External Mini-SAS HD

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity (TE) External Mini-SAS HD connector system to determine its conformance to the requirements of Product Specification 108-2462, Revision A.

1.2 Scope

This report covers the electrical, mechanical and environmental performance of the TE External Mini-SAS HD connector system. Testing was performed at the Harrisburg Electrical Components Test Laboratory from April 18, 2012 to May 1, 2012 and November 28, 2012 to February 14, 2013. The test file numbers for the testing are EA20120136T (Test Group 4), EA20120715T (Test Groups 1 thru 3), EA20120789T and EA20140392T (Test Group 5). This documentation is on file at and available from the Harrisburg Electrical Components Test Laboratory.

1.3 Conclusion

All Part Numbers listed in paragraph 1.5 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2462, Revision A.

1.4 Product Description

The External Mini-SAS HD receptacle assembly is the next generation SAS high-density and high-speed I/O interface. This interface was adopted for the SAS 3.0 standard and is designed to support 6G and future 12G SAS applications. The assembly is offered in 4x, 8x, and 16x versions.

1.5 Test Specimens

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

Table 1 – Test Specimens

Test Group	Quantity	Part Number	Description
1	4	2149027-1 Rev. 8	External Mini-SAS HD 1X1 Receptacle
1	2	2169265-1 Rev. 3	1x1 Test Board Bezel
1	6	2149966-1 Rev. 12	External Mini-SAS HD 1X2 Receptacle
1	6	2169265-2 Rev. 3	1x2 Test Board Bezel
1	4	2149375-1 Rev. 9	External Mini-SAS HD 1X4 Receptacle
1	4	2169265-3 Rev. 3	1X4 Test Board Bezel
2	4	2149027-1 Rev. 8	External Mini-SAS HD 1X1 Receptacle
3	4	2149027-1 Rev. 8	External Mini-SAS HD 1X1 Receptacle
1,2,3	18	60-1824005-3 Rev. A	External Mini-SAS HD LLCR PCB
4	4	2149027-1 Rev. 8	External Mini-SAS HD 1X1 Receptacle
4	4	2163481-2 Rev. A	4x Cable Assembly
5	2	2149027-1 Rev. 8	External Mini-SAS HD 1X1 Receptacle
5	8	2149966-1 Rev. 12	External Mini-SAS HD 1X2 Receptacle
5	2	2149375-1 Rev. 9	External Mini-SAS HD 1X4 Receptacle
5	6	2163168-1 Rev. C	4x Cable Assembly
5	4	2202213-1 Rev. 3	8x Cable Assembly
5	5	2274296 Rev. 3	Plug Assembly – HD Mini-SAS (these parts were not subjected to 5 cycles of preconditioning prior to testing)
5	1	2169265-1 Rev. 3	1X1 Test Board Bezel
5	3	2169265-2 Rev. 3	1X2 Test Board Bezel
5	2	2169265-3 Rev. 3	1X4 Test Board Bezel
5	11	2169264-1 Rev. 3	External Mini-SAS HD Mechanical PCB

NOTE In Test Group 1 and Test Group 5 the bezels were attached prior to testing. The torque applied to the M2 mounting screw did not exceed 0.29 N*m [2.6 in*lbs].

1.6 Qualification Test Sequence

Table 2 - Test Sequence

Test or Examination	Test Groups				
	1	2	3	4	5
	Test Sequence (a)				
Initial Examination of Product	1	1	1	1	1
Low Level Contact Resistance	3(b),6,8	2(b),4,6	2(b), 5,7		
Insulation Resistance				2,6	
Withstanding Voltage				3,7	
Random Vibration	5				
Mechanical Shock	7				
Durability	4(c)				
Plug Insertion Force	2				
Plug Extraction Force	9				
Latch Retention					2(b)
Rotational Cable Pull					3
Thermal Shock				4(d)	
Humidity/Temp Cycling		5		5	
Temperature Life		3(d)	3(d)		
Mixed Flowing Gas			4(e)		
Thermal Disturbance			6		
Final Examination of Product	10	7	8	8	4

NOTE

(a) The numbers indicate sequence in which tests were performed.
(b) Specimens were preconditioned with 5 cycles of durability.
(c) Latches were engaged during durability.
(d) Specimens were preconditioned with 25 cycles of durability.
(e) Specimens were exposed 7 days unmated and then 7 days mated.

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%

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. Where specified, specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2 Low Level Contact Resistance – Test Groups 1 thru 3

All low level contact change in resistance measurements were less than 20 milliohms.

2.3 Insulation Resistance – Test Group 4

All insulation resistance measurements were greater than 1000 megohms.

2.4 Withstanding Voltage – Test Group 4

No dielectric breakdown or flashover occurred.

2.5 Vibration, Random – Test Group 1

No discontinuities of 1 microsecond or longer were detected during vibration testing.

2.6 Mechanical Shock – Test Group 1

No discontinuities of 1 microsecond or longer were detected during mechanical shock testing.

2.7 Durability – Test Group 1

No physical damage occurred to the specimens as a result of mating and unmating the specimens 250 times.

2.8 Plug Insertion Force – Test Group 1

All plug insertion force measurements were below the maximum requirement of 100 N [22.5 lbf].

2.9 Plug Extraction Force – Test Group 1

All plug extraction force measurements were below the maximum requirement of 50 N [11.25 lbf].

2.10 Latch Retention – Test Group 5

All specimens met the requirement of a 44.5 N [10 lbf] load held for 120 seconds.

2.11 Rotational Cable Pull – Test Group 5

All specimens met the requirement of 16.7 N [3.75 lbf] load applied at 40° from vertical, and then rotated 360° with no displacement of the cage assembly or connector from the printed circuit board, nor did the cable assembly release from the cage assembly.

2.12 Thermal Shock – Test Group 4

No evidence of physical damage detrimental to product performance was visible as a result of exposure to a thermal shock environment.

2.13 Humidity/Temperature Cycling – Test Groups 2 and 4

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

2.14 Temperature Life – Test Groups 2 and 3

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

2.15 Mixed Flowing Gas – Test Group 3

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

2.16 Thermal Disturbance – Test Group 3

No evidence of physical damage detrimental to product performance was visible as a result of exposure to thermal disturbance.

2.17 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 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 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. The grounds were not tested because they were bussed throughout the connector.

3.3 Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. Adjacent contacts consisted of signal to signal contacts and signal to ground contacts. A test voltage of 100 volts DC was applied for two minutes before the resistance was measured.

3.4 Withstanding Voltage

A test potential of 300 volts AC was applied between the adjacent contacts of mated specimens. Adjacent contacts consisted of signal to signal contacts and signal to ground contacts. This potential was applied for one minute and then returned to zero.

3.5 Vibration, Random

The test specimens were subjected to a random vibration. The parameters of this test condition are specified by 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. Refer to Figure 1 for an image of the typical test setup.

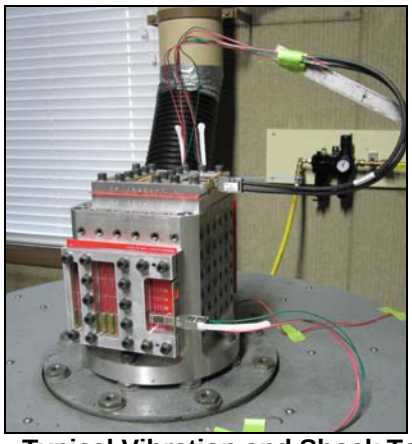

Figure 1 – Typical Vibration and Shock Test Setup

3.6 Mechanical Shock

The test specimens were subjected to a mechanical shock test. The parameters of this test condition are 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. Refer to Figure 1 for an image of the typical test setup.

3.7 Durability

Specimens were mated and unmated 250 times at a maximum rate of 500 cycles per hour by hand with the latches engaged.

3.8 Plug Insertion Force

The PCB was bolted to a plate that was attached a free floating air bearing table. The air bearing table was attached to the base of the tensile/compressive machine. The cable assembly was held in a vise that was attached to the moveable cross head of the tensile/compressive machine. The cable was manually aligned with the connector and force was applied in a downward direction at a rate of 0.5 inches per minute until the latches engaged. Refer to Figure 2 for images of the typical test setup.

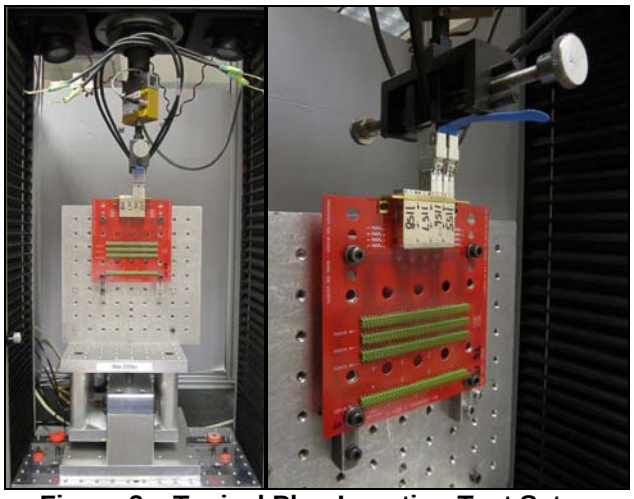

Figure 2 – Typical Plug Insertion Test Setup

3.9 Plug Extraction Force

The PCB was held in a vise that was attached to a free floating X-Y table. The X-Y table was mounted to the base of the tensile/compressive machine. The cable assembly was clamped in an air jaw that was attached to the moveable cross head of the tensile/compressive machine. The latches were disabled and force was applied in an upward direction at a rate of 0.5 inches per minute until the cable assembly was removed from the cage. Refer to Figure 3 for images of the typical test setup.

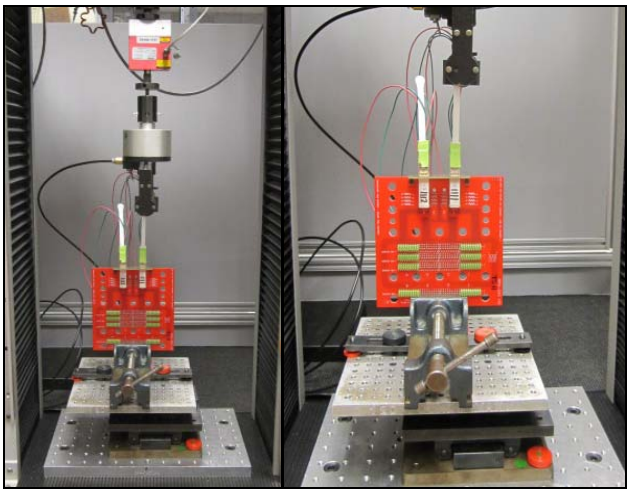

Figure 3 – Typical Plug Extraction Test Setup

3.10 Latch Retention

The PCB was bolted to a plate that was held in a vise that was attached to a rotational table. The rotational table was mounted to a free floating X-Y table that was attached to the base of the tensile/compressive machine. The cable assembly was held in an air jaw that was attached to the moveable cross head of the tensile/compressive machine. Force was applied in an upward direction at a rate of 0.25 inches per minute until 10 pounds was achieved and then held for 120 seconds. Refer to Figure 4 for an image of the test setup.

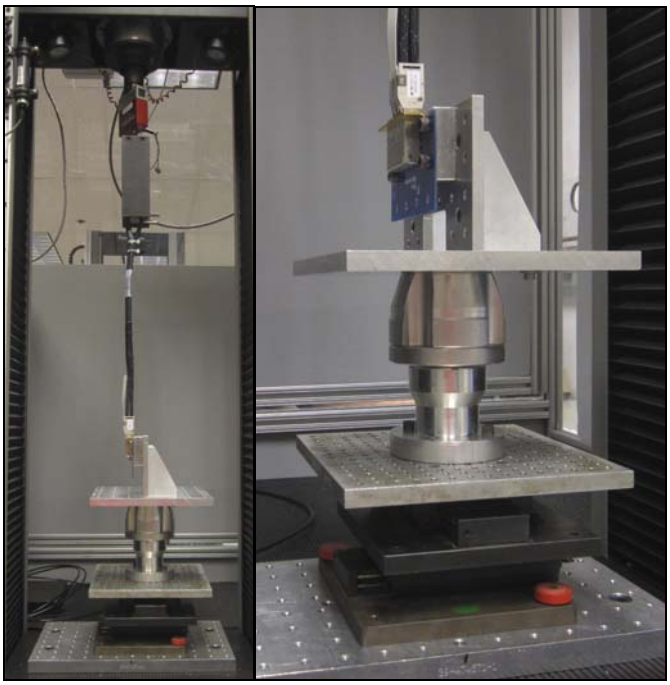

Figure 4 – Typical Test Setup, Latch Retention

3.11 Rotational Cable Pull

The PCB was bolted to a plate on the rotational cable pull test machine. The cable of the plug was attached to a 3.75 lb weight. The load was applied at 40° from vertical and then rotated 360° at a rate of 4 RPM with the load still applied. Refer to Figure 5 for an image of the test setup.

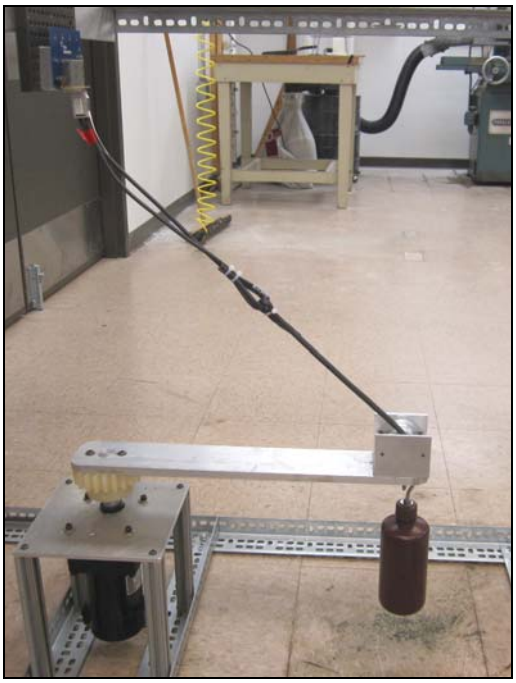

Figure 5 – Typical Test Setup, Rotational Cable Pull

3.12 Thermal Shock

Mated specimens were subjected to 10 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55°C and 85°C. The transition between temperatures was less than one minute.

3.13 Humidity/Temperature Cycling

The mated test specimens were subjected 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 per the humidity/temperature cycling profile illustrated in Figure 6.

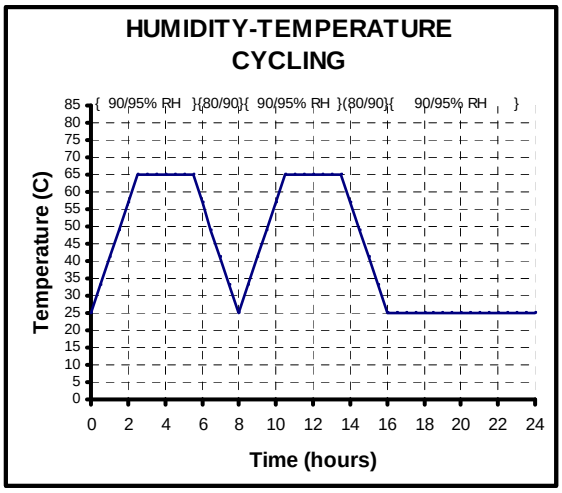

Figure 6 – Humidity Temperature Cycling Profile

3.14 Temperature Life

Mated specimens were exposed to a temperature of 85°C for 500 hours. Specimens were preconditioned with 25 cycles of durability prior to exposure.

3.15 Mixed Flowing Gas, Class IIA

All specimens were subjected to a Class IIA Mixed Flowing Gas test. Test parameters are listed in Table 3. The specimens were exposed in the unmated condition for the first 7 days (both connector halves exposed) and mated for the final 7 days.

Table 3 – MFG Test Parameters

Environment	Class IIA
Temperature (^{0}C)	30 ± 1
Relative Humidity (%)	70 ± 2
Chlorine (Cl2) Concentration (ppb)	10 ± 3
Hydrogen Sulfide (H2S) Concentration (ppb)	10 ± 5
Nitrogen Dioxide (NO2) Concentration (ppb)	200 ± 50
Sulfur Dioxide (SO2) Concentration (ppb)	100 ± 20
Exposure Period	14 Days

3.16 Thermal Disturbance

Mated specimens were exposed to 10 temperature cycles between 15 ± 3°C and 85 ± 3°C. Ramp times were 2.3°C per minute with 30 minute dwell times which ensured the contacts reached the temperature extremes (5 minute minimum). Humidity was not controlled.

3.17 Final Examination

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