1 INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity VITA 66.5, Style A, Fiber-Optic Connector for Use with Multi-Mode MT Ferrules to determine its conformance to the requirements of Product Specification 108-163027, Revision B.

1.2 Scope

This report covers the optical, mechanical and environmental performance of the VITA 66.5, Style A, Fiber-Optic Connector for Use with Multi-Mode MT Ferrules. Testing was performed at the Fiber Optic Test Laboratory of the Harrisburg Electrical Component Test Laboratory (HECTL) between 26-May-2020 and 18-Aug-2020. The test file numbers for this testing are EA20200192T (for Test Group 1) and EA202000193T (for Test Group 2). This documentation is on file at and available from the HECTL – Fiber Optics Lab.

1.3 Conclusion

The VITA 66.5, Style A, Fiber-Optic Connector for Use with Multi-Mode MT Ferrules listed in paragraph 1.5. conformed to the optical, mechanical and environmental performance requirements of Product Specification 108-163027, Revision B.

1.4 Product Description

The VITA 66.5, Style A, connector system provides a high-density, blind-mate optical interconnect in a backplane/card configuration. The connectors accommodate a 12-fiber multi-mode MT ferrule interface, enabling a single, 12-count fiber ribbon to interface directly to a transceiver. The receptacle connector kit consists of an outer shell, a floating insert sub-assembly, a retainer sub-assembly and connector mounting screws. The floating insert is secured between the connector shell and the backplane. Using a captive screw, the retainer block secures the MT ferrule/cable assembly within the connector insert. The plug connector face plate is assembled directly to the card-edge transceiver, which contains an integral MT interface.

1.5 Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for test:

Part Number	Description	Test Group	
		1	2
		Quantity per Test Group	
2332700-1	Connector Kit, Receptacle, Fiber Optic, VITA 66.5, Style A	3	3
2332701-1	Face Plate Kit, Plug, Fiber Optic, VITA 66.5, Style A	3	3
2828720-2	Cable Assembly, Fiber Optic, MT to MPO, 12-Fiber Ribbon, OM3, 50/125	6	6

Figure 1.5-1

1.6. Qualification Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)	
	1	2
	TEST SEQUENCE (b)	
Visual and mechanical inspection	1	1
Attenuation	2	2
Temperature cycling	3	
Vibration, sinusoidal		3
Vibration, random	4	
Shock, mechanical – sawtooth		4
Bench handling shock		5
Durability	5	
End of service life	6	6

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

Figure 1.6-1

1.7. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

- Temperature: 20.0 to 27.5°C
- Relative Humidity: 40.0 to 74.1%

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2 SUMMARY OF TESTING

2.1 Visual and Mechanical Inspection

A Certificate of Conformance (C of C) was issued by Product Assurance stating that all specimens in this test package, for both Test Group 1 and Test Group 2, were produced, inspected, and accepted as conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts. The samples were visually examined, and no damage or defects were found that would prevent them from performing their intended function. End-face Geometry and End-face Workmanship of the test sample MT ferrules were measured and confirmed within TE specification limits for production-grade, multimode, single-row MT ferrules, as applicable.

2.2 Test Group 1

2.2.1 Initial Attenuation of All Channels

All Initial Attenuation measurements met the requirements for maximum attenuation of any channel, sample average attenuation, and group average attenuation. Summary data for Initial Attenuation performance of Test Group 1, at 850 nm and 1300 nm, are presented in Table 2.2.1-1.

Table 2.2.1-1 Initial Attenuation Performance

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.53	0.59
Sample Average, Maximum	0.18	0.13
Group Average	0.11	0.08
Channel Pass - Fail Count	36 - 0	36 - 0
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Requirements		
Maximum, Any Channel	≤ 1.2	
Sample Average	≤ 0.7	
Group Average	≤ 0.65	

NOTE: *All units in dB.*

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2.2.2 Temperature Cycling

All Attenuation and Attenuation Increase measurements met requirements both during and after the Temperature Cycling test. Summary optical performance data at 850 nm and 1300 nm during Temperature Cycling are presented in Table 2.2.2-1; summary data after Temperature Cycling are presented in Table 2.2.2-2. No evidence of physical damage was visible following Temperature Cycling.

Table 2.2.2-1 Optical Performance During Temperature Cycling

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	1.13	1.18
Group Average	0.11	0.07
Channel Pass - Fail Count	36 - 0	
Sample Pass - Fail Count	3 - 0	
Attenuation Increase Statistics		
Group Maximum	0.59	0.59
Group Average	0.00	-0.01
Channel Pass - Fail Count	36 - 0	
Sample Pass - Fail Count	3 - 0	
Requirements (Any Channel)		
Attenuation	≤ 1.2	
Attenuation Increase	≤ 0.75	

NOTE: *All units in dB.*

Table 2.2.2-2 Optical Performance After Temperature Cycling

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.70	0.69
Group Average	0.09	0.07
Channel Pass - Fail Count	36 - 0	
Sample Pass - Fail Count	3 - 0	
Attenuation Increase Statistics		
Group Maximum	0.19	0.10
Group Average	-0.02	-0.02
Channel Pass - Fail Count	36 - 0	
Sample Pass - Fail Count	3 - 0	
Requirements (Any Channel)		
Attenuation	≤ 1.2	
Attenuation Increase	≤ 0.75	

NOTE: *All units in dB.*

2.2.3 Vibration, Random

All Attenuation and Attenuation Increase measurements at 850 nm and 1300 nm met requirements after Random Vibration testing in each of three mutually perpendicular axes. Summary performance data are provided in Table 2.2.3-1, which include interim optical measurements (after exposure in each axis) and final measurements after Random Vibration. No optical discontinuities (transient reductions in optical power of 1.0 dB or more for a period of 1 µs or longer) were observed during Random Vibration. The samples showed no physical change during or after testing; no cracks, breaks or loose parts were visible.

Table 2.2.3-1 Optical Performance After Random Vibration

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.64	0.69
Group Average	0.09	0.08
Channel Pass - Fail Count	36 - 0	36 - 0
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Increase Statistics		
Group Maximum	0.06	0.05
Group Average	-0.02	-0.04
Channel Pass - Fail Count	36 - 0	36 - 0
Sample Pass - Fail Count	3 - 0	3 - 0
Requirements (Any Channel)		
Attenuation	≤ 1.2	
Attenuation Increase	≤ 0.75	

NOTE: *All units in dB.*

2.2.4 Durability

All Attenuation and Attenuation Increase measurements met requirements after the cleaning cycles of the Durability test. No evidence of physical damage beyond minor wear was visible following the samples being mated and unmated 100 times. Summary performance data at 850 nm and 1300 nm are presented in Table 2.2.4-1.

Table 2.2.4-1 Optical Performance After Durability Cleaning Cycles
(summary data after cleaning, following 25~, 50~, 75~ and 100~)

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.77	0.73
Group Average	0.11	0.08
Channel Pass - Fail Count	36 - 0	36 - 0
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Increase Statistics		
Group Maximum	0.28	0.53
Group Average	-0.02	-0.03
Channel Pass - Fail Count	36 - 0	36 - 0
Sample Pass - Fail Count	3- 0	3 - 0
Requirements (Any Channel)		
Attenuation	≤ 1.2	
Attenuation Increase	≤ 0.75	

NOTE: *All units in dB.*

2.2.5 End of Service Life

All channels of Test Group 1 met the End of Service Life requirements for maximum Attenuation and Attenuation Increase of any channel, maximum sample average Attenuation, and maximum group average Attenuation. Summary optical performance data at 850 nm and 1300 nm are presented in Table 2.2.5-1.

Table 2.2.5-1 End of Service Life

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.48	0.58
Sample Average, Maximum	0.21	0.12
Group Average	0.09	0.04
Channel Pass - Fail Count	36 - 0	36 - 0
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Increase Statistics		
Group Maximum	0.08	0.07
Group Average	-0.02	-0.04
Channel Pass - Fail Count	36 - 0	36 - 0
Sample Pass - Fail Count	3 - 0	3 - 0
Requirements		
Attenuation, Any Channel	≤ 1.2	
Attenuation, Sample Average	≤ 0.7	
Attenuation, Group Average	≤ 0.65	
Attenuation Increase, Any Channel	≤ 0.75	

NOTE: *All units in dB.*

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2.3 Test Group 2

2.3.1 Initial Attenuation of All Channels

All Initial Attenuation measurements of Test Group 2 met the requirements for maximum average attenuation of any channel, maximum sample average attenuation, and maximum group average attenuation. Summary Initial Attenuation data at 850 nm and 1300 nm are presented in Table 2.3.1-1.

Table 2.3.1-1 Initial Attenuation Performance

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.13	0.15
Sample Average, Maximum	0.09	0.10
Group Average	0.07	0.06
Channel Pass - Fail Count	36 - 0	36 - 0
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Requirements		
Maximum, Any Channel	≤ 1.2	
Sample Average	≤ 0.7	
Group Average	≤ 0.65	

NOTE: *All units in dB.*

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2.3.2 Vibration, Sinusoidal

All Attenuation and Attenuation Increase measurements at 850 nm and 1300 nm met requirements after Sinusoidal Vibration testing in each of three mutually perpendicular axes. Summary performance data are provided in Table 2.3.2-1, which include interim optical measurements (after exposure in each axis) and final measurements after Sinusoidal Vibration. No optical discontinuities (transient reductions in optical power of 1.0 dB or more for a period of 1 μs or longer) were observed during Sinusoidal Vibration. The samples showed no physical change during or after Sinusoidal Vibration; no cracks, breaks or loose parts were visible.

Table 2.3.2-1 Optical Performance After Sinusoidal Vibration

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.65	0.61
Group Average	0.10	0.07
Channel Pass - Fail Count	35 - 0 (a)	35 - 0 (a)
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Increase Statistics		
Group Maximum	0.60	0.58
Group Average	0.02	0.01
Channel Pass - Fail Count	35 - 0 (a)	35 - 0 (a)
Sample Pass - Fail Count	3 - 0	3 - 0
Requirements (Any Channel)		
Attenuation	≤ 1.2	
Attenuation Increase	≤ 0.75	

NOTE: *All units in dB.*

(a) 35 of 36 channels: Group 2, Sample 2, Fiber Path 12 is not included in the group statistics. Cleaning of end-face debris from the FC launch interface of that fiber path caused an unexpected increase in optical through power.

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2.3.3 Shock, Mechanical – Sawtooth

All Attenuation and Attenuation Increase measurements at 850 nm and 1300 nm met requirements after Shock, Mechanical – Sawtooth testing in each of six mutually perpendicular planes. Summary performance data are provided in Table 2.3.3-1, which include interim optical measurements (after exposure in each plane) and final measurements after Shock testing. No optical discontinuities (transient reductions in optical power of 1.0 dB or more for a period of 1 μs or longer) were observed during Shock testing. Following Shock testing, no cracks, breaks, or loose parts were visible on the samples.

Table 2.3.3-1 Optical Performance After Shock

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.18	0.17
Group Average	0.09	0.06
Channel Pass - Fail Count	35 - 0 (a)	35 - 0 (a)
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Increase Statistics		
Group Maximum	0.06	0.07
Group Average	0.01	0.00
Channel Pass - Fail Count	35 - 0 (a)	35 - 0 (a)
Sample Pass - Fail Count	3 - 0	3 - 0
Requirements (Any Channel)		
Attenuation	≤ 1.2	
Attenuation Increase	≤ 0.75	

NOTE: *All units in dB.*

(a) 35 of 36 channels: Group 2, Sample 2, Fiber Path 12 is not included in the group statistics.

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2.3.4 Bench Handling Shock

All Attenuation and Attenuation Increase measurements met requirements after the Bench Handling Shock test. Summary optical performance data at 850 nm and 1300 nm after Bench Handling Shock are presented in Table 2.3.4-1. Following testing, the samples exhibited no cracks, breaks, or loose parts.

Table 2.3.4-1 Optical Performance After Bench Handling Shock

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.14	0.14
Group Average	0.08	0.05
Channel Pass - Fail Count	35 - 0 (a)	35 - 0 (a)
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Increase Statistics		
Group Maximum	0.00	-0.02
Group Average	-0.02	-0.04
Channel Pass - Fail Count	35 - 0 (a)	35 - 0 (a)
Sample Pass - Fail Count	3 - 0	3 - 0
Requirements (Any Channel)		
Attenuation	≤ 1.2	
Attenuation Increase	≤ 0.75	

NOTE: *All units in dB.*

(a) 35 of 36 channels: Group 2, Sample 2, Fiber Path 12 is not included in the group statistics.

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2.3.5 End of Service Life

All channels of Test Group 2 met the End of Service Life requirements for Attenuation and Attenuation Increase of any channel, maximum sample average Attenuation, and maximum group average Attenuation. Summary optical performance data at 850 nm and 1300 nm are presented in Table 2.3.5-1.

Table 2.3.5-1 End of Service Life

Wavelength	850 nm	1300 nm
Attenuation Statistics		
Group Maximum	0.14	0.13
Sample Average, Maximum	0.08	0.07
Group Average	0.06	0.05
Channel Pass - Fail Count	36 - 0 (a)	36 - 0 (a)
Sample Pass - Fail Count	3 - 0	3 - 0
Attenuation Increase Statistics		
Group Maximum	0.02	0.01
Group Average	-0.01	-0.01
Channel Pass - Fail Count	36 - 0 (a)	36 - 0 (a)
Sample Pass - Fail Count	3 - 0	3 - 0
Requirements		
Attenuation, Any Channel	≤ 1.2	
Attenuation, Sample Average	≤ 0.7	
Attenuation, Group Average	≤ 0.65	
Attenuation Increase, Any Channel	≤ 0.75	

NOTE: *All units in dB.*

(a) The Tear-down Attenuation measurement method of Section 3.7 enabled reporting Attenuation and Attenuation Increase statistics for all 36 fiber paths.

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3. TEST METHOD

3.1. Visual and Mechanical Inspection

The specimens were examined visually, dimensionally and functionally per the product drawings and inspection plans per TIA/EIA-455-13A. A Certificate of Conformance was issued stating that all specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts.

3.2. Initial Attenuation of All Channels

Attenuation (multi-mode) was measured in accordance with TIA/EIA-455-171A, Method D1, processes. All fiber paths were measured initially and at the end of the test sequence at both 850 nm and 1300 nm. Attenuation was measured at the minimum connector mating engagement distance as defined per ANSI/VITA 66.0. This distance was maintained by the test fixture.

Initial Attenuation measurements were recorded using encircled flux compliant launch conditions per IEC 61280-4-1 using a build-up Insertion Loss procedure. Reference optical measurements (P_0) and source monitor measurements (SM_0) were recorded at 850 nm and 1300 nm for all channels of each MT-to-MPO test lead cable assembly, per Figure 3.2-1.

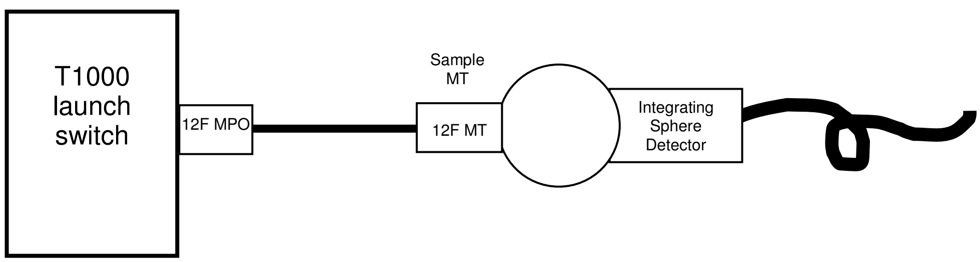

Figure 3.2-1 Configuration for Reference Optical Measurements (P_0)

Then, the VITA 66.5, Style A, receptacle (backplane) and plug (plug-in module) connectors were installed in the environmental test fixture shown in Figure 3.2-2. The receptacle connector was mounted to a plate containing an aperture, simulating a backplane. This plate was oriented vertically in the test fixture, as shown in Figure 3.2.2. The plug connector was mounted to fixturing accepting an MT cable assembly, mechanically simulating an assembled transceiver and interposer. This fixturing was mounted to a plate simulating the plug-in module card, which was oriented horizontally in the test fixture.

Figure 3.2-2 VITA 66.5, Style A, Connectors Installed in the Environmental Test Fixture

Optical measurements (P_1) and source monitor measurements (SM_1) were made at 850 nm and 1300 nm with the MT end of an MT-to-MPO test lead installed in the VITA 66.5, Style A, plug housing and the MT end of a second test lead installed in the receptacle connector. The MPO housing at the opposite end of that lead was removed to enable mating to integrating sphere detector. The Attenuation values were calculated by subtracting P_1 from P_0 and compensating for any change in the test system sources. The configuration to measure P_1 is shown in Figure 3.2-3.

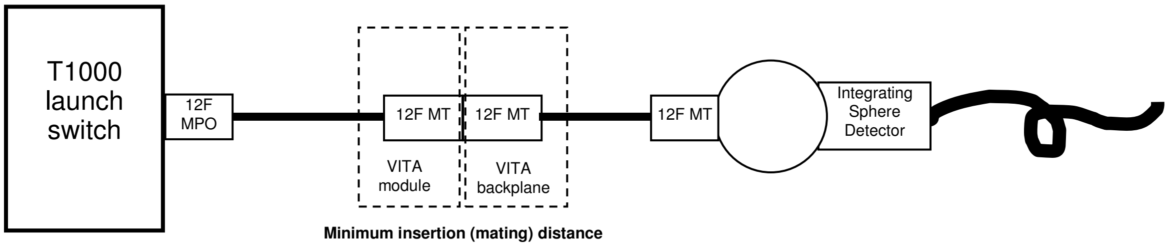

Figure 3.2-3 Configuration for Optical Measurements (P_1)

The MPO housing was then re-installed at the end of the second test lead and mated to the test system detector bank. Correlation optical measurements of all paths were recorded for each sample, which correspond to the Attenuation values of each sample path. Using these measurements, Attenuation was traceable through each sequential test by adding or subtracting the respective change in the correlation measurements from the Attenuation values. The correlation measurement configuration is shown in Figure 3.2-4.

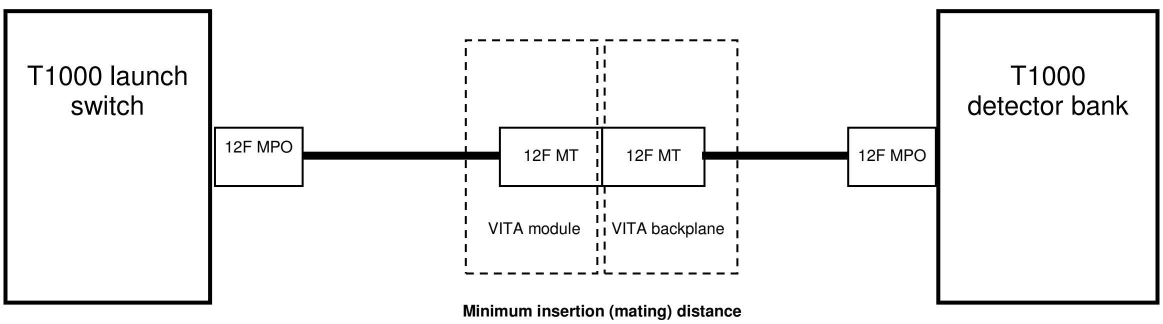

Figure 3.2-4 Configuration for Correlation Measurements

3.3. Attenuation Increase

Attenuation Increase was performed per TIA-455-20B for each test as applicable. The increase in attenuation was calculated at both wavelengths, 850 nm and 1300 nm, by subtracting the initial sample measurements before test from the during/after measurements and compensating for any change in source monitors. Attenuation Increase represents a change in attenuation that results from a decrease in optical power (degraded performance).

3.4. Temperature Cycling

Temperature Cycling was performed per TIA-455-3B, Test Condition C, except with the dwell at the hot extreme performed first. Mated samples were mounted in the environmental test fixtures at the ANSI/VITA 66.0 minimum connector engagement distance. Figure 3.4-1 shows the test fixtures with samples installed, placed within the environmental chamber.

A 2-hour optical performance stability examination was performed prior to the start of environmental cycling. To start Temperature Cycling, the chamber was ramped from 23°C to 85°C in 1.5 hours, followed by a 1-hour dwell at 85°C. This was followed by 1.5-hour ramp to 23°C, with a 1-hour dwell at 23°C. This was followed by a 1.75-hour ramp to -40°C, followed by a 1-hour dwell at -40°C. Next, followed a 1.75-hour ramp to 23°C, followed by a 1-hour dwell at 23°C, completing one cycle. The samples were exposed to 21 Temperature Cycles. Optical measurements were recorded at the start and at the end of each dwell, and every 15 minutes during the dwells and ramps. Final optical performance was recorded a minimum of 2 hours after the samples remained undisturbed at 23°C. Attenuation and Attenuation Increase data were calculated from the optical measurements.

Figure 3.4-1 Connectors Installed in Environmental Test Fixtures, Inside the Chamber

3.5. Vibration, Random

Random Vibration was performed per TIA-455-11D, Test Condition VI, Test Condition Letter D, except with a modified duration of 1 hour per direction. The samples, still mounted in the environmental fixtures at the minimum connector engagement distance, were installed undisturbed into the mechanical test fixtures. These fixtures were then mounted to the vibration table cube, as shown in Figure 3.5-1, and baseline optical measurements recorded. Each mated sample pair was subjected to 11.95 G_{RMS} between 50 and 2000 Hz of Random Vibration for 1 hour in each of three mutually perpendicular directions.

Four fiber paths per sample (fibers 1, 6, 7 and 12) were actively monitored for optical discontinuities during the test. An optical discontinuity was defined as a degradation in optical power of 1.0 dB or more at a 1300 nm wavelength for a period of 1 microsecond or longer. Any discontinuities were noted and recorded. Optical measurements were recorded after exposure in each axis on all non-monitored fiber paths, with the test fixtures remaining secured to the vibration table. After completing the final axis, the actively monitored paths were re-mated to their respective test system channels, and final optical measurements were recorded for all fiber paths.

Figure 3.5-1 Connectors Installed in Environmental & Mechanical Test Fixtures, Mounted to the Vibration Table Cube

3.6. Durability

Samples were subjected to Durability testing, 100 mating cycles, per TIA-455-21A. The plug and receptacle connector mounting plates of each sample were first removed from the environmental fixtures. The receptacle mounting plates were placed into one of two slot positions of the Durability apparatus. As shown in Figure 3.6-1, the Durability apparatus accommodates two mating sets of plug and receptacle connectors. With the actuator holding the receptacle plate in the forward position, a gage block was placed to set the connector engagement to the maximum distance per ANSI/VITA 66.0. A spacer block was placed between the base for the receptacle mounting plate and the actuator to hold receptacle connector in the forward position. The plug connector plate was then positioned against the gage block and mounted to the apparatus. Baseline optical measurements were recorded.

The spacer block was removed from one slot position of the Durability apparatus, and the actuator was manually moved in backward and forward directions (alternating), fully unmating and re-mating the sample five times. The spacer was then re-inserted to hold the sample in the fully-mated position for optical measurements. The sample in the second slot position of the Durability apparatus was subjected to 5 Durability cycles in the same manner. With guidance from Telcordia GR-1435-CORE, Issue 1, optical measurements were recorded after 5, 10, 15, 20, 24, 25, 30, 35, 40, 45, 49, 50, 55, 60, 65, 70, 74, 75, 80, 85, 90, 95, 99 and 100 Durability cycles. The samples were unmated, removed from the Durability apparatus, cleaned, visually inspected, re-installed to the apparatus at the maximum engagement distance and re-mated only after the 24th, 49th, 74th, and 99th Durability cycles.

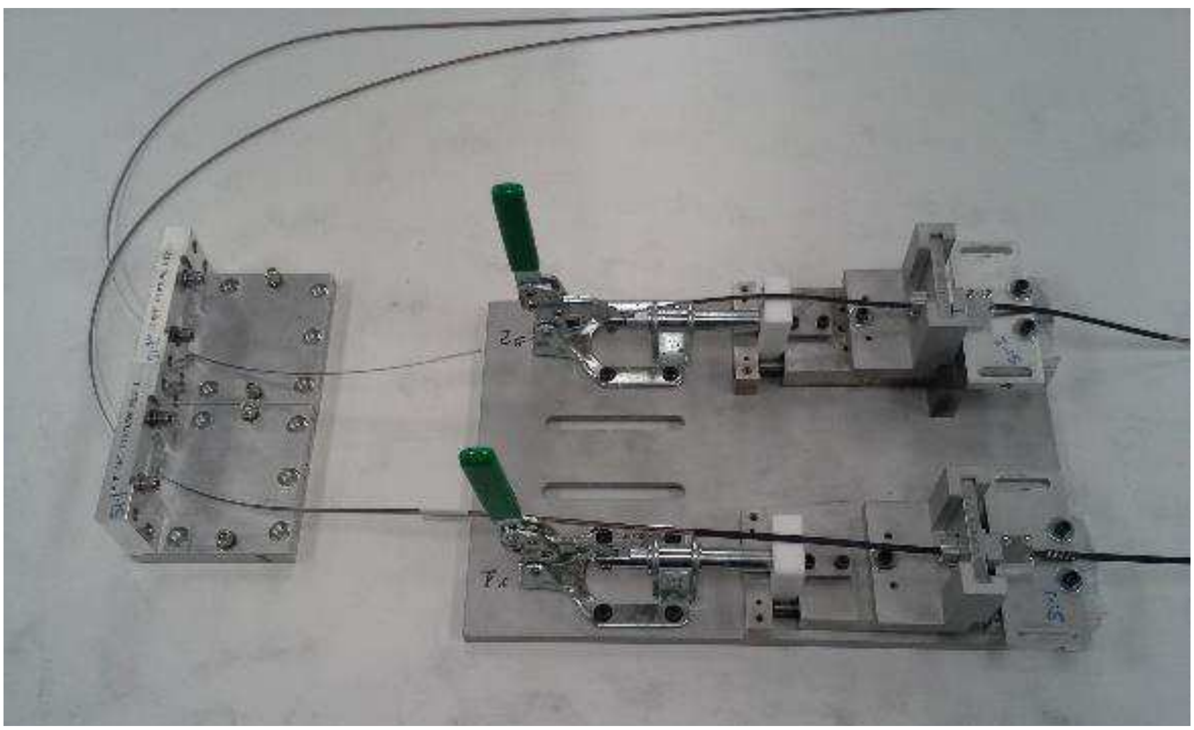

Figure 3.6-1 Durability Apparatus, with Two Mated Sets of Connectors Installed

3.7. End of Service Life (EOSL)

The optical performance of the samples at the completion of the test sequences is evaluated against that during the initial sample installation. The samples were configured in the environmental test fixtures at the minimum connector mating engagement distance. An optical performance stability examination was performed prior to the start of the EOSL examination. EOSL optical measurements (P_1) were made per the Initial Attenuation test method (TIA/EIA-455-171A, Method D1, including the specified launch conditions). Attenuation Increase data were calculated by subtracting the Initial Attenuation data from the EOSL Attenuation data.

An improvement in attenuation was observed in Test Group 2 due to the cleaning of debris from launch and/or receive lead end faces. To eliminate this observed improvement, a Tear-down Attenuation measurement was performed to determine the true losses of each sample path. This measurement used a reverse build-up method with guidance from TIA/EIA-455-171, Method D1.

First, the receive MPO connector was unmated from the test system detector bank. Then, the MPO housing was removed, and the MT end face was cleaned. Using the same detector cap as for Initial Attenuation, the MT was mated to the integrating sphere detector, as shown in Figure 3.2-3.

Next, the plug and receptacle connectors were unmated. The MT was removed from the plug connector and mated to the integrating sphere detector, again using the same detector cap, as shown in Figure 3.2.1. Optical measurements (P_0) and source monitor measurements (SM_0) were recorded at 850 nm and 1300 nm. Final Tear-down Attenuation values were calculated by subtracting P_1 from P_0 and compensating for any changes in the source monitor.

3.8. Vibration, Sinusoidal

Sinusoidal Vibration was performed with guidance from TIA-455-11, Test Condition 1. The samples, remaining mounted in the environmental fixtures at the minimum mating engagement distance per ANSI/VITA 66.0, were installed undisturbed into the mechanical test fixtures. The fixtures were then mounted to the vibration table cube, as shown previously in Figure 3.5-1, and baseline optical measurements were recorded.

The samples were exposed to simple harmonic motion, having an amplitude of 1.52 mm [0.060 in] peak-to-peak. The vibration frequency was varied logarithmically, with an entire frequency sweep from 10 Hz to 55 Hz and return to 10 Hz being traversed in one minute. The samples were subjected to 120 such sweeps, for a test time of two hours, in each of three mutually perpendicular directions. The total test time for each sample was 6 hours.

Four fiber paths per sample (fibers 1, 6, 7 and 12) were actively monitored for optical discontinuities during the test. An optical discontinuity was defined as a degradation in optical power of 1.0 dB or more at a 1300 nm wavelength for a period of 1 microsecond or longer. Any discontinuities were noted and recorded. Optical measurements were recorded after exposure in each axis on all non-monitored fiber paths, with the test fixtures remaining secured to vibration table. After completing the final axis, the actively monitored paths were re-mated to their respective test system channels, and final optical measurements were recorded for all fiber paths. Attenuation and Attenuation Increase data were calculated.

3.9. Mechanical Shock

Shock testing was performed per EIA/TIA-455-14A, Test Condition E. After Sinusoidal Vibration, the samples remained secured to the vibration table cube, mounted within the environmental and mechanical test fixtures at the minimum connector engagement distance. Baseline optical measurements at the 850 nm and 1300 nm wavelength were recorded.

The samples were subjected to three 50-G, 11-millisecond sawtooth (terminal peak) shock pulses in the upward direction. The test was repeated with the pulses applied in the downward direction. The samples were dismounted from the cube fixture, then remounted as needed to repeat the test in the remaining mutually perpendicular planes.

Four fiber paths per sample (fibers 1, 6, 7 and 12) were actively monitored for optical discontinuities during the test. An optical discontinuity was defined as a degradation in optical power of 1.0 dB or more at a 1300 nm wavelength for a period of 1 microsecond or longer. Any discontinuities were noted and recorded. With the test fixtures remaining secured to vibration table, optical measurements were recorded on all non-monitored fiber paths after exposure in each plane. After completing the final plane, the actively monitored paths were re-mated to their respective test system channels, and final optical measurements were recorded for all fiber paths. Attenuation and Attenuation Increase data were calculated.

3.10. Bench Handling Shock

Bench Handling Shock testing was performed per MIL-STD-810G, Method 516.6, Procedure VI. The samples were removed from the mechanical test fixtures, but they remained mounted within their environmental fixtures at the minimum connector engagement distance. Baseline optical measurements were recorded. The samples were unmated, and the plug (plug-in module) connector mounting plate was removed from the environmental fixture. The receptacle (backplane) connector mounting plate remained mounted to the environmental fixture.

One edge of a plug connector mounting plate was manually raised and aligned with a calibrated digital level supported at a 45° angle as shown in Figure 3.10-1. The plate was then released and allowed to drop back to its original flat position on the bench top. The same edge of the plate was raised and dropped seven more times for a total of eight drops for that plate edge. The plate was then subjected to eight drops from each of the three remaining edges for a grand total of 32 drops per plug connector sample.

In a like manner, each receptacle connector and environmental fixture was subjected to 32 drops, eight drops for each of the four edges, as shown in Figure 3.10-2. The samples were cleaned, inspected and reconnected at the minimum connector engagement distance. Then, final optical measurements were recorded.

Figure 3.10-1 Plug Connector Installed on the Mounting Plate, positioned at 45° for the Bench Handling Shock Test

Figure 3.10-2 Receptacle Connector Installed on the Environmental Fixture, positioned at 45° for the Bench Handling Shock Test