RF SMPM, Coaxial, Snap-In Connector System for VITA 67 VPX Standard

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity* (TE) RF SMPM, Coaxial, Snap-In Connector System for VITA 67 VPX Standard to determine conformance with requirements of Product Specification 108-163026 Revision C.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the RF SMPM, Coaxial, Snap-In RF Connector System for VITA 67 VPX Standard. Testing was performed at the Winston-Salem Electrical Components Test Laboratory between February 19, 2021 and August 16, 2021, and the Harrisburg Electrical Components Test Laboratory between February 19, 2021 and September 17, 2021. The test file numbers for this testing are WE-20210197, WE-20210198, and EA20210042T. This documentation is on file at and available from the Harrisburg Electrical Components Test Laboratory.

1.3 Conclusion

The RF SMPM, Coaxial, Snap-In RF Connector System for VITA 67 VPX Standard specimens listed in paragraph 1.4., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-163026 Revision C.

1.4 Test Specimens

The test specimens were representative of normal production lots. See Table 1 for Test Specimen Detail, including part numbers and descriptions of product used for test.

Table 1 – Test Specimen Detail

Test Group	Qty	Part Number	Description
1	24	2332684-1, Rev 3	VITA 67.2 RF (.086) in 8 pos body, mated to 2101012-1 / 2157553-1
	3	2332708-1, Rev 1	Built into cable assemblies 2370530-5 / 2370633-5
	27	2332676-1, Rev 5	VITA 67.3 RF (.086) in 9 pos body, mated to 2101012-1 / 2332834-1
	3	2365211-1, Rev 1	Built into cable assemblies 2370532-5 / 2370633-5
2	24	2332684-1, Rev 3	VITA 67.2 RF (.086) in 8 pos body, mated to 2101012-1 / 2157553-1
	3	2332708-1, Rev 1	Built into cable assemblies 2370530-5 / 2370633-5
	27	2332676-1, Rev 5	VITA 67.3 RF (.086) in 9 pos body, mated to 2101012-1 / 2332834-1
	3	2365211-1, Rev 1	Built into cable assemblies 2370532-5 / 2370633-5
3	24	2332684-1, Rev 3	VITA 67.2 RF (.086) in 8 pos body, mated to 2101012-1 / 2157553-1
	3	2332708-1, Rev 1	Built into cable assemblies 2370530-5 / 2370633-5
	27	2332676-1, Rev 5	VITA 67.3 RF (.086) in 9 pos body, mated to 2101012-1 / 2332834-1
	3	2365211-1, Rev 1	Built into cable assemblies 2370532-5 / 2370633-5
4	5	2332684-1, Rev 3	VITA 67.2 RF (.086) in 8 pos body, mated to 2101012-1 / 2157553-1
	1	2332708-1, Rev 1	Built into cable assemblies 2370530-2 / 2370633-2, FLEX 4”
	5	2332676-1, Rev 5	VITA 67.3 RF (.086) in 9 pos body, mated to 2101012-1 / 2332834-1
	1	2365211-1, Rev 1	Built into cable assemblies 2370532-2 / 2370633-2 FLEX 4”
	5	2332684-2, Rev 3	VITA 67.2 RF (.047) in 8 pos body, mated to 2157248-1 / 2157553-1
	1	2332708-1, Rev 1	Built into cable assemblies 2370529-2 / 2370632-2 FLEX 4”
	5	2332676-2, Rev 5	VITA 67.3 RF (.047) in 9 pos body, mated to 2157248-1 / 2332834-1
	1	2365211-1, Rev 1	Built into cable assemblies 2370531-2 / 2370632-2 FLEX 12”

1.4 Test Specimens (continued)

Table 1 – Test Specimen Detail (continued)

Test Group	Qty	Part Number	Description
5	8	2332684-1, Rev 3	VITA 67.2 RF (.086) in 8 pos body, mated to 2101012-1 / 2157553-1
	1	2332708-1, Rev 1	Built into cable assemblies 2370530-1 / 2370633-1, FLEX 36”
	9	2332676-1, Rev 5	VITA 67.3 RF (.086) in 9 pos body, mated to 2101012-1 / 2332834-1
	1	2365211-1, Rev 1	Built into cable assemblies 2370532-1 / 2370633-1 FLEX 36”
	8	2332684-2, Rev 3	VITA 67.2 RF (.047) in 8 pos body, mated to 2157248-1 / 2157553-1
	1	2332708-1, Rev 1	Built into cable assemblies 2370529-1 / 2370632-1 FLEX 36”
	9	2332676-2, Rev 5	VITA 67.3 RF (.047) in 9 pos body, mated to 2157248-1 / 2332834-1
	1	2365211-1, Rev 1	Built into cable assemblies 2370531-1 / 2370632-1 FLEX 36”
6	24	2332684-1, Rev 3	VITA 67.2 RF (.086) in 8 pos body, mated to 2101012-1 / 2157553-1
	3	2332708-1, Rev 1	Built into cable assemblies 2370530-4 / 2370633-4
	42	2332676-1, Rev 5	VITA 67.3 RF (.086) in 14 pos body, mated to 2101012-1 / 2332829-1
	3	2361107-1, Rev 1	Built into cable assemblies 2370532-4 / 2370633-4
	24	2332684-2, Rev 3	VITA 67.2 RF (.047) in 8 pos body, mated to 2157248-1 / 2157553-1
	3	2332708-1, Rev 1	Built into cable assemblies 2370529-4 / 2370632-4
	42	2332676-2, Rev 5	VITA 67.3 RF (.047) in 14 pos body, mated to 2157248-1 / 2332829-1
	3	2361107-1, Rev 1	Built into cable assemblies 2370531-4 / 2370632-4
7	8	2332684-1, Rev 3	VITA 67.2 RF (.086) in 8 pos body, mated to 2101012-1 / 2157553-1
	1	2332708-1, Rev 1	Built into cable assemblies 2370530-1 / 2370633-1, FLEX 36”
	9	2332676-1, Rev 5	VITA 67.3 RF (.086) in 9 pos body, mated to 2101012-1 / 2332834-1
	1	2365211-1, Rev 1	Built into cable assemblies 2370532-1 / 2370633-1 FLEX 36”
	8	2332684-2, Rev 3	VITA 67.2 RF (.047) in 8 pos body, mated to 2157248-1 / 2157553-1
	1	2332708-1, Rev 1	Built into cable assemblies 2370529-1 / 2370632-1 FLEX 36”
	9	2332676-2, Rev 5	VITA 67.3 RF (.047) in 9 pos body, mated to 2157248-1 / 2332834-1
	1	2365211-1, Rev 1	Built into cable assemblies 2370531-1 / 2370632-1 FLEX 36”
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	1	2332708-1, Rev 1	Built into cable assemblies 2370530-1 / 2370633-1, FLEX 4”
	5	2332676-1, Rev 5	VITA 67.3 RF (.086) in 9 pos body, mated to 2101012-1 / 2332834-1
	1	2365211-1, Rev 1	Built into cable assemblies 2370532-1 / 2370633-1 FLEX 4”
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1.5 Qualification Test Sequence

Table 2 - Test Sequence

Test or Examination	Test Group								
	1	2	3 (a)	4	5	6	7	8	9
	Test Sequence (b)								
Initial examination of product	1	1	1	1	1	1	1	1	1
LLCR	2,8		2,4						
VSWR				2					
Insulation resistance		2,6							
Withstand voltage		3,7							
Insertion loss								2	
Frequency response								3	
Isolation									2
Power handling							2		
Vibration, Class V3						2			
Mechanical shock, Class OS2						3			
Durability	5								
Mating force	3,6								
Unmating force	4,7								
Thermal shock (non-operating)		4							
Operating temperature					2				
Corrosion resistance			3						
Humidity		5							
Final examination of product	9	8	5	3	3	4	3	4	3

Note: *(a) For 1-piece backplane module connector system only: Two sets of cables shall be used on the backplane for this test group. One set of cables shall be prepared and used for LLCR measurements. A separate environmental set shall be prepared and used for corrosion exposure only. Following corrosion exposure, the environmental cables shall be replaced with the original measurement cables in the same positions as originally installed shall be used for the final measurement.*

(b) Numbers indicate sequence in which tests are performed.

1.6 Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15°C to 35°C
Relative Humidity: 20% to 80%

2. SUMMARY OF TESTING

Unless otherwise specified, the summary of testing results below are applicable to both the VITA 67.2 and VITA 67.3 versions of the products tested.

2.1 Initial Examination of Product – All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance (C of C) was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2 Low Level Contact Resistance (LLCR) – Test Groups 1, 3

All LLCR measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 8 milliohms initially for center contacts, less than 2 milliohms initially for outer contacts, and had a change in resistance (ΔR) of less than 5 milliohms after testing. See Table 3 for a summary of results.

Table 3 – Low Level Contact Resistance (mOhms)

Test Group	Final Results	Center Contact	Outer Contact
1	Max	5.26	0.99
	Max Delta	0.43	0.42
3	Max	7.00	1.87
	Max Delta	1.60	1.40

2.3 Voltage Standing Wave Ratio (VSWR) – Test Group 4

- VITA 67.2 specimen VSWR was less than 1.5:1 to 26.5 GHz when using the specified semi-rigid cable.
- VITA 67.3 specimen VSWR was less than 1.5:1 to 40 GHz when using the specified semi-rigid cable.

2.4 Insulation Resistance – Test Group 2

All insulation resistance measurements were greater than 10,000 megohms initially, and 5,000 megohms after testing.

2.5 Withstanding Voltage – Test Group 2

No dielectric breakdown or flashover occurred; leakage current was less than 5 milliamperes.

2.6 Insertion Loss (IL) – Test Group 8

- VITA 67.2 insertion loss measurements were less than -0.12 sqrt f (GHz) dB maximum from 1.0 to 26.5 GHz.
- VITA 67.3 insertion loss measurements were less than -0.12 sqrt f (GHz) dB maximum from 1.0 to 40 GHz.

2.7 Frequency Response – Test Group 8

- VITA 67.2 frequency response was less than ±1.0 dB from 1.0 to 26.5 GHz.
- VITA 67.3 frequency response was less than ±1.0 dB from 1.0 to 40 GHz.

2.8 Isolation – Test Groups 9

- VITA 67.2 isolation noise floor measurements were below 140 dB from 3.0 to 30 MHz, below 120 dB from 30 MHz to 3.0 GHz, and below 100 dB from 3.0 to 26.5 GHz.
- VITA 67.3 isolation noise floor measurements were below 140 dB from 3.0 to 30 MHz, below 120 dB from 30 MHz to 3.0 GHz, below 100 dB from 3.0 to 27 GHz, and below 90 dB from 27 to 40 GHz.

2.9 Power Handling – Test Group 7

- VITA 67.2 VSWR was less than 1.5 at 3.0 to 30 MHz and 30 dBm, and less than 1.5 at 30 MHz to 26.5 GHz and 20 dBm.
- VITA 67.3 VSWR was less than 1.5 at 3.0 to 30 MHz and 30 dBm, and less than 1.5 at 30 MHz to 40 GHz and 20 dBm.

2.10 Vibration, Class V3 – Test Group 6

No discontinuities of 100 nanoseconds or greater were detected during vibration testing. Following vibration testing, no cracks, breaks, or loose parts on the specimens were visible.

2.11 Mechanical Shock, Class OS2 – Test Group 6

No discontinuities of 100 nanoseconds or greater were detected during mechanical shock testing. Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible.

2.12 Durability – Test Group 1

No evidence of physical damage was visible as a result of mating and unmating the specimens 500 times.

2.13 Mating Force – Test Group 1

All mating force measurements were less than 145 N for 8 position specimens, and 165 N for 9 position specimens.

2.14 Unmating Force – Test Group 1

All unmating force measurements were greater than 25 N for 8 positions specimens, and 30 N for 9 position specimens.

2.15 Thermal Shock (non-operating) – Test Group 2

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

2.16 Operating Temperature – Test Group 5

- VITA 67.2 VSWR was less than 1.5:1 to 26.5 GHz at temperatures between -40 and 85°C.
- VITA 67.3 VSWR was less than 1.5:1 to 40 GHz at temperatures between -40 and 85°C.

2.17 Corrosion Resistance – Test Group 3

Specimens were able to be mated and unmated; and met all LLCR requirements after exposure to a corrosive atmosphere. See Table 3 for LLCR results summary.

2.18 Humidity – Test Group 2

No evidence of physical damage was visible as a result of exposure to a moisture laden atmosphere.

2.19 Final Examination of Product – All Test Groups

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

3. TEST METHODS

3.1. Initial Examination of Product

A C of C was issued stating that all specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts.

3.2 Low Level Contact Resistance (LLCR)

LLCR measurements were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

3.3 Voltage Standing Wave Ration (VSWR)

VSWR was measured on mated specimens using a network analyzer with a sweep range of 1.0 to 40 GHz.

3.4 Insulation Resistance

Insulation resistance was measured between each center contact to all other contacts and between the shell and all the contacts of mated specimens. A test voltage of 500 volts DC was applied for a maximum of 2 minutes before the resistance was measured.

3.5 Withstanding Voltage

A test potential of 325 volts rms was applied between the center and adjacent outer contacts of mated specimens for 1 minute and then returned to zero.

3.6 Insertion Loss (IL)

A full Two-Port Calibration was performed using a network analyzer, the insertion loss, S_{21}, of the specimen was measured.

3.7 Frequency Response

Frequency response data was calculated from insertion loss data by subtracting the minimum measured IL from the maximum measured IL.

3.8 Isolation

Sinusoidal frequencies between 3.0 MHz and 26.5 GHz (VITA 67.2), or 3.0 MHz and 40 GHz (VITA 67.3) respectively were applied to one end of the "driven line". The "quiet line" was monitored using a spectrum or signal analyzer to measure any crosstalk signals.

3.9 Power Handling

VSWR measurements were taken at an operating temperature of 105°C at 3.0 to 30 MHz and 30 dBm, and at 30 MHz to 26.5 GHz and 20 dBm (VITA 67.2), or 30 MHz to 40 GHz and 20 dBm (VITA 67.3) respectively. Mated specimens were held at 105°C for 1 hour before performing VSWR.

3.10 Vibration, Class V3

Mated specimens were subjected to a random vibration test. The parameters of this test condition were specified by a random vibration spectrum with excitation frequency bounds of 5 and 2000 Hz. The Power Spectral Density (PSD) at 5 Hz was 0.005 G^2/Hz. The spectrum sloped up at 3 dB per octave to a PSD of 0.1 G^2/Hz at 100 Hz. The spectrum remained flat at 0.1 G^2/Hz from 100 to 1000 Hz. The spectrum sloped down at 6 dB per octave to a PSD of 0.025 G^2/Hz at the upper bound frequency of 2000 Hz. The root-mean square amplitude of the excitation was 12.0 GRMS. Specimens were subjected to this test for 1 hour in each of the 3 mutually perpendicular axes for a total test time of 3 hours per specimen. Cables on the specimens were secured to the vibrating surface no more than 25.4 mm from the module. Specimens were monitored for discontinuities of 100 nanoseconds or greater using an energizing current of 100 milliamperes.

3.11 Mechanical Shock, Class OS2

Mated specimens were subjected to a saw-tooth waveform with an acceleration amplitude of 40 gravity units (g's peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular axes for a total of 18 shocks. Cables on the specimens were secured to the vibrating surface no more than 25.4 mm from the module. Specimens were monitored for discontinuities of 100 nanoseconds or greater using an energizing current of 100 milliamperes.

3.12 Durability

Specimens were mated and unmated 500 times at a maximum rate of 600 cycles per hour.

3.13 Mating Force

The force required to mate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm per minute.

3.14 Unmating Force

The force required to unmate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm per minute.

3.15 Thermal Shock (non-operating)

Mated specimens were subjected to 5 cycles of thermal shock. See Figure 1 for test chamber profile.

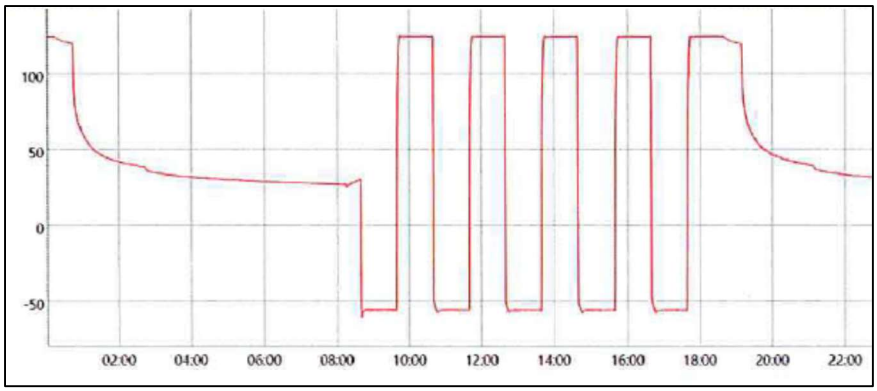

Figure 1 – Thermal Shock Test Chamber Profile

3.16 Operating Temperature

Mated specimens were exposed to temperatures between -40 and 85°C. VSWR measurements were taken at 22, -40 and 85°C.

3.17 Corrosion Resistance

Mated specimens were exposed to a 48 hour salt fog environment with periodic SO_2 injections. Specimens with a 2-piece backplane module were mounted in an optional enclosure with drain holes. Upon completion, specimens were rinsed and then dried for a minimum of 24 hours at 40°C.

3.18 Humidity

Mated specimens were exposed to 10 humidity/temperature cycles. Each cycle lasted 24 hours and consisted of cycling the temperature between 30 and 60°C while maintaining 95 percent humidity at all times except during descending temperature periods when the relative humidity may drop as low as 85%. See Figure 2 for test chamber profile.

3.18 Humidity (continued)

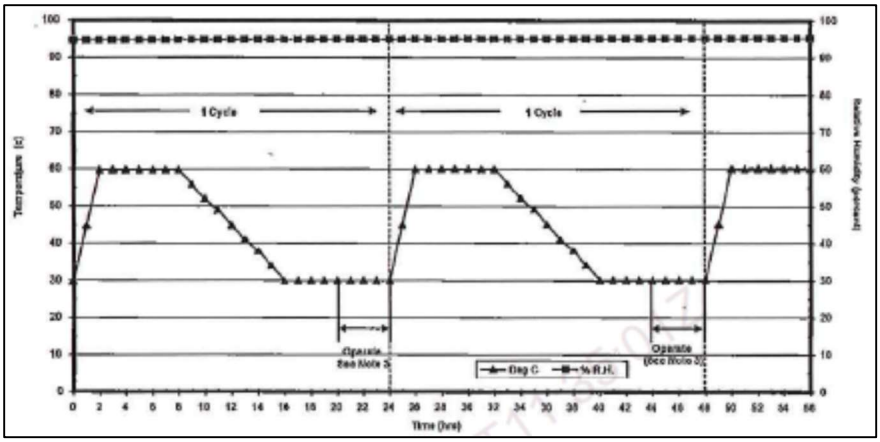

Figure 2 – Humidity Test Chamber Profile

3.19 Final Examination of Product

Specimens were visually examined with a microscope at 10X magnification for evidence of physical damage detrimental to product performance.