Stacked Modular Jack with LED's, Category 5e

1. INTRODUCTION

1.1. Purpose

Testing was performed on the TE Connectivity (TE) Stacked Modular Jack with LED's, Category 5e to determine their conformance to the requirements of Product Specification 108-60109 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Stacked Modular Jack with LED's, Category 5e. Testing was performed at the Engineering Assurance Product Testing Laboratory between 22Dec 2015 and 03Feb 2016.

1.3. Conclusion

The Stacked Modular Jack with LED's, Category 5e listed in paragraph 1.5, conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-60109 Revision A.

1.4. Product Description

TE Connectivity (TE) Stacked Modular Jacks with LED's, Category 5e are designed to meet requirements for applications such as networking, computer, and telecommunications equipment.

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	Quantity	Part Number	Description
1	3	2295251-1	Stacked Modular Jack with LED's, Category 5e
2,3,4,5,6,7,8,9	36	2295251-1	Stacked Modular Jack with LED's, Category 5e

Figure 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%

1.7. Qualification Test Sequence

Test or Examination	Test Group (a)									
	1	2	3	4	5	6	7	8	9	
	Test Sequence (b)									
Initial examination of product	1	1	1	1	1	1	1	1	1	
Low level contact resistance	3,7	2,4	2,4				2,4			
Insulation resistance				2,6						
Withstanding voltage				3,7						
Crosstalk (FEXT)						2				
Crosstalk (NEXT)						3				
Insertion loss						4				
Return loss						5				
Surge									2	
Vibration	5									
Mechanical shock	6									
Durability	4									
Mating force	2									
Unmating force	8									
Plug retention in jack					2					
Pull rotational load							3			
Press fit insertion force.								2		
Press fit extraction force.								3		
Thermal shock				4						
Humidity-temperature cycling				5						
Temperature life		3(c)								
Mixed flowing gas			3(c)							
Final examination of product	9	5	5	8	3	6	5	4	3	

NOTE

(a) See paragraph 4.1.A.
(b) Numbers indicate sequence in which tests are performed.
(c) Precondition specimens with 10 cycles durability.

Figure 2

2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups

All specimens submitted for testing were representative of normal production lots. They were inspected and accepted by the Quality Assurance Department.

2.2. Low Level Contact Resistance - Test Groups 1, 2, 3 and 7

All contact resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage had a change in resistance (ΔR) of less than 30 milliohms after testing.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
1	40	Initial	42.43	148.75	83
		After Durability/Vibration/Mechanical shock ΔR	-3.90	0.16	-1.43
2	40	Initial	46.03	158.61	82.67
		After Temperature life ΔR	-2.90	28.44	3.88
3	40	Initial	43.60	141.99	54.53
		After Mixed Flowing Gas ΔR	--1.05	4.94	0.92
7	40	Initial	42.22	146.34	82.00
		After Pull rotational load ΔR	-3.07	2.28	-0.51

NOTE *All values in milliohms.*

Figure 3

2.3. Insulation Resistance - Test Group 4

All insulation resistance measurements were greater than 500 megohms.

2.4. Withstanding Voltage - Test Group 4

No dielectric breakdown or flashover occurred.

2.5. Crosstalk (FEXT) - Test Group 6

All crosstalk (FEXT) results were less than the specified values (Figure 4) from 1 to 100 MHz.

2.6. Crosstalk (NEXT) - Test Group 6

All crosstalk (NEXT) results were less than the specified values (Figure 4) from 1 to 100 MHz.

2.7. Insertion loss - Test Group 6

All Insertion loss results were less than the specified values (Figure 4) from 1 to 100 MHz.

2.8. Return loss - Test Group 6

All Return loss results were less than the specified values (Figure 4) from 1 to 100 MHz.

Category 5e, 100 Ohm Twisted Pair

Frequency (MHz)	FEXT Loss (dB)	NEXT Loss (dB)	Insertion Loss (dB)	Return Loss (dB)
1.00	65.0	65.0	0.10	30.0
4.00	63.1	65.0	0.10	30.0
8.00	57.0	64.9	0.11	30.0
10.00	55.1	63.0	0.13	30.0
16.00	51.0	58.9	0.16	30.0
20.00	49.1	57.0	0.18	30.0
25.00	47.1	55.0	0.20	30.0
31.25	45.2	53.1	0.22	30.0
62.50	39.2	47.1	0.32	24.1
100.00	35.1	43.0	0.40	20.0

NOTE *See TIA 568-C.2, Aug. 2009*

Figure 4

2.9. Surge Test - Test Group 9

Samples tested withstand the test without damage. There is not electrical continuity between contacts after test; electrical continuity plug-jack is kept after test.

2.10. Vibration, Random - Test Group 1

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

2.11. Mechanical shock - Test Group 1

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

2.12. Durability - Test Group 1

No physical damage occurred as a result of mating and unmating the specimens 750 times.

2.13. Mating Force - Test Group 1

All mating force measurements were less than 35.56 N [8 lbf].

2.14. Unmating Force - Test Group 1

All unmating force measurements were less than 22.23 N [5 lbf].

2.15. Plug Retention In Jack - Test Group 5

All plug retention in jack measurements were greater than 66.67 kg [15 lbf] with no evidence of physical damage.

2.16. Pull rotational load - Test Group 7

The plug remained mated and no physical damage occurred as a result of pull testing.

2.17. Press fit insertion force - Test Group 8

All specimens had an insertion force less than the maximum allowable force of 44.5N [10 lbf] average per pin.

2.18. Press fit extraction force - Test Group 8

All specimens had an extraction force greater than the minimum allowable force of 8.9N [2.0 lbf] average per pin.

2.19. Thermal Shock - Test Groups 4

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

2.20. Humidity/temperature Cycling - Test Groups 4

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

2.21. Temperature Life - Test Groups 2

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

2.22. Mixed Flowing Gas - Test Group 5

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

2.23 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 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. Low Level Contact Resistance

Low level contact resistance 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.

3.3. Insulation Resistance

Insulation resistance was measured between adjacent contacts of unmated specimens that were not electrically connected. A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

3.4. Withstanding Voltage

A test potential of 1500 volts AC RMS was applied between the shield of the receptacle and all separable interfaces of the plug and receptacle. This potential was applied for 1 minute and then returned to zero.

3.5. Crosstalk (FEXT)

A network analyzer in the S_{21} mode was used to perform the crosstalk (FEXT) test. The S_{21} mode transmits power from Port 1 and receives the signal into Port 2 in a “through” type measurement.

3.6. Crosstalk (NEXT)

A network analyzer in the S_{21} mode was used to perform the crosstalk (NEXT) test. The S_{21} mode transmits power from Port 1 and receives the signal into Port 2 in a “through” type measurement.

3.7. Insertion loss

A network analyzer in the S_{21} mode was used to perform the insertion loss test. The S_{21} mode transmits power from Port 1 and receives the signal into Port 2 in a “through” type measurement.

3.8. Return loss

A network analyzer in the S_{11} mode was used to perform the return loss test. The S_{11} mode transmits power from Port 1 and receives the reflected signal back into Port 1.

3.9. Surge test

5 pulses in intervals of 1 minute of each polarity 10/1000us 1000 V have been applied to each samples between adjacent contacts.

3.10. Vibration, Random

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 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. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.11. Mechanical shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 30 gravity units (g peack) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular or greater using a current of 100 milliamperes DC.

3.12. Durability

Specimens were mated and unmated 750 times at a maximum rate of 600 cycles per hour.

3.13. Mating Force

The force required to mate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

3.14. Unmating Force

The force required to unmate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

3.15. Plug Retention in Jack

A 66.67 kg [15 lb] axial load was applied to individual specimens using a tensile/compression device with a free floating fixture and a rate of travel of .5 inch per minute.

3.16. Plug rotational load

An 44.45 kg [10 lb] axial load was applied to individual specimens, the specimens were then rotated 45 degree from the pull axis.

3.17. Press fit insertion force

With the printed circuit boards supported on aluminum bars, the specimens were pressed into them using a requester supplied insertion tool in a flat rock technique at a maximum rate of 12.7 mm [0.5 in] per minute.

3.18. Press fit extraction force

Specimens were removed from the test boards using a flat rock technique. An extraction tool (bed of nails) was used to remove the specimens at a rate of 12.7 mm per minute. The force to remove the specimens from the test board was recorded and the weight of the extraction tool was added to the total force measurement.

3.19. Thermal Shock

5 cycles between -40°C and 85°C with 30 minutes in each temperature extreme. Min Average rate of temperature change 3°C/min.

3.20. 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.

3.21. Temperature Life

Mated specimens were exposed to a temperature of 115°C for 432 hours.

3.22. Mixed Flowing Gas

Mated specimens were exposed for 14 days to a mixed flowing gas Class IIA exposure. Class IIA exposure is defined as a temperature of 30℃ 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 durability.

3.23. Final Examination of Product

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