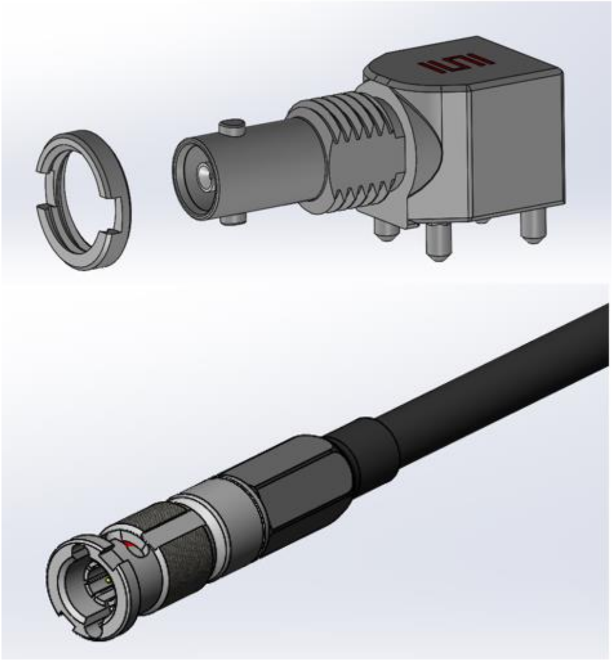
Project Number: Design Qualification Test Report	Tracking Code: 2669265_Report_Rev_1
Requested by: Iris Wang	Date: 11/22/2021
Part #: NR-HDBNC-J-P-GN-RA-BM1D/RFB8T-H4SP3-505050-0153	Tech: Tony Wagoner
Part description: HDBNC / RFB8T	Qty to test: 30
Test Start: 02/01/2021	Test Completed: 03/09/2021



DESIGN QUALIFICATION TEST REPORT

HDBNC / RFB8T
NR-HDBNC-J-P-GN-RA-BM1D/RFB8T-H4SP3-505050-0153

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
3/15/2021	**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.

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SCOPE

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

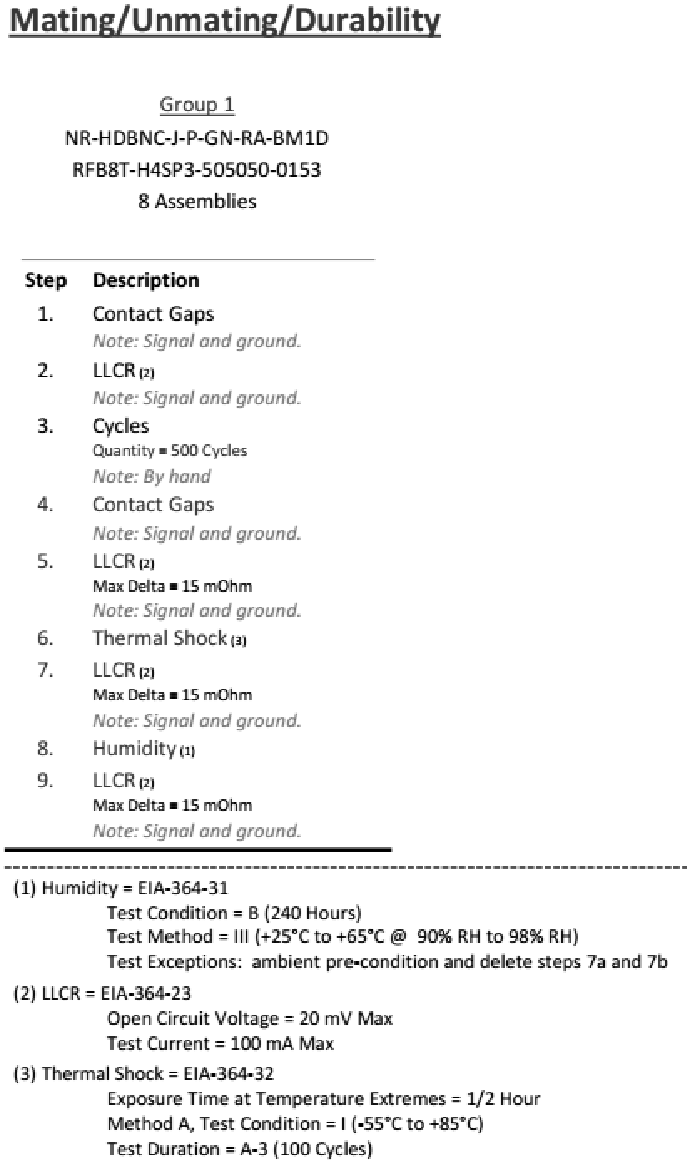
APPLICABLE DOCUMENTS

Standards: EIA Publication 364

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 and DWV/IR 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 and DWV/IR are visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.
8) Solder Information: Lead Free
9) Samtec Test PCBs used: PCB-111045-TST

FLOWCHARTS



Mating/Unmating/Durability

Group 1
NR-HDBNC-J-P-GN-RA-BM1D
RFB8T-H4SP3-505050-0153
8 Assemblies

Step	Description
1.	Contact Gaps *Note: Signal and ground.*
2.	LLCR (2) *Note: Signal and ground.*
3.	Cycles Quantity = 500 Cycles *Note: By hand*
4.	Contact Gaps *Note: Signal and ground.*
5.	LLCR (2) Max Delta = 15 mOhm *Note: Signal and ground.*
6.	Thermal Shock (3)
7.	LLCR (2) Max Delta = 15 mOhm *Note: Signal and ground.*
8.	Humidity (1)
9.	LLCR (2) Max Delta = 15 mOhm *Note: Signal and ground.*

(1) Humidity = EIA-364-31
Test Condition = B (240 Hours)
Test Method = III (+25°C to +65°C @ 90% RH to 98% RH)
Test Exceptions: ambient pre-condition and delete steps 7a and 7b

(2) LLCR = EIA-364-23
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max

(3) Thermal Shock = EIA-364-32
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-55°C to +85°C)
Test Duration = A-3 (100 Cycles)

FLOWCHARTS Continued

IR/DWV

Pin-to-Ground

Group 1
NR-HDBNC-J-P-GN-RA-BM1D
RFB8T-H4SP3-505050-0153
2 Assemblies

Step	**Description**
1.	DWV Breakdown (2)

Group 2
NR-HDBNC-J-P-GN-RA-BM1D
2 Assemblies

Step	**Description**
1.	DWV Breakdown (3)

Group 3
RFB8T-H4SP3-505050-0153
2 Assemblies

Step	**Description**
1.	DWV Breakdown (3)

Group 4
NR-HDBNC-J-P-GN-RA-BM1D
RFB8T-H4SP3-505050-0153
2 Assemblies

Step	**Description**
1.	IR (5) - Non Standard
2.	DWV at Test Voltage (1)
3.	Thermal Shock (6)
4.	IR (5) - Non Standard
5.	DWV at Test Voltage (1)
6.	Humidity (4)
7.	IR (5) - Non Standard
8.	DWV at Test Voltage (1)

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(1) DWV at Test Voltage = EIA-364-20
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 75% of the lowest breakdown voltage
Test voltage applied for 60 seconds

(2) DWV Breakdown = EIA-364-20
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 75% of the lowest breakdown voltage
Test voltage applied for 60 seconds

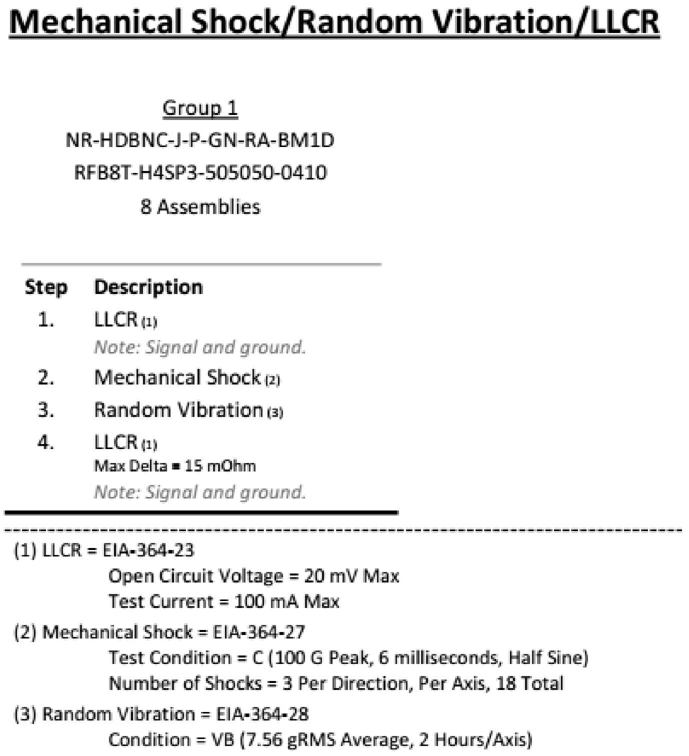
(3) DWV Breakdown = EIA-364-20
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 75% of the lowest breakdown voltage
Test voltage applied for 60 seconds

(4) Humidity = EIA-364-31
Test Condition = B (240 Hours)
Test Method = III (+25°C to +65°C @ 90% RH to 98% RH)
Test Exceptions: ambient pre-condition and delete steps 7a and 7b

(5) IR = Other
Test Condition = 1000 Vdc, 30 Seconds Max.

(6) Thermal Shock = EIA-364-32
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-55°C to +85°C)
Test Duration = A-3 (100 Cycles)

FLOWCHARTS Continued

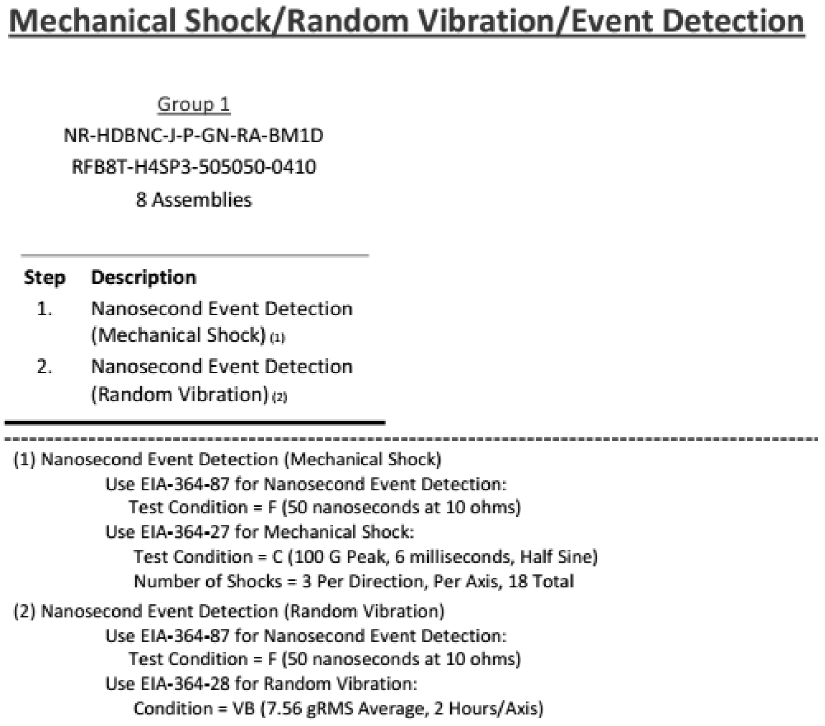


Mechanical Shock/Random Vibration/LLCR

Group 1
NR-HDBNC-J-P-GN-RA-BM1D
RFB8T-H4SP3-505050-0410
8 Assemblies

Step	Description
1.	LLCR (1) *Note: Signal and ground.*
2.	Mechanical Shock (2)
3.	Random Vibration (3)
4.	LLCR (1) Max Delta = 15 mOhm *Note: Signal and ground.*

(1) LLCR = EIA-364-23
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max
(2) Mechanical Shock = EIA-364-27
Test Condition = C (100 G Peak, 6 milliseconds, Half Sine)
Number of Shocks = 3 Per Direction, Per Axis, 18 Total
(3) Random Vibration = EIA-364-28
Condition = VB (7.56 gRMS Average, 2 Hours/Axis)



Mechanical Shock/Random Vibration/Event Detection

Group 1
NR-HDBNC-J-P-GN-RA-BM1D
RFB8T-H4SP3-505050-0410
8 Assemblies

Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) (1)
2.	Nanosecond Event Detection (Random Vibration) (2)

(1) Nanosecond Event Detection (Mechanical Shock)
Use EIA-364-87 for Nanosecond Event Detection:
Test Condition = F (50 nanoseconds at 10 ohms)
Use EIA-364-27 for Mechanical Shock:
Test Condition = C (100 G Peak, 6 milliseconds, Half Sine)
Number of Shocks = 3 Per Direction, Per Axis, 18 Total
(2) Nanosecond Event Detection (Random Vibration)
Use EIA-364-87 for Nanosecond Event Detection:
Test Condition = F (50 nanoseconds at 10 ohms)
Use EIA-364-28 for Random Vibration:
Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

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 (-65°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.

HUMIDITY:

1) Reference document: EIA-364-31, *Humidity Test Procedure for Electrical Connectors.*
2) Test Condition B, 240 Hours.
3) Method III, +25° C to + 65° C, 90% to 98% Relative Humidity excluding sub-cycles 7a and 7b.
4) All samples are pre-conditioned at ambient.
5) All test samples are exposed to environmental stressing in the mated condition.

MECHANICAL SHOCK (Specified Pulse):

1) Reference document: EIA-364-27, *Mechanical Shock Test Procedure for Electrical Connectors*
2) Test Condition C
3) Peak Value: 100 G
4) Duration: 6 Milliseconds
5) Wave Form: Half Sine
6) Velocity: 12.3 ft/s
7) Number of Shocks: 3 Shocks / Direction, 3 Axis (18 Total)

VIBRATION:

1) Reference document: EIA-364-28, *Vibration Test Procedure for Electrical Connectors*
2) Test Condition V, Letter B
3) Power Spectral Density: 0.04 G^2 / Hz
4) G 'RMS': 7.56
5) Frequency: 50 to 2000 Hz
6) Duration: 2.0 Hours per axis (3 axis total)

NANOSECOND-EVENT DETECTION:

1) Reference document: EIA-364-87, *Nanosecond-Event Detection for Electrical Connectors*
2) Prior to test, the samples were characterized to assure the low nanosecond event being monitored will trigger the detector.
3) After characterization it was determined the test samples could be monitored for 50 nanosecond events

MATING/UNMATING:

1) Reference document: EIA-364-13, *Mating and Unmating Forces Test Procedure for Electrical Connectors*.
2) The full insertion position was to within 0.003" to 0.004" of the plug bottoming out in the receptacle to prevent damage to the system under test.
3) One of the mating parts is secured to a floating X-Y table to prevent damage during cycling.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

LLCR:

1) EIA-364-23, *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: Other request, *Insulation Resistance Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Electrification Time 30 seconds max.
        iii. Test Voltage (1000 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 1000 megohms.

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: EIA-364-20, *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).

RESULTS

Insulation Resistance minimums, IR

Pin to GND

- **Initial**
    - **Mated-- 450000 Meg Ω ------------------------- Passed**
    - **Unmated --- 450000 Meg Ω ------------------------- Passed**
- **Thermal Shock**
    - **Mated-- 450000 Meg Ω ------------------------- Passed**
    - **Unmated --- 450000 Meg Ω ------------------------- Passed**
- **Humidity**
    - **Mated-- 450000 Meg Ω ------------------------- Passed**
    - **Unmated --- 450000 Meg Ω ------------------------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
    - **Breakdown Voltage--------------------------------- 1113 VAC**
    - **Test Voltage --835 VAC**
    - **Working Voltage --------------------------------------275 VAC**

Pin to GND

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

RESULTS Continued

LLCR Durability (16 LLCR test points)

Signal Pin

- **Initial -- 17.66 mOhms Max**

Ground Pin

- **Initial --2.69 mOhms Max**
- **Durability, 500 Cycles**
  - **<= +5.0 mOhms-------------------------------------- 16 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 Shock & Vibration Group (16 LLCR test points)

Signal Pin

- **Initial -- 34.43 mOhms Max**

Ground Pin

- **Initial --6.74 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms-------------------------------------- 16 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**

Mechanical Shock & Random Vibration:

- **Shock**
  - **No Damage------------------------------------ ---------------------------------- Pass**
  - **50 Nanoseconds----------------------------- ---------------------------------- Pass**
- **Vibration**
  - **No Damage------------------------------------ ---------------------------------- Pass**
  - **50 Nanoseconds----------------------------- ---------------------------------- Pass**

DATA SUMMARIES

INSULATION RESISTANCE (IR):

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	**HDBNC/RFB8T**	**HDBNC**	**RFB8T**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**HDBNC/RFB8T**
Break Down Voltage	1113
Test Voltage	835
Working Voltage	275

Pin to GND	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

DATA SUMMARIES Continued

LLCR Durability:

1) A total of 16 points were measured.
2) EIA-364-23, *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	2/4/2021	2/8/2021	2/23/2021	3/9/2021
Room Temp (Deg C)	23	23	23	23
Rel Humidity (%)	55	54	54	54
Technician	Peter Chen	Peter Chen	Peter Chen	Peter Chen
mOhm values	**Actual**	**Delta**	**Delta**	**Delta**
	Initial	**500 Cycles**	**Therm Shck**	**Humidity**
	Pin Type 1: Ground			
Average	2.56	0.13	0.37	0.94
St. Dev.	0.07	0.11	0.20	0.61
Min	2.47	0.02	0.09	0.21
Max	2.69	0.34	0.68	1.94
Summary Count	8	8	8	8
Total Count	8	8	8	8
	Pin Type 2: Signal			
Average	16.92	0.20	0.32	0.33
St. Dev.	0.35	0.30	0.39	0.29
Min	16.45	0.00	0.01	0.03
Max	17.66	0.97	1.31	0.97
Summary Count	8	8	8	8
Total Count	8	8	8	8

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
500 Cycles	**16**	**0**	**0**	**0**	**0**	**0**
Therm Shck	**16**	**0**	**0**	**0**	**0**	**0**
Humidity	**16**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Shock & Vibration

1) A total of 16 points were measured.
2) EIA-364-23, *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	1/19/2021	1/20/2021		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	40	38		
Technician	Scott Rollefstad	Scott Rollefstad		
mOhm values	Actual	**Delta**		
	Initial	**Shock-Vib**		
	Pin Type: Signal 1			
Average	34.02	0.19		
St. Dev.	0.24	0.11		
Min	33.76	0.01		
Max	34.43	0.39		
Summary Count	8	8		
Total Count	8	8		
	Pin Type: GND 1			
Average	6.47	0.23		
St. Dev.	0.22	0.13		
Min	6.17	0.05		
Max	6.74	0.42		
Summary Count	8	8		
Total Count	8	8		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Shock-Vib	**16**	**0**	**0**	**0**	**0**	**0**

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
Contacts tested	16
Test Condition	C, 100g's, 6ms, Half-Sine
Shock Events	108
Test Condition	V-B, 7.56 rms g
Vibration Events	108
Total Events	216

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: HZ-HPM-01
Description: Hipot Megommeter
Manufacturer: Hipotronics
Model: H306B-A
Serial #: M9905004
Accuracy: 2 % Full Scale Accuracy
… Last Cal: 2020-4-27, Next Cal: 2021-4-26

Equipment #: HZ-MO-03
Description: Micro-ohmmeter
Manufacturer: Keithley
Model: 580
Serial #: 297288
Accuracy: Last Cal: 2020-8-06, Next Cal: 2021-8-05

Equipment #: HZ-THC-01
Description: Humidity transmitter
Manufacturer: Thermtron
Model: HMM30C
Serial #: D0240037
Accuracy: Last Cal: 2020-3-3, Next Cal: 2021-3-2
Equipment #: HZ-PS-01
Description: Power Supply
Manufacturer: Agilent
Model: 6031A
Serial #: MY41000982
Accuracy: Last Cal: 2020-4-28, Next Cal: 2021-4-27

Equipment #: HZ-TSC-01
Description: Thermal Shock transmitter
Manufacturer: Keithley
Model: 10-VT14994
Serial #: VTS-3-6-6-SC/AC
Accuracy: Last Cal: 2020-11-1, Next Cal: 2021-11-1

Equipment #: SVC-01
Description: Shock & Vibration Table
Manufacturer: Data Physics
Model: LE-DSA-10-20K
Serial #: 10037
Accuracy: Last Cal: 2020-11-31, Next Cal: 2021-11-31

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: Last Cal: 2020-07-09, Next Cal: 2021-07-09

Equipment #: ED-03
Description: Event Detector
Manufacturer: Analysis Tech
Model: 32EHD
Serial #: 1100604
Accuracy: Last Cal: 2020-06-04, Next Cal: 2021-06-04