

AUGUST 31, 2009

TEST REPORT #208125

SSBP-20 AND SSBP-16
MICROWAVE COAXIAL ASSEMBLIES
TESTED FOR USE IN STANDARD MULTI-CONTACT
MIL-DTL-38999 CONNECTORS

PART NUMBERS

COAXIAL ASSEMBLIES

SIZE 20 SSBP

SSBP-20P (50000-001P)

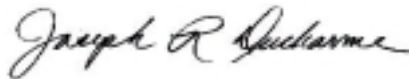
SSBP-20S (51000-001S)

SIZE 16 SSBP

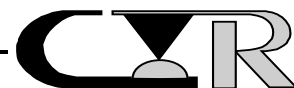
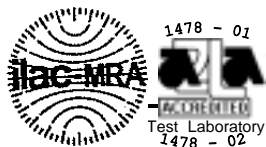
SSBP-16P (50200-001P)

SSBP-16S (51200-001S)

SOUTHWEST MICROWAVE, INC.



APPROVED BY: JOSEPH R. DUCHARME
PROJECT ENGINEERING MANAGER
CONTECH RESEARCH, INC.
ATTLEBORO, MA

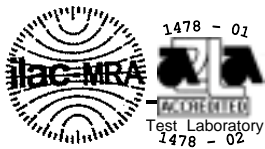


Contech Research

An Independent Test and Research Laboratory

REVISION HISTORY

DATE	REV. NO.	DESCRIPTION	ENG.
8/31/2009	1.0	Initial Issue.	JRD
10/6/2009	1.1	Clarifying input from test sponsor related to the sample description figure #2 added.	JRD



CERTIFICATION

This is to certify that the evaluation described herein was designed and executed by personnel of Contech Research, Inc. It was performed with the concurrence of Southwest Microwave, of Tempe, Arizona who was the test sponsor.

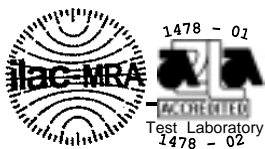
All equipment and measuring instruments used during testing were calibrated and traceable to NIST according to ISO 10012-1 and ANSI/NCSL Z540-1 and MIL-STD-45662 as applicable.

All data, raw and summarized, analysis and conclusions presented herein are the property of the test sponsor. No copy of this report, except in full, shall be forwarded to any agency, customer, etc., without the written approval of the test sponsor and Contech Research.



Approved By: Joseph R. Ducharme
Project Engineering Manager
Contech Research, Inc.
Attleboro, MA

JD:ld



SCOPE

To determine performance characterization of SSBP Coaxial Assemblies, Sizes 20 and 16 (as manufactured and submitted by the test sponsor Southwest Microwave) to meet vibration and shock performance levels of MIL-DTL-38999 "host" connectors.

APPLICABLE DOCUMENTS

1. Unless otherwise specified, the following documents of issue in effect at the time of testing performed form a part of this report to the extent as specified herein. The requirements of sub-tier specifications and/or standards apply only when specifically referenced in this report.
2. Military Specifications: MIL-DTL-38999K
3. Standards: EIA Publication 364

TEST SAMPLES AND PREPARATION

1. The following test samples were submitted by the test sponsor, Southwest Microwave, for the evaluation to be performed by Contech Research, Inc.

COAXIAL ASSEMBLIES, Description and Model Number
SIZE 20 SSBP

SSBP-20P (50000-001P) with 36 in. .047 flex. coax cable to SMA plug.
SSBP-20S (51000-001S) with 36 in. .047 flex. coax cable to SMA plug.

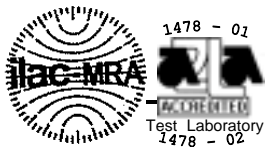
SIZE 16 SSBP

SSBP-16P (50200-001P) with 36 in. .086 flex. coax cable to SMA plug.
SSBP-16S (51200-001S) with 36 in. .086 flex. coax cable to SMA plug.

<u>Host Connectors (Generic MIL-reference)</u>		<u>Quantity</u>
D38999/26FD5SN	mating to D38999/20FD5PN	3
D38999/26FA98SN	mating to D38999/20FA98PN	4

Connector Cavity Content

<u>Arrangement</u>	<u>Contents</u>	<u>(Qty. per Connector)</u>
D5	SSBP-16	(5 per connector)
A98	SSBP-20	(3 per connector)



TEST SAMPLES AND PREPARATION continued

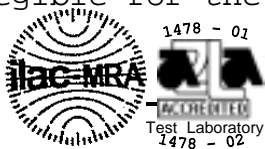
2. The SSBP coaxial contact assemblies were supplied by the test sponsor already terminated to cable per above with field-replaceable SMA cable plugs attached. The SSBP assemblies were installed in D38999 connectors as supplied by test sponsor.
3. All test samples were coded and identified by Contech Research to maintain continuity throughout the test sequences. Upon initiating testing, mated test samples remained with each other throughout the test sequences for which they were designated. All tests involve mated connectors with full compliment of SSBP coaxes loaded into appropriate sized contact cavities.
4. Connectors used were purchased using QPL sourcing and MIL-numbering. There were used for testing in "as is" condition as supplied by QPL manufacturer.
5. All equipment and measuring instruments used during testing were calibrated and traceable to NIST according to ISO 10012-1 and ANSI/NCSL Z540-1, as applicable.

TEST SELECTION

1. All tests were performed in accordance with the applicable sequences and procedures as specified in MIL-DTL-38999K. The interchangeability (dimensional inspection) was "accepted" without study based upon manufacturers' QPL listing and further analysis was not performed by test sponsor or Contech Research.
2. The following test groups were established, see Test Plan Flow Diagram, Figure #1.
3. Test set ups and/or procedures which are standard or common are not detailed or documented herein provided they are certified as being performed in accordance with the applicable (industry or military) test methods, standards and/or drawings as specified in the detail specification.

SAMPLE CODING

All samples were coded. Mated test samples remained with each other throughout the test group/sequences for which they were designated. Coding was performed in a manner which remained legible for the test duration.



Connector Selection (MIL PART NUMBER)

1. Connectors used were from more than one manufacturer. The use of multi-sourced connectors, identified by MIL-number from current QPL, provided product descriptions independent of the manufacturer. The standardization of connector (and contact cavities) design and dimensioning permits "SSBP" to be interchangeable, for this testing, with non-coax (i.e., standard) signal contacts as follows:

<u>Description</u>	<u>MIL Contact Number</u>	<u>SSBP Coax Descr.(number)</u>
Size 20, Pin	M39029/58-363	SSBP-20P (50000-001P)
Size 20, Skt	M39029/56-351	SSBP-20S (51000-001S)
Size 16, Pin	M39029/58-364	SSBP-16P (50200-001P)
Size 16, Skt	M39029/56-352	SSBP-16S (51200-001S)

2. The use of MIL part numbers does not imply application preference for any connector or manufacturer, MIL or COTS-equivalent provided that standardized dimensions for contact cavities and insert alignment are maintained. This testing is on the SSBP coax assemblies and any differences between host connectors was ignored.

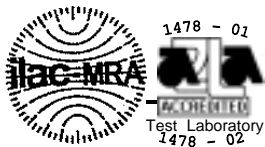


FIGURE #1

Test Plan Flow Diagram

VIBRATION (60 g's)

VSWR @ START
|
VSWR @ 6 HOURS
|
VSWR @ FINAL
|
MECHANICAL SHOCK

VIBRATION (43 g's)

VSWR @ START
|
VSWR @ 4 HOURS
|
VSWR @ START
|
MECHANICAL SHOCK

VIBRATION (50 g's)

VSWR @ START
|
VSWR @ 4 HOURS
|
VSWR @ START
|
MECHANICAL SHOCK

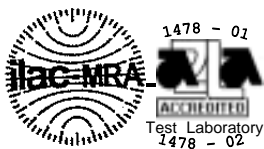
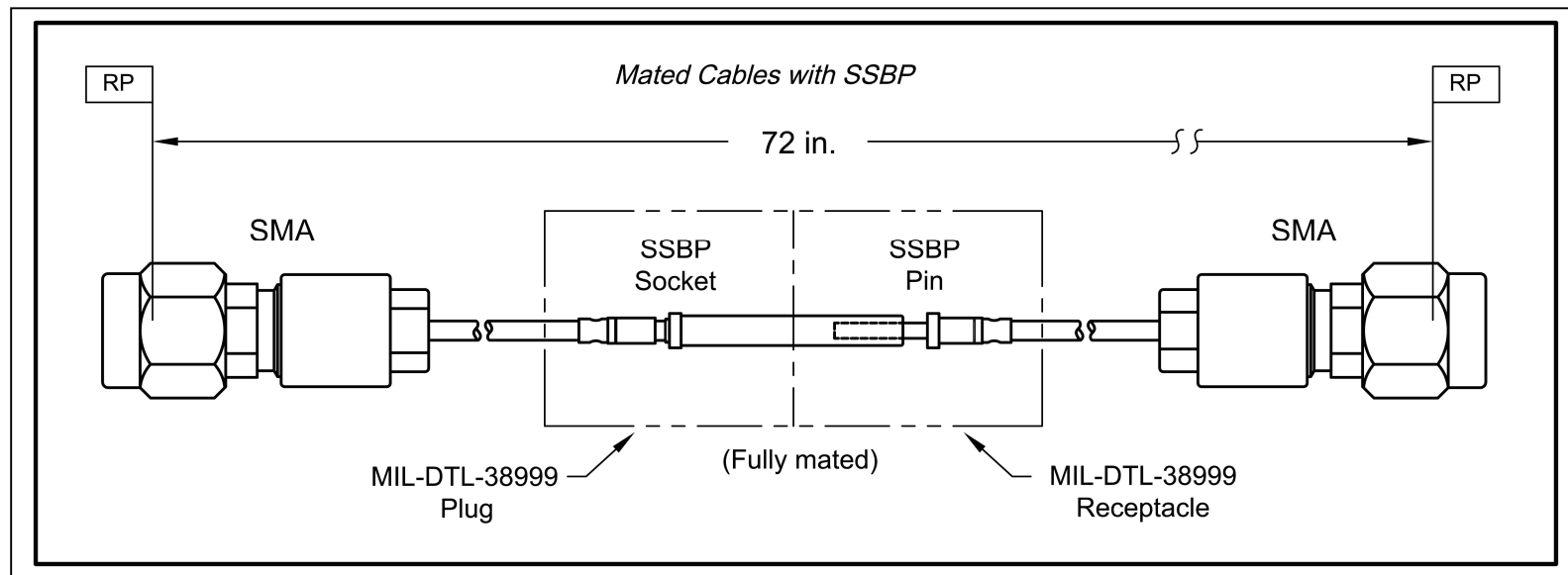


VOLTAGE STANDING WAVE RATIO (VSWR)

1. Testing focuses on coaxial assemblies, results of VSWR measurements are deemed critical to confirm performance.
2. VSWR measurements were taken multiple times during the testing. Signal continuity was maintained at 6 GHz during vibration.
3. All VSWR measurements were at 6 GHz. test configuration is in accordance with Figure 2.

Figure 2.

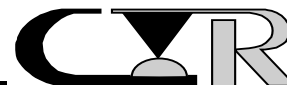
Schematic of Single-Line SSBP-to-SSBP within mated D38999 "host" connectors. VSWR measurements include RP to RP (SMA/plugs, cables, and SSBP P/S pair).



DATA SUMMARY

<u>TEST</u>	<u>REQUIREMENTS</u>	<u>VSWR RESULTS</u>	
VIBRATION			
SINE	NO DAMAGE	PASSED	
VSWR		MAXIMUM	MINIMUM
*D38999/26FD5SN	Initial	1.074	1.054
	Completion	1.147	1.024
*D38999/26FA98SN	Initial	1.103	1.035
	Completion	1.075	1.064
RANDOM (43 g's)	NO DAMAGE	PASSED	
VSWR		MAXIMUM	MINIMUM
*D38999/26FD5SN	Initial	1.217	1.054
	Completion	1.074	1.057
*D38999/26FA98SN	Initial	1.071	1.057
	Completion	1.150	1.065
RANDOM (50 g's)	NO DAMAGE	PASSED	
VSWR		MAXIMUM	MINIMUM
*D38999/26FD5SN	Initial	1.203	1.028
	Completion	1.063	1.011
*D38999/26FA98SN	Initial	1.203	1.044
	Completion	1.059	1.028
MECHANICAL SHOCK	NO DISCONTINUITY >1.0	PASSED	

* Host connector with corresponding mate.

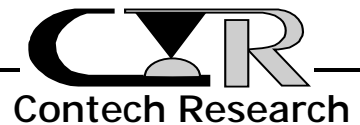
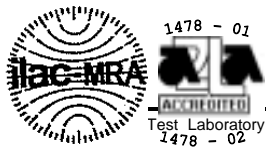


Contech Research

An Independent Test and Research Laboratory

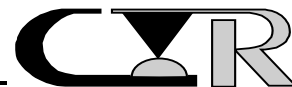
EQUIPMENT LIST

ID#	Next Cal	Last Cal	Equipment Name	Manufacturer	Model #	Serial #	Accuracy	Freq. Cal
14	7/13/2010	7/13/2009	Accelerometer	PCB Piezotronics	302A	7040	See Cal Cert	12mon
30	4/21/2010	4/21/2009	Discontinuity Monitor	Assoc. Test Lab	DM-600-01	382-1	See Cal Cert	12mon
473	12/5/2009	12/5/2008	Network Analyzer	Hewlett Packard	8753C	3310A2696	See Cal Cert	12 mon.
474	12/5/2009	12/5/2008	S-Parameter (Test Set)	Hewlett Packard	85047A	3033A03119	See Cal Cert	12 mon.
553	3/13/2010	3/13/2009	12 channel Power Unit	PCB Co.	483A	1303	See Cal Cert	12mon
1166	8/24/2010	8/24/2009	Sine/Rndm Vib Control Digitizer	Hewlett Packard	E1432A	US39342279	See Cal Cert	12mon
1167			Interface	Hewlett Packard	E8491B	US390100753	N/A	N/A
1168			Mainframe	Hewlett Packard	E8408A	US39000357	N/A	N/A
1174			Drill Press Stand	Sears	Craftsman	N/A	N/A	N/A
1271			Amplifier	Unholtz Dickie	SA15	3483	N/A	N/A
1272			Shaker Table	Unholtz Dickie	S202PB	263	N/A	N/A
1348			Low&High Temp Oven	Curtin Matheson	Equitherm	108T-11	N/A	Ea Test
1533			Computer	Systemax	Venture	105248475	N/A	N/A



An Independent Test and Research Laboratory

TEST RESULTS



PROCEDURE:-continued

6. Prior to performing variable measurements, the test samples were allowed to recover to room ambient conditions.
7. VSWR was measured at scheduled points during vibration.

REQUIREMENTS:

1. There shall be no evidence of physical damage to the SSBP coaxes or connector samples as tested.
2. There shall be no contact interruption greater than 1.0 microsecond.
3. There shall be no evidence of axial movement of the SSBP coaxes or connector samples relative to each other.

RESULTS:

1. The test samples as tested met the requirements as specified.
2. There was no physical damage to the test samples as tested.
3. There was no interruption greater than 1.0 microsecond.
4. The sinusoidal vibration profiles are illustrated in the Figures #3, #4 and #5.
5. The sinusoidal vibration photos are illustrated in the Figures #6, #7 and #8.

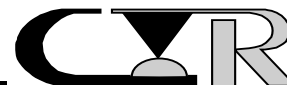
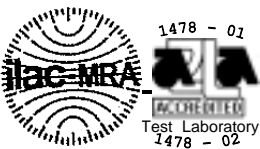
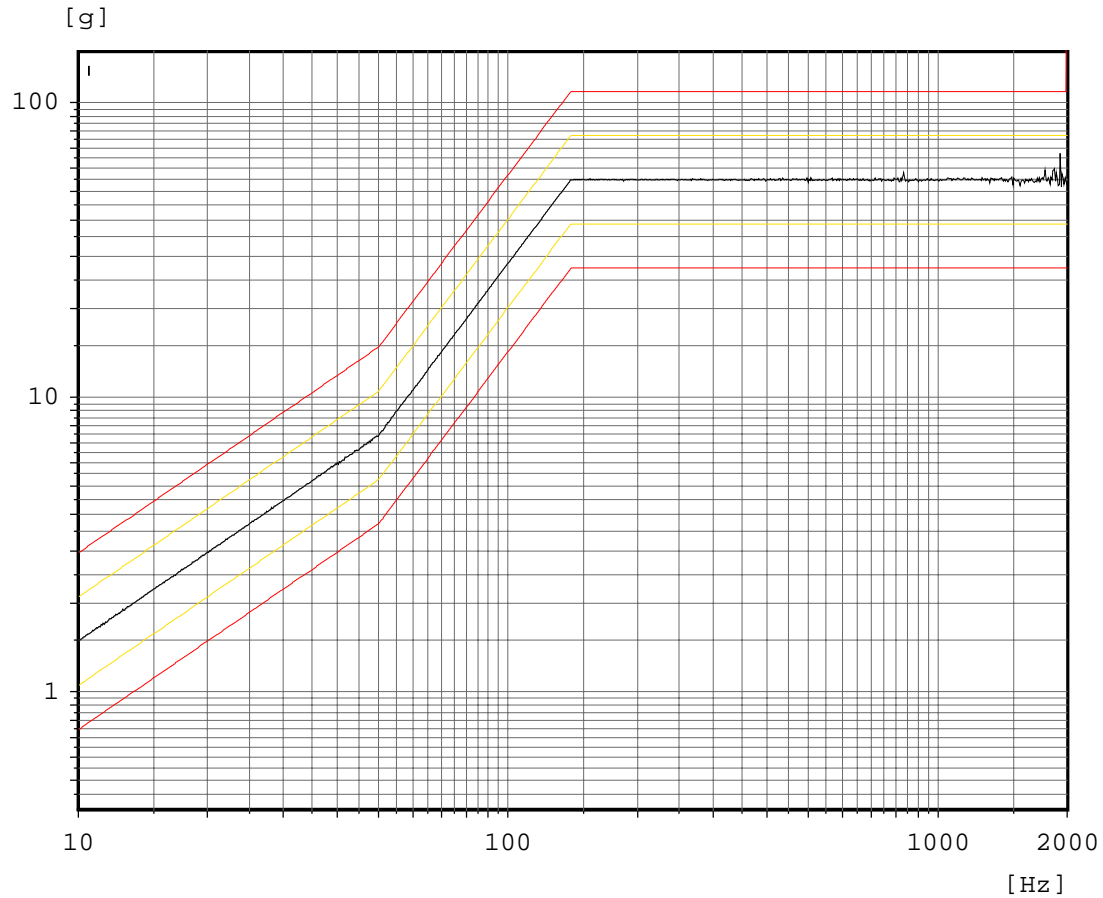


FIGURE #3

Sine

Channel 1



Project# 208125
Run 60G
Z-Axis
Test Conditions:
10-2000-10Hz
ID#:9P10R,1P2R
Tech:MOB
Date:07/09/09

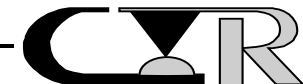
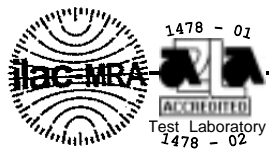
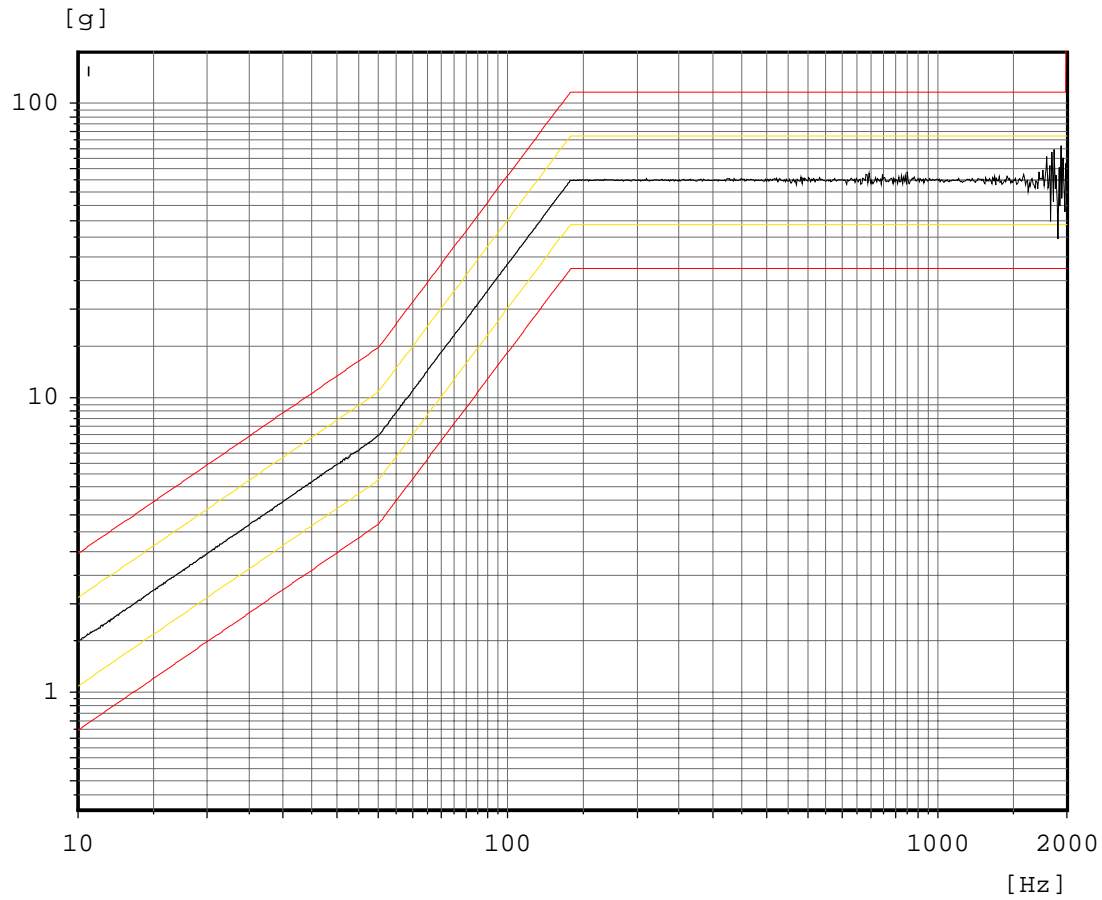


FIGURE #4

Sine

Channel 1



Project# 208125
Run 60G Sine
X-Axis
Test Conditions:
10 to 2000 to 10 Hz
60G
ID#:9P10R,1P2R
Tech:MOB
Date:07/13/09

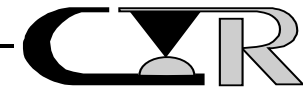
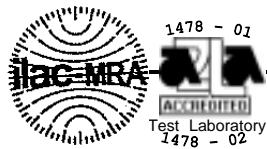
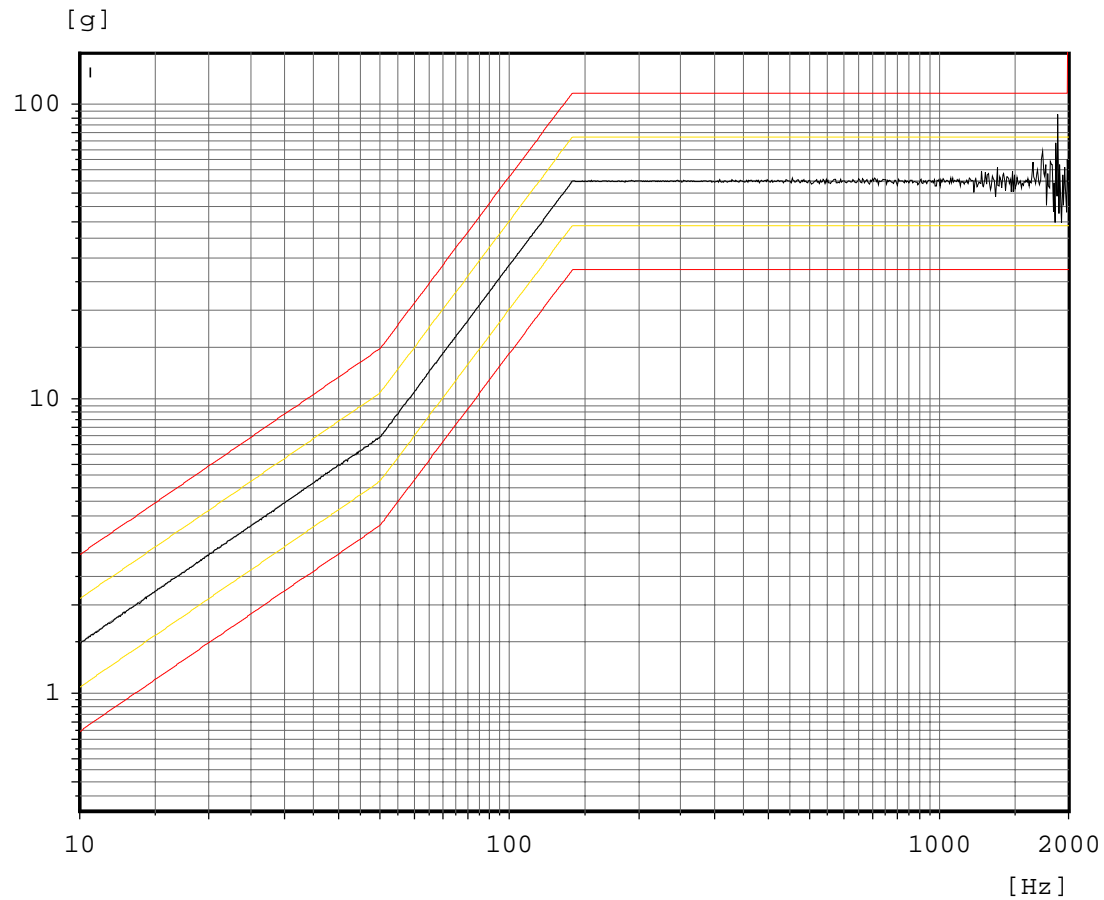


FIGURE #5

Sine

Channel 1



Project# 208125
Run60G
Y-Axis
Test Conditions:
10-2000-10Hz, 60G
ID#: 9P10R, 1P2R
Tech: MOB
Date: 07/15/09

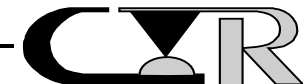
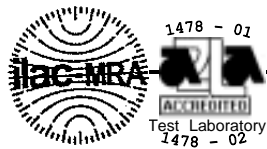


FIGURE #6

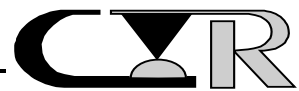
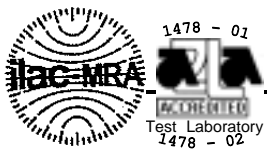
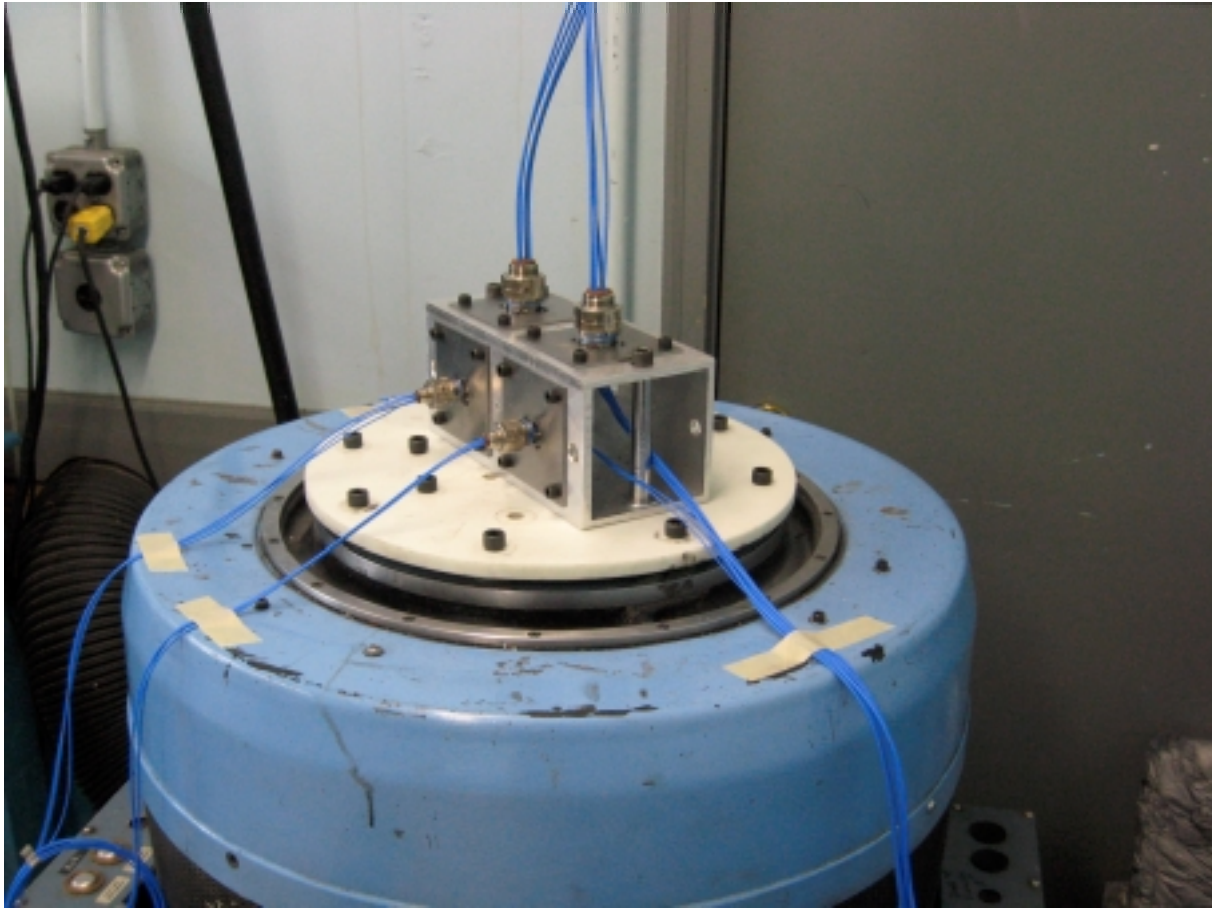


FIGURE #7

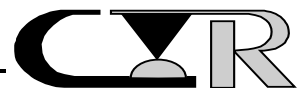
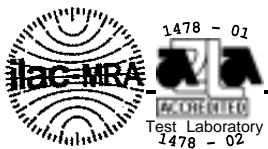
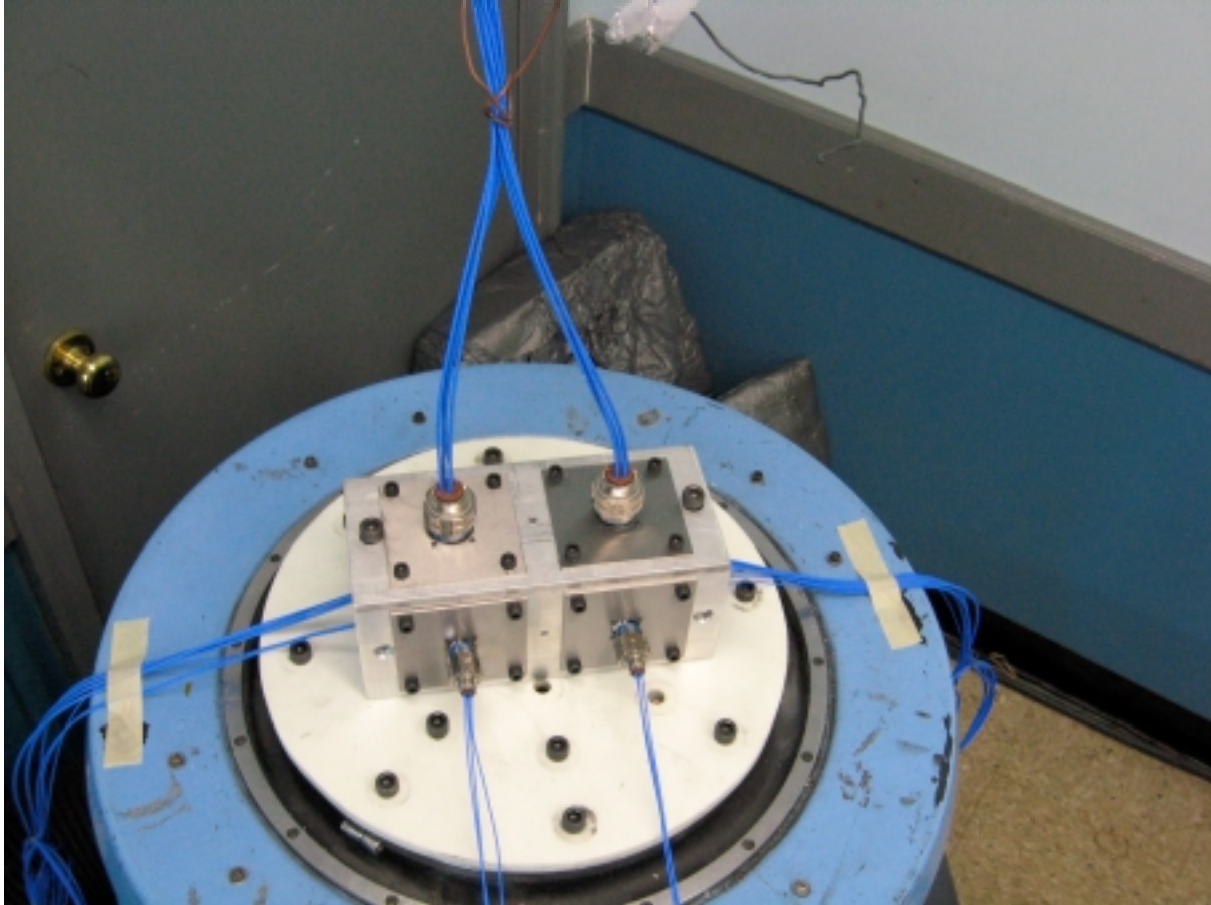
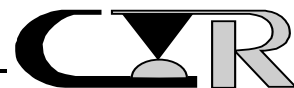
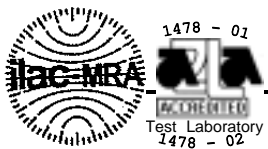
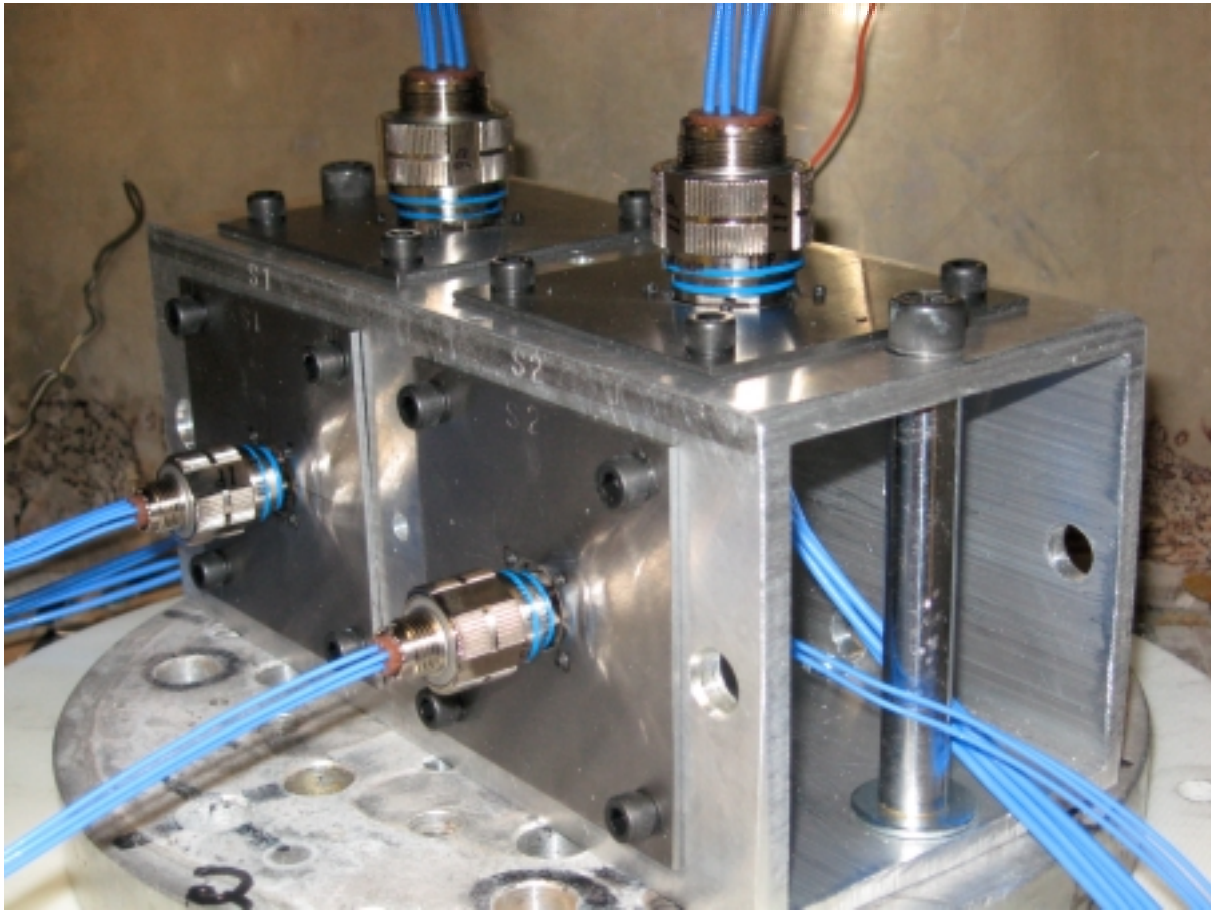


FIGURE #8



PROJECT NO.: 208125

SPECIFICATION: MIL-DTL-38999

PART NO.: See Item 5.

PART DESCRIPTION: SSBP Coaxes

SAMPLE SIZE: 1 Each

TECHNICIAN: S-R

START DATE: 7/08/09

COMPLETE DATE: 7/15/09

ROOM AMBIENT: 22°C

RELATIVE HUMIDITY: 35%

EQUIPMENT ID#: 473, 474

VOLTAGE STANDING WAVE RATIO (VSWR)

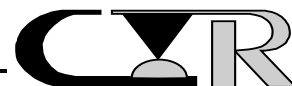
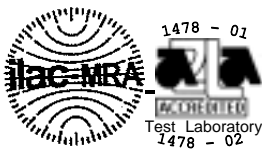
PROCEDURE:

1. The test was performed in accordance with Specification EIA-364, Test procedure 108. Basic interconnect schematic is shown in Figure 2 (page 8).
2. The test equipment including cables and adapters was calibrated using precision 0 and 50 ohm loads and high frequency test leads.
3. The test samples under test were terminated using SMA terminations which connected to test system and the characteristic VSWR was measured.
4. The VSWR was plotted over the range of frequencies listed with discreet points measured as noted below.
5. Test Conditions:
 - a) Frequency Range : 3.0 MHz thru 6.0 GHz
 - b) Termination Impedance : 50 Ω
 - c) No. of Positions Tested : 3 positions

REQUIREMENTS:

The VSWR shall be measured and recorded.

RESULTS: See Next Page.



RESULTS:

The following is a summary of the data observed:

VSWR (Sine, 60 g's):

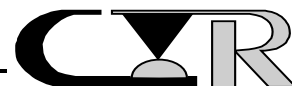
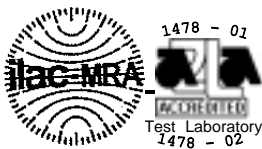
FREQUENCY 6GHz
(Milliohms)

For SSBP in Connector

<u>Part Number (ID#)</u>	<u>Avg.</u>	<u>Max.</u>	<u>Min.</u>	<u>Std. Dev.</u>
<u>D38999/2*FA-98*N (Reference Hosts)</u>				
1P2R (initial)	1.061	1.074	1.054	0.011
1P2R (Z-axis1)	1.031	1.041	1.024	0.009
1P2R (Z-axis2)	1.034	1.037	1.031	0.003
1P2R (X-axis1)	1.029	1.035	1.026	0.005
1P2R (X-axis2)	1.030	1.036	1.024	0.006
1P2R (Y-axis1)	1.031	1.036	1.025	0.005
1P2R (Y-axis2)	1.072	1.147	1.024	0.066

D38999/2*FD-5*N (Reference Hosts)

9P10R (initial)	1.078	1.103	1.035	0.038
9P10R (Z-axis1)	1.045	1.054	1.038	0.008
9P10R (Z-axis2)	1.090	1.175	1.040	0.074
9P10R (X-axis1)	1.101	1.178	1.156	0.067
9P10R (X-axis2)	1.094	1.176	1.042	0.072
9P10R (Y-axis1)	1.063	1.071	1.056	0.011
9P10R (Y-axis2)	1.069	1.075	1.064	0.006



Contech Research

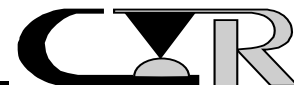
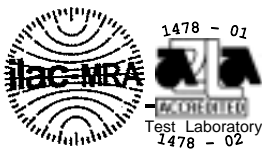
An Independent Test and Research Laboratory

REQUIREMENTS:

1. There shall be no evidence of physical damage to the SSBP coax and connector test samples as tested.
2. There shall be no SSBP-mated interruption greater than 1.0 microsecond.
3. There shall be no evidence of axial movement of the SSBP coax and connector test samples relative to each other.

RESULTS:

1. The test samples as tested met the requirements as specified.
2. There was no physical damage to the test samples as tested.
3. There was no interruption greater than 1.0 microsecond.
4. The random vibration profiles are illustrated in Figures #9 and #10.
5. The random vibration photos are illustrated in Figures #11 and #12.



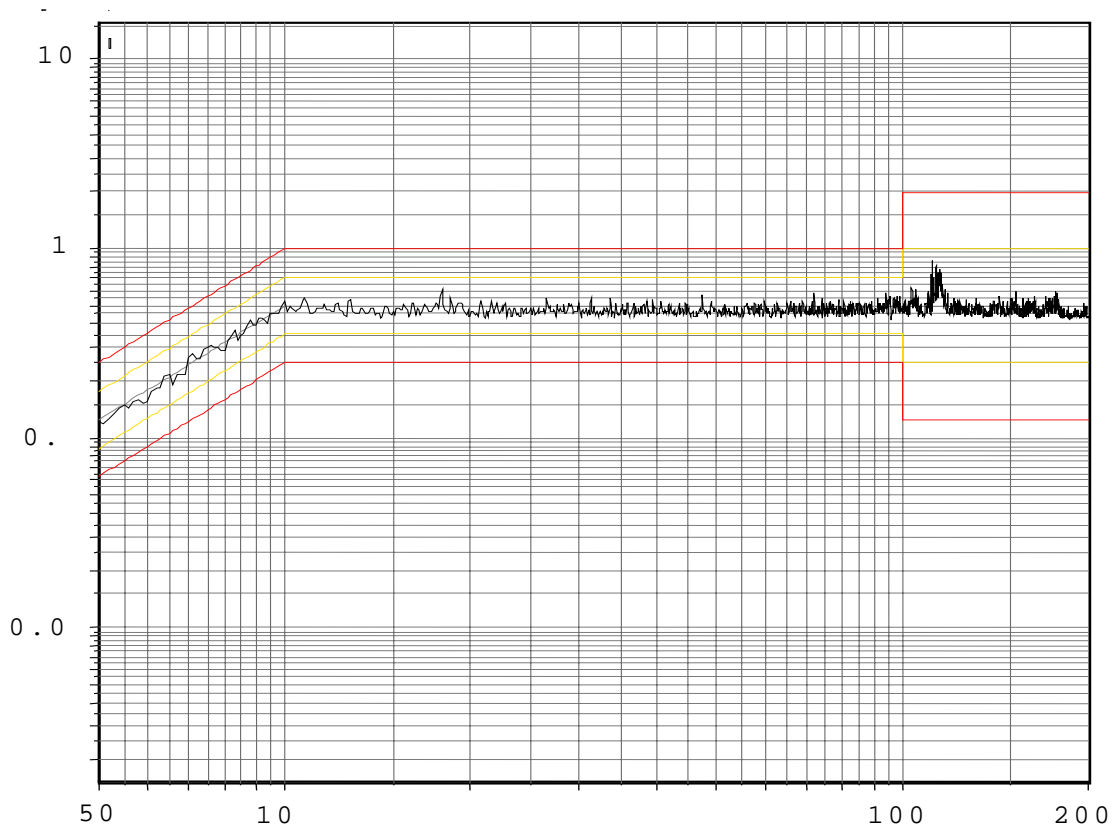
Contech Research

An Independent Test and Research Laboratory

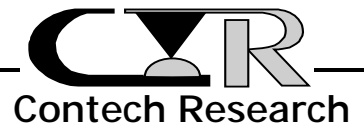
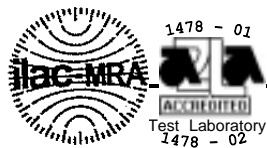
FIGURE #9

Random

Control channel



Project# 208125
Run 43.9G
Longitudinal-Axis
Test Conditions:
50Hz to 2000Hz
43.9G Random
ID#:11P12R,3P4R
Tech: MOB
Date:07/17/09

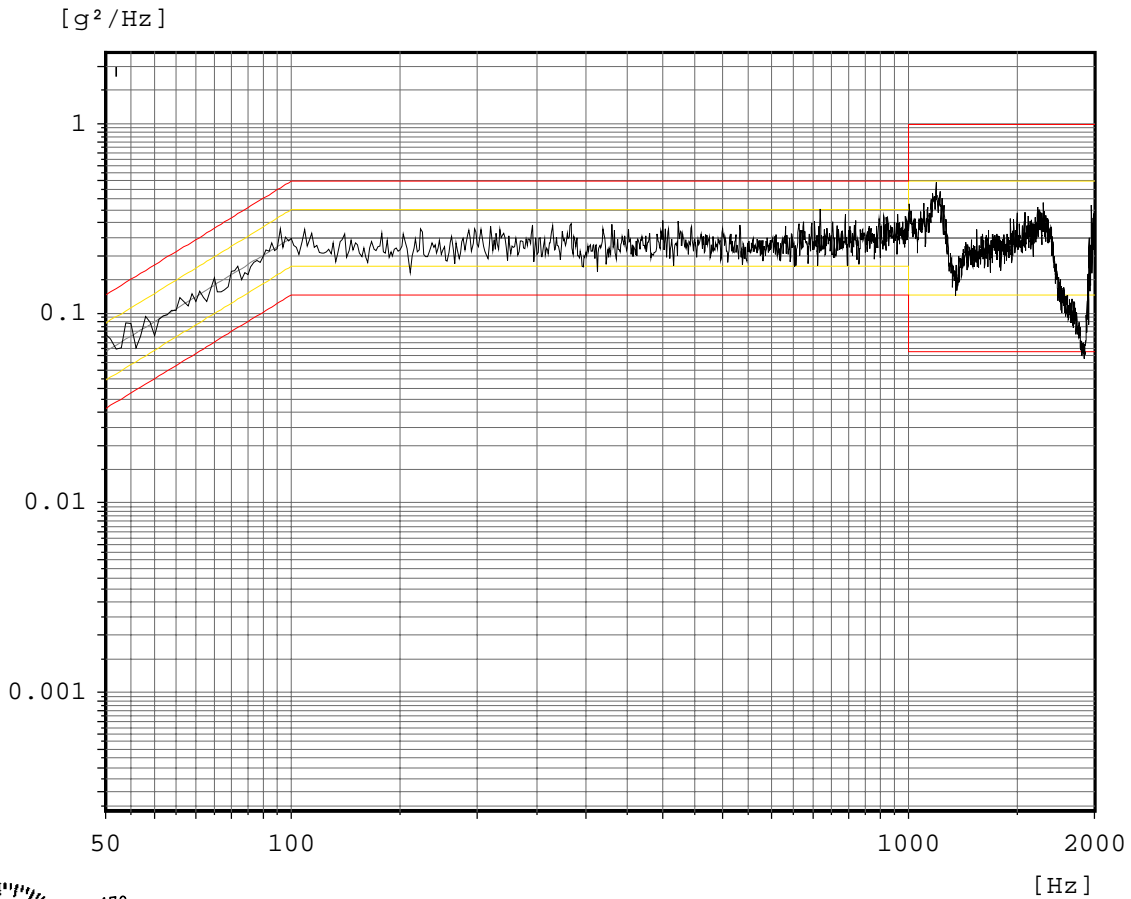


An Independent Test and Research Laboratory

FIGURE #10

Random

Control channel



Project# 208125
Run 43.9G
Perpendicular -Axis
Test Conditions:
43.9G Random
50Hz to 2000Hz
ID#:11p12R,3P4R
Tech:MOB
Date:07/20/09

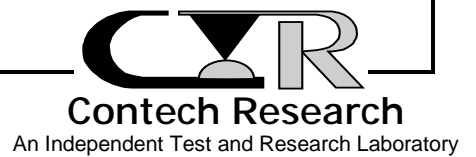
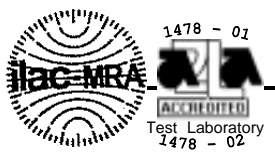
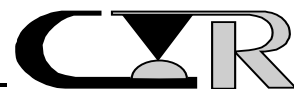
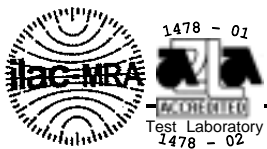


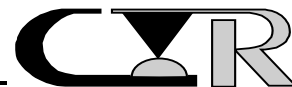
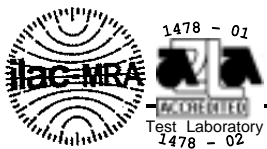
FIGURE #11



Contech Research

An Independent Test and Research Laboratory

FIGURE #12



PROJECT NO.: 208125

SPECIFICATION: MIL-DTL-38999

PART NO.: See Item 5.

PART DESCRIPTION: SSBP Coaxes

SAMPLE SIZE: 1 Each

TECHNICIAN: S-R

START DATE: 7/14/09

COMPLETE DATE: 7/21/09

ROOM AMBIENT: 22°C

RELATIVE HUMIDITY: 49%

EQUIPMENT ID#: 473, 474

VOLTAGE STANDING WAVE RATIO (VSWR)

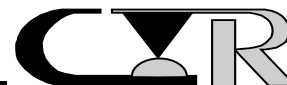
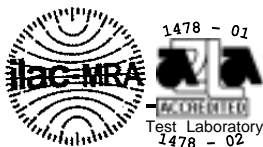
PROCEDURE:

1. The test was performed in accordance with Specification EIA-364, Test procedure 108. (See Figure 2, page 8.)
2. The test equipment including cables and adapters was calibrated using precision 0 and 50 ohm loads and high frequency test leads.
3. The test samples under test were terminated using SMA terminations which connected to test system and the characteristic VSWR was measured.
4. The VSWR was plotted over the range of frequencies listed with discreet points measured as noted below.
5. Test Conditions:
 - a) Frequency Range : 3.0 MHz thru 6.0 GHz
 - b) Termination Impedance : 50 Ω
 - c) No. of Positions Tested : 3 positions

REQUIREMENTS:

The VSWR shall be measured and recorded.

RESULTS: See Next Page.



Contech Research

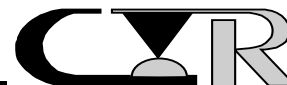
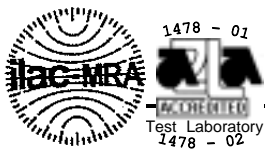
An Independent Test and Research Laboratory

RESULTS:

The following is a summary of the data observed:

VSWR (Random, 43 g's):

	FREQUENCY 6GHz (Milliohms)			
SSBP in Connectors Part Number (ID#)	<u>Avg.</u>	<u>Max.</u>	<u>Min.</u>	<u>Std. Dev.</u>
<u>D38999/2*FA-98*N (Reference Hosts)</u>				
3P4R (initial)	1.111	1.217	1.054	0.092
3P4R (longitudinal1)	1.048	1.052	1.042	0.005
3P4R (longitudinal2)	1.057	1.066	1.044	0.012
3P4R (perpendicular1)	1.053	1.056	1.048	0.004
3P4R (perpendicular2)	1.064	1.074	1.057	0.009
<u>38999/2*FD-5*N (Reference Hosts)</u>				
11P12R (initial)	1.064	1.071	1.057	0.007
11P12R (longitudinal1)	1.047	1.054	1.034	0.011
11P12R (longitudinal2)	1.043	1.504	1.035	0.010
11P12R (perpendicular1)	1.206	1.546	1.032	0.295
11P12R (perpendicular2)	1.115	1.150	1.065	0.045



Contech Research

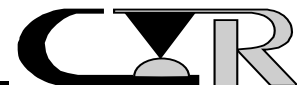
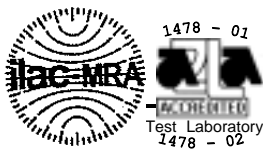
An Independent Test and Research Laboratory

REQUIREMENTS:

1. There shall be no evidence of physical damage to the SSBP coax and connector test samples as tested.
2. There shall be no contact interruption greater than 1.0 microsecond.
3. There shall be no evidence of axial movement of the SSBP coax and connector test samples relative to each other.

RESULTS:

1. The test samples as tested met the requirements as specified.
2. There was no physical damage to the test samples as tested.
3. There was no interruption greater than 1.0 microsecond.
4. The random vibration profiles are illustrated in Figures #13 and #14.
5. The random vibration photos are illustrated in Figures #15 and #16.

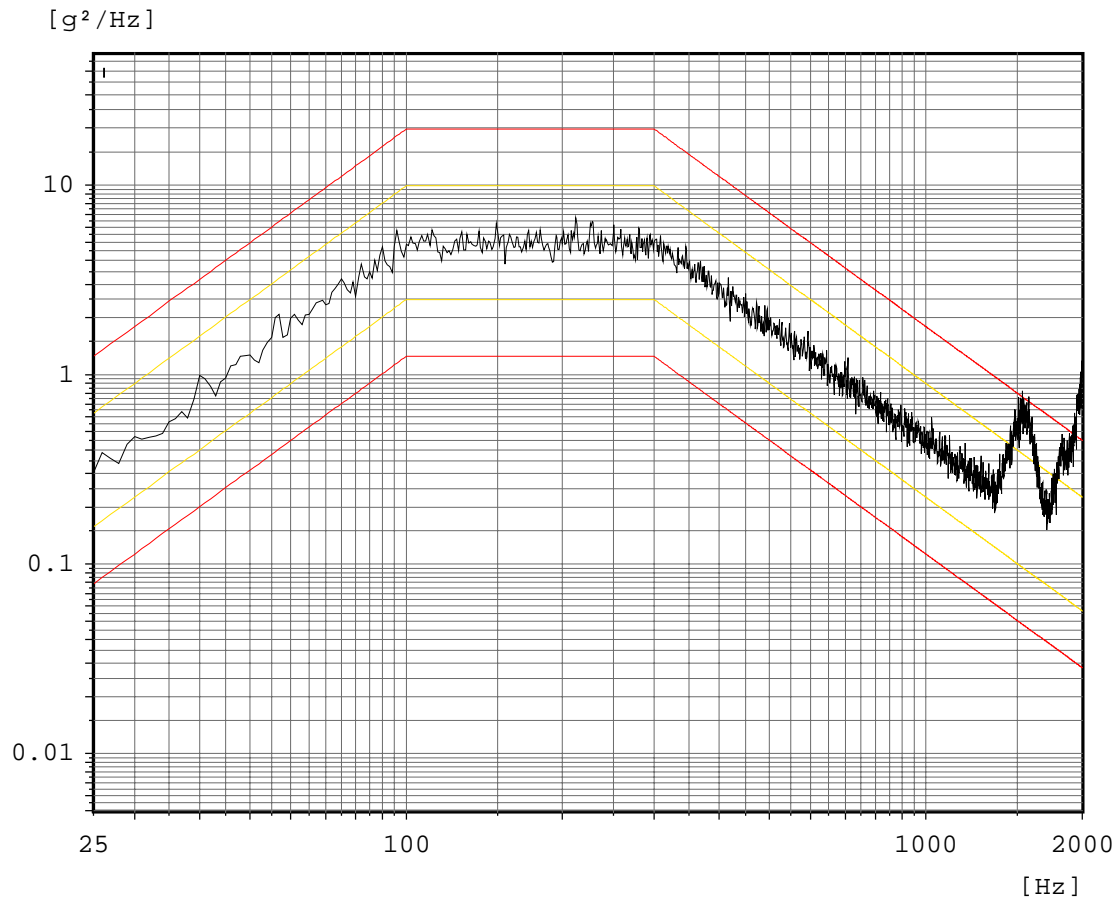


Contech Research

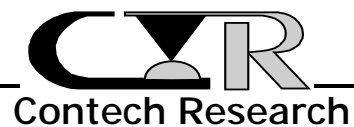
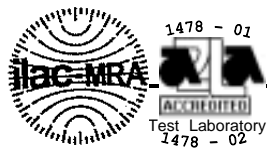
An Independent Test and Research Laboratory

Random

FIGURE #13
Control channel



Project# 208125
Run 50G
Longitudinal -Axis
Test Conditions:
25 Hz to 2000 Hz
50G Random
ID#: 13P14R,5P6R
Tech:MOB
Date:08/02/09

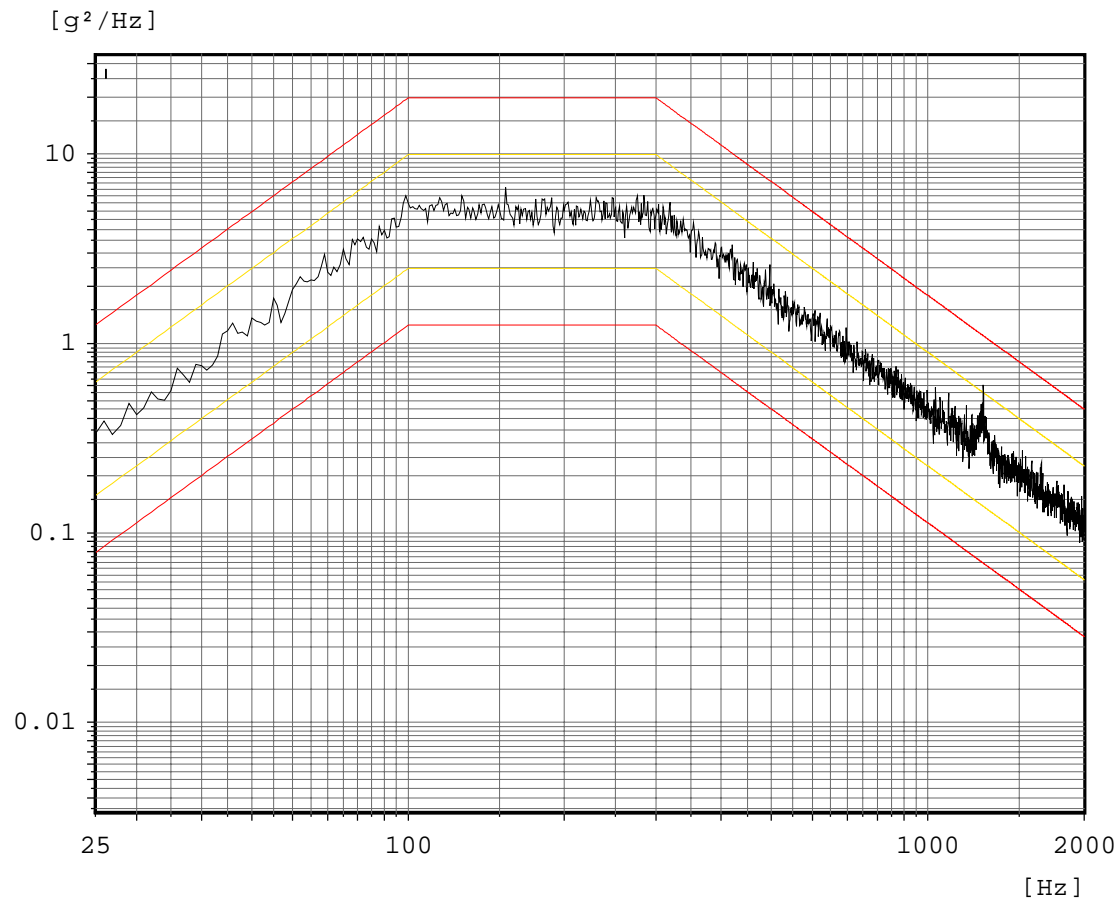


An Independent Test and Research Laboratory

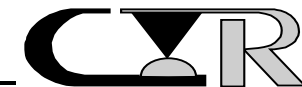
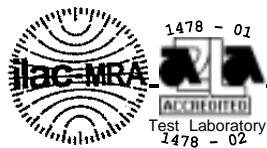
FIGURE #14

Random

Control channel



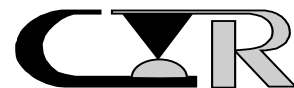
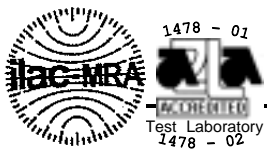
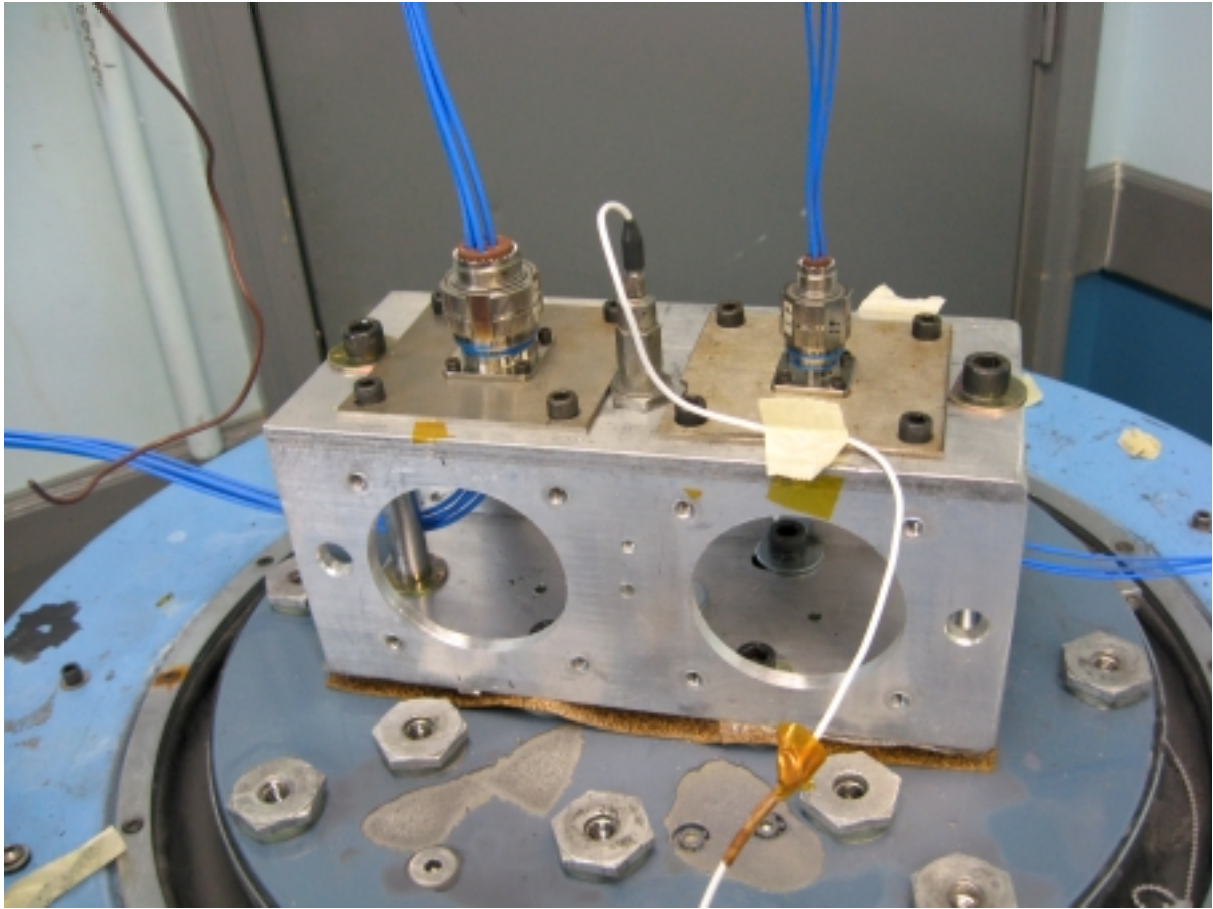
Project# 208125
Run:50G
Perpendicular -Axis
Test Conditions:
25Hz to 2000Hz
50G Random
ID#:13P14R,5P6R
Tech: MOB
Date:08/07/09



Contech Research

An Independent Test and Research Laboratory

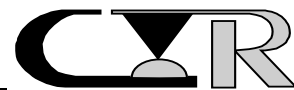
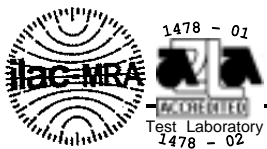
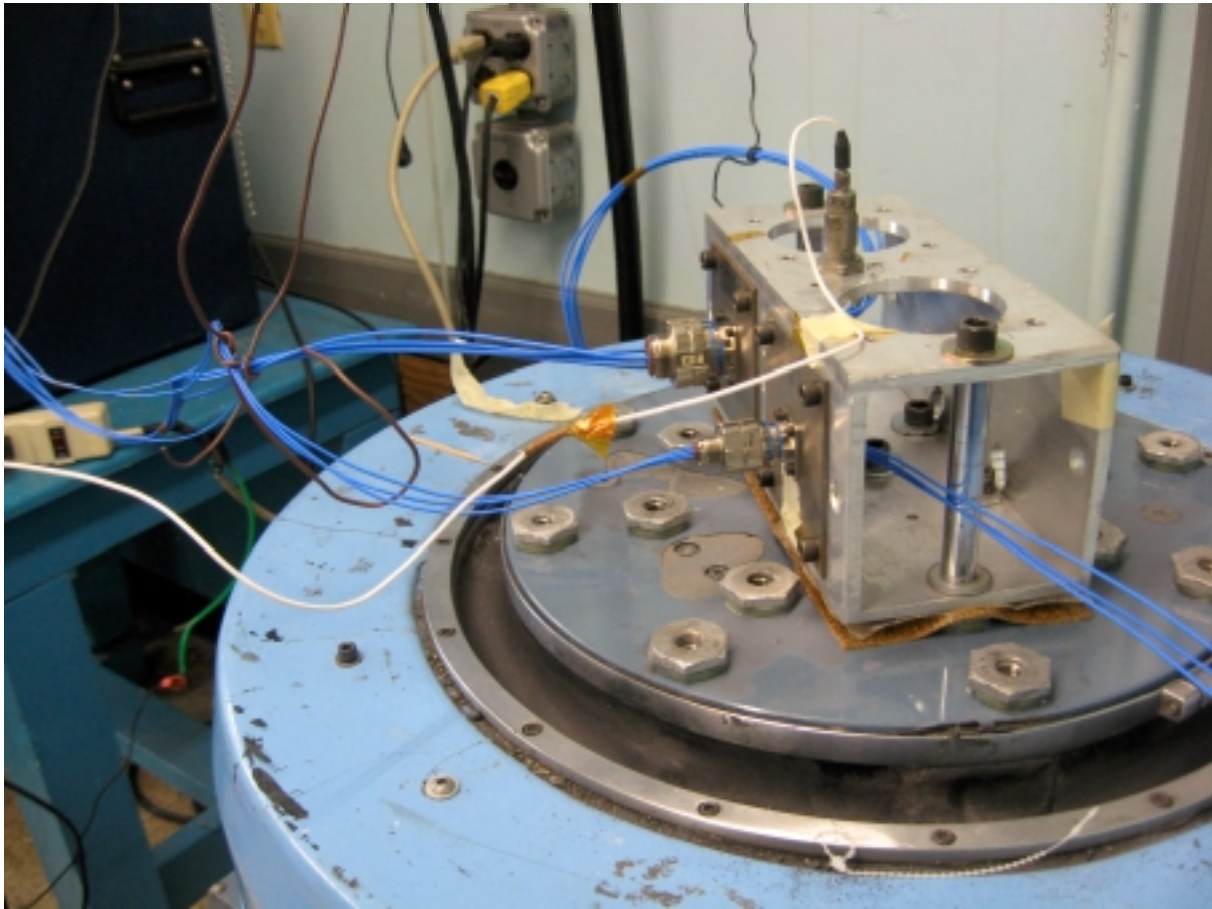
FIGURE #15



Contech Research

An Independent Test and Research Laboratory

FIGURE #16



Contech Research

An Independent Test and Research Laboratory

PROJECT NO.: 208125

SPECIFICATION: MIL-DTL-38999

PART NO.: See Item 5.

PART DESCRIPTION: SSBP Coaxes

SAMPLE SIZE: 1 Each P/N

TECHNICIAN: S-R

START DATE: 7/21/09

COMPLETE DATE: 7/27/09

ROOM AMBIENT: 22°C

RELATIVE HUMIDITY: 46%

EQUIPMENT ID#: 473, 474

VOLTAGE STANDING WAVE RATIO (VSWR) VIA

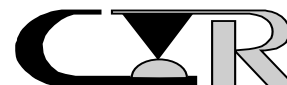
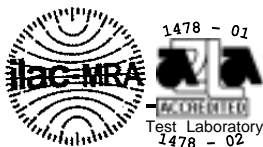
PROCEDURE:

1. The test was performed in accordance with Specification EIA-364, Test procedure 108. (Refer to Figure 2, page 8.)
2. The test equipment including cables and adapters was calibrated using precision 0 and 50 ohm loads and high frequency test leads.
3. The test samples under test were terminated using SMA terminations which connected to test system and the characteristic VSWR was measured.
4. The VSWR was plotted over the range of frequencies listed with discreet points measured as noted below.
5. Test Conditions:
 - a) Frequency Range : 3.0 MHz thru 6.0 GHz
 - b) Termination Impedance : 50 Ω
 - c) No. of Positions Tested : 3 positions

REQUIREMENTS:

The VSWR shall be measured and recorded.

RESULTS: See Next Page.



Contech Research

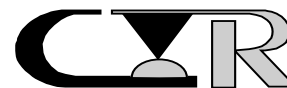
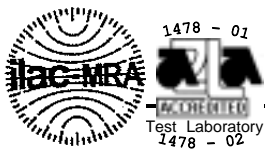
An Independent Test and Research Laboratory

RESULTS:

The following is a summary of the data observed:

VSWR (Random, 50 g's):

Host connectors Part Number (ID#)	FREQUENCY 6GHz (Milliohms)			
	<u>Avg.</u>	<u>Max.</u>	<u>Min.</u>	<u>Std. Dev.</u>
<u>D38999/2*FA-98*N</u>				
5P6R (initial)	1.043	1.054	1.028	0.013
5P6R (longitudnal1)	1.058	1.066	1.044	0.012
5P6R (longitudnal2)	1.038	1.063	1.006	0.029
5P6R (perpendicular1)	1.037	1.064	1.001	0.027
5P6R (perpendicular2)	1.037	1.063	1.011	0.026
<u>D38999/2*FD-5*N</u>				
13P14R (initial)	1.145	1.203	1.044	0.088
13P14R (longitudnal1)	1.047	1.057	1.028	0.017
13P14R (longitudnal2)	1.048	1.060	1.029	0.016
13P14R (perpendicular1)	1.047	1.056	1.030	0.014
13P14R (perpendicular2)	1.047	1.059	1.028	0.017



Contech Research

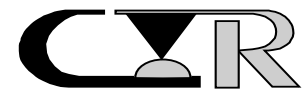
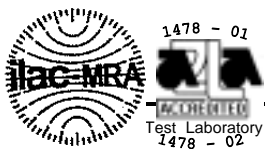
An Independent Test and Research Laboratory

REQUIREMENTS:-continued

3. There shall be no contact interruption greater than 1.0 microsecond.

RESULTS:

1. The test samples as tested met the requirements as specified.
2. There was no evidence of physical damage to the test samples as tested.
3. There was no contact interruption greater than 1.0 microsecond.
4. The Mechanical Shock characteristics are shown in Figures #17 and #18 (Calibration Pulse) and #19 (Test Pulse). Each figure displays the shock pulse contained within the upper and lower limits as defined by the appropriate test specification.

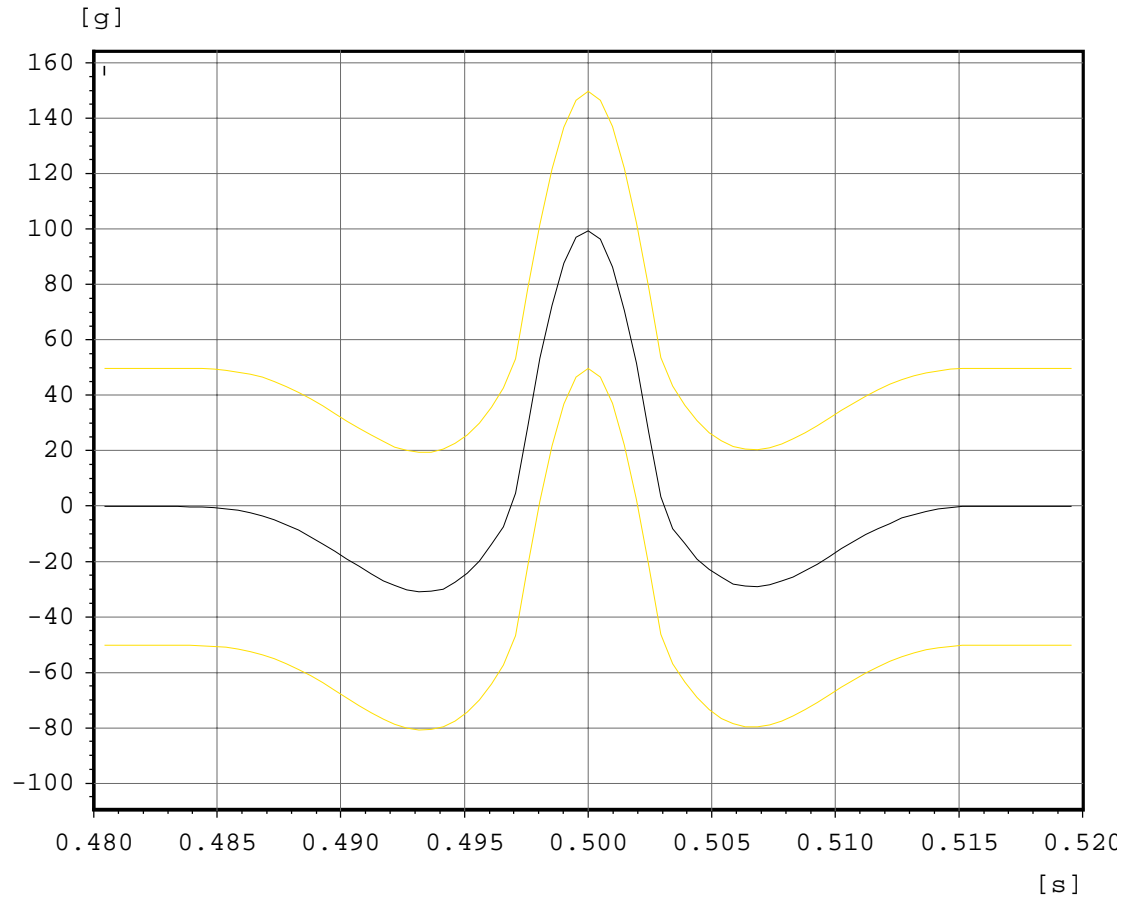


Contech Research
An Independent Test and Research Laboratory

FIGURE #17

Classical Shock

Channel 1



Project 208125
Cal Wave 1
Southwest
Microwave
Tech: /MOB
07/27/09

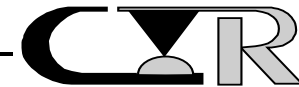
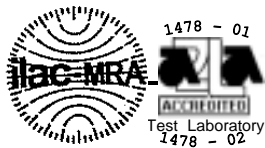
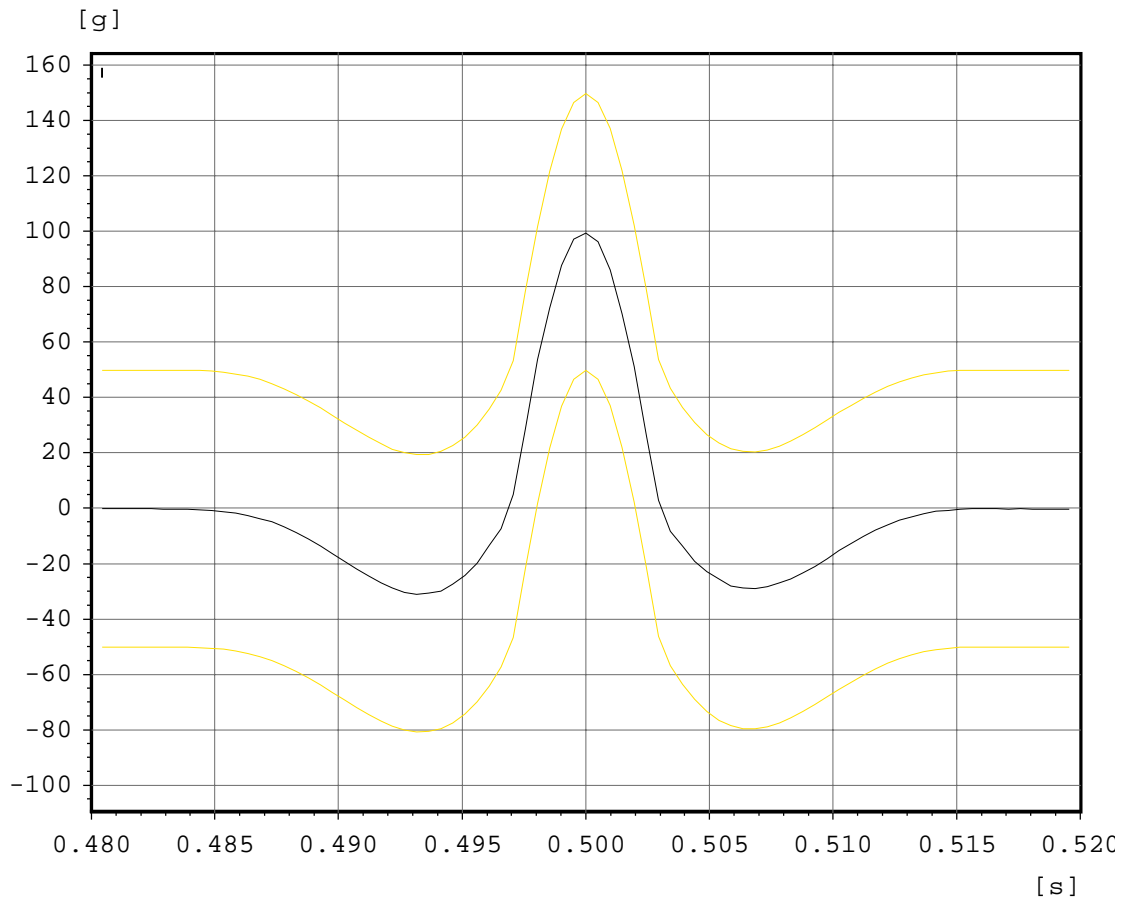


FIGURE #18

Classical Shock

Channel 1



Project 208125
Cal Wave 2
Southwest
Microwave
Tech: /MOB
07/21/09

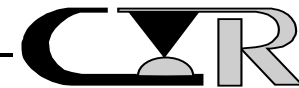
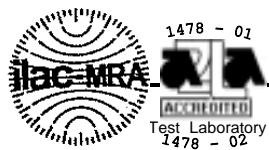
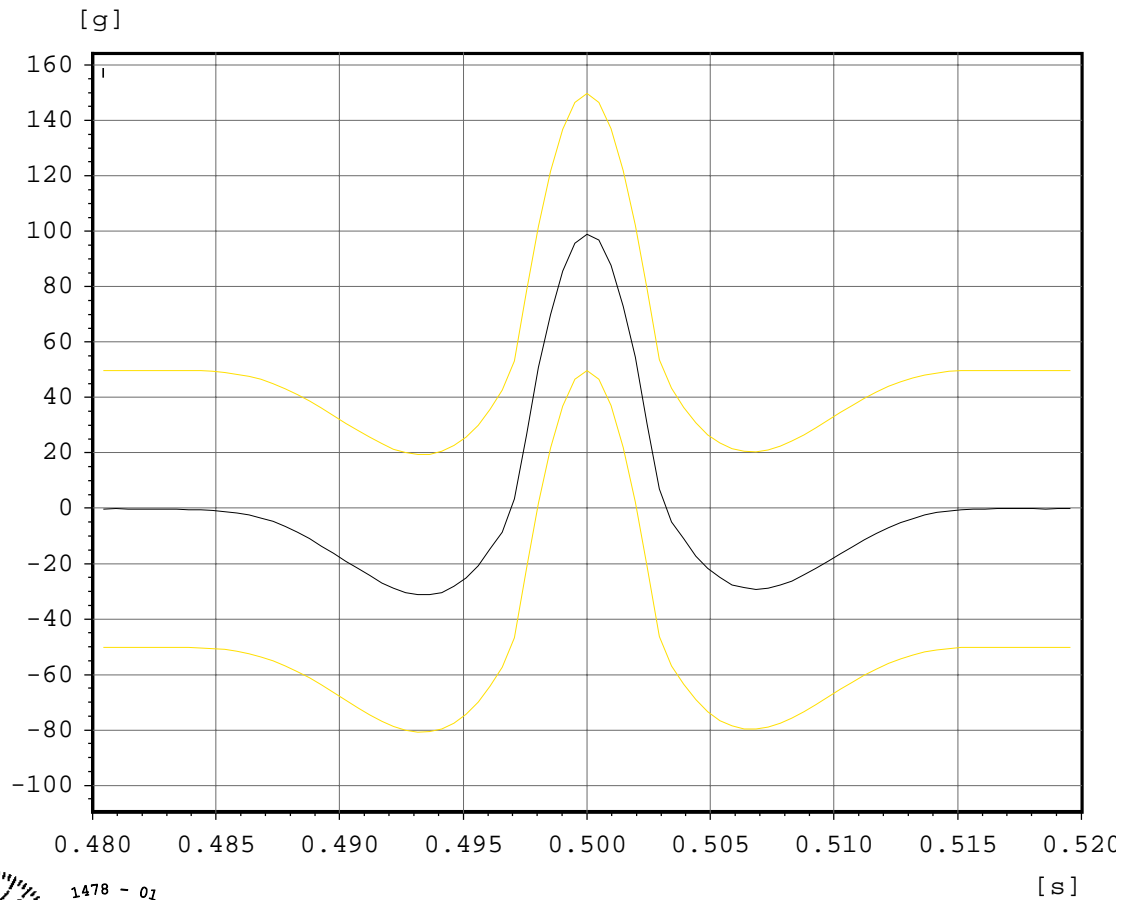


FIGURE #19

Classical Shock

Channel 1



Project 208125
Actual wave
Southwest
Microwave
Tech: /MOB
07/27/09

