QUALIFICATION TEST REPORT

Connector, SMA Series, Coax, Semi-Rigid Cable

501-144 Rev. A

Product Specification:	108-12055 Rev.D.
CTL No.:	CTL3346-065-434
Date:	May 8, 1991
Classification:	Unrestricted
Prepared By:	James A. D'Angelo
Per EC:	0990-0062-94

Corporate Test Laboratory Harrisburg, Pennsylvania

Table of Contents

Table of Contents

AMP INCORPORATED
HARRISBURG, PENNSYLVANIA 17105 PHONE: 717-564-0100 TWX: 510-657-4110
CORPORATE TEST LABORATORY

Qualification Test Report
Connector, SMA Series, Coax, Semi-Rigid Cable

1. Introduction

1.1 Purpose

Testing was performed on AMP* SMA Series, Plug and Jack Coax Connectors, terminated with Semi-Rigid Cable (RG 402/U) to determine if it meets the requirements of AMP Product Specification 108-12055 Revision D.

1.2 Scope

This report covers the electrical, mechanical and environmental performance of the SMA Series, Coax Connectors, terminated with Semi-Rigid Cable (RG 402/U) manufactured by the Federal Systems Division of the Aerospace and Government Systems Sector. The testing was performed between September 24, 1990 and May 6, 1991.

1.3 Conclusion

The SMA Series, Coax Connectors with Semi-Rigid Cable meets the electrical, mechanical and environmental performance requirements of AMP Product Specification 108-12055 Rev.0.

* Trademark

1.4 Product Description

The SMA series coaxial connectors are used on semi-rigid coax cable types RG 405/U and RG 402/U. The connector may be either a plug or a jack. A connector plug contains a male inner contact and a rotating threaded collar. A connector jack contains the female inner contact and external threads.

The types of coaxial connectors available include plugs with or without center contacts, and right angle plugs, and connector jacks of the straight panel, or blukhead type.

1.5 Test Samples

The test samples were randomly selected from current production and the following part numbers were used for test:

Test Group	Quantity	Part Number	Description
1	2	228635-2	SMA Connector, Plug
	2	228636-1	SMA Connector, Jack
2	2	228635-2	SMA Connector, Plug
	2	228636-1	SMA Connector, Jack
3	2	228635-2	SMA Connector, Plug
	2	228636-1	SMA Connector, Jack
4	2	228635-2	SMA Connector, Plug
	2	228636-1	SMA Connector, Jack
5	2	228635-2	SMA Connector, Plug
	2	228636-1	SMA Connector, Jack
6	2	228635-2	SMA Connector, Plug
	2	228636-1	SMA Connector, Jack
7	2	228635-2	SMA Connector, Plug
	2	228636-1	SMA Connector, Jack

All plug and jack connectors were terminated on RG 402/U semi-rigid cable.

1.6 Qualification Test Sequence

Test or Examination	Test Groups 1	2	3	4	5	6	7
Examination of Product	1,8	1,5	1,5	1,8	1,5	1,6	1,5
Termination Resistance, Dry Circuit	2,7	2,4	2,4				
Dielectric Withstanding Voltage				3,7			
Insulation Resistance				2,6			
RF Hi Pot					3		
RF Leakage							3
RF Insertion Loss							4
Voltage Standing Wave Ratio							2
Permeability					2		
Corona					4		
Vibration	5						
Physical Shock	6						
Contact Engag. & Separating Force	4						
Cable Retention						5	
Durability	3						
Coupling Nut Retention						3	
Center Contact Retention						2	
Coupling Proof Torque						4	
Thermal Shock				4			
Humidity-Temperature Cycling				5			
Mixed Flowing Gas			3				
Temperature Life		3					

The numbers indicate sequence in which tests were performed.

2. Summary of Testing

2.1 Examination of Product - Groups 1 thru 7

All samples submitted for testing were selected from normal production lots. They were inspected and accepted by the Product Assurance Department of the Aerospace and Government System Sector.

2.2 Termination Resistance, Dry Circuit - Groups 1,2,3

All termination resistance measurements were taken at 1.0 ampere dc. and 50 millivolts open circuit voltage were less then the specification requirement. The following measurements were taken on each mated connector. See figure 1 for contact resistance measurement points.
Vic = Inner contact resistance
Voc = Outer contact resistance
Vbb = Shield to body contact resistance

Test Group	Test Sample #	Measurement	Initial Meas.	Initial Max.Req.	After Phy. Shk. Final Meas.	After Phy. Shk. Final Max.Req
1	1	Vic	2.55	3.0	3.10	4.0
		Voc	1.14	2.0	1.21	N/A
		Vbb Jack	0.40	0.5	0.48	N/A
		Vbb Plug	0.20	0.5	0.19	N/A
1	2	Vic	2.39	3.0	3.02	4.0
		Voc	1.22	2.0	2.10	N/A
		Vbb Jack	0.42	0.5	0.42	N/A
		Vbb Plug	0.19	0.5	0.22	N/A
					After Temp. Life	
2	1	Vic	2.46	3.0	2.45	4.0
		Voc	0.69	2.0	0.57	N/A
		Vbb Jack	0.32	0.5	0.38	N/A
		Vbb Plug	0.18	0.5	0.18	N/A
2	2	Vic	2.42	3.0	2.35	4.0
		Voc	0.69	2.0	0.64	N/A
		Vbb Jack	0.34	0.5	0.35	N/A
		Vbb Plug	0.18	0.5	0.18	N/A
					After IMFG	
3	1	Vic	1.32	3.0	0.88	4.0
		Voc	1.94	2.0	2.23	N/A
		Vbb Jack	0.33	0.5	0.30	N/A
		Vbb Plug	0.18	0.5	0.16	N/A
3	2	Vic	1.16	3.0	0.85	4.0
		Voc	1.64	2.0	2.07	N/A
		Vbb Jack	0.36	0.5	0.40	N/A
		Vbb Plug	0.17	0.5	0.15	N/A

All values in milliohms

2.3 Dielectric Withstanding Voltage - Group 4

There was no dielectric breakdown or flashover between center and outer contact when a test voltage of 1500 vac was applied for one minute.

2.4 Insulation Resistance - Group 4

All insulation resistance measurements were greater than the specification requirement of 5,000 megohms minimum for the initial measurement and 200 megohms minimum for measurement taken after test.

2.5 RF Hi Pot - Group 5

There was no breakdown or flashover between center and outer contact when a test voltage of 1000 vac 5 MHz was applied for one minute.

2.6 RF Leakage - Group 7

There was less than -60 dB of leakage when a 0 dBm signal was applied at 2.5 GHz.

2.7 RF Insertion Loss - Group 7

Insertion loss was less than the specified requirement of $.03\sqrt{F(GHz)}$.

2.8 Voltage Standing Wave Ratio - Group 5

All voltage standing wave ratio measurements were less than the specification requirement of 1.035+.005F(GHz) for the plug and less than 1.05+008F(GHz) for the jack.

2.9 Permeability - Group 5

All permeability measurements were less then the specification requirement of 2.0 Mμ.

2.10 Corona/Altitude - Group 5

There was no corona discharge greater than 5 picocoulombs at or below a potential of 375 volts dc at an altitude of 70,000 feet.

2.11 Vibration - Group 1

There were no discontinuities of the contacts greater than one microsecond during vibration. Following vibration, there were no cracks, breaks or loose parts on the connector assemblies.

2.12 Physical Shock - Group 1

There were no discontinuities of the contacts greater than one microsecond during physical shock. Following physical shock testing, there were no cracks, breaks or loose parts on the connector assemblies.

2.13 Contact Engaging & Separating Force - Group 1

All insertion force measurements were less then the specification requirement of 2.0 pounds. All withdrawal force measurements were greater than the specification requirement of 2.0 ounces.

2.14 Cable Retention - Group 6

There was no loss of electrical continuity or physical damage as a result of applying a 60 pound tensile load to the cable for 30 seconds.

2.15 Durability - Group 1

There was no physical damage to the samples as a result of mating and unmating the connector 500 times.

2.16 Coupling Nut Retention - Group 6

The coupling nut did not loosen or dislodge from the plug body as a result of applying a tensile load of 60 pounds between the coupling nut and plug body for 1 minute.

2.17 Center Contact Retention - Group 6

The center contact did not displace from the specified interface dimension as a result of applying a 6 pound force to the center contact for 5 seconds in each direction.

2.18 Coupling Proof Torque - Group 6

The coupling mechanism did not dislodge from the connector body as a result of torquing the coupling nut to 15 inch-pounds for 1 minute.

2.19 Thermal Shock - Group 4

There was no evidence of physical damage to either the contacts or the connector as a result of thermal shock.

2.20 Humidity-Temperature Cycling - Group 4

There was no evidence of physical damage to either the contacts or the connector as a result of exposure to humidity-temperature cycling.

2.21 Industrial Mixed Flowing Gas - Group 3

There was no evidence of physical damage to either the contacts or the connector as a result of exposure to the pollutants of industrial mixed flowing gas.

2.22 Temperature Life - Group 2

There was no evidence of physical damage to either the contacts or the connector as a result of exposure to a temperature of 85°C for 96 hours.

3. Test Methods

3.1 Examination of Product

The product drawings and inspection plans were used to examine the samples. They were examined visually and functionally.

3.2 Termination Resistance, Dry Circuit

Termination resistance measurements were made using a four terminal measuring technique (figure 1). The test current was maintained at 1 ampere dc, with an open circuit voltage of 50 millivolts dc.

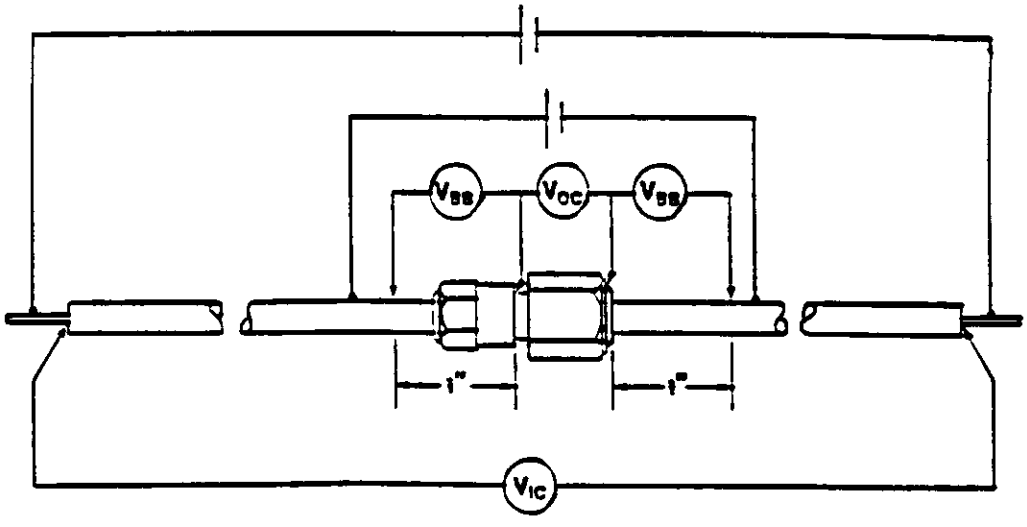

figure 1
Typical Termination Resistance measurement points

3.3 Dielectric Withstanding Voltage

A test potential of 1500 vac was applied between center contact and outer contact of the unmated connectors. This potential was applied for one minute and then returned to zero.

3.4 Insulation Resistance

Insulation Resistance was measured between center contact and the outer contact of the unmated connectors using a test voltage of 500 volts dc. This voltage was applied for two minutes before the the resistance was measured.

3.5 RF High Potential

An RF test potential of 1000 volts (rms) 5 Megahertz was applied between center contact and outer contact of the unmated connectors. This potential was applied for one minute and then returned to zero.

3.6 RF Leakage

RF Leakage was measured on mated connectors using the Triaxial Cavity method. A 0dBm signal at 2.5 GHz was applied to the connectors with a signal generator. RF Leakage was monitored with the spectrum analyzer.

3.7 RF Insertion Loss

RF Insertion Loss was measured on mated connectors using a HP8510B network analyzer. The RF insertion loss was measured over a frequency range of 15 to 18 GHz.

3.8 Voltage Standing Wave Ratio

VSWR was measured on unmated samples using an HP8510B network analyzer. The sweep range was 0.45 to 18.0 GHz.

3.9 Permeability

Magnetic permeability was measured on unmated samples using a 2.0 Mu pellet in a permeability indicator.

3.10 Corona/Altitude

A test voltage of 375 v(rms) at a 5 picocoulombs maximum discharge was applied between the center contact and outer contact of the mated connectors. This test voltage was applied with a simulated altitude of 70,000 feet.

3.11 Vibration, Sine

Mated connectors were subjected to sinusoidal vibration having a simple harmonic motion with an amplitude of 0.06 inch, double amplitude. The vibration frequency was varied logarithmically between the limits of 10 and 2000 Hz and returned to 10 Hz in 20 minutes. This cycle was performed 12 times in each of three mutually perpendicular planes for a total vibration time of 12 hours. Connectors were monitored for discontinuities greater than one microsecond, using a current of 100 milliamperes in the monitoring circuit.

3.12 Physical Shock

Mated connectors were subjected to a physical 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 three mutually perpendicular planes for a total of 18 shocks. The connectors were monitored for discontinuities greater than one microsecond, using a current of 100 milliamperes in the monitoring circuit.

3.13 Contact Engaging & Separating Force

SMA Jacks were preconditioned by inserting a .0375" diameter gage pin 3 times. Engaging force was measured by inserting a .037" gage. Separating force was measured by inserting and withdrawing a .0355" gage.

3.14 Cable Retention

A tensile load of 60 pounds was applied between the connector and cable for 30 seconds, during this hold period the connectors were monitored for discontinuities. The tensile load was removed and a torque of 55 inch-ounces was applied to the cable in both directions. After the torque load was removed, the tensile load test was repeated.

3.15 Durability

Connectors were mated and unmated 500 times at a rate not exceeding 600 per hour.

3.16 Coupling Nut Retention

A tensile load of 60 pounds was applied between the coupling nut and the plug body for a one minute hold period. The coupling nut was rotated for two revolutions in each direction, during this hold period.

3.17 Center Contact Retention

A 6 pound force was applied to the center contact for 5 seconds in each direction.

3.18 Coupling Proof Torque

The coupling nut of the mated connectors was torqued to 15 inch-pounds for 1 minute then released.

3.19 Thermal Shock

Mated connectors were subjected to five cycles of temperature extremes with each cycle consisting of 30 minutes at each temperature. The temperature extremes were -65°C and 115°C. The transition between temperatures was less than one minute.

3.20 Humidity-Temperature Cycling

Mated Connectors 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 the relative humidity was held at 95%. During five of the first nine cycles, the connectors were exposed to a cold shock at -10°C for 3 hours.

3.21 Mixed Flowing Gas, Class II

Mated connectors were exposed for 20 days in the mixed flowing gas chamber. Class II exposure is defined as a temperature of 30°C and a relative humidity of 70%. Pollutants are Cl_2 at 10 ppb, NO_2 at 200 ppb and H_2S at 10 ppb.

3.22 Temperature Life

Mated samples were subjected to 96 hours at an elevated temperature of 85°C.

4. Validation

Prepared by:

James A. D'Angelo 5/13/91

James A. D'Angelo
Test Engineer
Design Assurance Testing
Corporate Test Laboratory

Reviewed by:

Richard A. Groft 5/13/91

Richard A. Groft
Supervisor
Design Assurance Testing
Corporate Test Laboratory

Approved by:

John A Kalasky 5/15/91

John A. Kalasky
Reliability Manager
Federal Systems Division
Aerospace & Government Systems Sector