SFP Connector and Cage Assemblies

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics stacked SFP 2 X 4 assembly part number 1658390-1, consisting of cage assembly part number 1658224-1 and SFP connector part number 1658296-1, to | determine its conformance to the requirements of Product Specification 108-2161 Revision B.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the stacked SFP 2 X 4 | assembly part number 1658390-1. Testing was performed at the Harrisburg Electrical Components Test | Laboratory between 10Jul03 and 26Aug03. The test file number for this testing is CTL B044194-002. | Additional testing was performed between 15May09 and 14Aug09. The test file number for this testing | is EA20090341T. This documentation is on file at and available from the Harrisburg Electrical | Components Test Laboratory.

1.3. Conclusion

The stacked SFP 2 X 4 assembly part number 1658390-1 conformed to the electrical, mechanical, and | environmental performance requirements of Product Specification 108-2161 Revision B.

1.4. Product Description

The stacked SFP connectors are intended to function as a “hot” swappable interconnect between copper or fiber transceiver modules and various host equipment including such devices as networking switches and routers.

1.5. Test Specimens

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

- Test Group 1: 4 stacked SFP cage assemblies, mounted on printed circuit board PN 60-474335-1 with bezels, PN 39-474339-1, attached and 8 transceivers PN 60-474336-1, 2 per cage assembly only
- Test Group 2: 4 stacked SFP cage assemblies, mounted on printed circuit board PN 60-474335-1 with bezels, PN 39-474339-1, attached and 32 transceivers PN 60-474336-1, each cage assembly was fully loaded with 8 transceivers
- Test Group 3: 4 stacked SFP cage assemblies, mounted on printed circuit board PN 60-474335-1 and 8 transceivers PN 474336-1, 2 per cage assembly only
- Test Group 4: 4 stacked SFP cage assemblies, mounted on printed circuit board PN 60-474335-1 and 8 transceivers PN 474336-1, 2 per cage assembly only
- Test Group 5: 4 unmated and unmounted SFP connectors PN 1658296-1

1.6. Environmental Conditions

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

- Temperature: 15 to 35°C
- Relative Humidity: 25 to 75%

* Trademark
| Indicates change

1.7. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)				
	1	2	3	4	5
	Test Sequence (b)				
Initial examination of product	1	1	1	1	1
Low Level Contact Resistance (LLCR)		3,5,8	3,5,7	2,4,6	
Insulation resistance					2,6
Withstanding voltage					3,7
Random vibration		6			
Mechanical shock		7			
Durability		4			
Transceiver insertion force		2			
Transceiver extraction force		9			
Cable pull	2				
Press-fit insertion force			2		
Press-fit extraction force			8		
Cage latch strength	3				
Thermal shock					4
Humidity/temperature cycling			6		5
Temperature life			4(c)	3(c)	
Mixed flowing gas				5	
Final examination of product	4	10	9	7	8

NOTE

(a) See paragraph 1.5.
(b) Numbers indicate sequence in which tests are performed.
(c) Precondition specimens with 10 durability cycles.

Figure 1

2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. LLCR - Test Groups 2, 3 and 4

All LLCR measurements taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage had a change in resistance (ΔR) of less than 10 milliohms after testing. See Figure 2.

Test Group	Condition	Contact Resistance (values in milliohms)					
		Min	Max	Mean	Min (ΔR)	Max (ΔR)	Mean (ΔR)
2	Signal Contacts (N = 160)						
	Initial	23.394	43.434	32.808	---	---	—
	After durability	23.451	43.554	32.975	-0.722	1.822	0.167
	After shock	23.446	43.749	33.124	-0.960	1.673	0.316
	Shields (N = 8)						
	Initial	0.957	1.308	1.149	---	---	---
	After durability	1.018	1.571	1.268	-0.210	0.493	0.119
	After shock	1.264	1.758	1.439	-0.044	0.652	0.345
3	Signal Contacts (N = 160)						
	Initial	23.132	43.146	32.785	---	---	---
	After temperature life	23.419	42.967	32.998	-0.571	1.600	0.213
	After humidity-temperature cycling	23.266	43.917	33.050	-0.650	1.785	0.265
	Shields (N = 8)						
	Initial	0.925	1.364	1.238	---	---	---
	After temperature life	1.271	1.582	1.398	-0.093	0.657	0.160
	After humidity-temperature cycling	1.365	1.765	1.594	0.107	0.840	0.356
4	Signal Contacts (N = 160)						
	Initial	22.880	43.517	32.526	---	---	---
	After temperature life	24.031	44.805	33.315	-0.763	2.701	0.789
	After mixed flowing gas	23.941	45.175	33.396	-0.394	2.880	0.872
	Shields (N = 8)						
	Initial	1.171	1.424	1.279	---	---	---
	After temperature life	1.171	1.517	1.360	-0.110	0.346	0.081
	After mixed flowing gas	1.101	1.636	1.375	-0.236	0.441	0.096

Figure 2

2.3. Insulation Resistance - Test Group 5

All insulation resistance measurements were greater than 1000 megohms (1×10^9 ohms).

2.4. Withstanding Voltage - Test Group 5

No dielectric breakdown or flashover occurred.

2.5. Random Vibration - Test Group 2

No discontinuities were detected during vibration testing. Following vibration testing, no cracks, breaks, or loose parts on the specimens were visible.

2.6. Mechanical Shock - Test Group 2

No discontinuities were detected during mechanical shock testing. Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible.

2.7. Durability - Test Group 2

No physical damage occurred as a result of mating and unmating the specimens 100 times.

2.8. Transceiver Insertion Force - Test Group 2

All transceiver insertion force measurements were less than 40 N [8.99 lbf].

2.9. Transceiver Extraction Force - Test Group 2

All transceiver extraction force measurements were less than 11.5 N [2.59 lbf].

2.10. Cable Pull - Test Group 1

No evidence of the transceiver being unmated or the cage being dislodged was visible as a result of cable pull testing.

2.11. Press-fit Insertion Force - Test Group 3

| All cage assembly insertion force measurements were less than 44.5 N [10 lbf] per compliant pin.

2.12. Press-Fit Extraction Force - Test Group 3

All cage assembly extraction force measurements were greater than 445 N [100 lbf]. All connector extraction force measurements were greater than 222 N [50 lbf].

2.13. Cage Latch Strength - Test Group 1

There was no evidence of physical damage nor did any of the transceiver blocks become unmated after applying an axial (vertical) force of 180 N [40.5 lbf] to the cage latch.

2.14. Thermal Shock - Test Group 5

No evidence of physical damage was visible as a result of thermal shock testing.

2.15. Humidity/Temperature Cycling - Test Groups 3 and 5

No evidence of physical damage was visible as a result of humidity/temperature cycling.

2.16. Temperature Life - Test Groups 3 and 4

No evidence of physical damage was visible as a result of temperature life testing.

2.17. Mixed Flowing Gas - Test Group 4

No evidence of physical damage was visible as a result of exposure to the pollutants of mixed flowing gas.

2.18. Final Examination of Product - All Test Groups

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3. TEST METHODS

3.1. Initial Examination of Product

A Certification of Conformance was issued stating that all specimens in this test package have been produced, inspected, and accepted as conforming to product drawing requirements, and manufactured using the same core manufacturing processes and technologies as production parts.

| 3.2. LLCR

| LLCR measurements were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage. Both signal contacts and cage shields were measured.

3.3. Insulation Resistance

Insulation resistance was measured between selected adjacent contacts of each unmated and unmounted specimen. A test potential of 300 volts DC was applied for a maximum of 2 minutes before the resistance was measured.

3.4. Withstanding Voltage

A test potential of 300 volts AC was applied between selected adjacent contacts of each unmated and unmounted specimen. This potential was applied for 1 minute and then returned to zero. The rise time was set at 500 volts per second with the maximum leakage current limited to 0.5 milliampere. Testing was performed on the same contact pairs as in insulation resistance testing.

3.5. Random Vibration

Mated specimens were subjected to a random vibration test, specified by a random vibration spectrum, with excitation frequency bounds of 20 and 500 Hz. The spectrum remained flat at 0.02 G^2/Hz from 20 to the upper bound frequency of 500 Hz. The root mean square amplitude of the excitation was 3.10 Grms. This was performed for 15 minutes in each of 3 mutually perpendicular planes for a total vibration time of 45 minutes. Eight randomly selected contacts on each specimen were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.6. Mechanical Shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 30 gravity units (g's peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 18 shocks. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.7. Durability

Specimens were subjected to 100 cycles of manual durability using a transceiver as a mating half.

NOTE *The latches in the cage assembly remained enabled during this portion of the testing.*

3.8. Transceiver Insertion Force

Each transceiver was inserted into their respective cage assembly using a tensile machine at a maximum rate of 12.7 mm [.5 in] per minute. This force was applied until the cage latch snapped into its proper position.

3.9. Transceiver Extraction Force

Each transceiver was removed from its respective cage assembly using a tensile machine and a free-floating fixture at a maximum rate of 12.7 mm [.5 in] per minute .This force was applied until the transceiver was completely removed from their respective connector.

NOTE *The latches in the cage assembly were disabled for this portion of the testing.*

3.10. Cable Pull

Each cage assembly was attached to a vertical plate and loaded with a cabled transceiver. A 100 N [22.5 lbf) weight was then attached to the free end of the cable and slowly applied in an axial direction at a maximum rate of 12.7 mm [.5 in]. Finally, the cage assembly was turned 45 degrees from the cable axis and then rotated through 360 degrees with the load still applied. After completing 1 revolution, the weight was removed.

3.11. Press-fit Insertion Force

Press-fit insertion testing consisted of pressing the complete cage assemblies onto their respective printed circuit boards using a tensile machine. The “flat rock” method was used at a maximum rate of 12.7 mm [.5 in] per minute.

NOTE *A matching printed circuit board was inserted under the test board to prevent the cage posts from stubbing on the base of the tensile machine table plate.*

3.12. Press-fit Extraction Force

Press-fit extraction testing consisted of pressing on the cage retention posts to remove the inverted cage assemblies from their respective printed circuit boards using a tensile machine. Each assembly was supported under at least 3 sides to minimize the printed circuit board from bending while the force was applied at a maximum rate of 12.7 mm [.5 in] per minute.

NOTE *A “bed-of-nails” fixture was used to perform the extractions and was supplied by the requestor.*
An additional matching printed circuit board was placed over cage posts to align the pins of the fixture while the force was applied.
Testing required that the cage had to be removed first. After the cage was removed, the connectors were exposed and then removed from their respective printed circuit boards, one at a time.

3.13. Cage Latch Strength

Cage latch strength testing consisted of inserting a modified transceiver block into each cage assembly and vertically fixturing the cage onto a tensile machine. A ring was attached to the block and was loosely attached to a 180 N [40.5 lbf] “dead-weight” on the base of the tensile machine table. The tensile machine was then energized at a maximum rate of 12.7 mm [.5 in] per minute and was allowed to continue until the weight was lifted off of the base of the table. The weight remained suspended for 60 seconds and then returned to the table base.

3.14. Thermal Shock

Mated specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 105°C. The transition between temperatures was less than 1 minute.

3.15. Humidity/Temperature Cycling

Mated specimens were exposed to 10 cycles of humidity/temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 and 65°C twice while maintaining high humidity.

3.16. Temperature Life

Mated specimens were exposed to a temperature of 105°C for 300 hours. The specimens were preconditioned with 10 cycles of manual durability prior to exposure.

3.17. Mixed flowing Gas, Class IIA

Mated specimens were exposed for 20 days to a mixed flowing gas Class IIA exposure. Class IIA exposure is defined as a temperature of 30°C and a relative humidity of 70% with the pollutants of Cl_2 at 10 ppb, NO_2 at 200 ppb, H_2S at 10 ppb, and SO_2 at 100 ppb. Specimens were preconditioned with 10 cycles of manual durability prior to exposure.

3.18. Final Examination of Product

Specimens were visually examined for evidence of physical damage detrimental to product performance.