smiths connectors

Qualification Test Report Summary for the Smiths Connectors Solderless EMI Filtered Connector

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HYPERTAC IDI INTERCONNECT DEVICES SABRITEC

Revision Letter	Page Number	Paragraph / Appendix	Description of Revision	Approval Date
N/C	-	-	Original Release	2/6/2009

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1 Scope

The purpose of this document is to summarize the test results documented in Smiths Connectors Qualification Test Report (QTR) 679, which defined the test samples, test sequence, and test methods, used in the qualification of Sabritec's solderless filter connector design to the requirements as applicable from MIL-DTL-38999.

2 Order of Precedence

In case of a conflict between the text of this document and the applicable referenced documents, the text of this document shall take precedence.

3 Description of Test Articles

Smiths Connectors internal part number, customer part number, quantity tested, and a general description of articles that were tested to the requirements of this document are as in Table 1.

Table 1: Connector Part Numbers and Descriptions.

Part Number	Customer Part Number	Quantity	General Description
116431-5349	N/A	5	Solderless filter connector

4 Standard Ambient Test Conditions

All tests and examinations specified by this qualification test procedure were continued under any combination of conditions within the ranges stated in this paragraph, unless specified otherwise.

Temperature: 21°C to 27°C
Relative Humidity: 20% to 80%
Barometric Pressure: 725 +50/–70 mm Hg

5 References

MIL-STD-1344 Test Methods for Electrical Connectors

MIL-STD-202 Test Methods for Electronic and Electrical Components Parts

6 Test Equipment and Facilities

6.1 Test Equipment

Table 2 lists the equipment used during the performance of the testing completed herein.

Table 2: Test Equipment

Manufacturer	Description and Model	Smiths Connectors
Megohmmeter	Insulation Resistance Model 1863	296
Sun System	Chamber for Temp. Cycling Test Model EC11	274
Sun System	Chamber for Temp. Cycling Test Model EC13HA	299
Associated Research	AC/DC Hypot Tester for DWV Model 4450DT	130
Mitutoyo	Caliper for visual inspect Model 505-637-50	059
CTI	DWV, IR, and Capacitance Test System Model 4087	347
Derek Vacuum Tech.	Vacuum chamber for Altitude Test Model N/A	N/A
Cecomp Electronics	Falcon ARM760B manometer gauge Model N/A	991
Thermotron	Humidity Chamber Model N/A	058
Chatillon	Push-Pull Test Model TCM-500	044
Chatillon	Force Gauge Model DPP10	249
Bake	Test Indicator Model N/A	114
Agilent Technology	RF Analyzer Model E5071B	1353
HP	RF Analyzer Model 8713B	1540
Analogic	Multimeter Model DP100	037
Topward Electric Instrument Co.	Power Supply Model TPS-2000	099

6.2 Facilities

Smiths Connectors used its own facilities for testing and that of National Technical Systems (NTS), Fullerton, CA.

7 Calibration

All test equipment used in the performance of the tests required herein were calibrated in accordance with ANSI/NCSL Z540-1-1994. Records of all equipment are maintained in accordance with ANSI/NCSL Z540-1-1994 and made available for review. Unless otherwise specified, Smiths Connectors Quality Assurance verified that all test data and collection methods were accurate and reliable.

8 Test Sequence

The test procedures were conducted as one (1) group of test sequences. The group consisted of Sabritec's Solderless Filter Design Connector part number 116431-5349 which is based on MIL-DTL-38999, Series III, Size 25, Arrangement 35, pin interface with pc-tail terminations. The front interface dimensions of this receptacle connector fully meet the requirements of MIL-DTL-38999. The connectors went through the listed tests in the order specified.

Table 3: Test Sequence

Test Procedure (QTP #679)	Paragraph Reference
9.1	Initial Electrical Tests
9.2	Temperature Cycling
9.3	Ground Resistance
9.4	Capacitance
9.5	Insulation Resistance at Elevated Temperature
9.6	Dielectric Withstanding Voltage (Sea Level and Altitude)
9.7	Ground Resistance
9.8	Capacitance
9.9	Durability
9.10	Ground Resistance
9.11	Capacitance
9.12	Vibration
9.13	Ground Resistance
9.14	Capacitance
9.15	Shock
9.16	Ground Resistance
9.17	Capacitance
9.18	Attenuation
9.19	Humidity
9.20	Insulation Resistance
9.21	Dielectric Withstanding Voltage
9.22	Insert Retention
9.23	Contact Retention
9.24	Final Inspection

9 Test Results

Test Procedure	Para. Ref. (from original QTR #679)	Pass/Fail Criteria	Results
Initial Electrical Tests – Dielectric Withstanding Voltage	9.1.1	DWV was tested per the requirements of MIL-STD-1344, method 3001, test conditions I (sea level). The magnitude of voltage was 500 VDC minimum.	Pass
Initial Electrical Tests – Insulation Resistance	9.1.2	Connectors did have a minimum insulation resistance of 5 Giga ohms at 200 VDC, when tested in accordance with MIL-STD-1344, Method 3003.	Pass
Initial Electrical Tests – Attenuation	9.1.3	Each connector was subjected to Attenuation per the requirements of MIL-STD-220B. Only the contact with the lowest capacitance value for each filter band was tested for attenuation with the provided data sheet.	Pass
Initial Electrical Tests – Ground Resistance	9.1.4	In accordance with MIL-STD-202, Method 307, the maximum resistance for grounded contacts was 5 milliohms when measured from contact to connector shell.	Pass

Initial Electrical Tests – Capacitance	9.1.5	In accordance with MIL-STD-202, Method 305, test frequency 1 KHz +/- 0.1 KHz, and test voltage 1.0 VAC (RMS), the capacitance did meet the values as specified in Table 4 at ambient temperature. The capacitance measurements did have an allowable tolerance of ±20%. Pins 4, 11, 16, 23, 59, 60, 64, 69, 70, 106, 113, 118, and 125 are grounded to the shell. All other pins have a capacitance of 20,000 pF ± 20%.	Pass
Temperature Cycling	9.2	Mated connectors were subjected to the temperature cycling of MIL-STD-1344, Method 1003, test condition A, except that steps 2 and 4 were of 2 minutes maximum duration. The temperatures of step 1 were –55°C to +125 °C.	Pass
Ground Resistance	9.3	See paragraph 9.1.4.	Pass
Capacitance	9.4	See paragraph 9.1.5.	Pass
Insulation Resistance at Elevated Temperature	9.5	Connectors did have a minimum insulation resistance of 1 Giga ohms, when tested in accordance with MIL-STD-1344, Method 3003, at 125 °C at the 200 VDC.	Pass
Dielectric Withstanding Voltage (Sea Level and Altitude)	9.6	DWV was tested per the requirements of MIL-STD-1344, method 3001, test conditions I (sea level) and IV (altitude, 70,000ft). The magnitude of voltages was 500 VDC at sea level and 300 VDC at 70,000 feet.	Pass
Ground Resistance	9.7	See paragraph 9.1.4.	Pass
Capacitance	9.8	See paragraph 9.1.5.	Pass
Durability	9.9	Connectors were subjected to 500 mating cycles at a maximum rate of 300 cycles/hour. The mating and unmating was accomplished so that the plug and receptacle were completely separated during each cycle. The test connectors showed no defects detrimental to the operation of the connectors.	Pass
Ground Resistance	9.10	See paragraph 9.1.4.	Pass
Capacitance	9.11	See paragraph 9.1.5.	Pass
Vibration	9.12	Connectors have met the requirements for vibration in accordance with MIL-STD-1344, Method 2005, Test Condition VI, Letter J for 8 hours with no electrical discontinuity and no disengagement of mated connectors. The characteristics of Test Condition Letter J can be seen in Table 7 below. This test was performed at an outside test lab.	Pass
Ground Resistance	9.13	See paragraph 9.1.4.	Pass
Capacitance	9.14	See paragraph 9.1.5.	Pass

Shock	9.15	Connectors have met the requirements for shock in accordance with MIL-STD-1344, Method 2004, Test Condition D with no electrical discontinuity and no disengagement of mated connectors. A detector capable of detecting a discontinuity of 1 microsecond was used. This test was performed at an outside test lab.	Pass
Ground Resistance	9.16	See paragraph 9.1.4.	Pass
Capacitance	9.17	See paragraph 9.1.5.	Pass
Attenuation	9.18	Each connector was subjected to Attenuation per the requirements of MIL-STD-220B. Only the contact with the lowest capacitance value for each filter band was tested for attenuation with the provided data sheet.	Pass
Humidity	9.19	Wired and mated connectors were subjected to the Humidity test specified in method 1002 of MIL-STD-1344. The following details applied: Test condition letter – Type II The mated connectors were mounted in the vertical position. Step 7a was performed in the last 5 cycles. Three hours minimum after the start of step 7a during the final cycle and while the connectors were still subjected to high humidity, the insulation resistance was measured when the chamber temperature reached 20°C ±5° and condensation was observed on the connector. For qualification testing, insulation resistance was made on 50 percent of the circuits. Outer circuits were measured to the connector shell. Wired and mated connectors showed no deterioration which would adversely affect performance of the connector. Following the test, and during the final cycle, insulation resistance was 100 mega ohms or greater. Note: Connector was tested with rear pc-tails sealed in a block with an o-ring to seal the surface as this configuration would normally be utilized by the user in a similar fashion.	Pass
Insulation Resistance	9.20	See paragraph 9.1.2.	Pass
Dielectric Withstanding Voltage	9.21	DWV was tested per the requirements of MIL-STD-1344, method 3001, test conditions I (sea level). The magnitude of voltages was 500 VDC.	Pass
Insert Retention	9.22	Insert retention was tested per the requirements of MIL-STD-1344, method 2010, unless otherwise specified. The minimum contact retention force and/or maximum deflection followed the requirements of MIL-DTL-38999.	Pass
Contact Retention	9.23	Contact Retention was tested per the requirements of MIL-STD-1344, method 2007, unless otherwise specified. The minimum contact	Pass

		retention force and/or maximum deflection followed the requirements of MIL-DTL-38999.	
Final Inspection – Dielectric Withstanding Voltage	9.24.1	See paragraph 9.1.1.	Pass
Final Inspection – Dielectric Withstanding Voltage	9.24.2	See paragraph 9.1.2.	Pass
Final Inspection – Dielectric Withstanding Voltage	9.24.3	See paragraph 9.1.3.	Pass
Final Inspection – Dielectric Withstanding Voltage	9.24.4	See paragraph 9.1.4.	Pass
Final Inspection – Capacitance	9.24.5	See paragraph 9.1.5.	Pass

10.0 Test Procedures

10.1 Initial Electrical Tests

10.1.1 Dielectric Withstanding Voltage

DWV was tested per the requirements of MIL-STD-1344, method 3001, test conditions I (sea level). The magnitude of voltage was 500 VDC minimum.

Results:
Connector assemblies were tested for the requirements of Dielectric Withstanding Voltage. The test voltage for connectors was applied between the most closely spaced contacts and between connector shell and the contact closest to the shell. Test voltage was 500 Vdc. The test voltage was raised from zero to the specified value as uniformly as possible, at a rate of approximately 500 volts rms per second, for 5-10 seconds between each contact and the shell, leakage current did not exceed 500 microamperes. Connector assemblies met the requirements of Dielectric Withstanding Voltage.

10.1.2 Insulation Resistance

Connectors had a minimum insulation resistance of 5 Giga ohms at 200 VDC, when tested in accordance with MIL-STD-1344, Method 3003.

Results:
Connector assemblies have met the requirements for the Insulation Resistance testing. The test voltage was at 200 VDC, ±10 percent, and maintained a minimum insulation resistance of 5 Giga ohms.

10.1.3 Attenuation

Each connector was subjected to Attenuation per the requirements of MIL-STD-220B. Only the contact with the lowest capacitance value for each filter band was tested for attenuation with the provided data sheet.

Results:
Connector assemblies have met the requirements for the Attenuation at Ambient Temperature testing. Discrete measurements were made at 0.5, 1, 5, 20, 100, 500, and 1000 MHz.

10.1.4 Ground Resistance

In accordance with MIL-STD-202, Method 307, the maximum resistance for grounded contacts was 5 milliohms when measured from contact to connector shell.

Results:
The Connectors have met the requirements for the Ground Resistance testing. The Ground Resistance was measured in accordance with MIL-STD-202, Method 307.

10.1.5 Capacitance

In accordance with MIL-STD-202, Method 305, test frequency 1 KHz +/- 0.1 KHz, and test voltage 1.0 VAC (RMS), the capacitance did meet the values as specified in Table 4 at ambient temperature. The capacitance measurements did have an allowable tolerance of ±20%.

Table 4 Capacitance Values

Contact Locations	Capacitance (nF)
4, 11, 16, 23, 59, 60, 64, 69, 70, 106, 113, 118, 125	Ground
All others	20 nF

Results:
Connector assemblies have met the requirements for the Capacitance to Ground testing.

10.2 Temperature Cycling

Mated connectors were subjected to the temperature cycling of MIL-STD-1344, Method 1003, test condition A, except that steps 2 and 4 were of 2 minutes maximum duration. The temperatures of step 1 were –55^{o}C to +125 ^{o}C.

Results:

Connectors have met the requirements for the Temperature Cycling.

10.3 Ground Resistance

Refer to paragraph 10.1.4.

Results:
The Connectors have met the requirements for the Ground Resistance testing. The Ground Resistance was measured in accordance with MIL-STD-202, Method 307s.

10.4 Capacitance

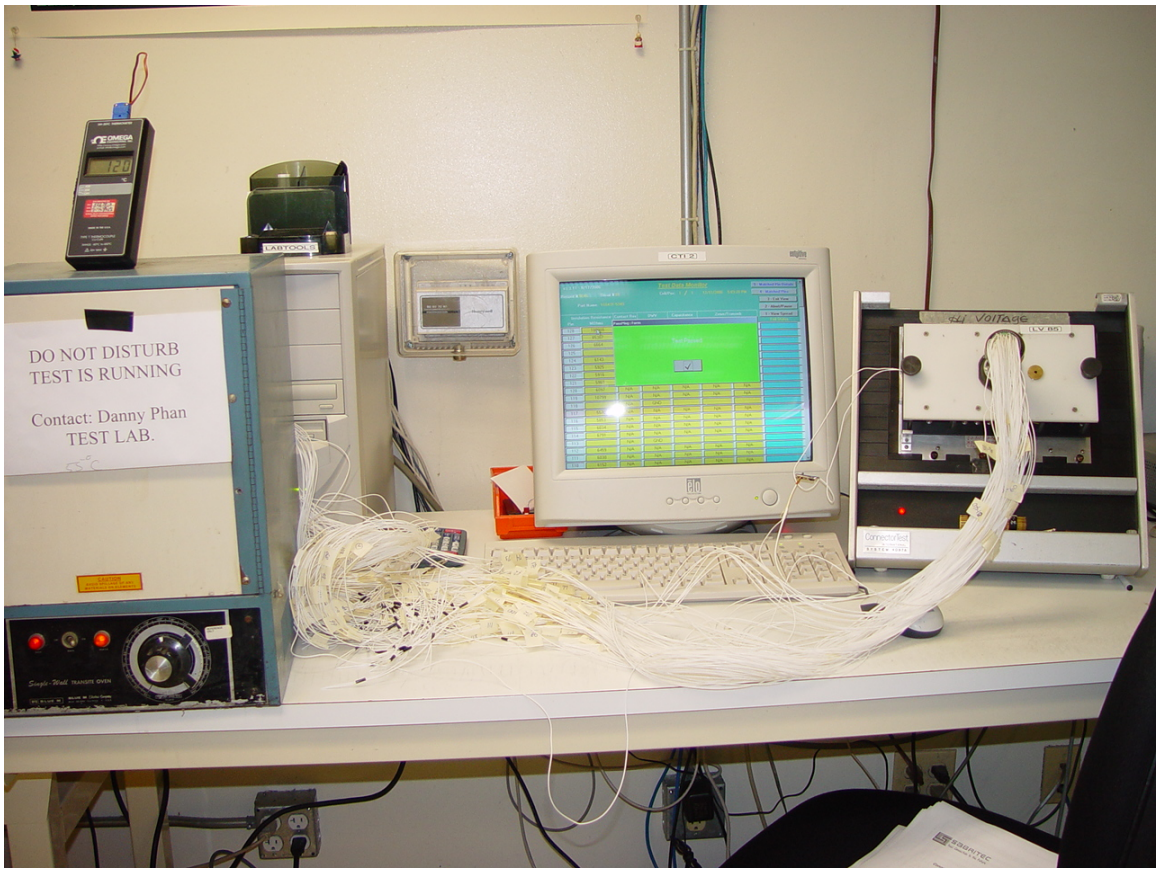
Refer to paragraph 10.1.5

Results:
Connector assemblies have met the requirements for the Capacitance to Ground testing.

10.5 Insulation Resistance at Elevated Temperature

Connectors had a minimum insulation resistance of 1 Giga ohms, when tested in accordance with MIL-STD-1344, Method 3003, at 125 °C at the 200 VDC.

Figure 1 Insulation Resistance at Elevated Temperature



Results:
Connector assemblies have met the requirements for the Insulation Resistance testing at Elevated Temperature The test voltage was at 200 VDC, ±10 percent, and maintained a minimum insulation resistance of 5 Giga ohms.

10.6 Dielectric Withstanding Voltage (DWV at Sea Level and Altitude)

DWV was tested per the requirements of MIL-STD-1344, method 3001, test conditions I (sea level) and IV (altitude, 70,000ft). The magnitude of voltages is specified in Table 5 below.

Table 5 DWV at Sea Level and Altitude

Altitude Level	Voltage Requirement
Sea Level	500VDC
70,000 ft	300 VDC

Figure 2 DWV at Altitude

Results:
Connector assemblies were tested for the requirements of Dielectric Withstanding Voltage at Sea Level and Altitude. The test voltage for connectors was applied between the most closely spaced contacts and between connector shell and the contact closest to the shell. Test voltage was 500 Vdc @ Sea Level and 300 VDC @ 70,000 ft. The test voltage was raised from zero to the specified value as uniformly as possible, at a rate of approximately 500 volts rms per second, for 5-10 seconds between each contact and the shell, leakage current did not exceed 500 microamperes. Connector assemblies met the requirements of Dielectric Withstanding Voltage.

10.7 Ground Resistance

Refer to paragraph 10.1.4.

Results:
The Connectors have met the requirements for the Ground Resistance testing. The Ground Resistance was measured in accordance with MIL-STD-202, Method 307.

10.8 Capacitance

Refer to paragraph 10.1.5

Results:
Connector assemblies have met the requirements for the Capacitance to Ground testing.

10.9 Durability

Connectors were subjected to 500 mating cycles at a maximum rate of 300 cycles/hour. The mating and unmating was accomplished so that the plug and receptacle are completely separated during each cycle. The connectors showed no defects detrimental to the operation of the connectors.

10.10 Ground Resistance

Refer to paragraph 10.1.4.

Results:
The Connectors have met the requirements for the Ground Resistance testing. The Ground Resistance was measured in accordance with MIL-STD-202, Method 307.

10.11 Capacitance

Refer to paragraph 10.1.5

Results:
Connector assemblies have met the requirements for the Capacitance to Ground testing.

10.12 Vibration

Connectors have met the requirements for vibration in accordance with MIL-STD-1344, Method 2005, Test Condition VI, Letter J for 8 hours with no electrical discontinuity and no disengagement of mated connectors. The characteristics of Test Condition Letter J can be seen in Table 7 below. This test was performed at an outside test lab.

Table 6 Values for Test Condition VI

Characteristics		
Test Condition Letter	Power spectral density	Overall G rms
J	1.0	41.7

Results: The connector passed the Vibration requirements stated above. This vibration test was performed at NTS.

10.13 Ground Resistance

Refer to paragraph 10.1.4.

Results:
The Connectors have met the requirements for the Ground Resistance testing. The Ground Resistance was measured in accordance with MIL-STD-202, Method 307.

10.14 Capacitance

Refer to paragraph 10.1.5

Results:
Connector assemblies have met the requirements for the Capacitance to Ground testing.

10.15 Shock

Connectors met the requirements for shock in accordance with MIL-STD-1344, Method 2004, Test Condition D with no electrical discontinuity and no disengagement of mated connectors. A detector capable of detecting a discontinuity of 1 microsecond was used. This test was performed at an outside test lab.

Results: The connectors passed the shock test requirements stated above. This test was performed at NTS.

10.16 Ground Resistance

Refer to paragraph 10.1.4.

Results:
The Connectors have met the requirements for the Ground Resistance testing. The Ground Resistance was measured in accordance with MIL-STD-202, Method 307.

10.17 Capacitance

Refer to paragraph 10.1.5

Results:
Connector assemblies have met the requirements for the Capacitance to Ground testing.

10.18 Attenuation

Each connector was subjected to Attenuation per the requirements of MIL-STD-220B. Only the contact with the lowest capacitance value for each filter band was tested for attenuation with the provided data sheet.

Results:
Connector assemblies have met the requirements for the Attenuation at Ambient Temperature testing. Discrete measurements were made at 0.5, 1, 5, 20, 100, 500, and 1000 MHz.

10.19 Humidity

Wired and mated connectors were subjected to the Humidity test specified in method 1002 of MIL-STD-1344. The following details applied:

Test condition letter – Type II
The mated connectors were mounted in the vertical position
Step 7a was performed in the last 5 cycles
Three hours minimum after the start of step 7a during the final cycle and while the connectors are still subjected to high humidity, the insulation resistance was measured when the chamber temperature reaches 20°C ±5° and condensation was observed on the connector.
For qualification testing, insulation resistance measurements were made on 50 percent of the circuits. Outer circuits were measured to the connector shell.

Wired and mated connectors showed no deterioration which would adversely affect performance of the connector. Following the test, and during the final cycle, insulation resistance was 100 mega ohms or greater.

Figure 3 Humidity

Results:

Connector assemblies have met the requirements for the Humidity testing. Wired and mated connectors showed no signs of deterioration.

10.20 Insulation Resistance

Connectors did have a minimum insulation resistance of 5 Giga ohms at 200 VDC, when tested in accordance with MIL-STD-1344, Method 3003.

Results:
Connector assemblies have met the requirements for the Insulation Resistance testing at Elevated Temperature The test voltage was at 200 VDC, ±10 percent, and maintained a minimum insulation resistance of 5 Giga ohms.

10.21 Dielectric Withstanding Voltage

Refer to paragraph 9.9, sea level condition only.

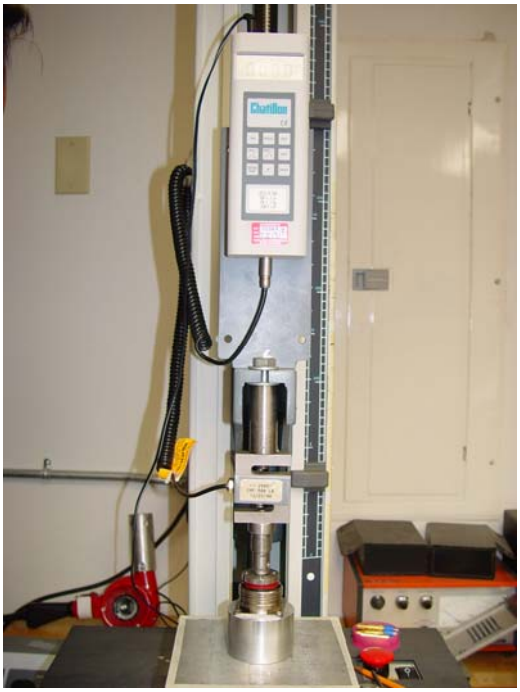
Results:
Connector assemblies were tested for the requirements of Dielectric Withstanding Voltage. The test voltage for connectors was applied between the most closely spaced contacts and between connector shell and the contact closest to the shell. Test voltage was 500 Vdc. The test voltage

was raised from zero to the specified value as uniformly as possible, at a rate of approximately 500 volts rms per second, for 5-10 seconds between each contact and the shell, leakage current did not exceed 500 microamperes. Connector assemblies met the requirements of Dielectric Withstanding Voltage.

10.22 Insert Retention

Insert retention was tested per the requirements of MIL-STD-1344, method 2010, unless otherwise specified. The minimum contact retention force and/or maximum deflection followed the requirements of MIL-DTL-38999.

Figure 4 Insert Retention



Results:
Connector assemblies were tested for the requirements of Insert Retention. Connector assemblies met the requirements of Insert Retention.

10.23 Contact Retention

Contact Retention was tested per the requirements of MIL-STD-1344, method 2007, unless otherwise specified. The minimum contact retention force and/or maximum deflection followed the requirements of MIL-DTL-38999.

Figure 5 Contact Retention

Results:
Connector assemblies were tested for the requirements of Contact Retention. Connector assemblies met the requirements of Contact Retention.

10.24 Final Inspection

10.24.1 Dielectric Withstanding Voltage

Refer to paragraph 10.1.1.

Results:
Connector assemblies were tested for the requirements of Dielectric Withstanding Voltage. The test voltage for connectors was applied between the most closely spaced contacts and between connector shell and the contact closest to the shell. Test voltage was 500 Vdc. The test voltage was raised from zero to the specified value as uniformly as possible, at a rate of approximately 500 volts rms per second, for 5-10 seconds between each contact and the shell, leakage current did not exceed 500 microamperes. Connector assemblies met the requirements of Dielectric Withstanding Voltage.

10.24.2 Insulation Resistance

Refer to paragraph 10.1.2.

Results:
Connector assemblies have met the requirements for the Insulation Resistance testing at Elevated Temperature The test voltage was at 200 VDC, ±10 percent, and maintained a minimum insulation resistance of 5 Giga ohms.

10.24.3 Attenuation

Refer to paragraph 10.1.3.

Results:
Connector assemblies have met the requirements for the Attenuation at Ambient Temperature testing. Discrete measurements were made at 0.5, 1, 5, 20, 100, 500, and 1000 MHz.

10.24.4 Ground Resistance

Refer to paragraph 10.1.4.

Results:
The Connectors have met the requirements for the Ground Resistance testing. The Ground Resistance was measured in accordance with MIL-STD-202, Method 307.

10.24.5 Capacitance

Refer to paragraph 10.1.5.

Results:
Connector assemblies have met the requirements for the Capacitance to Ground testing.

Appendix A – Customer Use Drawing (116431-5349)