CLOUDSPLITTER* Connector System

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity (TE) CLOUDSPLITTER Connector System to determine its conformance to the requirements of Product Specification 108-64022, Revision B.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the TE CLOUDSPLITTER Connector System. Testing was performed at the TE Harrisburg Electrical Components Test Laboratory between June 27, 2013 and October 31, 2013 and the Mundelein Electrical Components Test Laboratory between September 25, 2013 and October 2, 2013, and July 17, 2014 and August 12, 2014. This documentation is on file at the above listed labs under test file numbers EA20130341T, EA20130344T, EA20130584T and EA20140412T.

1.3 Conclusion

All part numbers listed in paragraph 1.5 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-64022, Revision B.

1.4 Product Description

The CLOUDSPLITTER cable plug and jack assemblies are designed for use in voice, data, signal, and power transmission applications. The CLOUDSPLITTER connector product is a 10 position interconnect product consisting of 8 signal contact positions and 2 power contact positions. The signal contacts are intended for use in Category 5e data transmission when used in accordance with the TIA/EIA 568-C.2 standard.

1.5 Test Specimens

The test specimens were representative of normal production lots, and the part numbers listed in Table 1 were used for qualification testing.

Table 1 – Test Specimen Identification

Test Group	Qty	Part Number	Description
1	17	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
2	10	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
3	10	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
4	4	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
5	15	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
6	8	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
7	4	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
8	5	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
9	2	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
10	3	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
11	3	2178126-1	Jack Assembly, CLOUDSPLITTER, SMT, Shielded
1 to 11 1 and 5	134 14	2178127-1 2178148-1	Cable Assembly CLOUDSPLITTER, Unshielded – Stranded Wire CLOUDSPLITTER Kit - Solid Wire
1,2,4,5,6,7,8,9,10,11	138	60-1824246-1 Rev A	Test PCB

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1.6 Qualification Test Sequence

Table 2 - Test Sequence

Test of Examination	Test Group (a)										
	1	2	3	4	5	6	7	8	9	10	11
	Test Sequence (b)										
Examination of Product	1,8	1,6	1,8	1,7	1,7	1,6	1,3	1,4	1,6	1,3	1,3
Termination Resistance, dry circuit	3,6	2,5		4,6		2,5					
Termination Resistance, rated current					2,5						
Insulation Resistance			2,6								
Dielectric Withstanding Voltage			3,7								
Temperature Rise vs. Current		3			3,6						
Vibration	4										
Mechanical Shock	5										
Durability				5							
Mating Force	2			2							
Unmating Force	7			3							
Plug Retention in Jack								2			
Plug Latch Deflection Force						3					
Pull						4					
Jack Retention to PCB – Perpendicular							2				
Jack Retention to PCB – Axial								3			
Thermal Shock			4								
Temperature/Humidity			5								
Mixed Flowing Gas		4(c)									
Temperature Life					4						
NEXT Loss									2		
Return Loss									3		
Insertion Loss									4		
FEXT Loss									5		
Breaking Capacity – High										2(d)	
Breaking Capacity – Low											2(d)
Breaking Capacity – Signal – High										2(d)	
Breaking Capacity – Signal - Low											2(d)

Note: (a) See paragraph 1.5.
(b) Numbers indicate sequence which tests were performed.
(c) Precondition specimens with 10 durability cycles.
(d) Noted tests are run concurrently.

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 Examination of Product

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

2.2 Termination Resistance, Dry Circuit

All initial power contact measurements were less than the 20 milliohm requirement. At the end of each testing sequence the power contacts had a delta less than the maximum requirement of 5 milliohms and the signal contacts had a delta less than their maximum delta requirement of 30 milliohms. Refer to Tables 3 through 7 for the summary data.

Table 3 – Test Group 1 (Stranded Wire) Termination Resistance Data in milliohms

	Initial (Actual)	Final (Delta)	Initial (Actual)	Final (Delta)
	Signals		Powers	
Min	71.21	-19.43	10.50	-0.28
Max	123.42	8.70	11.04	0.08
Average	77.28	-0.04	10.76	-0.10
Std Dev.	6.33	3.05	0.15	0.10
N =	80	80	20	20

Measurements include approximately 13 inches of cable bulk.

Table 4 – Test Group 1 (Solid Wire) Termination Resistance Data in milliohms

	Initial (Actual)	Final (Delta)	Initial (Actual)	Final (Delta)
	Signals		Powers	
Min	100.48	-22.70	20.41	-0.15
Max	157.70	18.71	20.84	0.25
Average	108.72	2.73	20.64	0.00
Std Dev.	9.52	6.80	0.14	0.12
N =	56	56	14	14

Measurements include approximately 31.5 inches of cable bulk.

Table 5 – Test Group 2 (Stranded Wire) Termination Resistance Data in milliohms

	Initial (Actual)	Final (Delta)	Initial (Actual)	Final (Delta)
	Signals		Powers	
Min	49.47	-5.14	7.35	-0.23
Max	62.99	13.60	7.81	0.46
Average	57.08	1.93	7.56	0.11
Std Dev.	2.53	3.04	0.11	0.17
N =	80	80	20	20

Measurements include approximately 5.5 inches of cable bulk.

Table 6 – Test Group 4 (Stranded Wire) Termination Resistance Data in milliohms

	Initial (Actual)	Final (Delta)	Initial (Actual)	Final (Delta)
	Signals		Powers	
Min	49.17	-11.61	6.19	0.12
Max	62.65	23.16	6.49	0.44
Average	52.42	0.17	6.35	0.26
Std Dev.	2.98	5.52	0.11	0.11
N =	40	40	10	10

Measurements include approximately 5 inches of cable bulk.

Table 7 – Test Group 6 (Stranded Wire) Termination Resistance Data in milliohms

	Initial (Actual)	Final (Delta)	Initial (Actual)	Final (Delta)
	Signals		Powers	
Min	92.49	-7.51	13.74	-0.27
Max	106.36	3.37	14.43	0.35
Average	96.58	-1.14	14.13	-0.04
Std Dev.	2.93	2.27	0.23	0.21
N =	32	32	8	8

Measurements include approximately 18 inches of cable bulk.

2.3 Termination Resistance, Rated Current

All power contact initial measurements were less than the 20 milliohm requirement, and at the end of the testing sequence the power contacts had a delta less than the maximum requirement of 5 milliohms and the signal contacts had a delta less than their maximum delta requirement of 45 milliohms. Refer to Table 8 and Table 9 for the summary data.

Table 8 – Test Group 5 (Stranded Wire) - Termination Resistance, Rated Current in milliohms

	Initial (Actual)	Final (Delta)	Initial (Actual)	Final (Delta)
	Signals		Powers	
Test Current	1.5 Amps	1.5 Amps	5 Amps	5 Amps
Min	53.76	-3.85	7.28	-0.29
Max	74.09	18.59	7.98	0.23
Average	59.49	1.91	7.70	0.05
Std Dev.	3.74	3.73	0.22	0.15
N =	64	64	14	14

Initial measurements include approximately 7 inches of cable bulk.

Table 9 – Test Group 5 (Solid Wire) - Termination Resistance, Rated Current in milliohms

	Initial (Actual)	Final (Delta)	Initial (Actual)	Final (Delta)
	Signals		Powers	
Test Current	1.5 Amps	1.5 Amps	5 Amps	5 Amps
Min	102.22	-9.67	20.67	-0.28
Max	137.67	44.77	21.32	0.30
Average	112.53	5.11	20.96	0.03
Std Dev.	9.56	13.62	0.23	0.16
N =	56	56	14	14

Measurements include approximately 31.5 inches of cable bulk.

2.4 Insulation Resistance

All signal to signal initial and final insulation resistance measurements were greater than the minimum requirement of 500 MΩ.

2.5 Dielectric Withstanding Voltage

All specimens met the initial and final dielectric withstanding voltage requirements. There was no breakdown or flashover during testing.

2.6 Temperature Rise vs. Current

Stranded Wire specimens were 100% energized with 1.5 Amps of current on the signal contacts, and 5.0 Amps of current on the power contacts. All recorded maximum temperature rise values were below the maximum requirement of 35°C (with the ambient removed).

Solid Wire specimens were 100% energized with 1.3 Amps of current on the signal contact, and 5.0 Amps of current on the power contacts. All recorded maximum temperature rise values were below the maximum requirement of 35°C (with the ambient removed).

2.7 Vibration

No apparent physical damage or discontinuities of one microsecond or greater occurred during testing.

2.8 Mechanical Shock

No apparent physical damage or discontinuities of one microsecond or greater occurred during testing.

2.9 Durability

Specimens were subjected to 1,500 cycles of durability on a machine.

2.10 Mating Force

Refer to Table 10 for the mating force results summary information. All specimens from Test Group 1 and Test Group 4 had mating force measurements less than the maximum requirement of 44 Newtons.

Table 10 – Mating Force Results Summary in Newtons

Results	Test Group 1	Test Group 4
Minimum	22.81	30.09
Maximum	42.79	32.26
Average	32.40	31.02
Std Dev.	4.95	0.92
N =	17	4

2.11 Unmating Force

All unmating forces were less than the maximum requirement of 35 Newtons. Refer to Table 11 below for the unmating force results summary information in Newtons.

Table 11 – Unmating Force Results Summary in Newtons

Results	Test Group 1	Test Group 4
Minimum	23.04	15.14
Maximum	30.59	17.03
Average	26.56	16.25
Std Dev.	2.47	0.82
N =	16	4

2.12 Plug Retention to Jack

None of the plugs were dislodged from the jack when an axial load of 89 N was applied to the mated specimens with latch engaged.

2.13 Plug Latch Deflection Force

All specimens were depressed a distance of 5 mm and did not require more than 5 Newtons for the deflection.

2.14 Pull

All of the plugs tested when pulling on the side opposite the latch remained mated and there was no evidence of damage after applying 75 Newtons of force.

2.15 Jack Retention to PCB – Perpendicular

All specimens required a force greater than 95 Newtons to dislodge the jack from the PCB after reflow soldering.

2.16 Jack Retention to PCB – Axial

All specimens required a force greater than 95 Newtons to dislodge the jack from the PCB after reflow soldering.

2.17 Thermal Shock

Specimens did not show evidence of damage detrimental to the performance of the connector.

2.18 Temperature/Humidity

Specimens did not show evidence of damage detrimental to the performance of the connector.

2.19 Mixed Flowing Gas

Specimens did not show evidence of damage detrimental to the performance of the connector.

2.20 Temperature Life

Specimens did not show evidence of damage detrimental to the performance of the connector.

2.21 NEXT Loss

All specimens met the requirements of TIA-568-C.2 Category 5e Connecting Hardware.

2.22 Return Loss

All specimens met the requirements of TIA-568-C.2 Category 5e Connecting Hardware.

2.23 Insertion Loss

All specimens met the requirements of TIA-568-C.2 Category 5e Connecting Hardware.

2.24 FEXT Loss

All specimens met the requirements of TIA-568-C.2 Category 5e Connecting Hardware.

2.25 Breaking Capacity – High

There were no signs of physical damage visible to the parts after being subjected to breaking capacity of power contacts – high testing.

2.26 Breaking Capacity – Low

There were no signs of physical damage visible to the parts after being subjected to breaking capacity of power contacts – low testing.

2.27 Breaking Capacity – Signal – High

There were no signs of physical damage visible to the parts after being subjected to breaking capacity of signal contacts testing.

2.28 Breaking Capacity – Signal - Low

There were no signs of physical damage visible to the parts after being subjected to breaking capacity of signal contacts testing.

3. TEST METHODS

3.1. Examination of Product

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 Termination Resistance, Dry Circuit

A four wire measurement method was used to measure the eight signal contacts and two power contacts per specimen. A maximum test current of 100 milliamperes was applied with a voltage of 20 millivolts. Current and voltage were applied to the stripped end of the wire on the plug side. Current was applied to the soldered wires on the PCB and the remaining voltage probe was applied on the PCB for each circuit.

3.3 Termination Resistance, Rated Current

A four wire measurement method was used to measure the eight signal contacts and two power contacts per specimen. A test current of 5.0 Amps DC was applied to the power contacts, and a test current of 1.5 Amps DC was applied to the signal contacts in order to obtain the resistance value. Current and voltage were applied to the stripped end of the wire on the plug side. Current was applied to the soldered wires on the PCB and the remaining voltage probe was applied on the PCB for each circuit.

3.4 Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens and all contacts to the shell. A test voltage of 500 volts DC was applied for two minutes before the resistance was measured.

3.5 Dielectric Withstanding Voltage

A test potential of 1000 volts AC was applied between the adjacent contacts of mated specimens and all contacts to the shell. This potential was applied for one minute and then returned to zero.

3.6 Temperature Rise vs. Current

Specimens were 100% energized with 1.5 Amps of current for the signal contacts, and 5.0 Amps of current for the power contacts. The specimens were stabilized at these current levels until 3 readings taken at 5 minute intervals were within a 1°C temperature difference. The maximum temperature was recorded.

3.7 Vibration

The test specimens were subjected to a sinusoidal vibration test in accordance with EIA-364-28, Test Condition I with one exception, which lowered the time run per axis from two hours to fifteen minutes. See Figure 1 below for vibration setup photograph. The test specimens were subjected to a simple harmonic motion having an amplitude of 0.06 inch double amplitude (maximum total excursion). The vibration frequency was varied uniformly between the approximate limits of 10 to 55 Hertz (Hz). The entire frequency range of 10 to 55 Hz and return to 10 Hz was traversed in approximately 1 minute. The motion was applied for a period of 15 minutes in each of the three mutually perpendicular axes, so the motion was applied for a total period of approximately 45 minutes per test specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

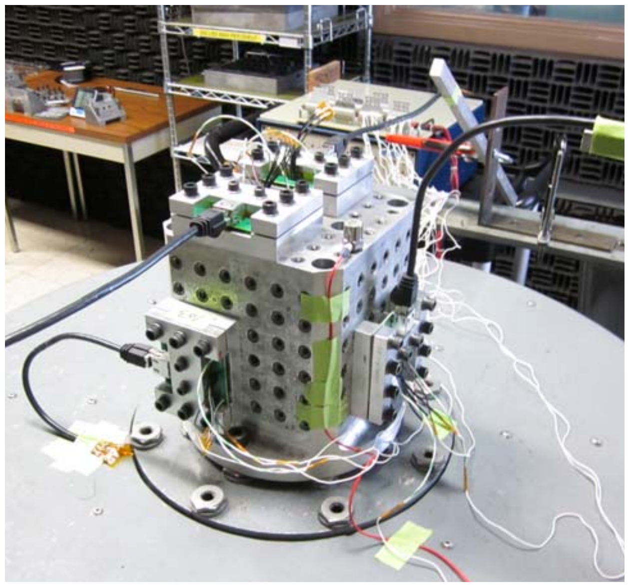

Figure 1 – Vibration Test Setup

3.8 Mechanical Shock

The test specimens were subjected to a mechanical shock test in accordance with EIA-364-27, Method A. See Figures 2 through 4 below for shock setup photographs. The parameters of this test condition are a half-sine waveform with an acceleration amplitude of 50 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.

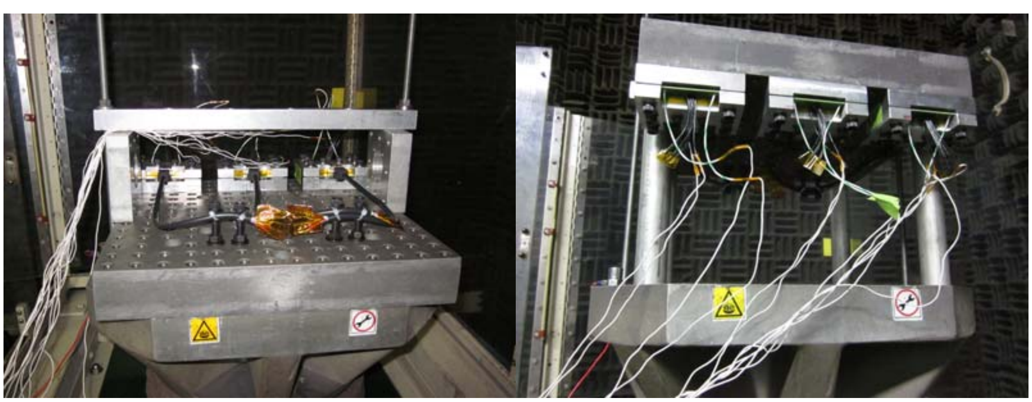

Figure 2 – Shock Setup Images, Part 1

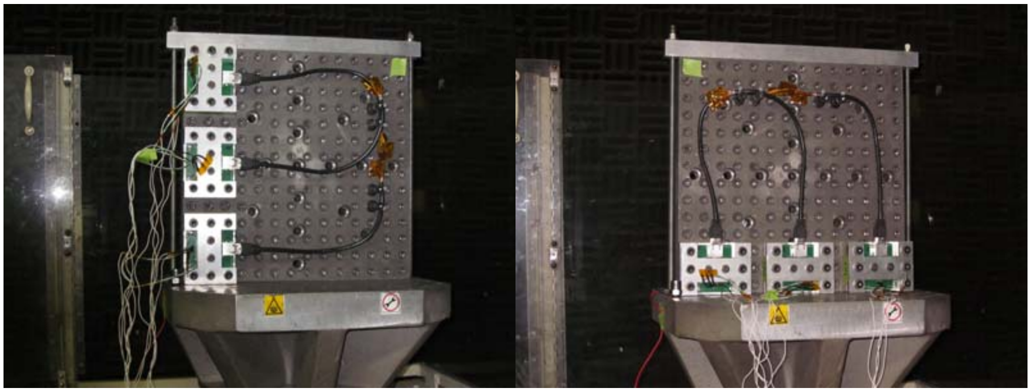

Figure 3 – Shock Setup Images, Part 2

Figure 4 – Shock Setup Images, Part 3

3.9 Durability

The specimens were subjected to a total of 1,500 cycles of durability testing in 500 cycle increments on a durability cycling machine with a rate of cycling set at 500 cycles per hour with the latch inoperative.

3.10 Mating Force

The PCB mounted receptacle was placed in a vise mounted to a rotational table on top of an X-Y table. The plug was started into the receptacle approximately 1/16 to 1/8 inch and approximately 0.5 to 1.0 pound of pre-load was placed on the plug to hold it in position, then a 0.260 inch slotted plate mounted in a fixture on the crosshead of the tensile testing machine pressed on the plug in the compression direction at a rate of 1 inch per minute until the plug was mated to the receptacle, the latch was engaged, and the force was recorded. Refer to Figure 5 for a detailed image of the test setup.

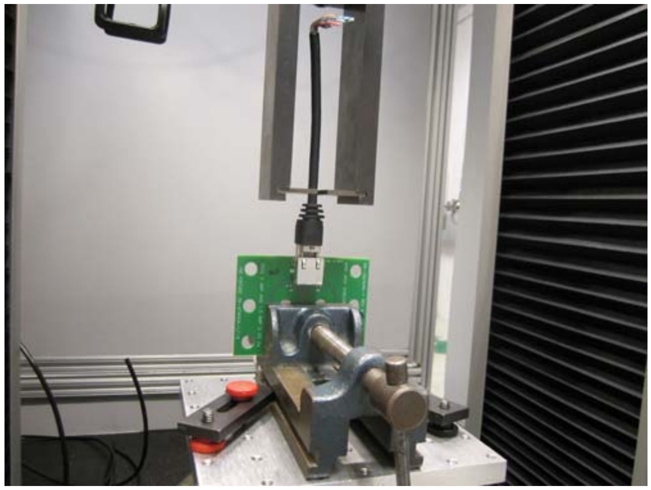

Figure 5 – Mating Force Test Setup

3.11 Unmating Force

The PCB with the jack and mated plug was held in a vise on the air table on the base of the tensile machine. The end of the cable was held in a vise mounted to the load cell on the crosshead of the load frame. The latch on the plug was disabled by wrapping a plastic wire tie around the plug and tightening it until the latch was depressed. The machine was started in the tensile direction at a rate of 1.0 inch per minute until the plug pulled out of the jack and the maximum force was recorded. See Figure 6 for a photograph of the test setup.

Figure 6 – Unmating Force Setup

3.12 Plug Retention to Jack

A force of 89 N was applied to the mated specimens using weights. The force was applied by clamping the plug cable in pneumatic air jaws attached to the cross arm. The weights were then attached to the PCB. The cross arm was moved in the up direction at a rate of 13 mm/min until the weights were lifted off the base plate of the tensile machine. Refer to Figure 7 for the test setup.

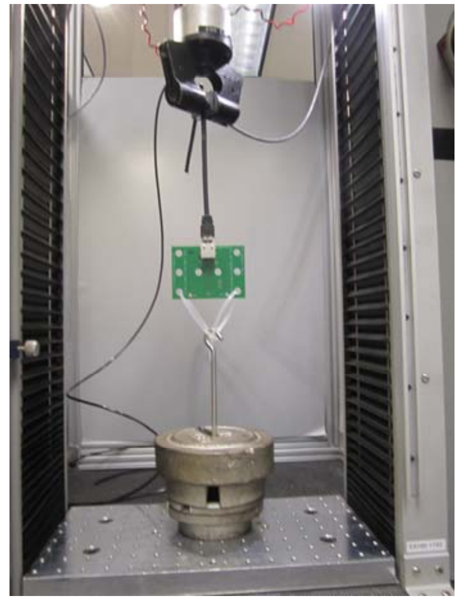

Figure 7 – Plug Retention in Jack Setup

3.13 Plug Latch Deflection Force

Specimens were held in a vice with the plug boot removed to expose the plug latch. A gauge pin was mounted to the load cell on the tensile testing machine. See Figure 8 for an image representative of the test set up. The load cell was lowered at a rate of 0.10 in/min until a displacement of approximately 4.5 mm was achieved. The force necessary to deflect the plug latch was recorded.

Figure 8 – Plug Latch Deflection Force Test Setup

3.14 Pull

Specimens were mounted in the angle vice set to +45° from parallel with the base plate of the tensile machine. The wire lead was looped and held with zip-ties to prevent damaging the wire leads while testing. The wire lead loop was placed on the wire mandrel mounted to the load cell on the crosshead. See Figure 9 for a representative image of the test set up. The crosshead was raised at a rate of 0.50 in/min until a load of approximately 75 N was reached. The specimens were tested with the latch facing down.

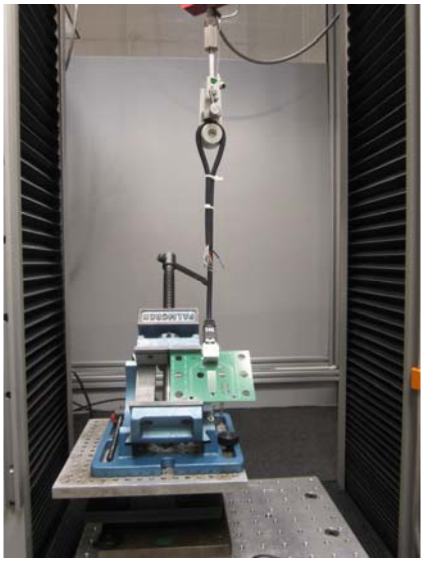

Figure 9 – Pull Test Setup

3.15 Jack Retention to PCB – Perpendicular

The jack retention to PCB was measured by holding the jack in a clamp mounted to a load cell. The PCB with the jack facing up was slipped under two stationary fingers that were positioned on either side of the jack. A perpendicular force was then applied at a rate of 50 mm/min to dislodge the jack from the PCB. Refer to Figure 10 for an image of the test setup.

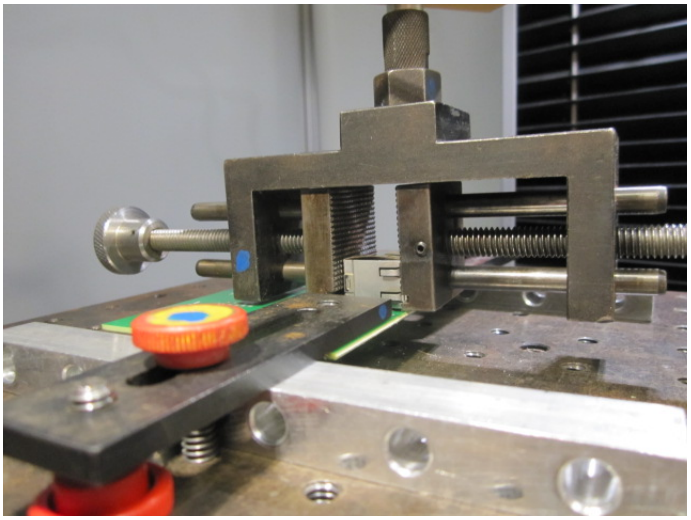

Figure 10 – Jack Retention to PCB Test Setup

3.16 Jack Retention to PCB – Axial

The specimens were held in a vise with the receptacle opening facing up. A flat piece of metal was clamped with the specimen to add rigidity to the printed circuit board. A downward axial force was then applied to the upper edge of the receptacle connector at a rate of 50 mm/min until the connector was dislodged from the board. The force was applied using a flat ended probe attached to a load cell and the movable cross arm. Refer to Figure 11 for an image of the test set up.

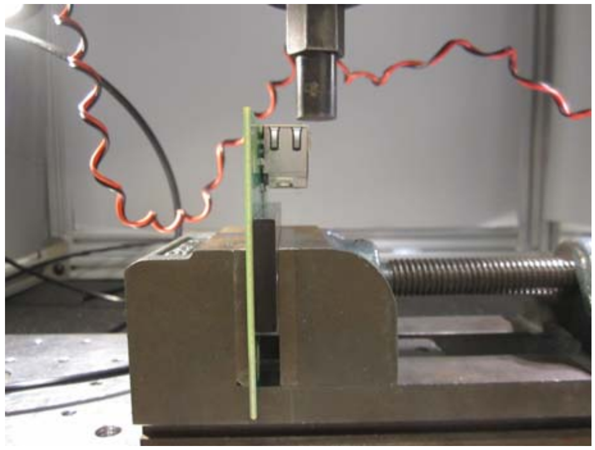

Figure 11 – Jack Retention to PCB Test Setup

3.17 Thermal Shock

Specimens were exposed to 25 cycles of thermal shock between -40 and 85°C with 30 min dwell at each extreme.

3.18 Temperature/Humidity

Specimens were exposed to 10 cycles of temperature/humidity exposure between 25 and 65°C at 80 to 100% relative humidity. Each cycle lasted 24 hours.

3.19 Mixed Flowing Gas

Specimens were subjected to a mixed flowing gas test in accordance with EIA 364-65B with the test parameters listed in Table 10. The test specimens consisted of ten mated connector assemblies. No termination resistance measurements were required during the exposure period. Specimens were preconditioned with 10 durability cycles prior to exposure.

Table 10 – MFG Test Parameters

Environment	Class IIA
Temperature (°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	20 Days

3.20 Temperature Life

The mated specimens were exposed to a temperature of 70°C for 96 hours in an air circulating oven.

3.21 NEXT Loss

The large adapter board was placed on top of the CAT6A test tower for NEXT. The adapter boards, with sample, were placed on top of the termination board on the test tower. The far end adapter board was terminated using a 4-port DMCM termination mini board. NEXT measurements were taken driven from port 1 of the network analyzer from both the plug and jack end of the sample. All 6 pair combinations were measured.

3.22 Return Loss

The large adapter board was placed on top of the CAT6A test tower. The adapter boards, with sample, were placed on top of the large adapter board on the test tower. The far end adapter board was terminated using a 4-port termination mini board. All pairs were measured driving from both the plug and jack end of the sample.

3.23 Insertion Loss

The DMCM 3 port resistor termination board was placed on top of the CAT6A test tower. The adapter boards, with sample, were placed on top of the termination board on the test tower. The far end adapter board was terminated using a 3-port DMCM termination mini board. Insertion Loss measurements were taken driven from port 1 of the network analyzer from the marked A end of the cable. All pair 4 pairs were measured for Insertion Loss.

3.24 FEXT Loss

The DMCM 3 port resistor termination board was placed on top of the CAT6A test tower. The adapter boards, with sample, were placed on top of the termination board on the test tower. The far end adapter board was terminated using a 3-port DMCM termination mini board. FEXT measurements were taken driven from port 1 of the network analyzer from the marked A end of the cable. All 12 pair combinations were measured for FEXT.

3.25 Breaking Capacity – High

Testing was conducted in accordance with 108-64022 and IEC 61984, section 7.3.5. High breaking capacity tests on power contacts were run for 150 cycles at 50 VDC and 2A.

3.26 Breaking Capacity – Low

Testing was conducted in accordance with 108-64022 and IEC 61984, section 7.3.5. Low breaking capacity tests on power contacts were run for 1500 cycles at 50 VDC and 0.2A.

3.27 Breaking Capacity – Signal – High

Testing was conducted in accordance with 108-64022 and IEC 61984, section 7.3.5. Breaking capacity of signal contacts were run for 150 cycles at 50 VDC and 0.3A.

3.28 Breaking Capacity – Signal - Low

Testing was conducted in accordance with 108-64022 and IEC 61984, section 7.3.5. Breaking capacity of signal contacts were run for 1500 cycles at 50 VDC and 0.01A.