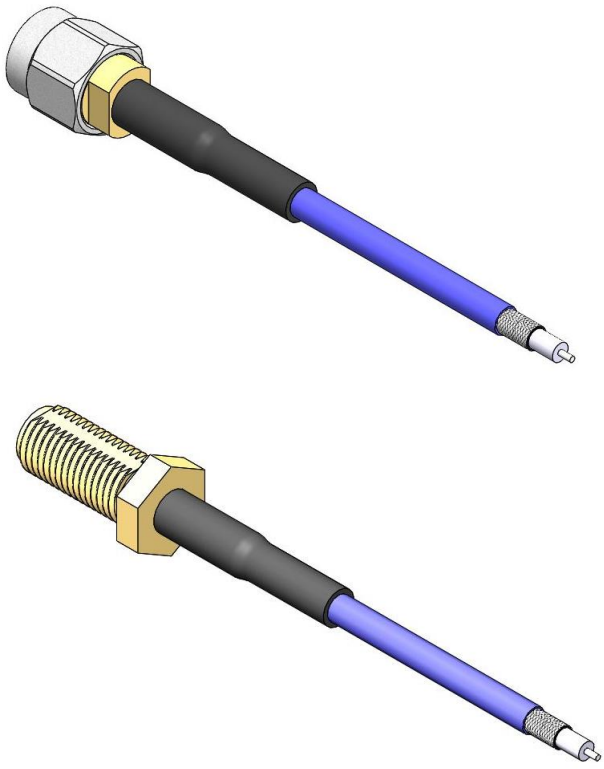
Project Number: Design Qualification Test Report	Tracking Code: 3444720_Report_Rev_1
Requested by: Jenny Chou	Date: 2/24/2023
Part #: RF086-01SP-505050-0152/RF086-01BJ-505050-0152	Tech: Peter Chen
Part description: RF086-01SP/ RF086-01BJ	Qty to test: 20
Test Start: 08/25/2022	Test Completed: 09/05/2022



DESIGN QUALIFICATION TEST REPORT

RF086-01SP/ RF086-01BJ
RF086-01SP-505050-0152/RF086-01BJ-505050-0152

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
9/5/2022	**1**	**Initial Issue**	**PC**

CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to IS0 10012-l and ANSI/NCSL 2540-1, as applicable.

SCOPE

To perform the following tests: Design Qualification test. Please see test plan.

APPLICABLE DOCUMENTS

Standards: MIL-PRF-39012

TEST SAMPLES AND PREPARATION

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the parts to be used for LLCR testing were cleaned according to TLWI-0001.
4) Either an automated cleaning procedure or an ultrasonic cleaning procedure may be used.
5) The automated procedure is used with aqueous compatible soldering materials.
6) Parts not intended for testing LLCR are visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.
8) Solder Information: Lead Free

FLOWCHARTS

IR/DWV

Pin-to-Ground

Group 1

RF086-01SP-505050-0152

RF086-01BJ-505050-0152

4 Assemblies

Step	Description
1.	Interface Gaging MAX. CONTACT DEPTH = 0.008 "
2.	IR (2) - Non Standard
3.	DWV at Test Voltage(1) - Non Standard Test Voltage = 500 V
4.	LLCR (3) - Non Standard *Note: Signal and ground.*
5.	Thermal Shock (4) - Non Standard
6.	IR (2) - Non Standard
7.	DWV at Test Voltage(1) - Non Standard Test Voltage = 500 V
8.	LLCR (3) - Non Standard *Note: Signal and ground.*
9.	Interface Gaging MAX. CONTACT DEPTH = 0.008 "

(1) DWV at Test Voltage = Other
Test Condition = 1 (Sea Level) Test voltage applied for 60 seconds
MIL-PRF-39012, Paragraph 4.6.14 per MIL-STD-202-301

(2) IR = Other
Test Condition = 500 Vdc, 2 Minutes Max
MIL-PRF-39012, Paragraph 4.6.8 per MIL-STD-202-302

(3) LLCR = Other
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max
MIL-PRF-39012, Paragraph 4.6.13 except current to be 100mA nominal and voltage to be 20 mV maximum.

(4) Thermal Shock = Other
Exposure Time at Temperature Extremes =1/2 Hour
Method A, Test Condition = I (-55°C to +125°C)
Test Duration = test condition B except 10 cycles instead of 5.
MIL-PRF-39012, Paragraph. 4.6.17 per MIL-STD-202-107

FLOWCHARTS Continued

Cable Pull

Group 1
RF086-01SP-505050-0152

2 Assemblies
0 Degrees

Step	Description
1.	Cable Retention (2) - Non Standard *Note: Pull-to-destruct.*

Group 2
RF086-01BJ-505050-0152

2 Assemblies
0 Degrees

Step	Description
1.	Cable Retention (2) - Non Standard *Note: Pull-to-destruct.*

Group 3
RF086-01SP-505050-0152
RF086-01BJ-505050-0152
4 Assemblies
0 Degrees

Step	Description
1.	Interface Gaging MAX CONTACT DEPTH = 0.008 "
2.	LLCR (3) - Non Standard *Note: Signal and ground.*
3.	Cable Retention (1) - Non Standard APPLIED FORCE = 15 lbs
4.	LLCR (3) - Non Standard *Note: Signal and ground.*
5.	Interface Gaging MAX CONTACT DEPTH = 0.008 "

(1) Cable Retention = Other
Apply 15 pounds (6.80kg) for Cable Retention test.
MIL-PRF-39012, Paragraph 4.6.21

(2) Cable Retention = Other
Pull-to-destruct.
MIL-PRF-39012, Paragraph 4.6.21

(3) LLCR = Other
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max
MIL-PRF-39012, Paragraph 4.6.13 except current to be 100mA nominal and voltage to be 20 mV maximum.

FLOWCHARTS Continued

Coupling Nut Retention

Note: Coupling Nut retention per MIL-PRF-39012, 4.6.22 and MIL-PRF-39012/55h, Apply 60 pounds of force to coupling nut for 1 minute. (do not attempt to spin nut while under load). After 1 minute of applied force, Coupling nut must spin freely

Group 1
PRF01-P-C-EG-086-SD

10 Assemblies
Custom Group
Note: Coupling Nut must spin freely after applied force

Step	Description
1.	Connector Pull Retention = 60 lbs *Note: Coupling nut retention per MIL-PRF-39012, paragraph 4.6.22, 60 lbs pull force*

Coupling Proof Torque

Note: Coupling Proof Torque test per MIL-PRF-39012, 4.6.3 and MIL-PRF-39012/55H, Coupling Proof Torque value of 15 in-lbs required

Coupling Proof Torque

Group 1
PRF01-P-C-EG-086-SD
PRF01-J-C-EG-086-BD
10 Assemblies
Custom Group
Note: Apply 15 in-lbs of Torque to mate connector assemblies, Interface dimensions must meet requirements after applied force

Step	Description
1.	Coupling Proof Torque *Note: Apply 15 in-lbs of Torque to mate Connectors* *Interface dimensions to remain in specification after applied Force*

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

1) MIL-PRF-39012, *Paragraph. 4.6.17 per MIL-STD-202-107*
2) Test Condition: I (-55°C to +125°C)
3) Test Time: ½ hour dwell at each temperature extreme
4) Test Duration: Test condition B except 10 cycles instead of 5.
5) All test samples are pre-conditioned at ambient.
6) All test samples are exposed to environmental stressing in the mated condition.

LLCR:

1) MIL-PRF-39012, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
    a. <= +5.0 mOhms: ----------Stable
    b. +5.1 to +10.0 mOhms:----------Minor
    c. +10.1 to +15.0 mOhms: ----------Acceptable
    d. +15.1 to +50.0 mOhms: ----------Marginal
    e. +50.1 to +1000 mOhms: ----------Unstable
    f. >+1000 mOhms:----------Open Failure

INSULATION RESISTANCE (IR):

To determine the resistance of insulation materials to leakage of current through or on the surface of these materials when a DC potential is applied.

1) PROCEDURE:
    a. Reference document: MIL-PRF-39012, *Insulation Resistance Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Electrification Time 2.0 minutes
        iii. Test Voltage (500 VDC) corresponds to calibration settings for measuring resistances.
2) MEASUREMENTS:
3) When the specified test voltage is applied (VDC), the insulation resistance shall not be less than 5000 megohms.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

To determine if the sockets can operate at its rated voltage and withstand momentary over potentials due to switching, surges, and other similar phenomenon. Separate samples are used to evaluate the effect of environmental stresses so not to influence the readings from arcing that occurs during the measurement process.

1) PROCEDURE:
    a. Reference document: MIL-PRF-39012, *Withstanding Voltage Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Barometric Test Condition 1
        iii. Rate of Application 500 V/Sec
        iv. Test Voltage (VAC) until breakdown occurs
2) MEASUREMENTS/CALCULATIONS
    a. The breakdown voltage shall be measured and recorded.
    b. The dielectric withstanding voltage shall be recorded as 75% of the minimum breakdown voltage.
    c. The working voltage shall be recorded as one-third (1/3) of the dielectric withstanding voltage (one-fourth of the breakdown voltage).

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

CABLE PULL:

1) Secure cable near center and pull on connector
    a. At 0°, in-line with cable

Fig. 1
0° Connector pull, notice the electrical continuity hook-up wires.

RESULTS

Cable Pull force

- **0° Pull**
  - **SP**
    - **Min ---------- 27.89 lbs**
    - **Max ---------- 32.82 lbs**
  - **BJ**
    - **Min ---------- 34.86 lbs**
    - **Max ---------- 35.32 lbs**

Coupling Nut Retention

- **Coupling Nut Retention Force ---------- 60 Lbs (1 minute) ---------- Passed**

Coupling Proof Torque

- **Coupling Proof Torque Force ---------- 15 Inch-lbs ---------- Passed**

Insulation Resistance minimums, IR

Pin to Ground

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Test Voltage ---------- 500 VAC**

Pin to Ground

- **Initial DWV ---------- Passed**
- **Thermal DWV ---------- Passed**

RESULTS Continued

Interface Gaging

IR/DWV Group

SP

Initial

- **Min ---------- 0.09 mm (0.0035 Inch)**
- **Max ---------- 0.12 mm (0.0047 Inch)**

After Thermal Shock

- **Min ---------- 0.08 mm (0.0031 Inch)-**
- **Max ---------- 0.13 mm (0.0051 Inch)**

BJ

Initial

- **Min ---------- 0.05 mm (0.0020 Inch)-**
- **Max ---------- 0.06 mm (0.0024 Inch)**

After Thermal Shock

- **Min ---------- 0.04 mm (0.0016 Inch)-**
- **Max ---------- 0.07 mm (0.0028 Inch)**

Cable Pull Group

SP

Initial

- **Min ---------- 0.09 mm (0.0035 Inch)-**
- **Max ---------- 0.10 mm (0.0039 Inch)**

After Retention Force

- **Min ---------- 0.07 mm (0.0028 Inch)**
- **Max ---------- 0.10 mm (0.0039 Inch)**

BJ

Initial

- **Min ---------- 0.05 mm (0.0020 Inch)-**
- **Max ---------- 0.06 mm (0.0024 Inch)**

After Retention Force

- **Min ---------- 0.04 mm (0.0016 Inch)-**
- **Max ---------- 0.06 mm (0.0024 Inch)**

RESULTS Continued

LLCR IR/DWV (4 signal and 4 ground LLCR test points)

Signal Pin

- **Initial ---------- 21.45 mOhms Max**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

Ground Pin

- **Initial ---------- 7.05 mOhms Max**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

LLCR Cable Pull (4 signal and 4 ground LLCR test points)

Signal Pin

- **Initial ---------- 21.42 mOhms Max**
- **15 Ib Retention**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

Ground Pin

- **Initial ---------- 6.82 mOhms Max**
- **15 Ib Retention**
  - **<= +5.0 mOhms ---------- 4 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

DATA SUMMARIES

Cable Pull Force:

0° Pull

01SP	Force (lbs)
Minimum	27.89
Maximum	32.82
Average	30.36

01BJ	Force (lbs)
Minimum	34.86
Maximum	35.32
Average	35.09

Coupling Nut Retention

	Force (lbs)
Minimum	**60.00**
Maximum	60.00
Average	60.00

Coupling Proof Torque

	Force (inch-lbs)
Minimum	**15.00**
Maximum	15.00
Average	15.00

DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Pin to Ground
	Mated
Minimum	**01SP/01BJ**
Initial	45000
Thermal Shock	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**01SP/01BJ**
Test Voltage	500

Pin to Ground (500 VAC)	
Initial Test Voltage	Pass
After Thermal Shock Test Voltage	Pass

DATA SUMMARIES Continued

INTERFACE GAGING

IR/DWV Group

Gaging (.008 / .000 inch) (0.20/0.00 mm)						
SP	Initial		After thermal shock		Delata	
	mm	Inch	mm	Inch	mm	Inch
1	0.11	0.0043	0.13	0.0051	0.02	0.0008
2	0.12	0.0047	0.09	0.0035	0.03	0.0012
3	0.11	0.0043	0.13	0.0051	0.02	0.0008
4	0.09	0.0035	0.08	0.0031	0.01	0.0004
min	0.09	0.0035	0.08	0.0031	0.01	0.0004
max	0.12	0.0047	0.13	0.0051	0.03	0.0012
average	0.11	0.0042	0.11	0.0042	0.02	0.0008

Gaging (.008 / .000 inch) (0.20/0.00 mm)						
BJ	Initial		After thermal shock		Delata	
	mm	Inch	mm	Inch	mm	Inch
1	0.06	0.0024	0.04	0.0016	0.02	0.0008
2	0.05	0.0020	0.07	0.0028	0.02	0.0008
3	0.05	0.0020	0.06	0.0024	0.01	0.0004
4	0.06	0.0024	0.04	0.0016	0.02	0.0008
min	0.05	0.0020	0.04	0.0016	0.01	0.0004
max	0.06	0.0024	0.07	0.0028	0.02	0.0008
average	0.06	0.0022	0.05	0.0021	0.02	0.0007

Cable Pull Group

Gaging (.008 / .000 inch) (0.20/0.00 mm)						
SP	Initial		After Retention		Delata	
	mm	Inch	mm	Inch	mm	Inch
1	0.10	0.0039	0.09	0.0035	0.01	0.0004
2	0.09	0.0035	0.08	0.0031	0.01	0.0004
3	0.10	0.0039	0.07	0.0028	0.03	0.0012
4	0.10	0.0039	0.10	0.0039	0	0.0000
min	0.09	0.0035	0.07	0.0028	0	0.0000
max	0.10	0.0039	0.10	0.0039	0.03	0.0012
average	0.10	0.0038	0.09	0.0033	0.01	0.0005

Gaging (.008 / .000 inch) (0.20/0.00 mm)						
BJ	Initial		After Retention		Delata	
	mm	Inch	mm	Inch	mm	Inch
1	0.05	0.0020	0.04	0.0016	0.01	0.0004
2	0.05	0.0020	0.05	0.0020	0	0.0000
3	0.06	0.0024	0.06	0.0024	0	0.0000
4	0.05	0.0020	0.06	0.0024	0.01	0.0004
min	0.05	0.0020	0.04	0.0016	0	0.0000
max	0.06	0.0024	0.06	0.0024	0.01	0.0004
average	0.05	0.0021	0.05	0.0021	0.01	0.0002

DATA SUMMARIES Continued

LLCR IR/DWV:

1) A total of 4 signal and 4 ground points were measured.
2) MIL-PRF-39012, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
4) The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a. <= +5.0 mOhms: ----------Stable
   b. +5.1 to +10.0 mOhms:----------Minor
   c. +10.1 to +15.0 mOhms: ----------Acceptable
   d. +15.1 to +50.0 mOhms: ----------Marginal
   e. +50.1 to +1000 mOhms: ----------Unstable
   f. >+1000 mOhms:----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	8/29/2022	8/30/2022		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	54	54		
Technician	Peter Chen	Peter Chen		
mOhm values	**Actual Initial**	**Delta After Ther shock**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	21.27	0.37		
St. Dev.	0.25	0.12		
Min	20.85	0.25		
Max	21.45	0.57		
Summary Count	4	4		
Total Count	4	4		
	Pin Type 2: Ground			
Average	6.94	0.25		
St. Dev.	0.09	0.16		
Min	6.81	0.07		
Max	7.05	0.51		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After Ther shock	**8**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Cable Pull:

1) A total of 4 signal and 4 ground points were measured.
2) MIL-PRF-39012, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
4) The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a. <= +5.0 mOhms: ----------Stable
   b. +5.1 to +10.0 mOhms: ----------Minor
   c. +10.1 to +15.0 mOhms:----------Acceptable
   d. +15.1 to +50.0 mOhms:----------Marginal
   e. +50.1 to +1000 mOhms: ----------Unstable
   f. >+1000 mOhms:----------Open Failure

	LLCR Measurement Summaries by Pin Type			
Date	1/4/2022	1/4/2022		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	50	50		
Technician	Peter Chen	Peter Chen		
mOhm values	Actual **Initial**	**Delta** **15 lbf Retention**		
	Pin Type: Signal 1			
Average	21.19	0.42		
St. Dev.	0.20	0.40		
Min	20.97	0.13		
Max	21.42	1.01		
Summary Count	4	4		
Total Count	4	4		
	Pin Type: GND 1			
Average	6.70	0.17		
St. Dev.	0.10	0.10		
Min	6.57	0.04		
Max	6.82	0.28		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
After Pull	**8**	**0**	**0**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-04
Description: Dillon Quantrol TC21 25-1000 mm/min series test stand
Manufacturer: Dillon Quantrol
Model: TC2 I series test stand
Serial #: 04-1041-04
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Speed Accuracy: +/- 5% of indicated speed;
… Last Cal: 05/29/2022, Next Cal: 05/29/2023

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2021, Next Cal: 09/11/2022

Equipment #: TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnati Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14993
Accuracy: See Manual
… Last Cal: 06/30/2022, Next Cal: 06/30/2023

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2022, Next Cal: 05/15/2023