# ENGINEERING SUMMARY REPORT	Report #	ESR-9553
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Evaluation of RVPX product line to VITA 46 standards	**Revision #:**	**3**
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Revision History

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3	SL	2/19/2018

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Summary

1.1. Purpose of Test

Testing was performed on Amphenol's R-VPX Ruggedized VITA 46 connector to determine its conformance to the requirements of VITA 46. Testing also included intermatability with current VITA 46 compliant connectors offered by another connector manufacturer.

1.2. References

The following documents were referenced for testing in this report. Unless specified, the version in effect at time of testing will be followed.

RVPX 6U Connector module test plan, Rev. 6 (JAN, 2005)

EN-61000-4-2, Electrostatic Discharge Immunity Test

MIL-STD-1344

MIL-STD-810F

EIA Publication 364

ASTM G85

1.3. Testing Agencies

Contech Research, Inc.
750 Narragansett Park Drive
Rumford, RI 02916-1035

Samples and Test Schedule

2.1. Samples

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for test

Sample	Part Number	Description
VITA 46 6U Daughtercard *Amphenol*	RVPX-P08VM2	Right angle daughtercard 8 pos. end
	RVPX-P16DM2	Right angle daughtercard 16 pos. center
	RVPX-HMM6	Right angle daughtercard guide module
VITA 46 6U Backplane *Amphenol*	RVPX-J08EM2	Vertical receptacle backplane 8 pos. end
	RVPX-J16MM2	Vertical receptacle backplane 16 pos. middle
	RVPX-J16EM2	Vertical receptacle backplane 16 pos. end
	RVPX-HPM-2	Keyed guide pin machined
VITA 46 6U Daughtercard		Right angle daughtercard 8 pos. end
		Right angle daughtercard 16 pos. center
		Right angle daughtercard guide module
VITA 46 6U Backplane		Vertical receptacle backplane 8 pos. end
		Vertical receptacle backplane 16 pos. middle
		Vertical receptacle backplane 16 pos. end
		Keyed guide pin machined

Table 1: Sample Description

Figure 1: Typical Test Sample

2.2. Test sequence

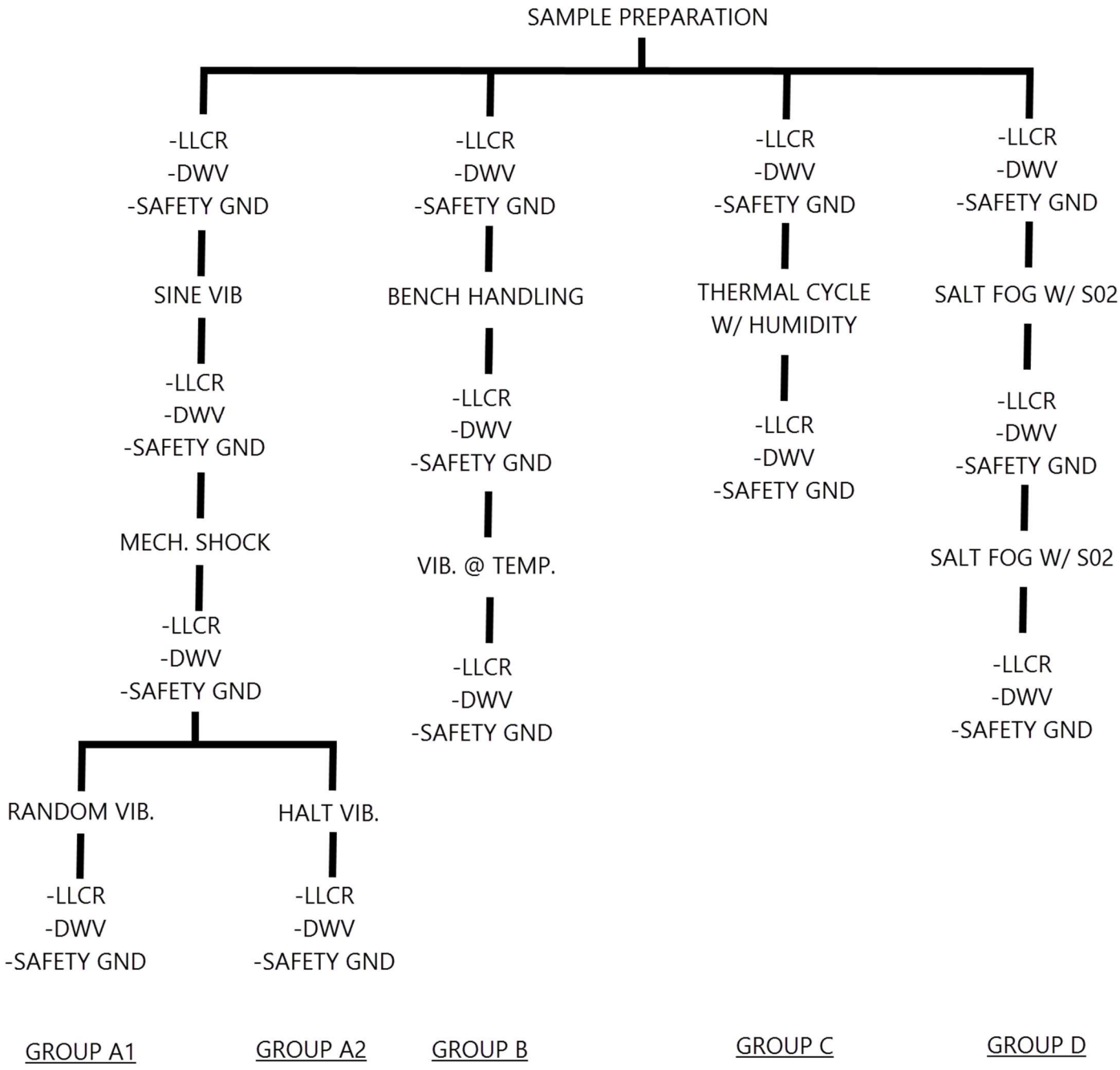

Figure 2: Test sequence groups A-D

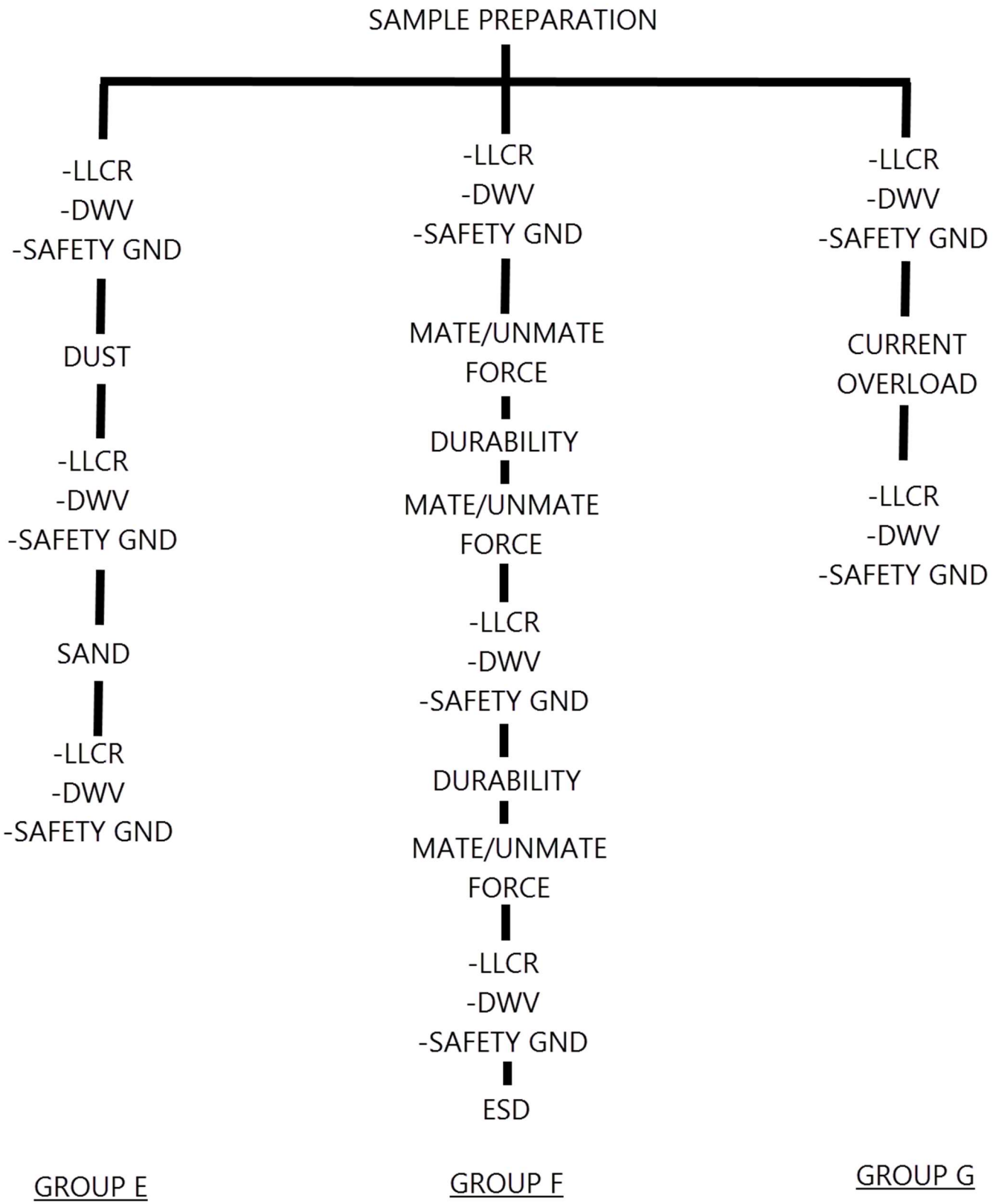

Figure 3: Test sequence Groups E-G

Summary of Testing

Subgroup	Samples	Environmental / Mechanical Test	Specification / Standard	Verification method	Result
A	RVPX DC / RVPX BP RVPX DC / VITA 46 BP VITA 46 DC / RVPX BP VITA 46 BP / VITA 46 DC	Shock	MIL-STD-1344A, Method 2004.1, Test Condition A	LLCR DWV Safety GND.	Pass
		Random Vibration 1	MIL-STD-1344A, Method 2005.1, Test Condition V, letter D, 1.5 hours/axis	LLCR DWV Safety GND.	Pass
		Random Vibration 2	HALT/step stress (0.125, 0.15, 0.175 g^2/Hz for 15 min. each; 0.2 g2/Hz for 45 min.)	LLCR DWV Safety GND.	Pass
B	RVPX DC / RVPX BP RVPX DC / VITA 46 BP VITA 46 DC / RVPX BP VITA 46 BP / VITA 46 DC	Bench Handling	MIL-STD-810F, Method 516.5, Procedure VI	LLCR DWV Safety GND.	Pass
		Vibration / Temperature	MIL-STD-1344A, Method 2005.1, Test Condition V, letter D, 1.5 hours/axis w/temperature cycle from -40°C to 100°C with 30 minute dwell and 15 minute ramps	LLCR DWV Safety GND.	Pass
C	RVPX DC / RVPX BP	Humidity	MIL-STD-1344A, Method 1002.2, Type III (240 hours)	LLCR DWV Safety GND.	Pass
D	RVPX DC / RVPX BP	Salt Fog + SO_2	ASTM G85, Annex A4 (cycles A4.4.4.1), Two 24 hour cycles	LLCR DWV Safety GND.	Pass
E	RVPX DC / RVPX BP	Dust	MIL-STD-810F, Method 510.4, Procedure I	LLCR DWV Safety GND.	Pass
		Sand	MIL-STD-810F, Method 510.4, Procedure II	LLCR DWV Safety GND.	Pass
F	RVPX DC / RVPX BP	Durability with Misalignment	EIA-364-09, 500 mate/unmate cycles	LLCR DWV Safety GND.	Pass
		Electrostatic Discharge	EN 61000-4-2	ESD	Pass
		Insertion / Extraction Force	MIL-STD-1344A, Method 2013.1	RECORD DATA	61.6lbs / 51.4lbs (initial)
G	RVPX DC / RVPX BP	Current Overload	IEC 60512-3	LLCR DWV Safety Ground	Pass

Notes: LLCR requirement: +10.0mΩ MAX CHANGE, +5.0mΩ MAX AVG. CHANGE
DWV requirement: NO BREAKDOWN, <5.0 mA LEAKAGE
Safety ground: 100.0mΩ MAX

Table 2: Test results

3.1. Initial Examination of product

All specimens submitted for testing were representative of normal production lots. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3.2. Low Level Contact resistance

All low level contact resistance measurements, taken at 10 milliamperes maximum and 20 millivolts maximum open circuit voltage. All measurements had a maximum average change in resistance (ΔR) of less than 5 milliohms after testing, and a maximum individual change in resistance (ΔR) of less than 10 milliohms after testing.

3.3. Safety Ground

All low level contact resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 100 milliohm initially, and less than 100 milliohm after testing.

3.4. Dielectric Withstanding voltage

Leakage current was less than 5.0 mA and no dielectric breakdown or flashover occurred.

3.5. Random Vibration

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

3.6. Mechanical Shock

No discontinuities were detected during mechanical shock testing. Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible.

3.7. Bench Handling

No discontinuities were detected during testing. Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible.

3.8. Humidity / Temperature Cycling

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

3.9. Salt fog with SO_2

No evidence of physical damage was visible as a result of exposure.

3.10. Dust Contamination

No evidence of physical damage was visible as a result of exposure to dust particles.

3.11. Electro Static Discharge (ESD)

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

3.12. Mating Force

All mating force measurements were less than 0.75 N [2.7 oz] than per contact.

3.13. Unmating Force

All unmating force measurements were greater than 0.15 N [0.54 oz] per contact.

3.14. Durability

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

3.15. Current Overload

No physical damage occurred.

3.16. Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

Test Methods

4.1. Initial Examination of product

Specimens were visually examined. Parts were checked for proper assembly and mounting. Parts were checked for evidence of physical abnormality detrimental to product performance.

4.2. Low Level Contact resistance

LLCR measurements were performed per EIA-364-23B or MIL-STD-1344A, method 3002.1. LLCR testing was performed at the beginning of each test group to establish a baseline and after tests according to the test sequence plan. Failure is defined as a resistance increase of greater than 10 mΩ on any individual contact, or greater than an average of 5 mΩ per connector module.

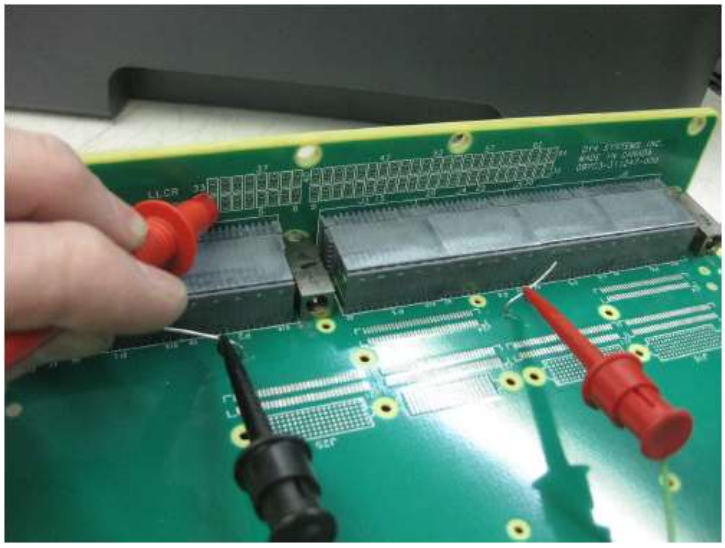

Figure 4: Typical LLCR Measurement set-up

4.3. Safety Ground

Safety ground testing was performed using a 4 point measurement with low voltage and current. The measurement was taken across each of the three alignment pin/socket contacts. Resistance shall be less than 0.1 ohm (ref. MIL-STD-464, A5.10.4, Shock, fault, and ignitable vapor protection)

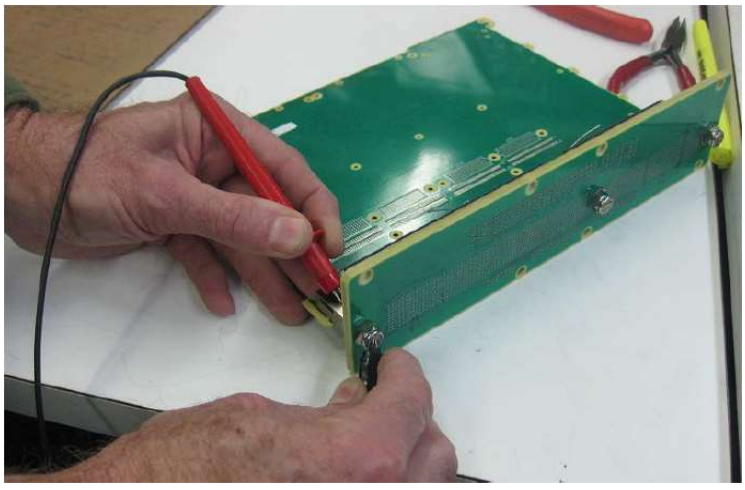

Figure 5: Typical Safety Ground Measurement set-up

4.4. Dielectric Withstanding voltage

Dielectric withstanding voltage was tested in accordance with MIL-STD-1344A, Method 3001.1. The test voltage was 500 V AC (rms) at 60 Hz. DWV was performed between contacts with the closest spacing, and was not done on contacts reserved for LLCR or interrupt monitoring. Failure is defined as arcing, flashover, or leakage current of greater than 5 milliamperes.

4.5. Vibration

4.5.1. Samples were subjected to a 10 minute sine vibration sweep of 5 g between 50 and 2000 Hz to identify their resonant frequencies and transmissibilities. Response accelerometers were located at the areas of highest displacement/acceleration of the first 3 vibration modes, e.g. center of middle rib. The frequency and transmissibility data was compared to data from typical 6U x 160mm conduction cooled product to ensure similarity.

4.5.2. Samples underwent different random vibration tests, according to MIL-STD-1344A, Method 2005.1. The first sample was tested to Test Condition V, letter D (0.1 G^2/Hz max., 1.5 hours per axis) as a minimum requirement of VITA 46. The second sample was tested to further explore the connector capability. The vibration level was applied as a step stress, i.e. 0.125 G^2/Hz for 15 minutes, 0.15 G^2/Hz for 15 minutes, 0.175 G^2/Hz for 15 minutes, and 0.2 G^2/Hz for 45 minutes, for a total duration of 1.5 hours.

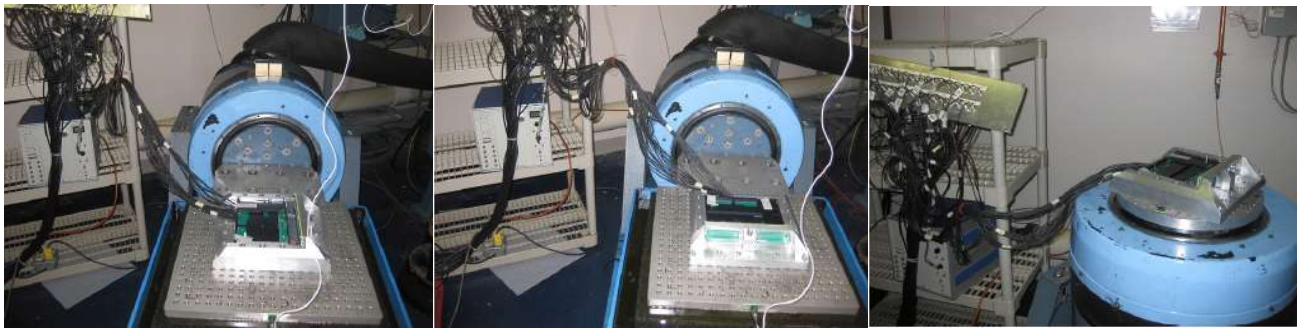

Figure 6: Vibration test set-up

4.6. Mechanical Shock

Each sample underwent shock following MIL-STD-1344A, Method 2004.1, Test Condition A (1/2 sine, 50 g in perpendicular axis, 80 g in other axes, 11 ms, 3 hits from both directions in each of 3 mutually perpendicular axes for a total of 18 hits).

Figure 7: Mechanical Shock test set-up

4.7. Bench Handling

One group B sample was tested in accordance with MIL-STD-810F, Method 516.5, Procedure VI.

4.8. Humidity / Temperature Cycling

One Group C sample was exposed to humidity and temperature cycling per MIL-STD-1344A, Method 1002.2, Type III (240 hrs.). No polarizing voltage was used. The sample was in a mated condition.

4.9. Salt fog with SO_2

One Group D sample underwent Salt Fog with SO2 per ASTM G85 (Annex A4, Cycle A4.4.4.1). The test sample was exposed in the mated condition in a sheet metal container.

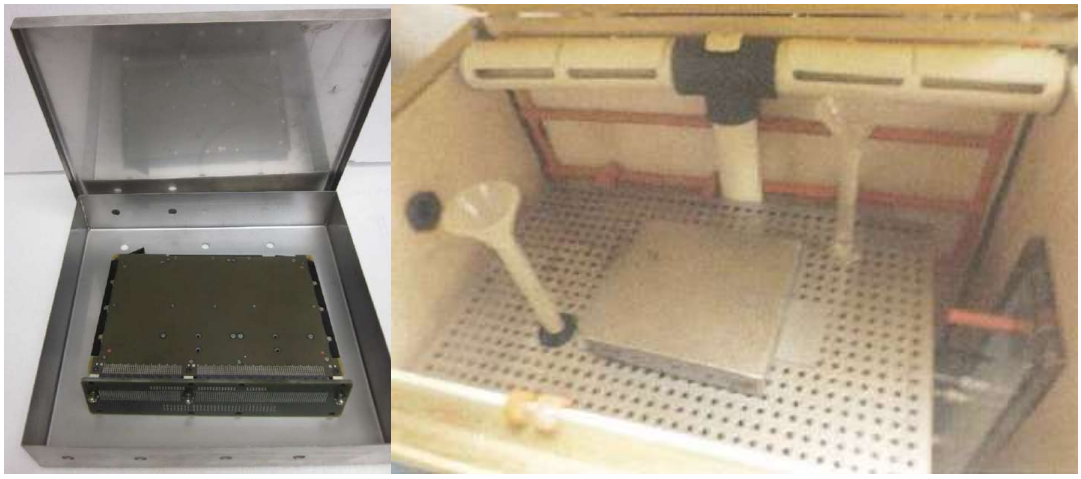

Figure 8: Salt Fog with SO_2 test set-up

4.10. Dust Contamination

One Group E sample underwent dust testing per MIL-STD-810F, Method 510.4, Procedure I (Blowing Dust, particle size < 150 μm, velocity 1750 ft/min). The sample was mated. The dust test on these two samples was followed by a Blowing Sand test, also per MIL-STD-810F, Method 510.4, Procedure II (Blowing Sand, particle size > 150 μm but < 850 μm, velocity 5700 ft/min). The test vehicles had excessive deposits removed using acceptable methods (ref. MIL-STD-810F).

4.11. Electro Static Discharge (ESD)

One Group F sample was tested for ESD protection using EN 61000-4-2. The test was performed on the module connector half. A 150 picofarad source capacitor, charged to 500 to 15,000 volts, discharged through a 330 ohm resistor did not result in greater than 20 volts to any contact, measured relative to ground.

4.12. Mating Force

The module insertion and extraction forces shall be tested in accordance with MIL-STD-1344A, Method 2013. Fixturing was representative of actual hardware. Forces were recorded on the third mating/unmating cycle. The maximum rate of mating and unmating was 10 cycles/minute.

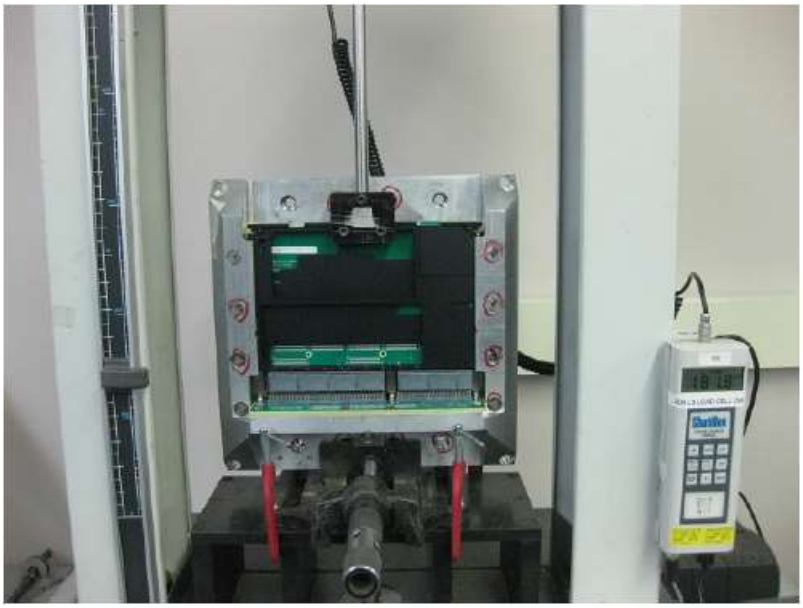

Figure 9: Mate / Extraction force test set-up

4.13. Unmating Force

The module insertion and extraction forces was tested in accordance with MIL-STD-1344A, Method 2013. Fixturing was representative of actual hardware. Forces were recorded on the third mating/unmating cycle. The maximum rate of mating and unmating was 10 cycles/minute.

4.14. Durability

The Group F sample of 3.7 underwent 500 mate/unmate cycles with an initial misalignment of 2 mm (0.079”) between the connector halves for each cycle. VI, LLCR, and DWV was performed after 200 mate/unmate cycles, as well as 500 cycles. The misalignment can be in any radial direction in the plane of the backplane (note that a fixture was required to perform this test). The test was conducted in accordance with MIL-M-28787. There was no permanent physical deformation of either half of the connector assembly.

4.15. Current Overload

The Group G samples were tested per IEC 60512-3. The current overload was done on both signal contacts (1 sample) and power contacts (1 sample), for two time periods; 5 minutes (at 150% of rated current) and 2 hours (at 125% of rated current). The samples were mated but without a mounting substrate. There was no electroplate peeling or discoloration. The allowable LLCR value after current overload is a 25% increase over the initial value (ref. MIL-C-28754).

4.16. Final Examination of Product

Specimens were visually examined for evidence of physical damage detrimental to product performance.

5. Conclusions

The R-VPX ruggedized VITA 46 connectors listed in paragraph 2.1., conformed to the electrical mechanical and environmental performance requirements of the VITA 46 test specification.