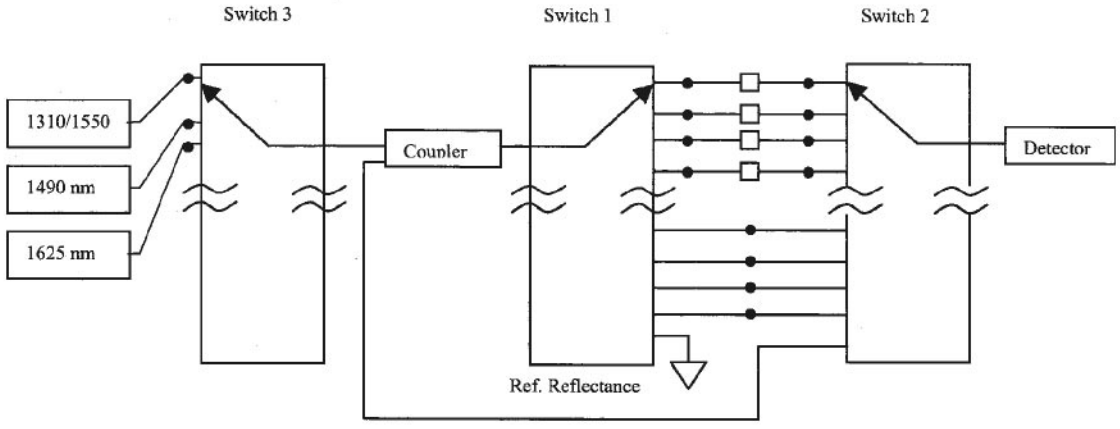

Exhibit 3-3

Exhibit 3-4 illustrates how the samples will be placed into the environmental chamber for all of the environmental testing.

Diagram of the Product Configuration

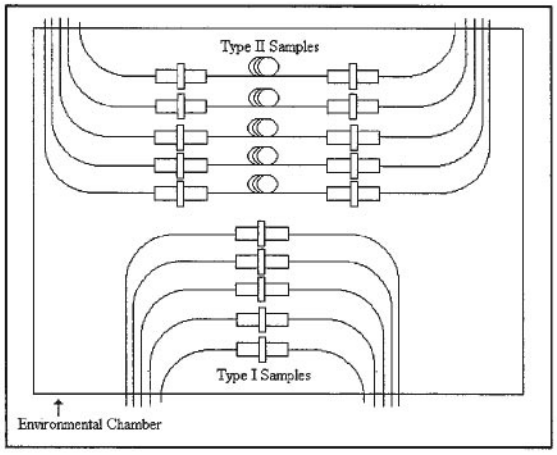

Exhibit 3-4

The following measurement errors are applied to the criteria in this report:

- 1310 nm, 1490 nm, 1550 nm, and 1625 nm

- Insertion Loss ±0.05 dB
- Increase in Loss ±0.05 dB

- 1310 nm and 1550 nm

- Reflectance ±2.0 dB

- 1490 nm

- Reflectance ±3.5 dB

- 1625 nm

- Reflectance ±4.0 dB

For example, the requirement for reflectance is -40 dB; therefore, a measurement of -38 dB will be considered to have met the criteria at 1310 nm. The requirement for insertion loss is 0.50 dB; therefore, a measurement of 0.55 dB will be considered to have met the criteria. The requirement for loss increase is 0.30 dB; therefore, a measurement of 0.35 dB will be considered to have met the criteria. Measurement error is not applied to the mean values.

The equipment used in the Fiber Optic Switching System consists of the components listed in Exhibit 3-5.

Summary of System Configuration

Component	Model Number	Serial Number	TML Number	Calibration Date	Rental (Y or N)
HP 81554 SM Dual Laser Source	HP 81554	2949G00619	Part of 2597	-	N
HP 81662A 1490 nm Laser Source	HP 81554	DE40402061	Part of 2597	-	N
HP 81663A 1625 nm Laser Source	HP 81554	DE41701296	Part of 2597	-	N
HP 81532A Power Sensor	HP 81532 A	2948G00174	Part of 2597	8/2003	N
HP 8164A Lightwave Multimeter	HP 8164 A	DE40707053	2597	-	N
JDS Fitel Optical Fiber Switch	CS50B2-0000-130	425(103769)	1450	Scheduled Maintenance	N
JDS Fitel Optical Fiber Switch	CS50B2-0000	426(103769)	1449	Scheduled Maintenance	N
JDS Fitel Optical Fiber Switch	SC51BZ-00NC-106	1271	1119	Scheduled Maintenance	N

Exhibit 3-5

SAMPLE SELECTION

Tyco Electronics selected and provided new test samples for this evaluation.

SAMPLE REPLACEMENT

No samples were replaced during the course of the evaluation.

SAFETY PROCEDURES

During the course of this evaluation, all safety procedures found in the General Fiber Safety Policy (LEX-PE-FIB-178), the Laser Safety Policy, and the Back Safety Policy shall be followed.

CRITERIA CONFORMANCE SUMMARY[1]

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance: VERIFY	ANALYZE	INSPECT	TEST	RESULTS	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.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance: VERIFY	ANALYZE	INSPECT	TEST	RESULTS	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**	
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[2]**	
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**	
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**	
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**	

[2] The evaluation to determine compliance to ASTM-G21 was not requested by Tyco Electronics.
[3] Type I media may include simplex, duplex, or quad cable products.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	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	
CR3-11 (3.4)	The ferrule extension distance and the spring loading force shall meet the conditional limits specified by TIA/EIA FOCIS documents.				√	C	
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.				√	C	
CR3-14 (3.4)	The latch spacing for the connector adapters sleeve shall meet the requirements specified in the TIA/EIA FOCIS documents.				√	C	
CR3-15 (3.4)	The glass transition temperature of the latched in the connector adapters shall be > 100°C.	√		√		C	
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.				√	C	
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 be within 6 months and the plugs to be 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[4]	

[4] The connectors tested were not APC type connectors.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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	
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	

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					Comments
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	
4.1	**Test Samples**						
4.1.1	**Definitions**						
4.1.2	**Population**						
4.2	**Criteria**						
4.2.1	**Overview of Optical Performance Criteria**						
4.2.2	**Modifications and Conditions**						
4.2.2.1	**Measurement Error**						
4.2.2.2	**Jumper Cable Assembly Measurements**						
4.2.2.3	**Reflectance Increase Criteria Applicability**						
4.2.2.4	**Reflectance Criteria Applicability**						
4.2.2.5	**Handling of Nonconformance**						
R4-1 (4.2.2.5)	Handling of Nonconformance 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 condtions 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.				√	C	
4.2.3	**Damage Criteria**						
4.3	**Cleaning Procedures**						

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
4.3.1	**Cleaning Procedure A**						
4.3.2	**Cleaning Procedure B**						
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**[5]	

[5] The SC/PC Fiber Optic Connectors and Adapters were not designed to meet this criterion.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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".				√	**NA[6]**	
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".				√	**NA[6]**	
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".				√	**C**	

[6] The SC/PC Fiber Optic Connectors and Adapters were subjected to the full Adhesive Test (4.4.4.2) in lieu of the Thermal Age Test. The SC/PC Fiber Optic Connectors and Adapters were compliant with the Adhesive Test Requirement.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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".				√	C	
4.4.2.5	**Dry-Out Step**				√		
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".				√	C	
O4-18 (4.4.2.4)	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".				√	C	

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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".				√	**C**	
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".				√	**C**	
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."				√	**NA**[7]	

[7] The tested connectors were not small form factor.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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".				√	C	
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".				√	C	
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'.				√	NA[8]	
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	

[8] The tested connectors were not small form factor.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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**	
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.				√	**NA**[9]	
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**	

[9] The tested connectors were not small form factor.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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.				√	NA[10]	
4.4.3.6	**Equilibrium Tensile Load**						
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".				√	C	
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…), 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."				√	NC[11]	

[10] The tested connectors were not small form factor.
[11] Of the body of measurements taken over 10 percent of the connector assemblies failed to meet the Maximum Reflectance and Reflectance Increase requirement criteria at all tested wavelengths.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
O4-40 (4.4.3.8)	Rematebility 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**[12]	
O4-41 (4.4.3.8)	Rematebility 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."				√	**NC**[13]	
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.				√	**C**	
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.				√	**C**	
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] Of the body of measurements taken the connector assemblies failed the Mean Loss objective at 1310 nm and over 5 percent of the connector assemblies failed to meet the objective criteria for max loss at 1550 nm and loss increase, max reflectance, and max reflectance increase at all wavelengths after a cleaning cycle.

[13] Of the body of measurements taken the connector assemblies failed the Mean Loss requirement criteria at 1310 nm, and over 10 percent of the connector assemblies failed to meet the requirement criteria for max loss, loss increase, max reflectance, and reflectance increase at all wavelengths after a non-cleaning cycle.

[14] Samples 1, 18, and 20 (trace labels 040, 096 and 094) were **non-compliant** with certain requirement and objective criteria after the two-sided cleaning following the 200th insertion, but returned to compliance after a two-sided cleaning following the 202nd insertion.

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."				√	C	
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.				√	C	
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**						
4.4.4.2	**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	

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	

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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**	
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.				√	**C**	
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[15]**	
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**	

[15] The SC/PC Fiber Optic Connectors and Adapters did not have right angle boots.

Intertek ETL SEMKO

FINAL REPORT FOR:

Tyco Electronics
2900 Fulling Mill Road
Middletown, PA 17057

Product: SC/PC Fiber Optic Connectors and Adapters

Tested to Section 3, General Requirements, of Telcordia Technologies' GR-326-CORE, Issue 3, September 1999

Date: July 7, 2004
Project: 305-33-15-001
Report: 3053315001
Part: 5

Prepared By: Justin Harbour **Date:** 7/7/2004

Justin Harbour, Project Engineer

Approved By: Robbie Payne **Date:** 7/7/2004

Robbie Payne, Team Leader - Engineering

This document is one part of a comprehensive evaluation report, and is not intended for stand-alone use.

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INTRODUCTION

PROJECT OBJECTIVE

Testing was performed to determine if the SC/PC Fiber Optic Connectors and Adapters met the requirements for Section 3, *General Requirements*, of GR-326-CORE, Issue 3, September 1999.

PRODUCT DESCRIPTION

The equipment tested were SC/PC Fiber Optic Connectors and Adapters, manufactured by Tyco Electronics. For further details, see the **PRODUCT DESCRIPTION** section in Part 3.

PRODUCT CONFIGURATION

The SC/PC Fiber Optic Connectors and Adapters were configured and verified for functionality as described in the **PRODUCT CONFIGURATION** section in Part 3, with no variances.

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.

CRITERIA CONFORMANCE SUMMARY

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance: VERIFY	ANALYZE	INSPECT	TEST	RESULTS	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**	

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance: VERIFY	ANALYZE	INSPECT	TEST	RESULTS	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	
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[1]	
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	
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.[2] 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	
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	

[1] The evaluation to determine compliance to ASTM-G21 was not requested by Tyco Electronics.
[2] Type I media may include simplex, duplex, or quad cable products.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	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	
CR3-11 (3.4)	The ferrule extension distance and the spring loading force shall meet the conditional limits specified by TIA/EIA FOCIS documents.				√	C	
CR3-12 (3.4)	The distance between the mechanical reference planes for the connector adapters shall be within 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.				√	C	
CR3-14 (3.4)	The latch spacing for the connector adapters sleeve shall meet the requirements specified in the TIA/EIA FOCIS documents.				√	C	
CR3-15 (3.4)	The glass transition temperature of the latched in the connector adapters shall be > 100°C.	√		√		C	
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.				√	C	
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[3]	

[3] The connectors tested were not APC type connectors.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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**	
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**	

LIST OF EVALUATION EQUIPMENT

Component	Model Number	Serial Number	Calibration Date	Rental (Y or N)
Instron	4202	-	At time of use	N
Mitutoyo Calipers	500-351	7085748	9/2003	N
Hunter Spring Force Gauge	L-10	82000215	12/2003	N
Leitz Microscope with Digital Micrometer	1337	17195	7/2003	N
Test Samples	-	-	-	N
Westover 400X Fiber Microscope	FM-C400	W0104-011A-1281	Scheduled Maintenance Program	N

FAILURE HISTORY SUMMARY

There were no failures to any criteria of Section 3 of GR-326-CORE.

GENERAL REQUIREMENTS (GR-326, SECTION 3)

GENERAL INFORMATION

The following evaluation was performed by Justin Harbour between 2/23/2004 and 5/13/2004 at Intertek in Lexington, Kentucky.

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 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.

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 SC/PC Fiber Optic Connectors and Adapters.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-1 [1]**.

1. Please refer to Tyco provided packet on SC connectors 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 on SC connectors for materials used in the plug and adapter.
5. No dissimilar metals come into contact with each other.
6. Cleaning instructions were provided via document 108-2088 Rev 06 (Section 5).
7. Refer to Tyco provided packet on SC connectors for operation and use of product documentation.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-2 [2]**. Upon request, Tyco Electronics provided documentation detailing the requirements of this section.

Failure History:

There were no failures during the course of this evaluation.

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 SC/PC Fiber Optic Connectors and Adapters and all shipping materials will be inspected for packaging and shipping as described in Requirement **R3-3 [3]**.

Configuration and Conditions:

The SC/PC Fiber Optic Connectors and Adapters and all shipping materials will be visually inspected for packaging and shipping.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **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:

There were no failures during the course of this evaluation.

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.[4]
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]**.

Configuration and Conditions:

The optical connectors/adapters will be visually inspected for compliance. No configuration will be needed for the SC/PC Fiber Optic Connectors and Adapters. All documentation will be reviewed.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-4 [4]**. Based on manufacturer's documentation, all metallic surfaces were corrosion resistant.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-5 [5]**. The connectors and plugs did not incorporate the use of index matching gel.

The SC/PC Fiber Optic Connectors and Adapters were **not evaluated** to Requirement **R3-6 [6]**. The evaluation to determine compliance to ASTM-G21 was not requested by Tyco Electronics.

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

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-7 [7]**. Documentation was reviewed and the connectors were found to have a V-0 classification under UL 94.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-8 [8]**. Tyco Electronics provided documentation detailing the requirements of this section.

Failure History:

There were no failures during the course of this evaluation.

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 SC/PC Fiber Optic Connectors and Adapters.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O3-9 [9]**. The connectors tested were of type SC.

Failure History:

There were no failures during the course of this evaluation.

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 Ferrule Extension Contact Force:

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 5-1.)

SC Connector

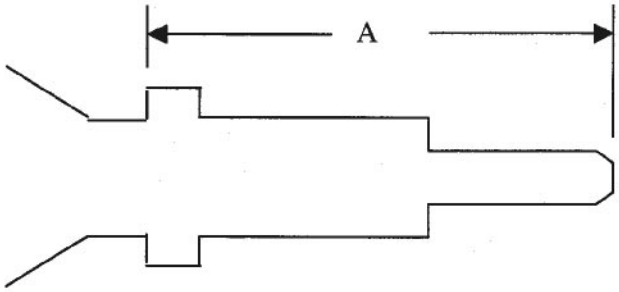

Exhibit 5-1

3. Attach the Intertek ferrule extension contact force adapter to the Instron.
4. Attach the 50 N load cell to the Instron.
5. Set the Instron configuration toggle switch to the SI mode of operation. (Remove side panel of Instron controller for access.)

6. Power the Instron and allow 30 minutes for it to stabilize.
7. Calibrate the Instron and load cell combination by pressing "load cal" and "enter".
8. Attach the connector with the ferrule facing upward in the adapter. Do not over tighten the grip screws.
9. Position the magnetic anvil over the center of the connector.
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. Set the crosshead speed to 1 mm/min.
15. Start the crosshead and allow the test to proceed until the crosshead stops.
16. Record the peak load in Newtons.
17. Repeat Steps 10 through 15 for the upper range of the ferrule end to mechanical reference plane distance under load. (B_u)
18. Compare the peak force results to the criteria of Conditional Requirement **CR3-11**or FOCIS document as appropriate.
19. Compare the mechanical and optical reference plane distance measured in step 2 to the criteria of Conditional Requirement **CR3-12** as given in Figure 3-1 of GR-326-CORE or the appropriate FOCIS document.

Test Procedure for Adapter Sleeve Ferrule Frictional Forces:

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. Attach a spring force gauge to the gauge pin polystyrene attachment line.
6. Holding the adapter in the left hand slowly pull on the spring gauge with the right hand until the pin is completely extracted. Be careful to keep the adapter and spring gauge aligned.
7. Record the peak force indicated by the spring gauge.

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 5-2.)

Example of an SC Connector Reference Plane

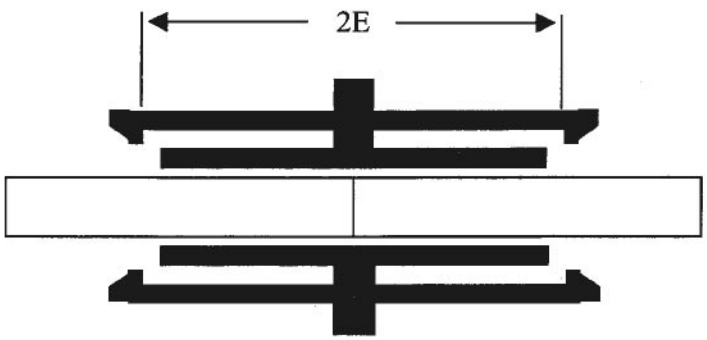

Exhibit 5-2

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

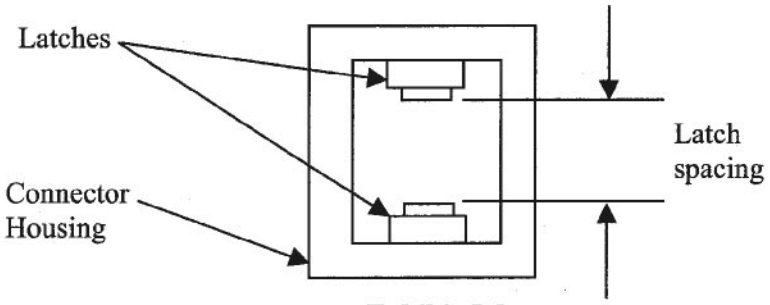

Exhibit 5-3

4. For those connectors that contain latches, measure the latch spacing using a digital micrometer. See Exhibit 5-3.
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. Verify that the EUT adapter latch has a good glass transition temperature by determining if the connectors latch properly following the temperature age test of Section 4.4.2.1 or the extended thermal age tests of 7.1.
2. Visually inspect the samples exposed during the above aging tests for visual signs of deformation or latching problems.
3. If latching issues are suspected, proper latching is determined by performing a latching test on the suspected samples using the latching intermateability procedures of Section 3.4.1.
4. Report the results for Conditional Requirement **CR3-15**.

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 SC/PC Fiber Optic Connectors and Adapters.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Conditional Requirement **CR3-10 [10]**. The SC connectors met all applicable parts for FOCIS-3A.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Conditional Requirement **CR3-11 [11]**. Ferrule extension and contact force was within the limits of FOCIS-3A.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Conditional Requirement **CR3-12 [212]**. Distance between mechanical reference planes was measured and found to be within the limits of TIA/EIA 604-3A.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Conditional Requirement **CR3-13 [213]**. Adapter Sleeve/Ferrule Frictional Force was measured and found to be within the limits of Section 2.2.2 of TIA/EIA 604-10A.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Conditional Requirement **CR3-14 [214]**. Adapter Sleeve Latch Spacing was measured and found to be within the limits of TIA/EIA 604-3A.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Conditional Requirement **CR3-15 [215]**. Documentation was reviewed to determine compliance to glass transition temperature.

Failure History:

There were no failures during the course of this evaluation.

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 operators 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 Ametek HunterSpring Force Gauge.
8. Using the hook side of the Ametek HunterSpring Force Gauge, hook onto the loop that extends to form the mandrel.
9. Pull on the mandrel until the connector uncouples from the adapter.
10. Record the force that is measured on the Ametek HunterSpring Force Gauge. Record all data on the datasheet provided in Appendix A.
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 SC/PC Fiber Optic Connectors and Adapters.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Conditional Objective **CO3-16 [216]**. 100 percent of the 144 connectors passed the Latching Intermateability Test.

Failure History:

There were no failures during the course of this evaluation.

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 5-4. 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 5-4

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

Configuration and Conditions:

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

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-17 [12]**. Samples were sufficiently marked for identification of supplier, model, and vintage.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O3-18 [13]**. The connector plugs were blue in color to signify a typical maximum reflectance of -55 dB.

Conditional Requirement **CR3-19 [14]** was **not applicable** to the SC/PC Fiber Optic Connectors and Adapters. The connectors tested were not APC type connectors.

Failure History:

There were no failures during the course of this evaluation.

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 SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O3-20 [15]**. The connectors tested were keyed.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O3-21 [16]**. The keying was clearly visible on the connectors tested.

Failure History:

There were no failures during the course of this evaluation.

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 Number 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 contains 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 SC/PC Fiber Optic Connectors and Adapters.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-22 [17]**. Safety instructions, which included appropriate radiation hazard warnings, were provided via document 108-2088 Rev 06 (Section 5).

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R3-23 [18]**. Cleaning instructions, which included toxicity hazard warnings and instructions for handling, use, and disposal, were provided via document 108-2088 Rev 06 (Section 5).

Failure History:

There were no failures during the course of this evaluation.

Intertek ETL SEMKO

FINAL REPORT FOR:

Tyco Electronics
2900 Fulling Mill Road
Middletown, PA 17057

Product: SC/PC Fiber Optic Connectors and Adapters

Tested to Section 4, Connector Tests and Criteria,
of Bellcore GR-326-CORE, Issue 3, September 1999

Date: July 7, 2004
Project: 305-33-15-001
Report: 3053315001
Part: 6

Prepared By: Justin Harbour **Date:** 7/7/2004

Justin Harbour, Project Engineer

Approved By: Robbie Payne **Date:** 7/7/2004

Robbie Payne, Team Leader - Engineering

This document is one part of a comprehensive evaluation report, and is not intended for stand-alone use.

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INTRODUCTION

PROJECT OBJECTIVE

Testing was performed to determine if the SC/PC Fiber Optic Connectors and Adapters met the requirements for Section 4, *Connector Tests and Criteria*, of GR-326-CORE, Issue 3, September 1999.

PRODUCT DESCRIPTION

The equipment tested was the SC/PC Fiber Optic Connectors and Adapters, manufactured by Tyco Electronics. For further details, see the **PRODUCT DESCRIPTION** section in Part 3.

PRODUCT CONFIGURATION

The SC/PC Fiber Optic Connectors and Adapters were configured and verified for functionality as described in the **PRODUCT CONFIGURATION** section in Part 3, with no variances.

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.

CRITERIA CONFORMANCE SUMMARY

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
4.1	**Test Samples**						
4.1.1	**Definitions**						
4.1.2	**Population**						
4.2	**Criteria**						
4.2.1	**Overview of Optical Performance Criteria**						
4.2.2	**Modifications and Conditions**						
4.2.2.1	**Measurement Error**						
4.2.2.2	**Jumper Cable Assembly Measurements**						
4.2.2.3	**Reflectance Increase Criteria Applicability**						
4.2.2.4	**Reflectance Criteria Applicability**						
4.2.2.5	**Handling of Nonconformance**						
R4-1 (4.2.2.5)	Handling of Nonconformance 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 condtions 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.				√	C	
4.2.3	**Damage Criteria**						
4.3	**Cleaning Procedures**						

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
4.3.1	**Cleaning Procedure A**						
4.3.2	**Cleaning Procedure B**						
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[1]**	

[1] The SC/PC Fiber Optic Connectors and Adapters were not designed to meet this criterion.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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".				√	NA[2]	
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".				√	NA[2]	
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".				√	C	

[2] The SC/PC Fiber Optic Connectors and Adapters were subjected to the full Adhesive Test (4.4.4.2) in lieu of the Thermal Age Test. The SC/PC Fiber Optic Connectors and Adapters were compliant with the Adhesive Test Requirement.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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".				√	C	
4.4.2.5	**Dry-Out Step**				√		
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".				√	C	
O4-18 (4.4.2.4)	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".				√	C	

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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".				√	C	
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".				√	C	
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."				√	NA[3]	

[3] The tested connectors were not small form factor.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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".				√	**C**	
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".				√	**C**[4]	
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'.				√	**NA**[5]	
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**	

[4] Part of the Proof test for Objective **O4-27** was delayed at the request of Tyco Electronics. The connectors were subjected to the remainer of the tests; Transmission With Applied Load, Impact, Durability, End of Test Criteria, and Connector Installation prior to being subjected to the Objective levels of the proof test.

[5] The tested connectors were not small form factor.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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**	
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.				√	**NA**[6]	
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**	

[6] The tested connectors were not small form factor.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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.				√	NA[7]	
4.4.3.6	**Equilibrium Tensile Load**					-	
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".				√	C	
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…), 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."				√	NC[8]	

[7] The tested connectors were not small form factor.
[8] Of the body of measurements taken over 10 percent of the connector assemblies failed to meet the Maximum Reflectance and Reflectance Increase requirement criteria at all tested wavelengths.

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance					
		VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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**[9]	
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."				√	**NC**[10]	
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.				√	**C**	
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.				√	**C**	
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**[11]	

[9] Of the body of measurements taken the connector assemblies failed the Mean Loss objective at 1310 nm. Over 5 percent of the connector assemblies failed to meet the objective criteria for max loss at 1550 nm and loss increase, max reflectance, and max reflectance increase at all wavelengths after a cleaning cycle.

[10] Of the body of measurements taken the connector assemblies failed the Mean Loss requirement criteria at 1310 nm. Over 10 percent of the connector assemblies failed to meet the requirement criteria for max loss, loss increase, max reflectance, and reflectance increase at all wavelengths after a non-cleaning cycle.

[11] Samples 1, 18 and 20 (trace labels 040, 096 and 094) were **non-compliant** with certain requirement and objective criteria after the two-sided cleaning following the 200th insertion but returned to compliance after a two-sided cleaning following the 202nd insertion.

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."				√	C	
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.				√	C	
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**						
4.4.4.2	**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	

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	

Section (Para.)	GR-326-CORE Requirement and Objective Summary	Method of Conformance: VERIFY	ANALYZE	INSPECT	TEST	RESULTS	Comments
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**	
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.				√	**C**	
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**[12]	
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**	

[12] The SC/PC Fiber Optic Connectors and Adapters did not have right angle boots.

LIST OF EVALUATION EQUIPMENT

Component	Model Number	Serial Number	Calibration Date	Rental (Y or N)
HP 81554 SM Dual Laser Source	HP 81554	2949g00619	-	N
HP 81532A Power Sensor	HP 81532 A	2948g00174	8/2003	N
HP 8153A Lightwave Multimeter	HP 8153 A	2946g00499	-	N
JDS Fitel Optical Fiber Switch	CS50B2-0000-130	425(103769)	Scheduled Maintenance	N
JDS Fitel Optical Fiber Switch	CS50B2-0000	426(103769)	Scheduled Maintenance	N
JDS Fitel Optical Fiber Switch	SC51BZ-00NC-106	1271	Scheduled Maintenance	N
Envirotronics 27 ft^3 Environmental Chamber	SH27C	03984130-S-10903	10/2003	N
Intertek Mechanical Test Fixture	-	-	-	N
Intertek Impact Test Fixture	-	-	-	N
Intertek Durability Test Fixture	-	-	-	N
DORC Interferometer	ZX1-Mini	2365203	Scheduled Maintenance	N
Mapped Reference Connector	#541	-	5/2004	N
Vibration Table	C40A	14953	10/2003	N
Arc Fusion Splicer	FSM-20CSII	2054	Scheduled Maintenance	N
Kimwipes	EX-L	-	-	N
CLETOP	-	-	-	N
2-Propanol	9334-03	-	-	N
High Precision Fiber Cleaver	CT-04	14742	Scheduled Maintenance	N
NO-NIK Fiber Optic Stripper	-	-	-	N
Clauss Fiber Optic Stripper	CFS-2	-	-	N
Ripley Co./Miller Fiber Optic Stripper	FO103-85	-	-	N
Clauss No-NIK	FJS-2	-	-	N
Ceramic Scissors	CEMIC-124	-	-	N
Westover 400X Fiber Microscope	FM-C400	W0104-011A-1281	-	N

Component	Model Number	Serial Number	Calibration Date	Rental (Y or N)
JDS Fitel Mandrel	BR 1503-FA	016	-	N
JDS Fitel Standard Reflector	BR-1503-FA	016	8/2003	N
Siecor Splice Trays	-	-	-	N
Intertek Test Software	-	-	-	N
HP Computer	Vectra VL Series 4	012165	-	N
NEC Monitor	Multisync A700+	012355	-	N
Test Jumper	TBD	TBD	-	N

FAILURE HISTORY SUMMARY

Durability – Section 4.4.3.8. The test samples were **non-compliant** with Requirement **R4-39** and Objectives **O4-40, O4-41,** and **O4-44**.

Samples 1, 18, and 20 (trace labels 040, 096, and 094) were **non-compliant** with loss and reflectance requirement criteria after the two-sided cleaning following the 200th insertion but returned to compliance after a two-sided cleaning following the 202nd insertion.

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

GENERAL INFORMATION

The following evaluation was performed by Justin Harbour and Robbie Payne between 1/8/2004 and 5/28/2004 at Intertek in Lexington, Kentucky.

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 6-1

Jumper Assembly

Exhibit 6-2

Reflectance – The ratio of power reflected by a connector or other discrete element to the incident power.

Maximum Reflectance – Maximum reflectance value measured during the course of a particular test.

POPULATION (4.1.2)

Fifteen pigtail assemblies and five jumper assemblies were 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 6-3 and Exhibit 6-4. It also states that all measurements shall be taken at 1310 nm and 1550 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 6-3

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 6-4

MODIFICATIONS AND CONDITIONS (4.2.2)

MEASURMENT ERROR (4.2.2.1)

This section states that Telcordia Technologies' will allow a measurement error of 2 dB for reflectance and 0.05 dB for loss measurements at 1310 nm and 1550 nm. In addition to the Telcordia Technologies' specified wavelengths, testing was performed at two other wavelengths, 1490 nm and 1625 nm. Intertek applied an allowance of 3.5 dB at 1490 and 4 dB at 1625 nm for reflectance and 0.05 dB for loss measurements at both wavelengths. These allowances were based on observed repeatability of the switch system.

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 of GR-326-CORE.
- Reflectance - Subtract 3 dB from each measurement and apply the respective criteria from Table 4-3 of GR-63-CORE.

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 of GR-326-CORE, do not apply to connections with reflectance 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 condtions 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:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-1 [217]**. No samples were replaced during the course of the evaluation.

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. 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. Then 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. Then twist the connector counter-clockwise and pull down across the strip.
5. Verify the cleanliness of the connector by placing it in the 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 Method:

1. Connectors and adapters will be chosen at random from the samples that will be provided for this testing.
2. The connectors and adapters will be cleaned and mated to form the connector assemblies which will go through all subsequent tests.
3. Initial reflectance will be measured using the optical switching system.
4. Initial insertion loss of the connector assemblies under test will be measured as the connector assemblies are spliced into the measurement system.
5. Refer to Exhibit 6-1 for a diagram of a pigtail assembly.
6. Refer to Exhibit 6-2 for a diagram of a jumper assembly.
7. Using the Arc Fusion Splicer, splice the samples into the switch. Please refer to the Intertek Work Instruction Number LEX-WE-FIB-036 for details on how to splice.
8. Load the switch software for the switch that will be in use. The shortcut to the software is located on the Desktop Screen on the computer adjacent to the switch. Select the "Globe" icon to start the software.
9. Once the software is loaded, select the "Setup Test" button with the mouse.
10. Using the mouse, select the option button that is beside the New Product Test label. This will automatically fill in the appropriate fields with the exception of the correct channel numbers and project number.
11. After filling in the fields that contain the project number and the channel numbers, select <OK>.
12. The test will start and the progress bar will show the progress.
13. Once the test is finished, verify the test data by using GR326formatter1-1.exe located in the P:\Fiber drive. This program will open the text file, compare the data against the requirements and objectives, then saves the text file as an excel spreadsheet.

14. If some of the connectors are out of specification or do not meet the requirements, verify the setup. Make sure that there are no sharp bends in the fiber cable. Verify the cleanliness of the connector by looking at the connector of concern with the microscope. Be sure that the channel is not active while viewing. If the connector has debris on it, clean the endface of the connector using a lint free cloth and alcohol if necessary. Before plugging the connector back into the adapter, clean the adapter with compressed air.
15. Once the connectors have been cleaned or any other issues have been addressed, take another New Product measurement.
16. Once again, verify the numbers by using GR326formatter1-1.exe located in the P:\Fiber drive, if they meet the requirements, move on to the next test. If some of the connectors do not meet the requirements, repeat Steps 8 and 9 until all of the connectors meet the requirements.

Configuration and Conditions:

The connector assemblies will be in an operational state during the course of this evaluation. See the **PRODUCT CONFIGURATION** section in Part 3 for details. A mode filter is required on either side of the connectors under test as shown in Exhibit 6-5. Each mode filter consists of at least a 2-meter length of fiber coiled into two 360° loops that are 12.5 inches in diameter.

New Product Test Configuration

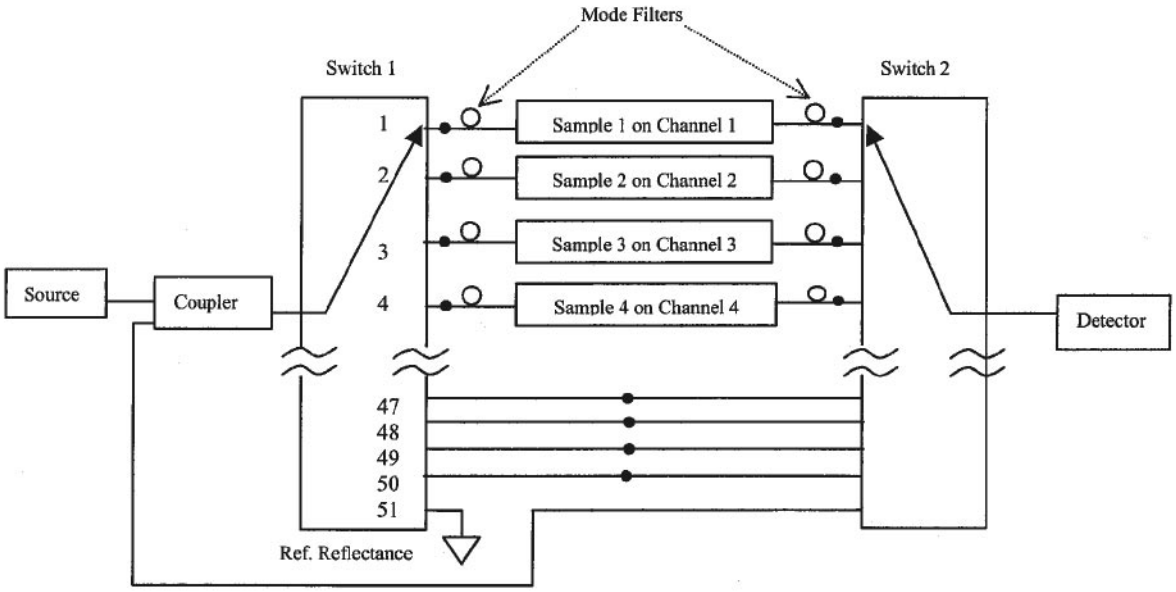


Exhibit 6-5

Test Results:

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

Conditional Objective **CO4-8** was **not applicable** to the SC/PC Fiber Optic Connectors and Adapters. The SC/PC Fiber Optic Connectors and Adapters were not designed to meet this criterion.

See Exhibit 6-6 through Exhibit 6-9 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 (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Mean Loss (**R4-4, O4-5**)	0.08	0.20	Yes	0.15	Yes
Max Reflectance (**R4-6, CR4-7**)	-55.82	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)

Exhibit 6-6

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**)	0.15	0.40	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Mean Loss (**R4-4, O4-5**)	0.06	0.20	Yes	0.15	Yes
Max Reflectance (**R4-6, CR4-7**)	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)

Exhibit 6-7

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**)	0.14	0.40	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Mean Loss (**R4-4, O4-5**)	0.08	0.20	Yes	0.15	Yes
Max Reflectance (**R4-6, CR4-7**)	-55.93	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)

Exhibit 6-8

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**)	0.15	0.40	Yes (25 Y, 0 N)	0.20	Yes (25Y, 0 N)
Mean Loss (**R4-4, O4-5**)	0.06	0.20	Yes	0.15	Yes
Max Reflectance (**R4-6, CR4-7**)	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25Y, 0 N)

Exhibit 6-9

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.

Test Method:

1. After the new product measurements have been made, take all of the connector assemblies through the hole in the wall. 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 GR326formatter1-1.exe located in the P:\Fiber drive, 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.

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 Thermal Age Test for the temperature profile in Exhibit 6-10.
9. Verify that the actual environmental profile for the chamber is accurate and within tolerance on a daily basis.
10. Following the 168-hour hold 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 (using GR326formatter1-1.exe located in the P:\Fiber drive) 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

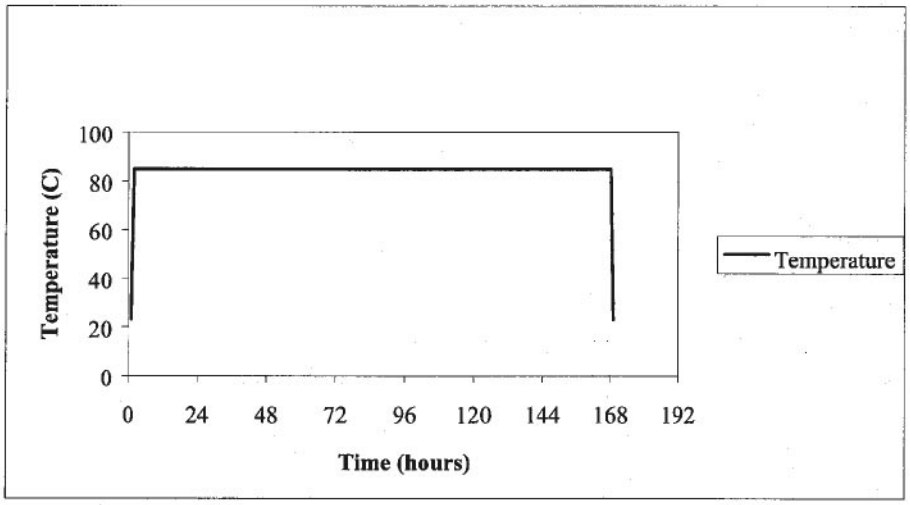


Exhibit 6-10

Configuration and Conditions:

The connector assemblies will be placed in an environmental chamber and remain operational during the course of this evaluation. See the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-11 for a diagram of the test setup.

Environmental Test Configuration

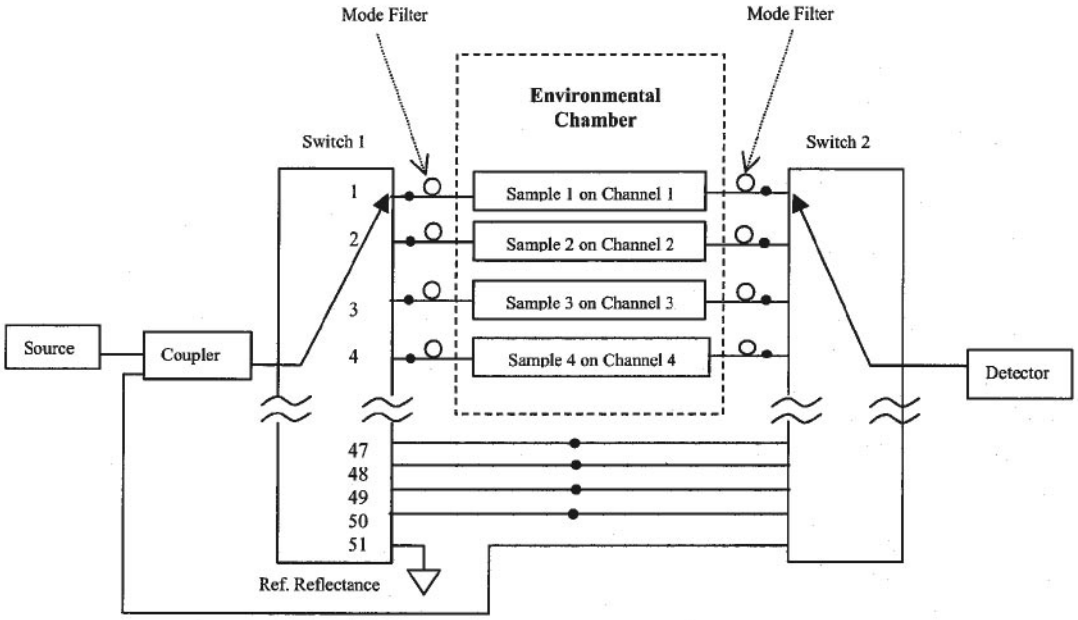


Exhibit 6-11

Test Results:

Requirement **R4-9** and Objective **O4-10** were **not applicable** to the SC/PC Fiber Optic Connectors and Adapters. The SC/PC Fiber Optic Connectors and Adapters were subjected to the full Adhesive Test (4.4.4.2) in lieu of the Thermal Age Test. The SC/PC Fiber Optic Connectors and Adapters were compliant with the Adhesive Test Requirement.

Failure History:

There were no failures during the course of the Adhesive Test (4.4.4.2).

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.

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 GR326formatter1-1.exe located in the P:\Fiber drive. 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 controller on the corresponding computer for the appropriate switch. Using the mouse, select the "Setup Test" button, then select "Thermal Cycle" and enter the channel numbers to be tested. Finally, enter the project number and select <OK>. 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 as shown in Exhibit 6-12. 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 and the software on the computer shows that the test is complete, verify the data (using GR326formatter1-1.exe located in the P:\Fiber drive) 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.

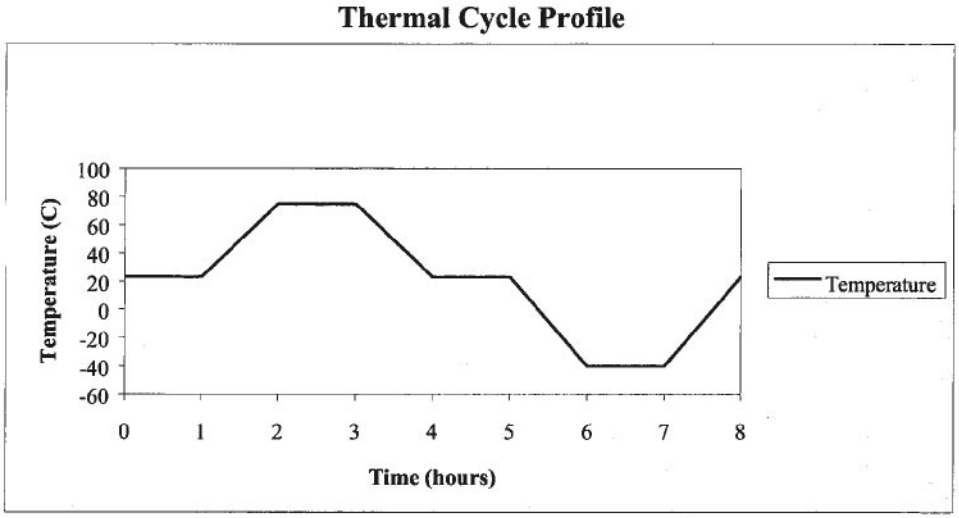

Thermal Cycle Profile
Temperature (C)
100
80
60
40
20
0
-20
-40
-60
0
1
2
3
4
5
6
7
8
Time (hours)
Temperature

Exhibit 6-12

Configuration and Conditions:

The connector assemblies will remain in an environmental chamber and will be operational during the course of this evaluation. See the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-13 for a diagram of the test setup.

Environmental Test Configuration

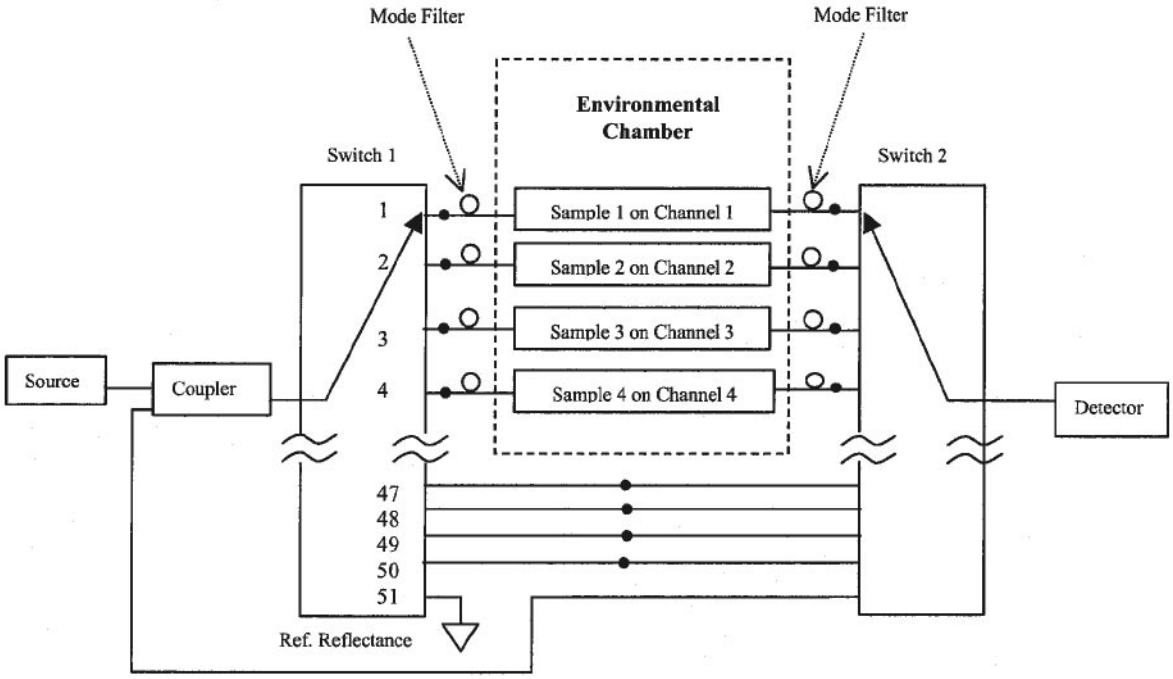


Exhibit 6-13

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-11 [28]**. The connector assemblies met the requirement criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-12 [29]**. The connector assemblies met the objective criteria.

See Exhibit 6-14 through Exhibit 6-17 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	0.23	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	0.10	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53.68	-40	Yes (25 Y, 0N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	3.06	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-14

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	0.06	0.30	Yes	0.20	Yes
Loss Increase	0.14	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-52.42	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	2.58	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-15

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	0.10	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	-55.03	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	2.22	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-16

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	0.21	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	0.12	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-52.82	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	2.18	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-17

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.

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 GR326formatter1-1.exe located in the P:\Fiber drive. 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 controller on the corresponding computer for the appropriate switch. Using the mouse, select the "Setup Test" button. Then, select "Humidity Age" and enter the channel numbers to be tested. Finally, enter the project number and select <OK>. 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 6-18.
5. The chamber shall be programmed so that it will hold a temperature of 75°C and a humidity of 95 percent 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 and the software on the computer shows that the test is complete, verify the data (using GR326formatter1-1.exe located in the P:\Fiber drive) 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

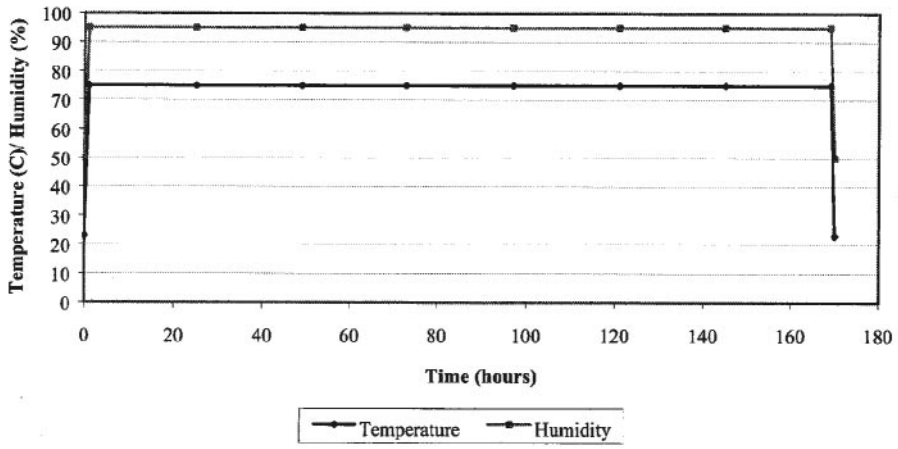


Exhibit 6-18

The environmental plot shown in Exhibit 6-18 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 the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-19 for a diagram of the test setup.

Environmental Test Configuration

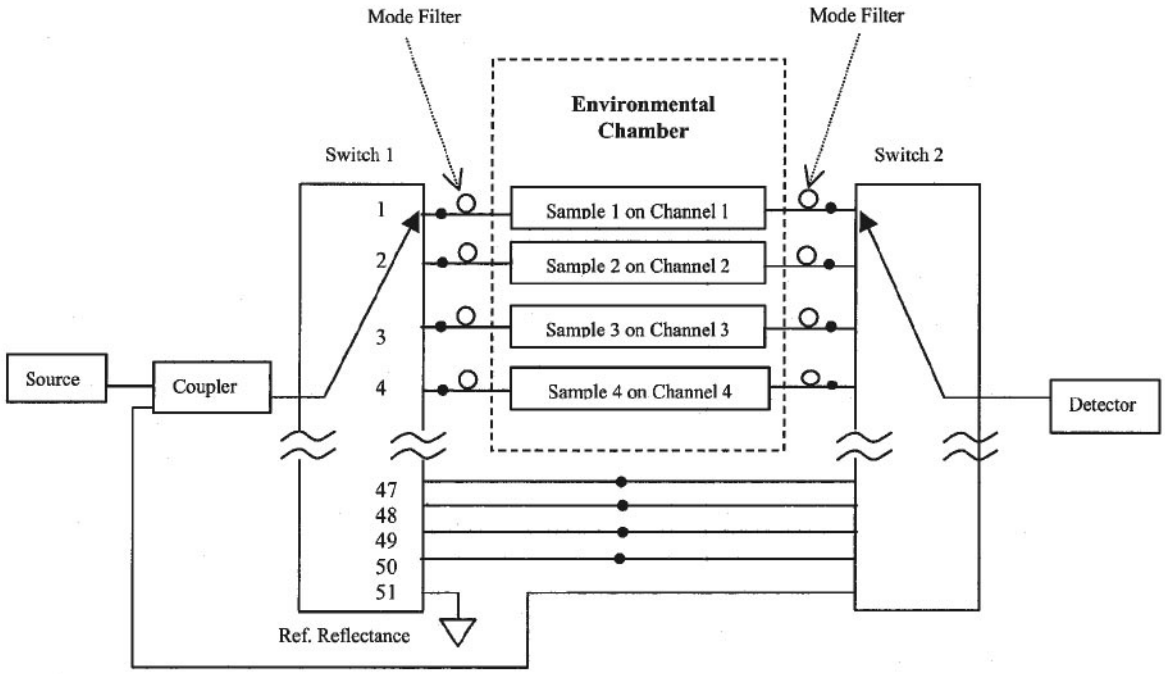


Exhibit 6-19

Test Results:

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

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-14 [31]**. The connector assemblies met the requirement criteria.

See Exhibit 6-20 through Exhibit 6-23 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	0.21	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	-57.72	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.49	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-20

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	0.16	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	0.05	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53.83	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	1.17	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-21

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	0.08	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	-57.54	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	1.15	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-22

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	0.18	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	0.05	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53.58	-40	Yes (25Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	3.22	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-23

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/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 6-24.

Sample Group: The same sample group from the Humidity Age Test will be used.

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 GR326formatter1-1.exe located in the P:\Fiber drive. 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 controller on the corresponding computer for the appropriate switch. Using the mouse, select the "Setup Test" button. Then, select "Humidity Condensation" and enter the channel numbers to be tested. Finally, enter the project number and press OK. 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 GR326formatter1-1.exe located in the P:\Fiber drive, it will eliminate the unnecessary data and only look at the measurements that were 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 6-24. 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 GR326formatter1-1.exe located in the P:\Fiber drive) to ensure that the connectors met the requirements for the Thermal Cycle Test. The GR326formatter1-1.exe program will automatically 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.

Humidity/Condensation Cycling Test Profile

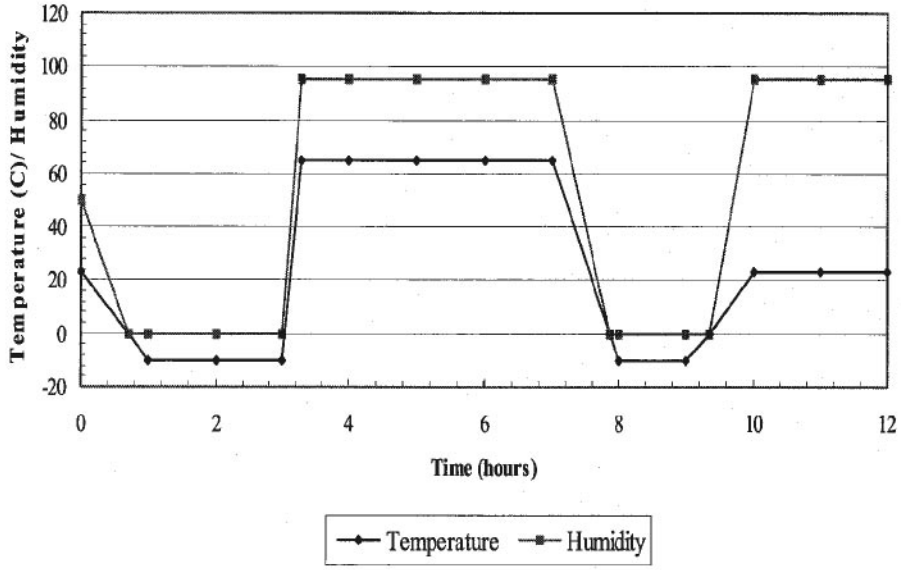


Exhibit 6-24

The environmental plot shown in Exhibit 6-24 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 the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-25 for a diagram of the test setup.

Environmental Test Configuration

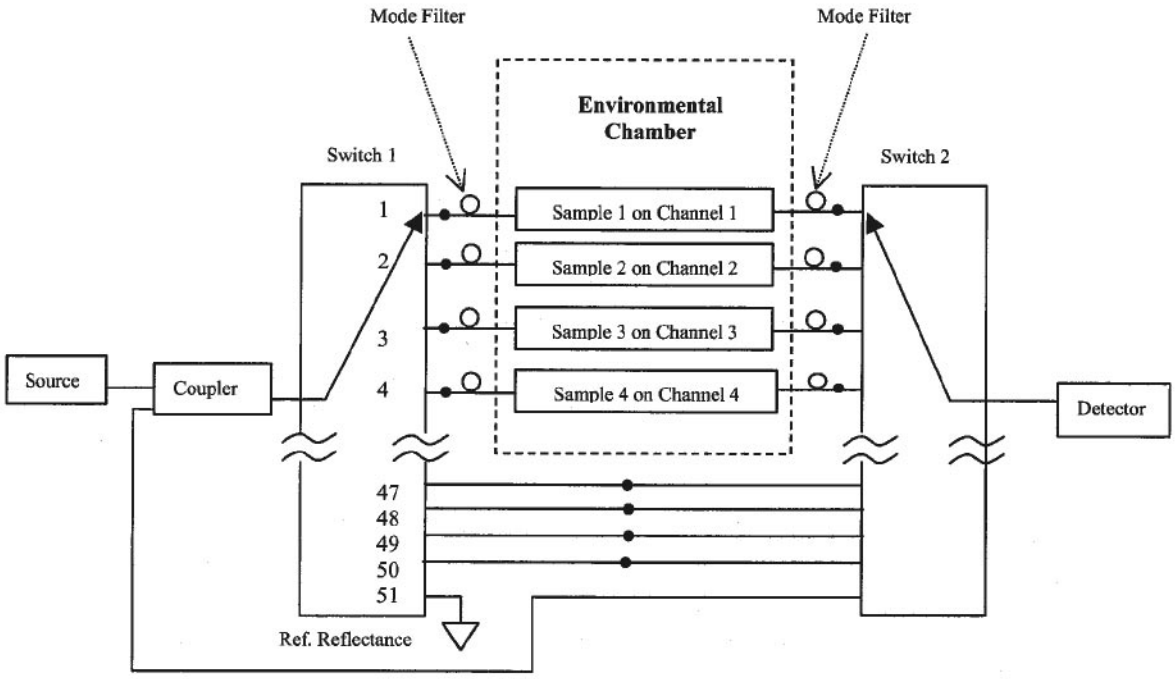


Exhibit 6-25

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-15 [32]**. The connector assemblies met the requirement criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-16 [33]**. The connector assemblies met the objective criteria.

See Exhibit 6-26 through Exhibit 6-29 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	0.26	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	0.15	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-56.84	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.87	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-26

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	0.05	0.30	Yes	0.20	Yes
Loss Increase	0.07	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53.77	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	1.23	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-27

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	0.08	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	-56.32	-40	Yes (25 Y, 0 N)	-55*	Ycs (25 Y, 0 N)
Reflectance Change	1.58	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-28

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	0.06	0.30	Yes	0.20	Yes
Loss Increase	0.07	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-51.09	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	3.91	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-29

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.

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.

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 GR326formatter1-1.exe located in the P:\Fiber drive. 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. Once the data from the previous test has been verified, program the environmental chamber in accordance with the temperature profile shown in Exhibit 6-30. 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.

Dry-Out Step Profile

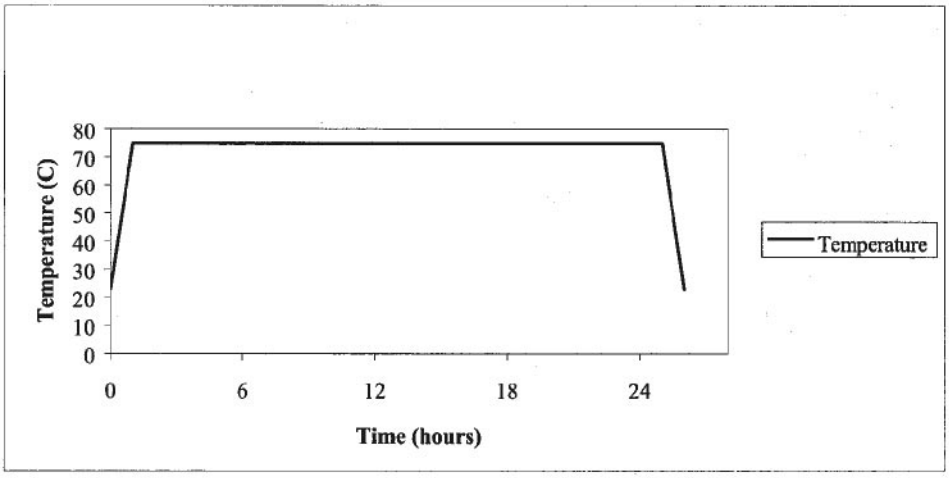


Exhibit 6-30

Configuration and Conditions:

The connector assemblies will remain in an environmental chamber and will be operational during the course of this evaluation. See the **PRODUCT CONFIGURATION** section in Part 3 for details Exhibit 6-31 for a diagram of the test setup.

Environmental Test Configuration

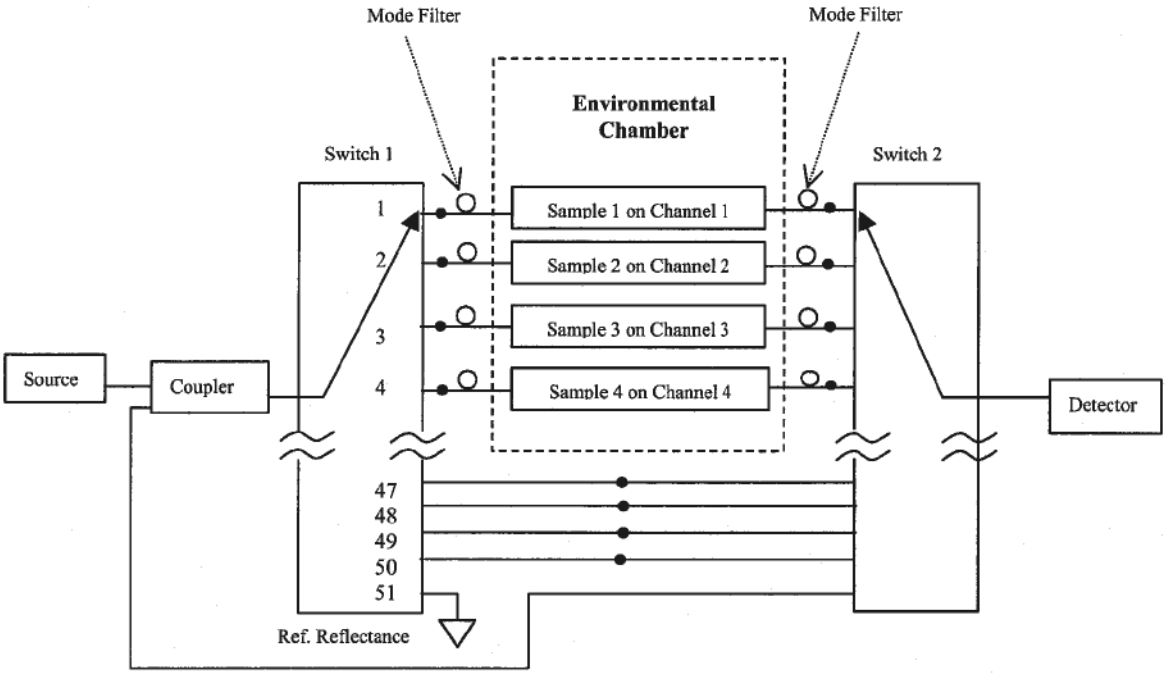


Exhibit 6-31

Test Results:

There are no criteria for this section.

Failure History:

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.

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 GR326formatter1-1.exe located in the P:\Fiber drive. 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 controller on the corresponding computer for the appropriate switch. Using the mouse, select the "Setup Test" button. Then, select "Post-Thermal Cycle" and enter the channel numbers to be tested. Finally, enter the project number and select <OK>. 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 6-32 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 and the software on the computer shows that the test is complete, verify the data (using GR326formatter1-1.exe located in the P:\Fiber drive) 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.

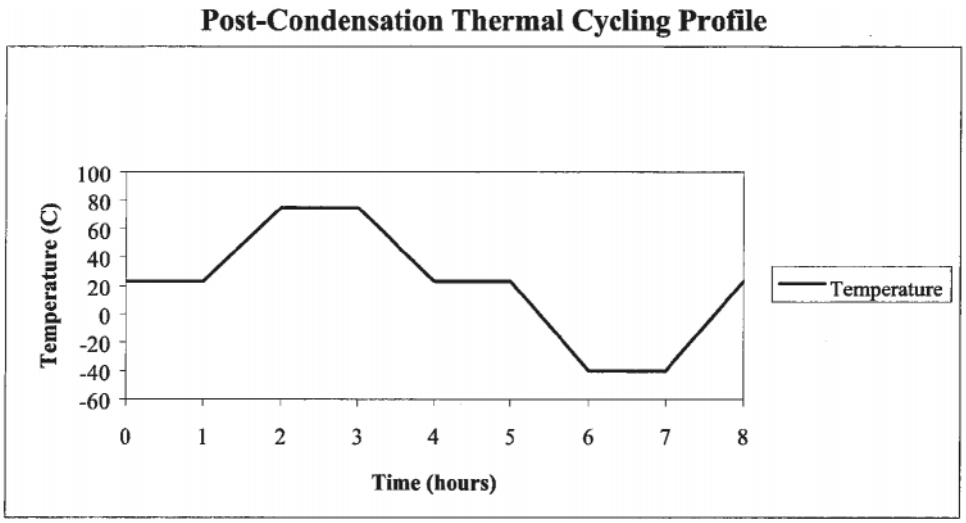

Post-Condensation Thermal Cycling Profile
Temperature (C)
100
80
60
40
20
0
-20
-40
-60
0
1
2
3
4
5
6
7
8
Time (hours)
Temperature

Exhibit 6-32

Configuration and Conditions:

The connector assemblies will remain in an environmental chamber and will be operational during the course of this evaluation. See the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-33 for a diagram of the test setup.

Environmental Test Configuration

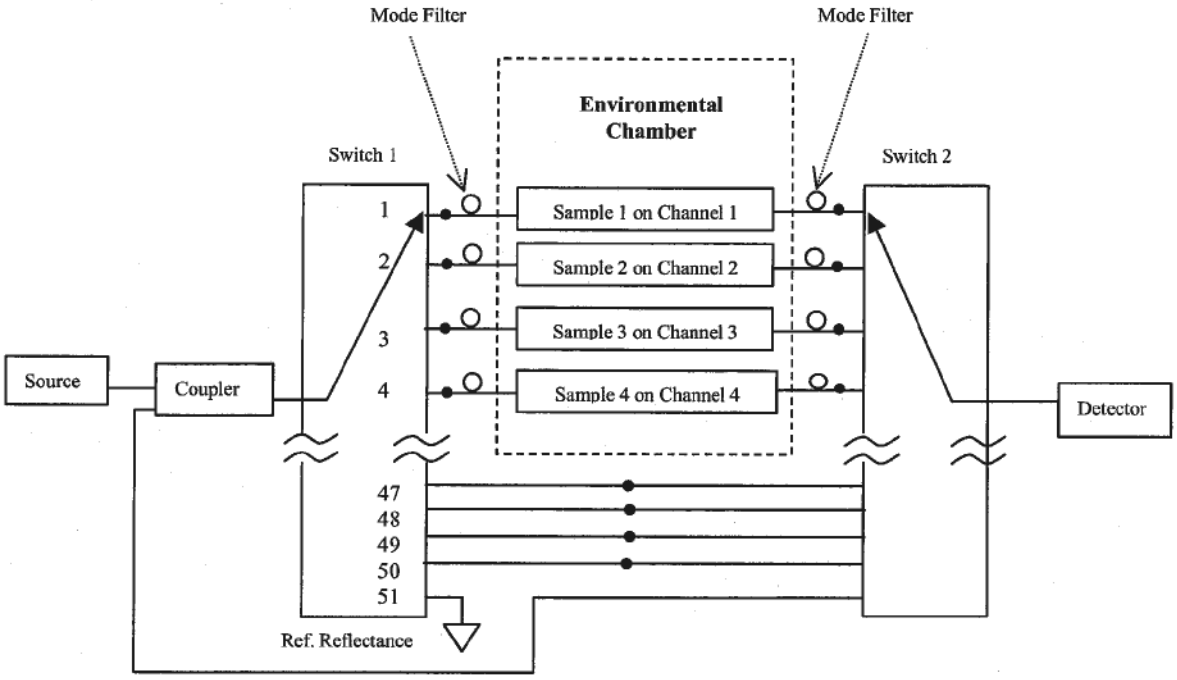


Exhibit 6-33

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-17 [34]**. The connector assemblies met the requirement criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-18 [35]**. The connector assemblies met the objective criteria.

See Exhibit 6-34 through Exhibit 6-37 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	0.29	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	0.07	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-57.67	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	2.33	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-34

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	0.29	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	-54.32	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.68	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-35

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	0.07	0.30	Yes	0.20	Yes
Loss Increase	0.07	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-57.31	-40	Yes (25Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	2.59	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-36

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	0.22	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	0.07	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53.68	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	1.32	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-37

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.

MECHANICAL TESTS (4.4.3)

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.

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 by selecting the option button that is beside Standard Operation. 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 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. The file for the GR-326 vibration is located on the C:\Fiber drive. Load GR-326 4.4.3.1. 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 of 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

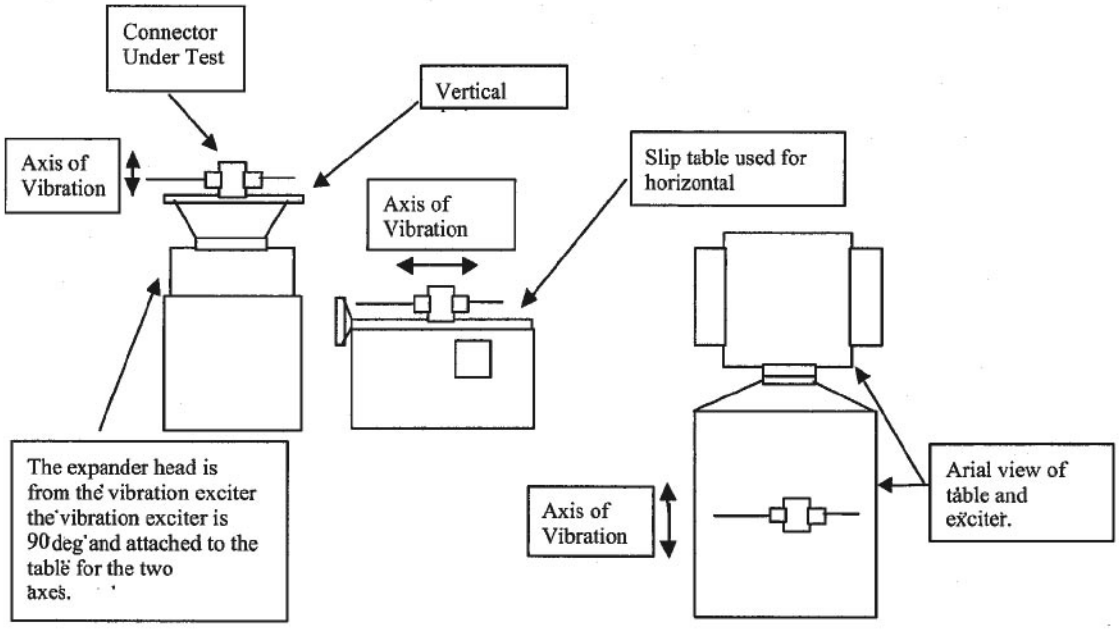


Exhibit 6-38

Configuration and Conditions:

The connector assemblies will be placed on the vibration table and will be operational during the course of this evaluation. See the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-39 for a diagram of the test setup.

Vibration Test Configuration

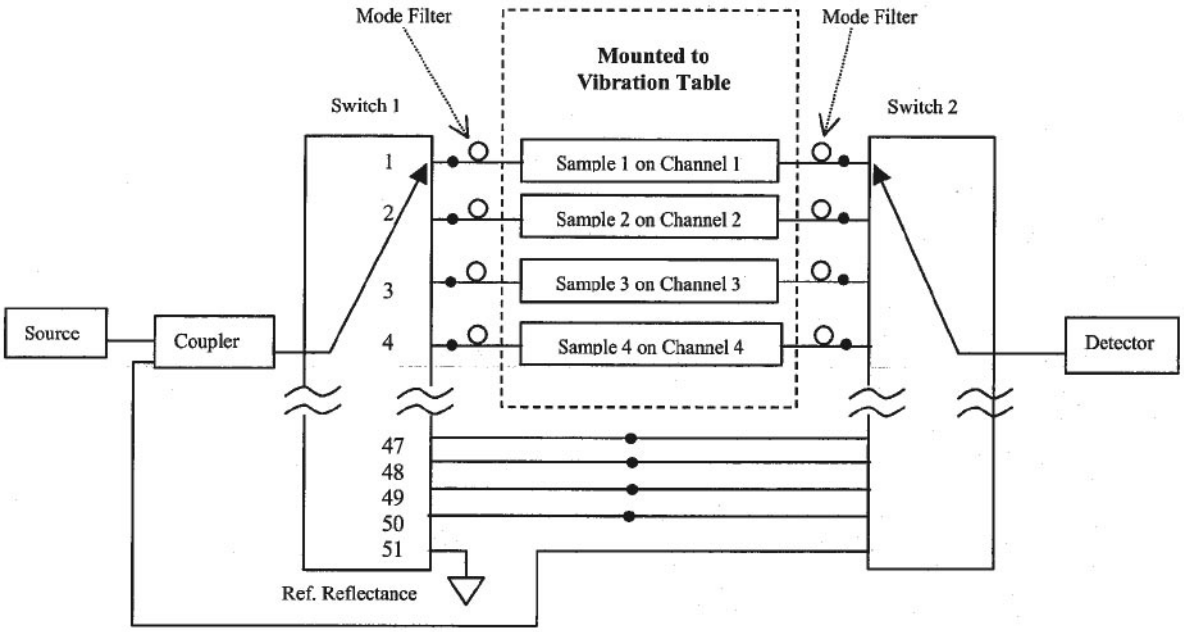


Exhibit 6-39

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-19 [36]**. The connector assemblies met the requirement criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-20 [37]**. The connector assemblies met the objective criteria.

See Exhibit 6-40 through Exhibit 6-43 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	0.12	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	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-40

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	0.10	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	0.08	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-41

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	0.25	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	0.11	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-42

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	0.10	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-54.30	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.70	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-43

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.

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.

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.[13]

[13] 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

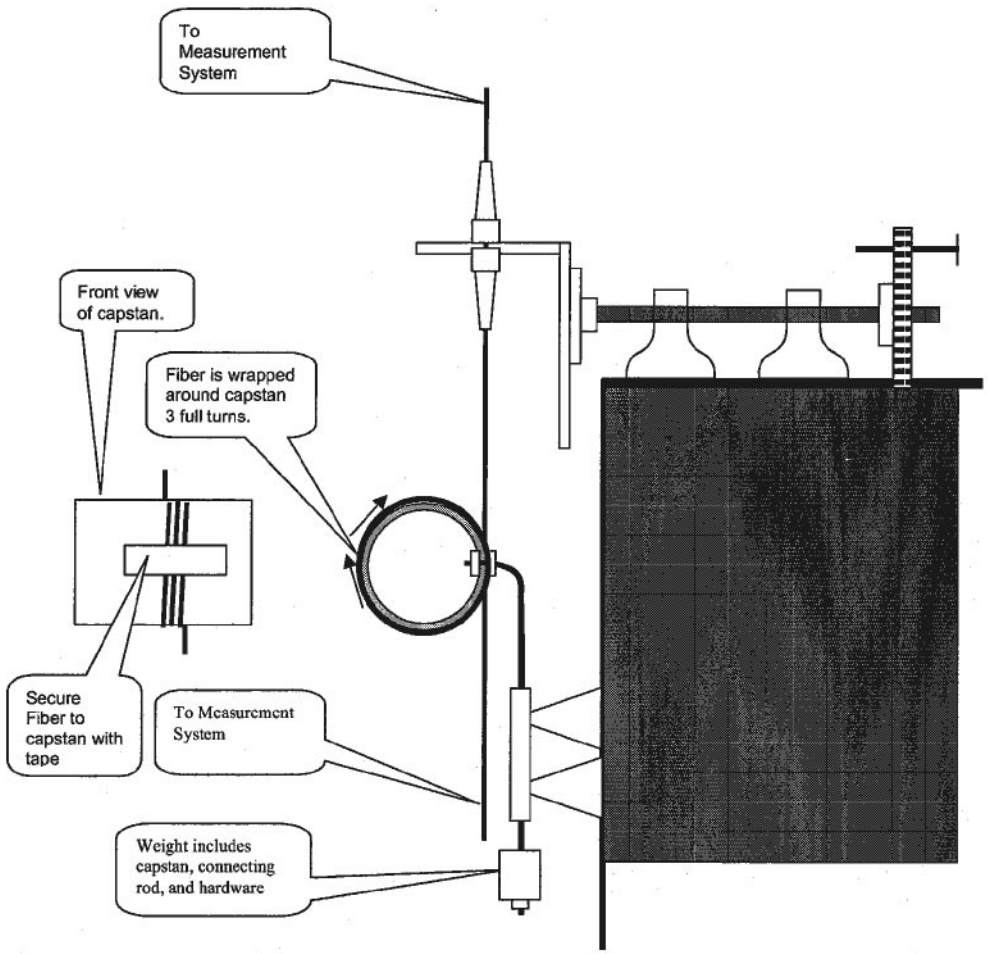


Exhibit 6-44

Diagram of the Mechanical Fixture's Rotation Plate

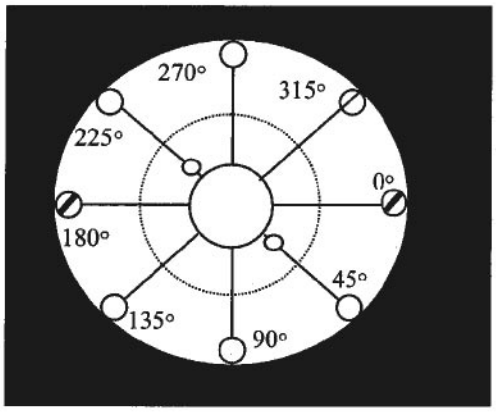


Exhibit 6-45

Isometric Drawing of the Mechanical Fixture's Rotating Arm

Exhibit 6-46

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. This will relieve the stress that is imposed by the weight of the capstan and the rod that is connected to it.
6. 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.
7. 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	Shaft and Nut (kg)	Mass 1 (kg)	Total (kg)	Total (lbs)
15 lbs	0.25	6.55	6.80	14.99
10 lbs	0.25	4.25	4.50	9.923
7.5 lbs	0.25	3.15	3.40	7.497
5.0 lbs	0.25	2.15	2.40	5.292
4.4 lbs	0.25	1.75	2.00	4.410
3.3 lbs	0.25	1.25	1.50	3.308
3.0 lbs	0.25	1.10	1.35	2.977
2.0 lbs	0.25	0.66	0.91	2.007
1.65 lbs	0.25	0.50	0.75	1.654
1.54 lbs	0.25	0.45	0.70	1.544
1.3 lbs	0.25	0.34	0.59	1.301
1.1 lbs	0.25	0.25	0.50	1.103
1 lb	0.25	0.22	0.47	1.036
0.55 lbs	0.25	-	0.25	0.551

Exhibit 6-47

8. Based on the chart in Exhibit 6-47, 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.

9. Load the Mechanicals.exe file from the P:\Fiber drive (shortcut is located on the desktop of all the computers that are beside a switch). The first form in the program will appear and will allow you to select options or enter data such as the project number, channel number, wavelengths to be tested, which test, load type, angle in which load will be applied, and the load that will be applied. Select the Flex Test and the Initial option buttons and fill in the correct channel number for the initial measurement for the mechanical tests. 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. Be sure that the appropriate project number is placed in the correct field as this will also be the location on the J:\ drive that the data is stored under the file name Mechanicals.xls. Select the "Begin Reading" button.
10. After the laser stabilizes, the software will show you the insertion loss measurements in real time mode. Select the "Take Reading" button. 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 1550 nm. Select "Take Reading". Again, be sure not to disturb the connector under test while the loss and reflectance measurements are performed. Be sure that the loss measurements are made at both wavelengths.
11. Once the measurements have been performed, the program will automatically return to the first form that was originally displayed.
12. Select the Flex Test, No Load, and 2 lb option buttons and fill in the correct channel number for the initial measurement for the mechanical tests. Once again, verify that the appropriate project number is in the correct field.
13. After the laser stabilizes, the insertion loss measurements will be displayed in real time. It is very important that the Flex Test is not performed until after the laser has stabilized and the measurements are being displayed in real time.
14. At this point, remove the wire that is relieving the load from the connector and gradually apply the load to the connector under test.
15. 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 this cycle 99 additional times for a total of 100 cycles.
16. Once the flexing portion of the Flex Test is complete, remove the load by using the wire (running it through the capstan and hooking it onto the bolt) and select the Take Reading button. 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 1550 nm. Select Take Reading. Again, be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time. Be sure that the loss and reflectance measurements are made at both wavelengths.
17. 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.
18. 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.
19. Refer to Exhibit 6-48 for diagram of Tension Test Fixture.

Tension Test Fixture

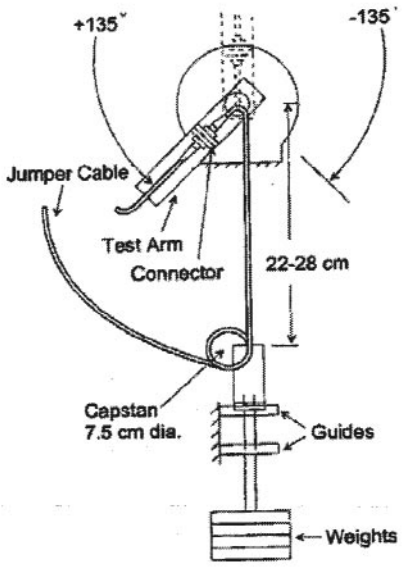


Exhibit 6-48

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 the **PRODUCT CONFIGURATION** section in Part 3 for details and

Exhibit **6-49** for a diagram of the test setup. See Exhibit 6-50 for a mechanical diagram of the Flex Test.

Mechanical Test Setup

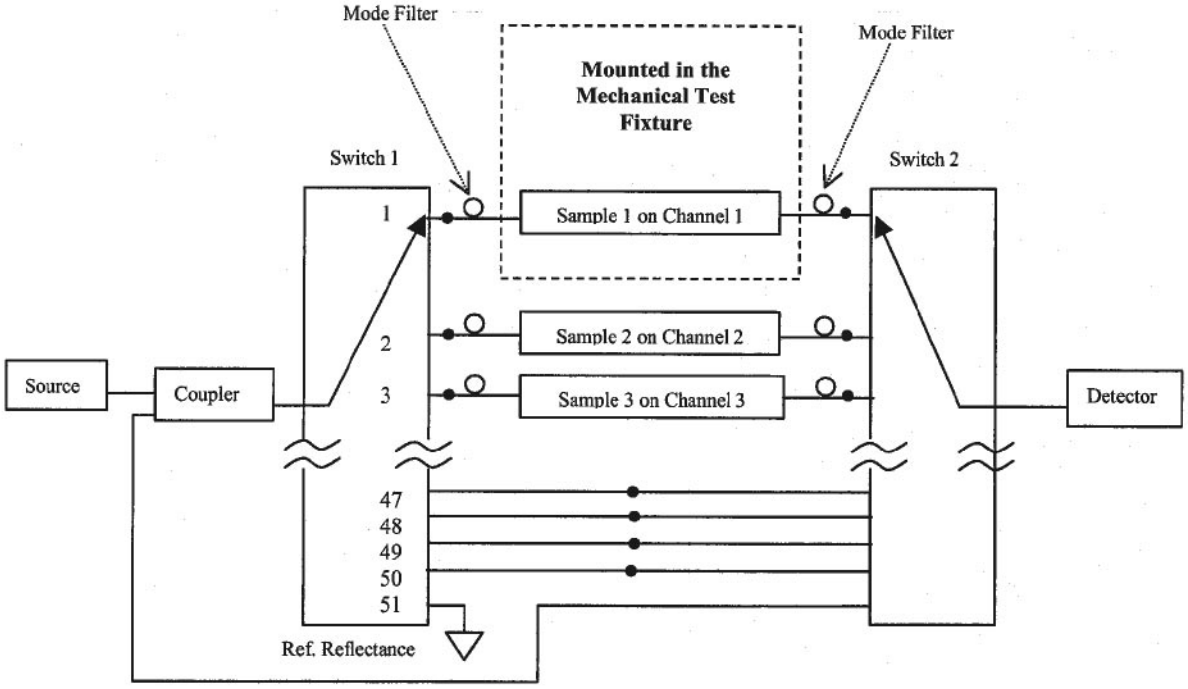


Exhibit 6-49

Diagram of Flex Test

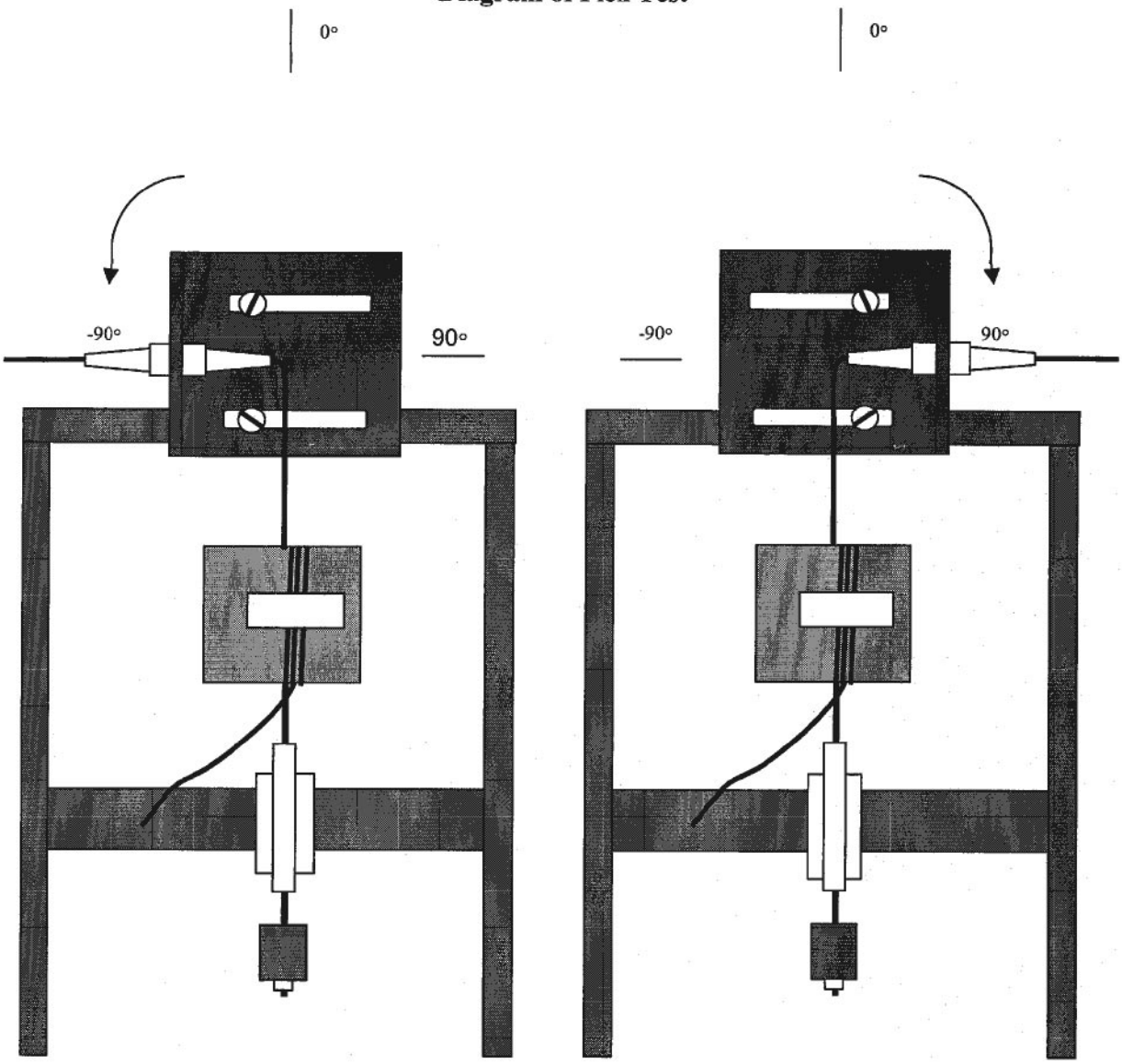


Exhibit 6-50

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-21 [38]**. The connector assemblies met the requirement criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-22 [39]**. The connector assemblies met the requirement criteria.

Conditional Objective **CO4-23 [218]** was **not applicable** to the SC/PC Fiber Optic Connectors and Adapters. The SC/PC Fiber Optic Connectors and Adapters were not small form factor.

See 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	0.19	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	0.05	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-57.18	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	2.82	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-51

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	0.11	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	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-52

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	0.28	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	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.02	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-53

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	0.21	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.02	0.30	Yes	0.20	Yes
Loss Increase	0.02	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0N)
Max Reflectance	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-54

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.

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.

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 Twist Test, the No Load, and 3.0 lb option buttons and fill in the correct channel number for the initial measurement for the mechanical tests. Again, verify that the appropriate project number is in the correct field.
4. Select the Begin Reading button.
5. Once the laser has stabilized and the real time measurements are being displayed on the screen, proceed with the Twist Test.
6. Gradually apply the load to the connector under test. Be sure that the wire is removed from the center of the capstan, if it is not, it will be difficult to twist the capstan about the axis of the fiber.
7. 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.

8. 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.
9. Using the wire, relieve the connector of the load. Allow the connector to stabilize for approximately twenty seconds and select Take Reading. Be sure not to disturb the connector under test, the loss 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 1550 nm. Select Take Reading. Again, be sure not to disturb the connector under test, the loss measurements will be performed at this time. Be sure that the loss measurements are made at both wavelengths.
10. 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.
11. Refer to Exhibit 6-55 for diagram of Tension Test Fixture.

Tension Test Fixture

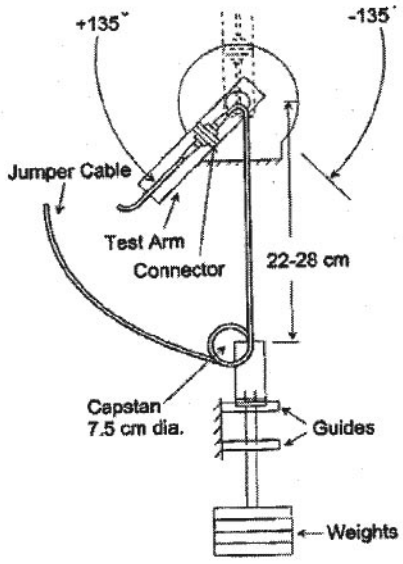


Exhibit 6-55

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 the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-56 for a diagram of the Mechanical Test setup. See Exhibit 6-57 for a mechanical diagram of the Twist Test.

Mechanical Test Setup

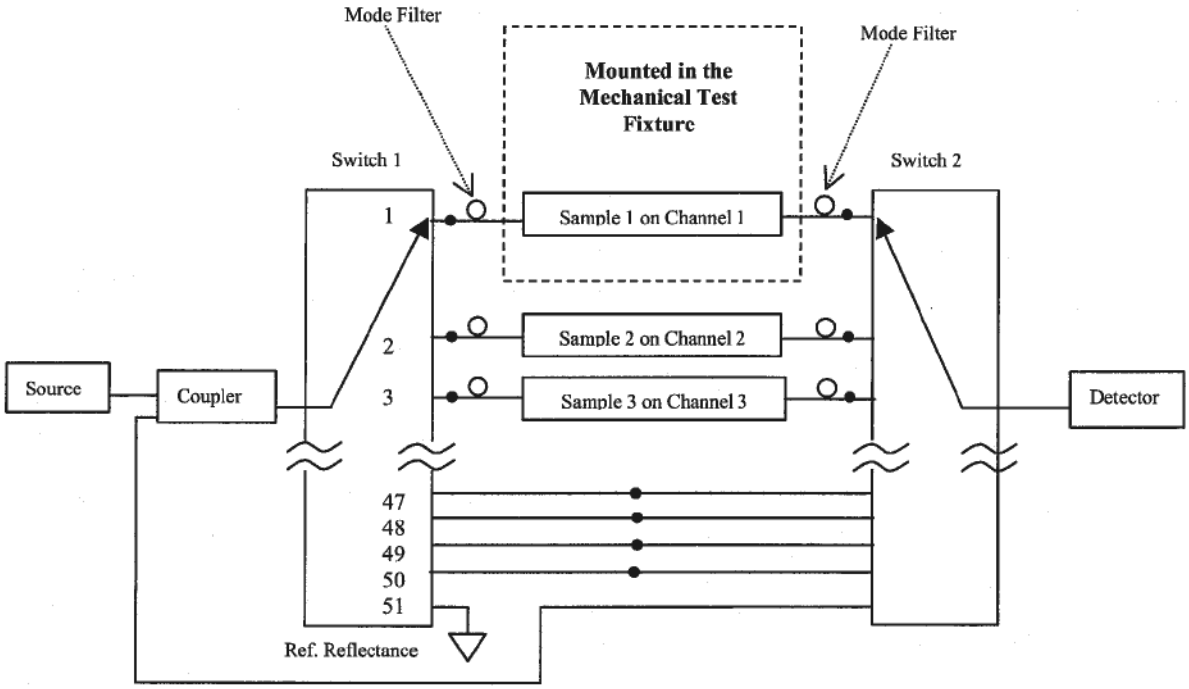


Exhibit 6-56

Diagram of Twist Test

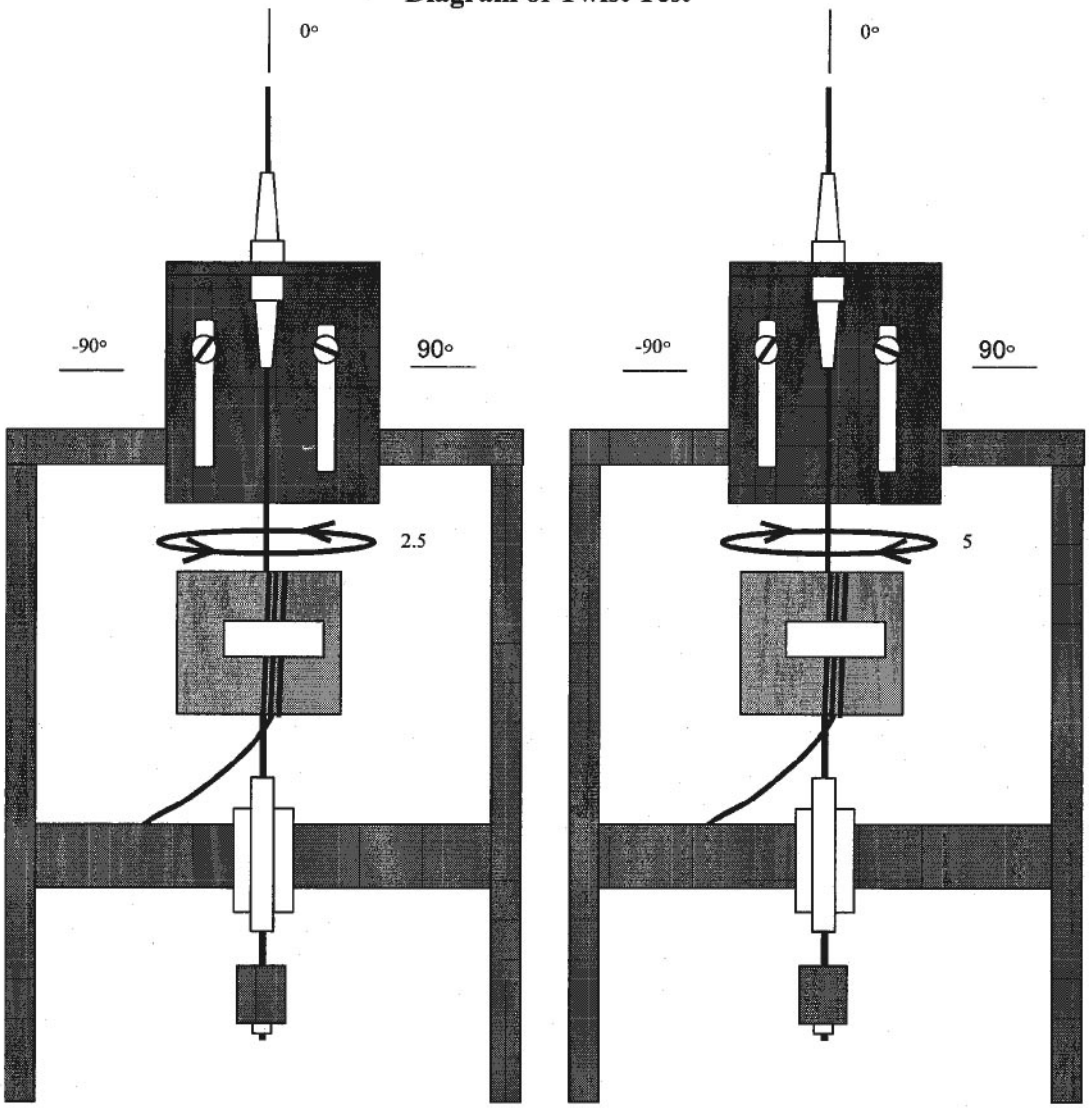


Exhibit 6-57

Test Results:

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

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-25 [41]**. The connector assemblies met the objective criteria.

See Exhibit 6-58 through Exhibit 6-61 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	0.17	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	0.07	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.16	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-58

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	0.11	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	0.00	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-59

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	0.28	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	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-60

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	0.19	0.50	Yes (25 Y, 0 N)	0.30	Yes (25 Y, 0 N)
Mean Loss	0.02	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	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-61

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.

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.

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 is perpendicular to the floor. After placing the 10 lbf load on the fixture, select the Proof Test, No Load, 10-lb, and 0 deg option buttons. Select Begin Reading.
4. Once the laser has stabilized and the real time measurements are being displayed on the screen, proceed with the Proof Test.

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 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 1550 nm. Select Take Reading. Again, be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time. Be sure that the loss and reflectance measurements are made at both wavelengths.
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 perpindicular to the floor. After placing the 15 lbf load on the fixture, select the Proof Test, No Load, 15 pounds, and 0 deg option buttons. Select Begin Reading.
8. Once the laser has stabilized and the real time measurements are being displayed on the screen, proceed with the Proof Test.
9. 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 Take Reading. Be sure not to disturb the connector under test, the loss 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 1550 nm. Select Take Reading. Again, be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time. Be sure that the loss and reflectance measurements are made a both wavelengths.
10. 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).
11. 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 5 lbf (or 3.3 lbf for small form factor) load on the fixture, select the Proof Test, No Load, 5.0 lb (or 3.3 lbf for small form factor), and 90 deg option buttons. Select Begin Reading.
12. Once the laser has stabilized and the real time measurements are being displayed on the screen, proceed with the Proof Test.
13. 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 1550 nm. Select Take Reading. Again, be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time. Be sure that the loss and reflectance measurements are made a both wavelengths.
14. 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 lbf for small form factor connectors).

15. 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.
16. Once the laser has stabilized and the real time measurements are being displayed on the screen, proceed with the Proof Test.
17. 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 1550 nm. Select Take Reading. Again, be sure not to disturb the connector under test, the loss and reflectance measurements will be performed at this time. Be sure that the loss measurements are made at both wavelengths.
18. 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.
19. Refer to Exhibit 6-62 for diagram of Tension Test Fixture.

Tension Test Fixture

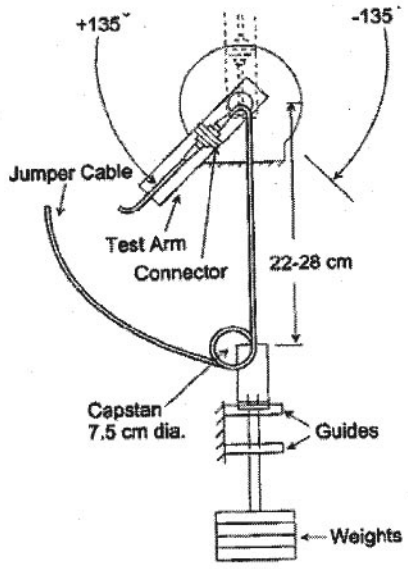


Exhibit 6-62

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 the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-69 for a diagram of the Mechanical Test setup.

Mechanical Test Setup

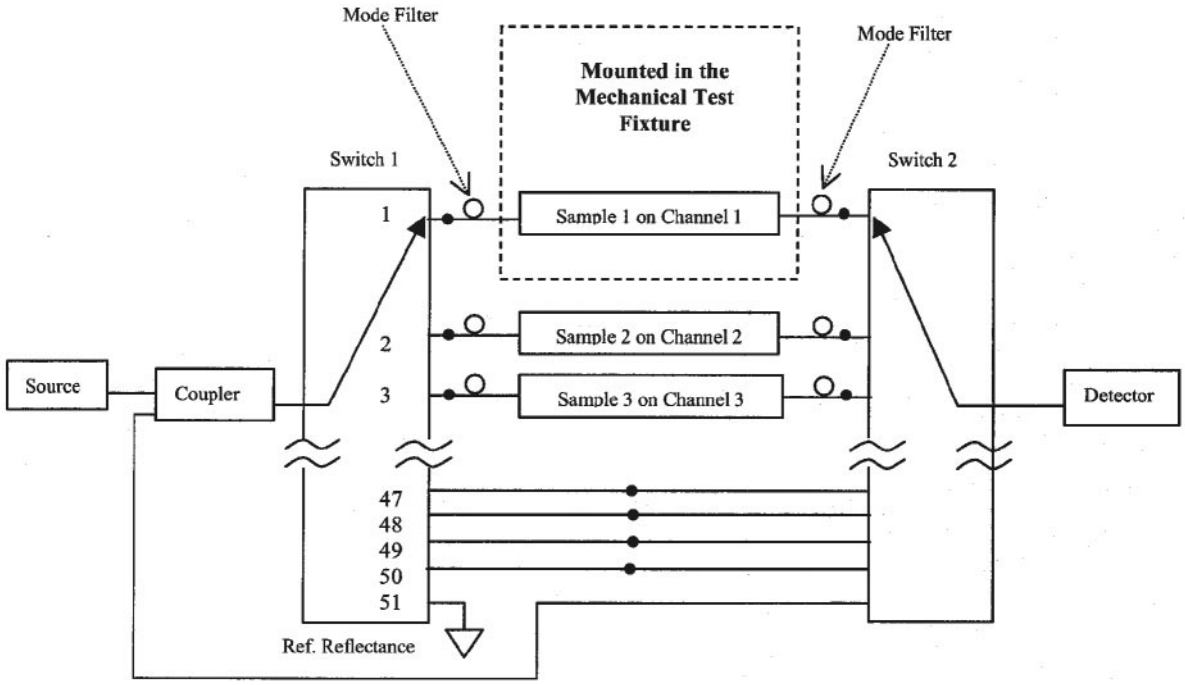


Exhibit 6-63

Test Results:

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

The SC/PC Fiber Optic Connectors and Adapters were **compliant**[14] with Objective **O4-27 [43]**. The connector assemblies met the objective criteria.

Conditional Objective **CO4-28 [219]** was **not applicable** to the SC/PC Fiber Optic Connectors and Adapters. The SC/PC Fiber Optic Connectors and Adapters were not small form factor.

See Exhibit 6-64 through Exhibit 6-67 for the maximum values measured during the course of this evaluation.

Maximum Values Measured from Sample Group at 1310 nm

Criteria Category	Max Values (dB) 10 lbs 0°/ 5 lbs 90°	Requirement		Max Values (dB) 15 lbs 0° / 7.5 lbs 90°	Objective /Conditional Requirement*	
		Criteria (dB)	Criteria Met?		Criteria (dB)	Criteria Met?
Max Loss	0.19	0.50	Yes (25 Y, 0 N)	0.17	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.3	Yes	0.06	0.20	Yes
Loss Increase	0.07	0.30	Yes (25 Y, 0 N)	0.09	0.20	Yes (25 Y, 0 N)
Max Reflectance	-59.08	-40	Yes (25 Y, 0 N)	-53.62	-55*	Yes (25 Y, 0 N)
Reflectance Increase	0.43	5	Yes (25 Y, 0 N)	3.17	2	Yes (25 Y, 0 N)

Exhibit 6-64

Maximum Values Measured from Sample Group at 1490 nm

Criteria Category	Max Values (dB) 10 lbs 0°/ 5 lbs 90°	Requirement		Max Values (dB) 15 lbs 0° / 7.5 lbs 90°	Objective /Conditional Requirement*	
		Criteria (dB)	Criteria Met?		Criteria (dB)	Criteria Met?
Max Loss	0.13	0.50	Yes (25 Y, 0 N)	0.12	0.30	Yes (25 Y, 0 N)
Mean Loss	0.03	0.3	Yes	0.03	0.20	Yes
Loss Increase	0.00	0.30	Yes (25 Y, 0 N)	0.04	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55.00	-40	Yes (25 Y, 0 N)	-53.29	-55*	Yes (25 Y, 0 N)
Reflectance Increase	0.00	5	Yes (25 Y, 0 N)	1.40	2	Yes (25 Y, 0 N)

Exhibit 6-65

[14] Part of the Proof test for Objective **O4-27** was delayed at the request of Tyco Electronics. The connectors were subjected to the remainder of the tests; Transmission With Applied Load, Impact, Durability, End of Test Criteria, and Connector Installation prior to being subjected to the Objective levels of the proof test.

Maximum Values Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB) 10 lbs 0°/ 5 lbs 90°	Requirement		Max Values (dB) 15 lbs 0° / 7.5 lbs 90°	Objective /Conditional Requirement*	
		Criteria (dB)	Criteria Met?		Criteria (dB)	Criteria Met?
Max Loss	0.28	0.50	Yes (25 Y, 0 N)	0.31	0.30	Yes (25 Y, 0 N)
Mean Loss	0.05	0.3	Yes	0.06	0.20	Yes
Loss Increase	0.00	0.30	Yes (25 Y, 0 N)	0.05	0.20	Yes (25 Y, 0 N)
Max Reflectance	-60.00	-40	Yes (25 Y, 0 N)	-54.14	-55*	Yes (25 Y, 0 N)
Reflectance Increase	0.14	5	Yes (25 Y, 0 N)	3.98	2	Yes (25 Y, 0 N)

Exhibit 6-66

Maximum Values Measured from Sample Group at 1550 nm

Criteria Category	Max Values (dB) 10 lbs 0°/ 5 lbs 90°	Requirement		Max Values (dB) 15 lbs 0° / 7.5 lbs 90°	Objective /Conditional Requirement*	
		Criteria (dB)	Criteria Met?		Criteria (dB)	Criteria Met?
Max Loss	0.19	0.50	Yes (25Y, 0N)	0.13	0.30	Yes (25Y, 0N)
Mean Loss	0.02	0.3	Yes	0.03	0.20	Yes
Loss Increase	0.01	0.30	Yes (25Y, 0N)	0.07	0.20	Yes (25Y, 0N)
Max Reflectance	-55.00	-40	Yes (25Y, 0N)	-54.62	-55*	Yes (25Y, 0N)
Reflectance Increase	0.00	5	Yes (25Y, 0N)	0.38	2	Yes (25Y, 0N)

Exhibit 6-67

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.

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 6-68 and Exhibit 6-69.

Sample Group: The same set of connectors that were used in the Proof Test will be used for this test.

Test Method:

1. After completing the measurements for the Proof Test, perform the Transmission with Applied Load 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 Proof Test final measurements to be used as the Transmission with Applied Load Test initial measurements.
2. Remove the load that was used during the Proof Test and 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.
3. Refer to Exhibit 6-68 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 6-68

4. Refer to Exhibit 6-69 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 6-69

5. Refer to the data sheets attached to this work instruction for order of tests.
6. Be sure that the appropriate load is selected, angle, test, project number, and channel number are selected on the form before selecting the Begin Reading button.
7. After the laser source is stabilized and the measurements are being displayed in real time, gradually apply the load to the connector under test. Allow at least 20 seconds for the measurements to stabilize before selecting the "Take Measurements" button. It will take longer for the measurements to stabilize as both the load and the angle are increased. 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 1550 nm. Select "Take Reading". Again, be sure not to disturb the connector under test. The loss and reflectance measurements will be performed at this time. Be sure that the loss and reflectance measurements are made at both wavelengths.

8. Once all of the applicable loads have been tested at all applicable angles for the first connector, perform one last measurement with the Transmission, No Load, and Final option buttons selected this will serve as a final measurement for the mechanical tests. Remove the connector assembly from the setup increment the fixture 45° and start over again at the Flex Test with a new sample.
9. Once all of the connectors have been tested, open P:\Fiber\Mech_Workup\Mechanicals_Workup.vbw. Enter the project number in thc appropriate field and run the program. After the program is complete look in the project folder on the J:\ drive under Mechanicals_done.xls to view the data. The program will yield the maximum values for each requirement and objective for each test (Flex, Twist, Proof, Transmission), how many connectors failed and passed each requirement and objective for each test, and the mean loss values for each test. If some of the connectors do not meet the requirements, contact the customer. Once a resolution has been reached, correct the problem and proceed with the testing.
10. Refer to Exhibit 6-70 for diagram of Tension Test Fixture.

Tension Test Fixture

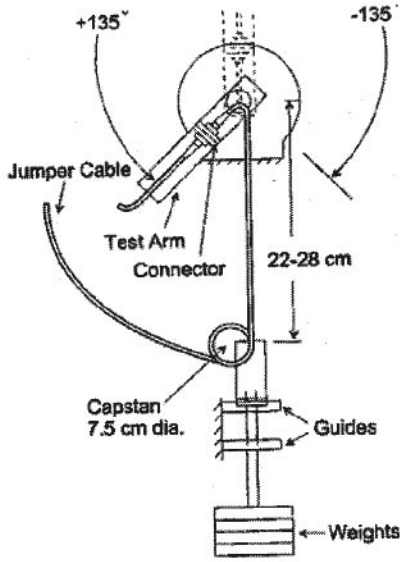


Exhibit 6-70

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 the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-71 for a diagram of the Mechanical Test setup.

Mechanical Test Setup

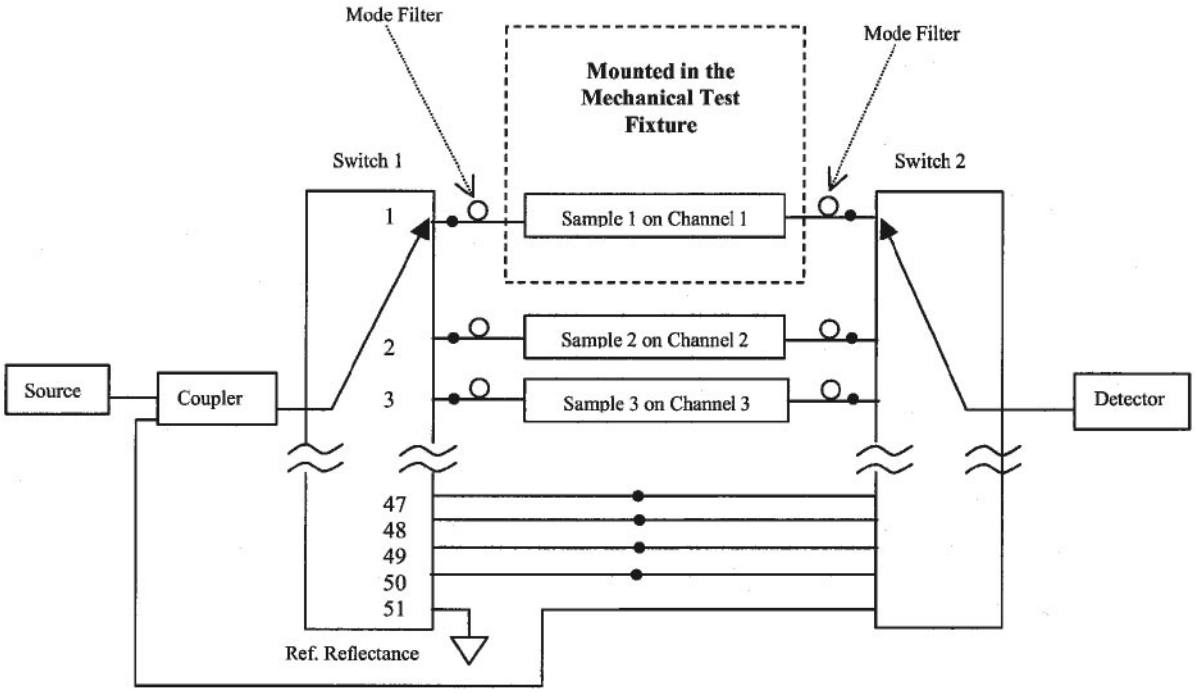


Exhibit 6-71

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirements **R4-29 [44]** and **R4-30 [45]**. The connector assemblies met the requirement criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objectives **O4-31 [46]** and **O4-32 [47]**. The connector assemblies met the objective criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Conditional Objectives **CO4-33 [220]** and **CO4-36 [221]**. The connector assemblies met the objective criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-34 [48]**. The SC/PC Fiber Optic Connectors and Adapters can be used in a high-density environment.

The SC/PC Fiber Optic Conncctors and Adapters were **compliant** with Conditional Requirement **CR4-35 [49]**. The connector assemblies met the requirement criteria. See Exhibit 6-80 through Exhibit 6-83 for the maximum values measured during the course of this evaluation.

Conditional Requirement **CO4-36 [50]** was **not applicable** to the SC/PC Fiber Optic Connectors and Adapters. The SC/PC Fiber Optic Connectors and Adapters were not small form factor.

See Exhibit 6-72 through Exhibit 6-83 for maximum values measured during 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	0.12	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	0	0.08	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	0	0.07	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2.0	0	0.10	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	No Load	0	0.02	0.3	Yes (25 Y, 0 N)	0.2	Yes (25 Y, 0 N)
Reflectance	0.25	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	0.7	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	1.5	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	2.0	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	No Load	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.25	0	0.21	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	0.7	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	1.5	0	0.04	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	2.0	0	0.03	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	No Load	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-72

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	0.04	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	0	0.09	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	0	0.09	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2.0	0	0.08	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	No Load	0	0.00	0.3	Yes (25 Y, 0 N)	0.2	Yes (25 Y, 0 N)
Reflectance	0.25	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	0.7	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	1.5	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	2.0	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	No Load	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.25	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	0.7	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	1.5	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	2.0	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	No Load	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-73

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	0.06	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	0	0.05	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	0	0.04	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2.0	0	0.04	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	No Load	0	0.00	0.3	Yes (25 Y, 0 N)	0.2	Yes (25 Y, 0 N)
Reflectance	0.25	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	0.7	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	1.5	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	2.0	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	No Load	0	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0N)
Increase in RL	0.25	0	0.02	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	0.7	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	1.5	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	2.0	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0N)
Increase in RL	No Load	0	0.04	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-74

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	0.04	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.7	0	0.07	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.5	0	0.08	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2.0	0	0.05	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	No Load	0	0.01	0.3	Yes (25 Y, 0 N)	0.2	Yes (25 Y, 0 N)
Reflectance	0.25	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	0.7	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	1.5	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	2.0	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	No Load	0	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.25	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	0.7	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	1.5	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	2.0	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	No Load	0	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-75

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	0.05	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.70	90	0.06	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.50	90	0.07	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2.00	90	0.08	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Reflectance	0.25	90	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	0.70	90	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	1.50	90	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	2.00	90	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.25	90	0.04	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	0.70	90	0.15	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	1.50	90	0.02	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	2.00	90	0.05	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-76

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	0.08	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.70	90	0.06	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.50	90	0.07	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2.00	90	0.11	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Reflectance	0.25	90	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	0.70	90	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25Y, 0 N)
Reflectance	1.50	90	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0N)
Reflectance	2.00	90	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0N)
Increase in RL	0.25	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0N)
Increase in RL	0.70	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	1.50	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	2.00	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-77

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	0.06	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.70	90	0.06	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.50	90	0.10	0.5	Yes (25 Y, 0N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2.00	90	0.12	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Reflectance	0.25	90	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	0.70	90	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	1.50	90	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	2.00	90	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.25	90	0.04	5	Yes (25 Y, 0N)	2	Yes (25 Y, 0 N)
Increase in RL	0.70	90	0.04	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	1.50	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	2.00	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-78

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	0.04	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	0.70	90	0.11	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	1.50	90	0.11	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Loss Increase	2.00	90	0.18	0.5	Yes (25 Y, 0 N)	0.3	Yes (25 Y, 0 N)
Reflectance	0.25	90	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	0.70	90	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	1.50	90	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance	2.00	90	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.25	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	0.70	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	1.50	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)
Increase in RL	2.00	90	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-79

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

Criteria Category			Max	Requirement (CR4-35)		Objective/Conditional Requirement*	
Measurement Type	Load (kg.)	Angle (Degree)	Values (dB)	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.55	135	0.10	0.5	Yes (25 Y, 0 N)	NA	-
Reflectance	0.55	135	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.55	135	0.01	5	Yes (25 Y, 0 N)	NA	-

Exhibit 6-80

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

Criteria Category			Max	Requirement (CR4-35)		Objective/Conditional Requirement*	
Measurement Type	Load (kg.)	Angle (Degree)	Values (dB)	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase	0.55	135	0.04	0.5	Yes (25 Y, 0 N)	NA	-
Reflectance	0.55	135	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.55	135	0.00	5	Yes (25 Y, 0 N)	NA	-

Exhibit 6-81

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	0.55	135	0.06	0.5	Yes (25 Y, 0 N)	NA	-
Reflectance	0.55	135	-60.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.55	135	0.00	5	Yes (25 Y, 0 N)	NA	-

Exhibit 6-82

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	0.55	135	0.16	0.5	Yes (25 Y, 0 N)	NA	-
Reflectance	0.55	135	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Increase in RL	0.55	135	0.00	5	Yes (25 Y, 0 N)	NA	-

Exhibit 6-83

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.

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.

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 switch software. Select the Impact option button, fill in the channels to be tested, enter the project number, and select "Start Test."
3. Once the measurements have finished, open Excel. Look in the project folder on the J:\drive and open the file named Impact.txt (be sure to use Excel to open file). Once the file is open, verify that all of the connectors meet the requirements before starting the test. If some of the connectors do not meet the requirements, clean the endfaces or straighten the patchcords as necessary. Repeat Steps 2 and 3 until all of the connectors are within the requirements and proceed with testing.
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 inches is sufficient) to the rack at a height of 1.5 meters above the center of the concrete block (Refer to Exhibit 6-84).
5. Disconnect the first sample 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

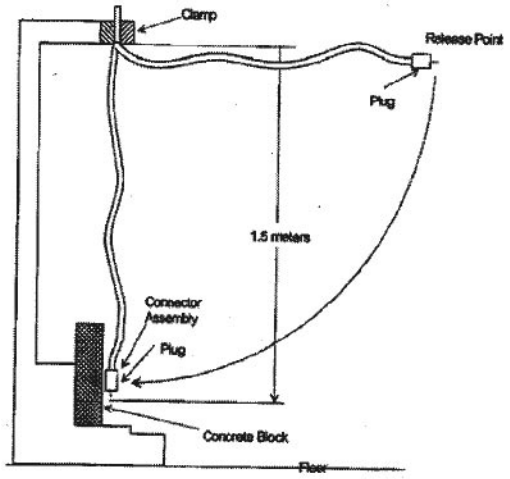


Exhibit 6-84

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 proceed to the next connector.
12. Perform the procedure outlined in Steps 5 through 11 until all of the connectors have been tested and cleaned.
13. Using the switch software, take loss and reflectance measurements by selecting the Impact option button, filling the in the channel numbers that were tested, filling in the project number for the test, and selecting "Start Test."
14. Once the measurements have finished, open Excel. Look in the project folder on the J:\ drive and open the file named Impact.txt (be sure to use Excel to open file). Once the file is open, 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 the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-85 for a diagram of the functional configuration.

Impact Test Setup (Functional Configuration)

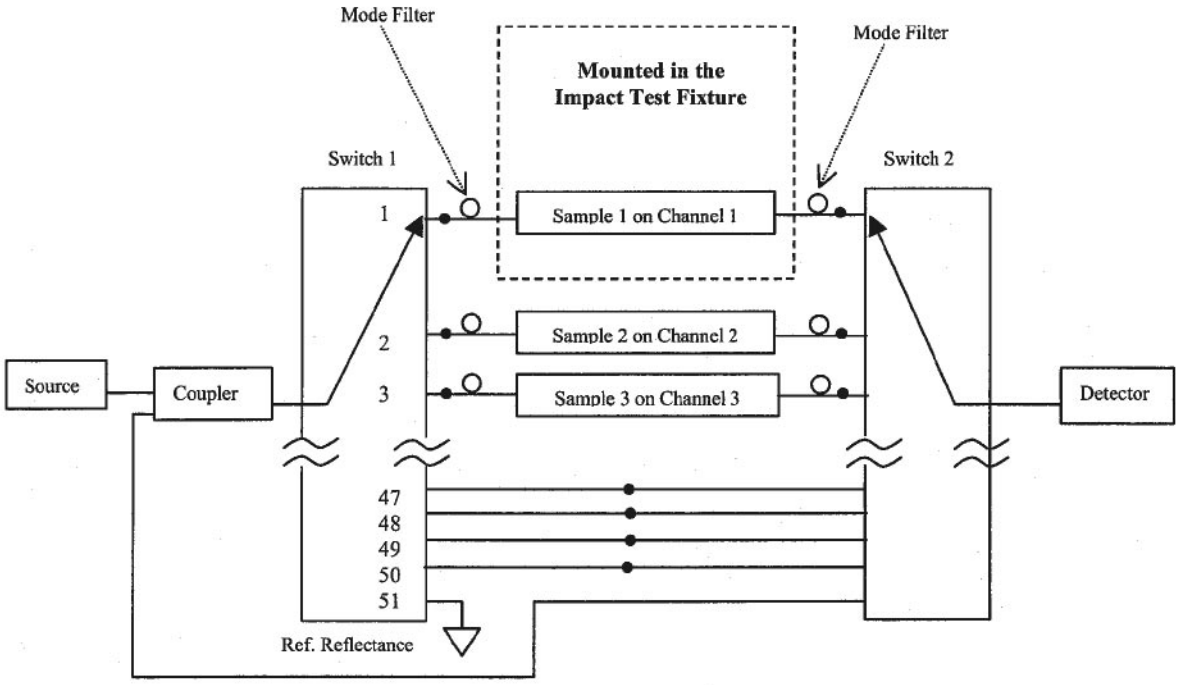


Exhibit 6-85

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-37 [50]**. The connector assemblies met the requirement criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-38 [51]**. The connector assemblies met the objective criteria.

See Exhibit 6-86 through Exhibit 6-89 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	0.29	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	0.13	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-56.14	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	3.68	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-86

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	0.25	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	0.10	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55.00	-40	Yes (25 Y, 0N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-87

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	0.22	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	0.12	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-56.36	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	2.43	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-88

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	0.08	0.30	Yes	0.20	Yes
Loss Increase	0.11	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53.40	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Change	1.60	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-89

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.

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.

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-inch x 2-inch) 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.
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, be sure not to select the Durability option button at this time. 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, this time select the Durability option button when setting up the test.
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. Measurements and cleanings shall be made as follows.
18. After insertions 24, 49, 74, 99, 124, 149, 174, and 199, take measurements (be sure to select the Durability option button when setting up the measurement) after inserting the connectors on this cycle but before cleaning them.
19. 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, be sure to select the Durability option button.
20. 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, be sure to select the Durability option button.
21. If the optical criteria are not met by all of the connections after the two-sided cleaning during the 200^{th} insertion then up to two re-cleanings may be performed.
22. 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 the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-90 for a diagram of the functional configuration. See Exhibit 6-91 for a diagram of the Durability setup.

Test Setup for the Durability Test (Functional Configuration)

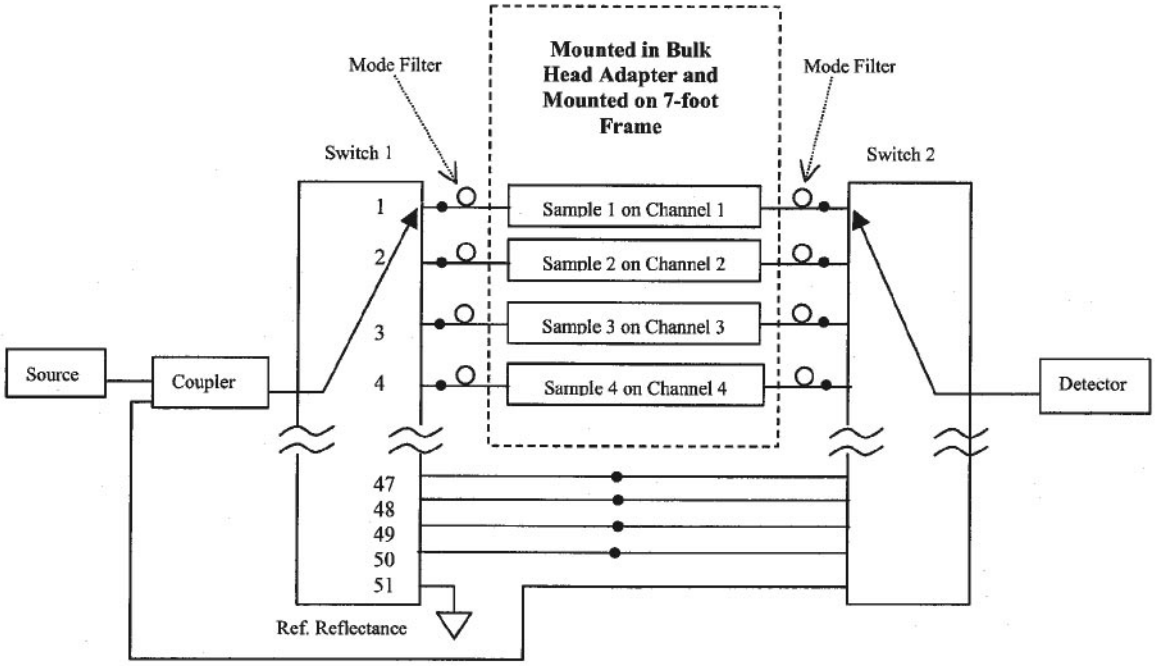


Exhibit 6-90

Setup Diagram for the Durability Test

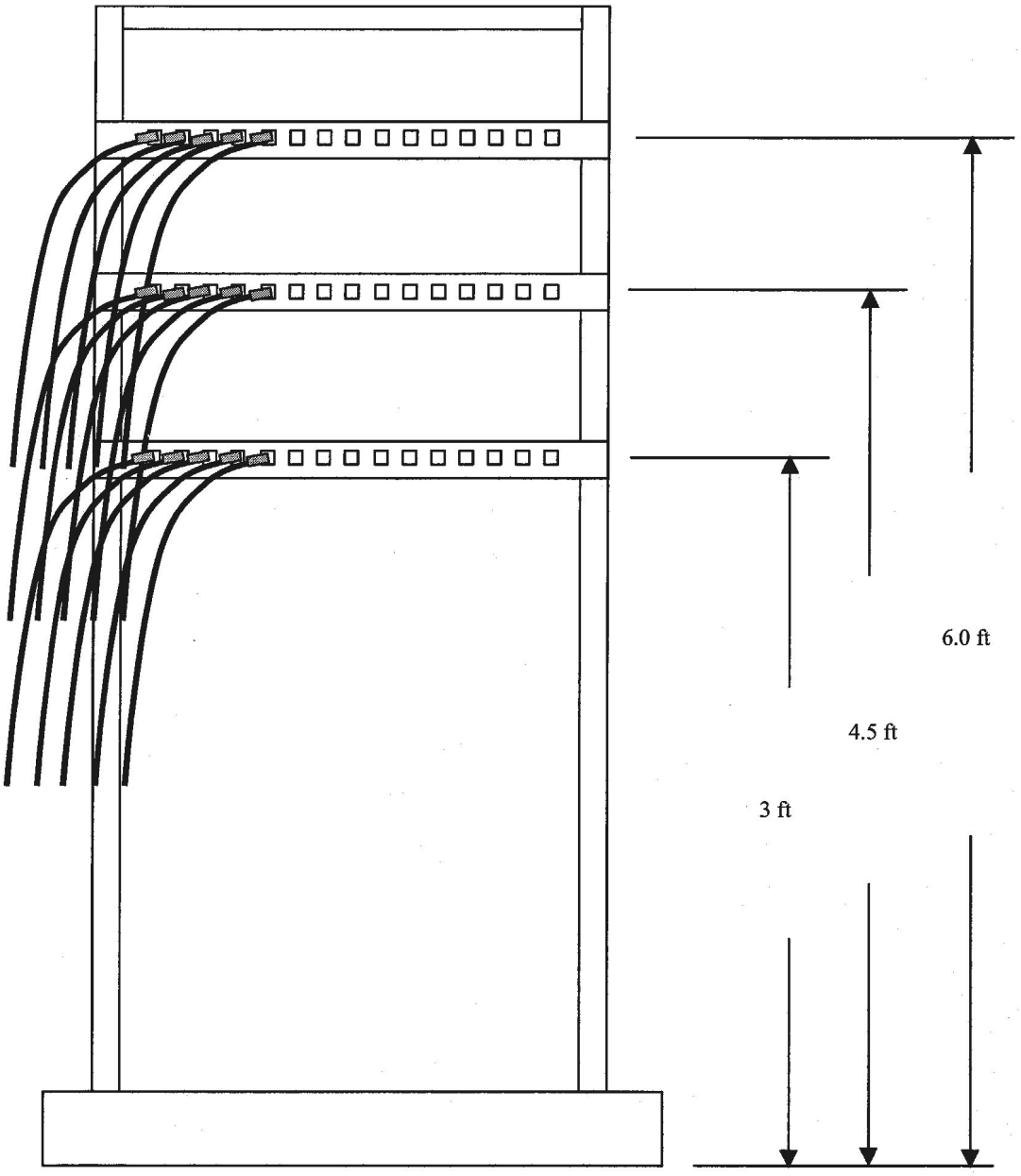


Exhibit 6-91

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **non-compliant** with Requirement **R4-39 [52]**. Of the body of measurements taken over 10 percent of the connector assemblies failed to meet the Maximum Reflectance and Reflectance Increase requirement criteria at all tested wavelengths.

The SC/PC Fiber Optic Connectors and Adapters were **non-compliant** with Objective **O4-40 [53]**. Of the body of measurements taken the connector assemblies failed the Mean Loss objective at 1310 nm and over 5 percent of the connector assemblies failed to meet the objective criteria for max loss at 1550 nm and loss increase, max reflectance, and max reflectance increase at all wavelengths after a cleaning cycle.

The SC/PC Fiber Optic Connectors and Adapters were **non-compliant** with Objective **O4-41 [54]**. Of the body of measurements taken the connector assemblies failed the Mean Loss requirement criteria at 1310 nm, and over 10 percent of the connector assemblies failed to meet the requirement criteria for max loss, loss increase, max reflectance, and reflectance increase at all wavelengths after a non-cleaning cycle.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-42 [55]**. The connector assemblies met the requirement criteria.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-43 [56]**. The connector assemblies met the objective criteria.

The SC/PC Fiber Optic Connectors and Adapters were **non-compliant** with Objective **O4-44 [57]**. Samples 1, 18 and 20 (trace labels 040, 096 and 094) were **non-compliant** with certain requirement and objective criteria after the two-sided cleaning following the 200th insertion but returned to compliance after a two-sided cleaning following the 202nd insertion.

See Exhibit 6-92 through Exhibit 6-99 for the maximum values measured during this evaluation.

Maximum Values Measured from Sample Group at 1310 nm During Test

Criteria Category	Max Values After Cleaning/Before Cleaning (dB)	Requirement, 90% Of Measurements After Cleaning		Objective/Conditional Requirement*, 95% Of Measurements After Cleaning		Objective, 90% Of Measurements Before Cleaning	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	4.05 / 7.28	0.5	Yes (96%)	0.3	Yes (96%)	0.5	No (86%)
Mean Loss	0.21 / 0.44	0.3	Yes	0.2	No	0.3	No
Loss Increase	3.93 / 7.22	0.3	Yes (96%)	0.2	No (94%)	0.3	No (83%)
Max Reflectance	-8.82 / -8.59	-40	No (87%)	-55*	No (81%)	-40	No (64%)
Reflectance Increase	51.18 / 50.36	5	No (83%)	2	No (78%)	5	No (60%)

Exhibit 6-92

Maximum Values Measured from Sample Group at 1490 nm During Test

Criteria Category	Max Values After Cleaning/Before Cleaning (dB)	Requirement, 90% Of Measurements After Cleaning		Objective/Conditional Requirement*, 95% Of Measurements After Cleaning		Objective, 90% Of Measurements Before Cleaning	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	3.83 / 5.23	0.5	Yes (96%)	0.3	Yes (96%)	0.5	No (87%)
Mean Loss	0.11 / 0.27	0.3	Yes	0.2	Yes	0.3	Yes
Loss Increase	3.78 / 5.21	0.3	Yes (96%)	0.2	No (93%)	0.3	No (83%)
Max Reflectance	-8.65 / -8.47	-40	No (88%)	-55*	No (83%)	-40	No (65%)
Reflectance Increase	46.35 / 46.53	5	No (85%)	2	No (85%)	5	No (61%)

Exhibit 6-93

Maximum Values Measured from Sample Group at 1550 nm During Test

Criteria Category	Max Values After Cleaning/Before Cleaning (dB)	Requirement, 90% Of Measurements After Cleaning		Objective/Conditional Requirement*, 95% Of Measurements After Cleaning		Objective, 90% Of Measurements Before Cleaning	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	3.85 / 4.73	0.5	Yes (96%)	0.3	No (94%)	0.5	No (85%)
Mean Loss	0.13 / 0.29	0.3	Yes	0.2	Yes	0.3	Yes
Loss Increase	3.73 / 4.67	0.3	Yes (95%)	0.2	No (94%)	0.3	No (80%)
Max Reflectance	-8.75 / -9.76	-40	No (88%)	-55*	No (83%)	-40	No (65%)
Reflectance Increase	51.25 / 49.96	5	No (84%)	2	No (78%)	5	No (60%)

Exhibit 6-94

Maximum Values Measured from Sample Group at 1625 nm During Test

Criteria Category	Max Values After Cleaning/Before Cleaning (dB)	Requirement, 90% Of Measurements After Cleaning		Objective/Conditional Requirement*, 95% Of Measurements After Cleaning		Objective, 90% Of Measurements Before Cleaning	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	3.68 / 4.35	0.5	Yes (96%)	0.3	Yes (95%)	0.5	No (88%)
Mean Loss	0.1 / 0.25	0.3	Yes	0.2	Yes	0.3	Yes
Loss Increase	3.63 / 4.33	0.3	Yes (95%)	0.2	No (94%)	0.3	No (83%)
Max Reflectance	-10.85 / -7.3	-40	No (84%)	-55*	No (84%)	-40	No (65%)
Reflectance Increase	44.15 / 47.7	5	No (86%)	2	No (85%)	5	No (61%)

Exhibit 6-95

Maximum Value Measured from Sample Group at 1310 nm After Test

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	0.07	0.30	Yes	0.20	Yes
Loss Increase	0.07	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-53.78	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Increase	3.80	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-96

Maximum Value Measured from Sample Group at 1490 nm After Test

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, 0N)
Mean Loss	0.06	0.30	Yes	0.20	Yes
Loss Increase	0.15	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-55.00	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Increase	0.00	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-97

Maximum Value Measured from Sample Group at 1550 nm After Test

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement*	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Max Loss	0.30	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	-55.92	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Increase	2.11	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-98

Maximum Value Measured from Sample Group at 1625 nm After Test

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	0.03	0.30	Yes	0.20	Yes
Loss Increase	0.12	0.30	Yes (25 Y, 0 N)	0.20	Yes (25 Y, 0 N)
Max Reflectance	-54.42	-40	Yes (25 Y, 0 N)	-55*	Yes (25 Y, 0 N)
Reflectance Increase	0.58	5	Yes (25 Y, 0 N)	2	Yes (25 Y, 0 N)

Exhibit 6-99

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

Failure History:

Samples 1, 18, and 20 (trace labels 040, 096, and 094) were **non-compliant** with loss and reflectance requirement criteria after the two-sided cleaning following the 200th insertion but returned to compliance after a two-sided cleaning following the 202nd insertion.

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.

Test Method:

1. After completing the Durability Test, the End of Test Criteria shall be conducted on the same set of connectors.
2. Verify the data taken in the previous test by opening Excel and opening the Durab.xls file in the project folder on the J:\ drive.
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. Be sure to select the EOTC (End of Test Criteria) option button when setting up the test.
5. Once the loss and reflectance measurements have been performed. 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.
6. Cutback measurements will be performed on the jumper assemblies at the End of Test.
7. For the Ferrule Endface Geometry Requirements, refer to the GR-326-CORE Work Instruction for Section 4.4.5.
8. For the Damage Criteria, refer to the GR-326-CORE Work Instruction for Section 4.2.

Configuration and Conditions:

The connector assemblies will be visually inspected. The endface geometry measurements will be performed, and optical measurements will be taken. See the **PRODUCT CONFIGURATION** section in Part 3 for details and Exhibit 6-100 for a diagram of the setup for the End of Test Criteria.

Test Setup for the End of Test Criteria

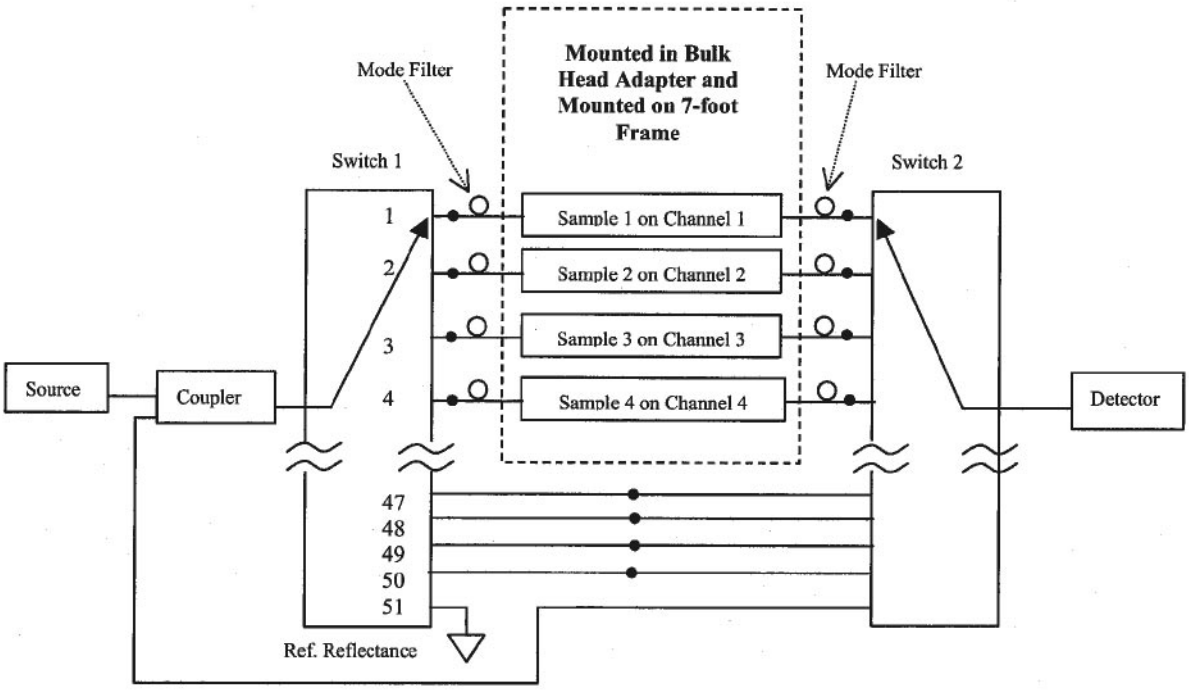


Exhibit 6-100

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-45 [58]**.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-46 [59]**.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-47 [60]**. See Exhibit 6-105 for details.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-48 [61]**. The test samples exhibited no permanent damage at the conclusion of testing.

See Exhibit 6-101 through Exhibit 6-105 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	0.27	0.50	Yes (25Y, 0N)	0.30	Yes (25Y, 0N)
Mean Loss	0.11	0.30	Yes	0.20	Yes
Max Reflectance	-55.18	-40	Yes (25Y, 0N)	-55*	Yes (25Y, 0N)
Reflectance Change	1.92	5	Yes (25Y, 0N)	2	Yes (25Y, 0N)

Exhibit 6-101

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 (25Y, 0N)	0.30	Yes (25Y, 0N)
Mean Loss	0.08	0.30	Yes	0.20	Yes
Max Reflectance	-54.32	-40	Yes (25Y, 0N)	-55*	Yes (25Y, 0N)
Reflectance Change	0.68	5	Yes (25Y, 0N)	2	Yes (25Y, 0N)

Exhibit 6-102

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	0.13	0.50	Yes (25Y, 0N)	0.30	Yes (25Y, 0N)
Mean Loss	0.08	0.30	Yes	0.20	Yes
Max Reflectance	-57.50	-40	Yes (25Y, 0N)	-55*	Yes (25Y, 0N)
Reflectance Change	1.60	5	Yes (25Y, 0N)	2	Yes (25Y, 0N)

Exhibit 6-103

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	0.18	0.50	Yes (25Y, 0N)	0.30	Yes (25Y, 0N)
Mean Loss	0.08	0.30	Yes	0.20	Yes
Max Reflectance	-53.81	-40	Yes (25Y, 0N)	-55*	Yes (25Y, 0N)
Reflectance Change	1.19	5	Yes (25Y, 0N)	2	Yes (25Y, 0N)

Exhibit 6-104

Maximum Values Measured From Sample Group

Criteria Category	Max/Min Values	Requirement	
		Criteria	Criteria Met?
Fiber Extension (**R4-67**)	22.3 / -76.5	-125 to 50 nm	Yes (50Y, 0N)
Ferrule Endface Radius (**R4-68**)	24.29 / 14.46	7 to 25 mm	Yes (50Y, 0N)
Apex Offset (**R4-69**)	41.53 / 3.75	< 50 µm	Yes (50Y, 0N)

Exhibit 6-105

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

Failure History:

There were no failures during the course of this evaluation.

MATERIALS AND ENVIRONMENTAL TESTS (4.4.4)

ADHESIVE TESTING (4.4.4.2)

Criteria:

R4-54 [67] 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).

Test Conditions:

Temperature: 65°C
Humidity: Uncontrolled

Sample Group: Five ceramic blanks

Test Method:

1. The customer must provide five ceramic blanks as described in Section 4.4.4.2, *Adhesive Testing*, and Section 5.3.6, *Adhesive Test*, in GR-326-CORE, Issue 3.
2. Five fresh connector plugs must be used for this test.
3. Initial plug endface geometry must meet the criteria for fiber undercut/protrusion, ferrule endface radius, and apex offset as stated in Section 4.4.5.1, *Ferrule Endface Geometry for Non-Angled Physical Contact Connectors*, and Section 4.4.5.2, *Endface Geometry Requirements for Angled Physical Contact (APC) Connectors*. See the work instruction for the geometrical measurements for detailed procedures on these taking these measurements.
4. After the initial endface geometry measurements are taken, each plug is secured in an environmental chamber. A sleeve guide is put over the ferrule and a ceramic blank is inserted in the sleeve guide so that it contacts the ferrule.
5. A two-pound load is applied to each plug under test via the ceramic blank.
6. With the plug loaded, the chamber temperature is increased to 65°C and held at 65°C for 7 days. See Exhibit 6-106 for a plot of the temperature exposure. See Exhibit 6-108 for a diagram of the Adhesive Test fixture.
7. After the exposure, the loads are removed and final endface geometry measurements are taken.
8. The endface geometry measurements should be within the tolerances allowed by the Fiber Undercut and Protrusion Requirement as stated in Section 4.4.5.1 and Section 4.4.5.2.

Adhesive Test Profile

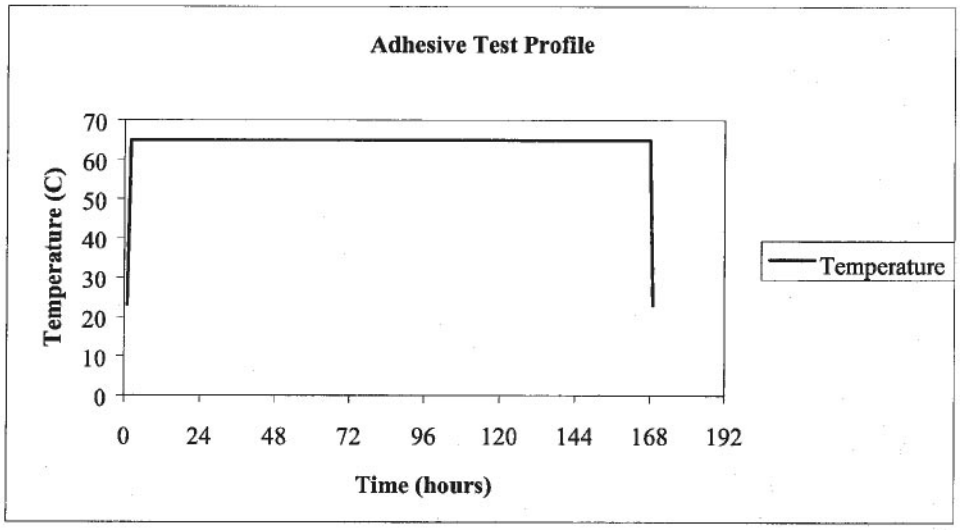


Exhibit 6-106

Adhesive Test Fixture

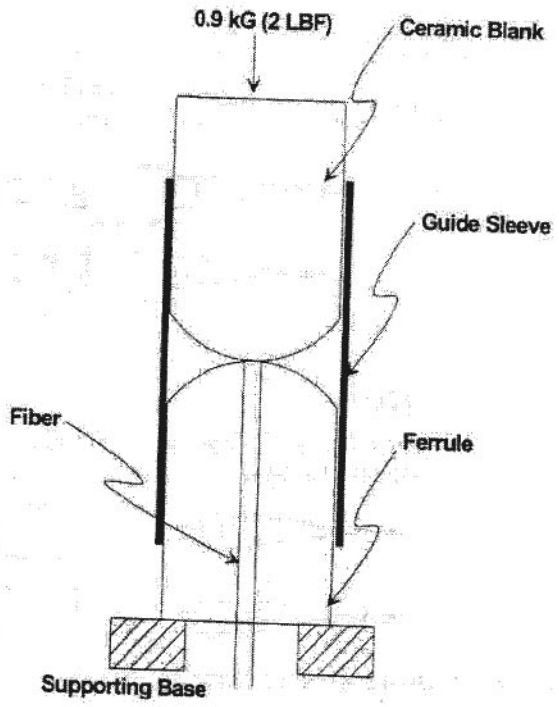


Exhibit 6-107

Configuration and Conditions:

The connector assemblies will be placed in an environmental chamber during the course of this evaluation. No optical measurements will be taken.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-54**.

See Exhibit 6-108 and Exhibit 6-109 for the maximum values measured before and after the test.

Maximum Values Measured From Sample Group Before Testing

Criteria Category	Min/Max Values	Requirement	
		Criteria	Criteria Met?
Fiber Extension	-18.6/-35.9	-125 to 50 nm	Yes (5 Y, 0 N)
Ferrule Endface Radius	20.41/14.36	7 to 25 mm	Yes (5 Y, 0 N)
Apex Offset	27.9/5.19	< 50 µm	Yes (5 Y, 0 N)

Exhibit 6-108

Maximum Values Measured From Sample Group After Testing

Criteria Category	Min/Max Values	Requirement	
		Criteria	Criteria Met?
Fiber Extension	-32.2/ -69.4	-125 to 50 nm	Yes (5 Y, 0 N)
Ferrule Endface Radius	20.71/14.51	NA	NA
Apex Offset	24.77/12.18	NA	NA

Exhibit 6-109

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

Failure History:

There were no failures during the course of this evaluation.

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):	≤ 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. Clean the endface of the Mapped Reference Connector and place it in the connector holder on the front of the interferometer.
4. Select the "ZX-1 Control" button.
5. Optimize the image focus and illumination, do this by using the front knobs and the source slide button on the computer screen.
6. Be sure that the interferometer is at maximum zoom by selecting the "In Arrow."
7. Select "Go to Inspect."
8. Once again, optimize the image focus and illumination. Do this by using the front knobs and the source slide button on the computer screen. To ensure that you have the correct setting, increase the intensity until the display starts changing to red and then decrease the intensity until there are no more red pixels visible. Select <OK.>
9. Passwords – Level 1 = Dorc1, Level 2 = Dorc2
10. Select the "Go to Fringe" button. Adjust the focus micrometer slightly, high contrast fringes should be obtained. Select OK. Again, you will be asked for the same passwords in Step 9.
11. Select the Setup icon. Select the Instrument Setup tab. Select the Calibrate PZT button. After the calibration is complete, select OK. Enter passwords when prompted.

12. Once the system is calibrated, measurements need to be performed on the Mapped Reference Connector to verify the performance of the interferometer and to confirm the calibration of the reference mirror.
13. Before making the measurements, be sure that the fitting regions being used are correct. 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. Once these values have been found, print them out. Double check that the correct Fitting Regions are being used by selecting the "Setup" icon and selecting the "PC Tab." The Fitting Regions will appear on the far right, verify that they are correct, if they are not, change accordingly and select "Apply." Next, go to the "Auto Tab." Then, select the "History File" button. At this time, enter the project number such as 001234Fo001MRC. This is what the file will be named when saved. Then, select "OK."
14. Using the Mapped Reference Connector, take a series of 25 measurements.
15. Before the measurements can be made, be sure to adjust the focus to obtain high contrast fringes as shown in Exhibit 6-111.
16. When taking the measurements, be sure that the Apex Offset (it will be the smallest black circle on the ferrule endface) is rotated to approximately 0°, 90°, 180°, and 270° for every measurement made. For instance, the first measurement will be made at approximately 0°, the second measurement will be made at approximately 90°, the third measurement will be made at approximately 180°, the fourth measurement will be made at approximately 270°, and so on. Continue rotating the sample 90° after every measurement until all of the measurements have been made.
17. After taking 25 measurements at 4 different angles, take 25 measurements with the connector in the same position.
18. After all of the Mapped Reference Connector Measurements have been made, look in the C:\DORC\Results folder under the name that the file was saved under in Step 13.
19. Verify the data. Look at the maximum, minimum, average, and standard deviation values for the Apex Offset, Radius of Curvature, and the Spherical Fiber Height columns.
20. Verify that the tolerances of the measurements are within the following:
21. Radius of Curvature: ±0.5 mm, Apex Offset: ±2 µm, Fiber Height: ±7 nm, Diameter: ±0.3 µm.
22. If the difference in the Apex Offset is more than specified in Step 19, the reference mirror needs to be re-calibrated. Use the Mapped Reference Connector to re-calibrate with the Apex Offset measured in 90° intervals as described above. This will ensure the magnitude of the adjustment for the Rx and Ry adjusters as shown in Exhibit 6-110.

Reference Mirror Adjustment

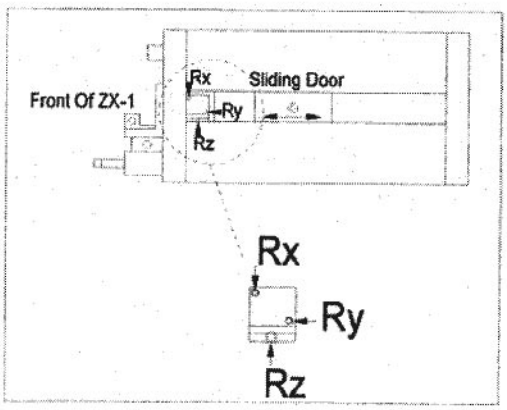


Exhibit 6-110

23. Start the measurement process by taking a measurement of the Mapped Reference Connector with the Apex positioned at approximately 0°, be sure that the focus has been adjusted to obtain high contrast fringes as shown in Exhibit 6-111. Write down the Apex Offset measurement taken, as we will be referring to this value after the next measurement. Rotate the connector 180° and take another set of measurements.
24. Look at the Apex Offset value recorded for the 180° measurement and compare it the Apex Offset value recorded for the 0°.
25. If these two values vary by more than 2 µm, adjust the Ry (Exhibit 6-110) knob accordingly (turn the knob slight amounts each time, remember, the measurements are being made in micrometers).
26. Once the adjustments have been made, repeat Steps 21 and 22. If the Apex is still outside the allowable range, repeat Step 23.
27. Continue this process until the Apex values at 0° and at 180° are within 2 µm of each other.
28. After adjusting the Ry knob (y axis) shown in Exhibit 6-110, the same shall be done for the Rx knob (x axis) shown in Exhibit 6-110. Repeat Steps 21 through 24 for the x axis.
29. Instead of making measurements at 0° and 180°, make measurements at 90° and 270°, hence, x axis.
30. Instead of adjusting the Ry knob, use the Rx knob for the slight adjustments.
31. This completes the re-calibration process for the Apex Offset.
32. If the difference in the diameter measurements exceeds the values in Step 19. Perform the following procedure:
33. Place the Mapped Reference Connector in the connector holder.
34. Choose Inspection Mode and adjust the Rz (Exhibit 6-110) knob for a sharp focus on the fiber perimeter.
35. Return to Fringe Mode and if necessary adjust the Rz (Exhibit 6-110) knob to obtain high contrast fringes as shown in Exhibit 6-111.
36. Verify the intensity settings as described in Step 8.
37. This completes the re-calibration process for the Diameter measurements.
38. Before starting the test on the project samples, be sure to rename the history file as it was done in Step 13 but leave off the MRC (Mapped Reference Connector).

39. Place the first sample in the connector holder and adjust the focus to obtain high contrast fringes as shown in Exhibit 6-111. Type in the sample number in the label field, for example, 1a or 1b (since there are two sides for each sample, you will need to label them #a or #b).
40. Select the right mouse button and the measurements will be performed.
41. Be sure to complete the geometrical measurements for **both sides** of the connector assembly.

Diagram of High Contrast Fringes

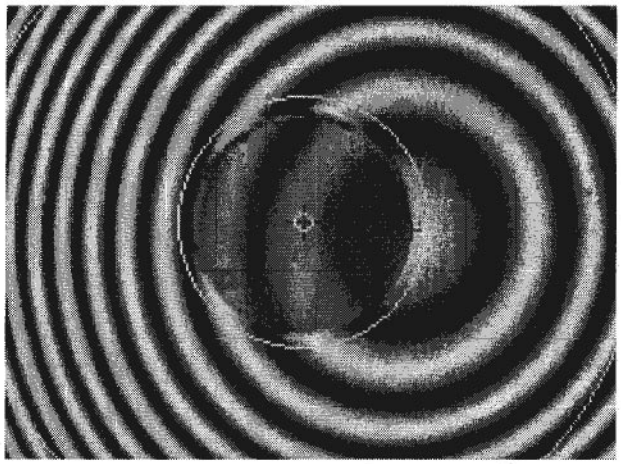


Exhibit 6-111

Configuration and Conditions:

The connector assemblies will remain operational during the course of this evaluation. See the **PRODUCT CONFIGURATION** section in Part 3 for details.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirements **R4-67, R4-68,** and **R4-70**.

See Exhibit 6-112 for the maximum values measured during this evaluation.

Maximum Values Measured From Sample Group

Criteria Category	Min/Max Values	Requirement	
		Criteria	Criteria Met?
Fiber Extension	32.2 /-41.4	-125 to 50 nm	Yes (82 Y, 0 N)
Ferrule Endface Radius	24.49/14.02	7 to 25 mm	Yes (82 Y, 0 N)
Apex Offset	41.31/2.73	< 50 µm	Yes (82 Y, 0 N)

Exhibit 6-112

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

Failure History:

There were no failures during the course of this evaluation.

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 were correct as of July 12, 2002. Please verify at time of test.

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 and selecting the "PC Tab."
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 6-113 for a diagram of the fitting regions.

Fitting Regions

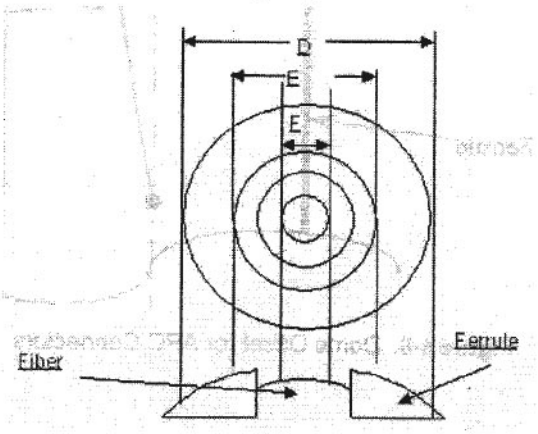


Exhibit 6-113

Configuration and Conditions:

Not Applicable

Test Results:

The SC/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=205 µm, 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 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.

Test Conditions:

Temperature: 23 ± 2°C
Humidity: 50% RH

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 is good to use 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 panel.

Diagram of Connector Installation Test

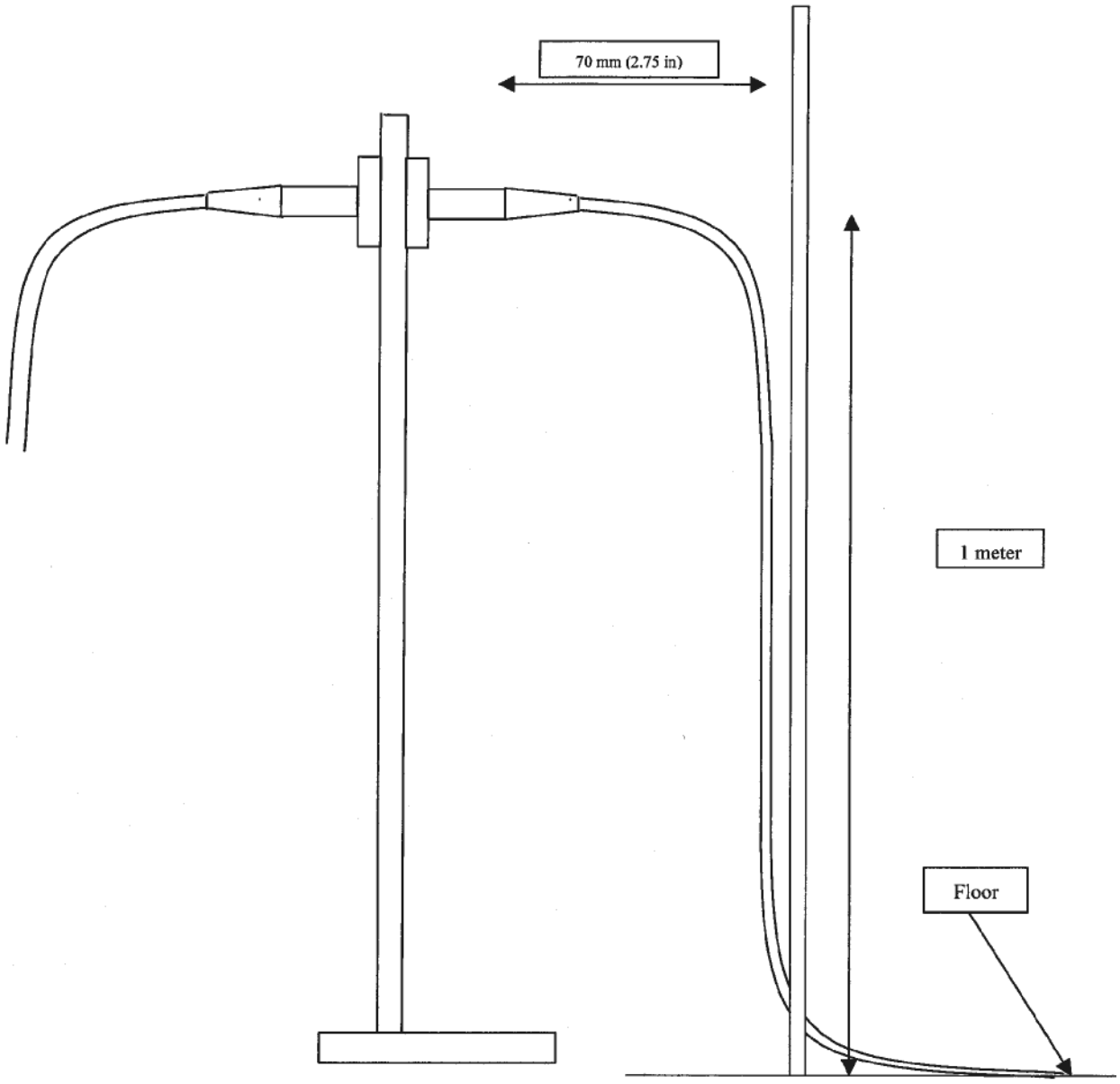


Exhibit 6-114

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 switch software, select the "Conins" option button. Enter the project number and channels to be tested. Finally, select <OK>.
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 the "Conins" option button. Enter the project number and channels to be tested. Finally, select <OK>.

8. Once the measurements have finished, open Excel. Then look in the project folder. Open the "conins.txt" file in Excel format.
9. Calculate the increase in loss by subtracting the initial loss and reflectance measurement at 1550 nm from the final loss and reflectance measurement at 1550 nm.
10. If the loss increase exceeds the requirement, notify the customer. Once a resolution has been resolved, proceed with testing.
11. 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.
12. 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.
13. Measure the length of the installed connector in order to determine compliance with Objective **O4-75**.
14. 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. See the **PRODUCT CONFIGURATION** section in Part 3 for details.

Test Results:

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Requirement **R4-72 [224]** and Objective **O4-73 [83]**. The maximum loss increase was 0.08 dB.

Conditional Requirement **CR4-74 [225]** was **not applicable** to the SC/PC Fiber Optic Connectors and Adapters. The SC/PC Fiber Optic Connectors and Adapters did not have right angle boots.

The SC/PC Fiber Optic Connectors and Adapters were **compliant** with Objective **O4-75 [226]**. The maximum boot length was 69.0 mm (2.72 in).

See Exhibit 6-115 for the maximum values measured during this evaluation.

Maximum Value Measured from Sample Group

Criteria Category	Max Values (dB)	Requirement		Objective/Conditional Requirement*	
		Criteria (dB)	Criteria Met?	Criteria (dB)	Criteria Met?
Loss Increase 1310 nm	0.02	0.20	Yes (25 Y, 0 N)	0.10	Yes (25 Y, 0 N)
Loss Increase 1490 nm	0.07	0.20	Yes (25 Y, 0 N)	0.10	Yes (25 Y, 0 N)
Loss Increase 1550 nm	0.05	0.20	Yes (25 Y, 0 N)	0.10	Yes (25 Y, 0 N)
Loss Increase 1625 nm	0.10	0.20	Yes (25 Y, 0 N)	0.10	Yes (25 Y, 0 N)

Exhibit 6-115

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

Failure History:

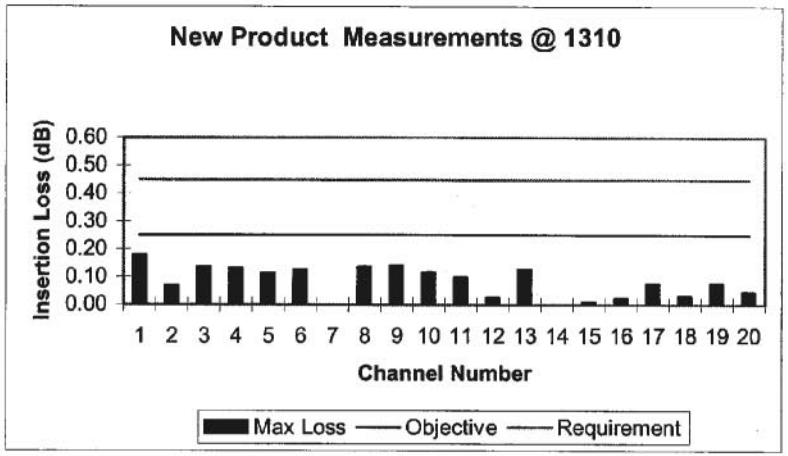
There were no failures during the course of this evaluation.

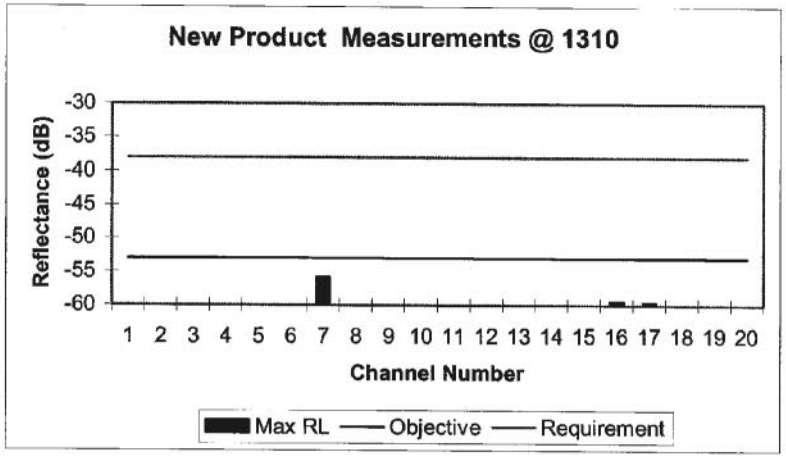
APPENDIX A

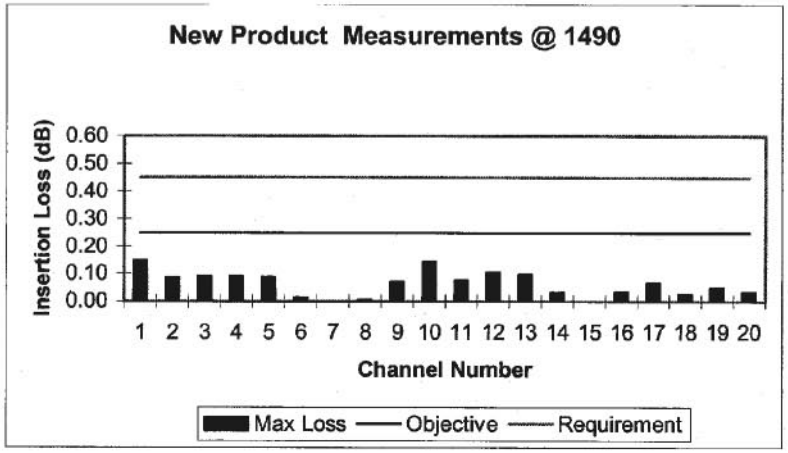
TEST DATA

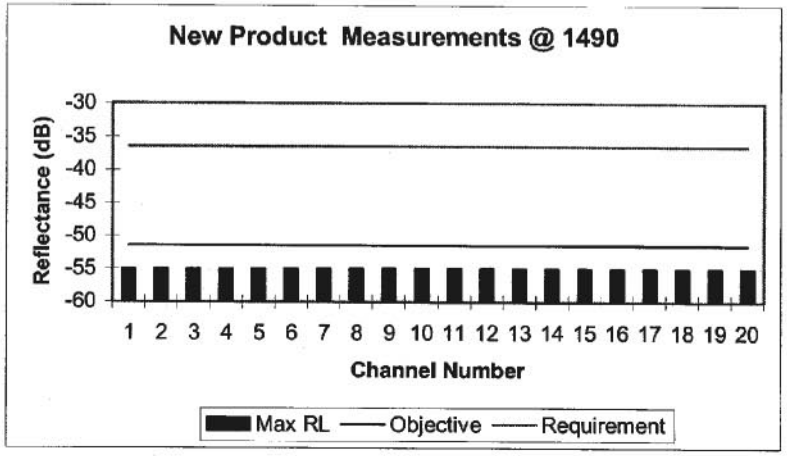
GRAPHICAL DATA BY TEST

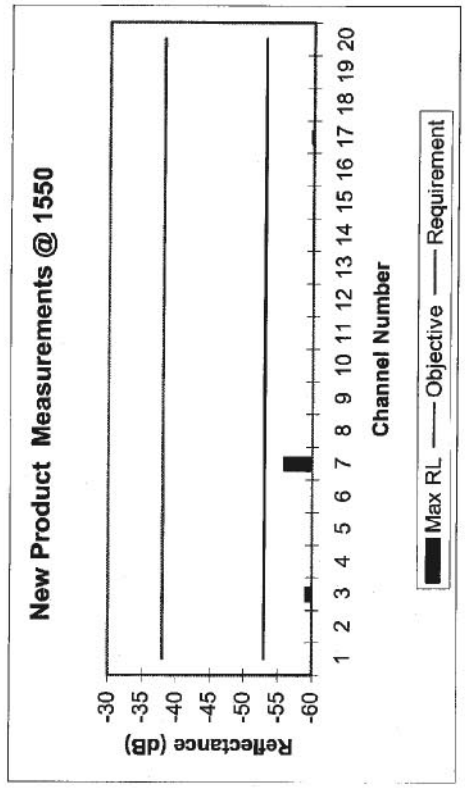
Section 4.4.1 Performance of New Product

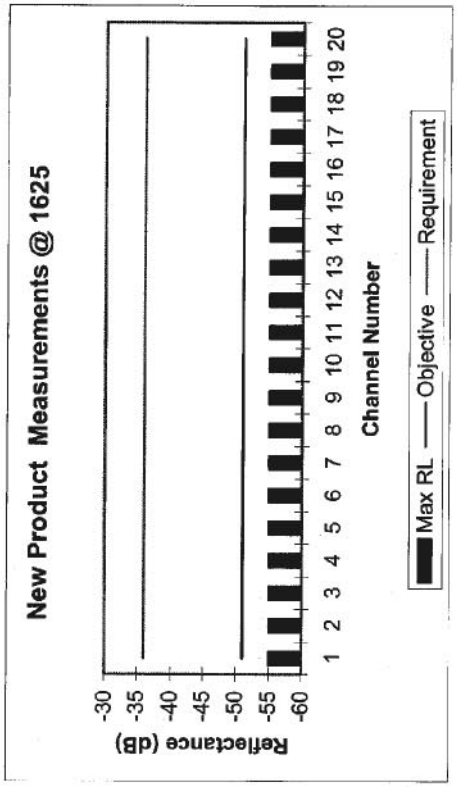


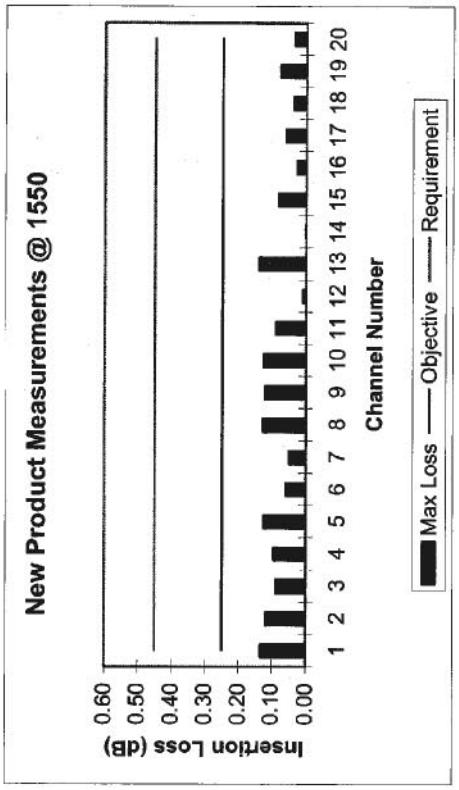


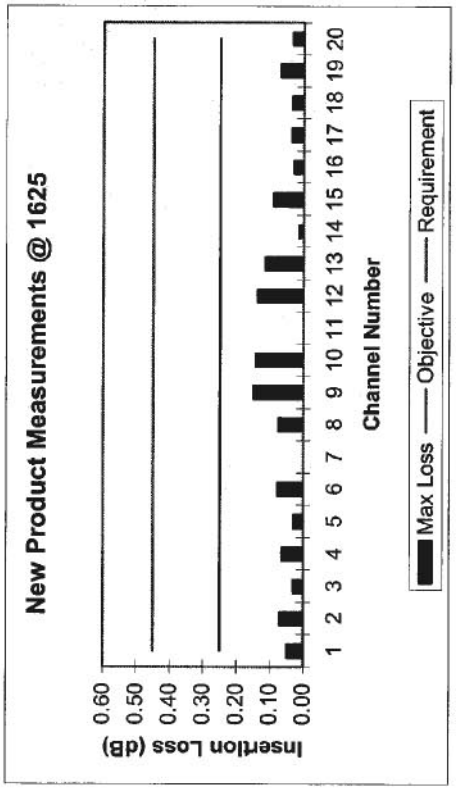




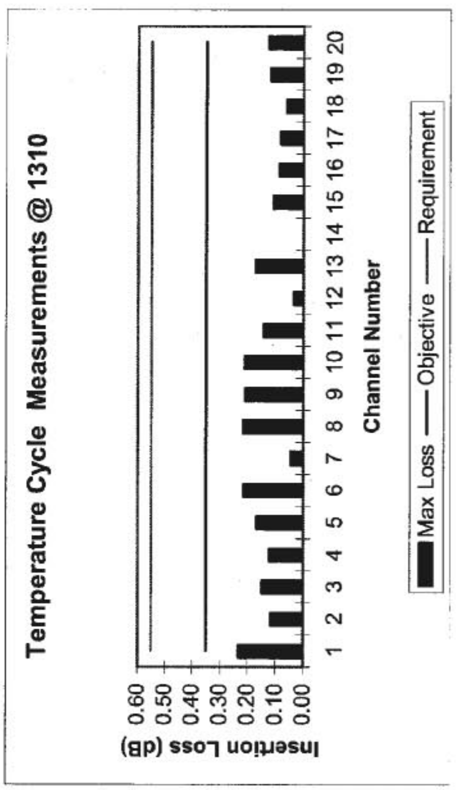

New Product Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

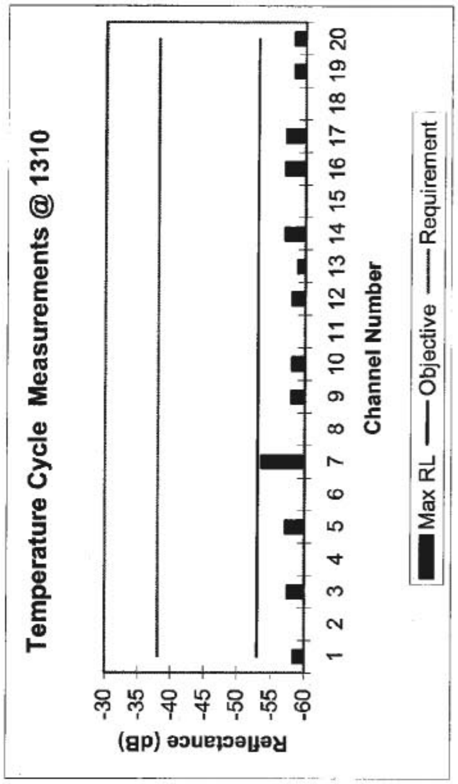

New Product Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

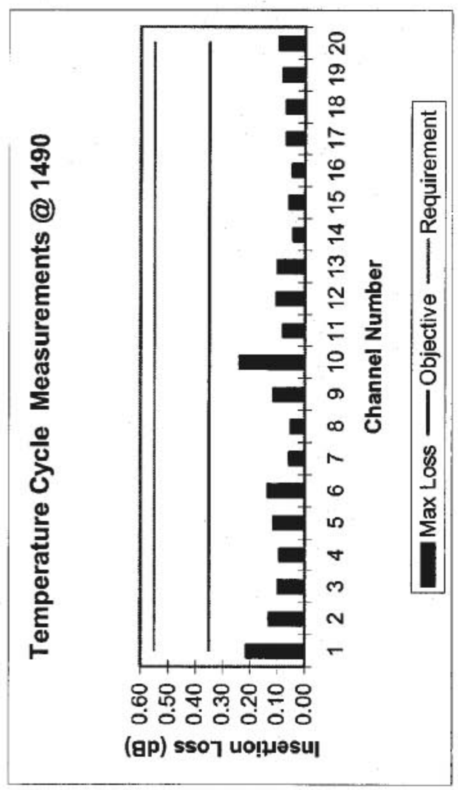

New Product Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

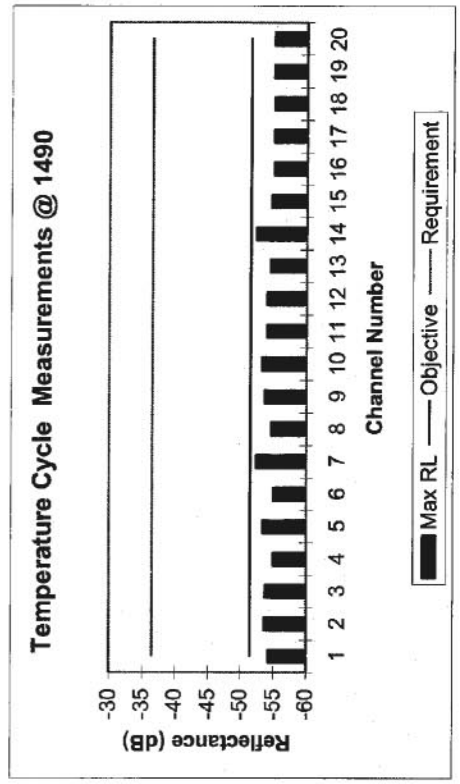

New Product Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

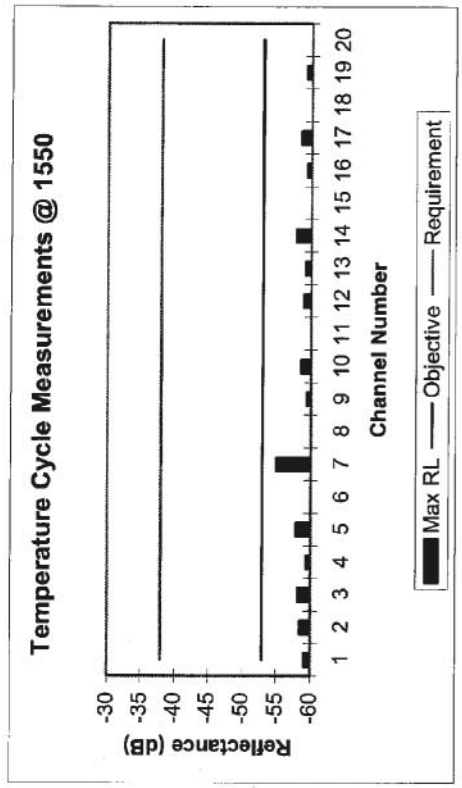
Section 4.4.2.2 Thermal Cycle Test

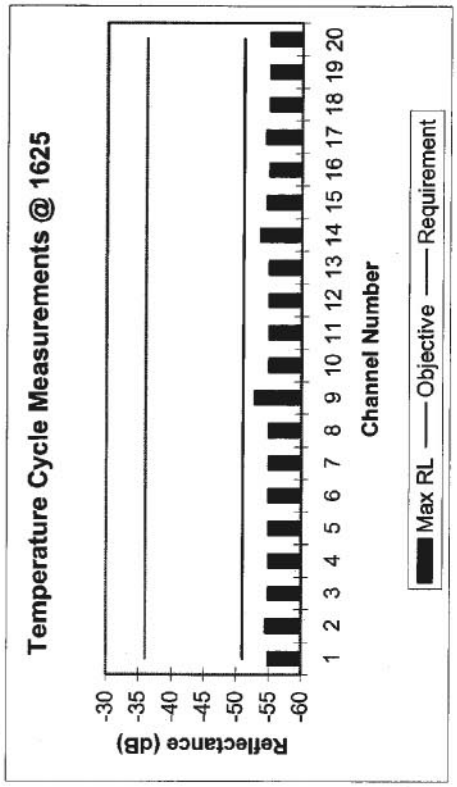


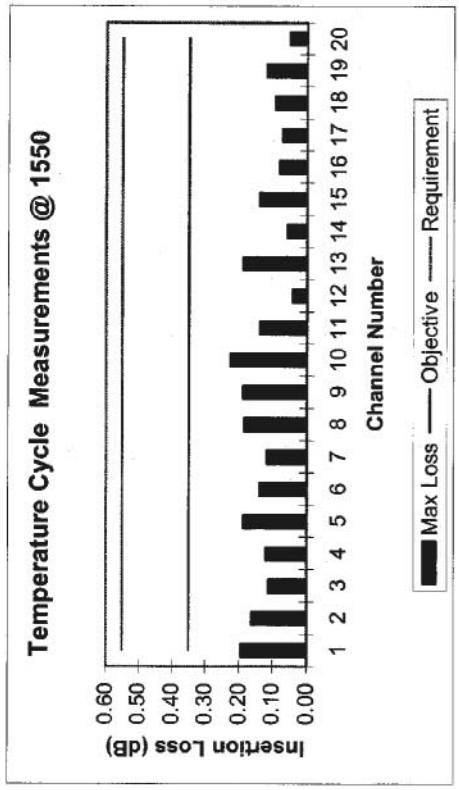


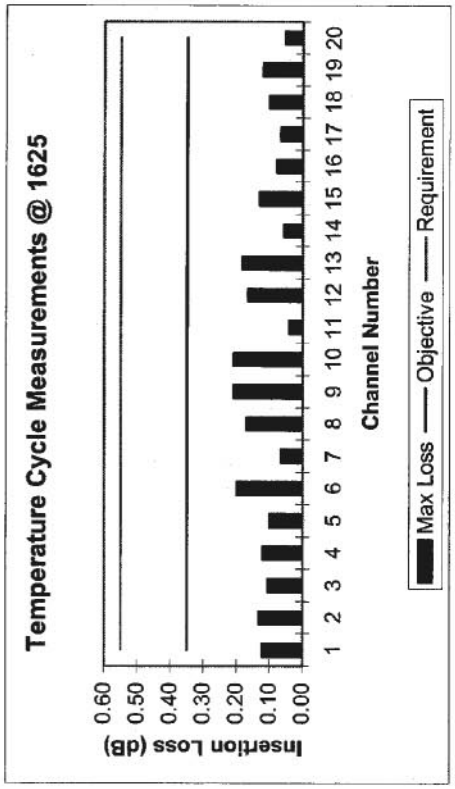




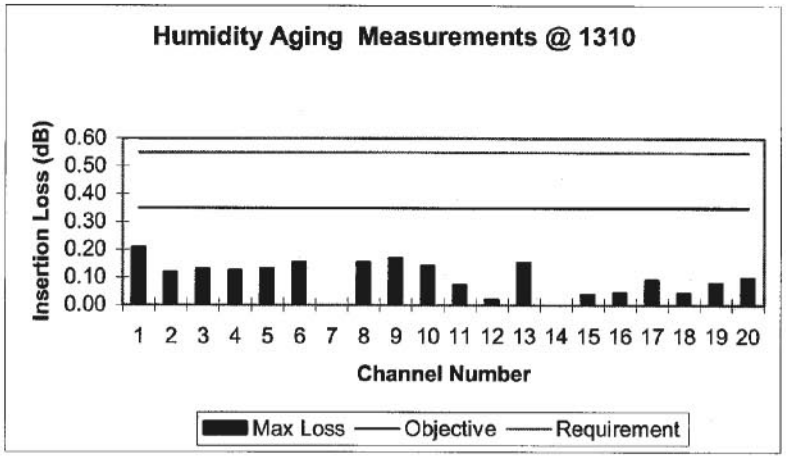

Temperature Cycle Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

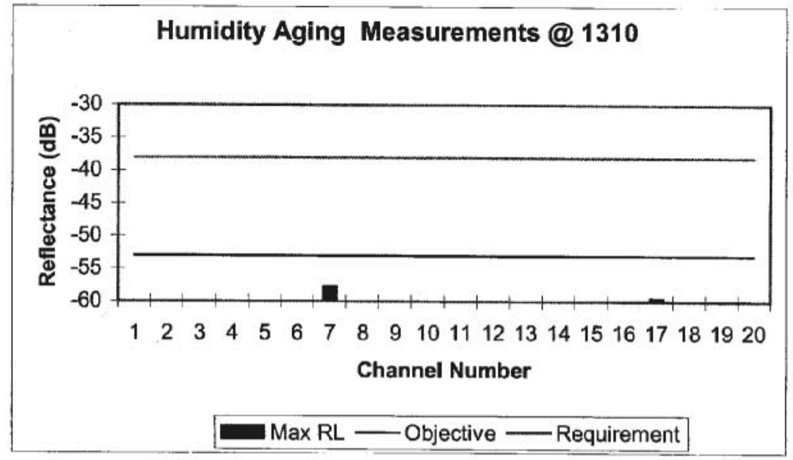

Temperature Cycle Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

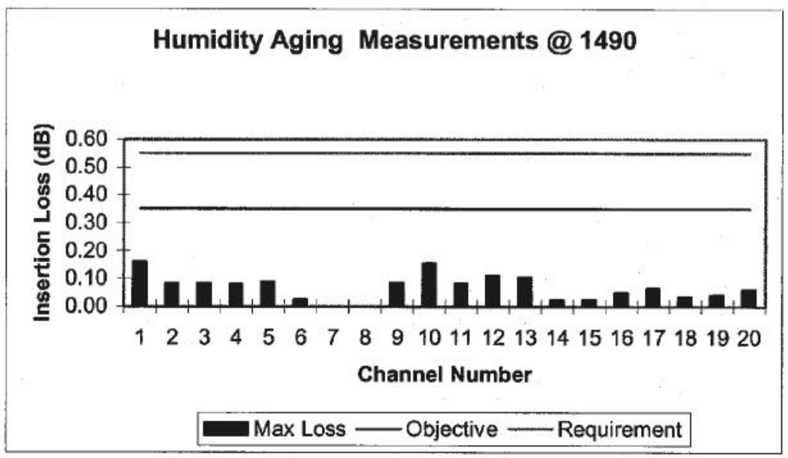

Temperature Cycle Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

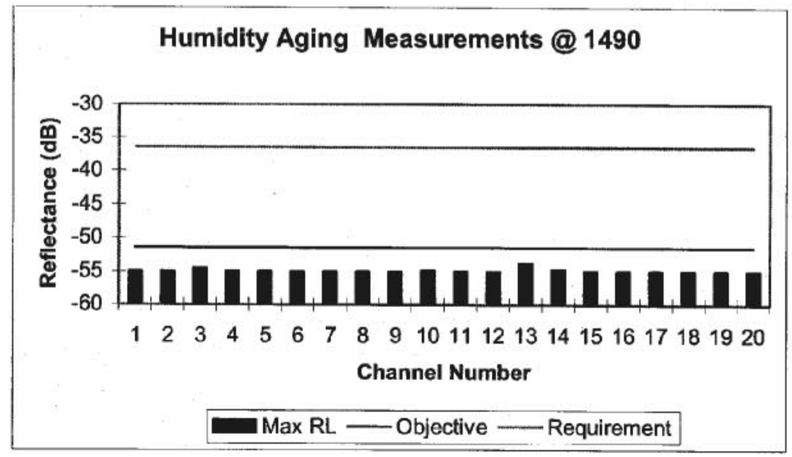

Temperature Cycle Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

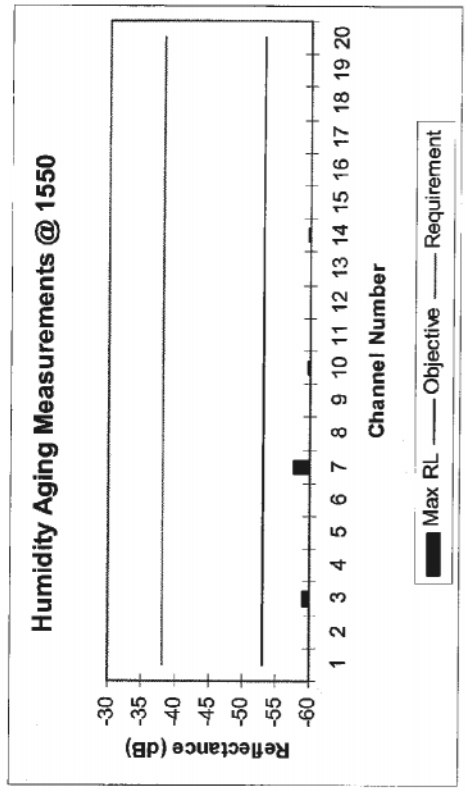
Section 4.4.2.3 Humidity Aging Test

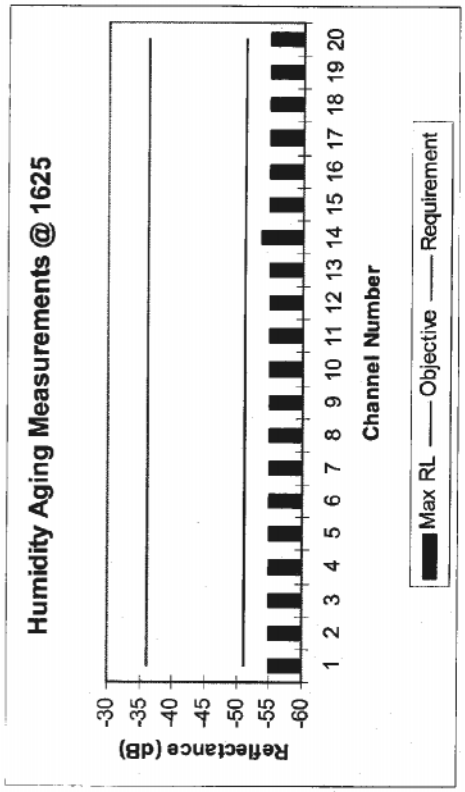


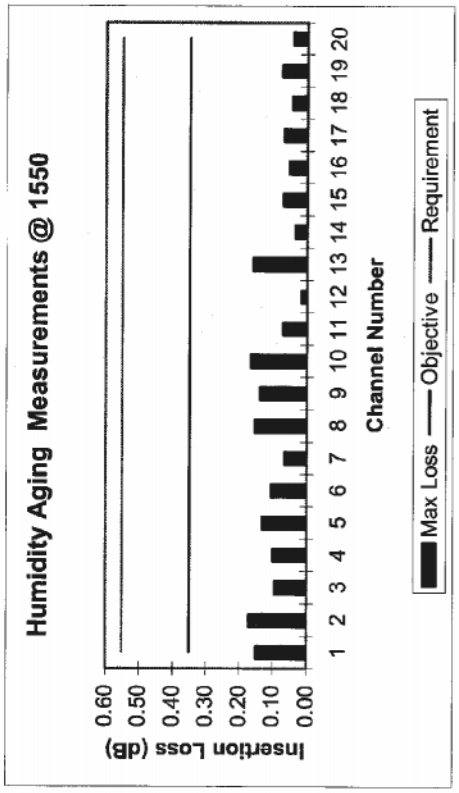


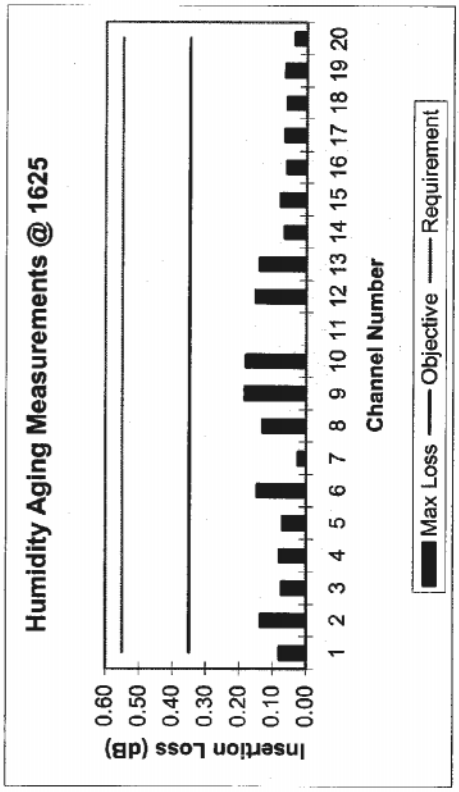




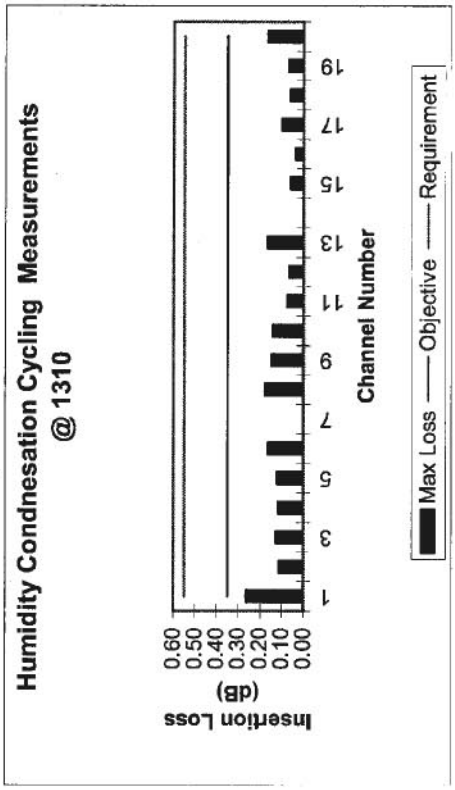

Humidity Aging Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

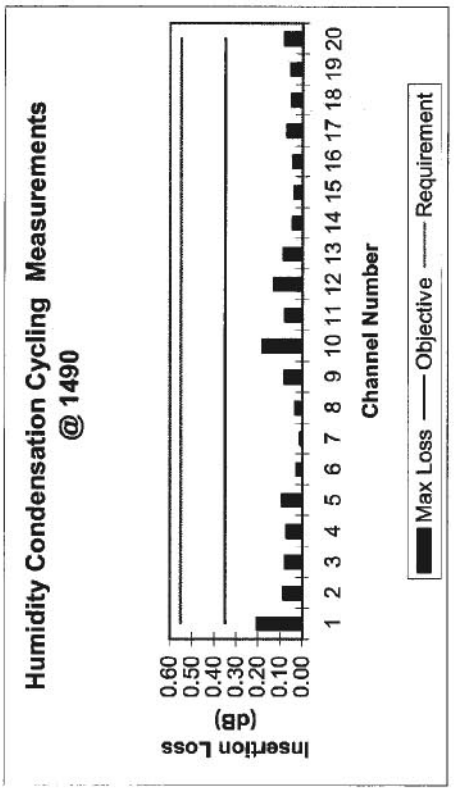

Humidity Aging Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

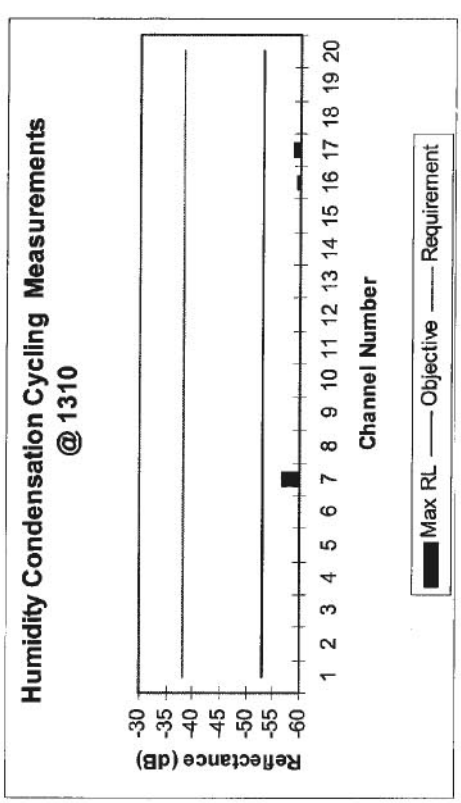

Humidity Aging Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

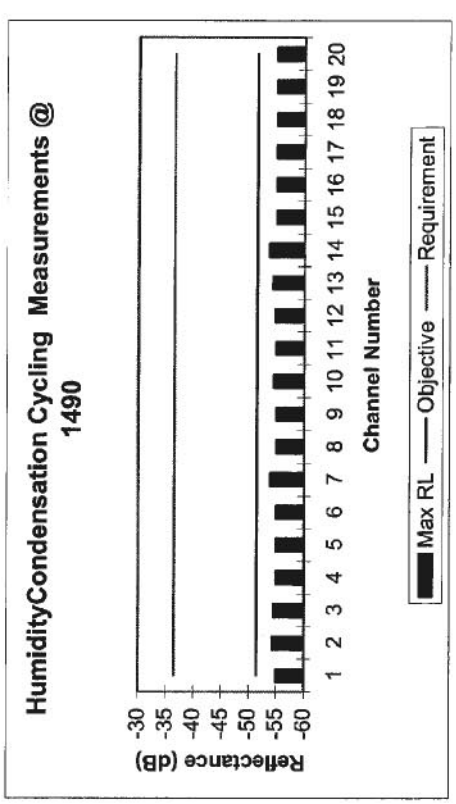

Humidity Aging Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

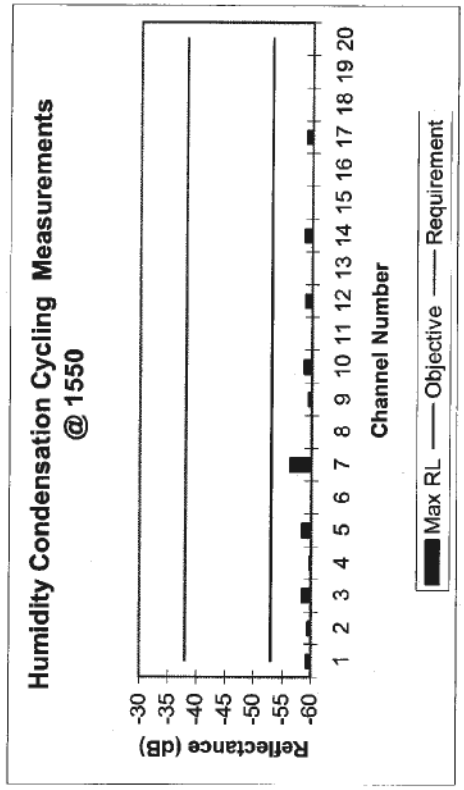
Section 4.4.2.4 Humidity/Condensation Cycling Test

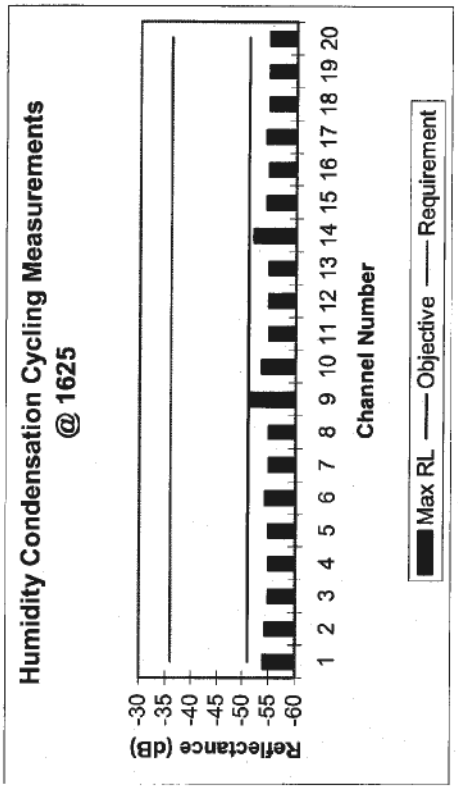


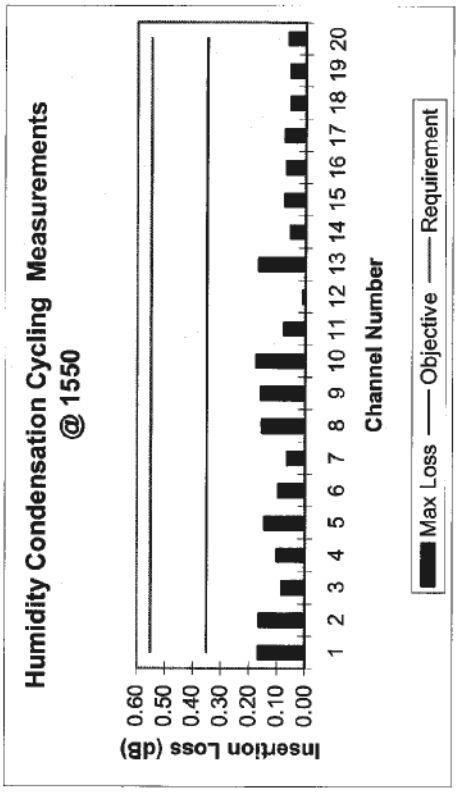


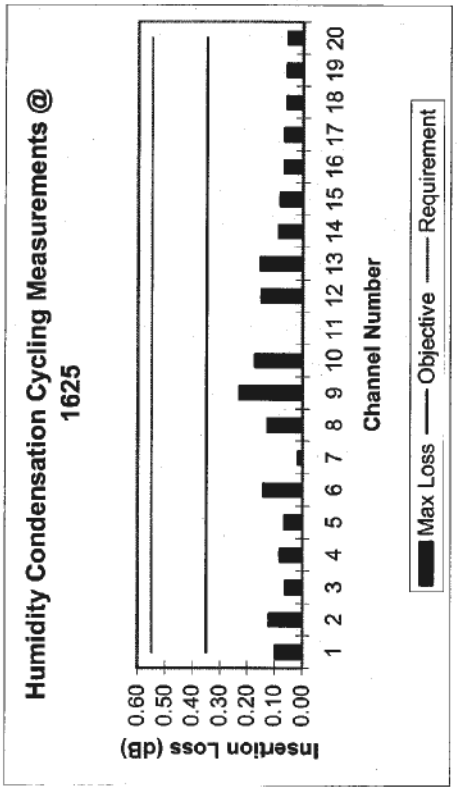




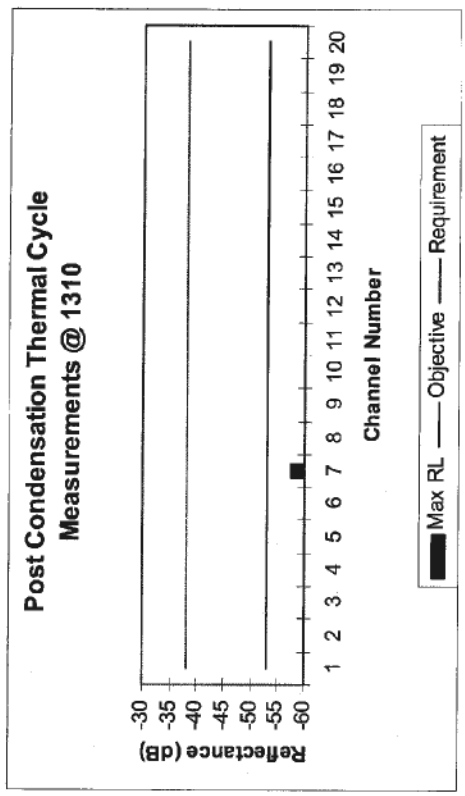

Humidity Condensation Cycling Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

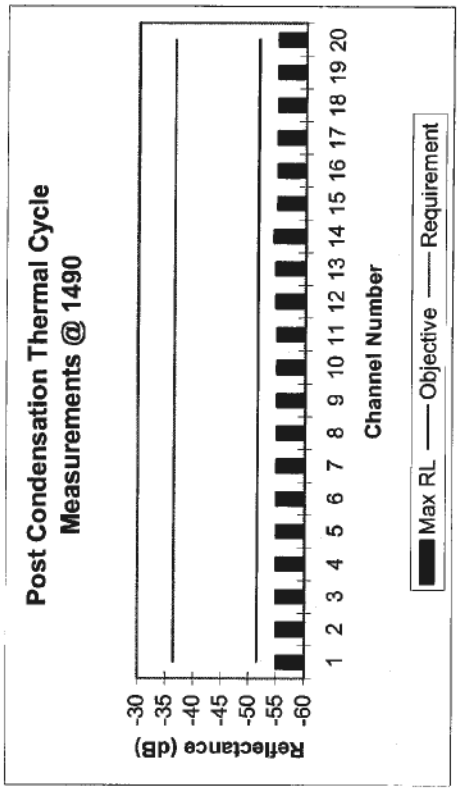

Humidity Condensation Cycling Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

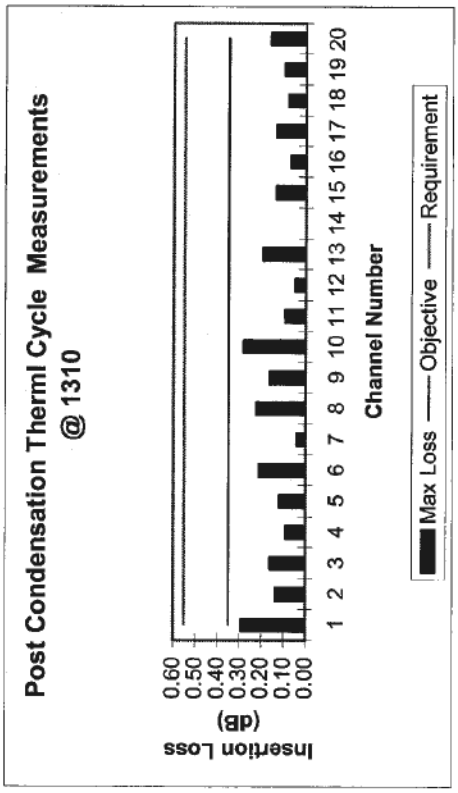

Humidity Condensation Cycling Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

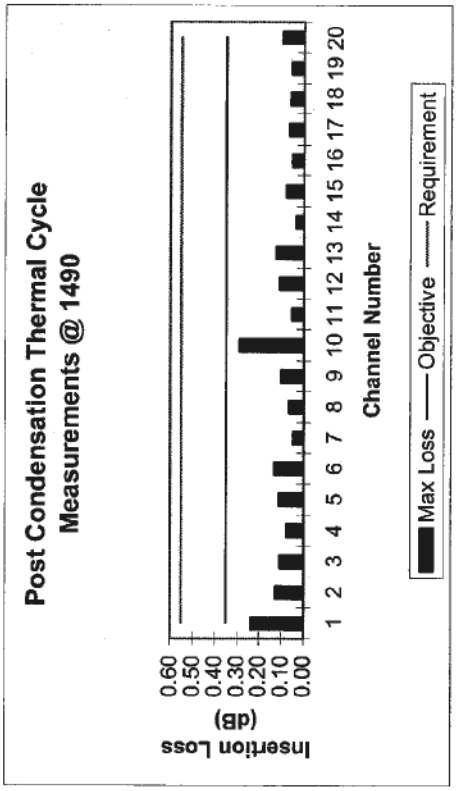

Humidity Condensation Cycling Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

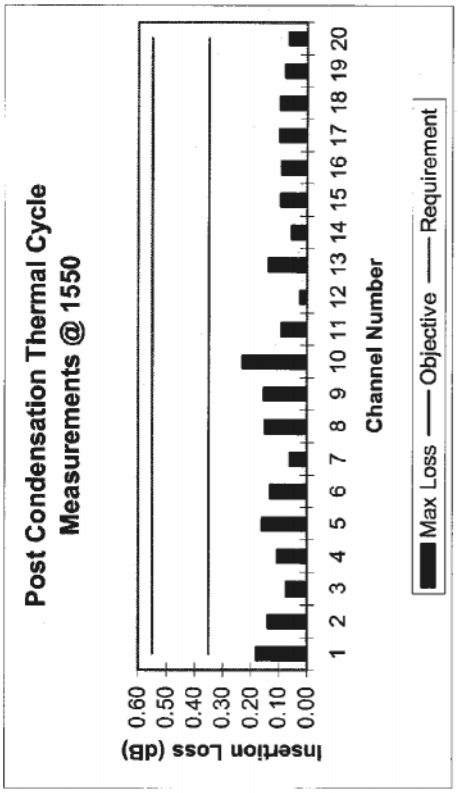
Section 4.4.2.6 Post Condensation Thermal Cycle Test

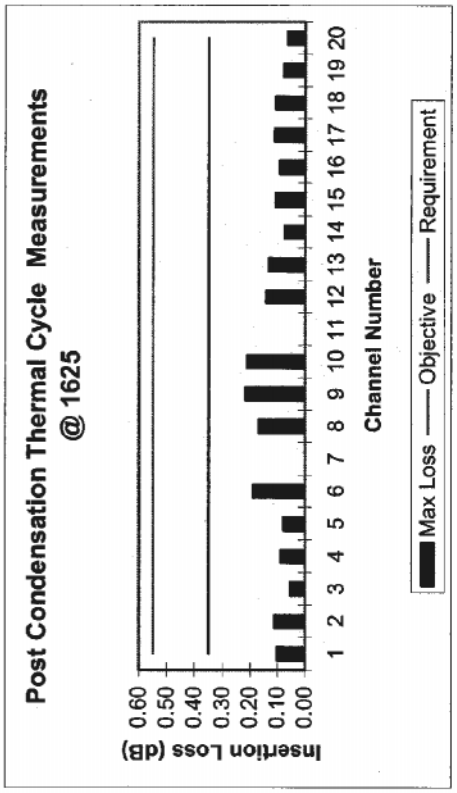


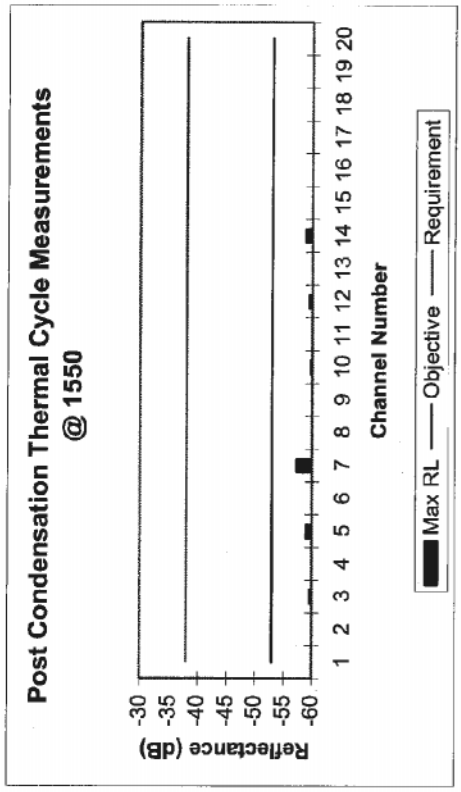


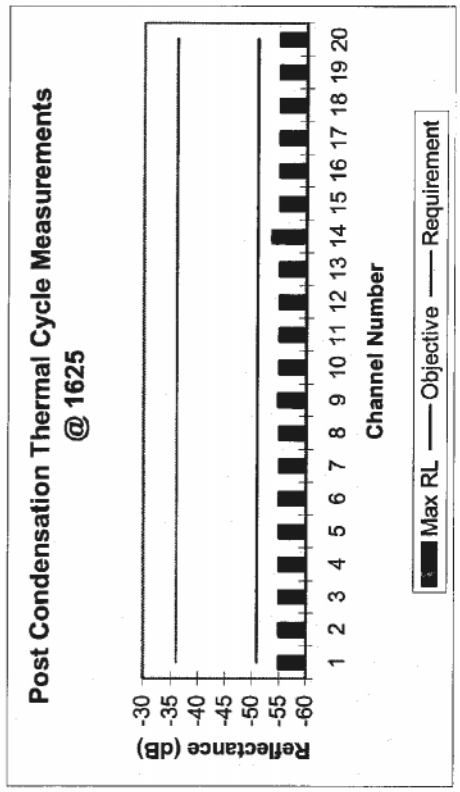




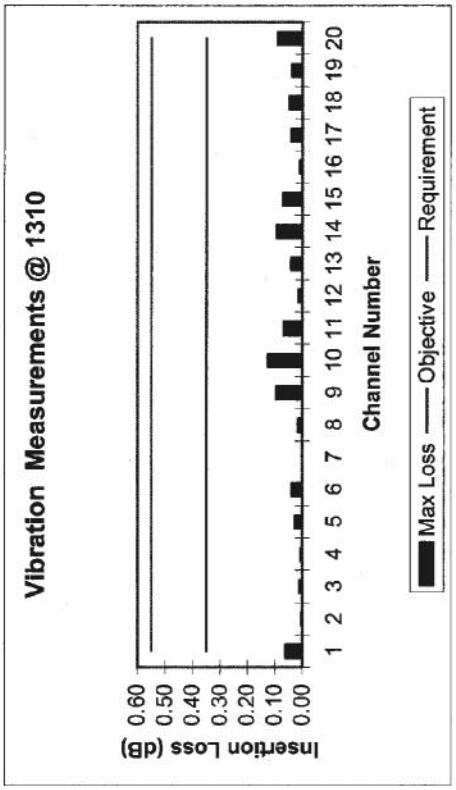

Post Condensation Thermal Cycle Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

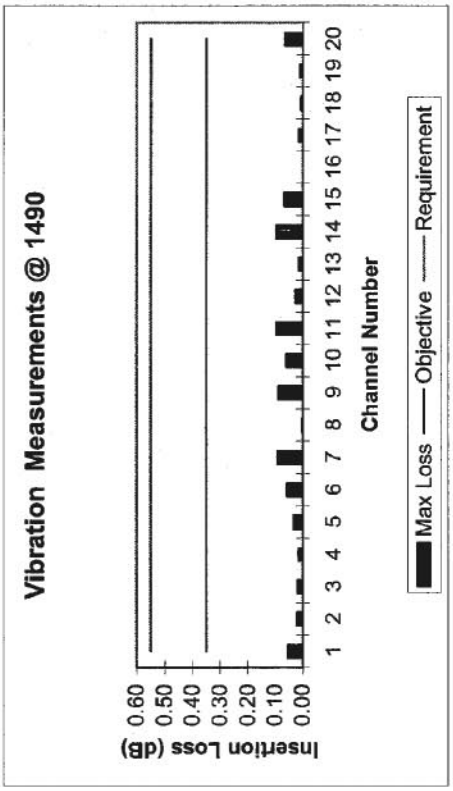

Post Condensation Thermal Cycle Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

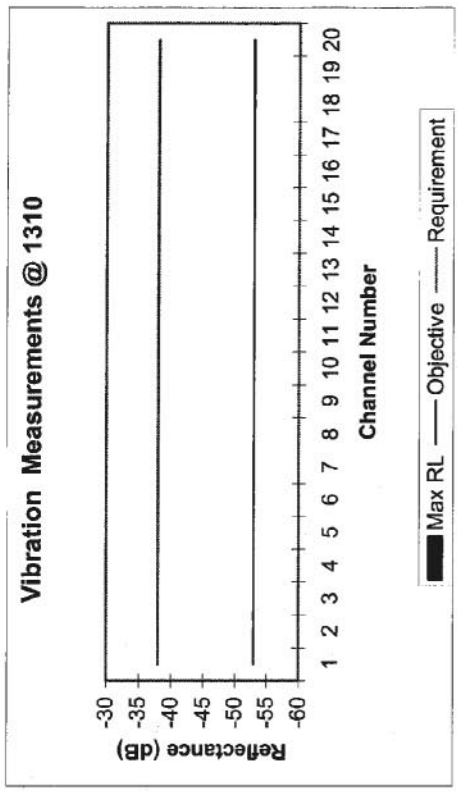

Post Condensation Thermal Cycle Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

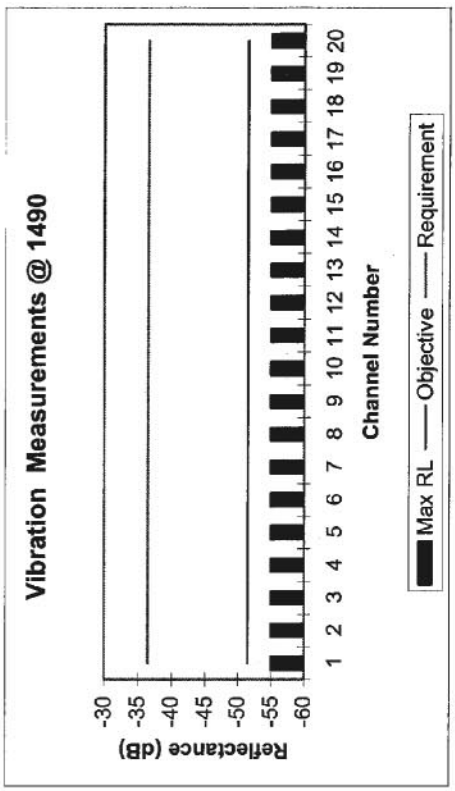

Post Condensation Thermal Cycle Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

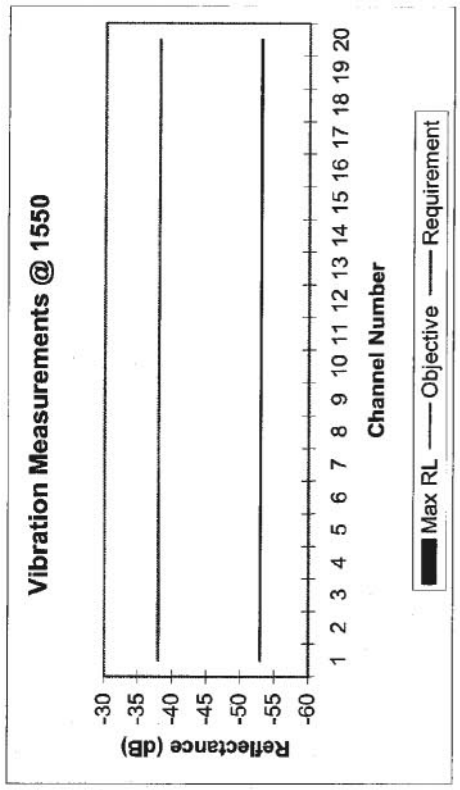
Section 4.4.3.1 Vibration Test

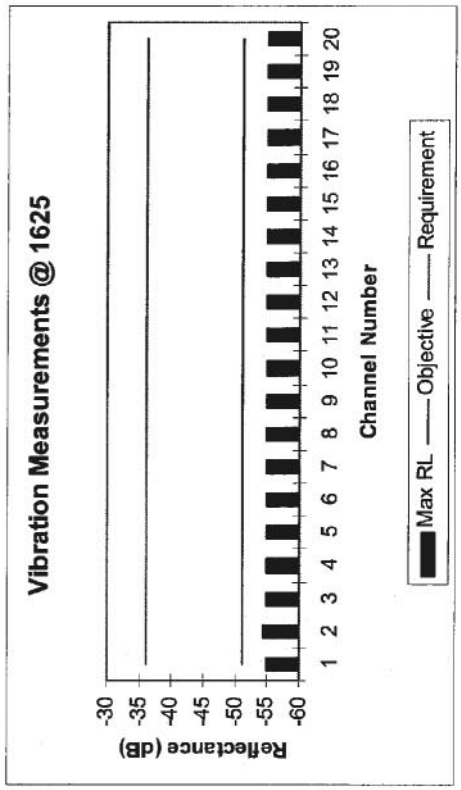


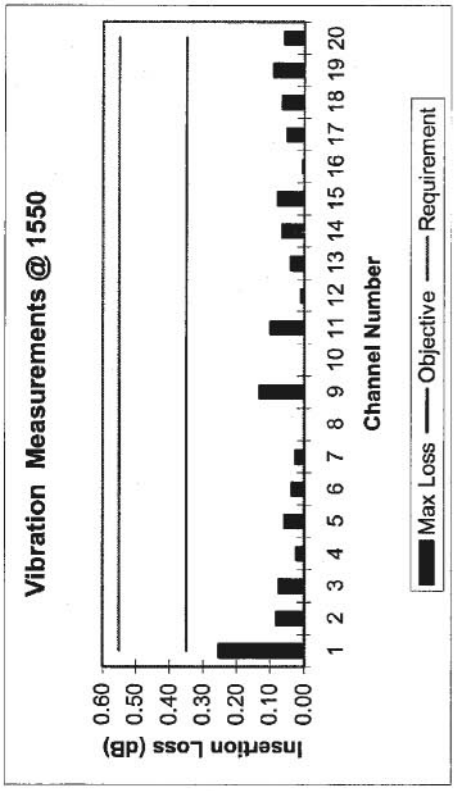


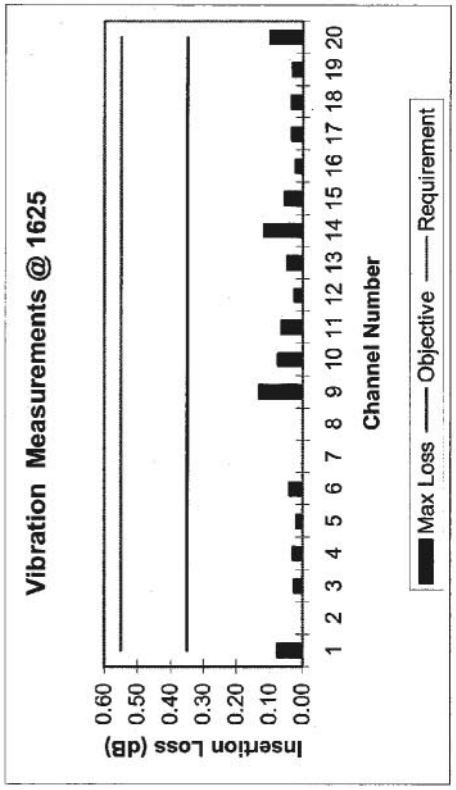




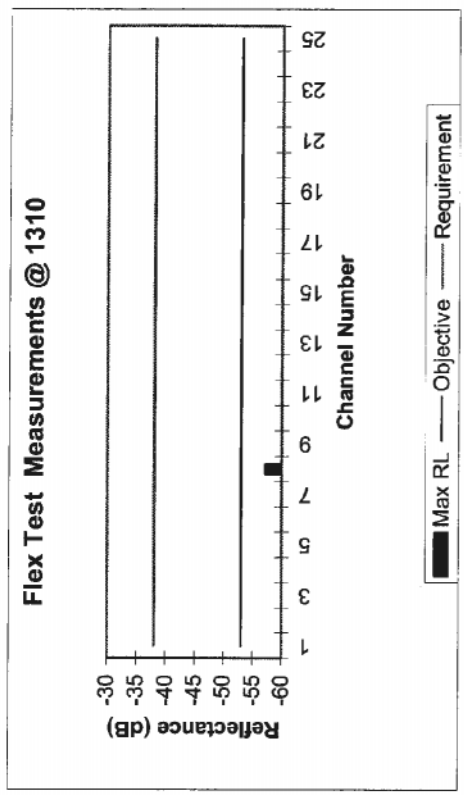

Vibration Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

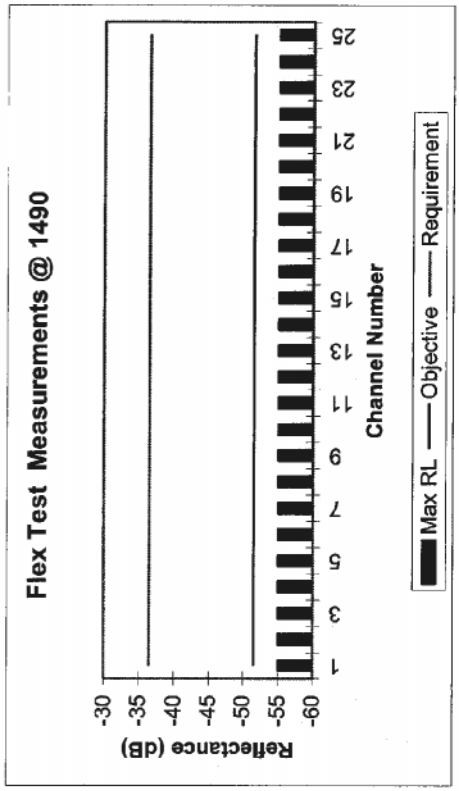

Vibration Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

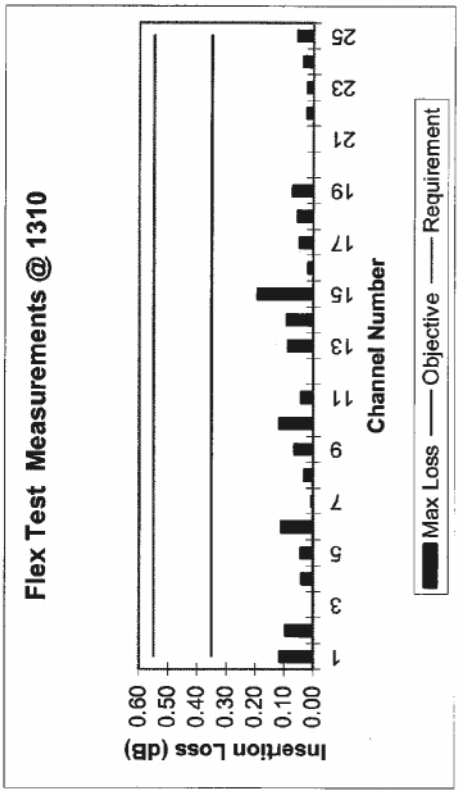

Vibration Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

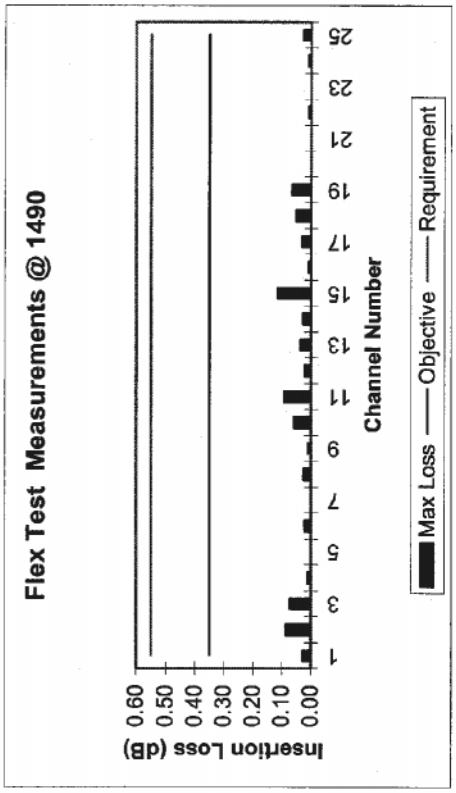

Vibration Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

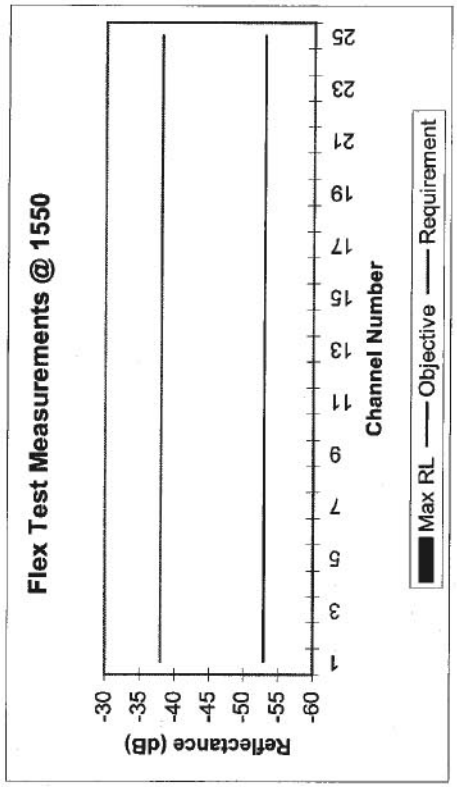
Section 4.4.3.2 Flex Test

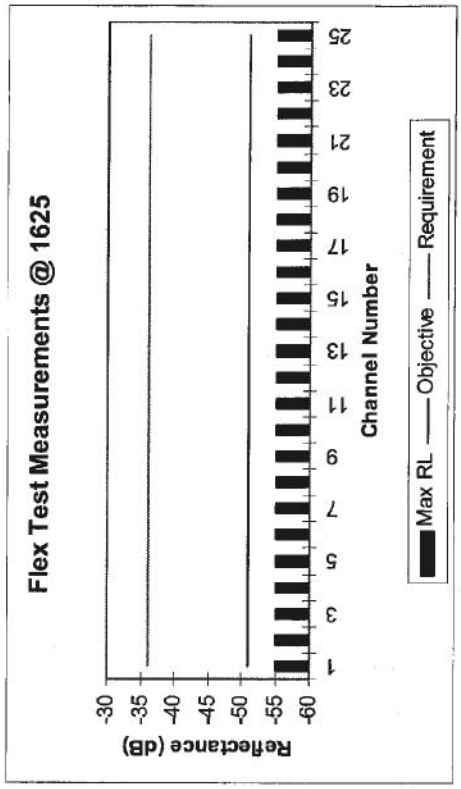


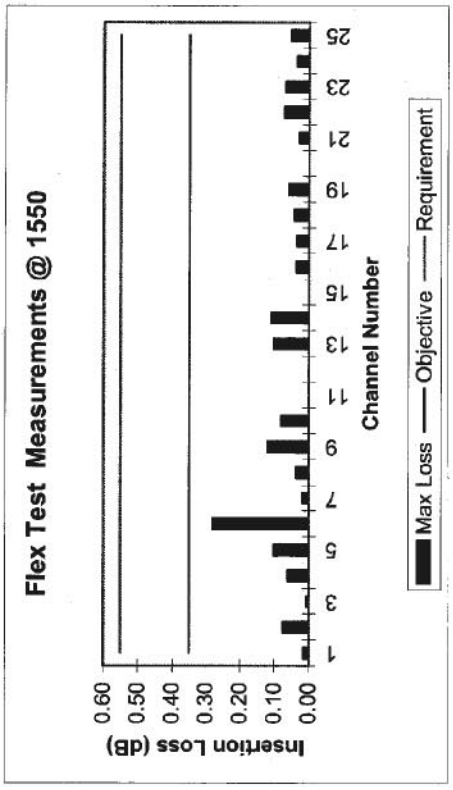


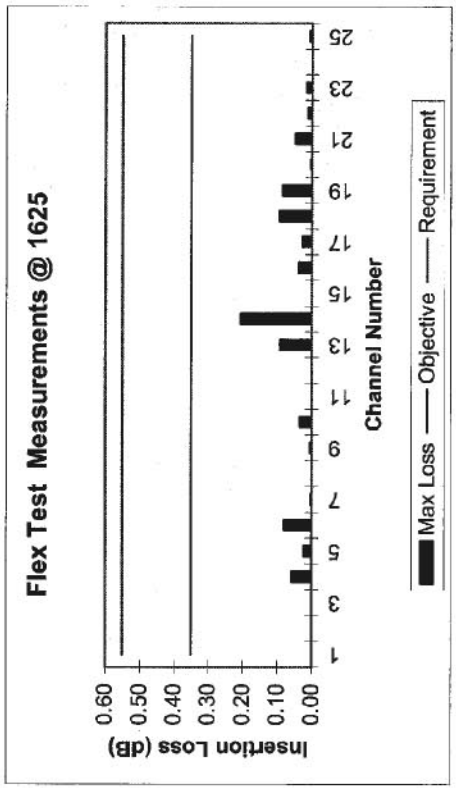




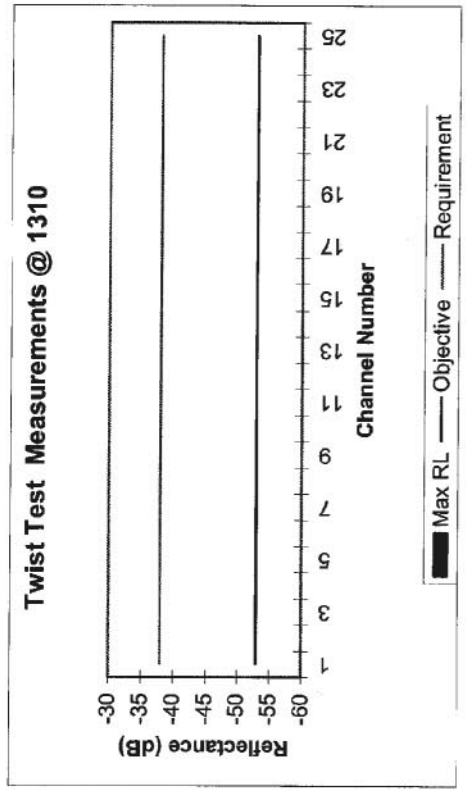

Flex Test Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

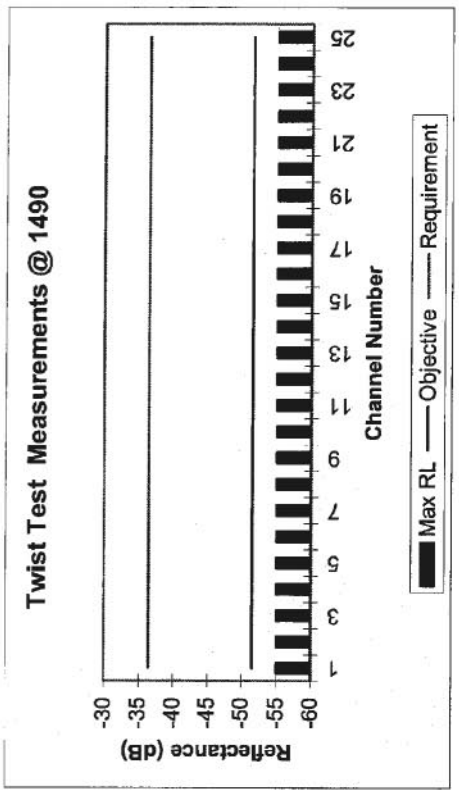

Flex Test Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

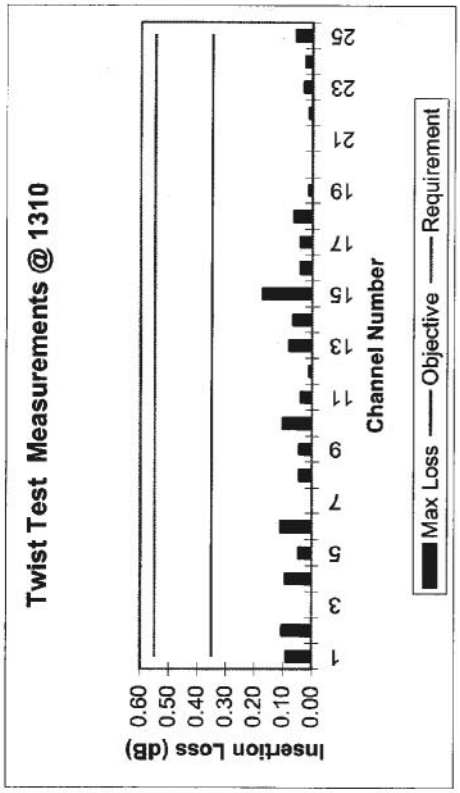

Flex Test Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

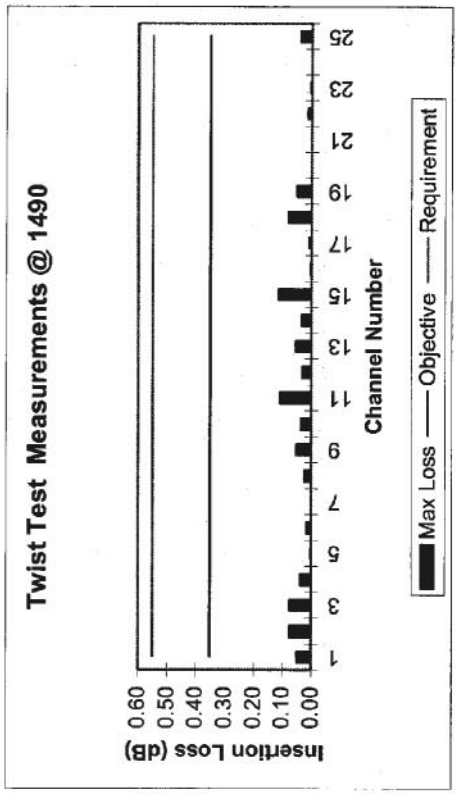

Flex Test Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

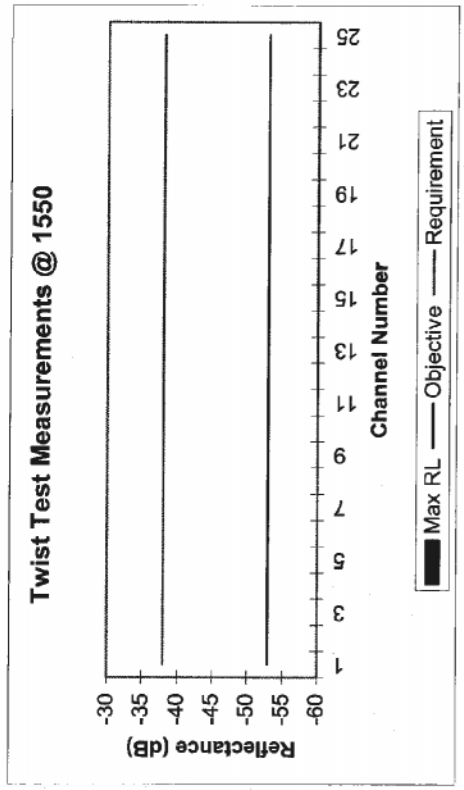
Section 4.4.3.3 Twist Test

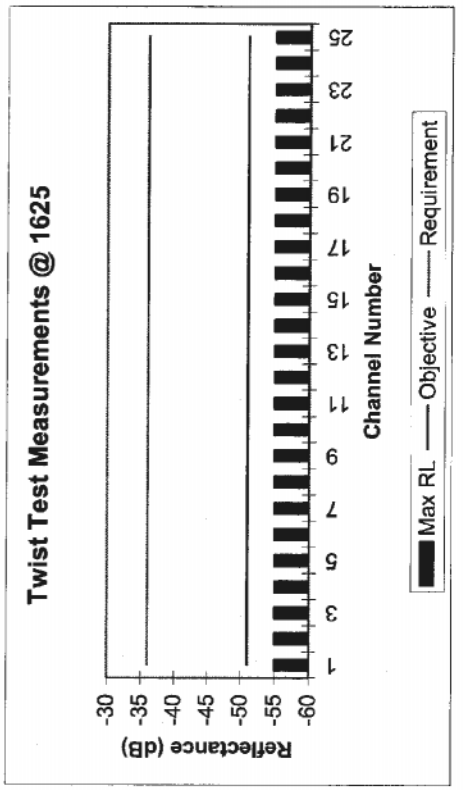


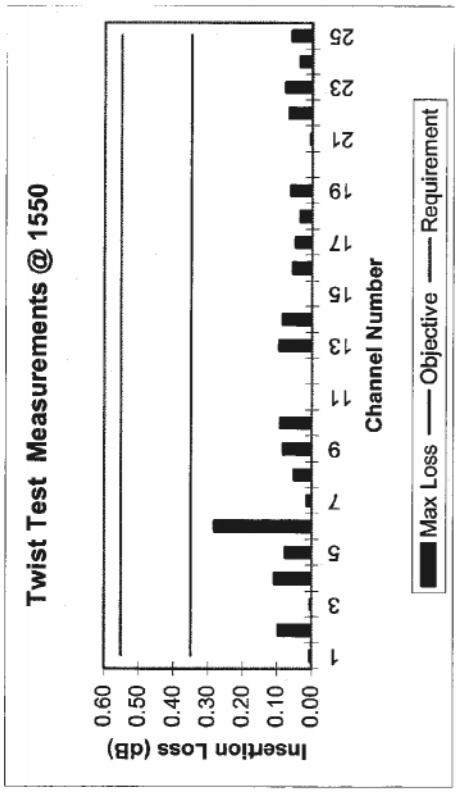


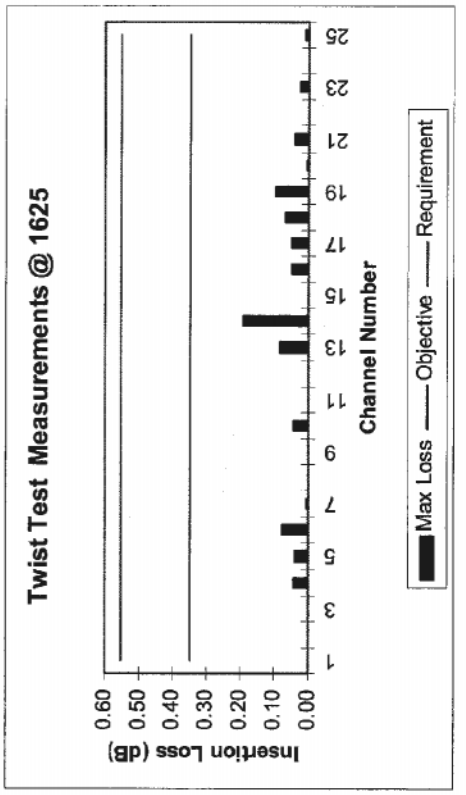




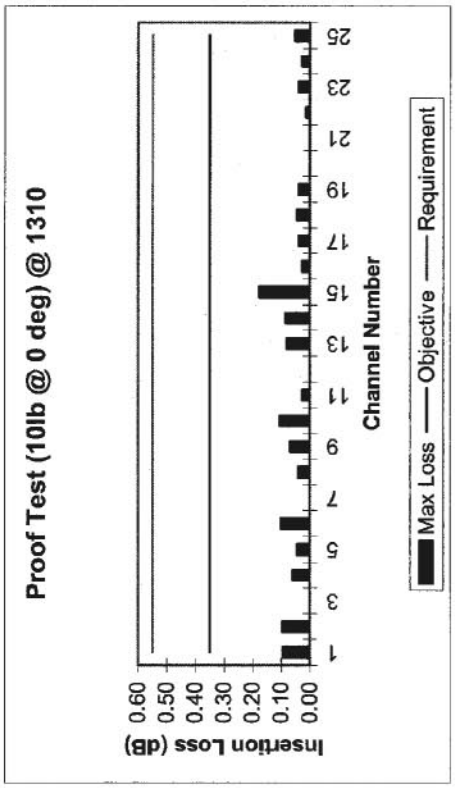

Twist Test Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

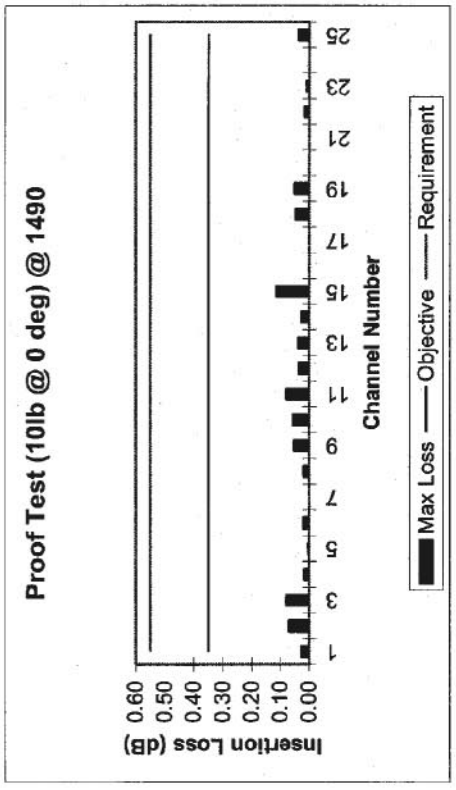

Twist Test Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

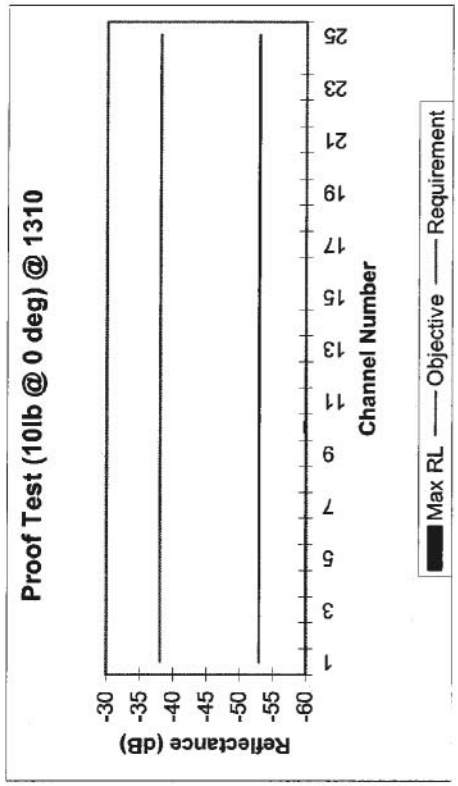

Twist Test Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

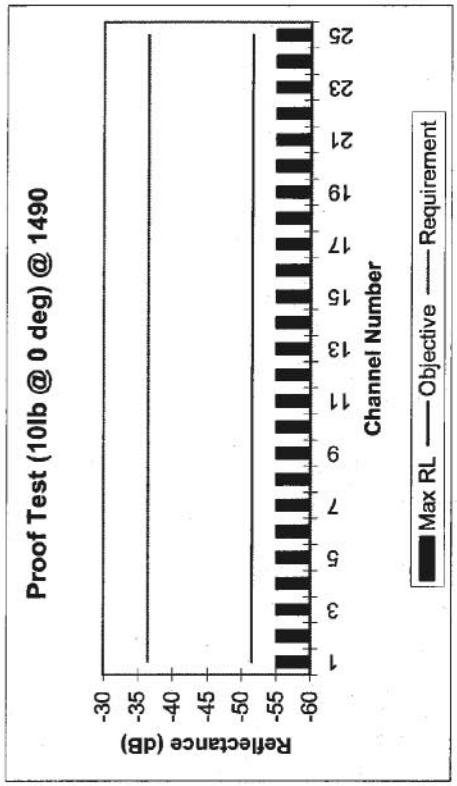

Twist Test Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

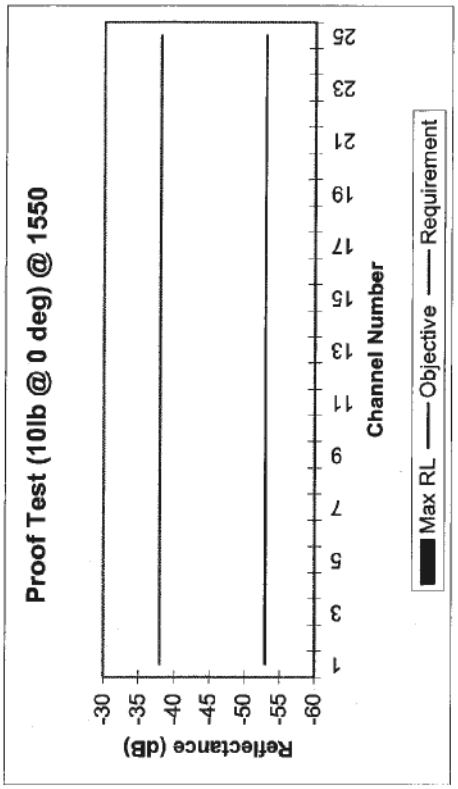
Section 4.4.3.4 Proof Test 10 lbs at 0°

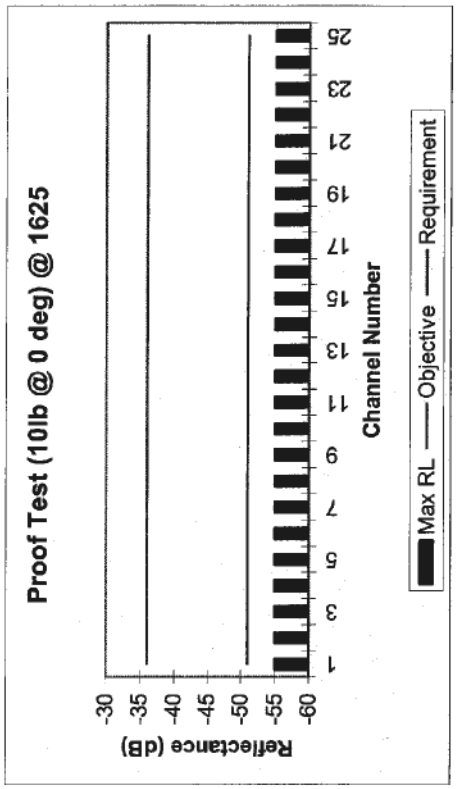


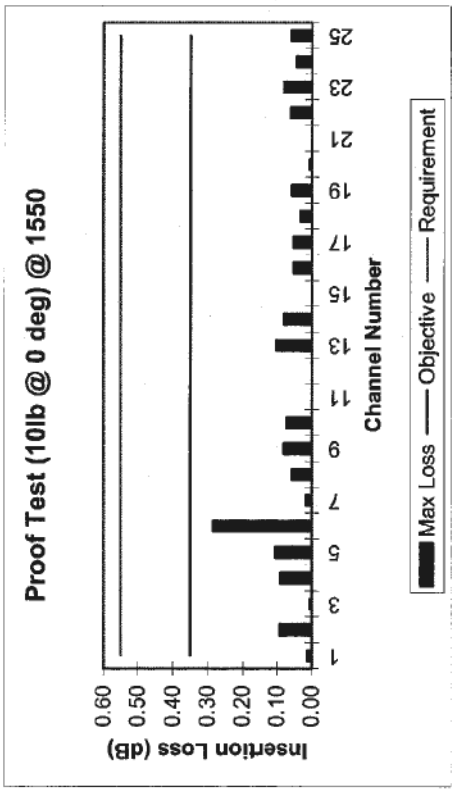


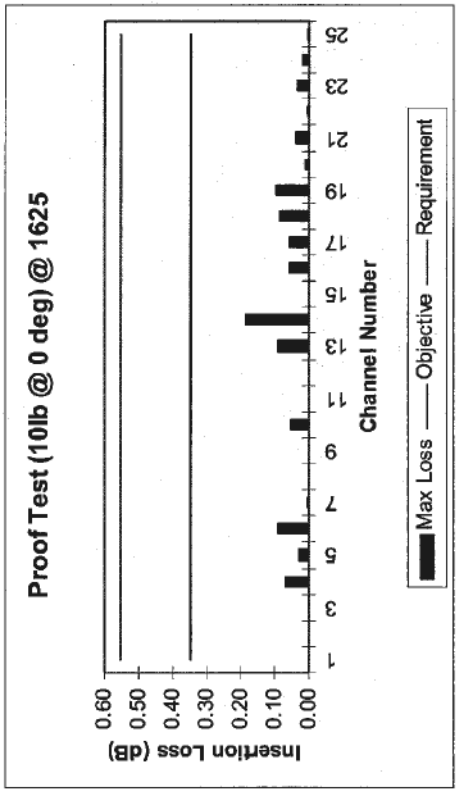




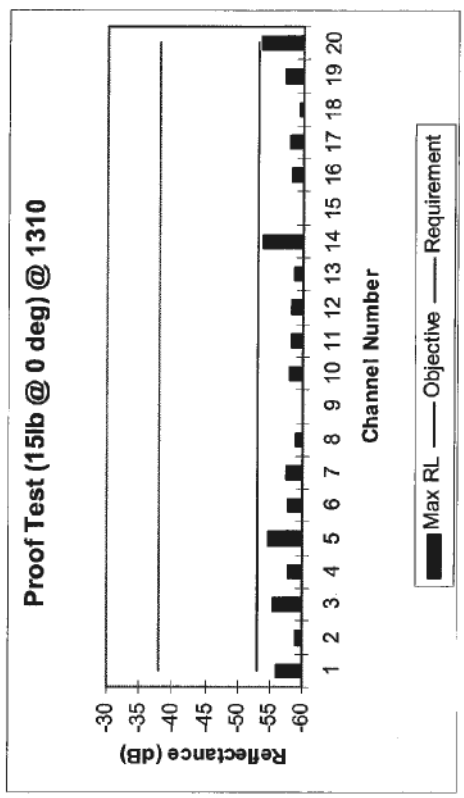

Proof Test (10lb @ 0 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

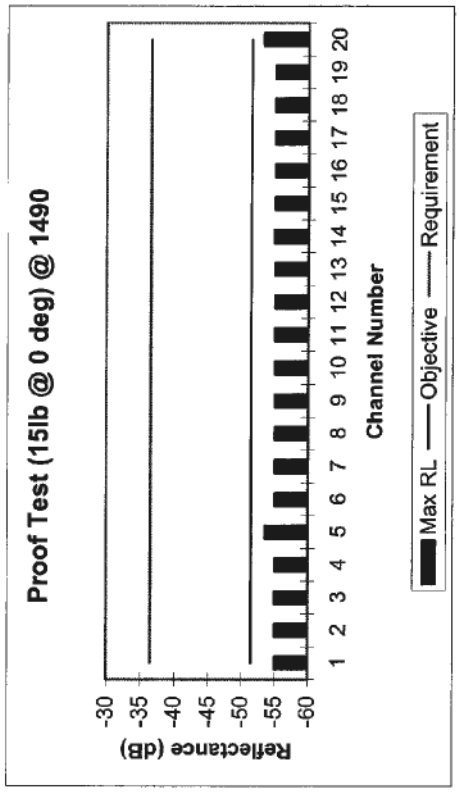

Proof Test (10lb @ 0 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

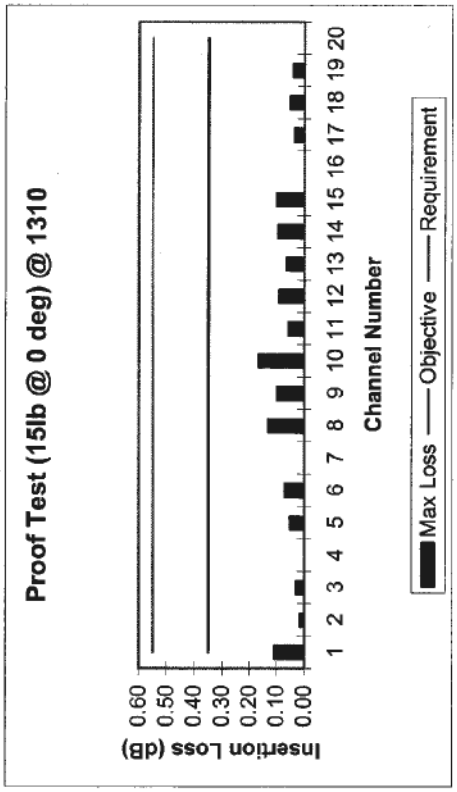

Proof Test (10lb @ 0 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

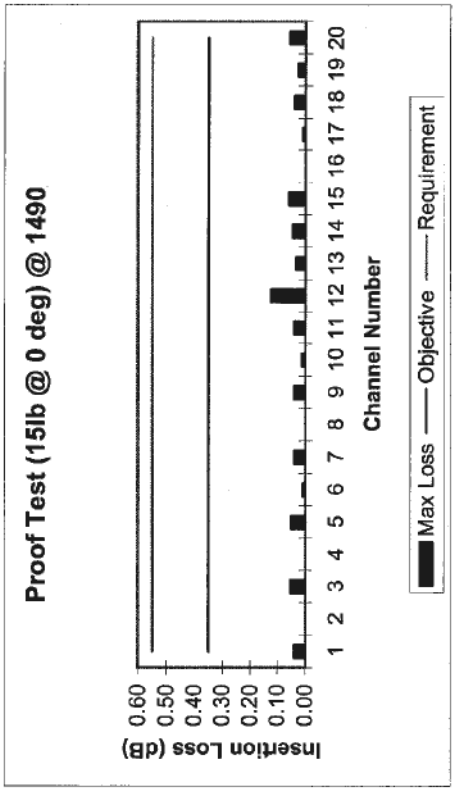

Proof Test (10lb @ 0 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

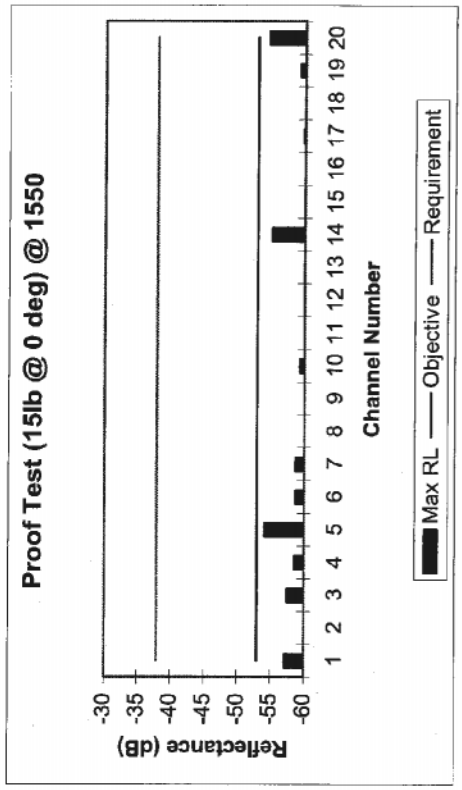
Section 4.4.3.4 Proof Test 15 lb at 0°

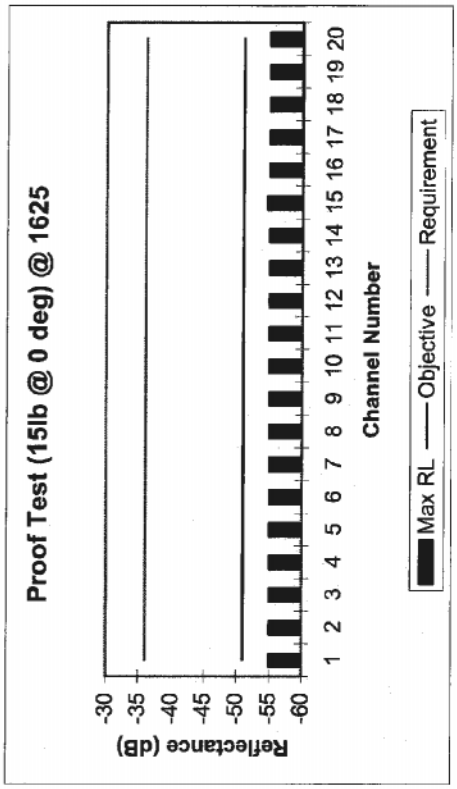


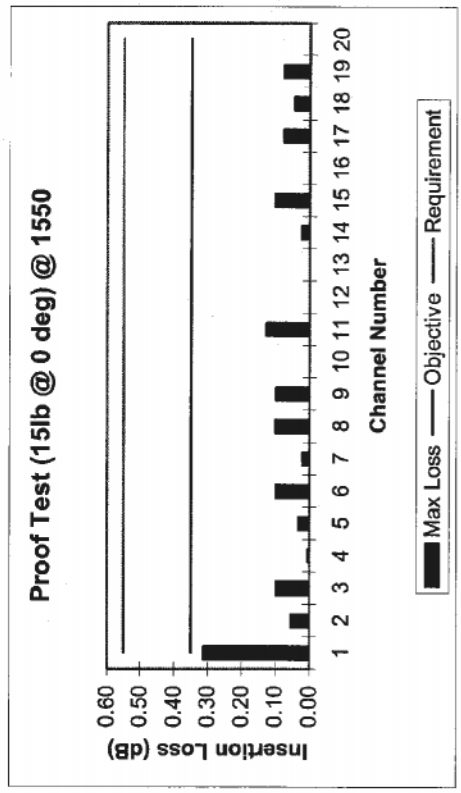


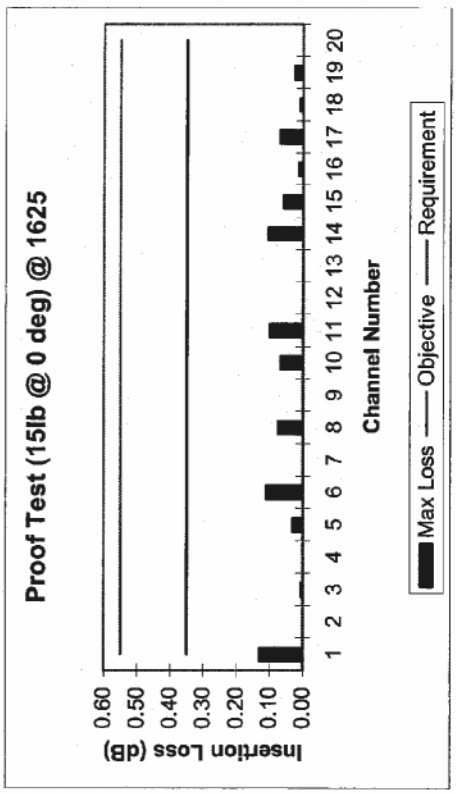




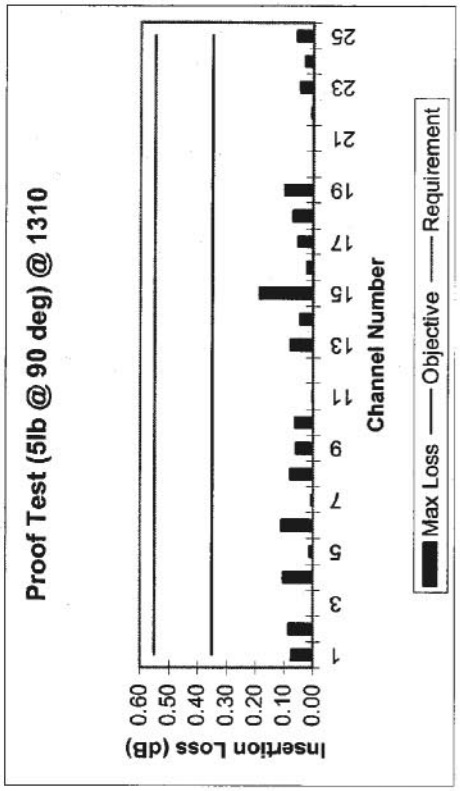

Proof Test (15lb @ 0 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

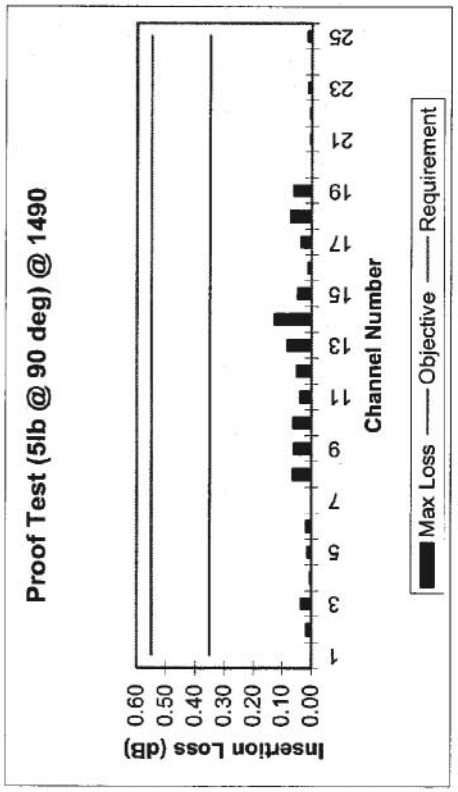

Proof Test (15lb @ 0 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

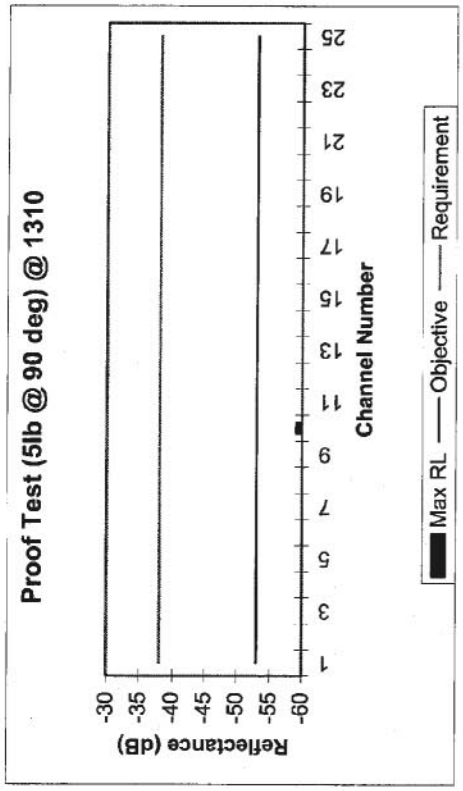

Proof Test (15lb @ 0 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

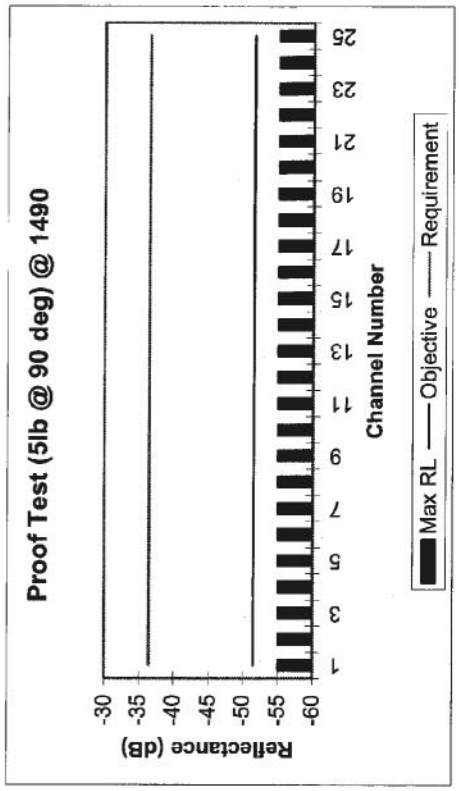

Proof Test (15lb @ 0 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

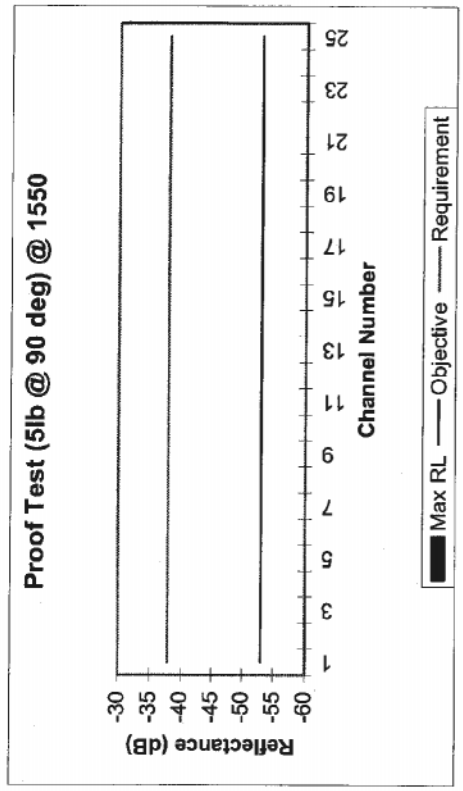
Section 4.4.3.4 Proof Test 5 lb at 90°

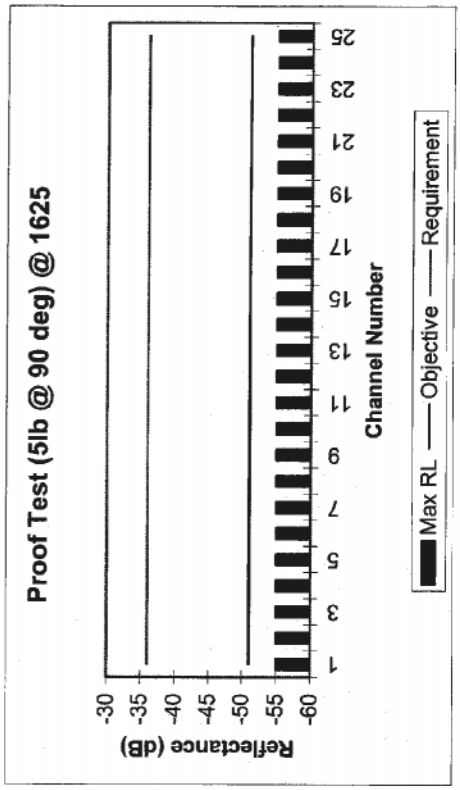


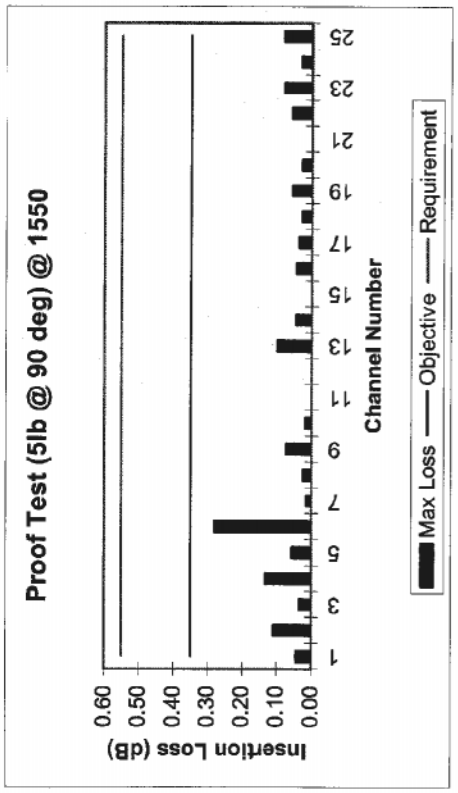


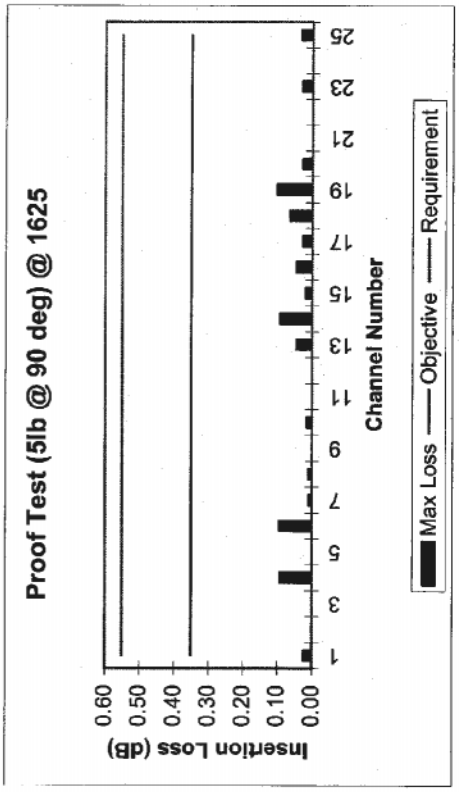




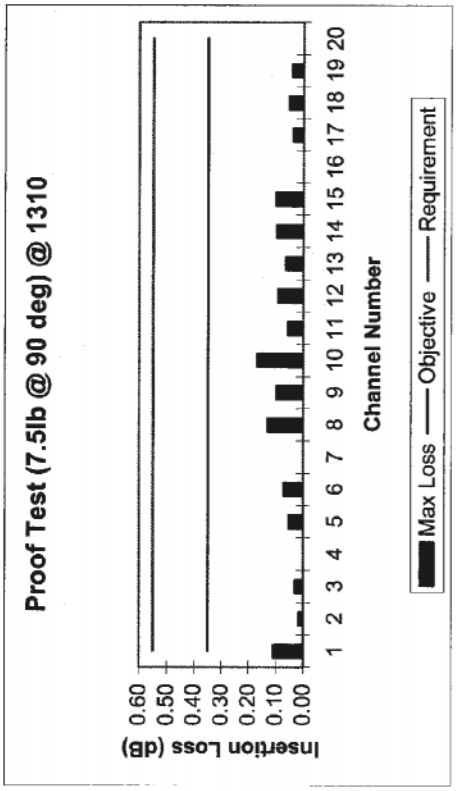

Proof Test (5lb @ 90 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

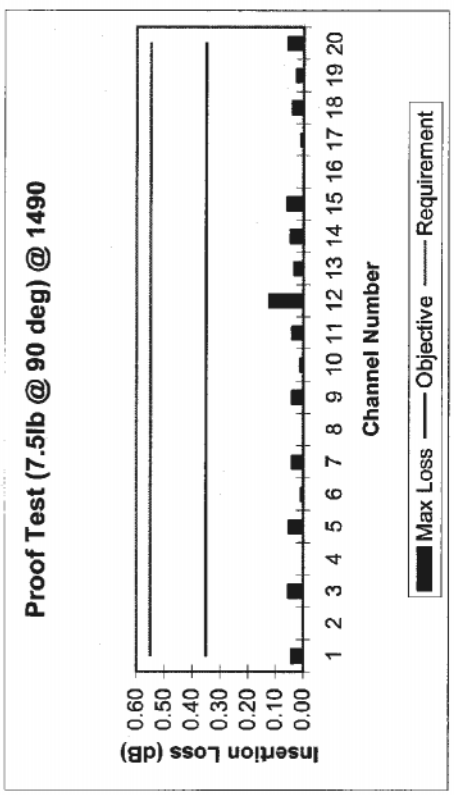

Proof Test (5lb @ 90 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

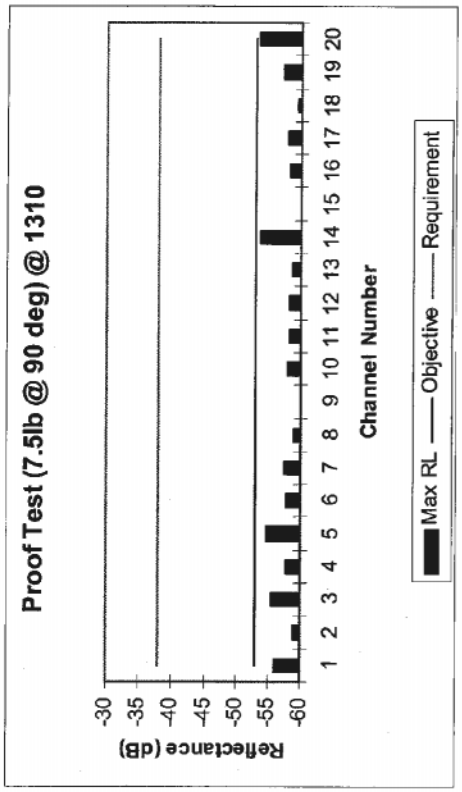

Proof Test (5lb @ 90 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

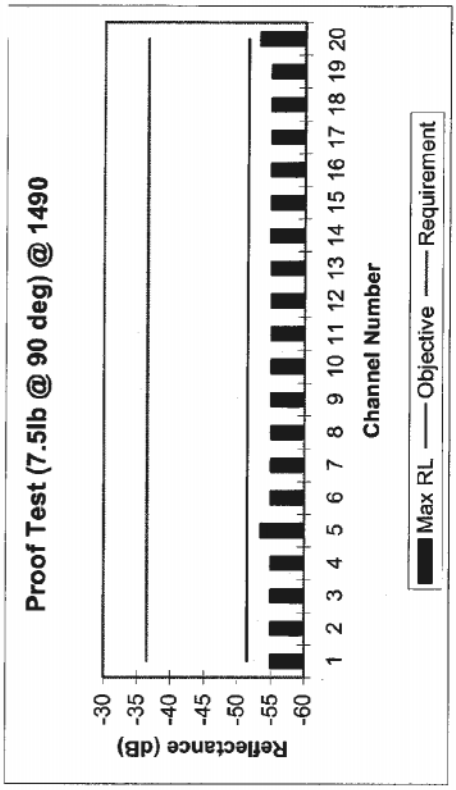

Proof Test (5lb @ 90 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

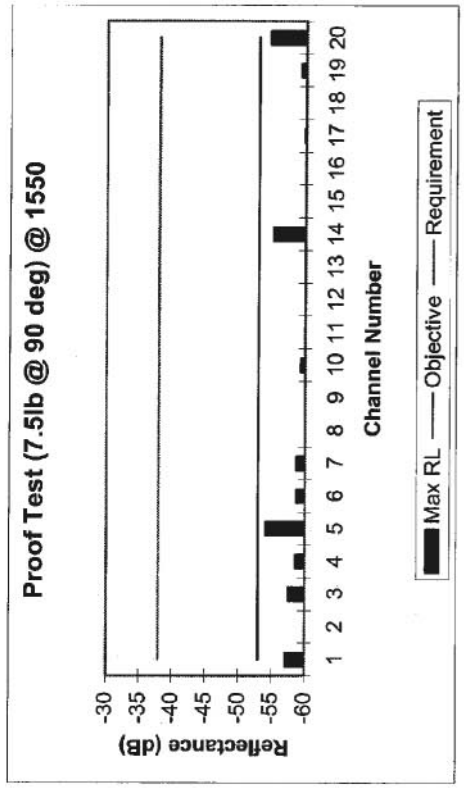
Section 4.4.3.4 Proof Test 7.5 lb at 90°

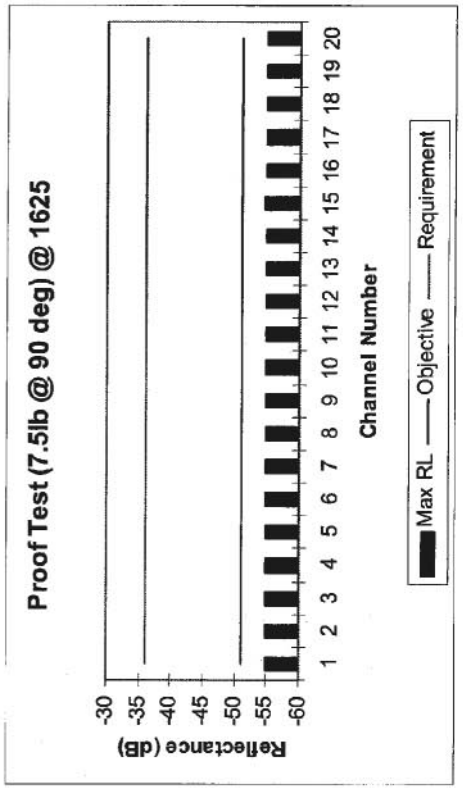


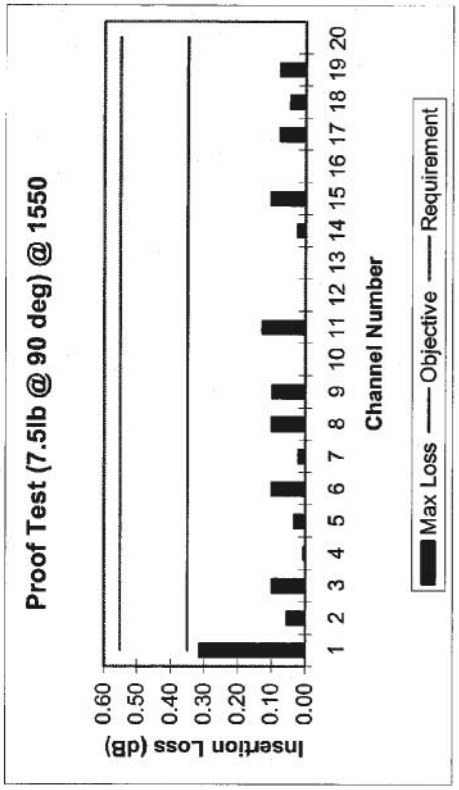


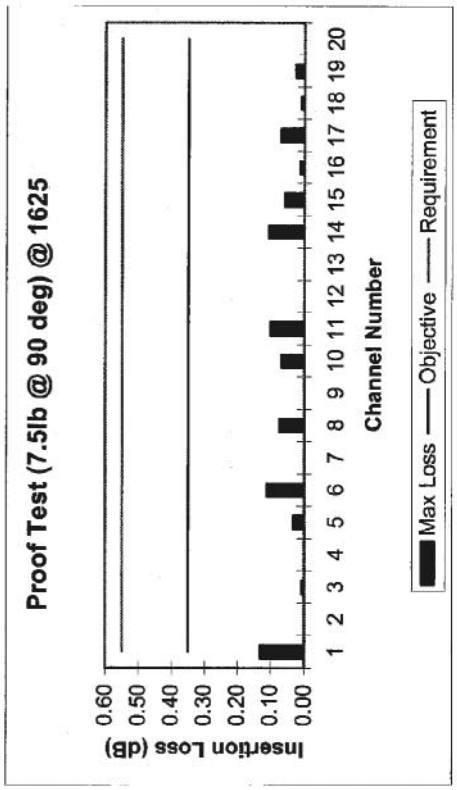




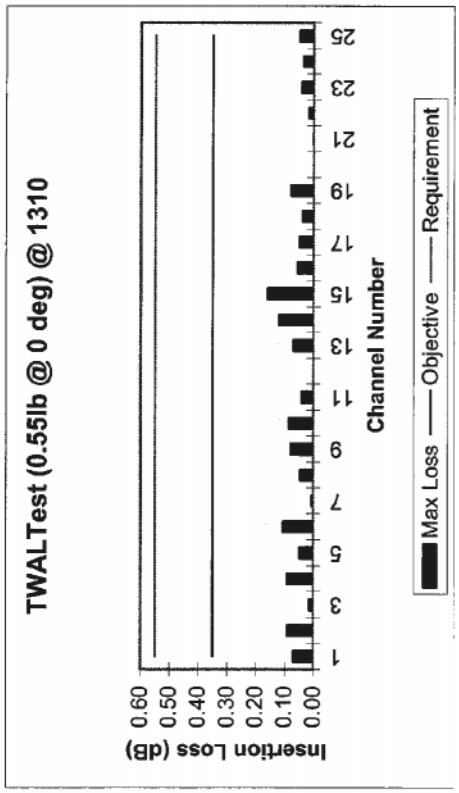

Proof Test (7.5lb @ 90 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

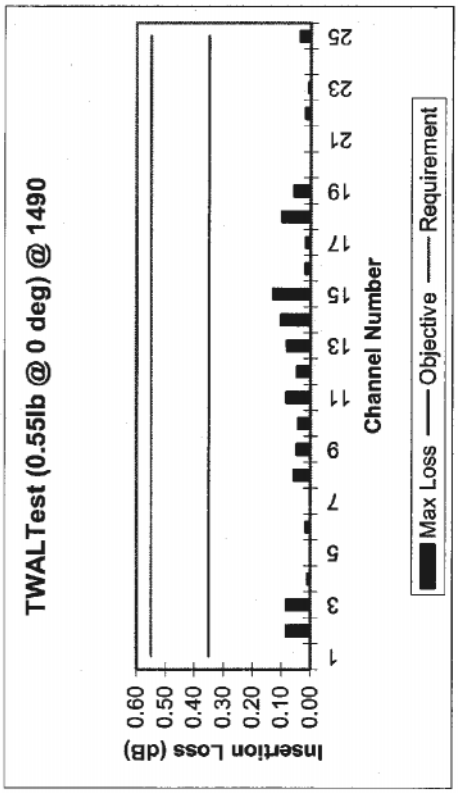

Proof Test (7.5lb @ 90 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

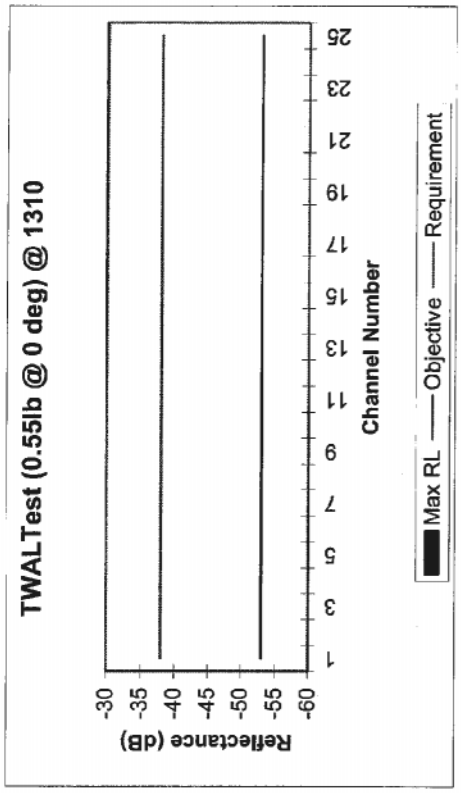

Proof Test (7.5lb @ 90 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

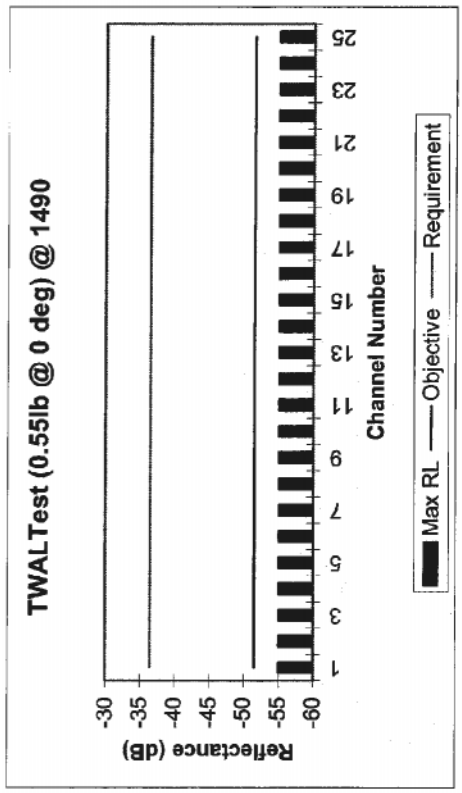

Proof Test (7.5lb @ 90 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

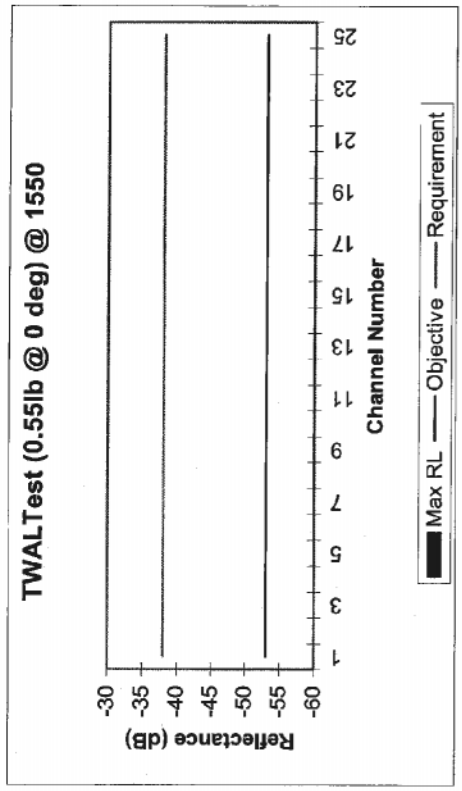
Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 0°

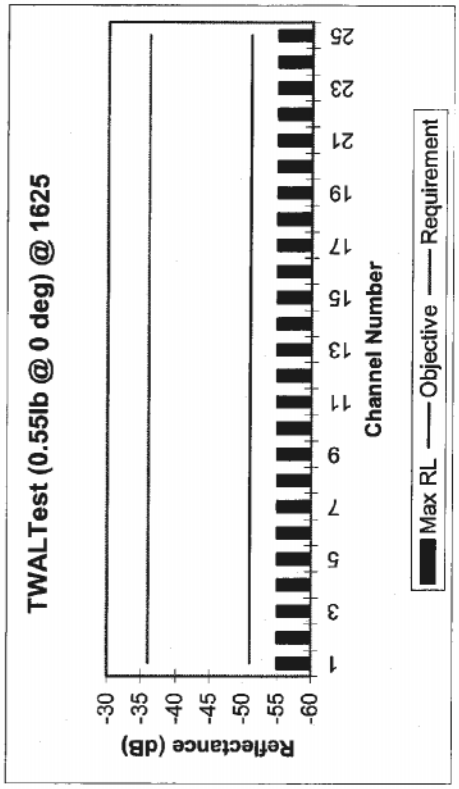


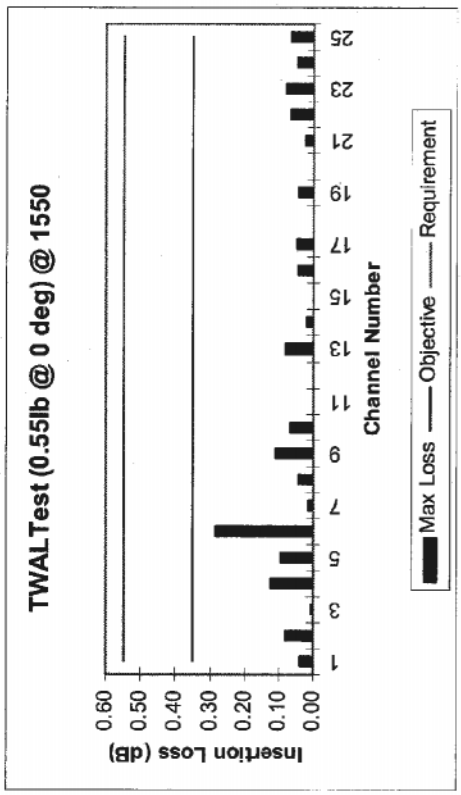


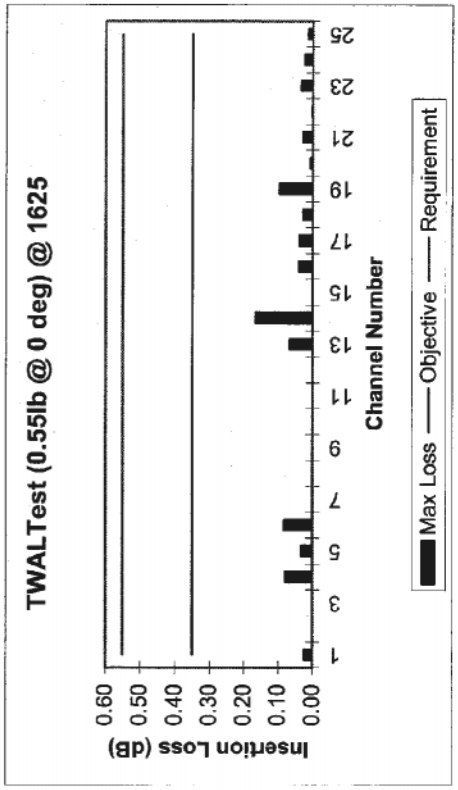




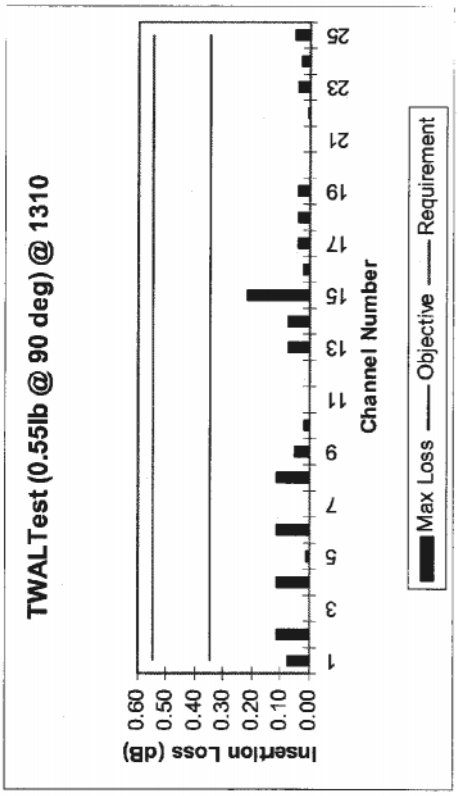

TWALTest (0.55lb @ 0 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

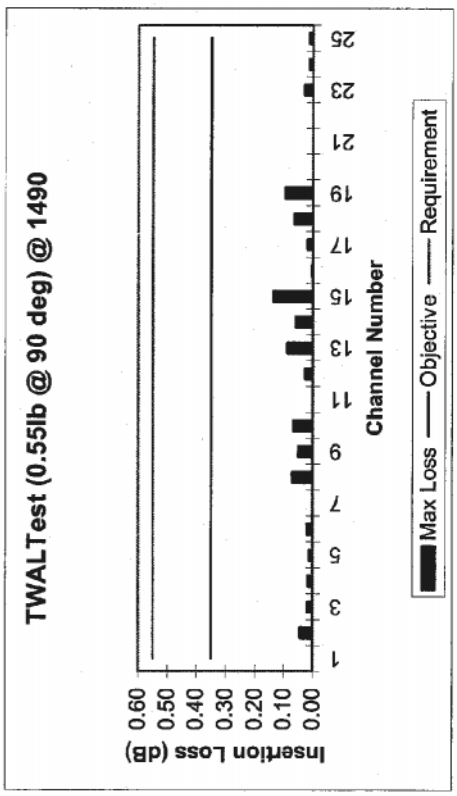

TWALTest (0.55lb @ 0 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

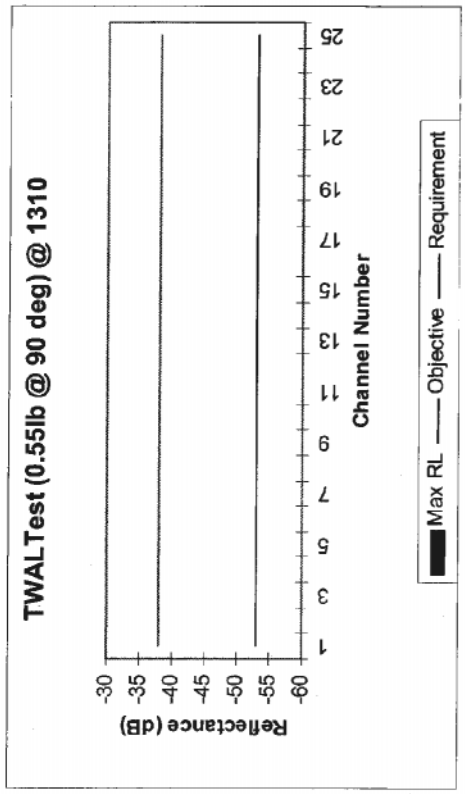

TWALTest (0.55lb @ 0 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

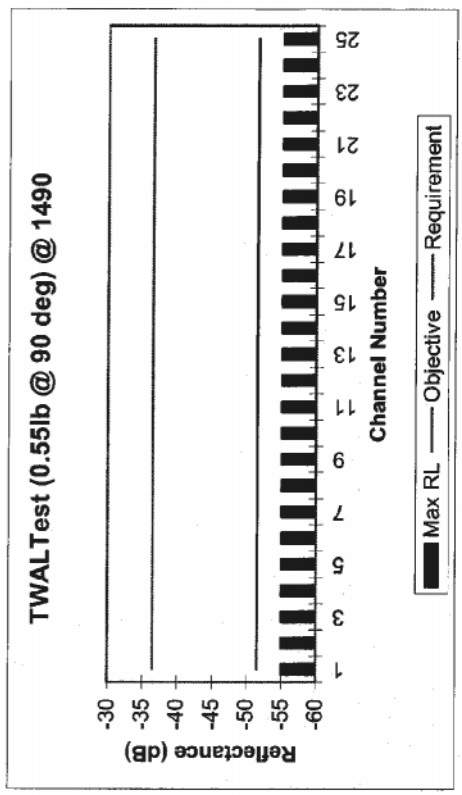

TWALTest (0.55lb @ 0 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

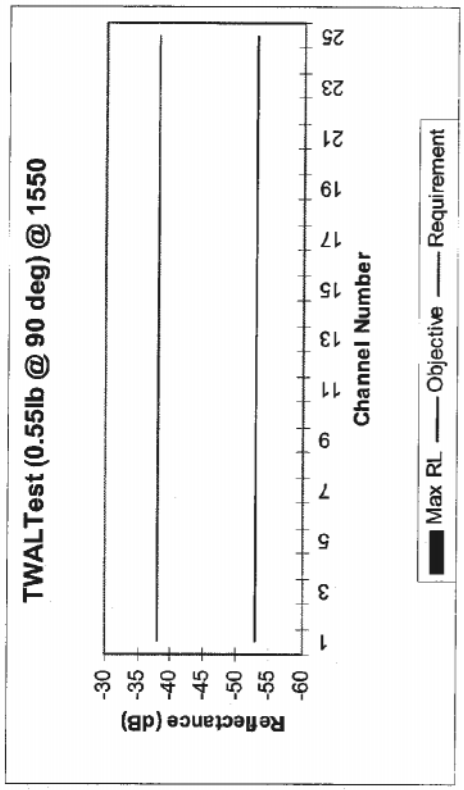
Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 90°

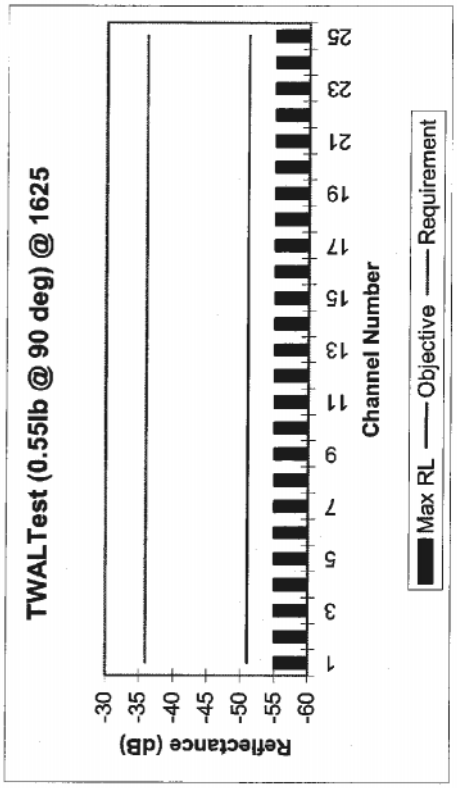


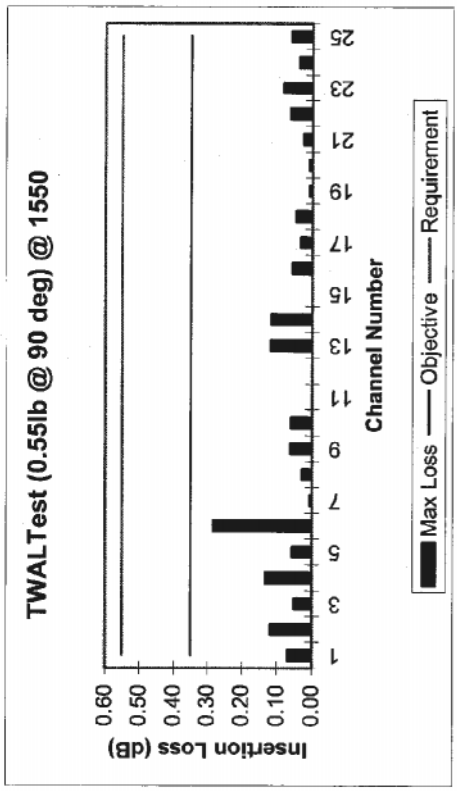


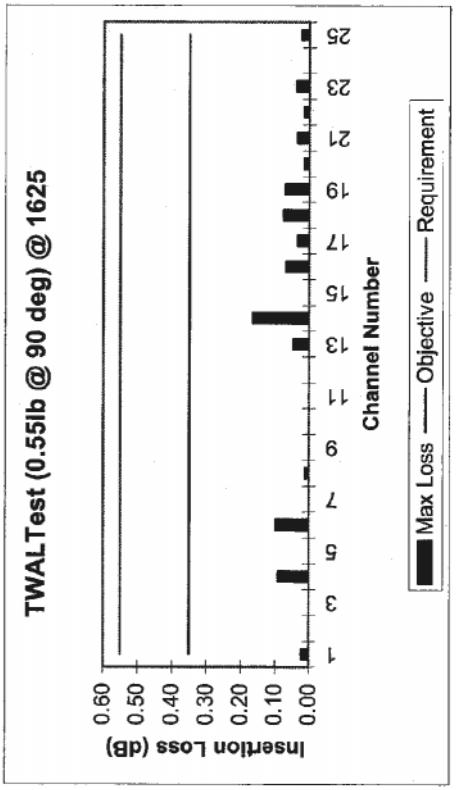




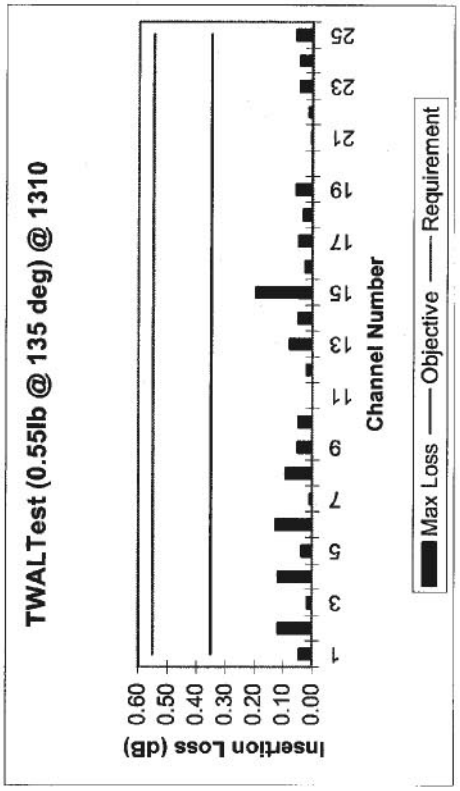

TWALTest (0.55lb @ 90 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

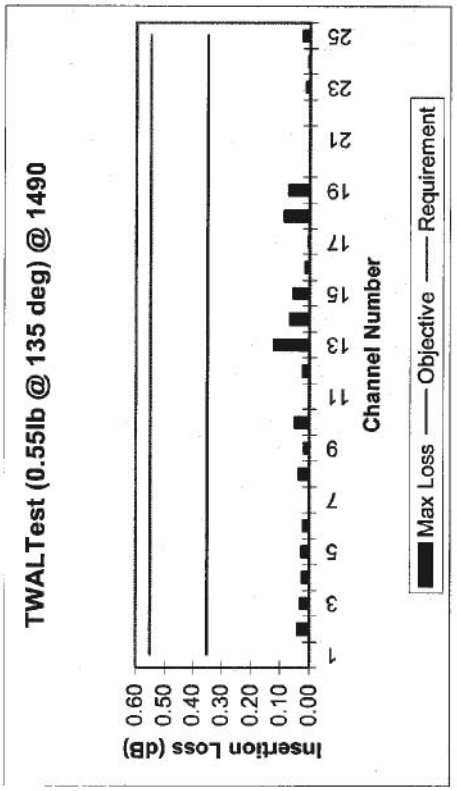

TWALTest (0.55lb @ 90 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

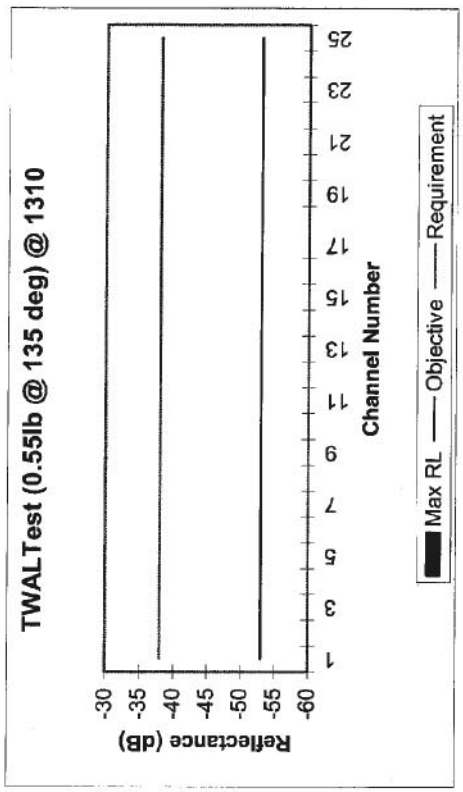

TWALTest (0.55lb @ 90 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

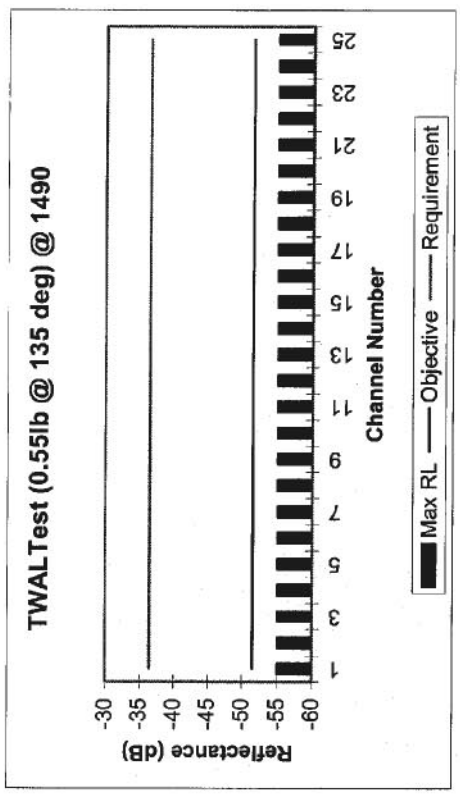

TWALTest (0.55lb @ 90 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

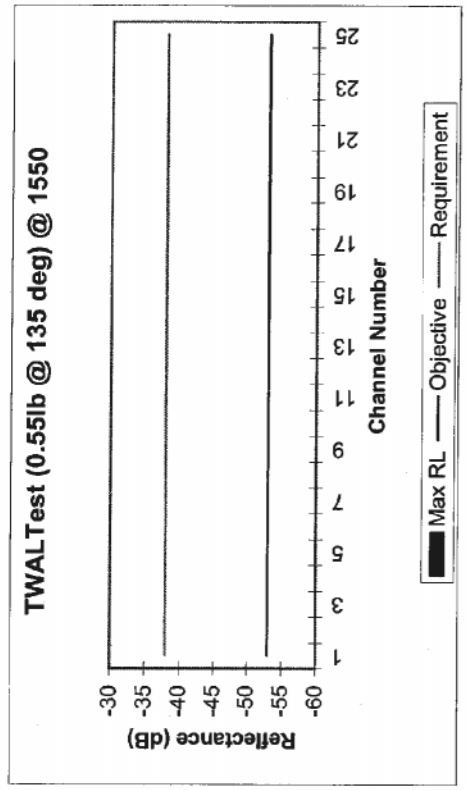
Section 4.4.3.5 Transmission With Applied Load 0.55 lbf at 135°

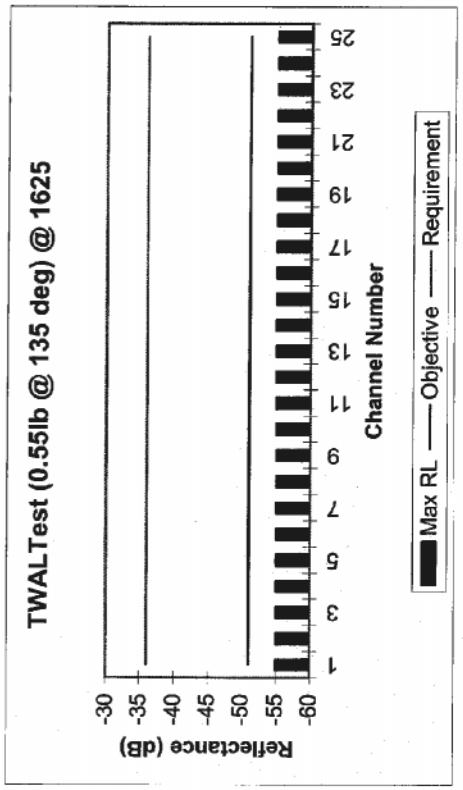


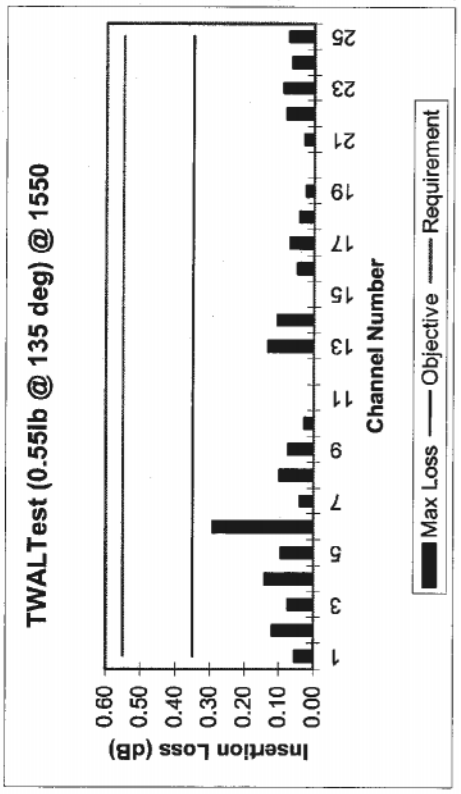


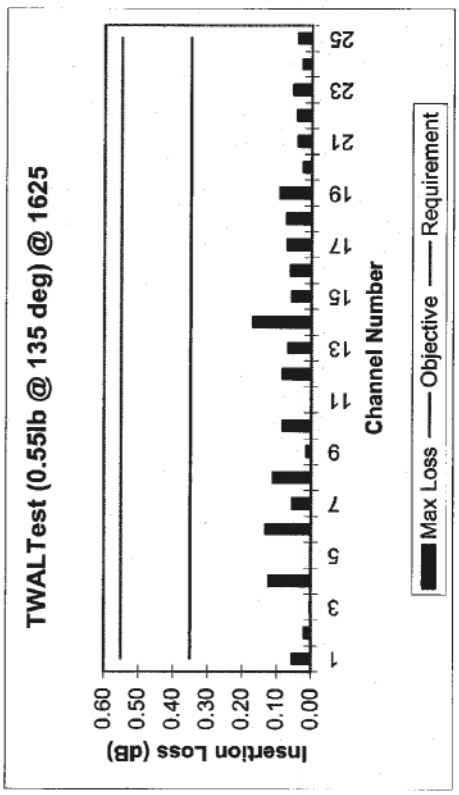




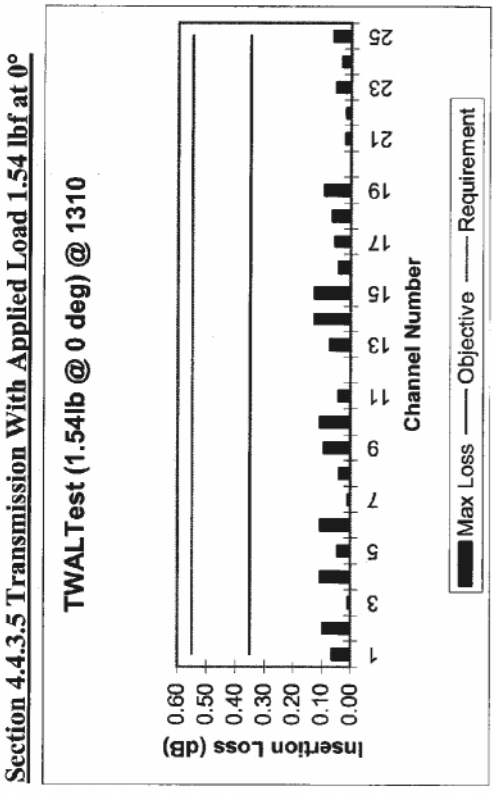

TWALTest (0.55lb @ 135 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

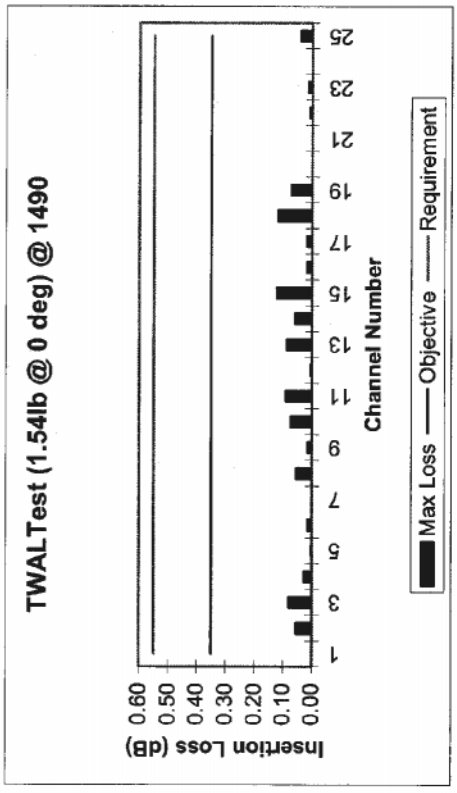

TWALTest (0.55lb @ 135 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

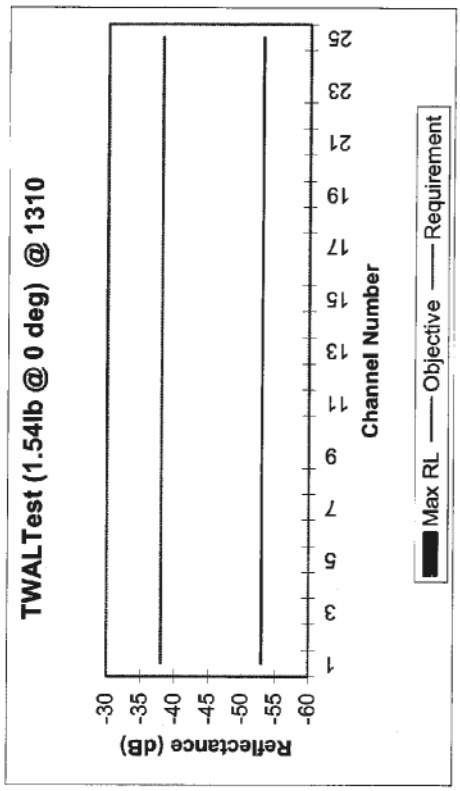

TWALTest (0.55lb @ 135 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

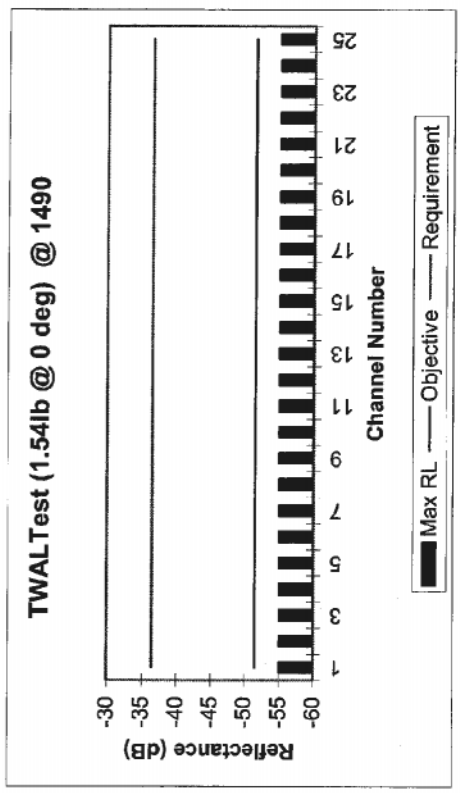

TWALTest (0.55lb @ 135 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

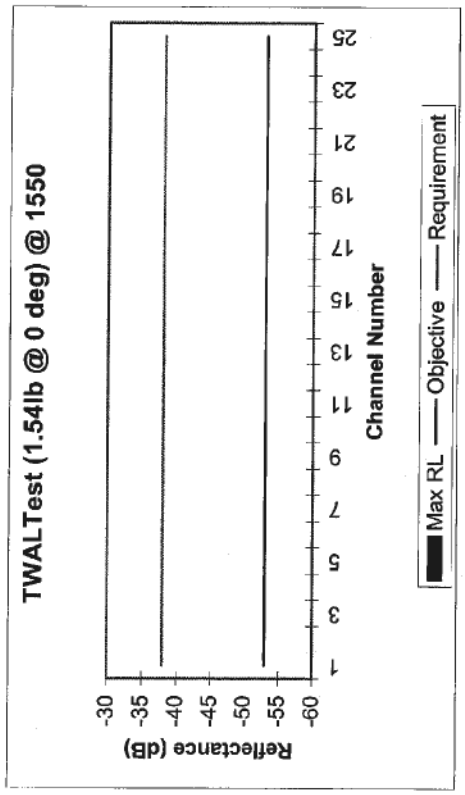
Section 4.4.3.5 Transmission With Applied Load 1.54 lbf at 0°

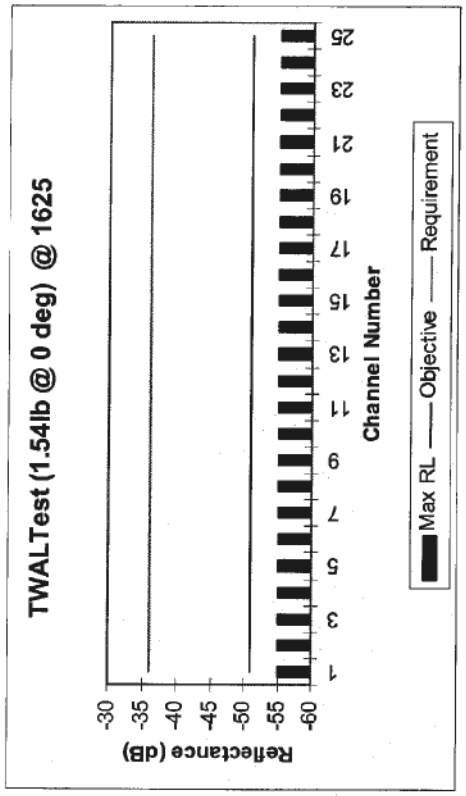


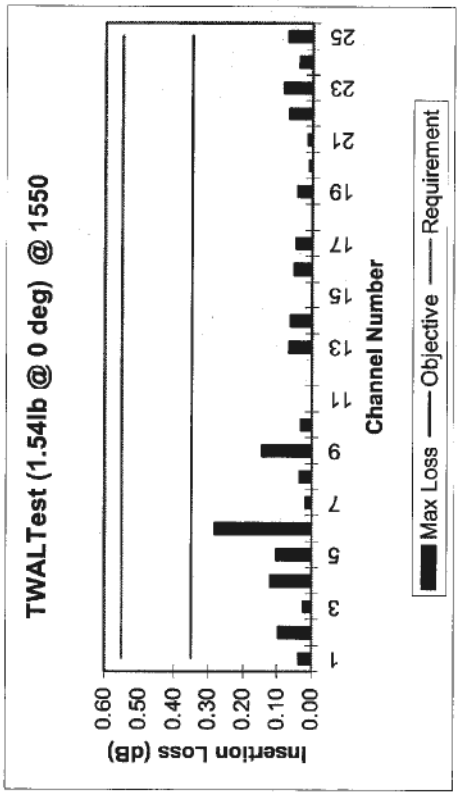


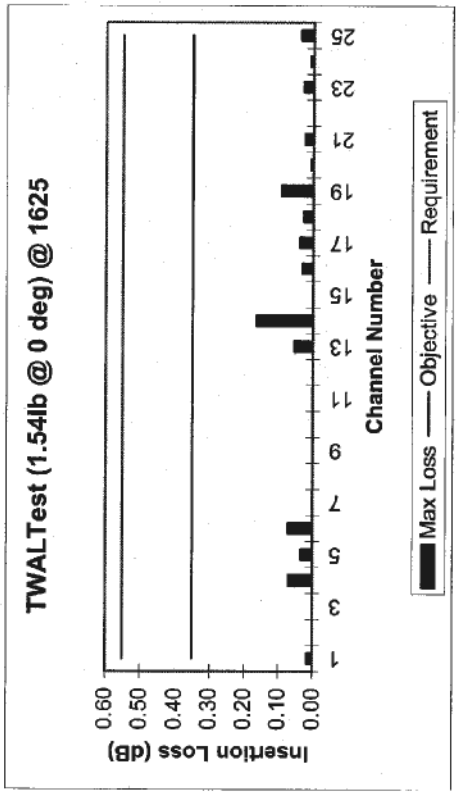




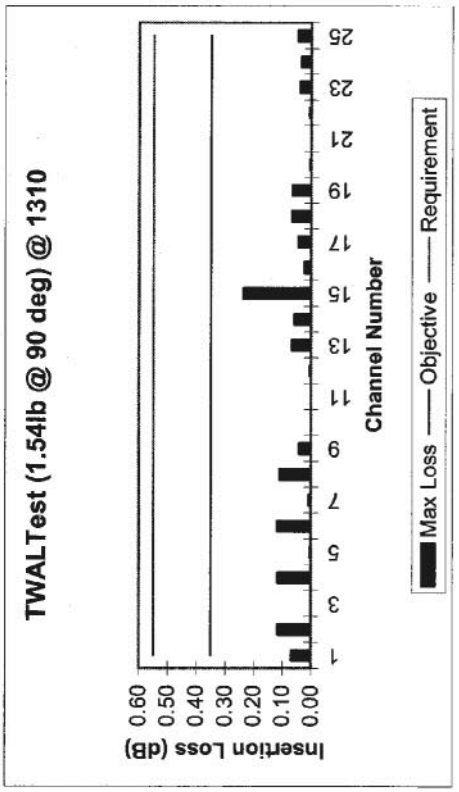

TWALTest (1.54lb @ 0 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

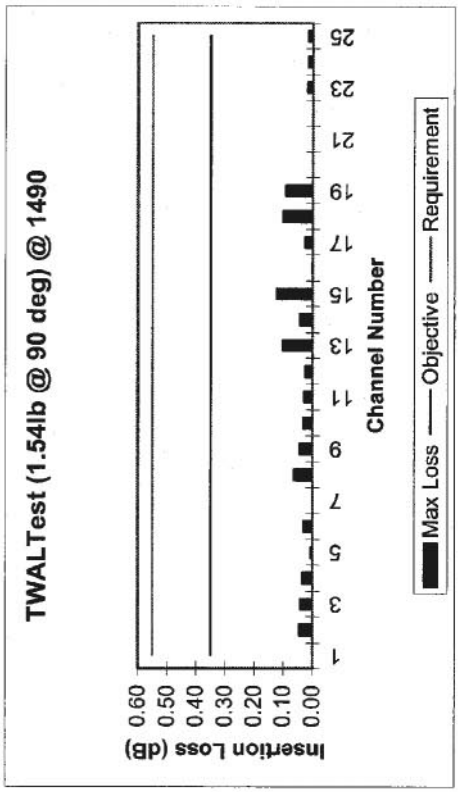

TWALTest (1.54lb @ 0 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

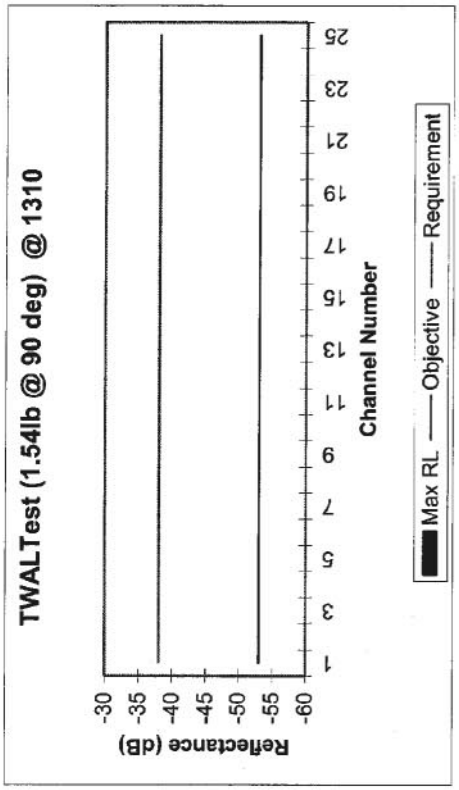

TWALTest (1.54lb @ 0 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

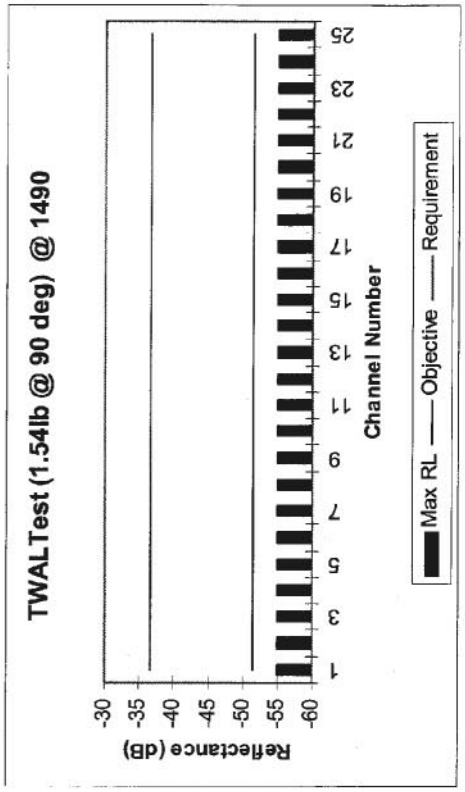

TWALTest (1.54lb @ 0 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

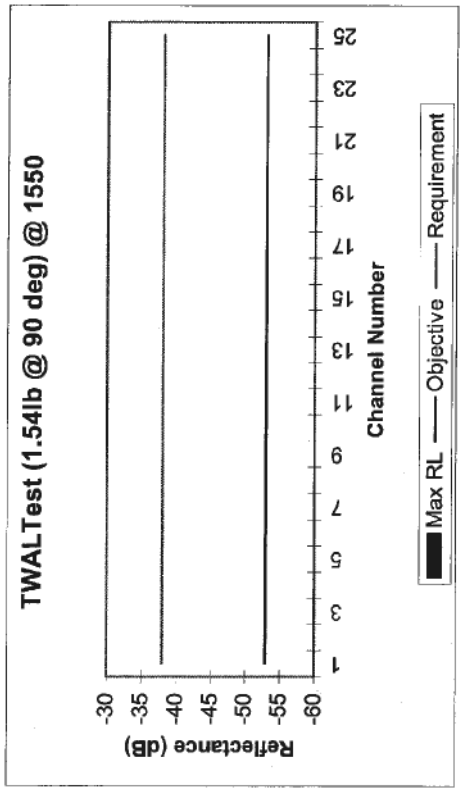
Section 4.4.3.5 Transmission With Applied Load 1.54 lbf at 90°

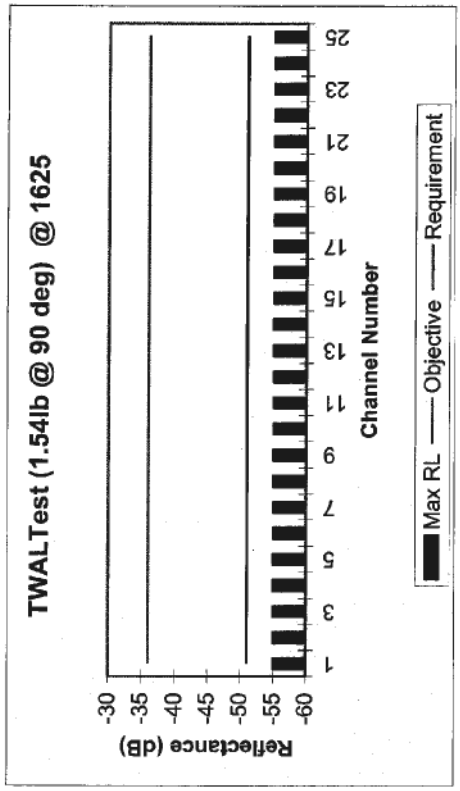


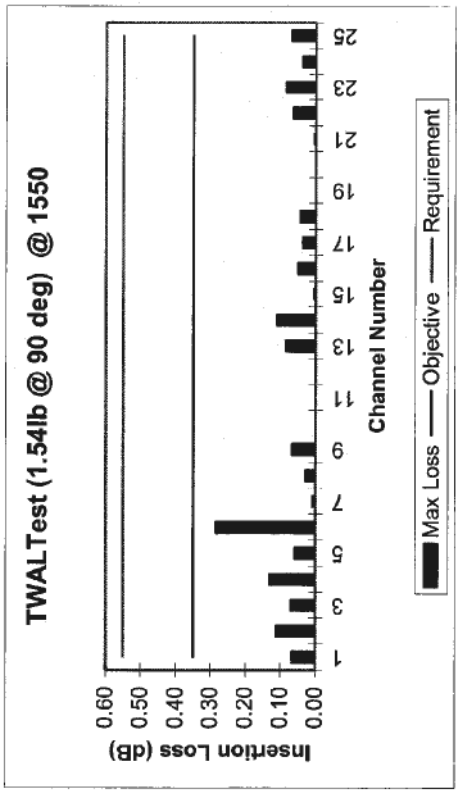


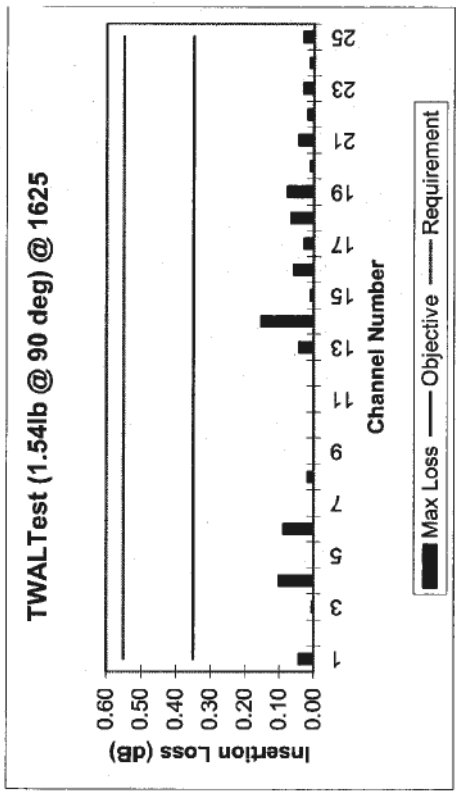




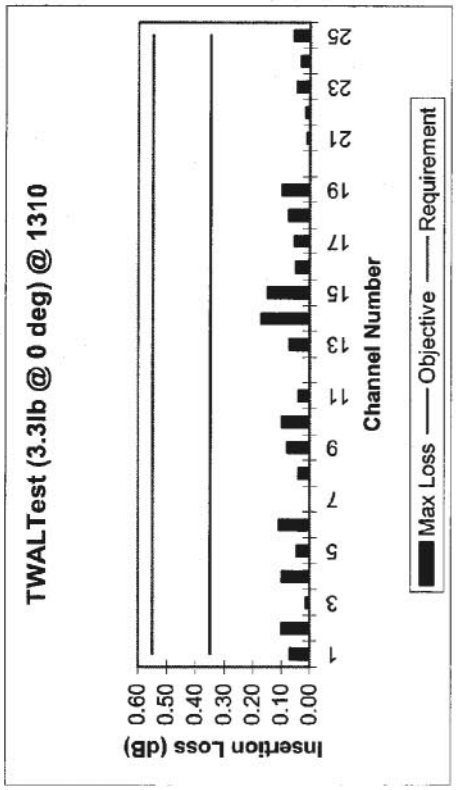

TWALTest (1.54lb @ 90 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

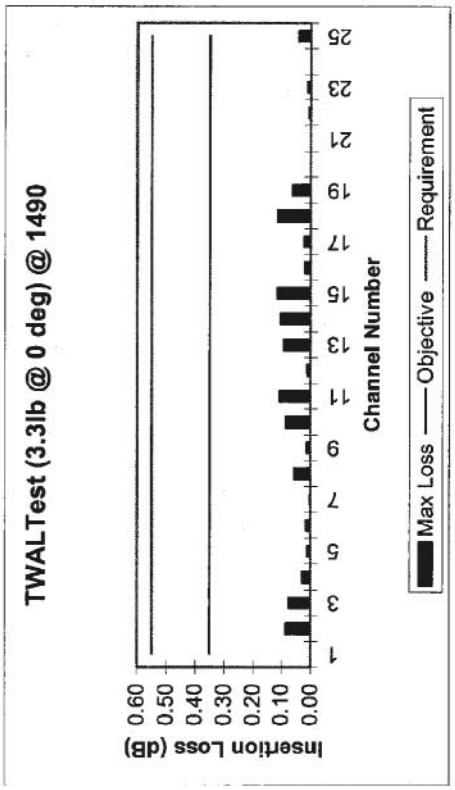

TWALTest (1.54lb @ 90 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

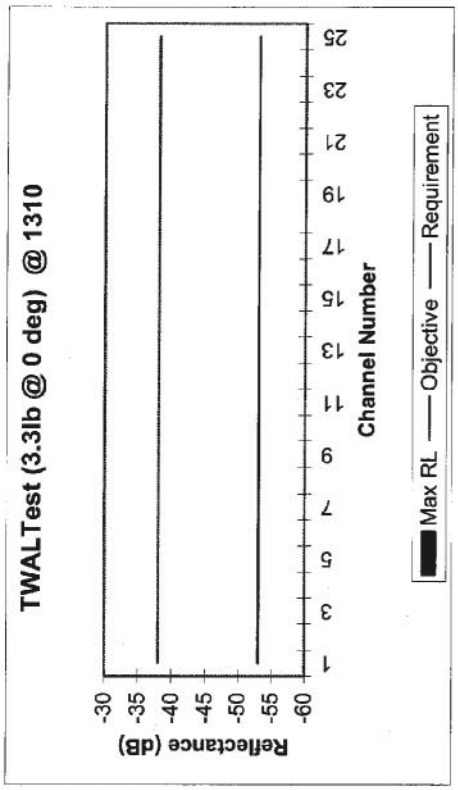

TWALTest (1.54lb @ 90 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

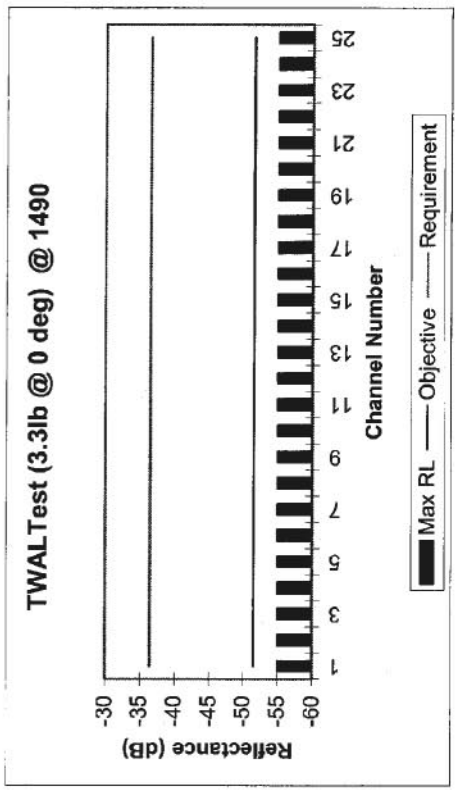

TWALTest (1.54lb @ 90 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

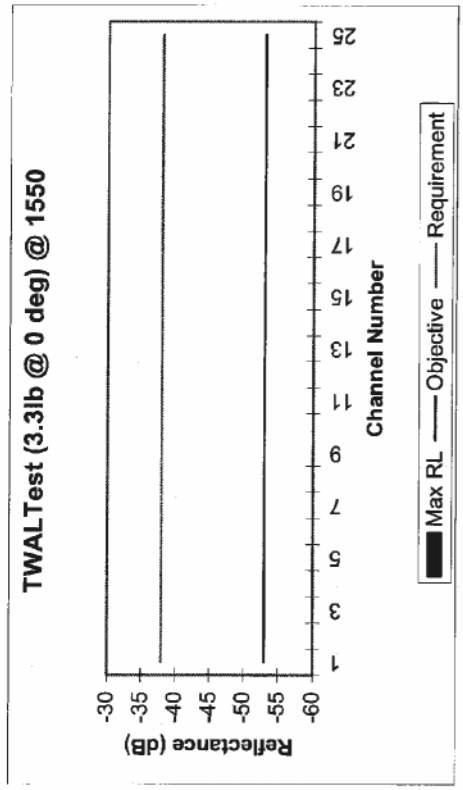
Section 4.4.3.5 Transmission With Applied Load 3.3 lbf at 0°

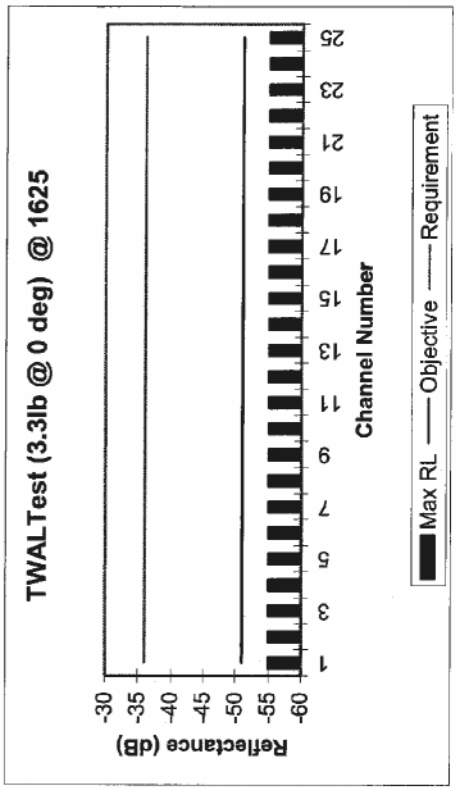


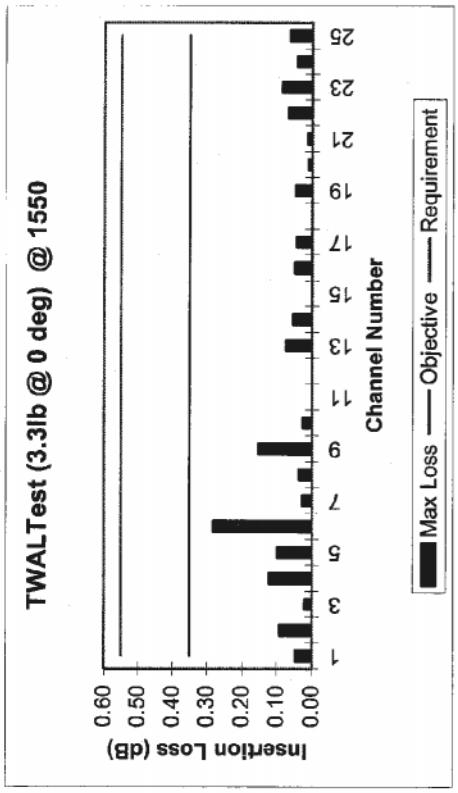


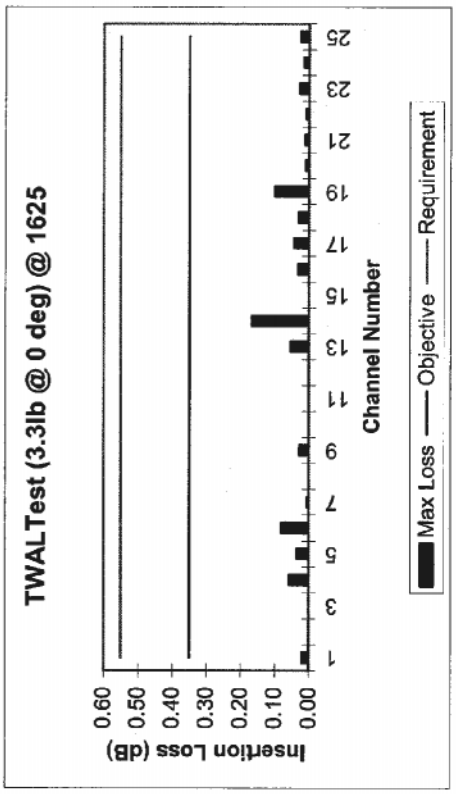




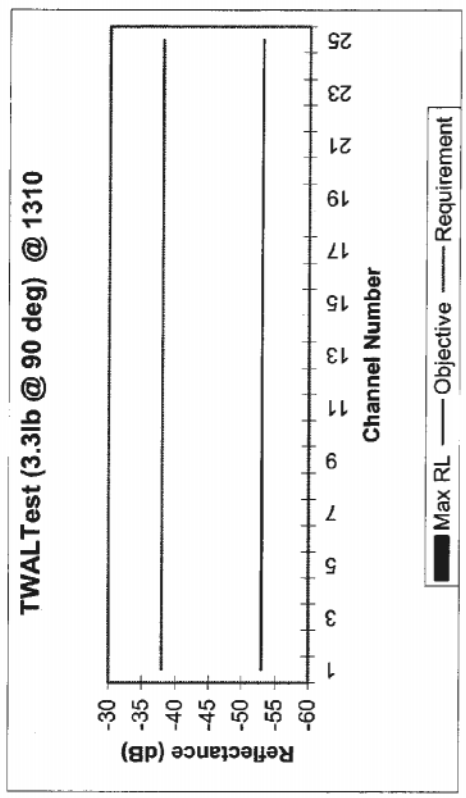

TWALTest (3.3lb @ 0 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

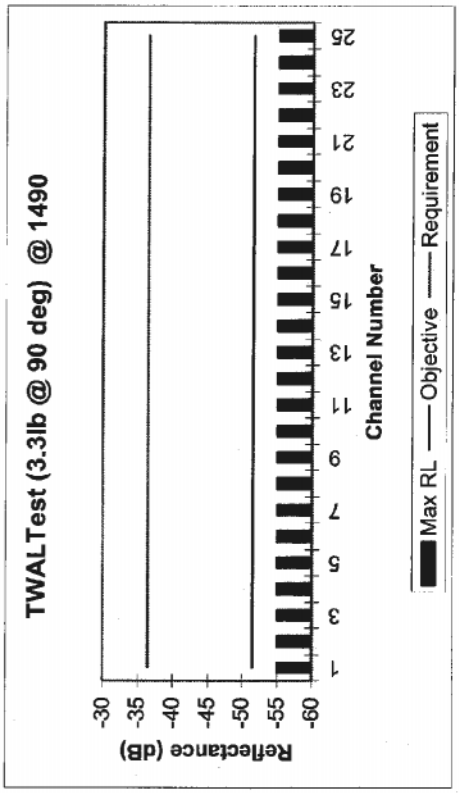

TWALTest (3.3lb @ 0 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

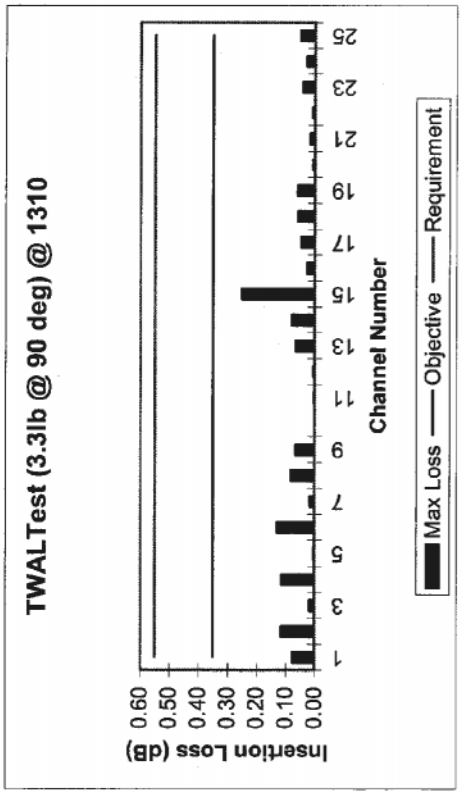

TWALTest (3.3lb @ 0 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

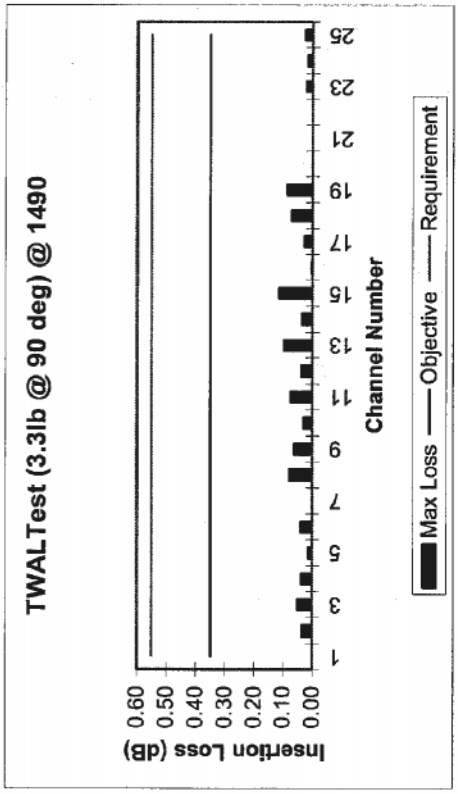

TWALTest (3.3lb @ 0 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

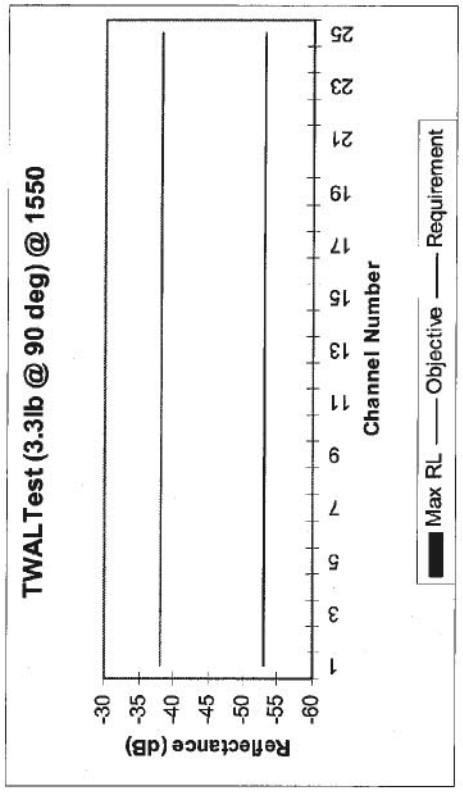
Section 4.4.3.5 Transmission With Applied Load 3.3 lbf at 90°

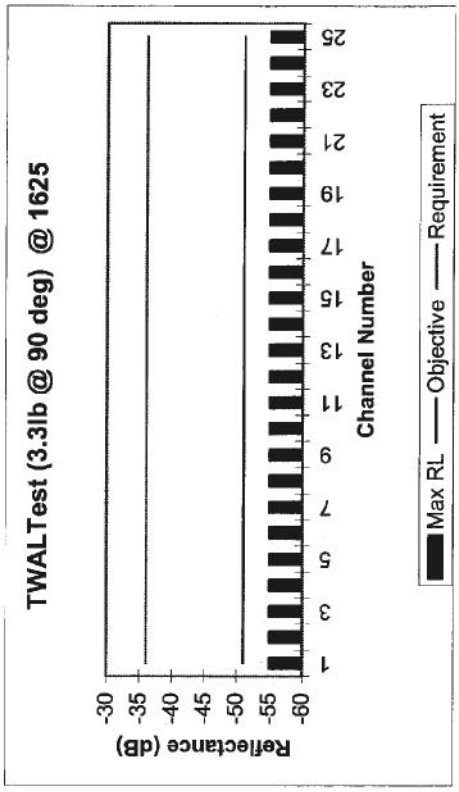


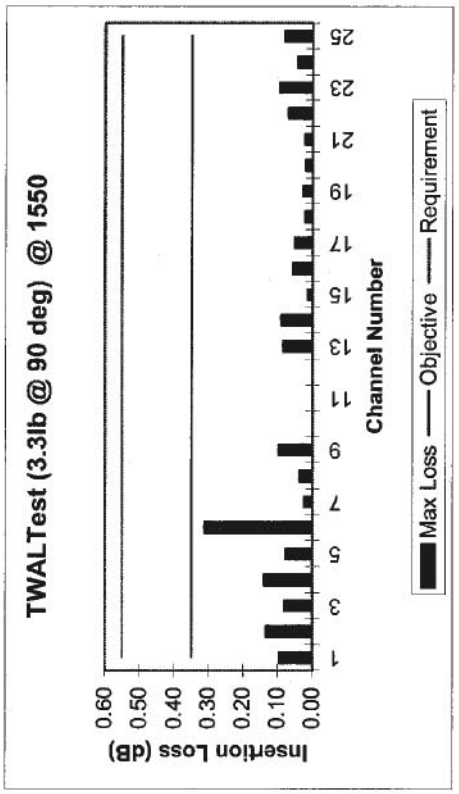


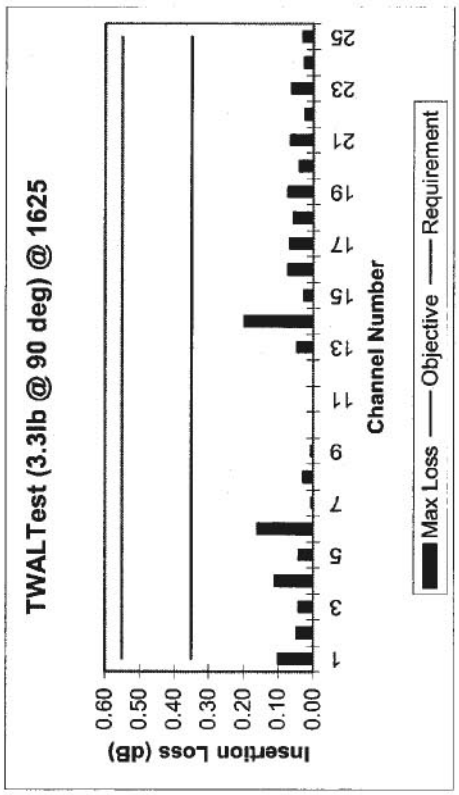




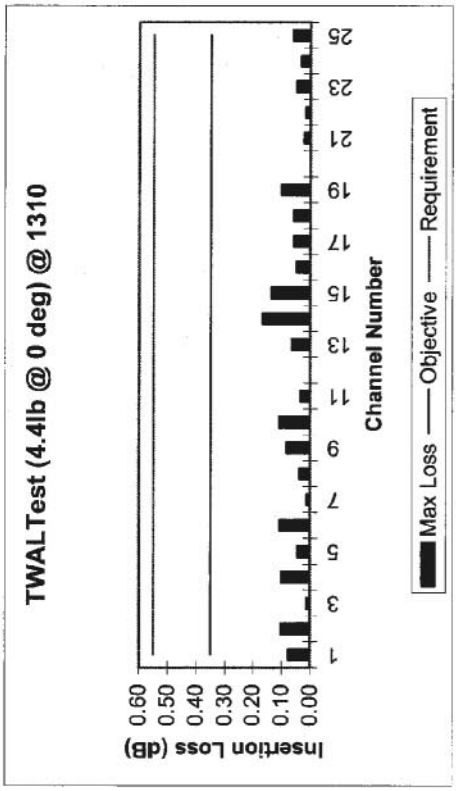

TWALTest (3.3lb @ 90 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

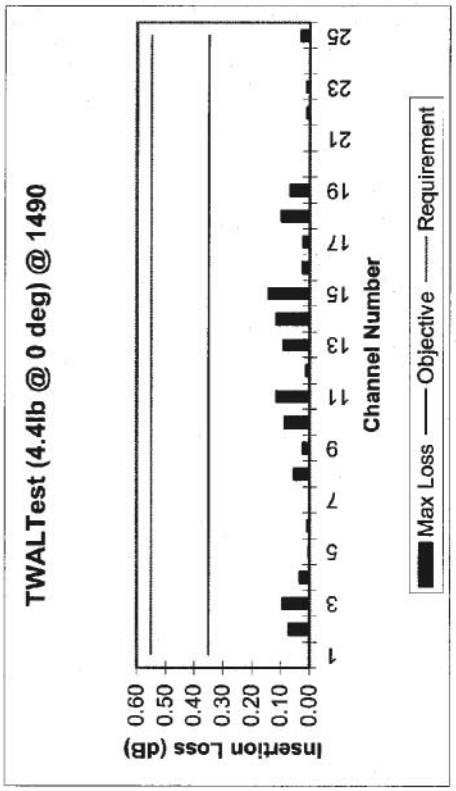

TWALTest (3.3lb @ 90 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

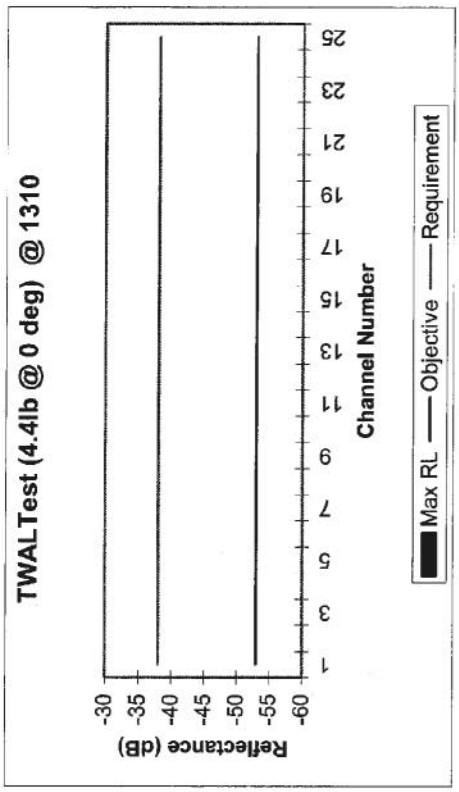

TWALTest (3.3lb @ 90 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

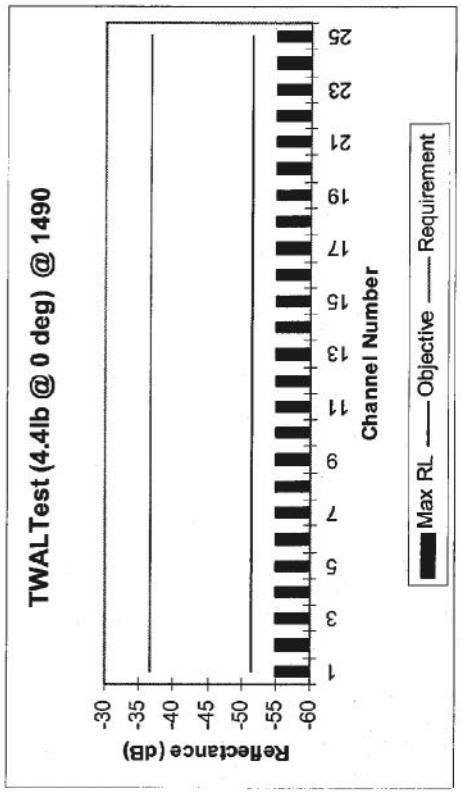

TWALTest (3.3lb @ 90 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

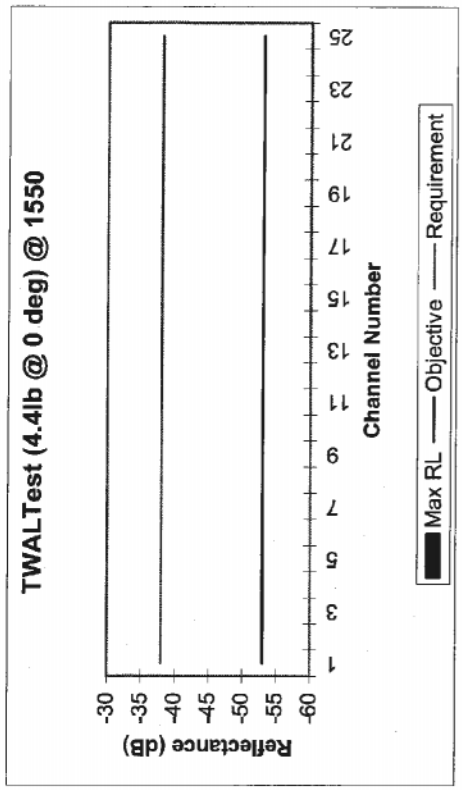
Section 4.4.3.5 Transmission With Applied Load 4.4 lbf at 0°

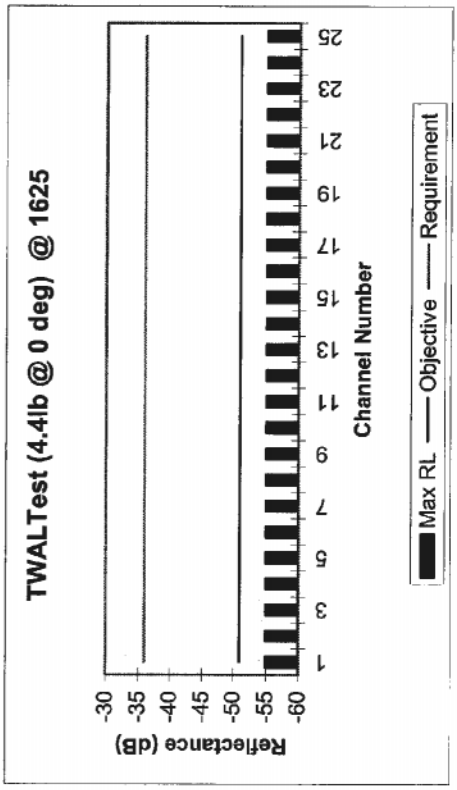


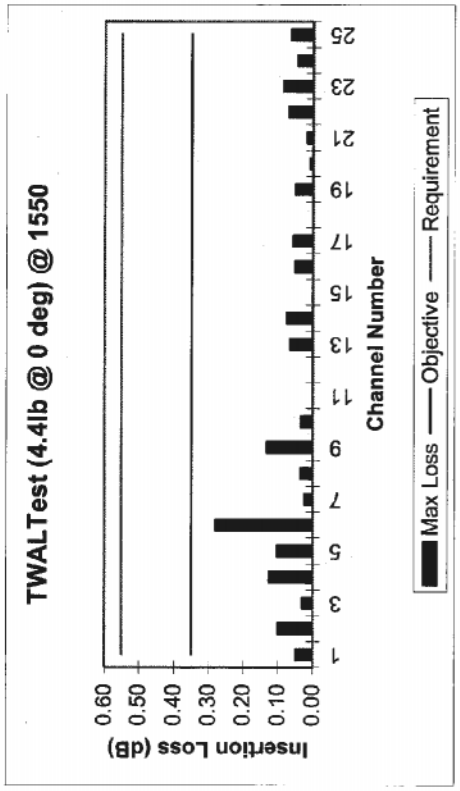


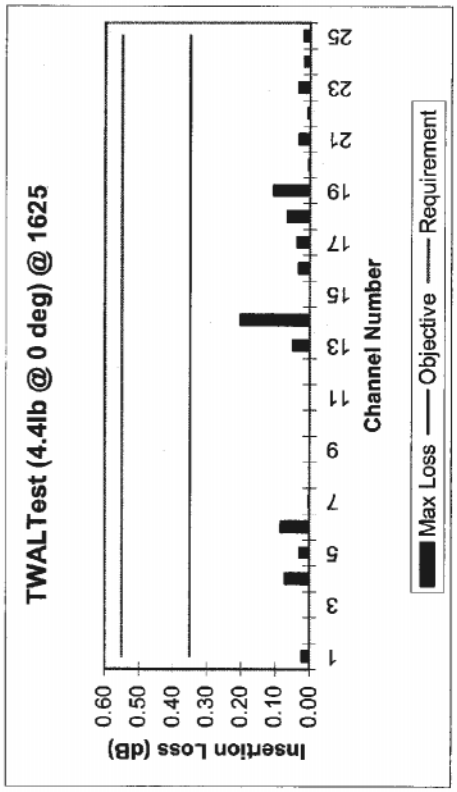




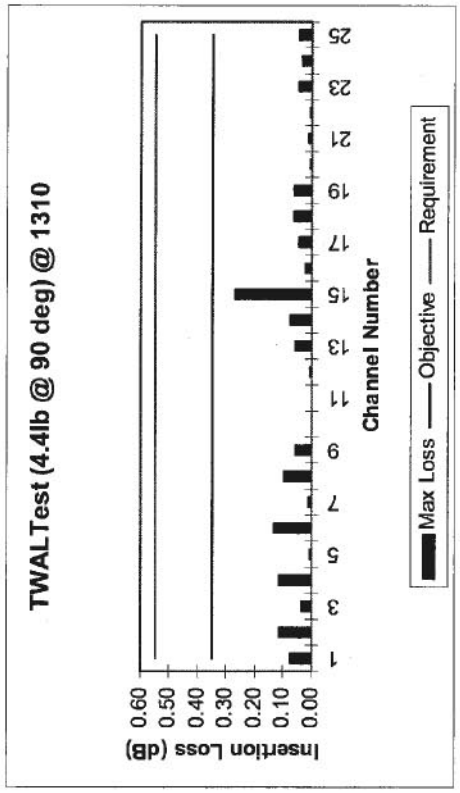

TWALTest (4.4lb @ 0 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

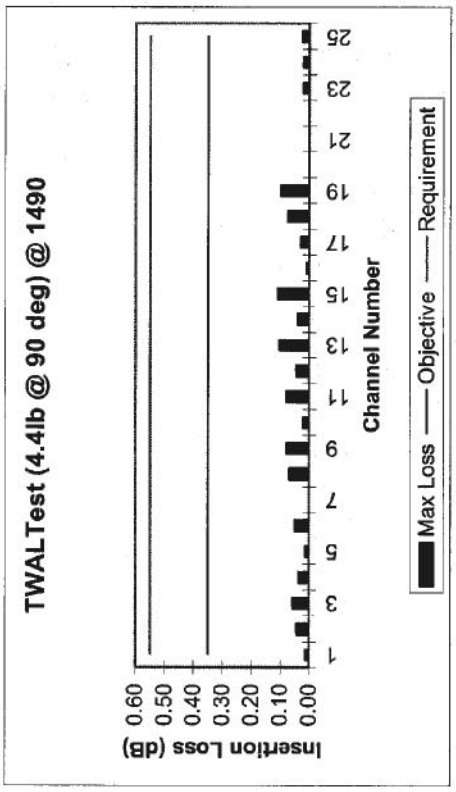

TWALTest (4.4lb @ 0 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

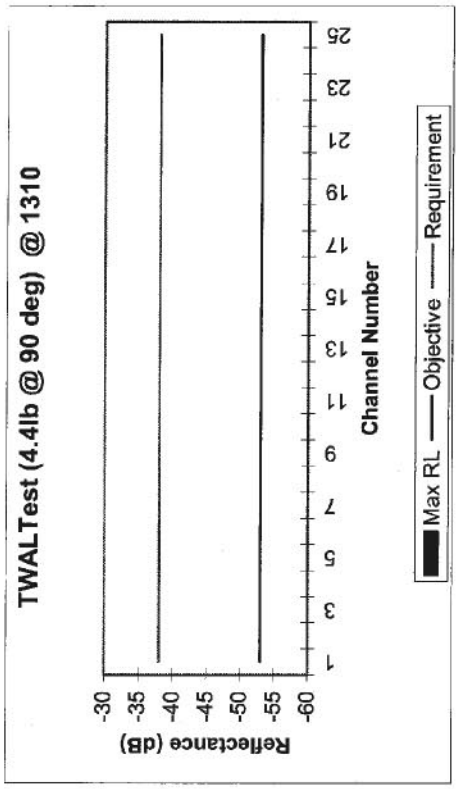

TWALTest (4.4lb @ 0 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

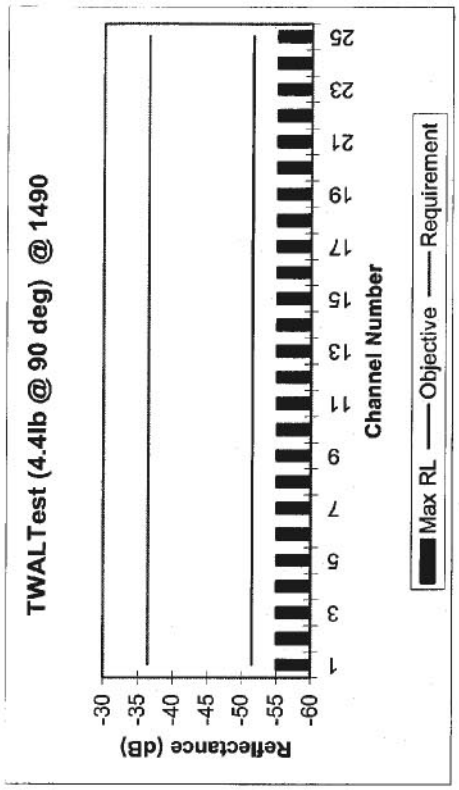

TWALTest (4.4lb @ 0 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

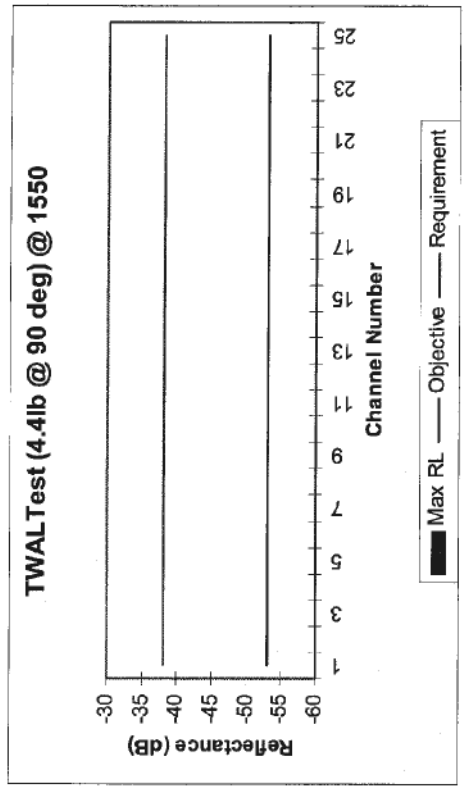
Section 4.4.3.5 Transmission With Applied Load 4.4 lbf at 90°

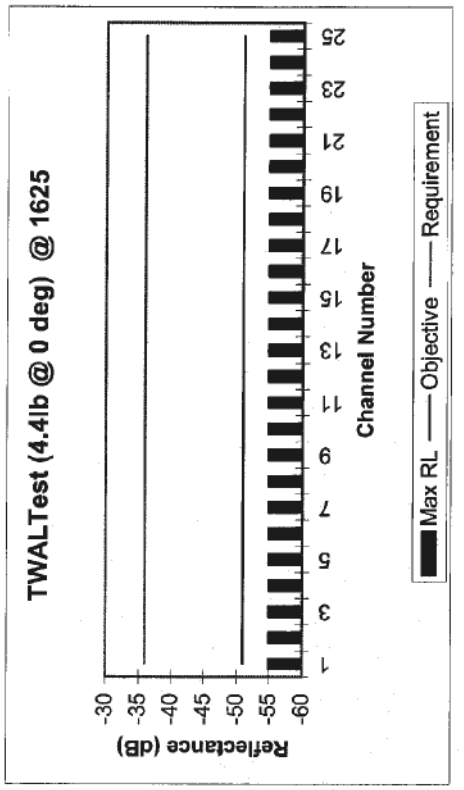


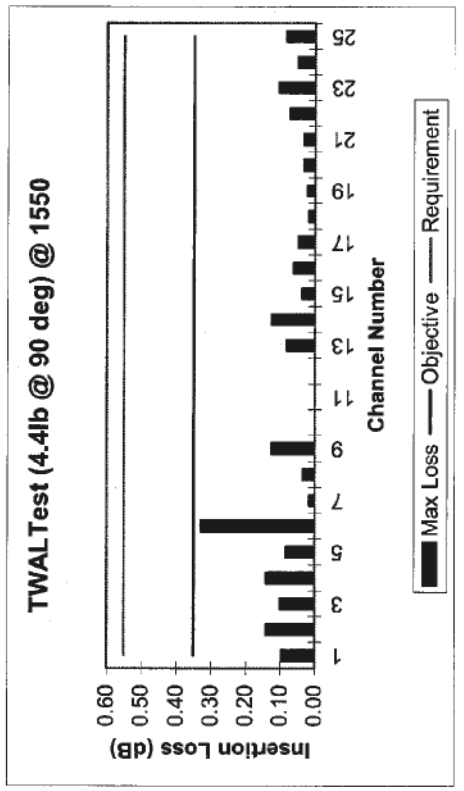


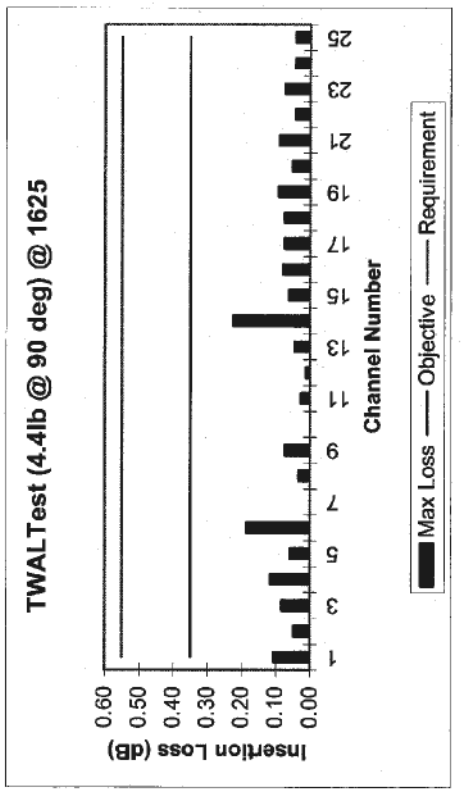




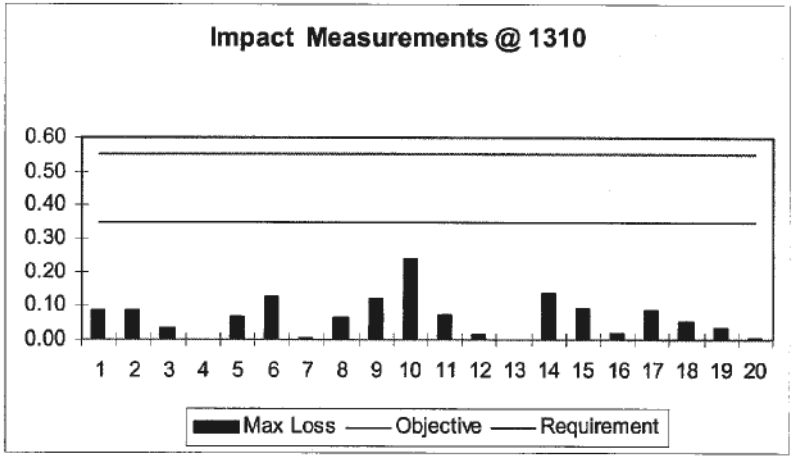

TWALTest (4.4lb @ 90 deg) @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

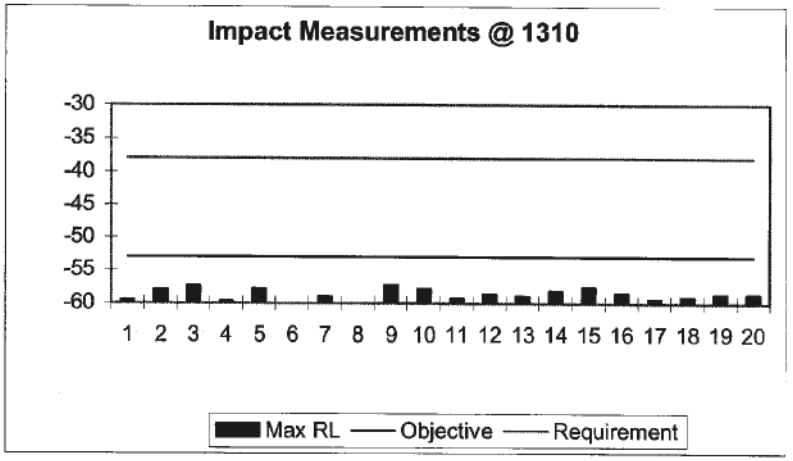

TWALTest (4.4lb @ 0 deg) @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max RL
Objective
Requirement

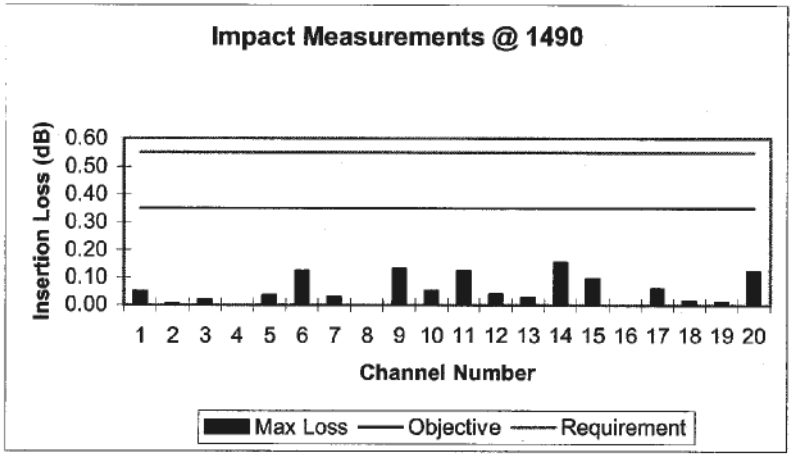

TWALTest (4.4lb @ 90 deg) @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

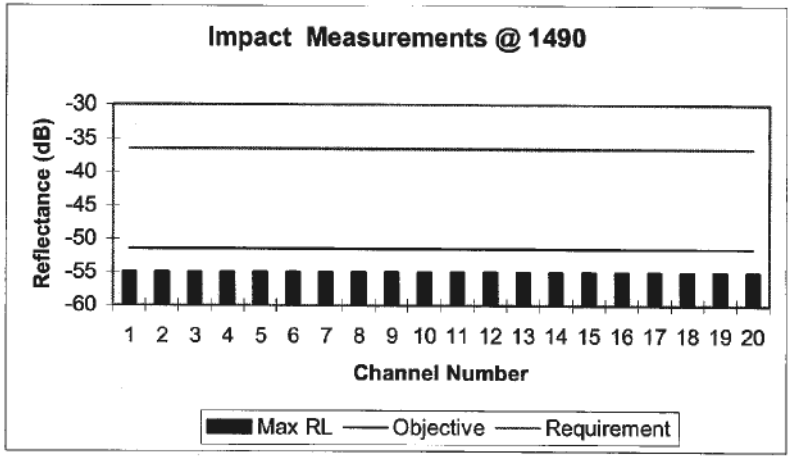

TWALTest (4.4lb @ 90 deg) @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
3
5
7
9
11
13
15
17
19
21
23
25
Channel Number
Max Loss
Objective
Requirement

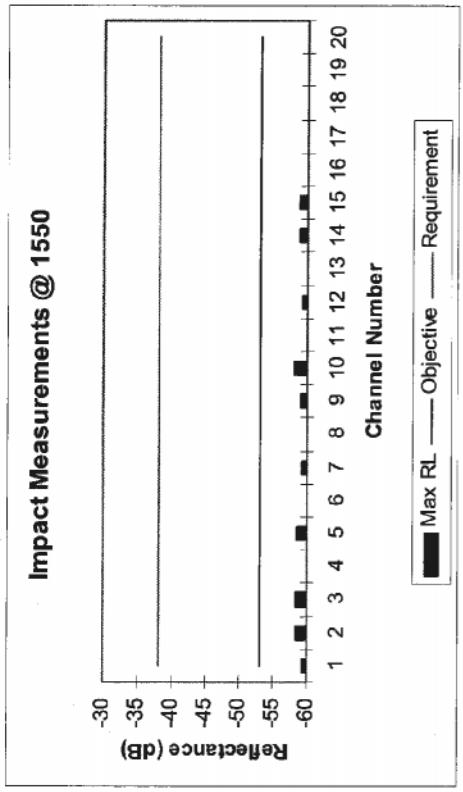
Section 4.4.3.7 Impact Test

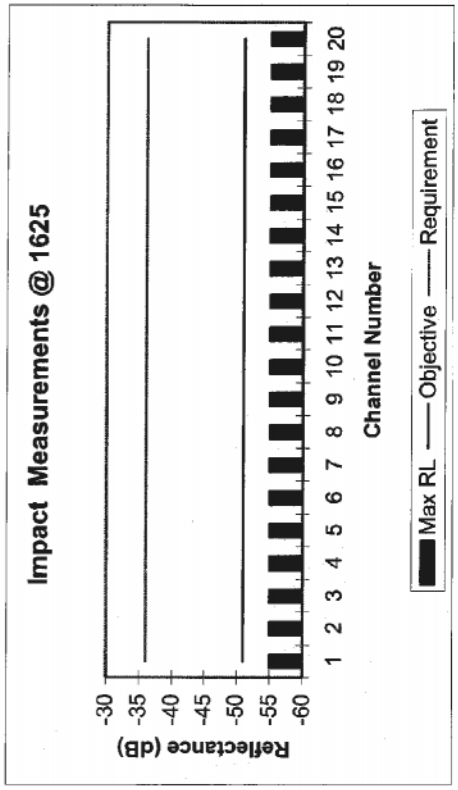


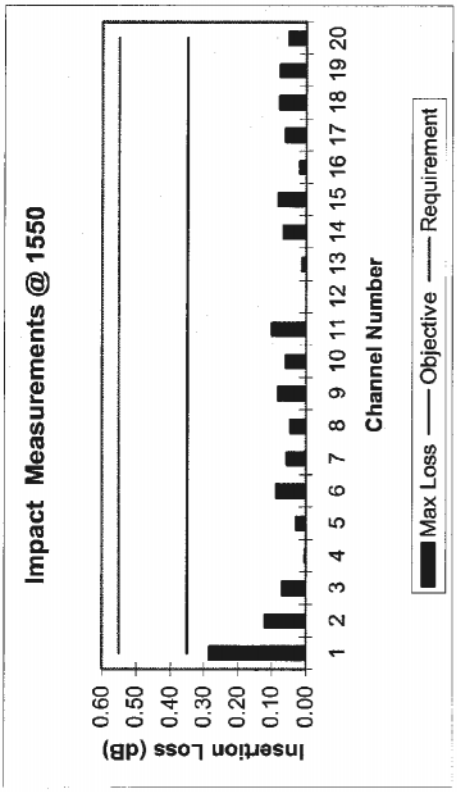


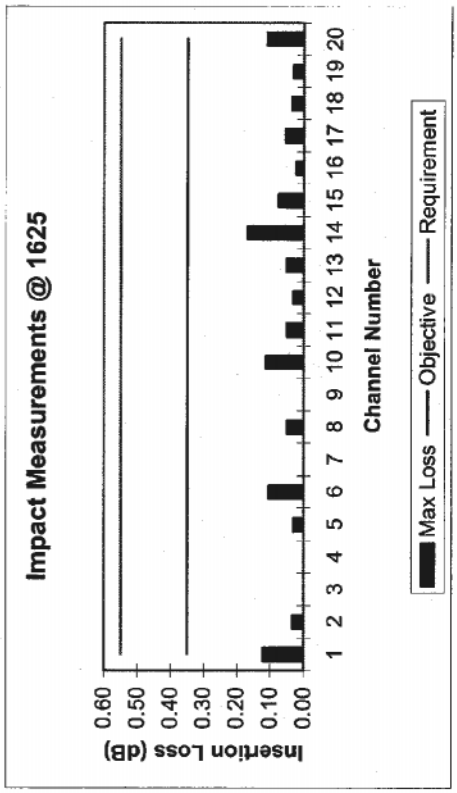




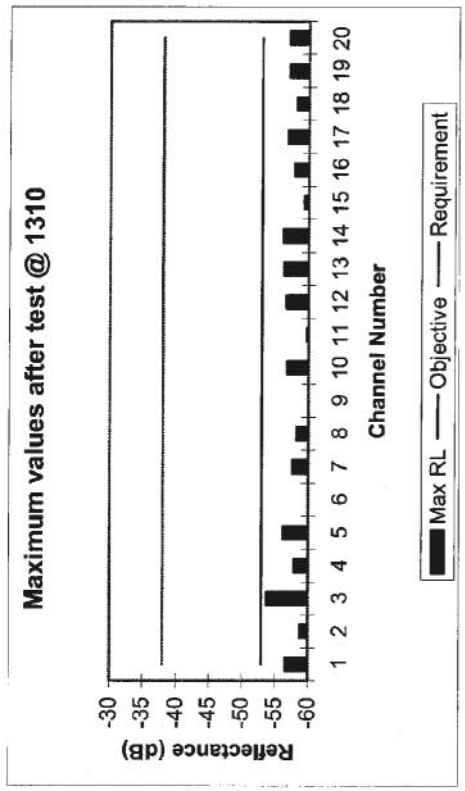

Impact Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

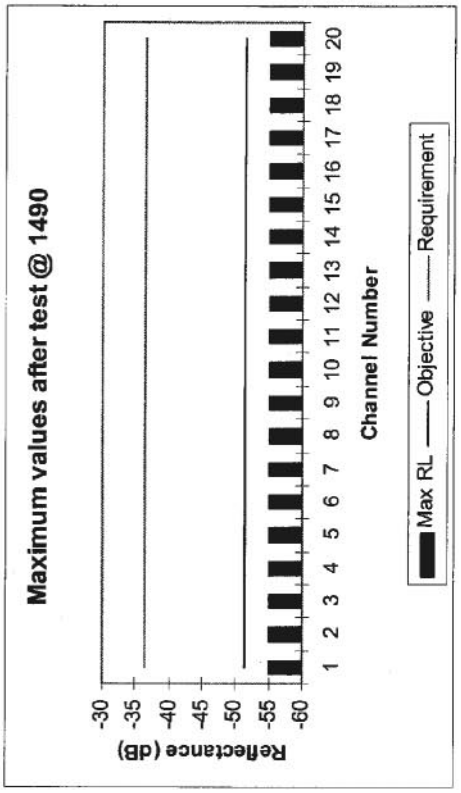

Impact Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

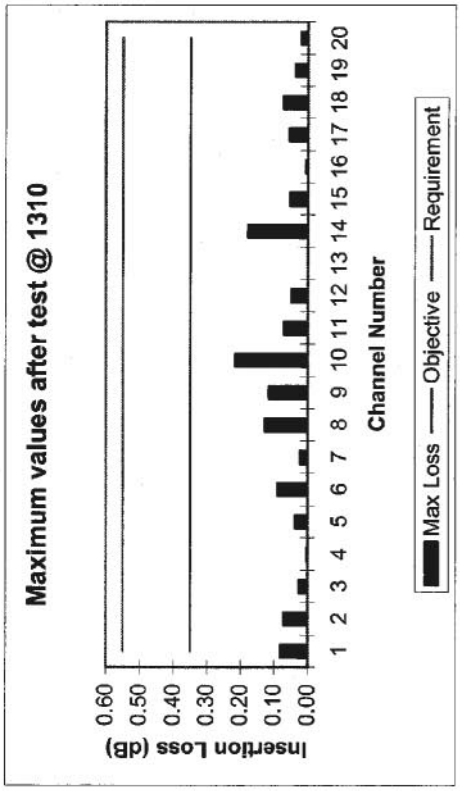

Impact Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

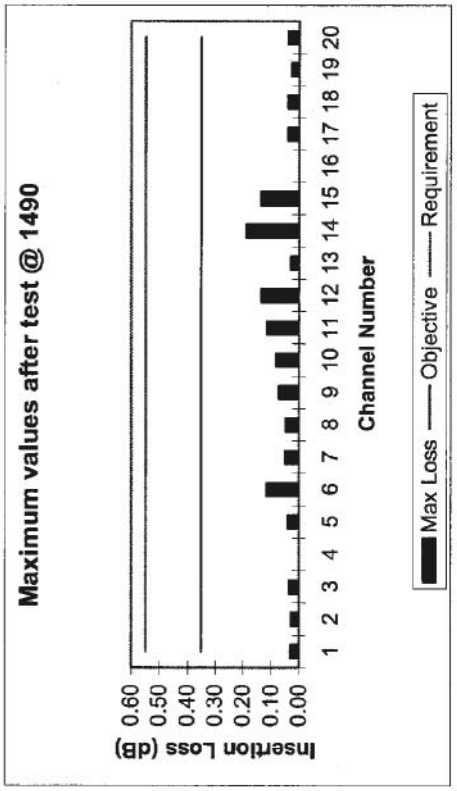

Impact Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

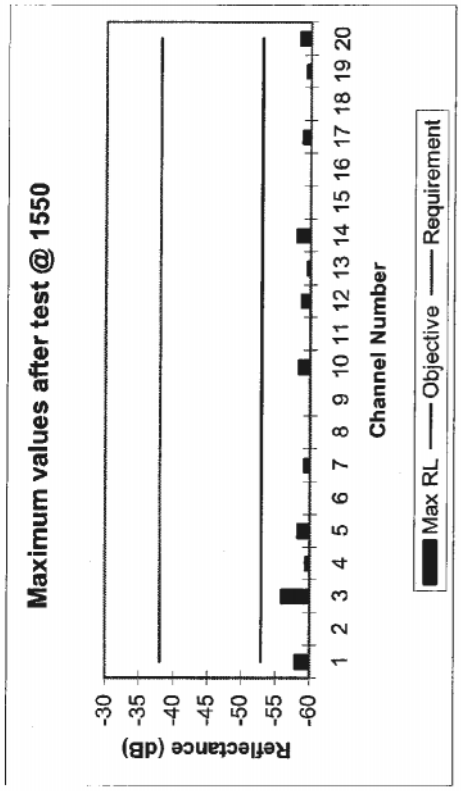
Section 4.4.3.8 Durability

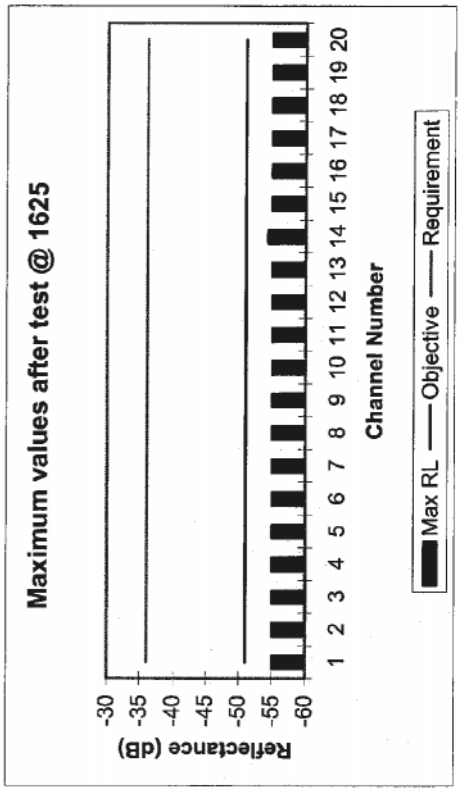


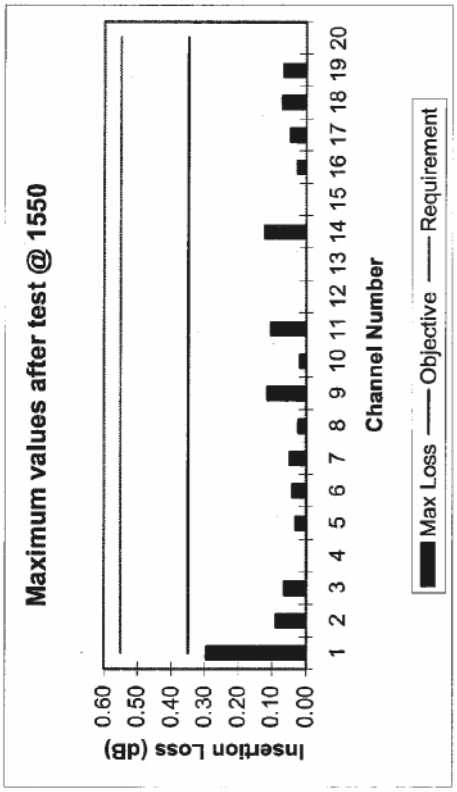


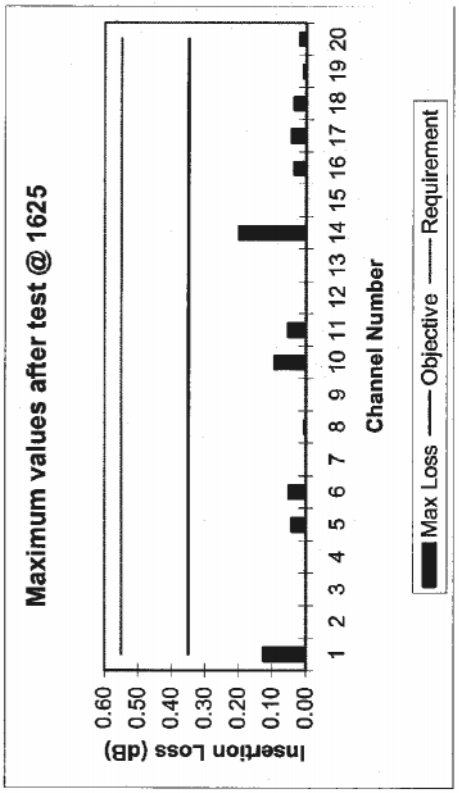




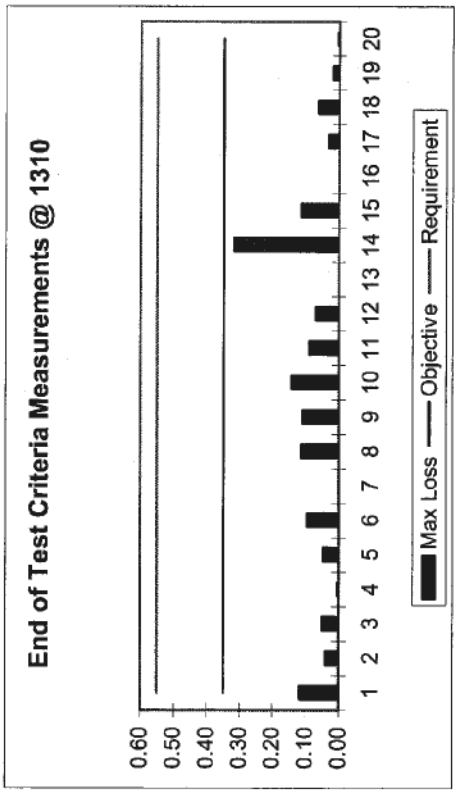

Maximum values after test @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

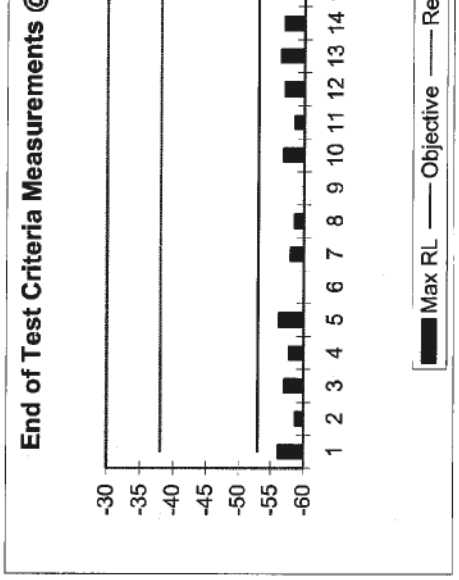

Maximum values after test @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

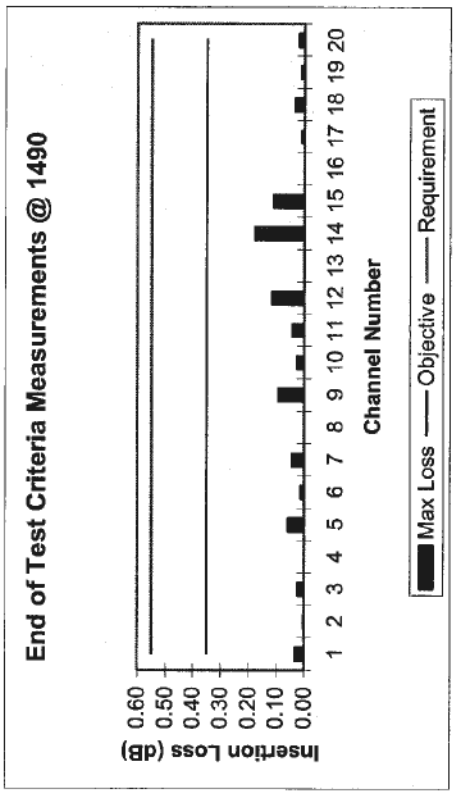

Maximum values after test @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

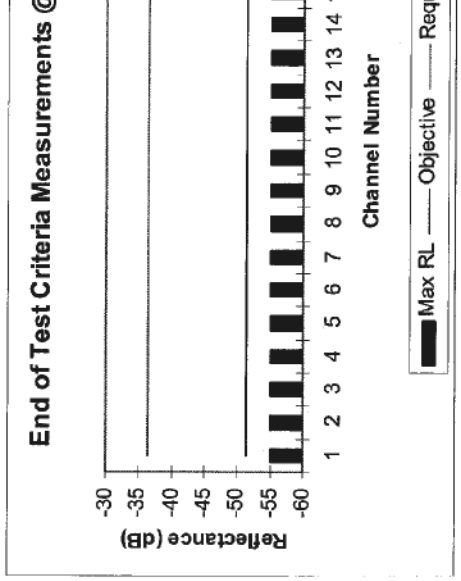

Maximum values after test @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

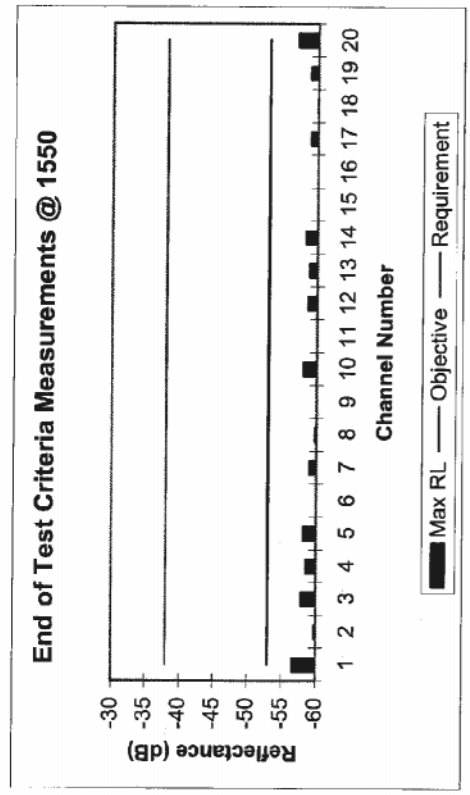
Section 4.4.3.9 End of Test Criteria

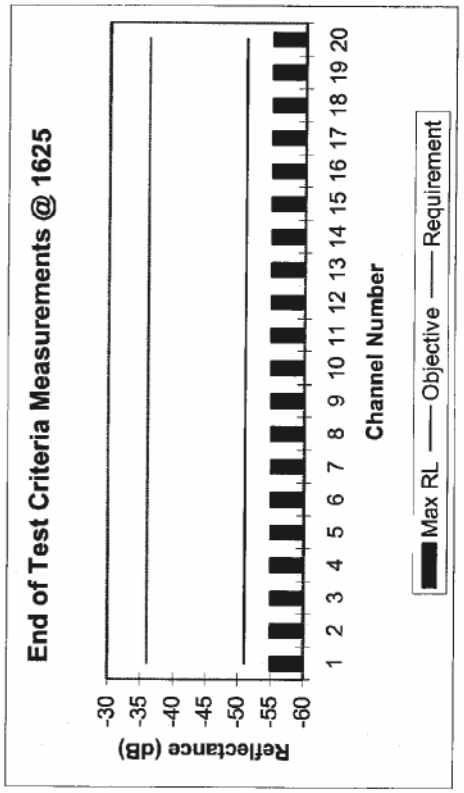


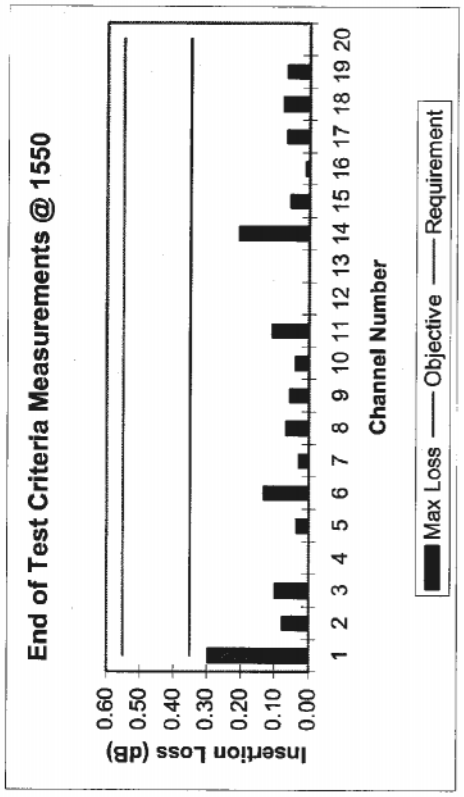


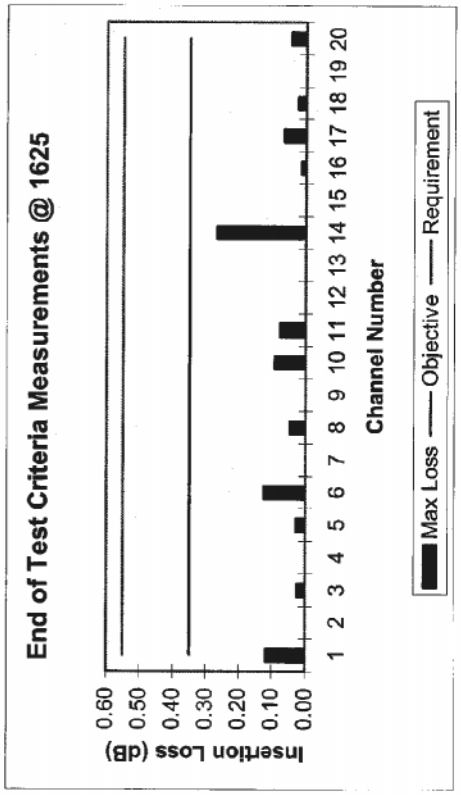


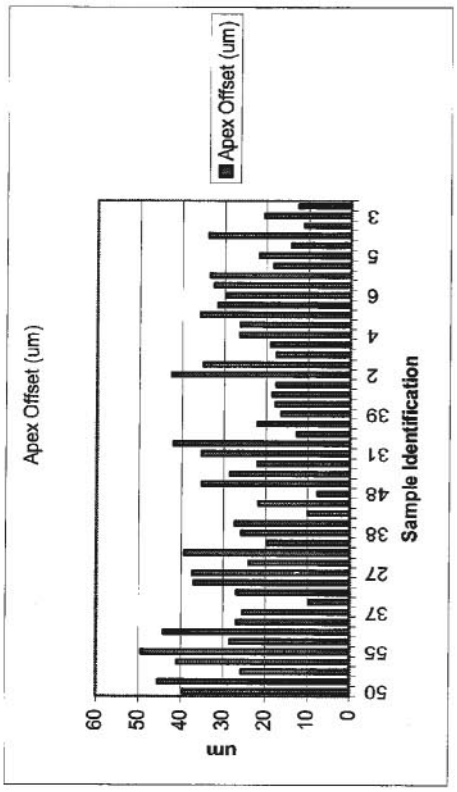



End of Test Criteria Measurements @ 1550
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

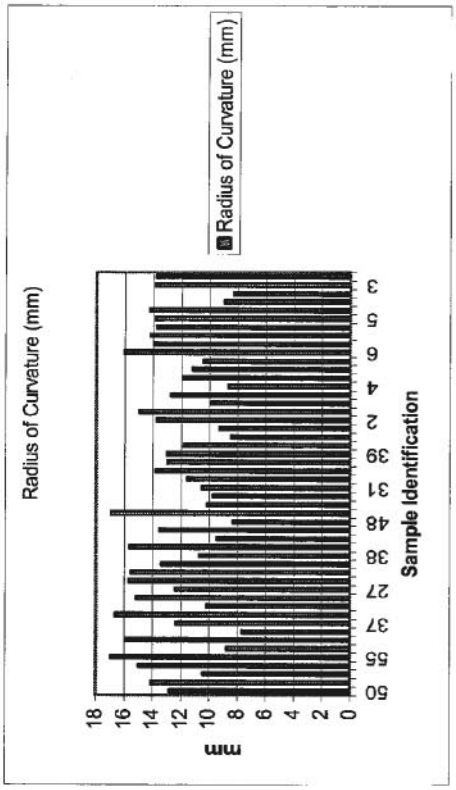

End of Test Criteria Measurements @ 1625
Reflectance (dB)
-30
-35
-40
-45
-50
-55
-60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max RL
Objective
Requirement

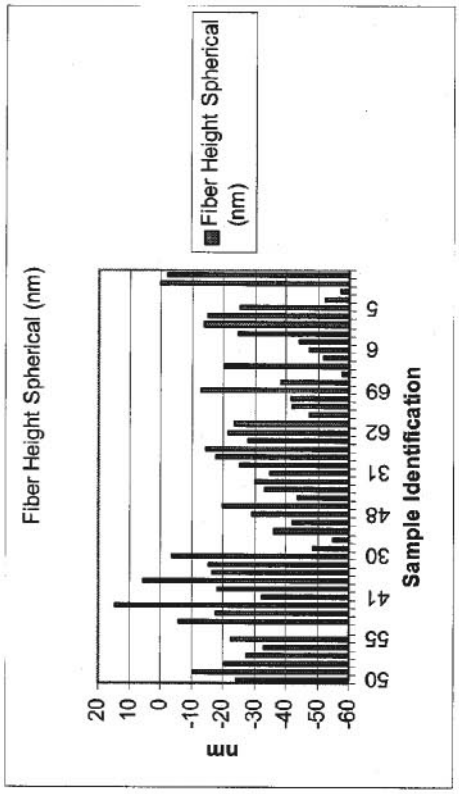

End of Test Criteria Measurements @ 1550
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement


End of Test Criteria Measurements @ 1625
Insertion Loss (dB)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Channel Number
Max Loss
Objective
Requirement

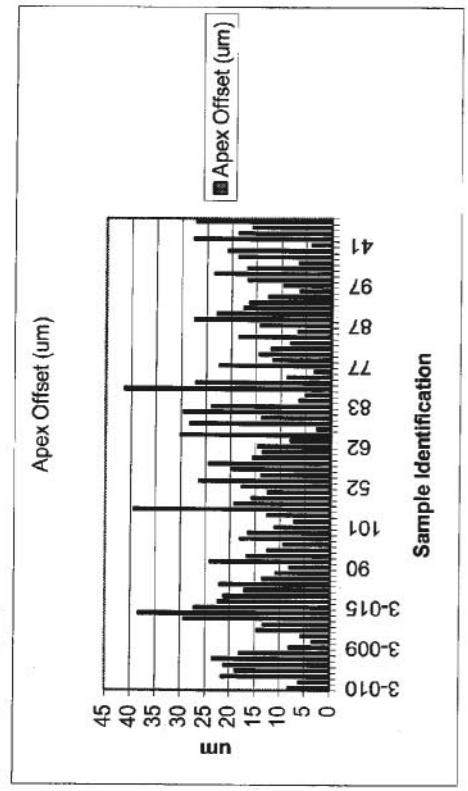


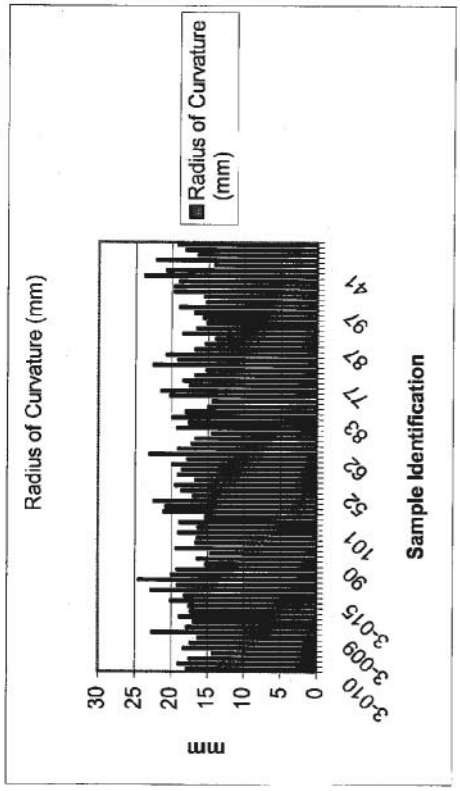
Section 4.4.3.9 End of Test Criteria - Geometrical Measurements

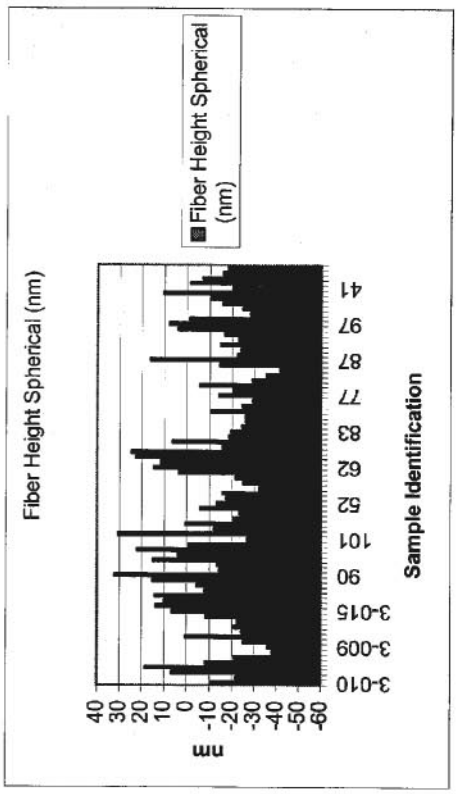




Section 4.4.5.1 Ferrule Endface Geometry for Non-Angled Physical Contact Connectors







Section 4.4.6 Connector Installation