Mini-UHF and BNC Right Angle PCB Jacks

1. INTRODUCTION

1.1. Purpose

Testing was performed on the TE Connectivity (TE) Mini-UHF and BNC Right Angle PCB Jacks to determine their conformance to the requirements of Product Specification 108-2440 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Mini-UHF and BNC Right Angle PCB Jacks. Testing was performed at the Harrisburg Electrical Components Test Laboratory and the TE EME Laboratory between 07Jan11 and 09Mar11. The test file number for this testing is EAEA20110025T. This documentation is on file at and available from the Harrisburg Electrical Components Test Laboratory and the TE EME Laboratory.

1.3. Conclusion

The Mini-UHF and BNC Right Angle PCB Jacks listed in paragraph 1.4., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2440 Revision A.

1.4. 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
1,2,3,6	5 each	2016166-1	50 ohm BNC right angle PCB jack
	5 each	2016167-1	Mini-UHF, right angle PCB jack
4,5	5 each	2016166-1	50 ohm BNC right angle PCB jack on EME test board
	5 each	2016167-1	Mini-UHF, right angle PCB jack on EME test board
1,2,3,6	5 each	5225395-1	BNC dual crimp plug with cable assembly
	5 each	1-5226600-0	Mini-UHF plug with cable assembly
1,2,3,4	5 each	60-1042822-1	PCB

Figure 1

1.5. Environmental Conditions

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

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

1.6. Qualification Test Sequence

Test or Examination	Test Group (a)					
	1	2	3	4	5	6
	Test Sets					
	1,2	3,4	5,6	7,8	9,10	11,12
	Test Sequence (b)					
Initial examination of product	1	1	1	1	1	1
Low Level Contact Resistance (LLCR)	2,6	2,4				
Voltage Standing Wave Ratio (VSWR)				2,4		
Insulation resistance			2,6			
Withstanding voltage			3,7			
RF insertion loss					2,4	
Resistance to reflow soldering						2
Random vibration	4					
Mechanical shock	5					
Durability	3			3	3	
Thermal shock			4			
Humidity/temperature cycling			5			
Temperature life		3(c)				
Ingress protection						3
Final examination of product	7	5	8	5	5	4

NOTE
(a) See paragraph 1.4.
(b) Numbers indicate sequence in which tests are performed.
(c) Precondition specimens with 10 durability cycles.

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. A Certificate of Conformance (C of C) was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Low Level Contact Resistance (LLCR) - Test Groups 1 and 2

All LLCR measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 10 milliohms for the signal (center) contact and less than 2.5 milliohms for the shield (outer) contact initially and after testing. Wire bulk was subtracted from each measurement: 10 milliohms for the BNC signal contact; 3.77 milliohms for the BNC shield contact; 9.24 milliohms for the Mini-UHF signal contact; and 3.57 milliohms for the Mini-UHF shield contact.

Condition/ Specimen ID	Initial	After Mechanical Shock	Initial	After Mechanical Shock
Test Group 1, Test Set 1	BNC Signal Contact		BNC Shield Contact	
1	5.05	5.27	0.39	1.16
2	4.68	4.95	0.39	1.26
3	4.45	5.03	0.53	0.67
4	5.17	7.07	0.33	2.05
5	4.79	6.24	0.36	1.00
Minimum	4.45	4.95	0.33	0.67
Maximum	5.17	7.07	0.53	2.05
Average	4.83	5.71	0.40	1.23
Standard Deviation	0.29	0.92	0.08	0.51
N =	5	5	5	5
Test Group 1, Test Set 2	Mini-UHF Signal Contact		Mini-UHF Shield Contact	
1	4.68	6.30	0.28	0.27
2	4.48	5.69	0.26	0.49
3	4.66	5.83	0.31	0.38
4	4.31	5.38	0.29	0.39
5	4.93	9.55	0.28	0.38
Minimum	4.31	5.38	0.26	0.27
Maximum	4.93	9.55	0.31	0.49
Average	4.61	6.55	0.28	0.38
Standard Deviation	0.23	1.71	0.02	0.08
N =	5	5	5	5

Figure 3 (continued)

Condition/ Specimen ID	Initial	After Temperature Life	Initial	After Temperature Life
Test Group 2, Test Set 3	BNC Signal Contact		BNC Shield Contact	
1	4.67	7.40	0.47	0.41
2	4.82	6.01	0.97	0.88
3	4.74	8.85	0.70	1.10
4	4.95	5.02	0.48	0.48
5	4.66	5.29	0.50	0.47
Minimum	4.66	5.02	0.47	0.41
Maximum	4.95	8.85	0.97	1.10
Average	4.77	6.51	0.62	0.67
Standard Deviation	0.12	1.60	0.22	0.31
N =	5	5	5	5
Test Group 2, Test Set 4	Mini-UHF Signal Contact		Mini-UHF Shield Contact	
1	4.32	6.03	0.35	0.59
2	4.38	7.93	0.35	0.30
3	4.59	5.66	0.27	1.47
4	5.11	5.83	0.18	1.10
5	5.15	6.26	0.25	0.84
Minimum	4.32	5.66	0.18	0.30
Maximum	5.15	7.93	0.35	1.47
Average	4.71	6.34	0.28	0.86
Standard Deviation	0.40	0.92	0.07	0.45
N =	5	5	5	5

NOTE *All values in milliohms.*

Figure 3 (end)

2.3. VSWR - Test Group 4

All VSWR measurements were less than 1.25 when measured between 0 and 2.5 GHz.

2.4. Insulation Resistance - Test Group 3

All insulation resistance measurements were greater than 5000 megohms.

2.5. Withstanding Voltage - Test Group 4

No dielectric breakdown or flashover occurred.

2.6. RF Insertion Loss - Test Group 5

All RF insertion loss measurements were:

- 0.1 dB, 0 to 1 Ghz, and 0.2 dB, 1 to 2.5 GHz for BNC specimens before and after 500 mating cycles.
- 0.1 dB, 0 to 530 MHZ, Equation 0.18 + 0.22f(GHz)^2.5 - 0.14e^-f(GHz), 530 MHZ to 2.5 GHz for Mini-UHF specimens before and after 500 mating cycles.

2.7. Resistance to Reflow Soldering - Test Group 6

No there was no visual evidence of damage including blistering, warpage or significant discoloration, and no visual evidence of damage to the dielectric material. There was some pooling of the shell plating observed on some specimens.

2.8. Random Vibration - Test Group 1

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

2.9. 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.

2.10. Durability - Test Group 1

No evidence of physical damage was visible as a result of manually mating and unmating the specimens 500 times.

2.11. Thermal Shock - Test Group 3

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

2.12. Humidity/temperature Cycling - Test Group 3

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

2.13. Temperature Life - Test Group 2

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

2.14. Ingress Protection - Test Group 6

There was no evidence of physical damage and no ingress of dust or water.

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.

3. TEST METHODS

3.1. Initial Examination of Product

A C of C 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. LLCR

LLCR measurements were made using a 4 terminal measuring technique (Figure 4). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage. Positive voltage and current were applied to the plated through holes of the PCB while the negative voltage and current leads were applied to the stripped end of the cable assembly. Cable bulk was subtracted from the measurements.

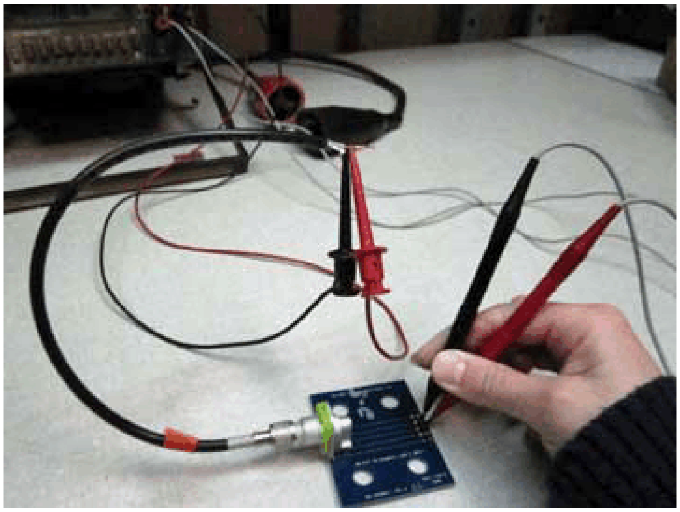


Figure 4
LLCR Measurement Points

3.3. VSWR

Specimens were tested using an Agilent 8364C Network Analyzer. The 2.4 mm to 2.4mm adapters were connected to port 1 and port 2 of the network analyzer. The 2.4mm to 3.5mm adapters were connected to port 1 and port 2 of the network analyzer. The TE test cables were connected to port 1 and port 2 of the network analyzer. A full 2 port calibration was performed using an HP 85052D 3.5 mm calibration kit. The network analyzer was set to collect 1601 data points across a frequency range of 10.0 MHz to 2.5 GHz. After calibration, the mated BNC/Mini-UHF adapters and the 20 mm thru (A, B) was measured so they could be subtracted out of the final measurement. The appropriate adapter was then connected to the test cable on port 2. This was then connected to the specimen (D) on the test board with the cable on port 1 going to the 20 mm line (C). The insertion loss test was performed with the network analyzer in the S_{21} mode which transmits power from port 1 and receives the signal into port 2, in a “through” type of measurement. Five specimens of BNC boards and 5 Mini-UHF boards were subjected to 500 durability cycles, being remeasured after every 100 cycles.

3.4. Insulation Resistance

Insulation resistance was measured between the signal and shield contacts of unmated specimens (jacks). A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

3.5. Withstanding Voltage

A test potential of 1000 volts AC was applied between the signal and shield contacts of unmated specimens (jacks). This potential was applied for 1 minute and then returned to zero.

3.6. RF Insertion Loss

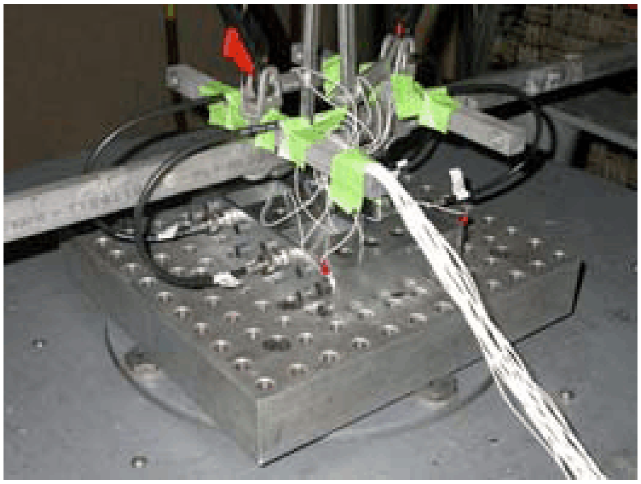
Specimens were tested using an Agilent 8364C Network Analyzer. The 2.4 mm to 2.4mm adapters were connected to port 1 and port 2 of the network analyzer. The 2.4 mm to 3.5 mm adapters were connected to port 1 and port 2 of the network analyzer. The TE test cables were connected to port 1 and port 2 of the network analyzer. A full 2 port calibration was performed using an HP 85052D 3.5 mm calibration kit. The network analyzer was set to collect 1601 data points across a frequency range of 10.0 MHZ to 2.5 GHz. After calibration, the mated BNC/Mini-UHF adapters and the 20 mm thru (A, B) was measured so they could be subtracted out of the final measurement. The appropriate adapter was then connected to the test cable on port 2. This was then connected to the specimen (D) on the test board with the cable on port 1 going to the 20 mm line (C). The insertion loss test was performed with the network analyzer in the S_{21} mode which transmits power from port 1 and receives the signal into port 2, in a “through” type of measurement. Five specimens of BNC boards and 5 Mini-UHF boards were subjected to 500 durability cycles, being remeasured after every 100 cycles.

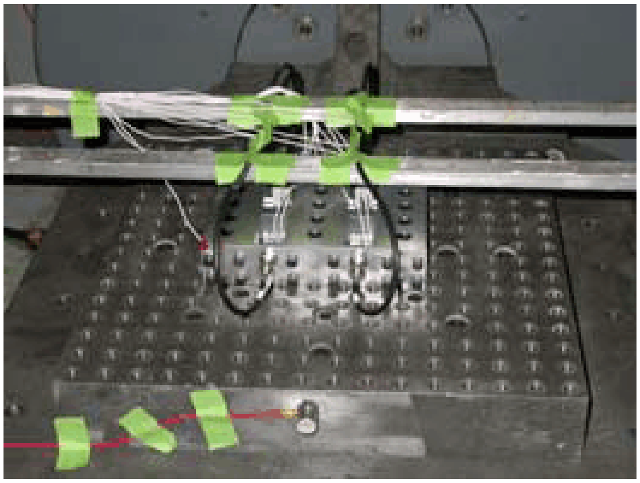
3.7. Resistance to Reflow Soldering

Specimens were placed on 4 x 6 x 0.0395 inch ceramic substrates and placed on a conveyor belt through a convection air oven and subjected to one reflow heat cycle of temperatures between 150 and 200°C for 60 to 180 seconds, between 255 and 260°C for 20 to 40 seconds, and above liquidus (217°C) for 60 to 150 seconds. The temperature on top of the specimen was monitored to enable temperature profiling. The specimens and substrates were allowed to cool to ambient temperatures and then examined using a microscope.

3.8. 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 Power Spectral Density (PSD) remained flat at 0.05 G^2/Hz from 20 to 500 Hz. The root-mean square amplitude of the excitation was 4.90 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.





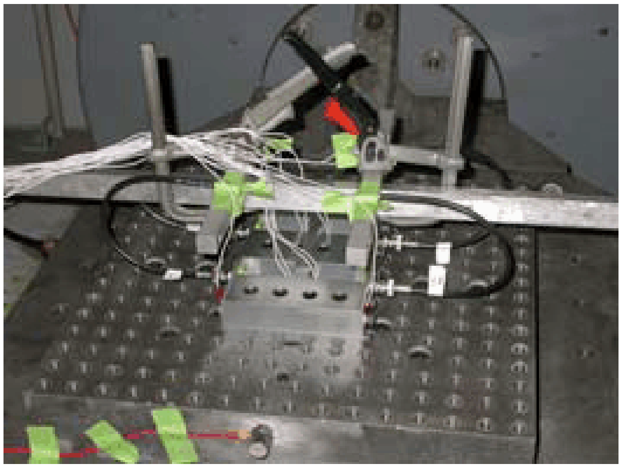


Figure 5

3.9. Mechanical Shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 50 gravity units (g 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.

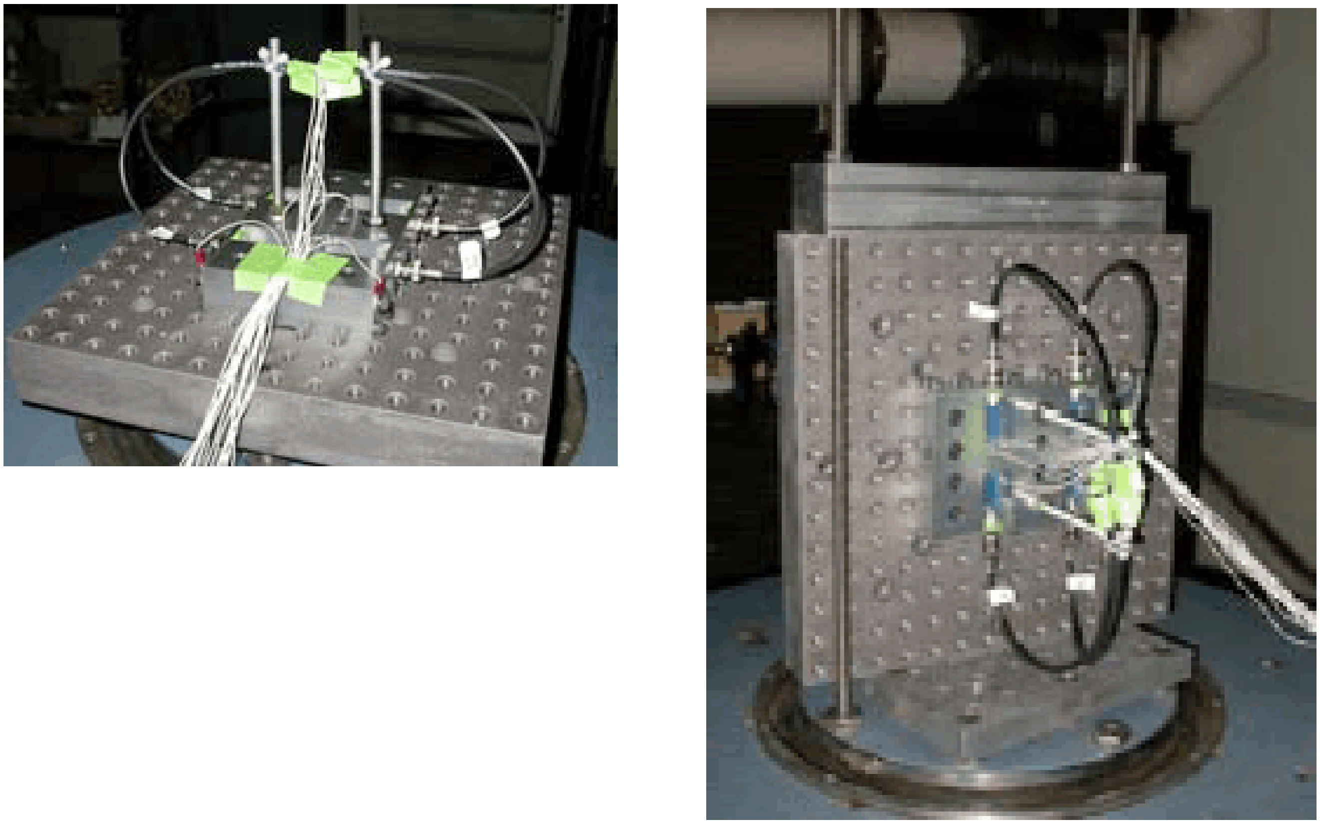


Figure 6

3.10. Durability

Specimens were manually mated and unmated 500 times at a maximum rate of 300 cycles per hour.

3.11. Thermal Shock

Mated specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 85°C with 1 minute transition between temperatures.

3.12. Humidity/temperature Cycling

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

3.13. Temperature Life

Mated specimens were exposed to a temperature of 80°C for 500 hours. Specimens were preconditioned with 10 cycles of durability.

3.14. Ingress Protection

Specimens were mounted to a brass plate which was mounted to the submersion tube with the jack interface on the inside. The tube was rotated 180 degrees allowing the specimens to be subjected to 1 meter of water which contained a chemical that would illuminate under black light. Specimens were observed for leaks and after exposure for evidence of leaks. Specimens were also subjected to ingress protection, IP6X, for eight hours. Specimens were mated to cable assemblies and secured to a piece of mesh and placed inside the dust chamber. Upon completion of testing, specimens were unmated and examined for dust residue.

3.15. Final Examination of Product

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