Single High 1x4 zSFP+ EMI Cages

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity 1x4 zSFP+ Ganged Cage to determine its conformance to the requirements of TE Product Specification 108-2364 Rev F.

1.2 Scope

This report covers the electrical, mechanical and environmental performance of the 1x4 zSFP+ Ganged Cages. Testing was performed at the Harrisburg Electrical Components Test Laboratory between November 19, 2014 and December 12, 2014 and is maintained under EA20140636T.

1.3 Conclusion

The Single High 1x4 zSFP+ EMI Cages listed in paragraph 1.4 conformed to the electrical, mechanical and environmental performance requirements of Product Specification 108-2364 Rev F.

1.4 Product Description

The zSFP+ interconnect is currently one of the fastest single-channel I/O connectors on the market today, transferring data at 28 Gbps with possible expansion to 40 Gbps. Through a design that is backward-compatible to SFP/SFP+ products, the interconnect is hot-swappable with existing SFP+ connectors for fast system upgrades of 28-40 Gbps. Alternatively, users can design-in the zSFP+ connector for 10-16 Gbps data rates, establishing a progressive path to higher speeds–an upgradeability that can result in long-term cost savings as this would eliminate the need to fully redesign for higher performance. The zSFP+ interconnect is compliant to SFF-8402 and has been adopted for Fibre Channel 32G (28.05 Gbps line rate). The entire product family is offered as a dual source option with Molex Incorporated.

1.5 Test Specimens

The test specimens were representative of normal production lots, and the following part numbers were used for the testing (Table 1):

Table 1 – Specimen Identification

Test Set	Quantity	Part Number	Description
1	3	2198722-1	zSFP+ 1x4 cage with Elastomeric Gasket
	6	1888247-1	SFP+ PT Connector
2	3	2227730-1	zSFP+ 1x4 cage with EMI Springs
	6	1888247-1	SFP+ PT Connector
3	3	2198722-1	zSFP+ 1x4 cage with Elastomeric Gasket
	6	1888247-1	SFP+ PT Connector
4	3	2227730-1	zSFP+ 1x4 cage with EMI Springs
	6	1888247-1	SFP+ PT Connector
5	3	2198722-1	zSFP+ 1x4 cage with Elastomeric Gasket
	6	1888247-1	SFP+ PT Connector
6	3	2227730-1	zSFP+ 1x4 cage with EMI Springs
	6	1888247-1	SFP+ PT Connector
7	3	2198722-1	zSFP+ 1x4 cage with Elastomeric Gasket
	6	1888247-1	SFP+ PT Connector
8	3	2227730-1	zSFP+ 1x4 cage with EMI Springs
	6	1888247-1	SFP+ PT Connector
1,2,3,4,5,6,7,8	24	60-1042248 Rev O	SFP+ 1x4 PCB

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1.6 Qualification Test Sequence

The specimens identified in paragraph 1.4, Table 1 were subjected to the test groups listed in Table 2.

Table 2 – Test Sequence

Test or Examination	Test Set 1,2	Test Set 3,4	Test Set 5,6	Test Set 7,8
	Group 1	Group 2	Group 3	Group 4
	Sequence			
Initial Examination of Product	1	1	1	1
LLCR	3,7		3,6	3,5
Random Vibration	5			
Mechanical Shock	6			
Durability	4			
Transceiver Insertion Force	2			
Transceiver Extraction Force	8			
Cage Latch Strength	9			
Cage Press Fit Insertion Force			2	2
Cage Press Fit Extraction Force			7	6
Rotational Cable Pull		2		
Thermal Shock			4 (b)	
Humidity/temperature Cycling			5 (b)	
Temperature Life				4 (a)(b)
Final Examination of Product	10	3	8	7

The numbers indicate sequence in which tests were performed.

(a) Precondition with 20 cycles of Durability.
(b) Perform testing with specimens mated to blank transceivers.

1.7 Environmental Conditions

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

Temperature:	15°C to 35°C
Relative Humidity	20% to 80%

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2. SUMMARY OF TESTING

2.1 Initial Examination of Product – All Test Groups

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

2.2 LLCR - Low Level Contact Resistance – Test Groups 1, 3 and 4

All low level contact resistance measurements were less than 35 milliohms initially and had a change in resistance (ΔR) of less than 10 milliohms after testing. Summary data for Test Sets 1, 2, 5, 6, 7, and 8 is shown in Tables 3 through 5.

Table 3 – LLCR Summary in mohms - Test Group 1

	Test Set 1 – Elastomeric Gaskets		Test Set 2 – EMI Springs	
	Initial (Actual)	After Mechanical Shock (ΔR)	Initial (Actual)	After Mechanical Shock (ΔR)
Min	14.41	-0.80	14.39	-0.57
Max	17.73	0.84	16.58	0.98
Avg	15.99	-0.03	15.50	0.03
Stdev	0.81	0.27	0.67	0.26
N	119	119	120	120

Table 4 – LLCR Summary in mohms - Test Group 3

	Test Set 5 - Elastomeric Gaskets		Test Set 6 - EMI Springs	
	Initial (Actual)	After Humidity/Temp Cycling (ΔR)	Initial (Actual)	After Humidity/Temp Cycling (ΔR)
Min	14.39	-2.38	14.21	-0.63
Max	19.50	1.19	17.17	0.96
Avg	15.94	0.22	15.46	0.16
Stdev	0.81	0.36	0.68	0.25
N	120	120	120	120

Table 5 – LLCR Summary in mohms - Test Group 4

	Test Set 7 – Elastomeric Gaskets		Test Set 8 – EMI Springs	
	Initial (Actual)	After Temp Life (ΔR)	Initial (Actual)	After Temp Life (ΔR)
Min	14.18	-0.45	14.79	-0.42
Max	17.10	1.20	16.89	1.75
Avg	15.59	0.30	15.84	0.35
Stdev	0.71	0.36	0.58	0.36
N	120	120	120	120

2.3 Random Vibration – Test Group 1

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

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2.4 Mechanical Shock – Test Group 1

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

2.5 Durability – Test Group 1

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

2.6 Transceiver Insertion Force – Test Group 1

All transceiver insertion force measurements were less than the maximum requirement of 34 N (7.64 lbf) for cages without a heat sink and clip.

2.7 Transceiver Extraction Force – Test Group 1

All transceiver extraction force measurements were less than the maximum requirement of 12.5 N (2.8 lbf) for cages without a heat sink and clip.

2.8 Cage Latch Strength – Test Group 1

No physical damage occurred to the specimens as a result of applying an axial load of 91.2 N (20.5 lbf) for one minute to the cage latch.

2.9 Cage Press Fit Insertion Force – Test Groups 3 and 4

All cage press fit insertion force results were less than the per pin maximum requirement of 73 N (16.4 lbf) for the ganged cage.

2.10 Cage Press Fit Extraction Force – Test Groups 3 and 4

All cage press fit extraction force results were greater than the minimum requirement of 8.9 N (2.0 lbf) per pin for the ganged cage.

2.11 Rotational Cable Pull – Test Group 2

All specimens held the 33.4 N (7.5 pound) weight during testing and did not show signs of physical damage.

2.12 Thermal Shock – Test Group 3

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

2.13 Humidity/Temperature Cycling – Test Group 3

No evidence of physical damage was visible as a result of exposure to humidity-temperature cycling.

2.14 Temperature Life – Test Group 4

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

2.15 Final Examination of Product - All Test Groups

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

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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 made using the same core manufacturing processes and technologies as production parts.

3.2 LLCR - Low Level Contact Resistance

Low level contact resistance measurements at low level current were made using a four terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

3.3 Random Vibration

Mated specimens were subjected to a random vibration spectrum with excitation frequency bounds of 20 and 500 Hertz (Hz). The spectrum remains flat at 0.02 G^2/Hz from 20 Hz to the upper bound frequency of 500 Hz. The root-mean square amplitude of the excitation was 3.10 GRMS.

The test specimens were subjected to this test for 15 minutes in each of the three mutually perpendicular axes, for a total test time of 45 minutes per test specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

3.4 Mechanical Shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform with an acceleration amplitude of 30 gravity units (g's peak) and a duration of 11 milliseconds.

Three shocks in each direction were applied along the three mutually perpendicular axes of the test specimens, for a total of eighteen shocks. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

3.5 Durability

Specimens were mated and unmated 100 times at a maximum rate of 500 cycles per hour with the cage latch operable.

3.6 Transceiver Insertion Force

Specimens were mounted to a right angle plate secured to an air bearing table on the base of the tensile machine. The transceiver was placed into the cage opening. The transceiver was pressed into the cage (until the retention mechanism latched) using a slotted plate fixture that was attached to the crosshead.

3.7 Transceiver Extraction Force

Specimens were mounted to a right angle plate secured to a floating X-Y table on the base of the tensile machine. The latching mechanism was disabled. The transceiver conductor was gripped using air jaws that were attached to the crosshead of the force machine. The transceiver was pulled out at a rate of 12.7 mm per minute.

3.8 Cage Latch Strength

Specimens were gripped in pneumatic vise attached to the crosshead of the force machine. A dead weight of 91.2 N (20.5 pounds) was suspended from the conductor to test the latching mechanism.

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3.9 Cage Press Fit Insertion Force

An X-Y table was attached to the base of the force machine. Bars were put in place to ensure alignment and a spacer board was used under the test specimen. An aluminum plate was inserted into the cage for support. Ganged cages were applied to the test boards using a flat rock technique at a rate of 12.7 mm per minute. An insertion tool supplied by the requestor was used to properly seat the cages.

3.10 Cage Press Fit Extraction Force

An X-Y table was attached to the base of the force machine and a probe was secured to the crosshead of the force machine. Specimens were removed from the test boards using a flat rock technique. An extraction tool (bed of nails) was used to remove the cages at a rate of 12.7 mm per minute. The force to remove the cage from the test board was recorded and the weight of the extraction tool was added to the total force measurement.

3.11 Rotational Cable Pull

The cable was put in the test fixture at an angle of approximately 40 degrees. A 33.4 N (7.5 pound) weight was attached to the end of the cable. The cable end with the weight attached was rotated through 360 degrees at a rate of approximately 4 rpm for 1 revolution.

3.12 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 one minute. Dummy plugs were inserted into cages during exposure.

3.13 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°C and 65°C twice while maintaining high humidity. Dummy plugs were inserted into cages during exposure.

3.14 Temperature Life

Mated specimens were exposed to a temperature of 105°C for 240 hours. Specimens were preconditioned with 20 cycles of durability before exposure. Dummy plugs were inserted into cages during exposure.

3.15 Final Examination of Product

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

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