



**SMA Series Printed Circuit Board Mounted Connectors**

**1. INTRODUCTION**

1.1. Purpose

Testing was performed on the AMP\* SMA series printed circuit board mounted connector to determine its conformance to the requirements of AMP Product Specification 108-1919 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the SMA series printed circuit board mounted connector. Testing was performed at the Americas Regional Laboratory between 18May99 and 13Jul99. The test file number for this testing is CTL 3494-004. This documentation is on file at and available from the Americas Regional Laboratory.

1.3. Conclusion

The SMA series printed circuit board mounted connector listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of AMP Product Specification 108-1919 Revision A.

1.4. Product Description

The SMA series printed circuit board mounted connector is a 50 ohm RF connector designed to operate in the frequency range between 0.5 and 4.0 GHz and is available in both vertical and right angle mounts. The body material is brass for the vertical product and stainless steel for the right angle product. The center contact is beryllium copper with gold plating. The dielectric material is PTFE.

1.5. Test Samples

Test samples were representative of normal production lots. Samples identified with the following part numbers were used for test:

Test Group	Quantity	Part Number	Description
1,2,4,5	5 each	221789-1	SMA vertical jack connector
1,3,4,5	5 each	221790-1	SMA right angle jack connector
1,4	10 each	447647-2	SMA plug connector with RG-142 cable
2,3	5 each	447647-2	SMA plug connector with RG-142 cable
5	10 each	221447-1	SMA unterminated plug connector

Figure 1

1.6. Environmental Conditions

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

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

## 1.7. Qualification Test Sequence

Test or Examination	Test Group (a)				
	1	2	3	4	5
	Test Sequence (b)				
Examination of product	1,9	1,5	1,5	1,8	1,4
Dry circuit resistance	3,7	2,4	2,4		
Voltage standing wave ratio					3
Insulation resistance				2,6	
Dielectric withstanding voltage				3,7	
RF insertion loss					2
Vibration	5				
Mechanical shock	6				
Durability	4				
Mating torque	2				
Unmating torque	8				
Thermal shock				4	
Humidity-temperature cycling				5	
Temperature life		3(c)			
Mixed flowing gas			3(c)		

**NOTE**

- (a) See paragraph 1.5.  
 (b) Numbers indicate sequence in which tests are performed.  
 (c) Precondition samples with 10 cycles durability.

Figure 2

**2. SUMMARY OF TESTING**

## 2.1. Examination of Product - All Test Groups

All samples submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by the Product Assurance Department. Samples were visually examined and no evidence of physical damage detrimental to product performance was observed.

## 2.2. Dry Circuit Resistance - Test Groups 1, 2 and 3

All dry circuit resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage had a maximum increase in resistance ( $\Delta R$ ) of less than 2 milliohms after testing.

Test Group	Number of Data Points	Condition	Dry Circuit Resistance		
			Min	Max	Mean
Center Contact					
1	10	After mechanical ( $\Delta R$ )	-0.39	+1.37	+0.324
2	5	After temperature life ( $\Delta R$ )	+0.02	+0.13	+0.092
3	5	After mixed flowing gas ( $\Delta R$ )	-0.09	+0.08	+0.018
Braid Connection					
1	10	After mechanical ( $\Delta R$ )	-3.04	+0.28	-0.769
2	5	After temperature life ( $\Delta R$ )	+0.10	+1.81	+0.515
3	5	After mixed flowing gas ( $\Delta R$ )	+0.27	+1.10	+0.526

**NOTE**

*All values in milliohms.*

Figure 3

## 2.3. Voltage Standing Wave Ratio - Test Group 5

All voltage standing wave ratio measurements were less than 1.3 to 1.

## 2.4. Insulation Resistance - Test Group 4

All insulation resistance measurements were greater than 5,000 megohms.

## 2.5. Dielectric Withstanding Voltage - Test Group 4

No dielectric breakdown or flashover occurred.

## 2.6. RF Insertion loss - Test Group 5

All insertion loss results were less than 0.3 dB at 4.0 GHz for vertical samples and less than 0.35 dB at 4.0 GHz for right angle samples.

## 2.7. Vibration - Test Group 1

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

## 2.8. 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 samples were visible.

## 2.9. Durability - Test Group 1

No physical damage occurred as a result of mating and unmating the samples 500 times.

## 2.10. Mating Force - Test Group 1

No physical damage occurred as a result of mating the samples to a torque of 8 inch pounds.

## 2.11. Unmating Force - Test Group 1

All unmating force measurements were greater than 6 inch ounces.

### 2.12. Thermal Shock - Test Group 4

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

### 2.13. Humidity-temperature Cycling - Test Group 4

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

### 2.14. Temperature Life - Test Group 2

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

### 2.15. Mixed Flowing Gas - Test Group 3

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

## 3. TEST METHODS

### 3.1. Examination of Product

Where specified, samples were visually examined for evidence of physical damage detrimental to product performance.

### 3.2. Dry Circuit Resistance

Dry circuit resistance measurements at low level current 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.

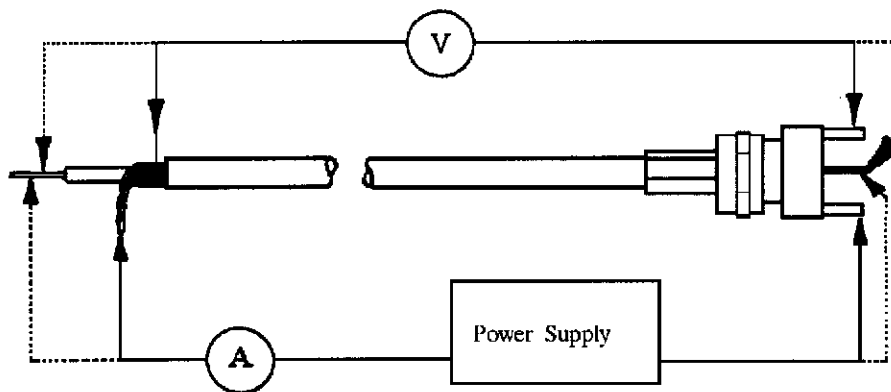


Figure 4  
Typical Dry Circuit Resistance Measurement Points

### 3.3. Voltage Standing Wave Ratio

VSWR was measured on mated samples using an HP8510B network analyzer. The sweep range was 0.5 to 4.0 GHz.

### 3.4. Insulation Resistance

Insulation resistance was measured between the center contact and the braid of unmated samples. A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

### 3.5. Dielectric Withstanding Voltage

A test potential of 1,000 volts AC was applied between the center contact and the braid of unmated samples. This potential was applied for 1 minute and then returned to zero.

### 3.6. RF Insertion Loss

A full Two-Port Calibration was performed on a network analyzer and the insertion loss,  $S_{21}$ , of the sample was measured.

### 3.7. Vibration, Sinusoidal

Mated samples were subjected to sinusoidal vibration, having a simple harmonic motion with an amplitude of 0.06 inch, double amplitude or 20 gravity units (g's peak) whichever is less. The vibration frequency was varied uniformly between the limits of 10 and 2,000 Hz and returned to 10 Hz in 20 minutes. This cycle was performed 12 times in each of 3 mutually perpendicular planes for a total vibration time of 12 hours. Samples were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

### 3.8. Mechanical Shock, Sawtooth

Mated samples were subjected to a mechanical shock test, having a sawtooth waveform of 100 gravity units (g peak) and a duration of 6 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular planes, for a total of 18 shocks. Samples were monitored for discontinuities of 1 microsecond or greater, using a current of 100 milliamperes DC.

### 3.9. Durability

Samples were mated and unmated 500 times at a maximum rate of 600 cycles per hour.

### 3.10. Mating Torque

All samples were torqued to 8 inch pounds using an in-line torque wrench.

### 3.11. Unmating Torque

The torque required to unmate individual samples was measured using an in-line torque wrench.

### 3.12. Thermal Shock

Unmated samples were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 85°C. The transition between temperatures was less than 1 minute.

### 3.13. Humidity-temperature Cycling

Unmated samples 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 (Figure 5).

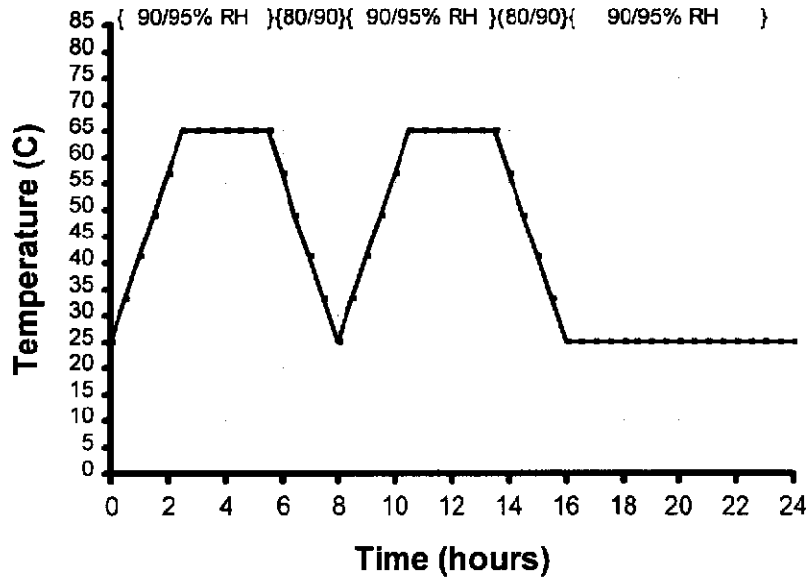


Figure 5  
Typical Humidity-Temperature Cycling Profile

3.14. Temperature Life

Mated samples were exposed to a temperature of 85°C for 1,000 hours. Samples were preconditioned with 10 cycles of durability.

3.15. Mixed Flowing Gas, Class IIA

Mated samples were exposed for 14 days to a mixed flowing gas Class IIA exposure. Class IIA exposure is defined as a temperature of 30°C and a relative humidity of 70% with the pollutants of Cl<sub>2</sub> at 10 ppb, NO<sub>2</sub> at 200 ppb, H<sub>2</sub>S at 10 ppb and SO<sub>2</sub> at 100 ppb. Samples were preconditioned with 10 cycles of durability.