

TEST REPORT #204690

VITA 46 CONNECTOR/MODULE QUALIFICATION TEST



George G. Olear II

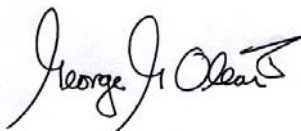
APPROVED BY: George G. Olear II
DIRECTOR OF MECHANICAL/ENVIRONMENTAL TESTING
CONTECH RESEARCH, INC.

CERTIFICATION

This is to certify that the evaluation described herein was designed and executed by personnel of Contech Research, Inc. It was performed in concurrence with Curtiss-Wright Controls Embedded Computing, of Kanata, Ontario, Canada who was the primary test sponsor. Other sponsors were Mercury Computer Systems and Radstone Embedded Computing.

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.

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



George G. Olear II
Director of Mechanical/Environmental Testing
Contech Research, Inc.

GGO:



REVISION HISTORY

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SCOPE

To perform qualification testing of the VITA 46 Connector Set as manufactured and submitted by the test sponsor, Curtiss-Wright Controls Embedded Computing.

APPLICABLE DOCUMENTS

Unless otherwise specified, the following documents of issue in effect at the time of testing 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.

Test Specifications:

VITA 46 Connector/Module Test Plan, rev. 6 (January, 2005)

MIL-STD-1344A, Test Methods for Electrical Connectors

MIL-STD-810F, Environmental Engineering Considerations and Laboratory Tests

EIA-364, Electrical Connector Test Procedures

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

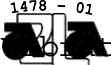
ASTM G-85, Standard Practice for Modified Salt Spray Testing

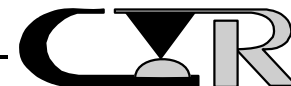
TEST SAMPLES AND PREPARATION

The following test samples were submitted by the test sponsor, Curtiss-Wright Controls Embedded Computing, for the evaluation to be performed by Contech Research, Inc.

- (1) Qty. 8 VITA 46 Modules, compliant with IEEE 1101.2 6U form factor (see Fig. 1 below). Connectors: Tyco MultiGig RT-2, 7-row, 30 microinch (nominal) gold contacts. Alignment modules: Tyco 1-1469492 (silver over nickel over copper finish)
- (2) Qty. 8 VITA 46 single slot backplanes (see Fig. 1 below), 0.15" thick. Connectors: Tyco MultiGig RT-2, 50 microinch (nominal) gold contacts. Alignment posts: Tyco 1-1469491 (silver over nickel over copper finish)

The following additional materials were submitted by the test sponsor to assist and perform the testing of items listed above.

- (1)  Vibration Test Fixture (see Fig. 2)



The test samples as submitted were certified by the manufacturer as being fabricated and assembled utilizing normal production techniques common for this type of product and inspected in accordance with the quality criteria as established for the product involved.

Connector test samples were supplied assembled and terminated to test boards by the test sponsor.

All test samples were coded and identified by Curtiss-Wright Controls Embedded Computing 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.

The test samples were tested in their 'as received' condition.

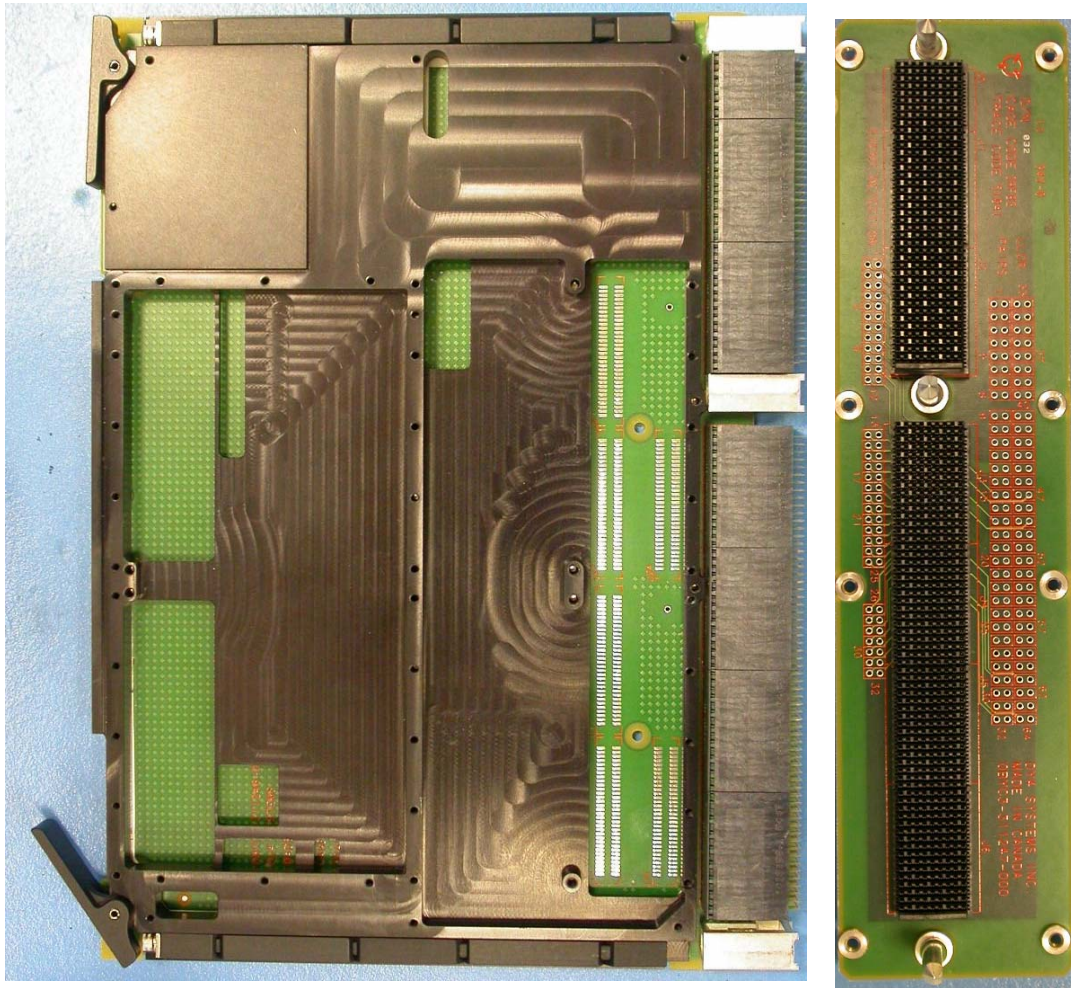


Fig. 1 VITA 46 Connector/Module Qualification Test Sample.



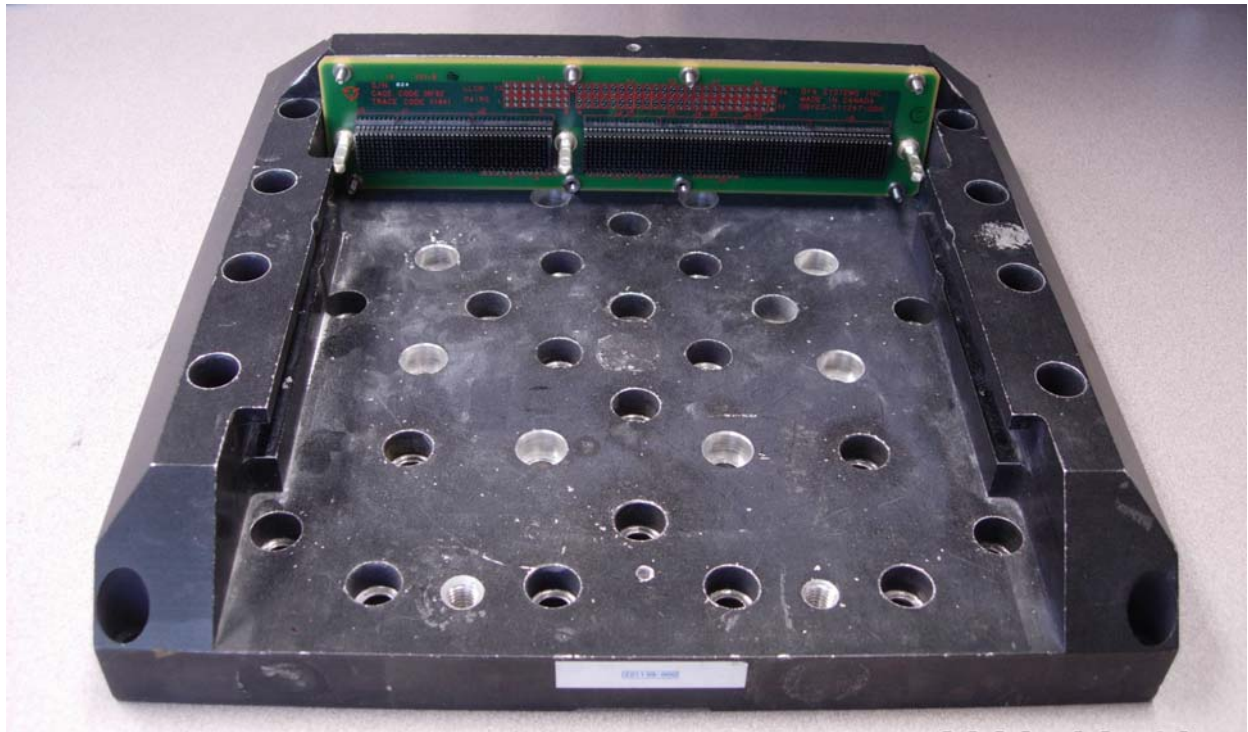


Fig. 2 Vibration fixture used for VITA 46 shock and vibration testing of conduction cooled test card in Fig. 1

TEST SELECTION

All tests were performed in accordance with the applicable sequences and procedures as specified in the VITA 46 Test Plan document, dated Jan. 4, 2005.

The following test sequences were established for this program (note: LLCR = low level contact resistance measurement, DWV = dielectric withstanding voltage, SG = safety ground resistance measurement):

Group A		Group B		Group C	
Sample 026	Sample 023	Sample 027	Sample 024		
Resonance	Resonance	LLCR/DWV/SG	LLCR/DWV/SG		
LLCR/DWV/SG	LLCR/DWV/SG	Bench Handling	Temp/Humidity		
Shock	Shock	Vibration @ Temp	LLCR/DWV/SG		
LLCR/DWV/SG	LLCR/DWV/SG	LLCR/DWV/SG			
Random	HALT Random				
LLCR/DWV/SG	LLCR/DWV/SG				

TEST SELECTION - Continued

Group D		Group E		Group F		Group G	
Sample 035		Sample 030		Sample 017			
LLCR/DWV/SG		LLCR/DWV/SG		LLCR/DWV/SG		LLCR/DWV/SG	
Salt Fog		Dust		ESD		Overload	
LLCR/DWV/SG		LLCR/DWV/SG		Mate/ Unmate		LLCR/DWV/SG	
		Sand		Durability 200			
		LLCR/DWV/SG		Mate\ Unmate			
				LLCR/DWV/SG			
				ESD			
				Mate/ Unmate			
				Durability 300			
				Mate\ Unmate			
				LLCR/DWV/SG			
				ESD			



Utility

P0

Diff.

P1Single-
Ended**P2**

Diff.

P3Single-
Ended**P4**

Diff.

P5

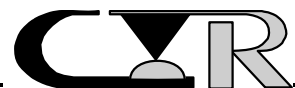
Diff.

P6

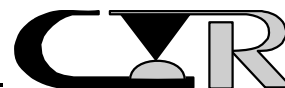
Interrupt Monitoring	LLCR	LLCR Position ID
P2 a11 - b11	P2 f11, g11	2, 34
P2 f12 - g12	P2 a12, b12	3, 35
P2 a13 - b13	P2 f13, g13	5, 37
P2 f14 - g14	P2 a14, b14	38, 6
P2 a15 - b15	P2 f15, g15	7, 39
P2 f16 - g16	P2 a16, b16	8, 40
P2 d11 - d12	P2 d9, d10	1, 33
P2 d15 - d16	P2 d13, d14	4, 36
P3 a1 - b1	P3 d1, e1	41, 9
P3 e2 - f2	P3 b2, c2	10, 42
P3 a3 - b3	P3 d3, e3	43, 11
P3 e4 - f4	P3 b4, c4	12, 44
P3 a5 - b5	P3 d5, e5	45, 13
P3 e6 - f6	P3 b6, c6	14, 46
P3 a7 - b7	P3 d7, e7	48, 16
P3 g1 - g3	P3 g5, g7	15, 47
P3 b10 - c10	P3 e10, f10	50, 18
P3 d11 - e11	P3 a11, b11	19, 51
P3 b12 - c12	P3 e12, f12	52, 20
P3 d13 - e13	P3 a13, b13	21, 53
P3 b14 - c14	P3 e14, f14	54, 22
P3 d15 - e15	P3 a15, b15	23, 55
P3 b16 - c16	P3 e16, f16	56, 24
P3 g13 - g15	P3 g9, g11	17, 49
P4 f1 - g1	P4 a1, b1	25, 57
P4 a2 - b2	P4 f2, g2	58, 26
P4 f3 - g3	P4 a3, b3	27, 59
P4 a4 - b4	P4 f4, g4	60, 28
P4 f5 - g5	P4 a5, b5	30, 62
P4 a6 - b6	P4 f6, g6	63, 31
P4 d1 - d2	P4 d3, d4	61, 29
P4 d5 - d6	P4 d7, d8	64, 32

Table 1. Connector configuration on 6U test card and contacts that were monitored or measured.

SUMMARY OF TEST RESULTS

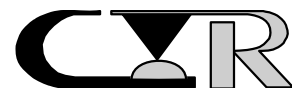


Environmental/Mechanical Test	Specification/Standard	Result
Shock	MIL-STD-1344A, Method 2004.1, Test Condition A	Pass
Random Vibration 1	MIL-STD-1344A, Method 2005.1, Test Condition V, letter D, 1.5 hours/axis	Pass
Random Vibration 2	HALT/Step stress (0.125, 0.15, 0.175 g ² /Hz for 15 min. each; 0.2 g ² /Hz for 45 min.)	Pass LLCR, DWV & Interrupt. Some gold wear-through
Bench Handling	MIL-STD-810F, Method 516.5, Procedure VI	Pass
Vibration/Temperature	Random Vibration 1 plus -40 to 100°C	Pass
Humidity	MIL-STD-1344A, Method 1002.2, Type III (240 hrs.)	Pass
Salt Fog + SO ₂	ASTM G85, Annex A4 (cycle A4.4.4.1), two 24 hr. cycles	Pass
Dust and Sand	MIL-STD-810F, Method 510.4, Procedures I and II	Pass
Durability with Misalignment	EIA-364-09, 500 mate/unmate cycles	Pass
Electrostatic Discharge (ESD)	EN 61000-4-2	Pass
Insertion/Extraction Force	MIL-STD-1344A, Method 2013.1	76.5/57.2 lbs. (initial)
Current Overload	IEC 60512-3	Pass



Contech Research

GROUP A TESTING (Shock &
Vibration Qualification and
HALT)



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: S/N 026, 023

PART DESCRIPTION: connector

SAMPLE SIZE: 2

TECHNICIAN: MAG

START DATE: 1-6-05

COMPLETE DATE: 1-25-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 26 %

EQUIPMENT ID#: 207, 400

LOW LEVEL CIRCUIT RESISTANCE (LLCR)

PURPOSE:

To evaluate contact resistance characteristics of the contact systems under conditions where applied voltages and currents do not alter the physical contact interface and will detect oxides and films that degrade electrical stability. It is also sensitive to and may detect the presence of fretting corrosion induced by mechanical or thermal environments as well as any significant loss of contact pressure.

PROCEDURE:

The test was performed in accordance with EIA 364, TP 23 with the following conditions:

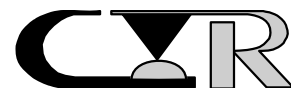
Test Current : 10ma
Open Circuit Voltage : 20mv
No. of Positions Tested : 64 per test sample

REQUIREMENTS:

Low level circuit resistance shall be measured and recorded prior to and after each environment, in this case shock and vibration. Failure is defined as a LLCR increase of 10 milliohms or greater.

RESULTS:

The LLCR data follows:



S/N 026

Delta
values
units:
milliohms

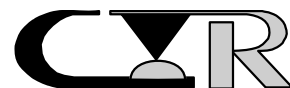
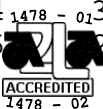
Temp °C 24 24 24
R.H. % 26 26 28
Date: 10Jan0 10Jan0 11Jan0
 5 5 5
Pos. ID Initia M Shk Vib
 1

1	27.7	-0.1	-1.0
2	30.0	-0.3	-0.9
3	23.2	-0.4	-1.1
4	29.3	-0.2	-2.1
5	30.8	-0.2	-0.6
6	24.7	-0.2	-0.7
7	29.7	-0.3	-0.7
8	22.5	-0.2	-0.6
9	35.7	-0.4	-1.1
10	28.9	-0.3	-0.9
11	34.0	-0.1	-0.9
12	29.1	-0.3	-1.3
13	34.0	-0.2	-1.2
14	28.5	-0.1	-0.7
15	34.2	-0.4	-1.0
16	33.0	-0.3	-1.0
17	34.9	-0.8	-1.6
18	37.4	-0.4	-1.1
19	29.1	-0.3	-0.7
20	37.2	-0.4	-0.9
21	29.3	-0.1	-0.6
22	37.6	-0.2	-0.9
23	27.9	-0.1	-0.4
24	37.2	-0.1	-0.6
25	22.7	0.1	-0.2
26	33.3	-0.5	-1.2
27	26.0	0.0	-0.5
28	31.5	-0.2	-0.7
29	27.8	0.1	-0.8
30	25.7	-0.1	-0.8
31	31.9	-0.2	-0.8
32	27.9	-0.1	-0.8
33	29.6	-0.1	-1.6
34	33.0	-0.2	-0.9
35	26.4	-0.3	-1.3

Temp °C 24 24 24
R.H. % 26 26 28
Date: 10Jan0 10Jan0 11Jan0
 5 5 5
Pos. ID Initia M Shk Vib
 1

36	27.7	-0.3	-1.1
37	34.2	-0.2	-0.9
38	22.3	-0.2	-0.7
39	32.6	-0.3	-0.6
40	25.7	-0.2	-0.6
41	35.1	-0.1	-0.8
42	29.5	-0.3	-0.9
43	33.6	-0.5	-1.1
44	29.5	-0.3	-1.2
45	34.0	-0.4	-1.5
46	29.4	0.0	-0.8
47	33.6	-0.3	-1.0
48	32.6	-0.2	-1.0
49	34.1	-0.1	-0.7
50	36.6	-0.3	-0.9
51	29.7	-0.1	-0.7
52	36.5	-0.1	-0.7
53	29.8	0.1	-0.4
54	36.8	-0.1	-0.7
55	28.8	-0.1	-0.7
56	36.6	-0.1	-0.7
57	25.9	0.0	-0.1
58	30.7	-0.6	-1.5
59	24.3	0.0	-0.5
60	33.4	-0.2	-0.7
61	28.2	-0.1	-1.0
62	23.8	0.0	-0.5
63	33.9	-0.3	-0.8
64	27.3	-0.1	-0.7

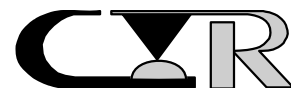
MAX	37.6	0.1	-0.1
MIN	22.3	-0.8	-2.1
AVG	30.6	-0.2	-0.9
STD	4.2	0.2	0.3



S/N 023

Delta
values
units:
milliohms

Temp °C	24	24	24	24	24	23
R.H. %	28	46	20	20	20	18
Date:	13Jan0	14Jan0	20Jan0	20Jan0	21Jan0	25Jan0
	5	5	5	5	5	5
Pos. ID	Initia	M Shk	Vibrat	Vibrat	Vibrat	Vibrat
	l		ion	ion	ion	ion
			Step 1	Step 2	Step 3	Step 4
1	29.0	-0.1	-2.2	-2.1	-2.4	-2.2
2	32.4	-0.1	-1.7	-1.5	-1.9	-1.6
3	24.0	-0.3	-1.1	-1.2	-1.5	-1.4
4	28.0	-0.2	-2.3	-2.2	-2.5	-2.4
5	29.6	-0.1	-1.3	-1.1	-1.5	-1.3
6	26.2	-0.3	-1.2	-1.1	-1.4	-1.2
7	30.9	-0.1	-1.2	-1.0	-1.3	-1.1
8	22.7	-0.2	-0.8	-0.8	-1.1	-1.0
9	33.9	-0.1	-1.3	-1.1	-1.6	-1.0
10	28.3	-0.2	-1.2	-1.2	-1.6	-1.6
11	33.3	-0.2	-2.0	-1.8	-2.2	-2.0
12	27.9	-0.1	-0.8	-0.9	-1.0	-1.1
13	34.1	-0.4	-1.9	-1.6	-2.1	-1.8
14	29.0	-0.4	-1.2	-1.2	-1.6	-1.5
15	34.1	-0.5	-1.9	-1.6	-1.9	-1.3
16	34.5	0.0	-1.8	-1.6	-2.0	-1.6
17	34.4	-0.3	-1.5	-1.1	-1.5	-0.2
18	36.7	-0.1	-1.5	-1.1	-1.6	0.3
19	28.7	-0.4	-1.2	-1.2	-1.4	-1.4
20	36.9	-0.1	-1.5	-1.0	-1.5	-1.0
21	28.9	-0.3	-1.3	-1.2	-1.4	-1.4
22	37.6	0.2	-1.3	-0.9	-1.4	-0.7
23	28.1	-0.3	-1.3	-1.3	-1.6	-1.5
24	39.1	-0.4	-1.7	-1.3	-1.7	-1.1
25	23.4	-0.2	-0.8	-0.2	-1.0	-0.9
26	34.4	-0.3	-1.5	-1.3	-1.7	-1.2
27	25.7	-0.1	-0.7	-0.8	-1.0	-1.1
28	32.3	-0.3	-1.7	-1.5	-1.8	-1.6
29	27.9	-0.1	-1.2	-1.1	-1.4	-1.3
30	27.1	-0.3	-1.4	-1.2	-1.6	-1.7
31	31.9	-0.2	-1.5	-1.1	-1.5	-1.4
32	27.7	-0.2	-1.0	-1.0	-1.3	-1.1
33	29.3	-0.1	-1.5	-1.4	-1.8	-1.6
34	35.3	0.0	-1.2	-0.9	-1.2	-1.0
35	26.8	-0.2	-1.3	-1.3	-1.5	-1.4



S/N

cont.

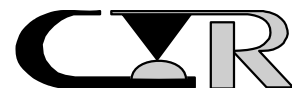
Date: 13Jan0 14Jan0 20Jan0 20Jan0 21Jan0 25Jan0

5 5 5 5 5 5

Pos. ID Initia M Shk Vibrat Vibrat Vibrat Vibrat
l ion ion ion ion

36	29.3	-0.1	-1.5	-1.5	-1.8	-1.7
37	32.5	-0.4	-1.5	-1.2	-1.6	-1.3
38	23.6	-0.1	-0.9	-0.9	-1.1	-1.0
39	33.9	-0.4	-1.4	-1.1	-1.5	-1.2
40	25.9	-0.3	-1.0	-1.0	-1.3	-1.2
41	33.7	-0.2	-1.5	-0.8	-1.7	-1.1
42	28.7	-0.4	-0.9	-0.9	-1.3	-1.2
43	32.6	-0.3	-1.7	-1.6	-2.0	-1.8
44	28.5	-0.1	-0.8	-0.8	-1.1	-1.0
45	33.7	-0.4	-2.0	-2.0	-2.3	-2.1
46	29.6	-0.4	-1.2	-1.1	-1.3	-1.3
47	34.8	-0.6	-1.8	-1.2	-1.8	-1.2
48	33.8	-0.4	-1.7	-1.5	-2.0	-1.7
49	33.7	-0.1	-1.1	-0.8	-1.3	-0.8
50	36.1	0.0	-1.3	-1.1	-1.5	-1.0
51	29.1	-0.2	-0.9	-0.8	-1.1	-1.0
52	36.6	-0.1	-1.9	-1.5	-1.9	-1.7
53	29.9	-0.5	-1.7	-1.6	-1.9	-1.8
54	37.0	0.1	-1.3	-1.0	-1.4	-1.1
55	28.8	-0.5	-1.4	-1.3	-1.5	-1.4
56	37.8	0.2	-1.1	-0.7	-1.1	-0.8
57	26.5	-0.1	-0.7	-0.5	-1.0	-1.0
58	31.6	-0.3	-1.8	-1.5	-1.9	-1.6
59	24.3	-0.4	-1.1	-1.1	-1.2	-1.1
60	34.0	-0.2	-1.6	-1.3	-1.7	-1.4
61	27.9	-0.2	-1.6	-1.5	-1.7	-1.6
62	25.0	-0.4	-1.2	-1.1	-1.3	-1.3
63	33.6	-0.2	-1.2	-0.8	-1.3	-1.0
64	27.7	-0.3	-1.2	-1.2	-1.5	-1.4

MAX	39.1	0.2	-0.7	-0.2	-1.0	0.3
MIN	22.7	-0.6	-2.3	-2.2	-2.5	-2.4
AVG	30.8	-0.2	-1.4	-1.2	-1.6	-1.3
STD	4.1	0.2	0.4	0.4	0.3	0.4



Safety Ground

S/N 026

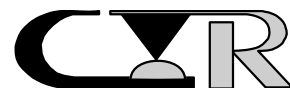
Delta
values
units:
milliohms

Temp °C	24	24	24
R.H. %	26	26	28
Date:	10Jan0	10Jan0	11Jan0
	5	5	5
Pos. ID	Initia	M Shk	Vib
	1		
1	0.40	0.01	0.08
2	0.26	0.00	-0.01
3	0.30	-0.04	-0.06
MAX	0.4	0.01	0.08
MIN	0.3	-0.04	-0.06
AVG	0.3	-0.01	0.00
STD	0.1	0.03	0.07
Open	0	0	0

S/N 023

Delta
values
units:
milliohms

Temp °C	24	24	24	24	24	23
R.H. %	28	46	20	20	20	18
Date:	13Jan0	14Jan0	20Jan0	20Jan0	21Jan0	25Jan0
	5	5	5	5	5	5
Pos. ID	Initia	M Shk	Vibrat	Vibrat	Vibrat	Vibrat
	1		ion	ion	ion	ion
			Step 1	Step 2	Step 3	Step 4
1	0.24	0.03	-0.01	0.03	0.0	0.0
2	0.23	0.05	0.28	0.04	0.2	0.1
3	0.30	0.10	1.01	0.56	0.4	1.1
MAX	0.3	0.10	1.01	0.56	0.4	1.1
MIN	0.2	0.03	-0.01	0.03	0.0	0.0
AVG	0.3	0.06	0.43	0.21	0.2	0.4
STD	0.0	0.04	0.53	0.30	0.2	0.6
Open	0	0	0	0	0	0



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 026, 023

PART DESCRIPTION: connector

SAMPLE SIZE: 2

TECHNICIAN: MAG

START DATE: 1-6-05

COMPLETE DATE: 1-25-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 26 %

EQUIPMENT ID#: 321

DIELECTRIC WITHSTANDING VOLTAGE (SEA LEVEL)

PURPOSE:

To determine if the connectors maintain their dielectric integrity after being stressed by exposure to mechanical and environmental conditioning.

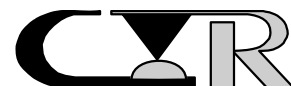
PROCEDURE:

1. The test was performed in accordance with MIL-STD-1344, Method 3001.
2. Test Conditions:

Between Adjacent Contacts (closest spacing)	:	Yes
Between Rows	:	No
Between Contacts and Hardware	:	No
Between Contacts and Shell	:	No
Mated Condition	:	Mated
Mounting Condition	:	Mounted
Hold Time	:	60 sec.
Rate of Application	:	500 volts/sec.
Test Voltage	:	500

REQUIREMENTS:

1. When the specified test voltage is applied, there shall be no evidence of breakdown, arcing, etc.
2. The leakage current shall not exceed 5 ma.

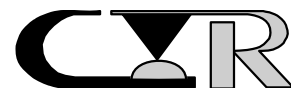


RESULTS:

1. All test samples as tested met the requirements as specified.
2. The following is a summary of the observed data.

	Initial	Shock	Vibration		Initial	Shock	Vibration
Req.	No Breakdown						
Sample ID	SN 026	SN 026	SN 026	Sample ID	SN 026	SN 026	SN 026
J1 a1-b1	Pass	Pass	Pass	J6 a1-b1	Pass	Pass	Pass
J1 e1-f1	Pass	Pass	Pass	J6 e1-f1	Pass	Pass	Pass
J1 c2-d2	Pass	Pass	Pass	J6 c2-d2	Pass	Pass	Pass
J1 g2-h2	Pass	Pass	Pass	J6 g2-h2	Pass	Pass	Pass
J1 c8-d8	Pass	Pass	Pass	J6 c8-d8	Pass	Pass	Pass
J1 g8-h8	Pass	Pass	Pass	J6 g8-h8	Pass	Pass	Pass
J1 a9-b9	Pass	Pass	Pass	J6 a9-b9	Pass	Pass	Pass
J1 e9-f9	Pass	Pass	Pass	J6 e9-f9	Pass	Pass	Pass

	Initial	Shk/Vib			Initial	Shk/Vib	
Req.	No Breakdown						
Sample ID	SN 023	SN 023		Sample ID	SN 023	SN 023	
J1 a1-b1	Pass	Pass		J6 a1-b1	Pass	Pass	
J1 e1-f1	Pass	Pass		J6 e1-f1	Pass	Pass	
J1 c2-d2	Pass	Pass		J6 c2-d2	Pass	Pass	
J1 g2-h2	Pass	Pass		J6 g2-h2	Pass	Pass	
J1 c8-d8	Pass	Pass		J6 c8-d8	Pass	Pass	
J1 g8-h8	Pass	Pass		J6 g8-h8	Pass	Pass	
J1 a9-b9	Pass	Pass		J6 a9-b9	Pass	Pass	
J1 e9-f9	Pass	Pass		J6 e9-f9	Pass	Pass	



PROJECT NO.:	204690	SPECIFICATION:	VITA 46
PART NO.:	026, 023	PART DESCRIPTION:	connector
SAMPLE SIZE:	2	TECHNICIAN:	ggo
START DATE:		COMPLETE DATE:	
ROOM AMBIENT:	24 °C	RELATIVE HUMIDITY:	28 %
EQUIPMENT ID#:	533, 1166, 1167, 1169, 1271, 1272, 1121		

VIBRATION, SINUSOIDAL

PURPOSE:

To record resonance data.

PROCEDURE:

Test Conditions:

Frequency	:	50 to 2000 Hz
Amplitude	:	5 G's
Sweep Time	:	20 minutes

REQUIREMENTS:

1. The sweep shall be recorded. Resonances shall be compared to typical 6U conduction cooled product.
2. The LLCR shall be measured and recorded.

SINE VIBRATION RESULTS:

1. The resonance plots follow. Channel 1 refers to the control accelerometer. Channels 2 to 4 are response accelerometers on the PWB and the conduction frame. The responses were compared to the 6U conduction cooled product upon which the VITA 46 test vehicle was designed. For the first two modes, the resonant frequencies were within 5%.
2. See the LLCR section for LLCR data.

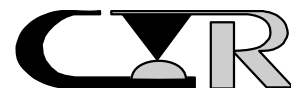
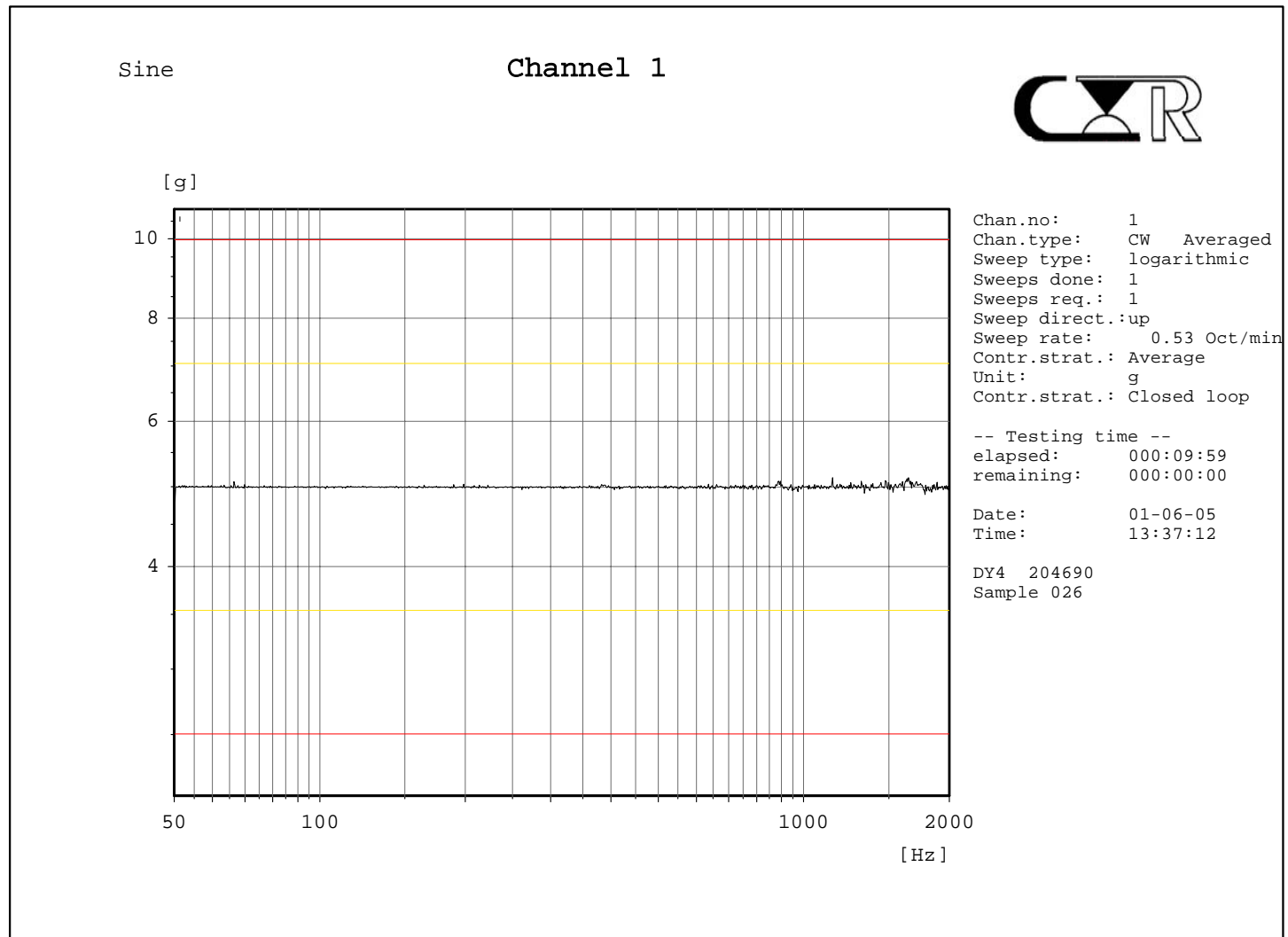


Fig. 3 Control accelerometer output (S/N 026, sine vibration)



C:\VcpNT\Daten\m+p\DY 4 SINE 204690 006.rsn

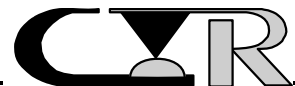
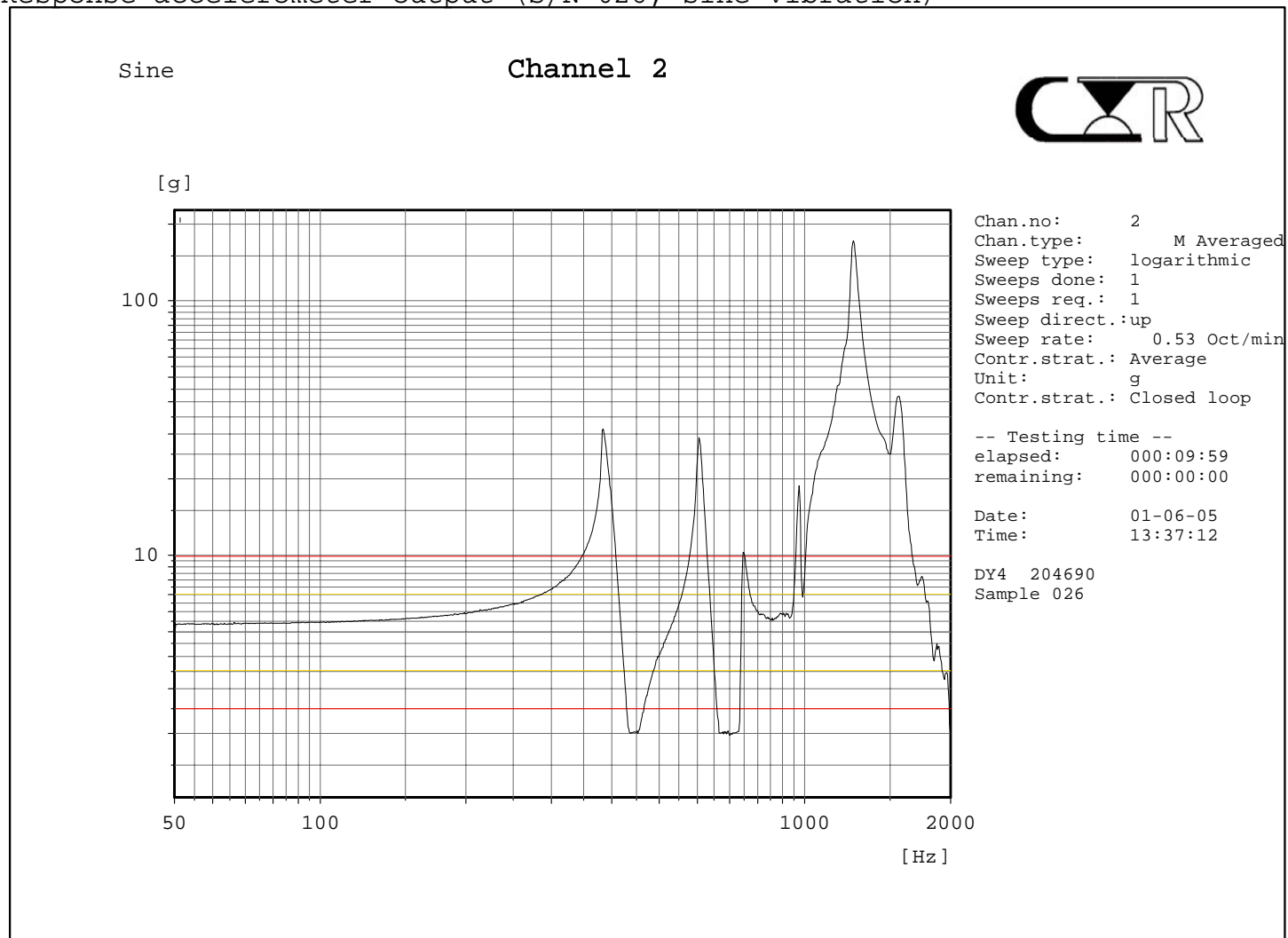


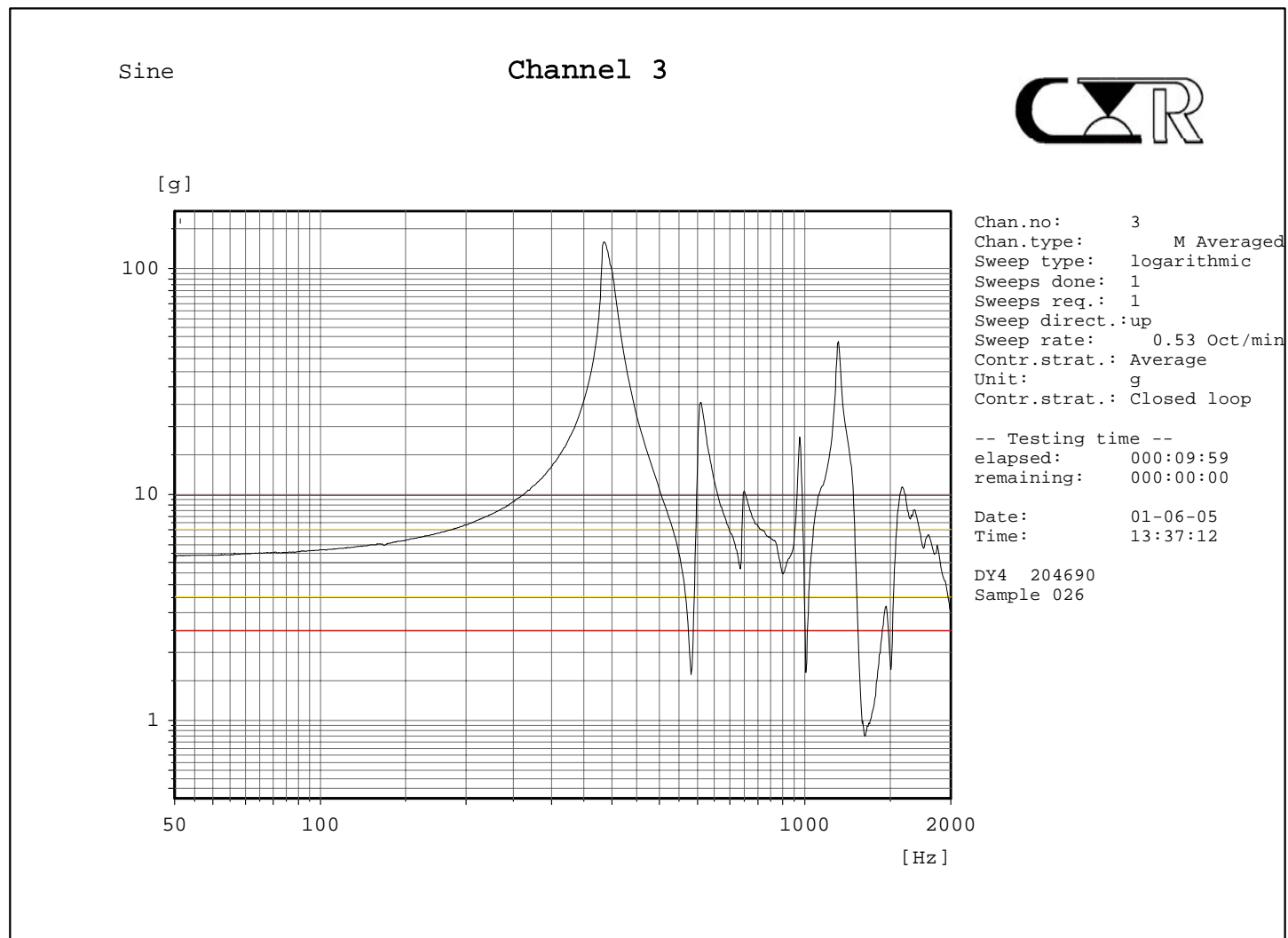
Fig. 4 Response accelerometer output (S/N 026, sine vibration)



C:\VcpNT\Daten\m+p\DY 4 SINE 204690 006.rsn



Fig. 5 Response accelerometer output (S/N 026, sine vibration)



C:\VcpNT\Daten\m+p\DY 4 SINE 204690 006.rsn

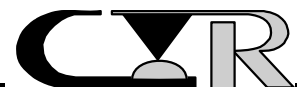
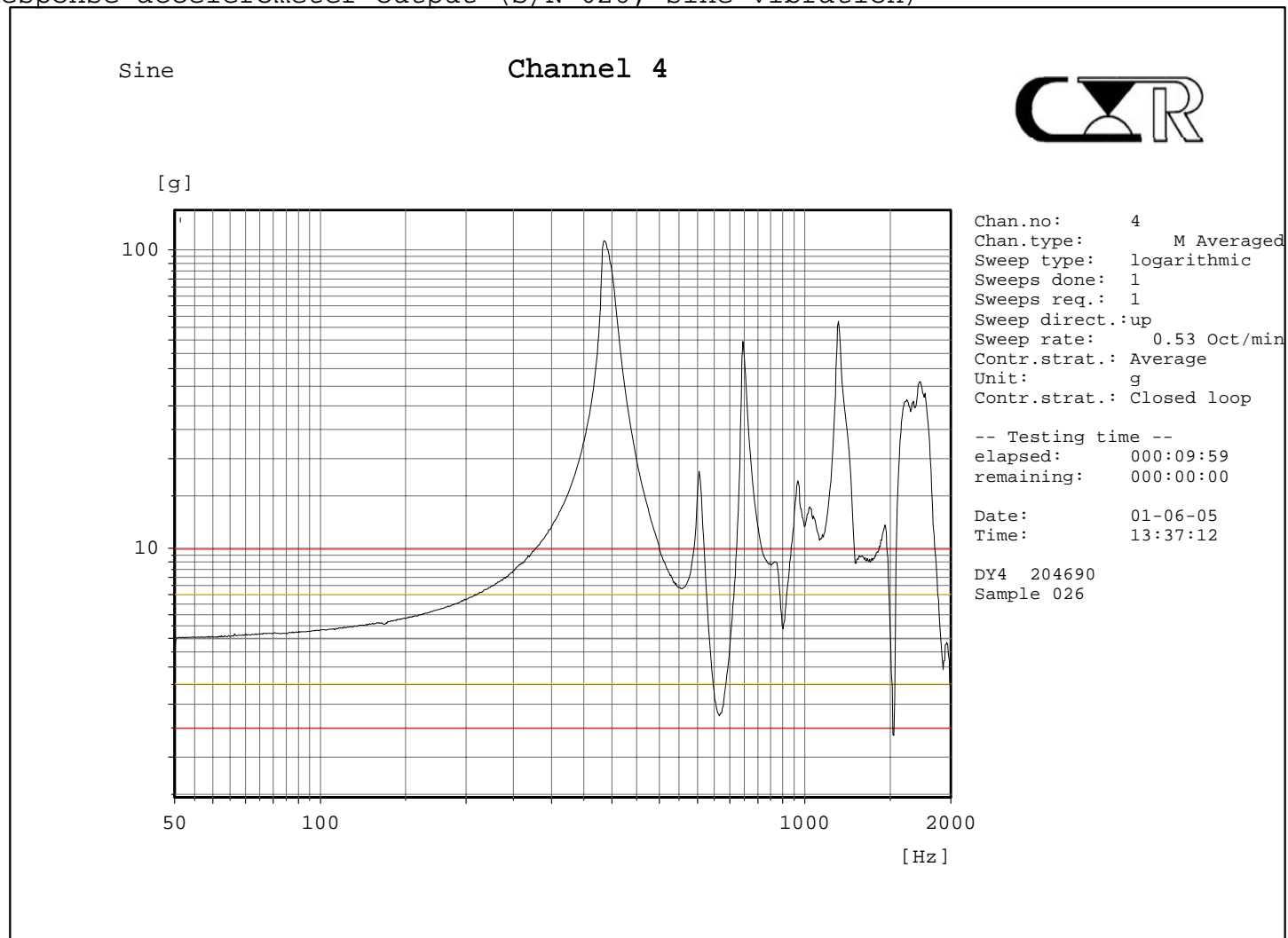


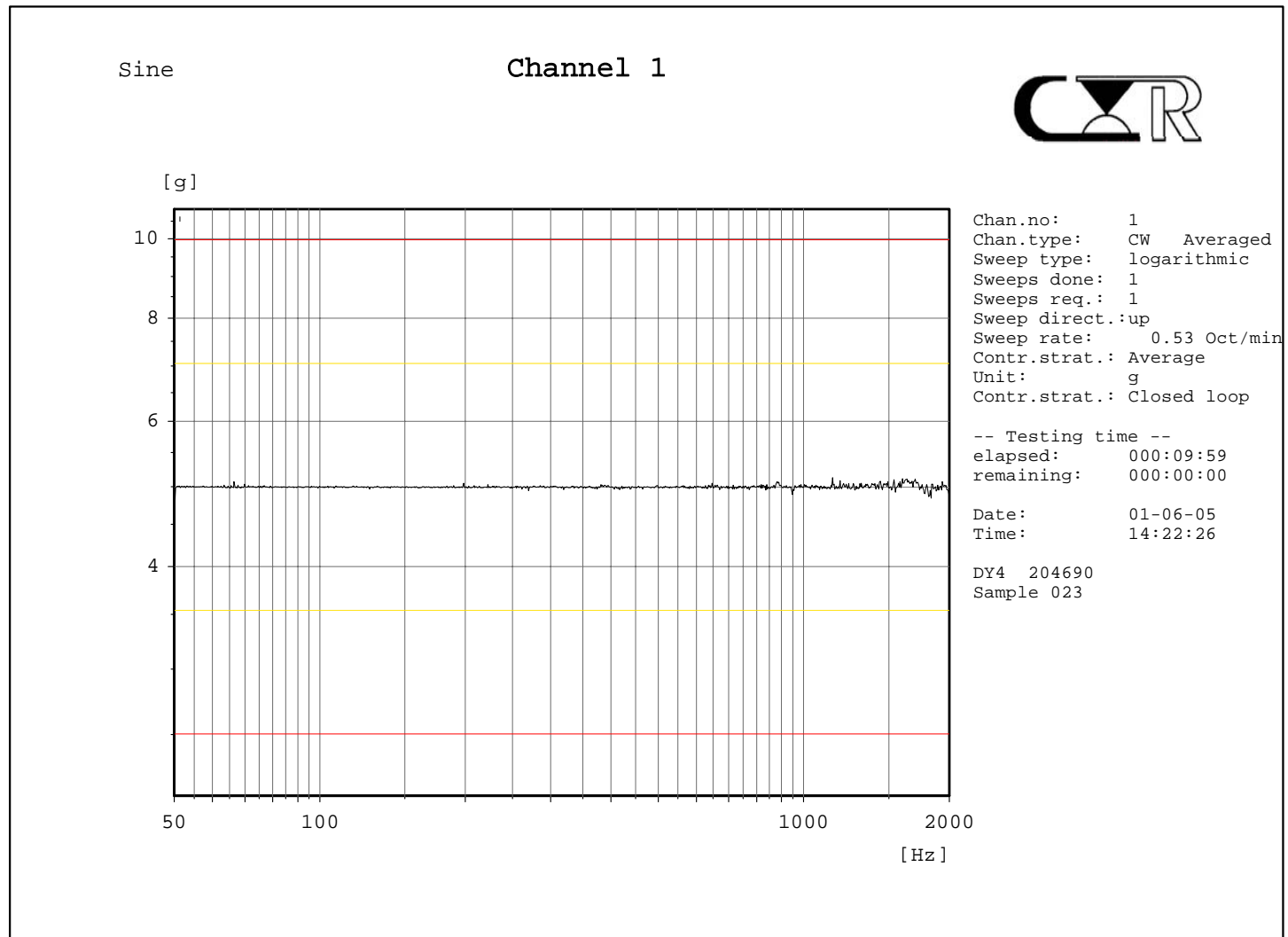
Fig. 6 Response accelerometer output (S/N 026, sine vibration)



C:\VcpNT\Daten\m+p\DY 4 SINE 204690 006.rsn



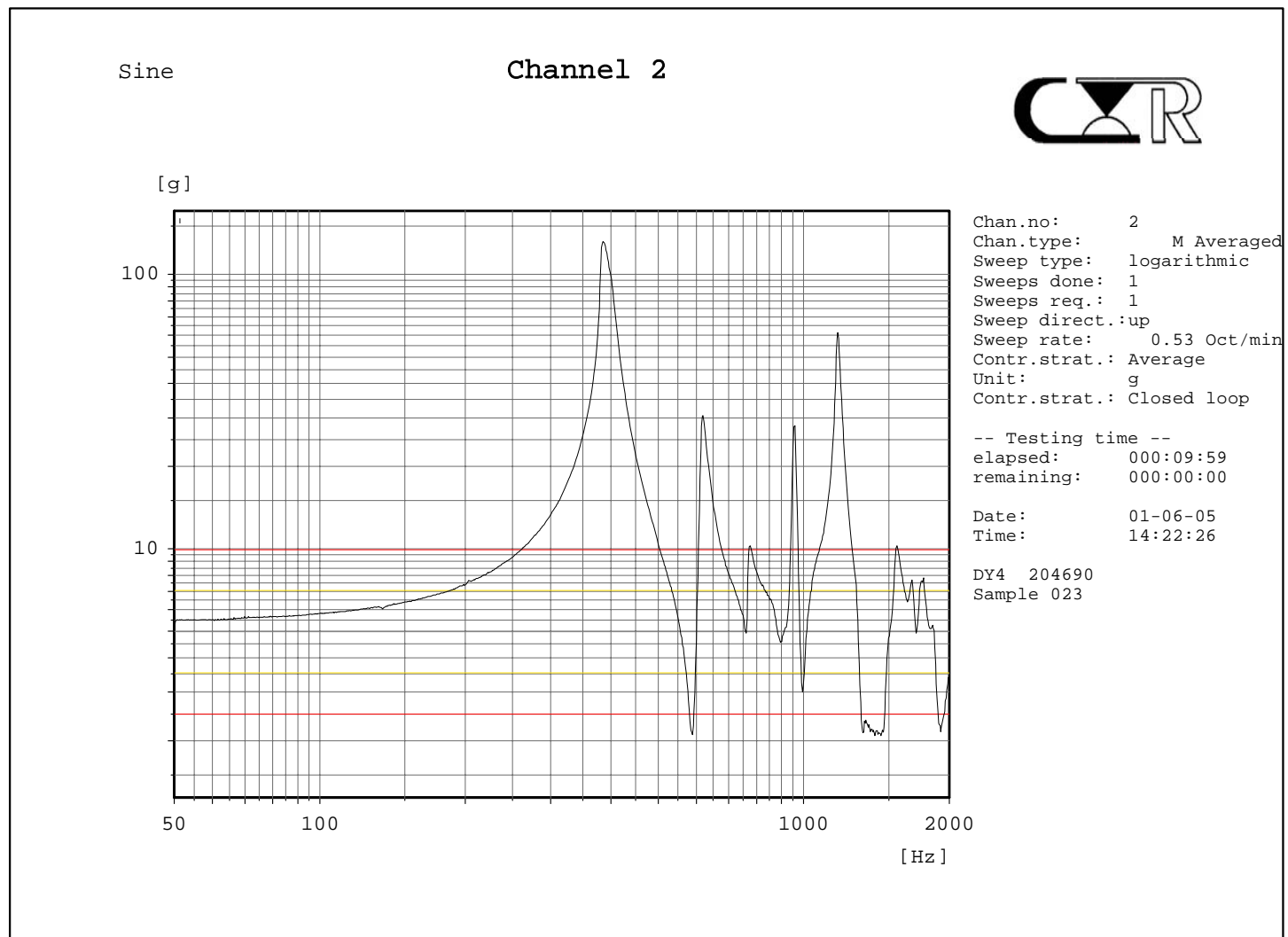
Fig. 7 Control accelerometer output (S/N 023, sine vibration)



C:\VcpNT\Daten\m+p\DY 4 SINE 204690 007.rsn



Fig. 8 Response accelerometer output (S/N 023, sine vibration)



C:\VcpNT\Daten\m+p\DY 4 SINE 204690 007.rsn

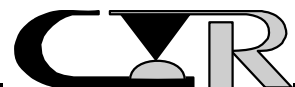
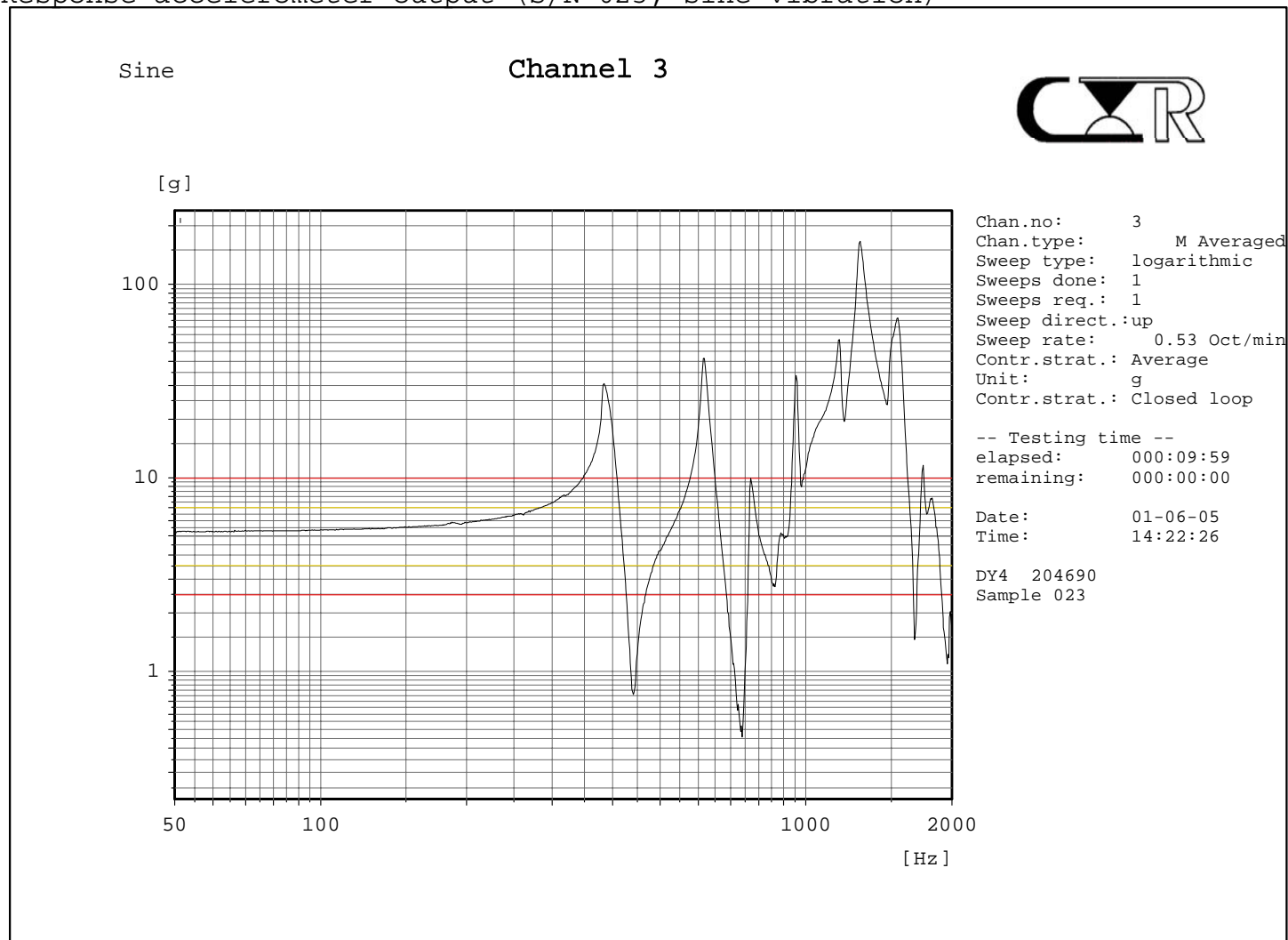


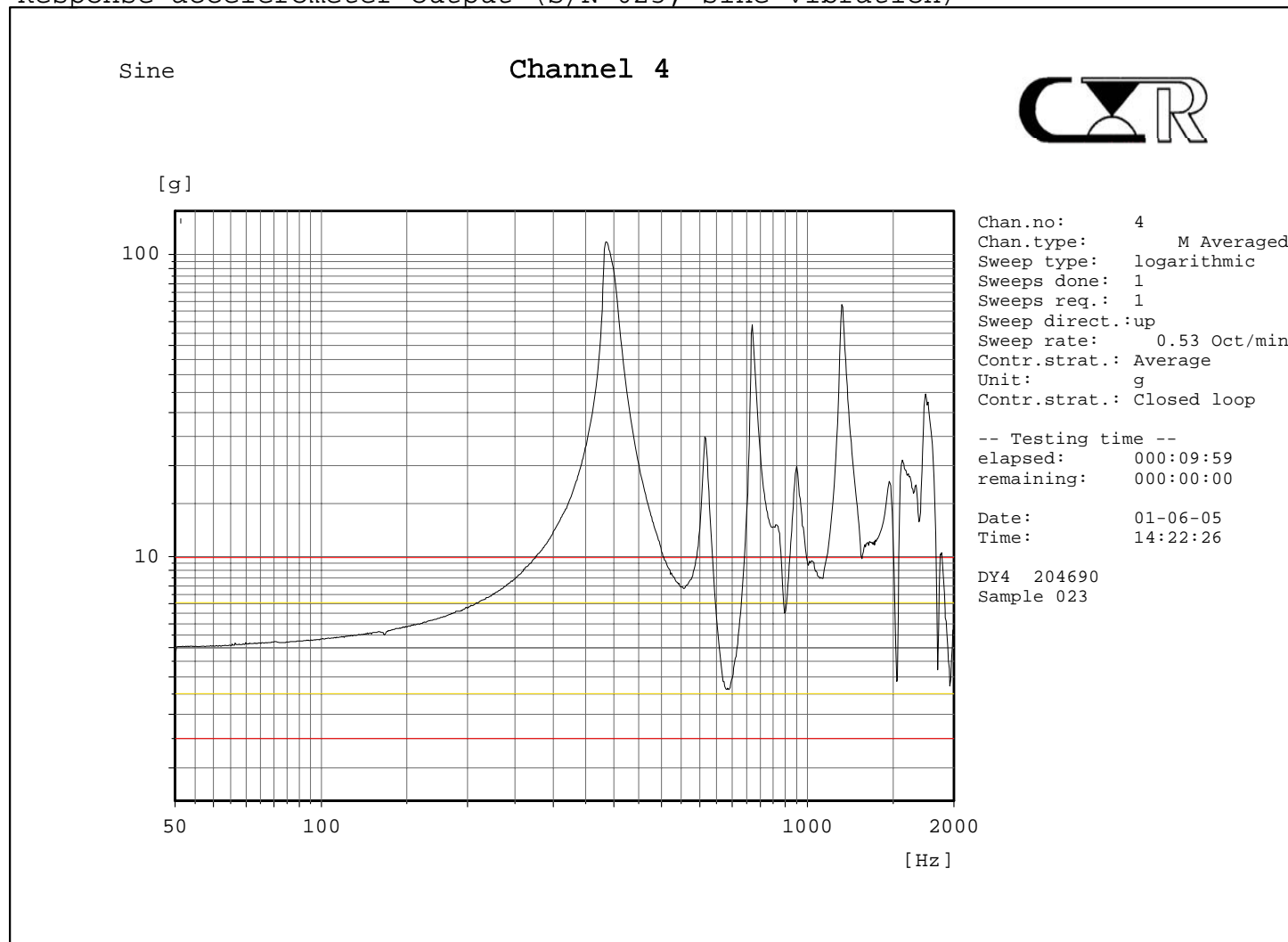
Fig. 9 Response accelerometer output (S/N 023, sine vibration)



C:\VcpNT\Daten\m+p\DY 4 SINE 204690 007.rsn



Fig. 10 Response accelerometer output (S/N 023, sine vibration)



C:\VcpNT\Daten\m+p\DY 4 SINE 204690 007.rsn



PROJECT NO.: 204690-1

SPECIFICATION: VITA 46

PART NO.: 026, 023

PART DESCRIPTION: blade

SAMPLE SIZE: 2

TECHNICIAN: MG/GGO

START DATE: 1-7-05

COMPLETE DATE: 1-14-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 28 %

EQUIPMENT ID#: 533, 1166, 1167, 1168, 1169, 1271, 1272,
1121

MECHANICAL SHOCK (SPECIFIED PULSE)

PURPOSE:

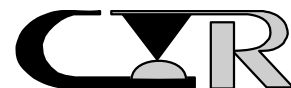
To determine the mechanical and electrical integrity of connectors for use with electronic equipment subjected to shocks such as those expected from handling, transportation, etc.

PROCEDURE:

1. The test was performed in accordance with MIL-STD-1344A, Method 2004.1, Test Condition A.
2. Test Conditions:
 - 'G' Level : 50 G's
 - Duration : 11 Milliseconds
 - Wave Form : ½ sine
 - No. of Shocks : 18 (3 in each of 6 directions: +/-X, +/-Y, and +/-Z)

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test samples as tested.
2. There shall be no contact interruption greater than 10 ns (ref. EIA-364-87, Test condition D).
3. The LLCR and DWV shall be measured and recorded.



SHOCK RESULTS:

1. There was no evidence of physical damage to the test samples as tested.
2. There was no interruption greater than 10 ns.
3. See the LLCR and DWV sections for LLCR and DWV data (passed).
4. The shock plots follow:

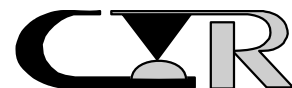
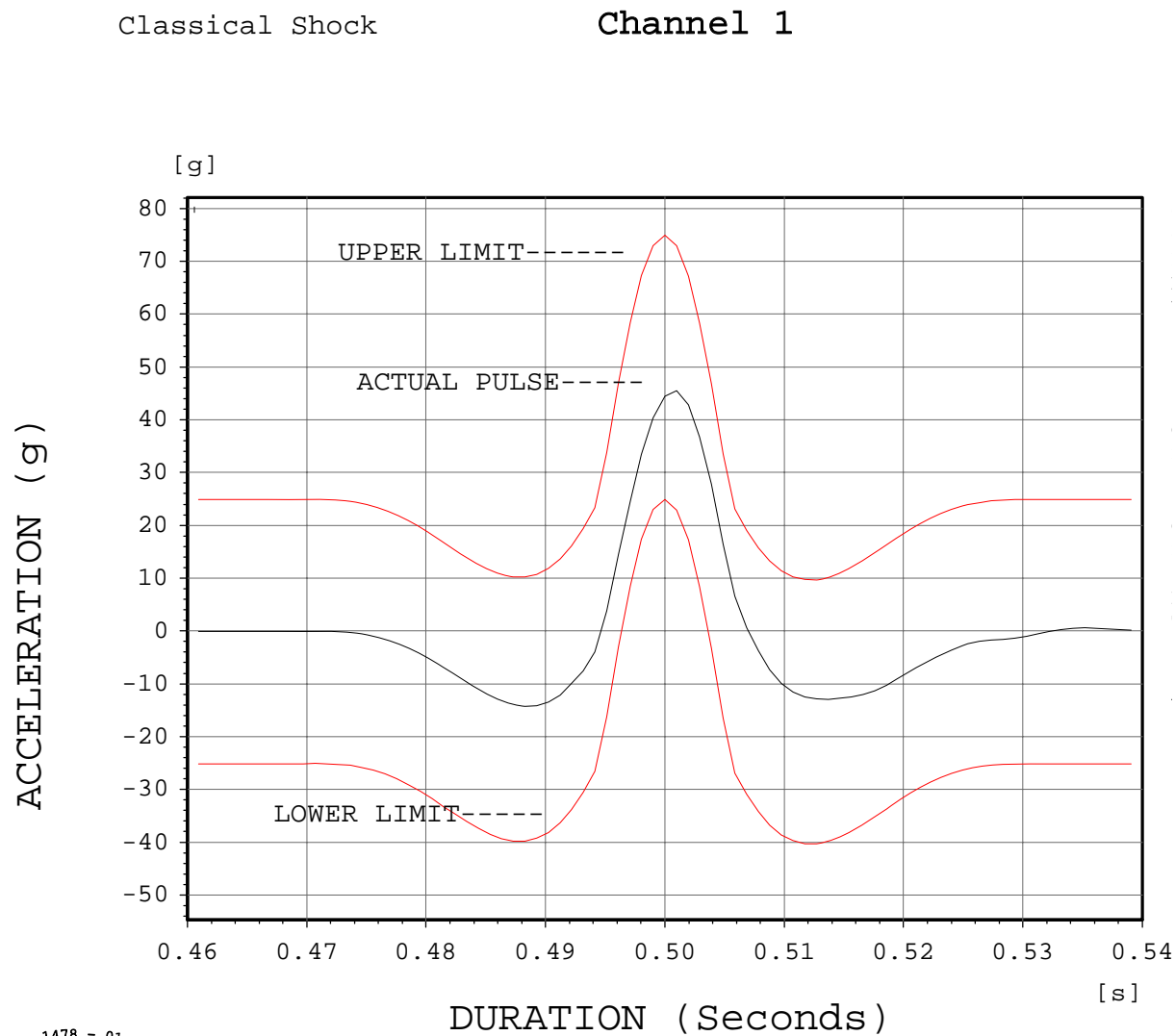


Fig. 11



Project 204690
DY4 Systems
Actual Pulse
Flat Axis
Sample ID# 023
Tech: MAG/
Date: 14Jan05

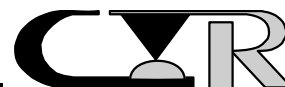
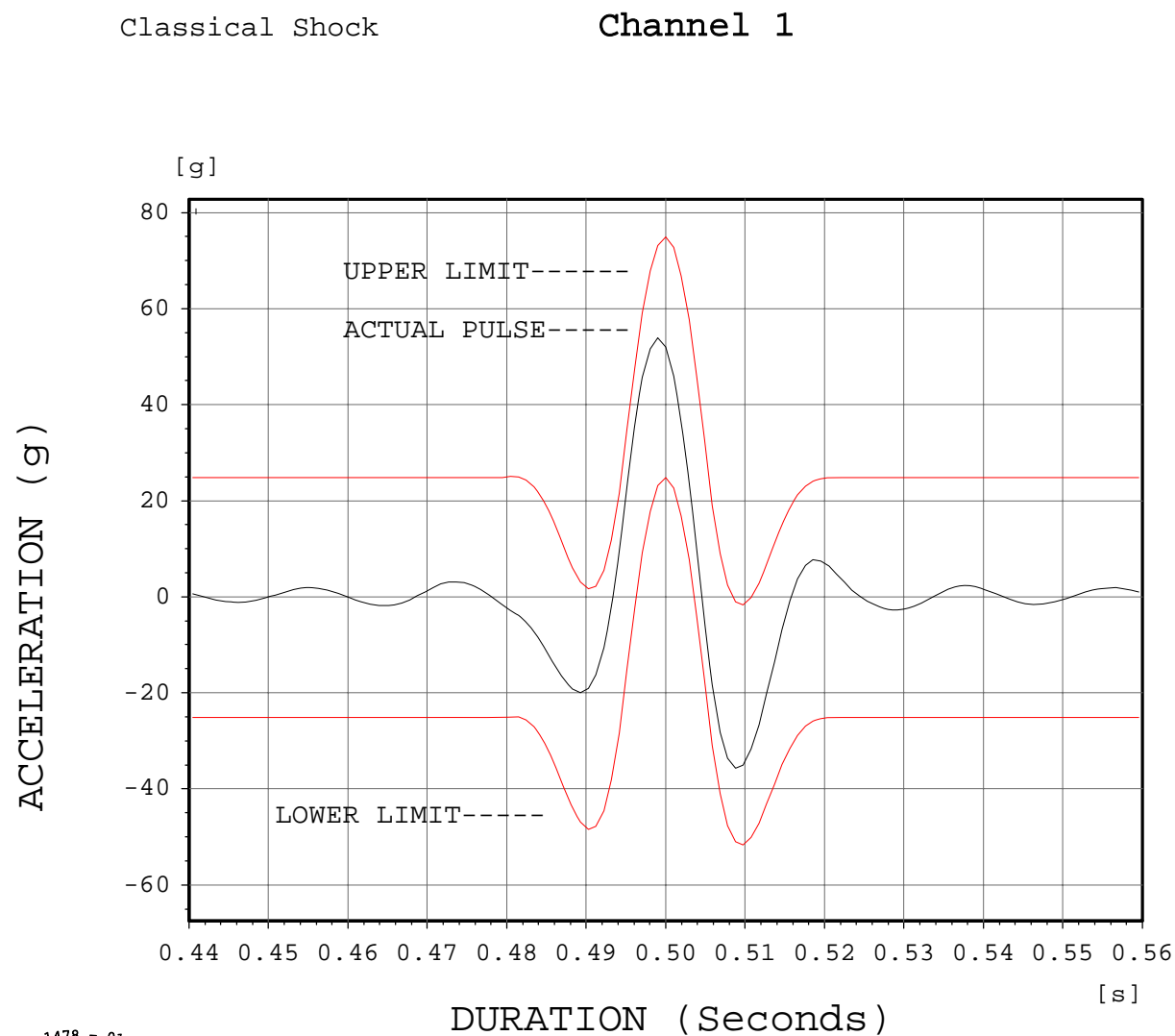


Fig. 12



Project 204690
DY4 Systems
Flat
Actual Pulse
Sample ID# 026
Tech: MAG/
Date: 10Jan05

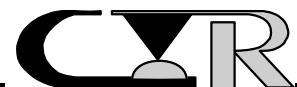
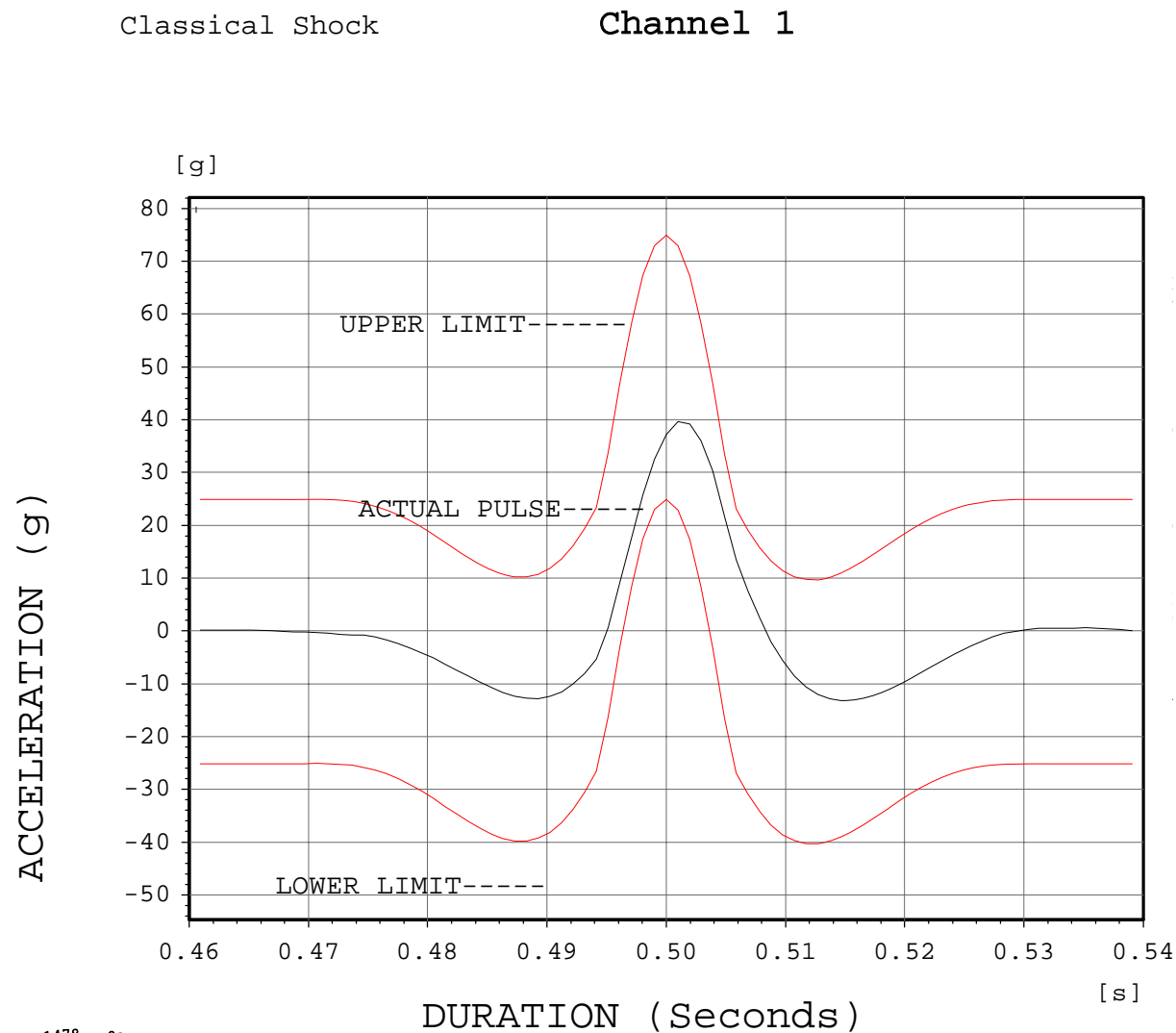


Fig. 13



Project 204690
DY4 Systems
Actual Pulse
Lat and Long Axis
Sample ID# 023
Tech: MAG/
Date: 14Jan05

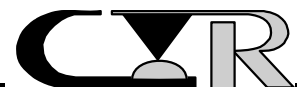
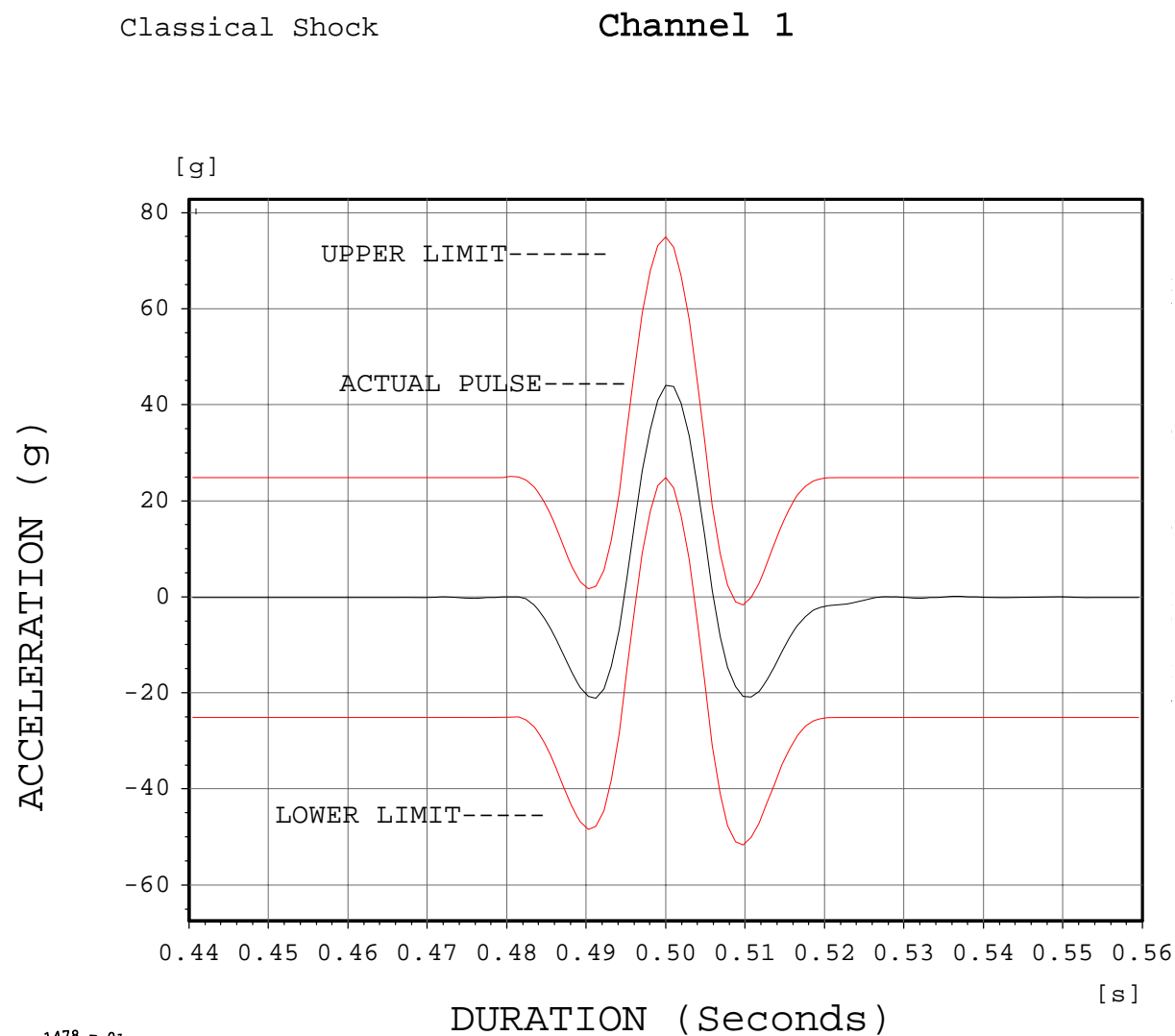
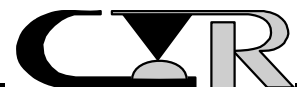


Fig. 14



Project 204690
DY4 Systems
Long
Actual Pulse
Sample ID# 026
Tech: MAG/
Date: 10Jan05



PROJECT NO.: 204690-1

SPECIFICATION: VITA 46

PART NO.: 026

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: MG/GGO

START DATE: 1-10-05

COMPLETE DATE: 1-11-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 26 %

EQUIPMENT ID#: 533, 1166, 1167, 1168, 1169, 1271, 1272,
1121

VIBRATION, RANDOM

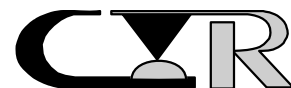
PURPOSE:

The purpose of the random vibration test was to determine if the VITA 46 connector was able to survive the vibration level and duration shown below ($0.1 \text{ g}^2/\text{Hz}$, 1.5 hours per axis).

INTRODUCTION:

Random vibration causes relative displacements which can result in connector contact gold plating wear-through, fretting corrosion, and eventually intermittent and open electrical contact. The motion which causes these displacements is the mode shape for the 1st natural frequency of the plug-in module, and is termed "oil-canning". Oil-canning causes the plug-in module's connectors to "rock" in the relatively fixed backplane connectors, leading to the contact issues mentioned above. The connectors in the middle of the card (e.g. P2, P3, P4) experience the most "rocking", whereas those near the card edges (e.g. P0, P6) experience much less due to the edge condition provided by the wedgelock retainers.

Oil-canning of the backplane can also cause connector contact relative displacements and the associated issues, however the vibration acceleration must be enough to overcome the static friction between contacts. For the connector set tested on the 6U test card, the minimum measured extraction force is 53 Lbf. The weight of the single slot backplane (ref. Fig. 1) is 0.36 Lb. A simple calculation ($F=ma$) gives an acceleration of 146 g. This is well beyond the accelerations expected from the random vibration input (e.g. $12 \text{ g}_{\text{rms}}$), thus backplane oil-canning is not expected to be an issue at the tested random vibration levels.



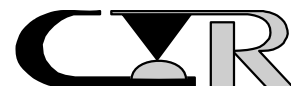
PROCEDURE:

Test Conditions (ref. MIL-STD-1344A, Method 2005.1, Test Condition V, letter D):

Power Spectral Density	0.1 g ² /Hz max.
Frequency	50-2000 Hz
grms	11.95
Duration	1.5 hour each axis
Samples	S/N 026

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test samples as tested.
2. There shall be no contact interruption greater than 10 nanoseconds (ref. EIA-364-87, Test condition D).
3. The LLCR and DWV shall be measured and recorded.
4. There shall be no visible wear-through of the connector contact gold plating under a magnification of 30-40X.



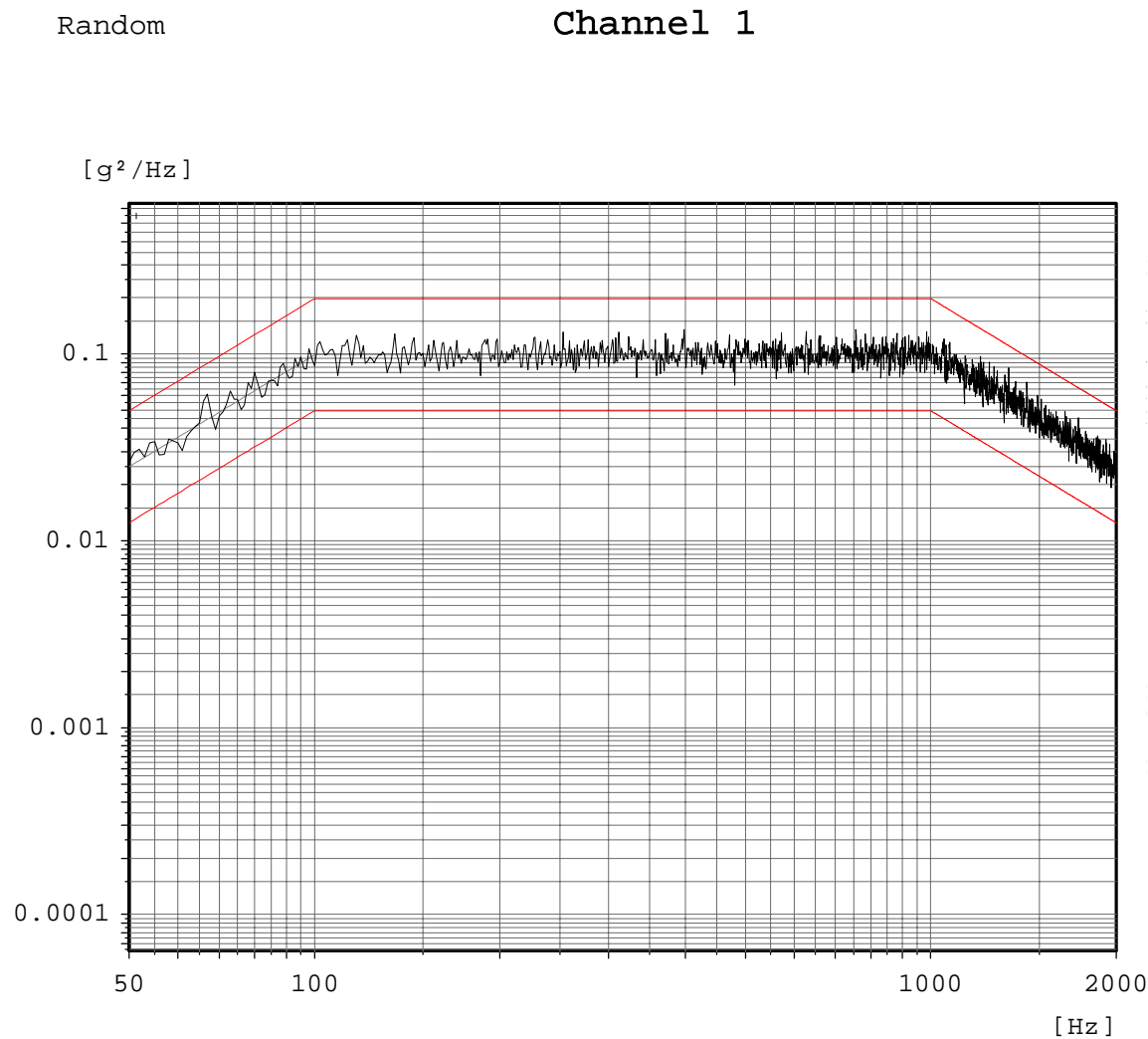
RANDOM VIBRATION QUAL. RESULTS:

1. There was no evidence of physical damage to the test samples.
2. There was no interruption greater than 10 nanoseconds.
3. See the LLCR and DWV sections for LLCR and DWV data (passed).
4. Visual Inspection was performed on the daughtercard connector blades by removing them from their housings. All blades that were measured for LLCR or monitored for interrupts were inspected. Two of the blades are shown below. There was evidence of fretting wear, but none of the locations exhibited gold wear-through or fretting corrosion. SEM/EDS (Scanning Electron Microscopy/Energy Dispersive Spectroscopy) confirmed that gold wear-through had not occurred.



Fig. 15 Connector blades after vibration qualification

Fig. 16 Control accelerometer output (S/N 026, random vibration, lateral axis)



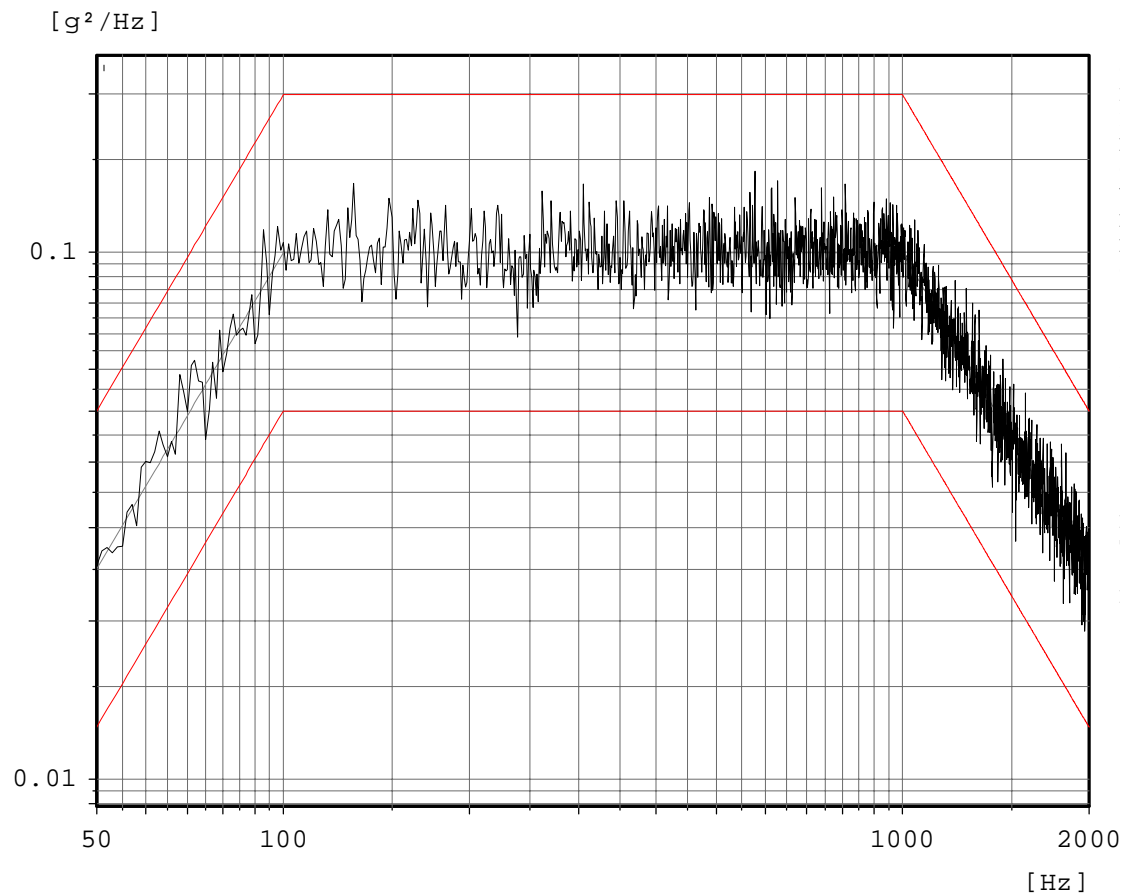
Project# 204690
DY4 Systems
Lateral-Axis
Test Conditions:
ID# 026
Tech: MAG
Date: 11Jan05



Fig. 17 Control accelerometer output (S/N 026, random vibration, flat axis)

Random

Control channel



Project# 204690

DY4 Systems

ID# 026

Flat-Axis

Date: 10Jan05

Test Conditions:

Tech: MAG

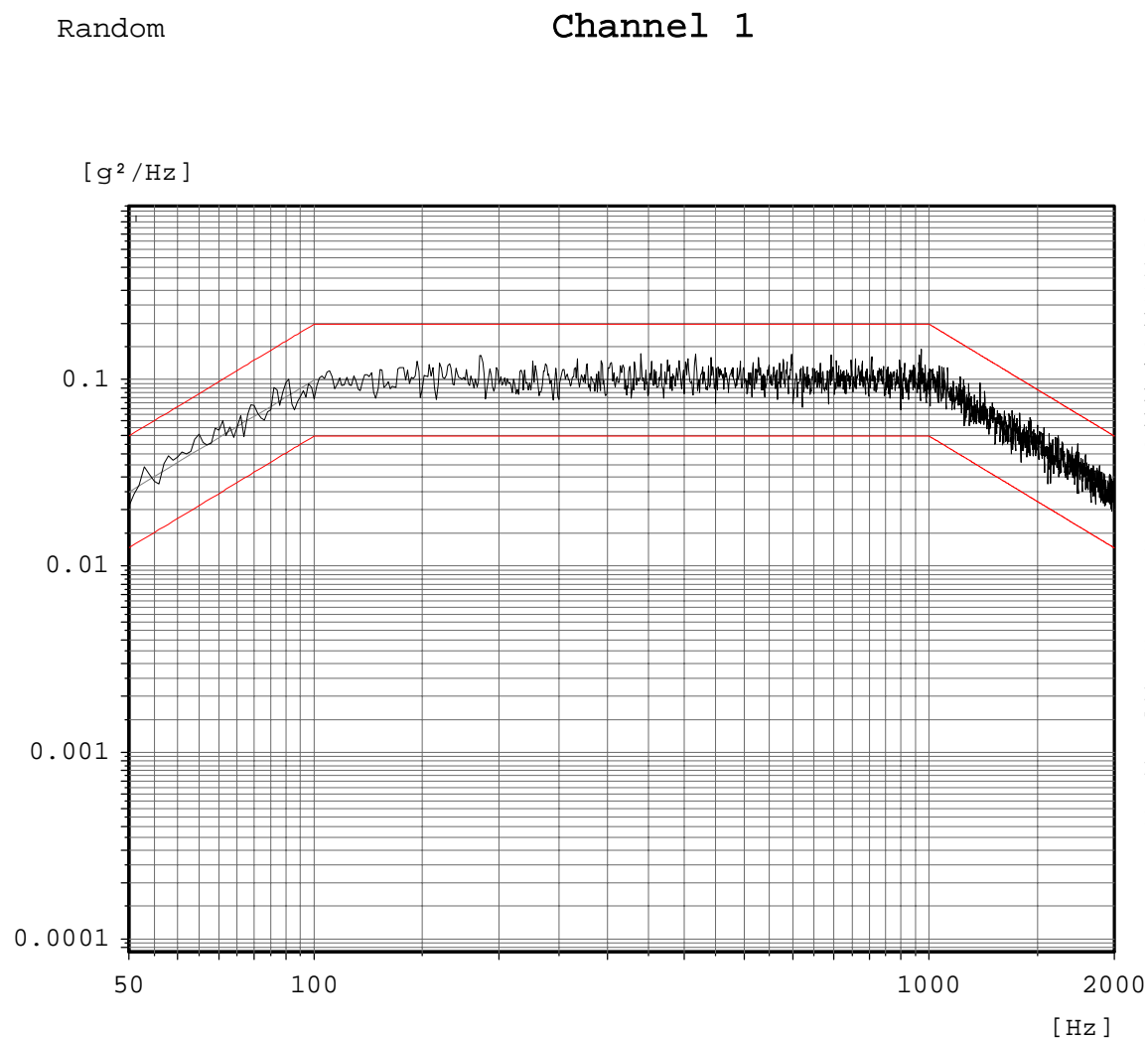


TR# 204690, REV.1.4

40 of 122

CR
Contech Research

Fig. 18 Control accelerometer output (S/N 026, random vibration, long axis)



Project# 204690
DY4 Systems
Longitudinal-Axis
Test Conditions:
ID# 026
Tech: MAG
Date: 11Jan05



PROJECT NO.: 204690-1

SPECIFICATION: VITA 46

PART NO.: 023

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: MG/GGO

START DATE: 1-20-05

COMPLETE DATE: 1-24-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 20 %

EQUIPMENT ID#: 533, 1166, 1167, 1168, 1169, 1271, 1272,
1121

VIBRATION, RANDOM, HALT

PURPOSE:

To perform Highly Accelerated Life Test (HALT) stepped random vibration in order to establish operating limits.

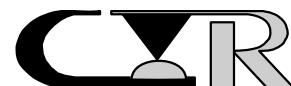
PROCEDURE:

Test Conditions (ref. VITA 46 Test Plan, Jan., 2005):

Power Spectral Density	0.125, .15, .175 and .2 g ² /Hz
Frequency	50-2000 Hz
grms	13.4, 14.6, 15.8, 16.9
Duration	15 minutes each level, 45 min. for 0.2 g ² /Hz
Samples	S/N 023

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test samples as tested.
2. There shall be no contact interruption greater than 10 nanoseconds (ref. EIA-364-87, Test condition D).
3. The LLCR and DWV shall be measured and recorded.
4. There shall be no visible wear-through of the connector contact gold plating under a magnification of 30-40X.



RANDOM VIBRATION HALT RESULTS/DISCUSSION:

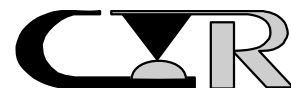
1. There was no evidence of physical damage to the test samples.
2. There was no interruption greater than 10 nanoseconds.
3. See the LLCR and DWV sections for LLCR and DWV data (passed).
4. Visual Inspection was performed on the daughtercard connector blades by removing them from their housings. All blades that were measured for LLCR or monitored for interrupts were inspected. Two of the blades are shown below in Fig. 19. There was evidence of fretting wear, and in some spots gold wear-through, with the worst case showing fretting corrosion debris (P3-1 blade, top contact). SEM/EDS confirmed that gold wear-through had occurred to the nickel underplate.

The contact with fretting corrosion debris was not being monitored for interrupts, nor measured for LLCR, so a determination of if or when it failed could not be made (also, note that only one of the two redundant contacts had fretting corrosion debris). Other contacts which showed gold wear-through, and were being monitored and measured, did not fail interrupt monitoring or LLCR.

Using the visual inspection criteria of the VITA 46 Test Plan, the gold wear-through and fretting corrosion locations established that the vibration limit (for the test vehicle used) was between $0.1 \text{ G}^2/\text{Hz}$ and $0.2 \text{ G}^2/\text{Hz}$, 50-2000 Hz, 1.5 hours/axis. The other criteria (LLCR and interrupt monitoring) give a higher vibration limit (i.e. $>0.2 \text{ G}^2/\text{Hz}$).

In an attempt to increase vibration life beyond the HALT stepped vibration levels/durations, the daughtercard connector is being made available with 50 microinches (nominal) of gold plating, compared to the 30 microinch (nominal) thickness used in this test. [Note that subsequent measurements showed that the actual average thickness was approximately 40 microinches]. The backplane connector already has 50 microinches (nominal) of gold in the contact area.

In addition, other approaches can be used to increase vibration life. For example, increased stiffening of the plug-in module will reduce displacements under vibration.



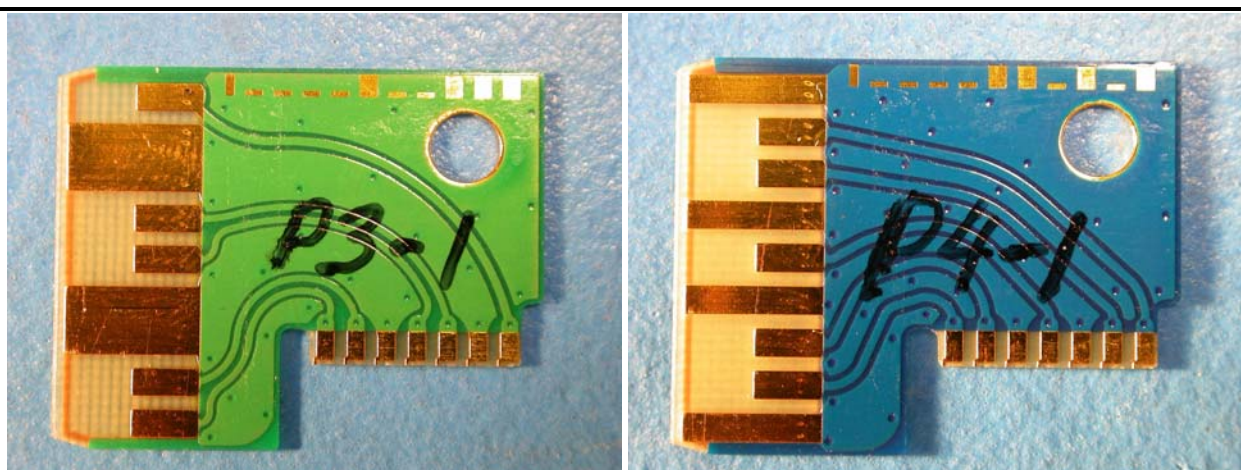
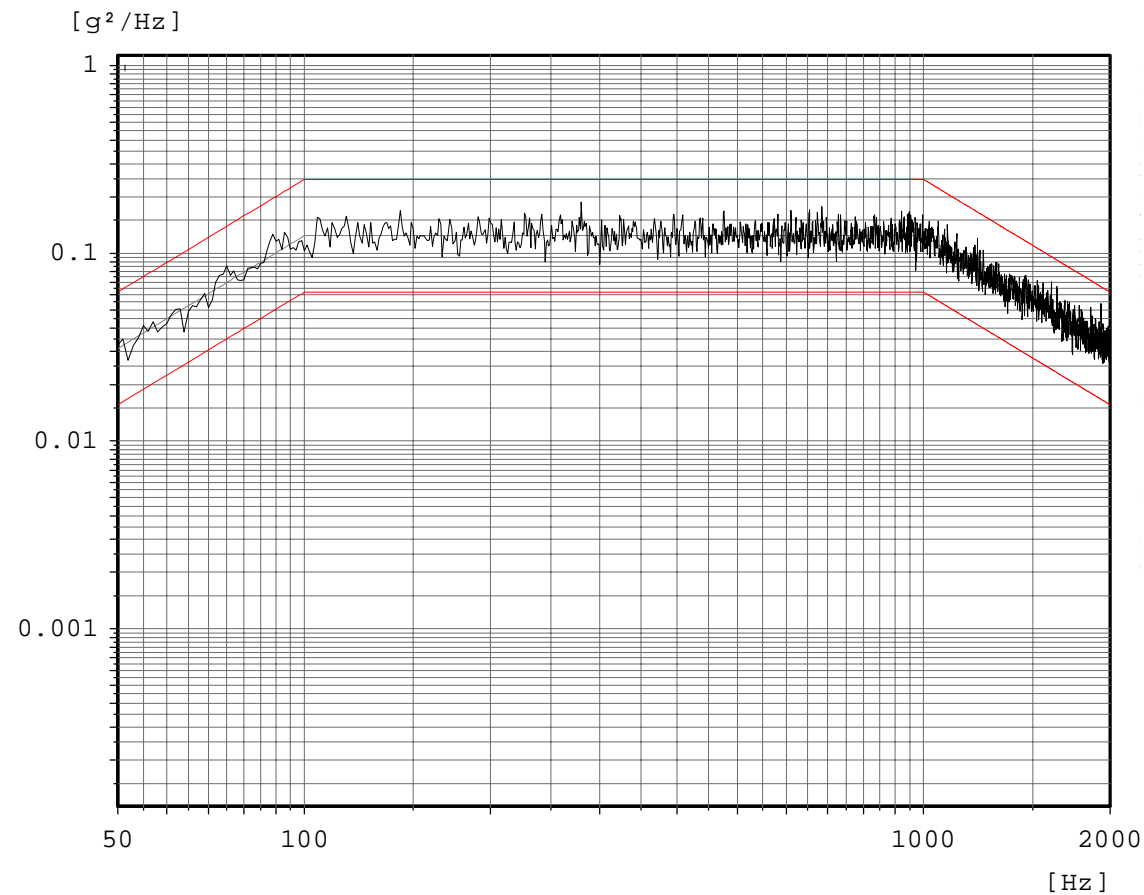


Fig. 19 Connector blades after HALT stepped vibration

Fig. 20 Control accelerometer output (S/N 023, stepped random vibration, flat axis)

Random

Channel 1



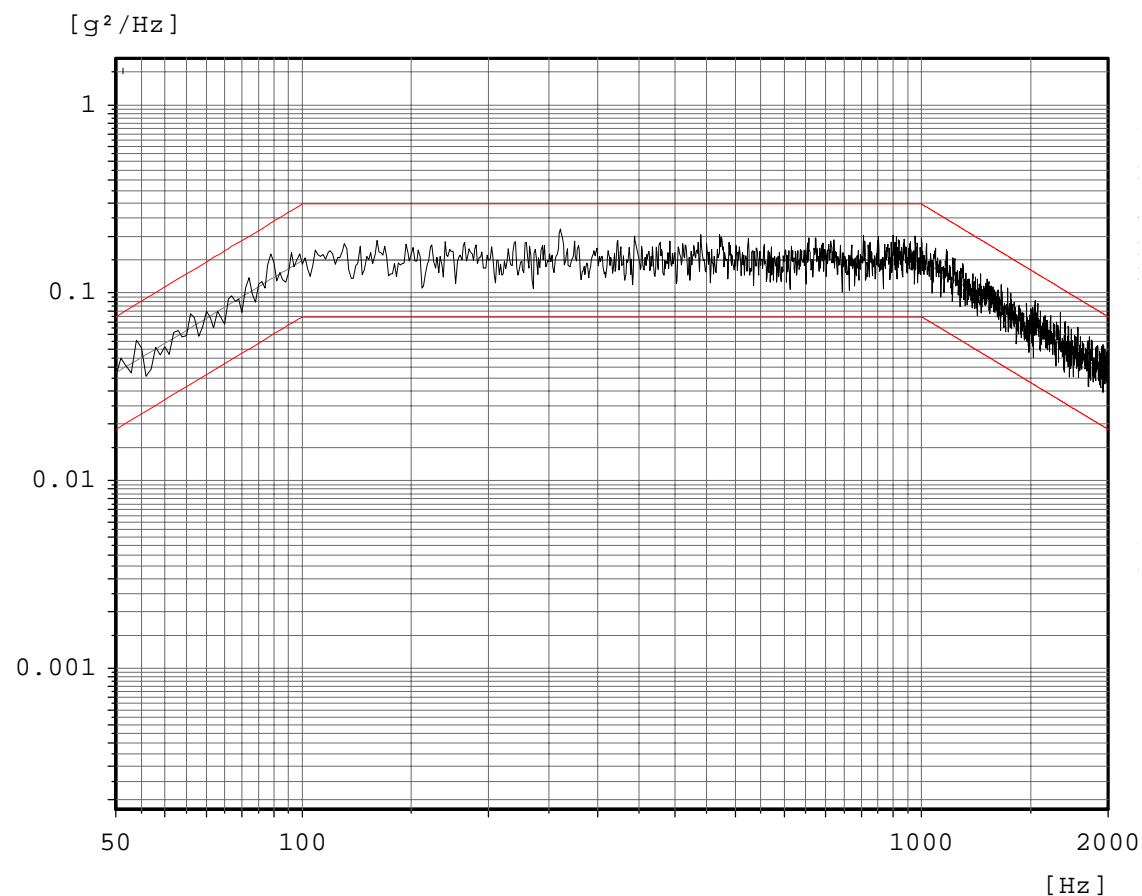
Project# 204690
DY4 Systems
Flat-Axis ID 023
Test Conditions:
0.125 G2/Hz
Tech:MAG
Date:20Jan05



Fig. 21 Control accelerometer output (S/N 023, stepped random vibration, flat axis)

Random

Channel 1



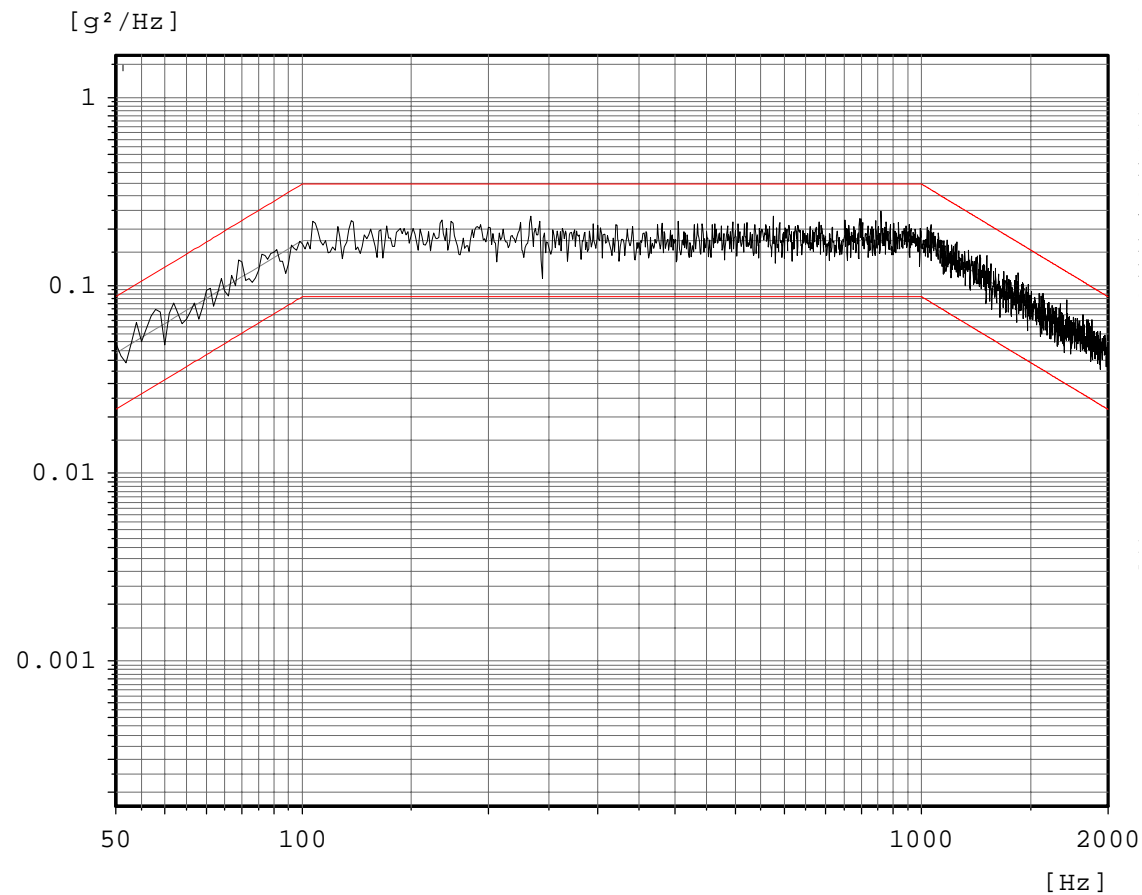
Project# 204690
DY4 Systems
Flat-Axis ID 023
Test Conditions:
0.150 G²/Hz
Tech: MAG
Date: 20Jan05



Fig. 22 Control accelerometer output (S/N 023, stepped random vibration, flat axis)

Random

Channel 1



Project# 204690
DY4 Systems
Flat-Axis ID 023
Test Conditions:
0.175 G²/Hz
Tech: MAG
Date: 21Jan05

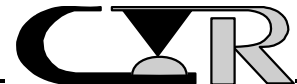
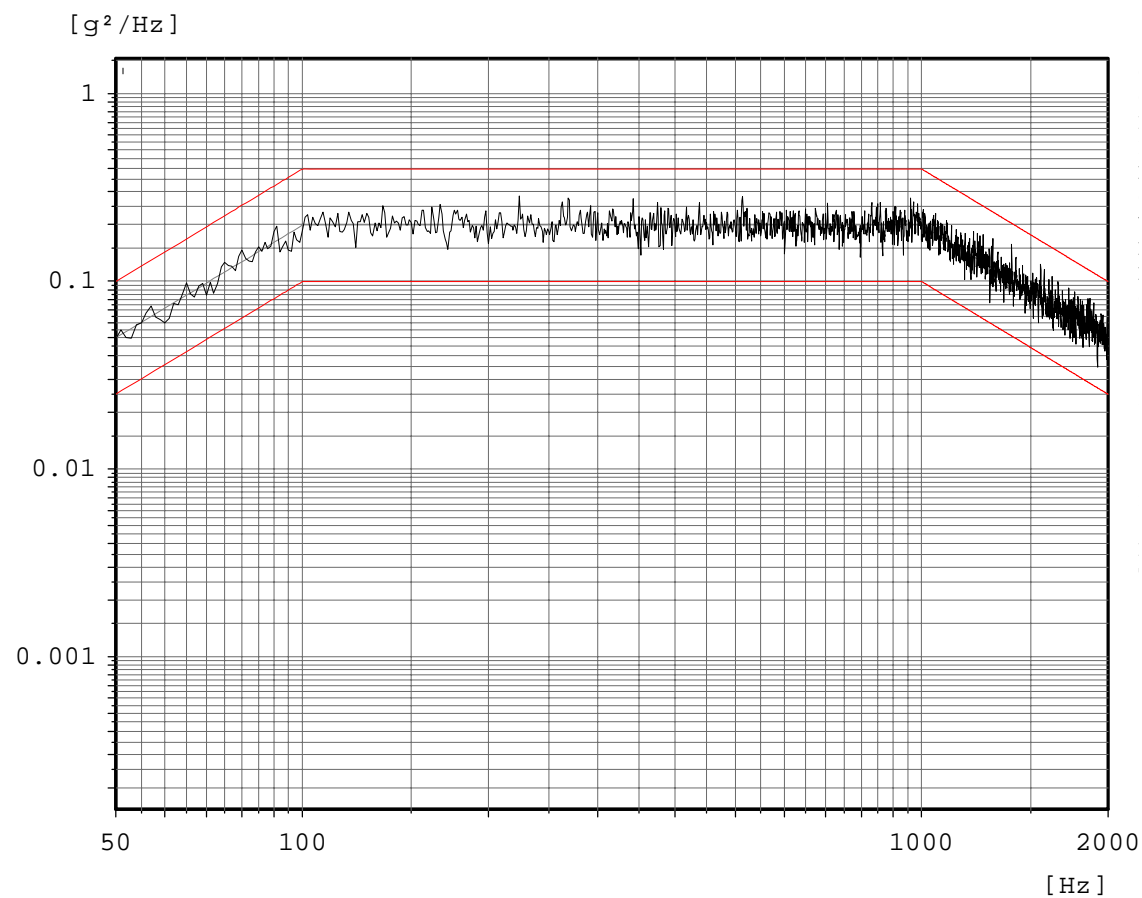


Fig. 23 Control accelerometer output (S/N 023, stepped random vibration, flat axis)

Random

Channel 1



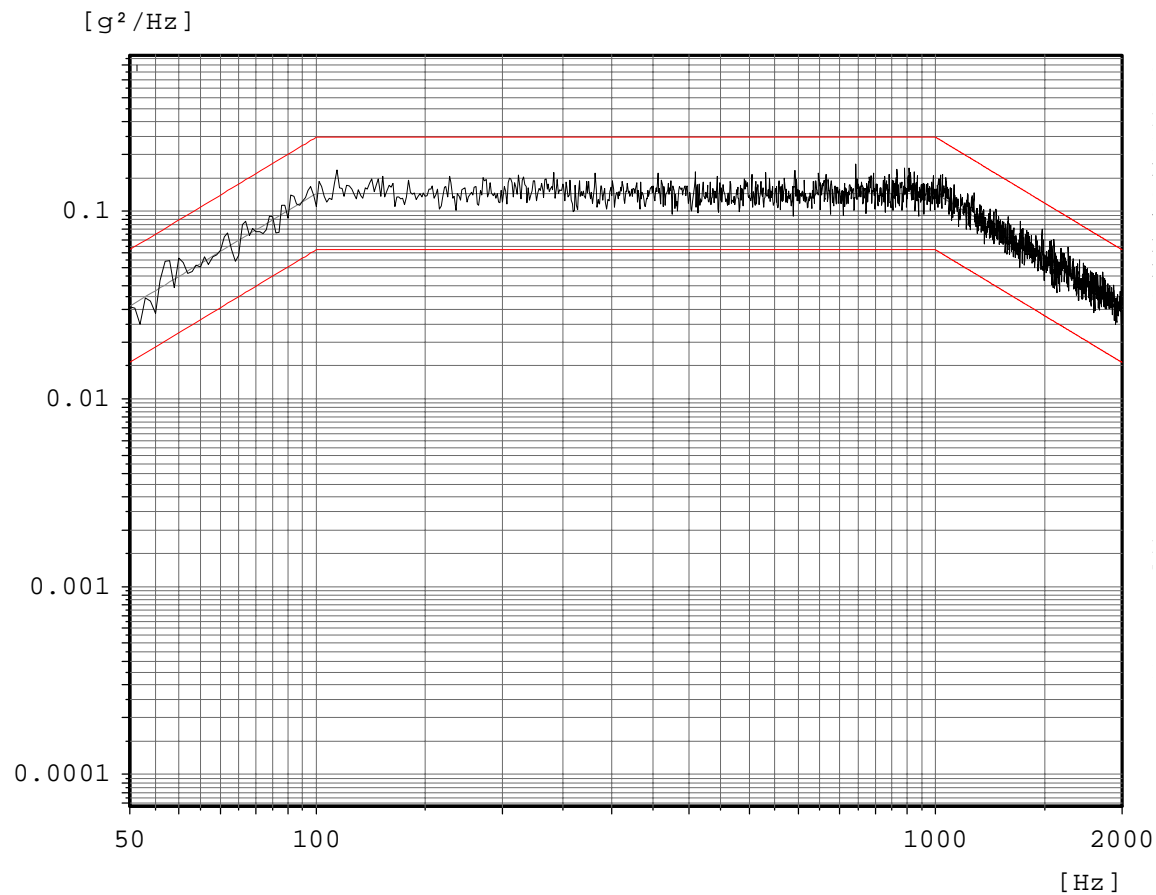
Project# 204690
DY4 Systems
Flat-Axis ID 023
Test Conditions:
0.200 G²/Hz
Tech: MAG
Date: 24Jan05



Fig. 24 Control accelerometer output (S/N 023, stepped random vibration, lateral axis)

Random

Channel 1



Project# 204690
DY4 Systems
Lateral-Axis
Test Conditions:
0.125 G²/Hz
Tech: MAG
Date: 20Jan05

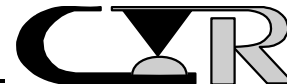
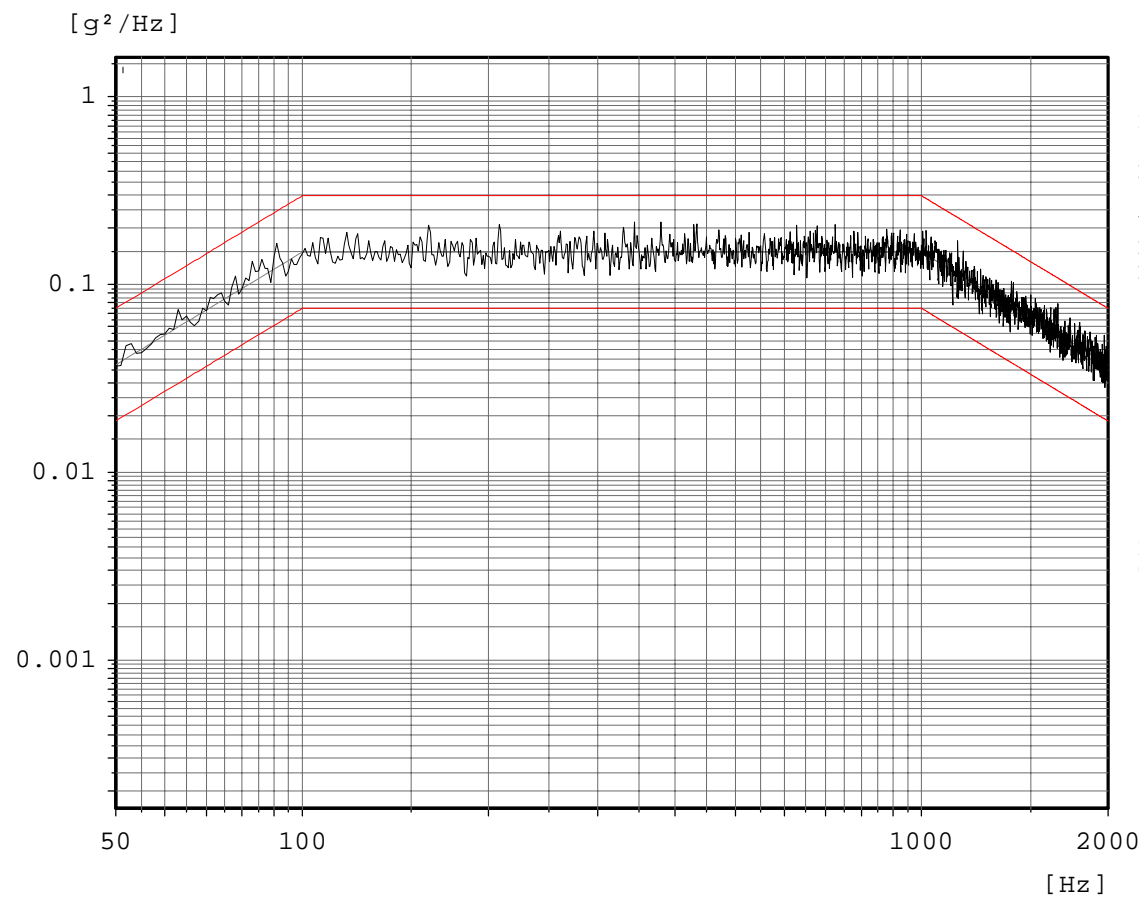


Fig. 25 Control accelerometer output (S/N 023, stepped random vibration, lateral axis)

Random

Channel 1



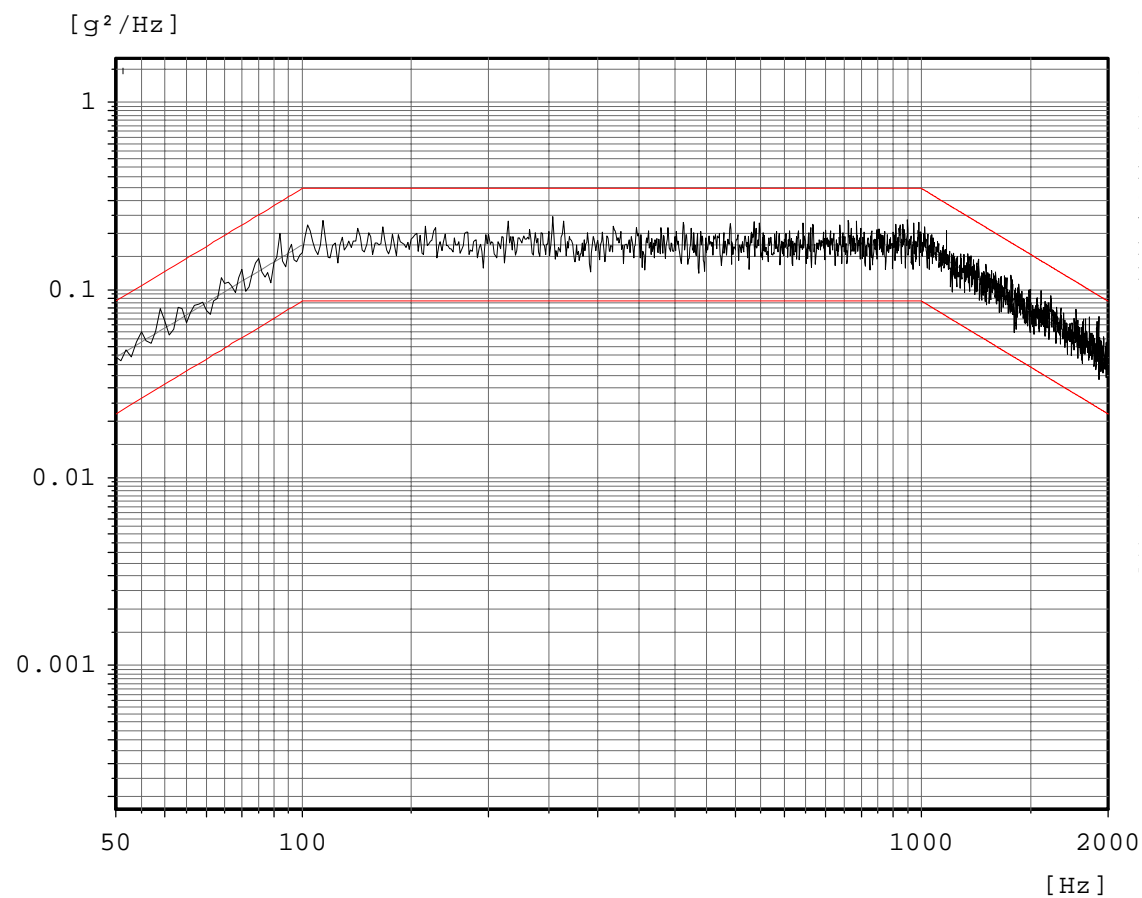
Project# 204690
DY4 Systems
Lateral-Axis
Test Conditions:
0.150 G²/Hz
Tech: MAG
Date: 20Jan05



Fig. 26 Control accelerometer output (S/N 023, stepped random vibration, lateral axis)

Random

Channel 1



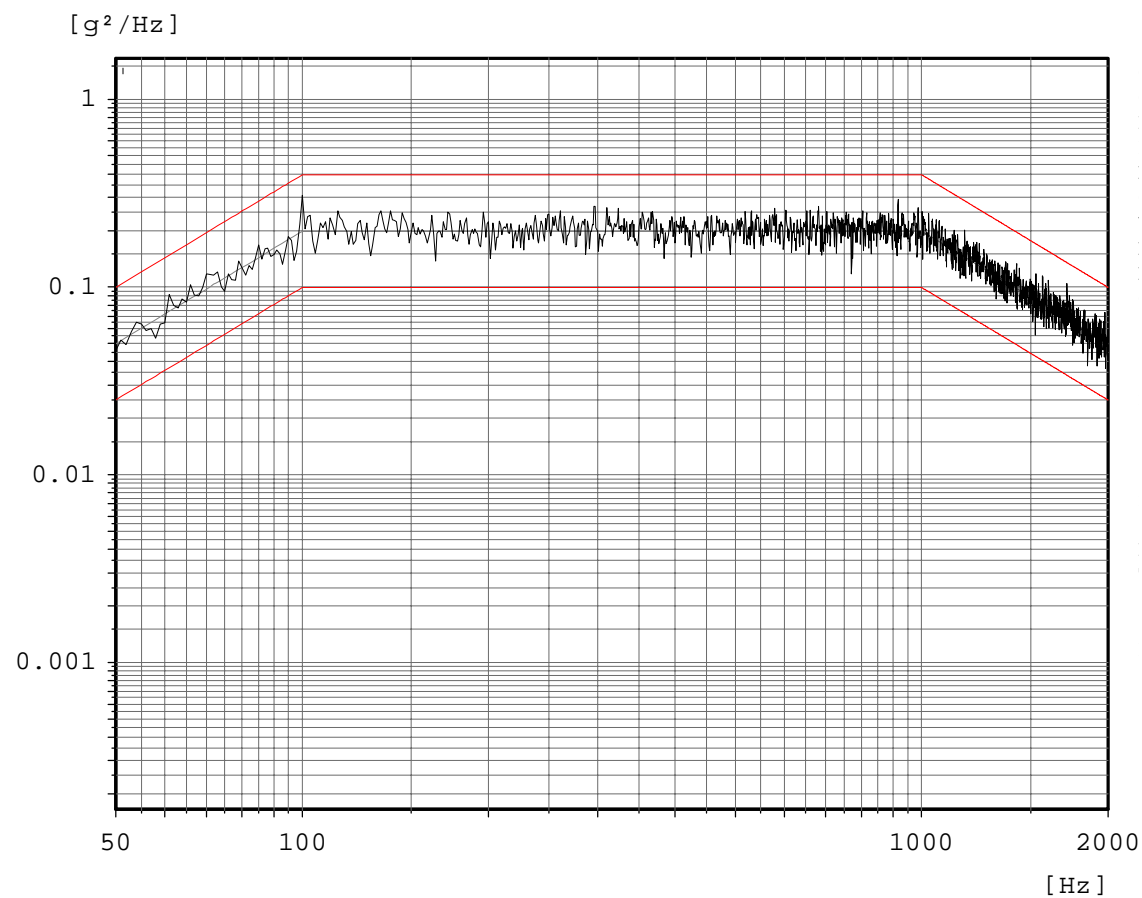
Project# 204690
DY4 Systems
Lateral-Axis
Test Conditions:
0.175 G²/Hz
Tech: MAG
Date: 21Jan05



Fig. 27 Control accelerometer output (S/N 023, stepped random vibration, lateral axis)

Random

Channel 1



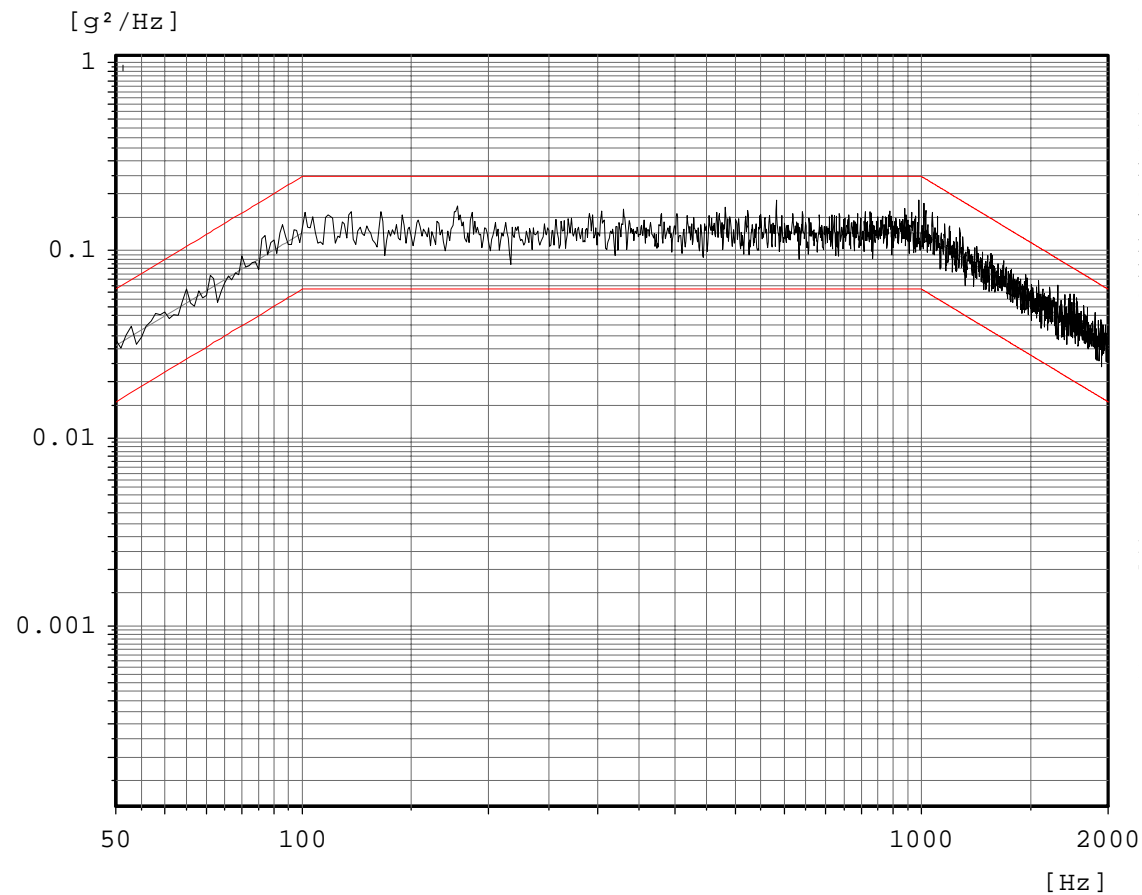
Project# 204690
DY4 Systems
Lateral-Axis
Test Conditions:
0.200 G²/Hz
Tech: MAG
Date: 24Jan05



Fig. 28 Control accelerometer output (S/N 023, stepped random vibration, long axis)

Random

Channel 1



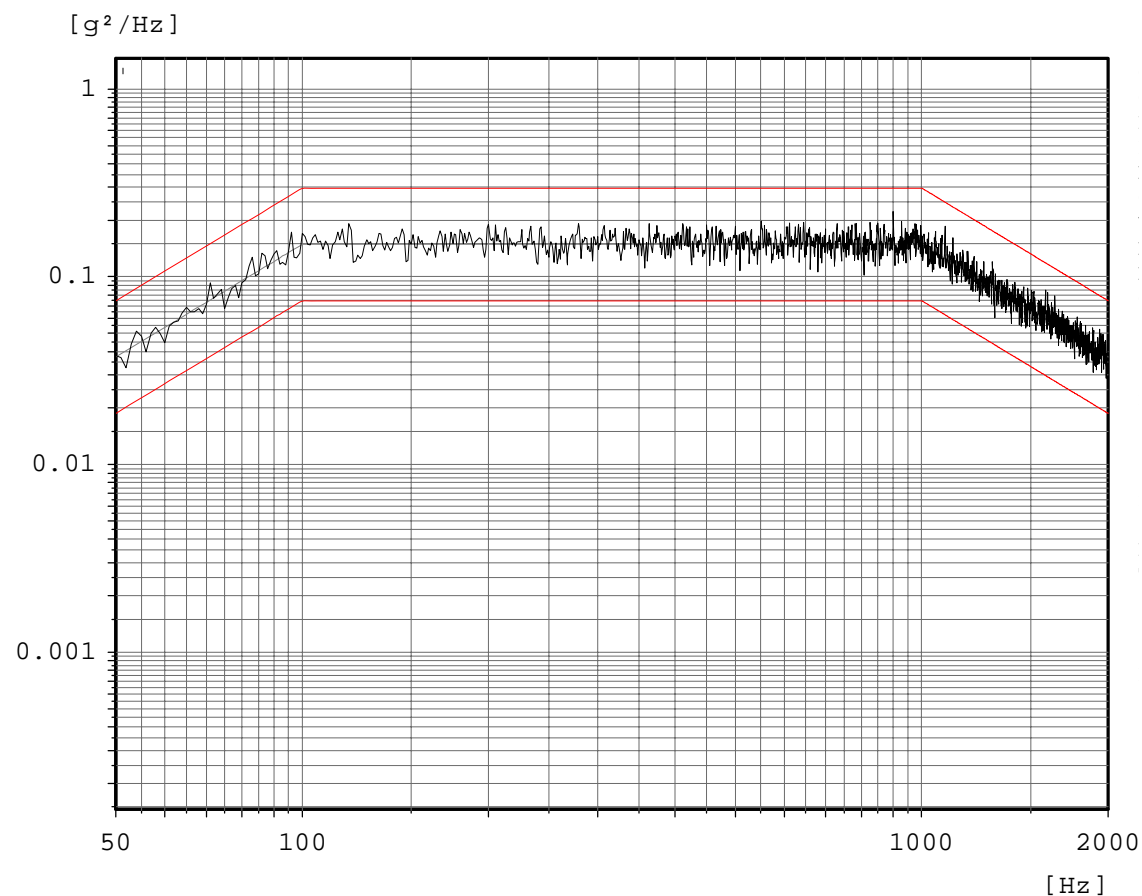
Project# 204690
DY4 Systems
Longitudinal-Axis
Test Conditions:
0.125 G²/Hz
Tech: MAG
Date: 20Jan05



Fig. 29 Control accelerometer output (S/N 023, stepped random vibration, long axis)

Random

Channel 1



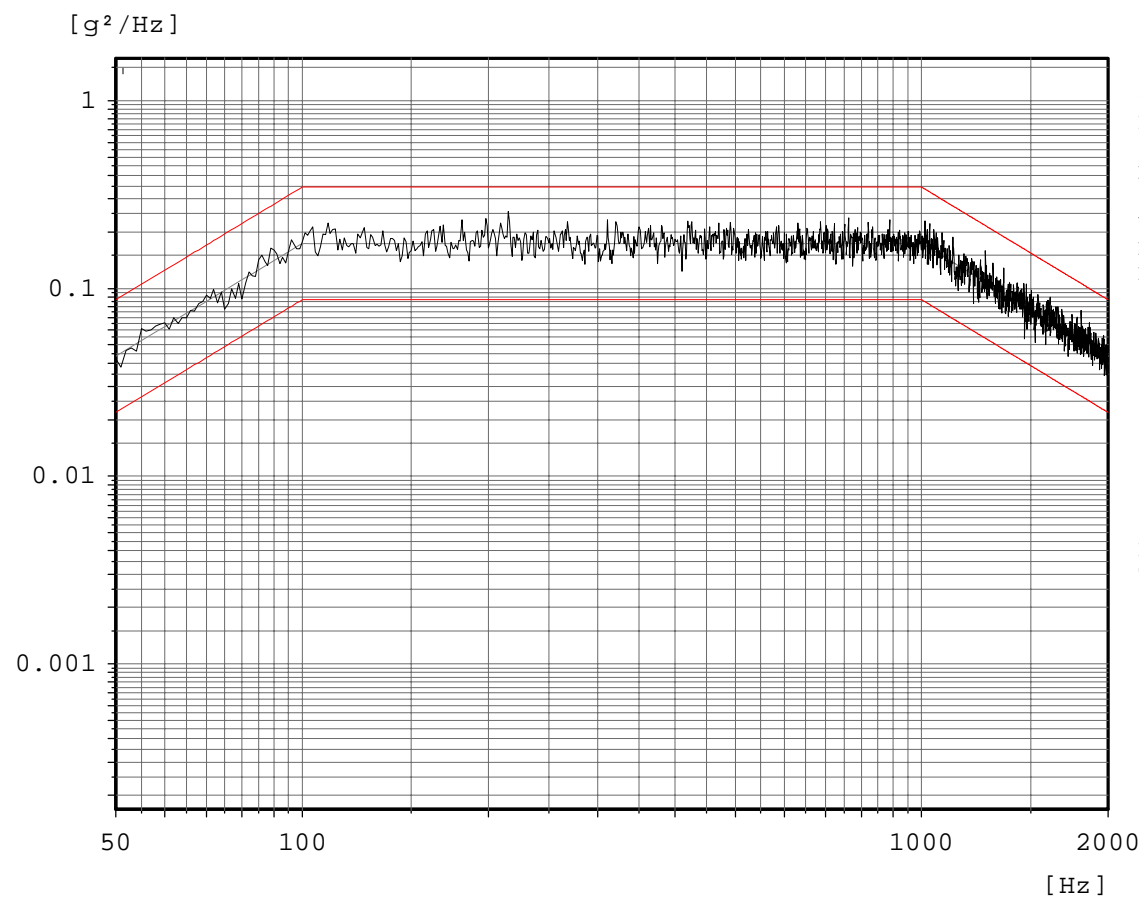
Project# 204690
DY4 Systems
Longitudinal-Axis
Test Conditions:
0.150 G²/Hz
Tech: MAG
Date: 20Jan05



Fig. 30 Control accelerometer output (S/N 023, stepped random vibration, long axis)

Random

Channel 1



Project# 204690
DY4 Systems
Long-Axis
Test Conditions:
0.175 G²/Hz
Tech: MAG
Date: 21Jan05

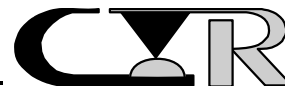
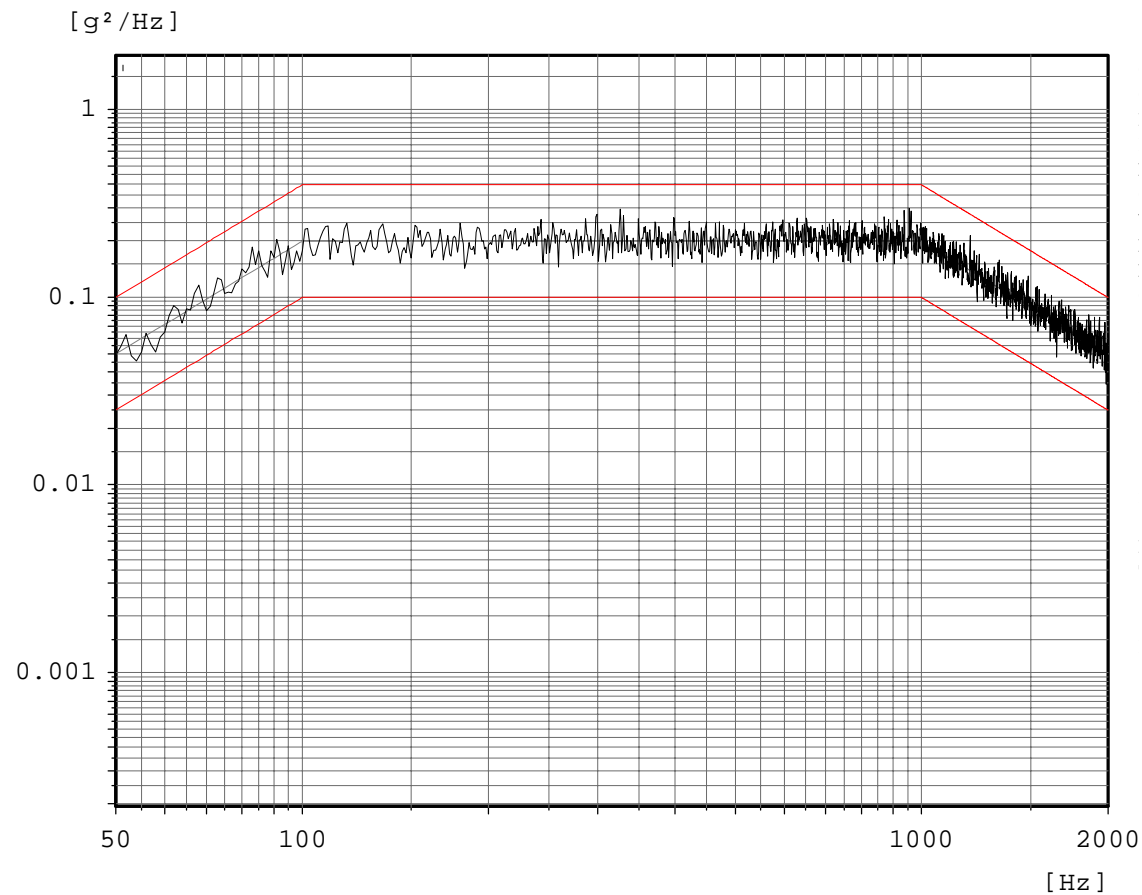


Fig. 31 Control accelerometer output (S/N 023, stepped random vibration, long axis)

Random

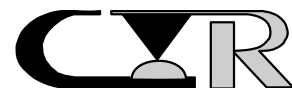
Channel 1



Project# 204690
DY4 Systems
Longitudinal-Axis
Test Conditions:
0.200 G²/Hz
Tech: MAG
Date: 24Jan05



GROUP B TESTING (Bench Handling & Vibration over Temperature)



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 027

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-25-05

COMPLETE DATE: 3-10-05

ROOM AMBIENT: 23 °C

RELATIVE HUMIDITY: 20 %

EQUIPMENT ID#: 673, 529

LOW LEVEL CIRCUIT RESISTANCE (LLCR)

PURPOSE:

To evaluate contact resistance characteristics of the contact systems under conditions where applied voltages and currents do not alter the physical contact interface and will detect oxides and films that degrade electrical stability. It is also sensitive to and may detect the presence of fretting corrosion induced by mechanical or thermal environments as well as any significant loss of contact pressure.

PROCEDURE:

The test was performed in accordance with EIA 364, TP 23 with the following conditions:

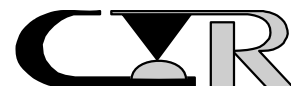
Test Current : 10ma
Open Circuit Voltage : 20mv
No. of Positions Tested : 64 per test sample

REQUIREMENTS:

Low level circuit resistance shall be measured and recorded prior to and after each environment, in this case vibration/temperature. Failure is defined as a LLCR increase of 10 milliohms or greater.

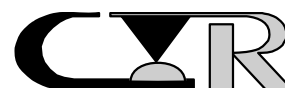
RESULTS:

The LLCR data follows:



Delta values
units: milliohms

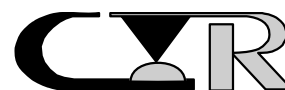
Temp °C	23	23	24				
R.H. %	18	18	20				
Date:	25Jan05	25Jan05	10Mar05				
Pos. ID	Initial	Bench Handling	Vibe @ Temp	Pos. ID	Initial	Bench	Vibe @ Temp
1	28.2	1.6	0.0	36	25.7	0.7	0.1
2	31.8	0.8	0.2	37	28.8	1.6	0.3
3	22.9	0.2	0.2	38	34.3	1.0	0.9
4	28.6	2.8	-0.5	39	23.5	1.0	0.0
5	31.4	0.5	0.2	40	34.8	0.3	0.4
6	26.0	3.6	0.1	41	26.6	0.6	0.1
7	31.3	1.2	0.6	42	33.4	-0.1	0.6
8	23.6	0.5	0.1	43	30.1	0.6	0.5
9	34.3	0.1	0.7	44	33.7	0.6	0.1
10	29.1	0.5	0.5	45	28.4	0.3	0.8
11	34.0	0.1	0.7	46	32.7	0.4	0.5
12	28.2	0.5	0.0	47	29.0	0.8	0.0
13	33.7	0.1	0.0	48	34.5	0.3	0.7
14	28.3	2.4	-0.3	49	33.9	0.9	0.3
15	33.5	0.5	0.9	50	33.6	0.2	0.8
16	34.5	0.2	0.1	51	37.2	0.3	0.5
17	34.3	0.5	0.8	52	29.3	0.4	0.6
18	37.4	0.2	1.1	53	36.6	-0.1	0.5
19	28.3	0.5	0.6	54	28.9	0.3	0.4
20	37.2	-0.1	0.5	55	37.5	1.0	0.5
21	28.3	0.5	0.9	56	29.7	0.5	0.6
22	37.9	0.4	0.6	57	39.3	0.4	0.3
23	28.9	0.8	0.9	58	26.2	1.1	0.3
24	39.6	0.3	0.4	59	31.8	0.1	0.2
25	22.9	0.7	0.2	60	25.1	0.4	-0.5
26	34.8	0.6	0.5	61	33.8	0.3	0.5
27	26.1	3.3	0.1	62	28.6	0.8	-0.4
28	31.7	0.5	0.5	63	24.4	0.6	0.2
29	27.8	1.1	0.2	64	33.8	0.4	0.5
30	25.8	0.6	0.1				
31	31.9	0.3	0.6	MAX	39.6	3.6	1.1
32	28.6	0.6	0.0	MIN	22.9	-0.1	-0.5
33	28.5	1.6	-0.1	AVG	30.9	0.7	0.4
34	34.7	0.4	0.8	STD	4.2	0.7	0.3
35	25.7	0.7	0.1				
36	28.8	1.6	0.3				



Safety Ground

Actual values
units: milliohms

Temp °C	23	23	24
R.H. %	18	18	20
Date:	25Jan05	25Jan05	10Mar05
Pos. ID	Initial	Bench	Vibe @
		Handling	Temp
1	0.40	0.36	0.29
2	0.40	5.83	0.24
3	0.88	0.29	0.19
MAX	0.9	5.8	0.3
MIN	0.4	0.3	0.2
AVG	0.6	2.2	0.2
STD	0.3	3.2	0.0
Open	0	0	0



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 027

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-25-05

COMPLETE DATE: 3-10-05

ROOM AMBIENT: 23 °C

RELATIVE HUMIDITY: 20 %

EQUIPMENT ID#: 673, 529

DIELECTRIC WITHSTANDING VOLTAGE (SEA LEVEL)

PURPOSE:

To determine if the connectors maintain their dielectric integrity after being stressed by exposure to mechanical and environmental conditioning.

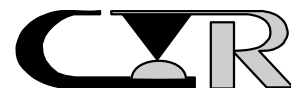
PROCEDURE:

1. The test was performed in accordance with MIL-STD-1344, Method 3001.
2. Test Conditions:

Between Adjacent Contacts (closest spacing)	:	Yes
Between Rows	:	No
Between Contacts and Hardware	:	No
Between Contacts and Shell	:	No
Mated Condition	:	Mated
Mounting Condition	:	Mounted
Hold Time	:	60 sec.
Rate of Application	:	500 volts/sec.
Test Voltage	:	500

REQUIREMENTS:

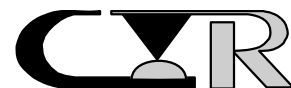
1. When the specified test voltage is applied, there shall be no evidence of breakdown, arcing, etc.
2. The leakage current shall not exceed 5 ma.



RESULTS:

1. The test sample as tested met the requirements as specified.
2. The following is a summary of the observed data.

Sample ID	SN 027	SN 027		Sample ID	SN 027	SN 027	
J1 a1-b1	Pass	Pass		J6 a1-b1	Pass	Pass	
J1 e1-f1	Pass	Pass		J6 e1-f1	Pass	Pass	
J1 c2-d2	Pass	Pass		J6 c2-d2	Pass	Pass	
J1 g2-h2	Pass	Pass		J6 g2-h2	Pass	Pass	
J1 c8-d8	Pass	Pass		J6 c8-d8	Pass	Pass	
J1 g8-h8	Pass	Pass		J6 g8-h8	Pass	Pass	
J1 a9-b9	Pass	Pass		J6 a9-b9	Pass	Pass	
J1 e9-f9	Pass	Pass		J6 e9-f9	Pass	Pass	



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 027

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-25-05

COMPLETE DATE: 1-25-05

ROOM AMBIENT: 23 °C

RELATIVE HUMIDITY: 18 %

EQUIPMENT ID#: N/A

MECHANICAL SHOCK (Bench Handling)

PURPOSE:

To determine the mechanical and electrical integrity of connectors for use with electronic equipment subjected to shocks such as those expected from handling.

PROCEDURE:

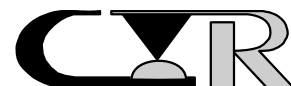
Sample under test was raised on one edge using the opposite edge as a hinge 4 inches or 45 degrees whichever is less then released to drop on the bench top. The opposite and adjacent edges were repeated in a similar manner giving a total of 4 drops for the bottom plane.

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test sample as tested.
2. The LLCR and DWV shall be measured and recorded.

BENCH HANDLING RESULTS:

1. There was no evidence of physical damage to the test sample.
2. See the LLCR and DWV sections for LLCR and DWV data (passed).



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 027

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 3-7-05

COMPLETE DATE: 3-10-05

ROOM AMBIENT: 24

RELATIVE HUMIDITY: 24 %

EQUIPMENT ID#: 553, 1166, 1167, 1168, 1169, 1271, 1272,
1121

VIBRATION, RANDOM
With Temperature Sweep

PURPOSE:

To evaluate the integrity of the test samples relative to a severe mechanical environment.

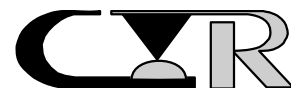
PROCEDURE:

Test Conditions (ref. MIL-STD-1344A, Method 2005.1, Test Condition V, letter D):

Power Spectral Density	0.1 g^2 /Hz max.
Frequency	15-2000 Hz
GRMS	
Temperature	-40 to 100°C
Duration	1.5 hr per axis - 15 min ramps, 30 min dwell
Samples	027

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test sample as tested.
2. There shall be no contact interruption greater than 10 nanoseconds (ref. EIA-364-87, Test condition D).
3. The LLCR and DWV shall be measured and recorded.



VIBRATION OVER TEMP. RESULTS:

1. There was no evidence of physical damage to the test sample as tested.
2. There was no interruption greater than 10 nanoseconds.
3. See the LLCR and DWV sections for LLCR and DWV data (passed).
4. Visual Inspection was performed on the daughtercard connector blades by removing them from their housings. Two of the blades are shown below. There was evidence of fretting wear, but none of the locations showed gold wear-through.

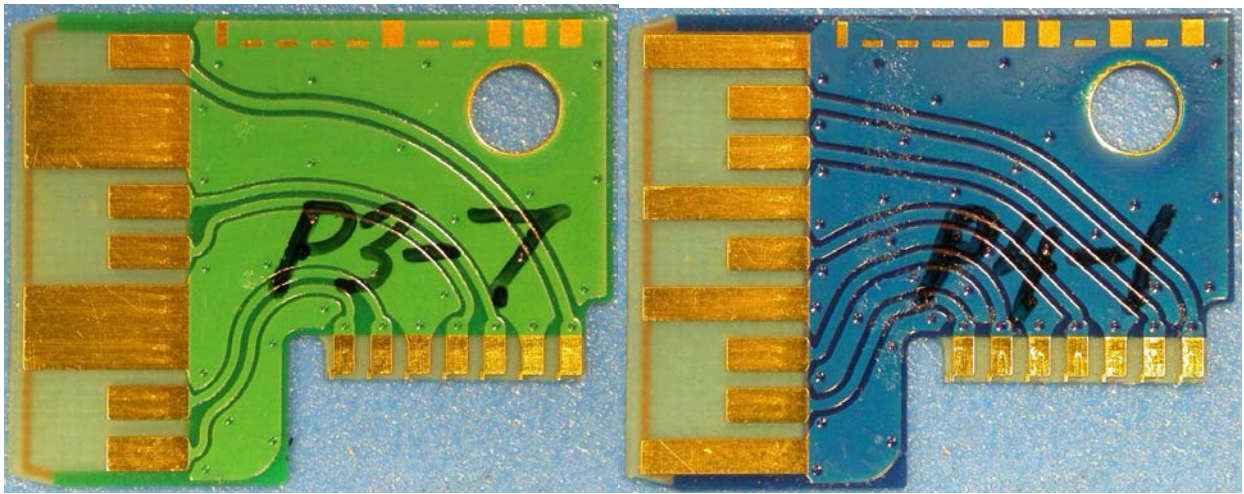
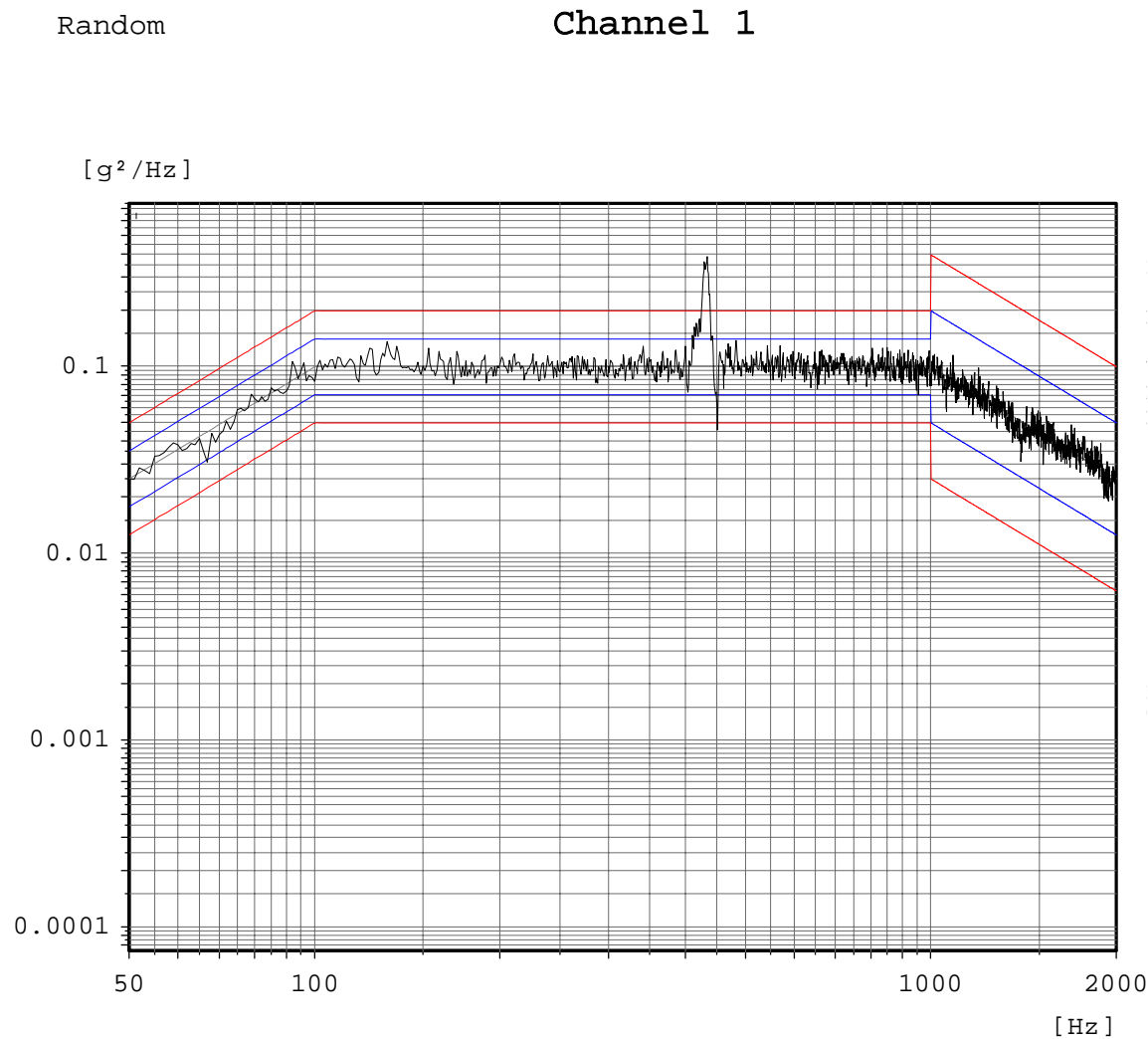


Fig. 32 Connector blades after combined vibration/temperature

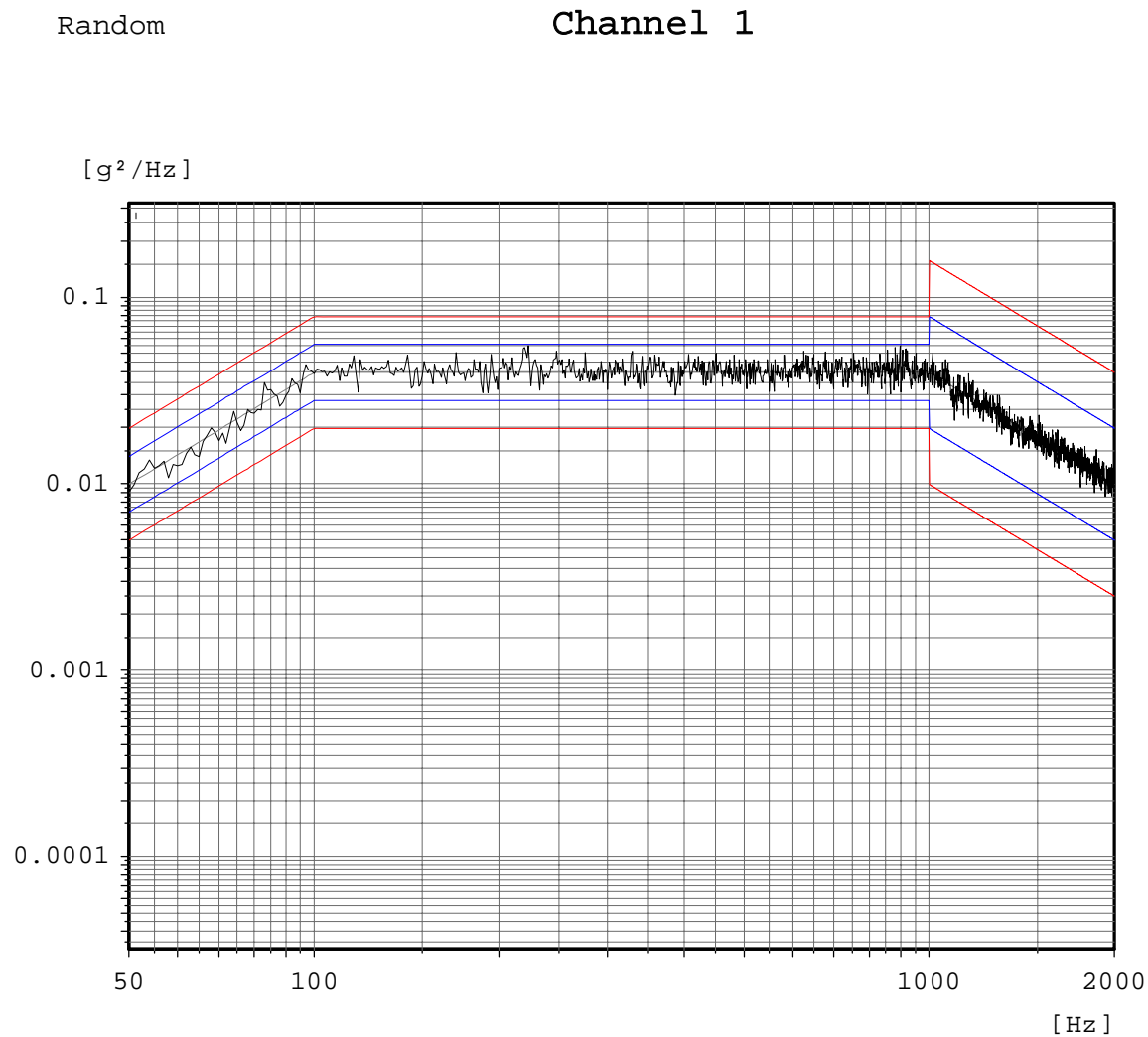
Fig. 33 Control accelerometer output (S/N 027, vibration/temp., flat axis)



Project# 204690
DY4 Systems
Flat-Axis
Test Conditions:
Method 2005.1 VD
Tech: MAG
Date: 09Mar05



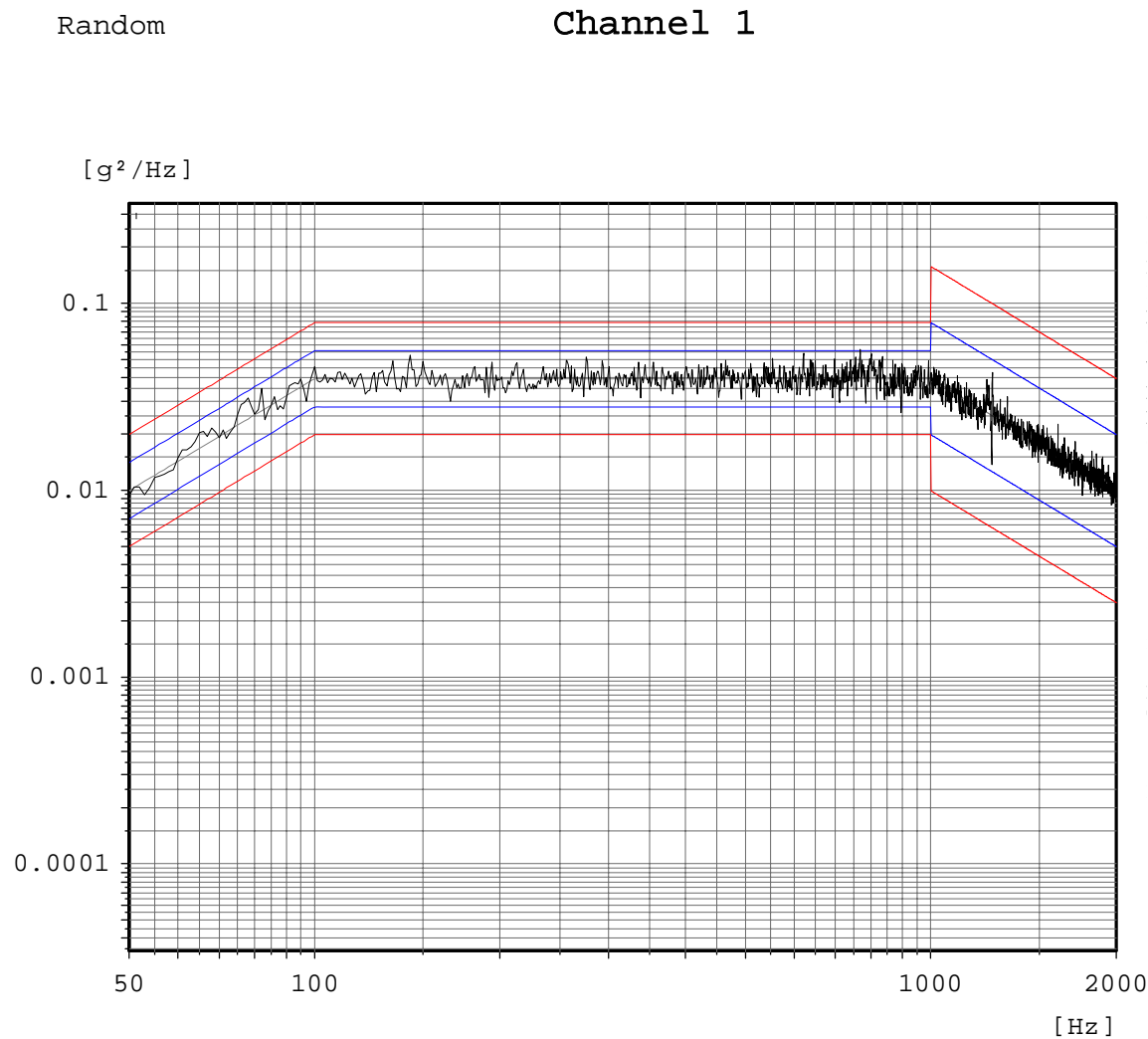
Fig. 34 Control accelerometer output (S/N 027, vibration/temp., lateral axis)



Project# 204690
DY4 Systems
Lateral-Axis
Test Conditions:
Method 2005.1 VD
Tech: MAG
Date: 10Mar05



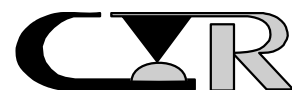
Fig. 35 Control accelerometer output (S/N 027, vibration/temp., long axis)



Project# 204690
DY4 Systems
Longitudinal-Axis
Test Conditions:
Method 2005.1 VD
Tech: MAG
Date: 09Mar05



GROUP C TESTING (Humidity)



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 024

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-13-05

COMPLETE DATE: 2-10-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 28 %

EQUIPMENT ID#: 207, 400, 673, 529

LOW LEVEL CIRCUIT RESISTANCE (LLCR)

PURPOSE:

To evaluate contact resistance characteristics of the contact systems under conditions where applied voltages and currents do not alter the physical contact interface and will detect oxides and films that degrade electrical stability. It is also sensitive to and may detect the presence of fretting corrosion induced by mechanical or thermal environments as well as any significant loss of contact pressure.

PROCEDURE:

The test was performed in accordance with EIA 364, TP 23 with the following conditions:

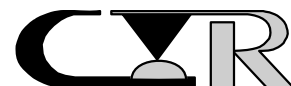
Test Current : 10ma
Open Circuit Voltage : 20mv
No. of Positions Tested : 64 per test sample

REQUIREMENTS:

Low level circuit resistance shall be measured and recorded prior to and after each environment, in this case humidity/temperature. Failure is defined as a LLCR increase of 10 milliohms or greater.

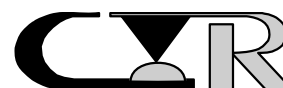
RESULTS:

The LLCR data follows:



Delta values
units: milliohms

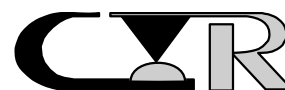
Temp °C	24	23			
R.H. %	28	28			
Date:	13Jan05	10Feb05			
Pos. ID	Initial	Humidity	Pos. ID	Initial	Humidity
1	28.8	-1.5	36	28.5	-0.8
2	31.9	-1.8	37	34.5	-1.0
3	24.1	-1.3	38	23.5	-1.0
4	29.1	-1.9	39	35.6	-1.4
5	31.8	-1.4	40	27.1	-1.6
6	25.8	-0.8	41	34.6	-1.7
7	32.7	-1.6	42	30.3	-1.1
8	23.5	-0.9	43	33.7	-1.2
9	34.7	-1.2	44	30.1	-1.0
10	30.0	-1.4	45	34.9	-1.6
11	34.7	-1.5	46	29.8	-0.9
12	29.5	-1.2	47	33.7	-0.5
13	35.2	-1.5	48	33.2	-1.0
14	29.0	-1.1	49	35.5	-0.6
15	35.3	-0.9	50	37.5	-1.2
16	34.1	-1.4	51	30.9	-1.3
17	35.3	-1.4	52	37.6	-1.4
18	37.8	-0.9	53	30.3	-0.7
19	30.0	-0.9	54	36.8	-0.8
20	37.8	-1.0	55	29.4	-0.8
21	29.7	-0.9	56	38.9	-0.7
22	37.3	-0.9	57	26.0	-0.7
23	29.1	-1.0	58	30.9	-0.6
24	39.5	-0.8	59	26.7	-2.1
25	22.8	-0.5	60	33.2	-0.6
26	34.1	-0.5	61	28.6	-1.1
27	27.0	-1.4	62	24.8	-0.8
28	31.6	-0.7	63	33.4	-0.5
29	27.9	-0.9	64	29.5	-1.2
30	27.0	-1.2			
31	31.6	-0.7	MAX	39.5	-0.5
32	30.0	-2.2	MIN	22.8	-2.2
33	28.9	-1.5	AVG	31.4	-1.1
34	34.3	-1.1	STD	4.1	0.4
35	27.0	-1.3	Open	0.0	0.0



Delta values
units: milliohms

Temp °C	24	23
R.H. %	28	28
Date:	13Jan05	10Feb05
Pos. ID	Initial	Humidity
1	5.48	-5.14
2	0.16	-0.04
3	5.71	-5.11
MAX	5.7	-0.04
MIN	0.2	-5.14
AVG	3.8	-3.43
STD	3.1	2.93
Open	0	0

Safety Ground



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 024

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-13-05

COMPLETE DATE: 2-10-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 28 %

EQUIPMENT ID#: 321

DIELECTRIC WITHSTANDING VOLTAGE (SEA LEVEL)

PURPOSE:

To determine if the connectors maintain their dielectric integrity after being stressed by exposure to mechanical and environmental conditioning.

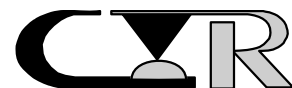
PROCEDURE:

1. The test was performed in accordance with MIL-STD-1344, Method 3001.
2. Test Conditions:

Between Adjacent Contacts (closest spacing)	:	Yes
Between Rows	:	No
Between Contacts and Hardware	:	No
Between Contacts and Shell	:	No
Mated Condition	:	Mated
Mounting Condition	:	Mounted
Hold Time	:	60 sec.
Rate of Application	:	500 volts/sec.
Test Voltage	:	500

REQUIREMENTS:

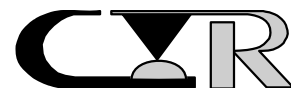
1. When the specified test voltage is applied, there shall be no evidence of breakdown, arcing, etc.
2. The leakage current shall not exceed 5 ma.



RESULTS:

1. The test sample as tested met the requirements as specified.
2. The following is a summary of the observed data.

Sample ID	SN 024	SN 024		Sample ID	SN 024	SN 024	
J1 a1-b1	Pass	Pass		J6 a1-b1	Pass	Pass	
J1 e1-f1	Pass	Pass		J6 e1-f1	Pass	Pass	
J1 c2-d2	Pass	Pass		J6 c2-d2	Pass	Pass	
J1 g2-h2	Pass	Pass		J6 g2-h2	Pass	Pass	
J1 c8-d8	Pass	Pass		J6 c8-d8	Pass	Pass	
J1 g8-h8	Pass	Pass		J6 g8-h8	Pass	Pass	
J1 a9-b9	Pass	Pass		J6 a9-b9	Pass	Pass	
J1 e9-f9	Pass	Pass		J6 e9-f9	Pass	Pass	



PROJECT NO.: 205690

SPECIFICATION: VITA 46

PART NO.: 024

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-28-05

COMPLETE DATE: 2-10-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 19 %

EQUIPMENT ID#: 27, 1230

HUMIDITY (THERMAL CYCLING)

PURPOSE:

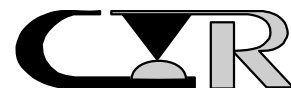
To evaluate the impact on electrical stability of the contact system when exposed to any environment which may generate thermal/moisture type failure mechanisms such as:

- a) Fretting corrosion due to wear resulting from micromotion, induced by thermal cycling. Humidity accelerates the oxidation process.
- b) Oxidation of wear debris or from particulates from the surrounding atmosphere which may have become entrapped between the contacting surfaces.
- c) Failure mechanisms resulting from a wet oxidation process.

PROCEDURE:

1. The test environment was performed in accordance with MIL-STD-1344, Method 1002, Procedure III

Relative Humidity	: 85% to 95%
Temperature Conditions	: 28°C to 71°C
Number of Cycles	: 10
Mating Conditions	: mated
Mounting Conditions	: N/A
Duration	: 240 hours

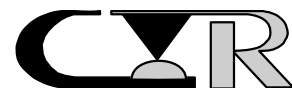


REQUIREMENTS:

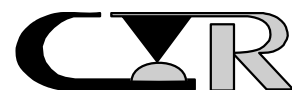
1. There shall be no evidence of physical damage to the test samples as tested.
2. The LLCR and DWV shall be measured and recorded.

RESULTS:

1. There was no evidence of physical damage to the test sample as tested.
2. See the LLCR and DWV sections for LLCR and DWV data (passed).



GROUP D TESTING (Salt Fog)



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 035

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-13-05

COMPLETE DATE: 2-8-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 28 %

EQUIPMENT ID#: 207, 400

LOW LEVEL CIRCUIT RESISTANCE (LLCR)

PURPOSE:

To evaluate contact resistance characteristics of the contact systems under conditions where applied voltages and currents do not alter the physical contact interface and will detect oxides and films that degrade electrical stability. It is also sensitive to and may detect the presence of fretting corrosion induced by mechanical or thermal environments as well as any significant loss of contact pressure.

PROCEDURE:

The test was performed in accordance with EIA 364, TP 23 with the following conditions:

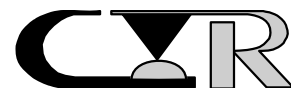
Test Current : 10ma
Open Circuit Voltage : 20mv
No. of Positions Tested : 64 per test sample

REQUIREMENTS:

Low level circuit resistance shall be measured and recorded prior to and after each environment, in this case salt spray. Failure is defined as a LLCR increase of 10 milliohms or greater.

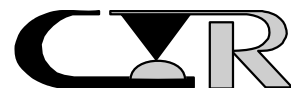
RESULTS:

The LLCR data follows:



Delta values
units: milliohms

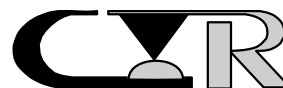
Temp °C	24	24			
R.H. %	28	21			
Date:	13Jan0	08Feb0			
	5	5			
Pos. ID	Initial	Salt Spray	Pos. ID	Initial	Salt Spray
1	29.2	-1.5	36	29.8	-1.5
2	31.3	-0.9	37	32.9	-1.0
3	24.0	-1.1	38	23.7	-0.5
4	27.3	-1.2	39	36.8	-2.2
5	31.0	-1.5	40	26.9	-1.0
6	26.6	-1.0	41	33.8	-1.0
7	33.7	-1.8	42	29.4	-0.7
8	23.7	-0.9	43	33.7	-0.8
9	33.5	-0.3	44	30.3	-0.9
10	28.7	-0.5	45	33.2	-0.3
11	34.1	-0.9	46	29.3	-0.3
12	29.7	-0.9	47	34.4	-0.2
13	34.1	-0.7	48	34.4	-1.6
14	28.8	-0.8	49	34.7	-0.5
15	34.4	-0.5	50	39.0	-1.4
16	36.6	-3.0	51	30.0	-0.8
17	34.7	-0.6	52	38.5	-1.4
18	38.4	-0.5	53	29.7	-1.0
19	29.3	-1.0	54	36.3	-0.9
20	38.4	-0.5	55	29.6	-0.7
21	29.4	-1.6	56	37.9	-0.8
22	36.3	-0.4	57	27.4	-1.1
23	28.9	-0.7	58	32.2	-0.9
24	39.6	-1.9	59	25.7	-0.7
25	23.7	-0.3	60	34.6	-0.6
26	35.0	-0.6	61	29.2	-0.7
27	27.5	-1.0	62	24.6	-0.9
28	32.5	-0.7	63	34.0	-1.4
29	28.4	-0.7	64	28.6	-0.6
30	26.7	-1.2			
31	31.8	-1.2	MAX	39.6	-0.2
32	27.8	-0.7	MIN	23.7	-3.0
33	28.5	-0.8	AVG	31.3	-0.9
34	35.5	-1.6	STD	4.2	0.5
35	26.3	-0.6			



Delta values
units: milliohms

Temp °C	24	24
R.H. %	28	21
Date:	13Jan05	08Feb05
Pos. ID	Initial	Salt Spray
1	0.28	0.27
2	5.71	-5.43
3	0.64	-0.30
MAX	5.7	0.27
MIN	0.3	-5.43
AVG	2.2	-1.82
STD	3.0	3.14
Open	0	0

Safety Ground



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 035

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-13-05

COMPLETE DATE: 2-8-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 24 %

EQUIPMENT ID#: 321

DIELECTRIC WITHSTANDING VOLTAGE (SEA LEVEL)

PURPOSE:

To determine if the connectors maintain their dielectric integrity after being stressed by exposure to mechanical and environmental conditioning.

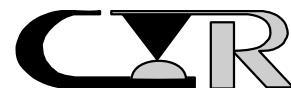
PROCEDURE:

1. The test was performed in accordance with MIL-STD-1344, Method 3001.
2. Test Conditions:

Between Adjacent Contacts (closest spacing)	:	Yes
Between Rows	:	No
Between Contacts and Hardware	:	No
Between Contacts and Shell	:	No
Mated Condition	:	Mated
Mounting Condition	:	Mounted
Hold Time	:	60 sec.
Rate of Application	:	500 volts/sec.
Test Voltage	:	500

REQUIREMENTS:

1. When the specified test voltage is applied, there shall be no evidence of breakdown, arcing, etc.
2. The leakage current shall not exceed 5 ma.



RESULTS:

1. 6 of 16 DWV measurement locations failed due to high leakage current.
2. The following is a summary of the observed data.

Sample ID	SN 035	SN 035		Sample ID	SN 035	SN 035	
J1 a1-b1	Pass	Fail		J6 a1-b1	Pass	Pass	
J1 e1-f1	Pass	Pass		J6 e1-f1	Pass	Pass	
J1 c2-d2	Pass	Pass		J6 c2-d2	Pass	Pass	
J1 g2-h2	Pass	Fail		J6 g2-h2	Pass	Pass	
J1 c8-d8	Pass	Fail		J6 c8-d8	Pass	Pass	
J1 g8-h8	Pass	Fail		J6 g8-h8	Pass	Pass	
J1 a9-b9	Pass	Fail		J6 a9-b9	Pass	Pass	
J1 e9-f9	Pass	Fail		J6 e9-f9	Pass	Pass	

3. Visual inspection results showed that the DWV failures were caused by salt bridges (see below)

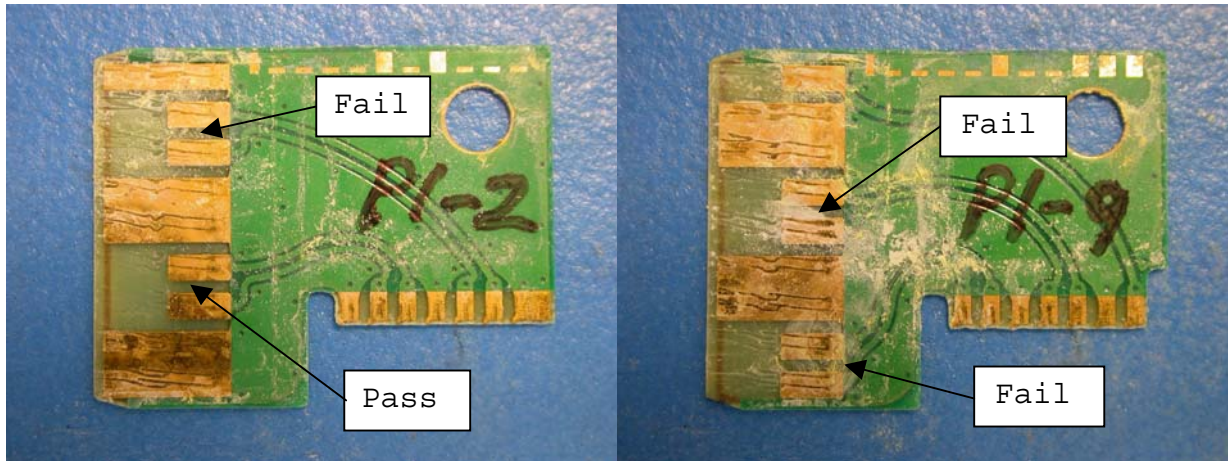


Fig. 36 Connector blades after 500 hr. salt fog

PROJECT NO.: 205690

SPECIFICATION: VITA 46

PART NO.: 035

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-17-05

COMPLETE DATE: 2-7-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 28 %

EQUIPMENT ID#: 118, 624, 550, 682, 1352

SALT SPRAY

PURPOSE:

To expose test samples to an environment simulating a marine atmosphere.

PROCEDURE:

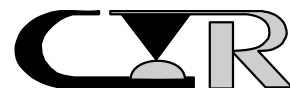
1. The test environment was performed in accordance MIL-STD-1344, Method 1001, Test Condition C.

2. Test Conditions:

Salt Solution	: 5%
Temperature	: 95°F +2°F/-3°F
Duration	: 500 Hours
Post Cleaning	: Yes
Mated Condition	: mated
Mounting Condition	: N/A
Collection Rate	: 2.13 ml/hr actual (Spec 0.5 to 3.0 ml/hr)
pH at Temp.	: 6.5 actual (Spec. 6.5-7.2)

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test sample as tested.
2. The LLCR and DWV shall be measured and recorded.



RESULTS:

1. There was no evidence of corrosion of the connectors, however heavy salt deposits were present (see Fig. 37 below).

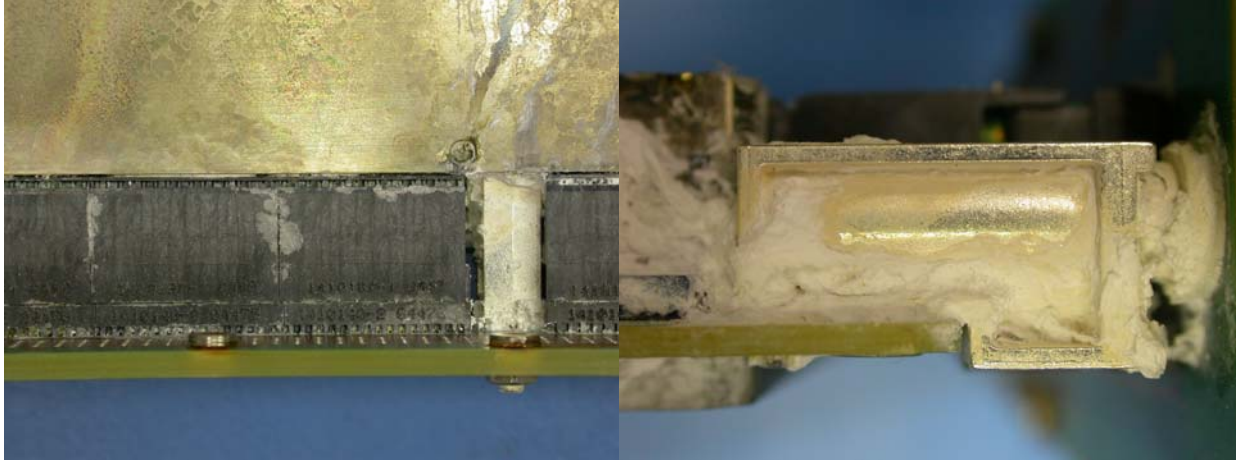


Fig. 37 VITA 46 test module after 500 hr. salt fog

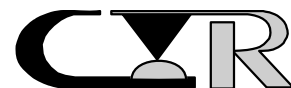
2. See the LLCR and DWV sections for LLCR and DWV data.

DISCUSSION:

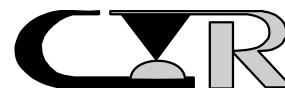
As a result of the DWV failures, the salt spray test was deemed to have been failed. The DWV failure was discussed in the VITA 46 Standard committee, and it was felt that the test methodology was overly severe in two areas:

1. The 500 hour duration was considered excessive, particularly in comparison with MIL-STD-810F, which calls for a standard exposure duration of 48 hours.
2. The fact that no enclosure was used was considered not representative of an actual deployed situation. In that case, the daughtercard and backplane are contained in a chassis, which provides a level of protection against the salt spray.

It was decided to re-do the salt test with a new test sample. Consideration for the methodology was given to MIL-STD-810F and to ASTM G85, Annex A.4 (salt fog and SO₂ test suggested by Raytheon). The ASTM G85 test was chosen. Also, an enclosure was built to simulate the effect of a chassis during the re-test.



GROUP D-1 TESTING (Salt Fog and
SO₂)



SCOPE

To perform salt fog/SO₂ testing on product submitted by the primary test sponsor, Curtiss-Wright Controls Embedded Computing.

APPLICABLE DOCUMENTS

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.

ASTM G85 (Annex A4, cycle A4.4.4.1)

TEST SAMPLES AND PREPARATION

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

<u>Qty</u>	<u>Description</u>
1	Test Board (VITA 46)

2. Unless otherwise indicated, all materials were certified by the manufacturer to be in accordance with the applicable product specification.
3. The test samples as submitted were certified by the manufacturer as being fabricated and assembled utilizing normal production techniques common for this type of product and inspected in accordance with the quality criteria as established for the product involved.
4. The test sample was tested in its 'as received' condition, using an enclosure as shown below (top cover not shown).

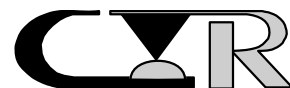




Fig. 38 Enclosure for salt + SO₂ test (top cover not shown)

5. The following test sequence was followed:

1	LLCR, SG, DWV
2	Preconditioning (10 cycles)
3	Salt Fog/SO ₂ (24 Hours)
4	LLCR, SG, DWV
5	Salt Fog/SO ₂ (24 Hours)
6	LLCR, SG, DWV

PROJECT NO.: 205199-1

SPECIFICATION: ASTM G85

PART NO.: 32

PART DESCRIPTION: Blade

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 4-29-05

COMPLETE DATE: 5-23-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 20` %

EQUIPMENT ID#: 682, 118, 280, 321, 1424

SALT FOG/SO₂

PURPOSE:

To evaluate the product's immunity to an accelerated corrosion.

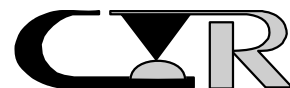
PROCEDURE:

1. The test environment was performed in accordance with ASTM G85.

REQUIREMENTS:

1. The safety ground LLCR shall be measured and recorded
2. The dielectric withstanding voltage when measured at 500VAC shall not exhibit arcing, breakdown, or leakage current greater than 5 ma.
3. The LLCR of the mating connectors shall be measured and recorded.

RESULTS: See Next Page

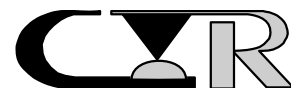


RESULTS:

1. The safety ground LLCR follows:

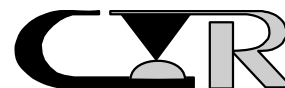
Actual values units: milliohms			
Temp °C	23	24	24
R.H. %	35	45	44
Date:	29Apr05	27May05	23Jun05
Pos. ID	Initial	Salt/SO2	Salt/SO2
1	0.32	0.27	0.33
2	0.17	6.69	0.58
3	5.33	0.20	0.33
MAX	5.3	6.7	0.6
MIN	0.2	0.2	0.3
AVG	1.9	2.4	0.4
STD	2.9	3.7	0.1
Open	0	0	0

2. There was no evidence of arcing, breakdown, or leakage current when DWV was measured at 500VAC.

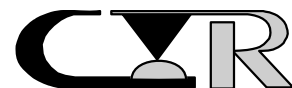


3. The LLCR of the mating connectors follows:

				Delta values units: milliohms
Date:	29Apr05	27May05	23Jun05	
Pos. ID	Initial	Salt/SO2	Salt/SO2	
1	27.6	-0.9	-0.8	
2	31.0	-0.8	-0.7	
3	23.1	-0.5	-0.4	
4	28.1	-0.7	-0.9	
5	30.9	-0.7	-0.7	
6	25.9	-0.6	-0.8	
7	33.4	-2.1	-2.1	
8	23.4	-0.8	-0.5	
9	34.0	-0.8	-0.6	
10	28.5	-0.6	-0.5	
11	33.6	-0.4	-0.5	
12	28.9	-0.5	-0.1	
13	33.4	-0.4	-0.2	
14	27.0	-0.5	-0.4	
15	33.7	0.0	0.0	
16	33.6	-0.5	-0.6	
17	34.2	-0.2	0.0	
18	37.6	-0.2	-0.4	
19	29.3	-0.5	-0.2	
20	38.6	-0.5	-0.5	
21	29.7	-0.5	-0.4	
22	37.0	0.0	-0.1	
23	28.3	-0.1	0.0	
24	38.6	-0.3	-0.2	
25	22.9	-0.5	0.1	
26	33.0	-0.3	-0.1	
27	25.9	-0.5	-0.3	
28	32.4	-0.6	-0.4	
29	28.7	-0.8	-0.5	
30	26.5	-0.7	-0.2	
31	31.1	-0.2	0.1	
32	28.5	-0.6	-0.4	
33	29.4	-1.2	-1.1	
34	34.2	-0.6	-0.8	
35	25.9	-0.6	-0.5	



36	29.0	-0.8	-0.9
37	34.6	-1.2	-1.1
38	23.5	-0.7	-0.6
39	35.9	-1.4	-1.4
40	27.0	-1.4	-1.4
41	33.2	-0.1	-0.1
42	28.8	-0.4	0.0
43	33.7	-0.8	-0.8
44	29.1	0.0	-0.1
45	33.4	-0.6	-0.4
46	27.3	0.1	0.1
47	33.6	-0.1	0.1
48	32.9	-0.6	-0.3
49	34.5	-0.1	-0.2
50	36.9	-0.4	-0.4
51	29.8	-0.3	-0.1
52	37.7	-0.2	0.0
53	29.9	-0.3	0.4
54	36.7	-0.3	-0.2
55	28.7	0.2	0.1
56	38.6	-1.2	-0.6
57	25.7	-0.4	-0.3
58	30.5	-0.4	-0.3
59	24.2	-0.4	0.0
60	34.3	-0.5	-0.3
61	28.3	-1.0	-0.1
62	24.3	-0.5	0.0
63	33.1	-0.1	-0.1
64	28.5	-0.7	-0.1
MAX	38.6	0.2	0.4
MIN	22.9	-2.1	-2.1
AVG	30.8	-0.5	-0.4
STD	4.2	0.4	0.4



4. Visual inspection showed considerably less salt deposits than for the UUT that underwent the 500 hour salt test. There was no evidence of corrosion on the connectors or on metal surfaces, and no salt bridges were present on the connector blades or backplane connector contacts (see below).

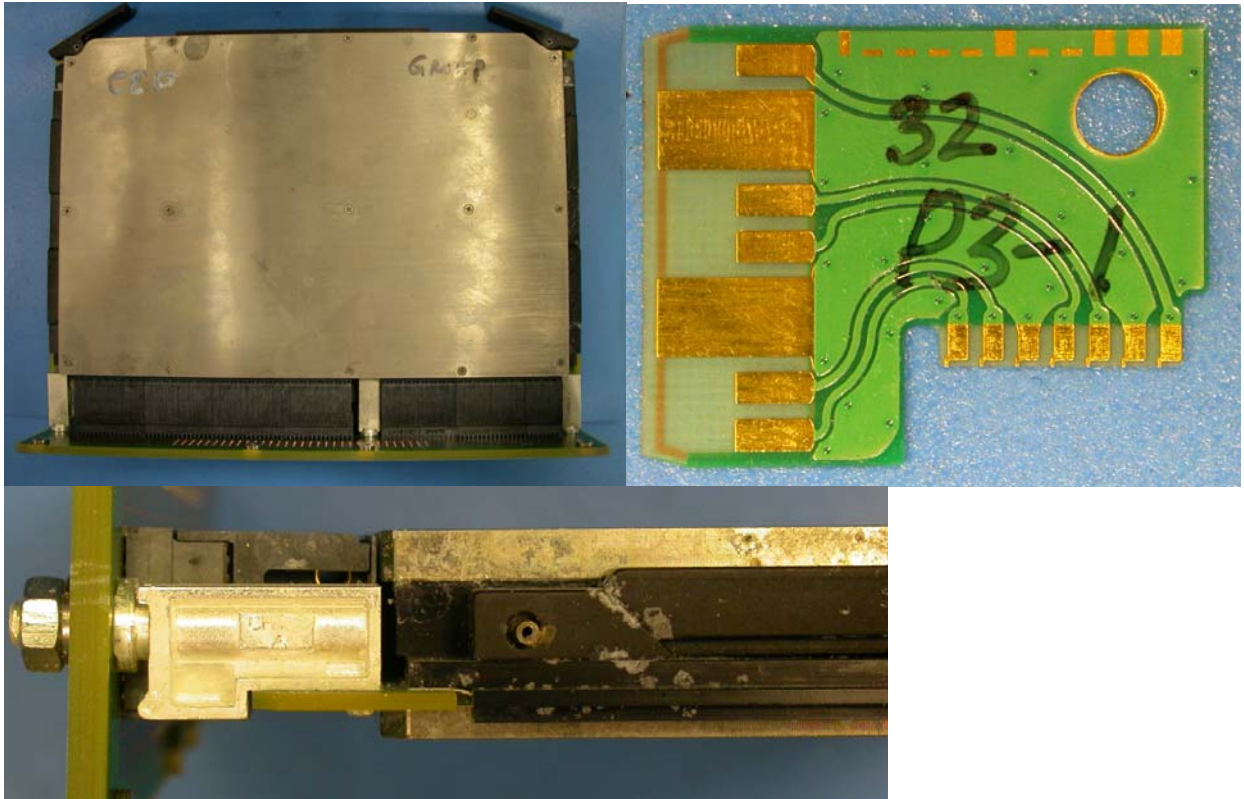
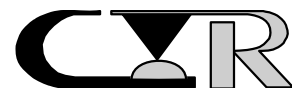


Fig. 39 VITA 46 test module after salt + SO₂

GROUP E TESTING (Sand & Dust)



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 030

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-26-05

COMPLETE DATE: 2-8-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 18 %

EQUIPMENT ID#: 677, 476

LOW LEVEL CIRCUIT RESISTANCE (LLCR)

PURPOSE:

To evaluate contact resistance characteristics of the contact systems under conditions where applied voltages and currents do not alter the physical contact interface and will detect oxides and films that degrade electrical stability. It is also sensitive to and may detect the presence of fretting corrosion induced by mechanical or thermal environments as well as any significant loss of contact pressure.

PROCEDURE:

The test was performed in accordance with EIA 364, TP 23 with the following conditions:

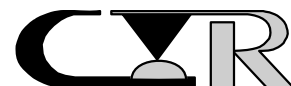
Test Current : 10ma
Open Circuit Voltage : 20mv
No. of Positions Tested : 64 per test sample

REQUIREMENTS:

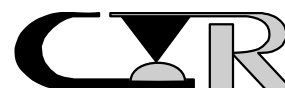
Low level circuit resistance shall be measured and recorded prior to and after each environment, in this case sand and dust. Failure is defined as LLCR increase of 10 milliohms or greater.

RESULTS:

The LLCR data follows:



Delta values units: milliohms							
Temp °C	24	24	24				
R.H. %	18	20	21				
Date:	26Jan05	03Feb05	08Feb05				
Pos. ID	Initial	Dust	Sand	Pos. ID	Initial	Dust	Sand
1	27.8	3.9	2.2	36	28.8	1.7	-0.2
2	31.0	2.0	0.5	37	34.1	0.0	1.8
3	24.1	0.4	2.9	38	23.0	-0.2	0.8
4	29.0	1.8	-0.5	39	34.7	0.7	-0.5
5	31.5	0.5	0.6	40	26.5	1.7	0.9
6	26.1	0.3	0.8	41	33.6	6.1	1.3
7	31.8	0.1	0.8	42	29.3	1.6	0.5
8	23.3	0.5	1.5	43	32.9	1.1	0.8
9	34.2	4.5	0.8	44	30.0	0.4	0.2
10	29.1	0.9	0.9	45	34.0	0.6	-0.1
11	33.5	1.9	0.0	46	29.4	0.2	0.3
12	29.4	1.8	0.8	47	34.2	0.8	-0.1
13	33.3	7.2	1.2	48	34.0	3.1	-0.7
14	28.5	2.4	0.6	49	34.5	0.1	0.3
15	34.2	0.9	0.0	50	37.5	0.9	0.3
16	34.0	4.0	0.4	51	29.8	1.6	0.3
17	35.0	-0.1	-0.2	52	38.7	1.5	0.0
18	38.2	0.0	0.2	53	31.1	0.7	0.8
19	29.1	2.0	0.3	54	37.2	0.9	1.9
20	38.7	4.1	1.5	55	28.7	1.1	0.3
21	30.4	0.1	0.1	56	37.6	1.3	0.4
22	37.7	1.8	1.7	57	27.0	0.7	0.2
23	28.6	2.0	0.9	58	31.6	0.6	-0.7
24	38.7	0.3	-0.1	59	24.5	0.7	0.5
25	24.0	0.0	0.0	60	33.5	0.6	0.3
26	34.7	-0.3	0.0	61	28.7	1.4	0.5
27	26.1	1.7	0.2	62	24.3	0.2	0.4
28	32.0	0.3	0.4	63	33.8	-0.2	-1.0
29	28.1	-0.2	1.3	64	28.8	0.8	1.4
30	26.3	0.6	0.6				
31	31.5	0.8	0.3	MAX	38.7	7.2	3.1
32	28.6	0.8	1.1	MIN	23.0	-0.3	-1.0
33	28.7	2.0	3.1	AVG	31.1	1.3	0.6
34	33.9	0.3	0.4	STD	4.1	1.5	0.8
35	27.9	0.4	0.9	Open	0.0	0.0	0.0



Safety Ground

Product: SN 030

File #: Safety
Gnd

Description: VITA 46 Module
Qual

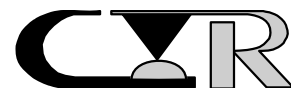
Open circuit voltage: 20mv

Current: 100ma

Delta values
units: milliohms

Temp °C	24	24	24
R.H. %	18	20	21
Date:	26Jan05	03Feb05	08Feb05
Pos. ID	Initial	Dust	Sand
1	0.24	0.06	0.04
2	0.20	576.72	5.08
3	0.60	-0.26	-0.36
MAX	0.6	576.72	5.08
MIN	0.2	-0.26	-0.36
AVG	0.3	192.17	1.59
STD	0.2	333.02	3.03
Open	0	0	0

Note: The out of specification reading above (577 milliohms) was deemed to be erroneous due to the inconsistency of the method used on the alignment module, i.e. the test technician complained about the difficulty of maintaining good contact between the probe and the middle alignment module (pos. ID 2).



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 030

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-26-05

COMPLETE DATE: 2-8-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 18 %

EQUIPMENT ID#: 321

DIELECTRIC WITHSTANDING VOLTAGE (SEA LEVEL)

PURPOSE:

To determine if the connectors maintain their dielectric integrity after being stressed by exposure to mechanical and environmental conditioning.

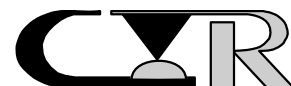
PROCEDURE:

1. The test was performed in accordance with MIL-STD-1344, Method 3001.
2. Test Conditions:

Between Adjacent Contacts (closest spacing)	:	Yes
Between Rows	:	No
Between Contacts and Hardware	:	No
Between Contacts and Shell	:	No
Mated Condition	:	Mated
Mounting Condition	:	Mounted
Hold Time	:	60 sec.
Rate of Application	:	500 volts/sec.
Test Voltage	:	500

REQUIREMENTS:

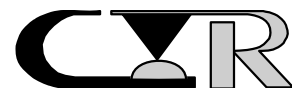
1. When the specified test voltage is applied, there shall be no evidence of breakdown, arcing, etc.
2. The leakage current shall not exceed 5 ma.



RESULTS:

1. The test sample as tested met the requirements as specified.
2. The following is a summary of the observed data.

Sample ID	SN 030	SN 030	SN 030	Sample ID	SN 030	SN 030	SN 030
J1 a1-b1	Pass	Pass	Pass	J6 a1-b1	Pass	Pass	Pass
J1 e1-f1	Pass	Pass	Pass	J6 e1-f1	Pass	Pass	Pass
J1 c2-d2	Pass	Pass	Pass	J6 c2-d2	Pass	Pass	Pass
J1 g2-h2	Pass	Pass	Pass	J6 g2-h2	Pass	Pass	Pass
J1 c8-d8	Pass	Pass	Pass	J6 c8-d8	Pass	Pass	Pass
J1 g8-h8	Pass	Pass	Pass	J6 g8-h8	Pass	Pass	Pass
J1 a9-b9	Pass	Pass	Pass	J6 a9-b9	Pass	Pass	Pass
J1 e9-f9	Pass	Pass	Pass	J6 e9-f9	Pass	Pass	Pass



PROJECT NO.:	204690	SPECIFICATION:	VITA 46
PART NO.:	030	PART DESCRIPTION:	Connector
SAMPLE SIZE:	1	TECHNICIAN:	MAG
START DATE:	2-3-05	COMPLETE DATE:	2-5-05
ROOM AMBIENT:	24 °C	RELATIVE HUMIDITY:	20 %
EQUIPMENT ID#:	403, 26		

DUST EXPOSURE

PURPOSE:

To simulate applications where components may be exposed for extended periods of time and are susceptible to exposure to a dust environment. To determine the impact of residual dust on the electrical stability of the contact system.

PROCEDURE:

1. The connectors were exposed in a mated condition.
2. Test Conditions(ref. MIL-STD-810F, Method 510.4 Procedure I):

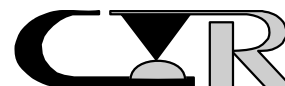
Size of Chamber	:	2.48 cu. ft.
Amount of Dust	:	9 gram/ft ³
Time of Exposure	:	90 minutes - 2 exposures
Dust	:	Talcum
Particle Size	:	N/A
Velocity	:	350 cfm

REQUIREMENTS:

1. The post test LLCR resistance and DWV shall be measured and recorded.
2. There shall be no evidence of physical damage to the test sample as exposed.

DUST RESULTS:

There was no evidence of physical damage to the test sample as exposed. Also see LLCR and DWV results above (passed).



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 030

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 2-7-05

COMPLETE DATE: 2-8-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 20 %

EQUIPMENT ID#: 339, 26

SAND EXPOSURE

PURPOSE:

To simulate applications where components may be exposed for extended periods of time and are susceptible to exposure to a dust environment. To determine the impact of residual dust on the electrical stability of the contact system.

PROCEDURE:

1. The connectors were exposed in a mated condition.
2. Test Conditions(ref. MIL-STD-810F, Method 510.4 Procedure II):

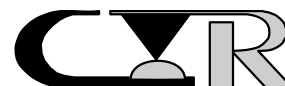
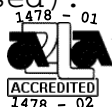
Size of Chamber : 2.48 cu. ft.
Amount of Dust : 9 gram/ft³
Time of Exposure : 90 minutes - 2 exposures
Particles : 140 Mesh Silica
Velocity : 350 cfm

REQUIREMENTS:

1. The post test LLCR resistance and DWV shall be measured and recorded.
2. There shall be no evidence of physical damage to the test sample as exposed.

SAND RESULTS:

There was no evidence of physical damage to the test sample as exposed (see Fig. 40). Also see LLCR and DWV results above (passed).



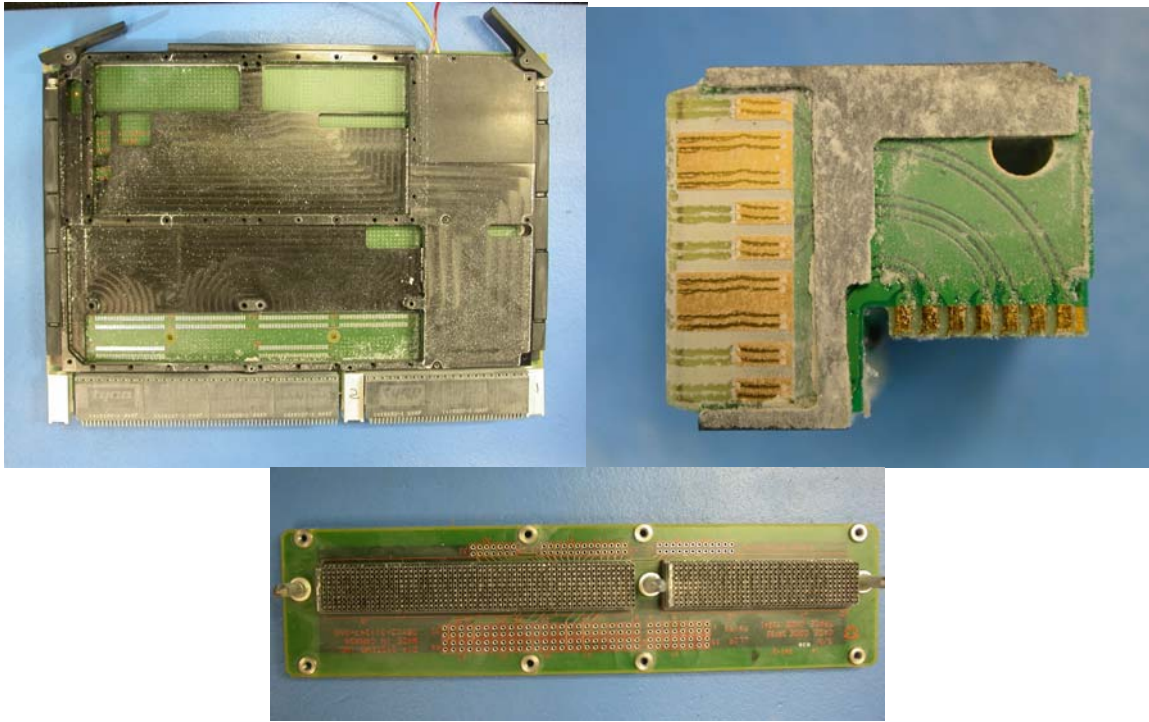
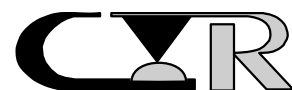


Fig. 40 Dust and sand test vehicle (clockwise from top left: daughtercard, P3 connector, backplane)

GROUP F TESTING (Durability & ESD)



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 017

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-26-05

COMPLETE DATE: 2-25-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 20 %

EQUIPMENT ID#: 677, 476, 673, 529

LOW LEVEL CIRCUIT RESISTANCE (LLCR)

PURPOSE:

To evaluate contact resistance characteristics of the contact systems under conditions where applied voltages and currents do not alter the physical contact interface and will detect oxides and films that degrade electrical stability. It is also sensitive to and may detect the presence of fretting corrosion induced by mechanical or thermal environments as well as any significant loss of contact pressure.

PROCEDURE:

The test was performed in accordance with EIA 364, TP 23 with the following conditions:

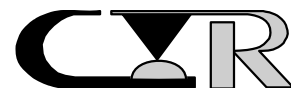
Test Current : 10ma
Open Circuit Voltage : 20mv
No. of Positions Tested : 64 per test sample

REQUIREMENTS:

Low level circuit resistance shall be measured and recorded prior to and after each environment, in this case durability.

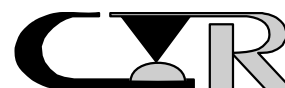
RESULTS:

The LLCR data follows:



Delta values
units: milliohms

Temp °C	24	24	23				
R.H. %	18	23	20				
Date:	26Jan05	23Feb05	25Feb05				
Pos. ID	Initial	Durability	Durability	Pos. ID	Initial	Durability	Durability
		200x	300x	36	30.074	-2.197	-2.191
1	29.9	-2.1	-2.2	37	33.5	-0.9	-0.9
2	31.0	-1.2	-1.3	38	23.9	-1.1	-1.2
3	23.6	-1.0	-1.0	39	34.9	-0.8	-0.8
4	27.8	-1.2	-1.3	40	27.1	-1.0	-0.9
5	30.4	-0.6	-0.6	41	33.4	-0.7	-0.5
6	26.4	-1.4	-1.3	42	28.2	-1.0	-0.8
7	32.1	-1.0	-0.9	43	33.2	-0.7	-0.6
8	23.9	-1.2	-1.1	44	30.2	-1.0	-1.0
9	33.8	-0.5	-0.5	45	33.7	-0.7	-0.9
10	27.4	-0.9	-1.0	46	29.0	-0.3	-0.4
11	33.6	-0.6	-0.6	47	33.9	-0.3	-0.3
12	29.4	-1.2	-1.2	48	33.0	-0.8	-0.6
13	33.9	-0.7	-0.6	49	34.3	-0.2	-0.3
14	28.5	-0.7	-0.6	50	38.4	-0.9	-1.3
15	34.3	-0.5	-0.3	51	29.7	-0.2	-0.5
16	33.8	-0.6	-1.0	52	37.3	-0.8	-0.7
17	35.0	-0.5	-0.6	53	30.0	-0.3	-0.5
18	38.8	-0.7	-1.0	54	38.4	-0.9	-1.0
19	29.1	-0.5	-0.5	55	29.9	-0.9	-0.8
20	38.0	0.0	-0.7	56	36.9	-0.7	-0.7
21	29.8	-0.9	-1.0	57	27.1	-0.6	-0.6
22	38.6	-0.6	-0.5	58	31.4	-0.3	-0.4
23	29.2	-0.8	-0.8	59	24.3	-0.5	-0.7
24	37.4	-0.5	-0.7	60	33.3	-0.5	-0.3
25	23.5	-0.1	-0.3	61	27.8	-0.5	-0.6
26	35.2	-0.8	-1.1	62	24.6	-0.6	-0.8
27	26.0	-0.4	-0.8	63	33.8	-0.8	-0.5
28	31.5	-0.5	-0.6	64	28.1	-0.3	-0.7
29	27.8	-0.6	-0.9				
30	26.0	-0.7	-0.5	MAX	38.8	0.0	-0.3
31	31.9	-0.8	-0.5	MIN	23.5	-2.2	-2.2
32	29.1	-0.5	-0.6	AVG	31.0	-0.8	-0.8
33	28.8	-1.4	-1.4	STD	4.1	0.4	0.4
34	33.4	-0.7	-0.7	Open	0.0	0.0	0.0
35	26.4	-1.0	-1.1				



Safety Ground

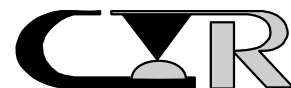
Product: SN 017
 Description: VITA 46 Module Qual
 Open circuit voltage: 20mv

File #: Safety Gnd

Current: 100ma

Delta values
 units: milliohms

Temp °C	24	24	23
R.H. %	18	23	20
Date:	26Jan05	23Feb05	25Feb05
Pos. ID	Initial	Durability	Durability
		200x	300x
1	0.47	-0.04	-0.05
2	0.23	0.01	0.00
3	0.23	0.02	0.11
MAX	0.5	0.02	0.11
MIN	0.2	-0.04	-0.05
AVG	0.3	-0.01	0.02
STD	0.1	0.03	0.08
Open	0	0	0



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 017

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 1-25-05

COMPLETE DATE: 2-25-05

ROOM AMBIENT: 18 °C

RELATIVE HUMIDITY: 23 %

EQUIPMENT ID#: 321

DIELECTRIC WITHSTANDING VOLTAGE (SEA LEVEL)

PURPOSE:

To determine if the connectors maintain their dielectric integrity after being stressed by exposure to mechanical and environmental conditioning.

PROCEDURE:

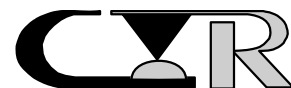
1. The test was performed in accordance with MIL-STD-1344, Method 3001.

2. Test Conditions:

Between Adjacent Contacts (closest spacing)	:	Yes
Between Rows	:	No
Between Contacts and Hardware	:	No
Between Contacts and Shell	:	No
Mated Condition	:	Mated
Mounting Condition	:	Mounted
Hold Time	:	60 sec.
Rate of Application	:	500 volts/sec.
Test Voltage	:	500

REQUIREMENTS:

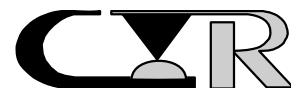
1. When the specified test voltage is applied, there shall be no evidence of breakdown, arcing, etc.
2. The leakage current shall not exceed 5 ma.



RESULTS:

1. The test sample as tested met the requirements as specified.
2. The following is a summary of the observed data.

Sample ID	SN 017	SN 017	SN 017	Sample ID	SN 017	SN 017	SN 017
J1 a1-b1	Pass	Pass	Pass	J6 a1-b1	Pass	Pass	Pass
J1 e1-f1	Pass	Pass	Pass	J6 e1-f1	Pass	Pass	Pass
J1 c2-d2	Pass	Pass	Pass	J6 c2-d2	Pass	Pass	Pass
J1 g2-h2	Pass	Pass	Pass	J6 g2-h2	Pass	Pass	Pass
J1 c8-d8	Pass	Pass	Pass	J6 c8-d8	Pass	Pass	Pass
J1 g8-h8	Pass	Pass	Pass	J6 g8-h8	Pass	Pass	Pass
J1 a9-b9	Pass	Pass	Pass	J6 a9-b9	Pass	Pass	Pass
J1 e9-f9	Pass	Pass	Pass	J6 e9-f9	Pass	Pass	Pass



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 017

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 2-22-05

COMPLETE DATE: 2-25-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 22 %

EQUIPMENT ID#: 46

DURABILITY

PURPOSE:

To determine the effects of subjecting the UUT to a predetermined number of mating and unmating cycles simulating the expected mechanical life.

PROCEDURE:

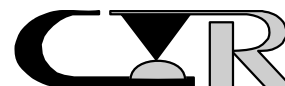
1. The test was performed in accordance with EIA 364, Test Procedure 09.
2. Test Conditions:

No. of Cycles :500 total (200 + 300 with LLCR, DWV, Force,
and ESD after 200 and 500 cycles}
Rate :300/hr max

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test sample so tested.
2. The LLCR and DWV shall be measured and recorded.

DURABILITY RESULTS:

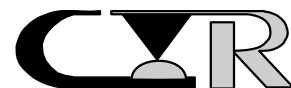


1. There was no evidence of physical damage to the test samples as tested. Visual Inspection was performed on the daughter-card connector blades by removing them from their housings. Two of the blades are shown below. Wear tracks were evident, but none of the locations showed gold wear-through.



Fig. 41 Connector blades after 500 cycles of durability

2. See the LLCR and DWV section above for the post durability and ESD results (passed).



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: 017

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 2-22-05

COMPLETE DATE: 2-25-05

ROOM AMBIENT: 24 °C

RELATIVE HUMIDITY: 22 %

EQUIPMENT ID#: 46, 486

MATING AND UNMATING FORCE

PURPOSE:

To determine the mechanical forces required to mate and unmate the connector.

PROCEDURE:

The test was performed in accordance with MIL-STD-1344, Method 2013.

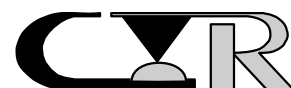
REQUIREMENTS:

The force (in pounds) required to mate and unmate the test samples shall be recorded.

RESULTS:

The following is the observed data:

Results:	<u>Initial</u>		Dur 200X		Post 2 nd ESD		Dur 300X	
Sample ID	Mate	Unmate	Mate	Unmate	Mate	Unmate	Mate	Unmate
ID 017	76.5	57.2	75.7	54.6	85.1	66.4	96.8	71.1



PROJECT NO.: 204690

SPECIFICATION: EN 61000-4-2

PART NO.: 017

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: OG/GGO/IS

START DATE: 1-25-05

COMPLETE DATE: 2-26-05

ROOM AMBIENT: 22 °C

RELATIVE HUMIDITY: 25 %

EQUIPMENT ID#: see attached

ESD

PURPOSE:

To determine if the connector can withstand electrostatic discharge.

PROCEDURE:

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

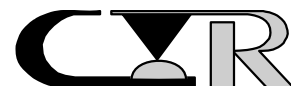
See Figs. 42 and 43 below for the test set-up. Note that two connector contacts were measured for voltage response from the ESD shock, which was applied directly in their vicinity.

REQUIREMENTS:

The discharge as stated above shall not result in greater than 20 volts to any contact, measured relative to ground.

ESD RESULTS:

The test sample as tested met the requirements as specified (see Figs. 44 through 49 below).



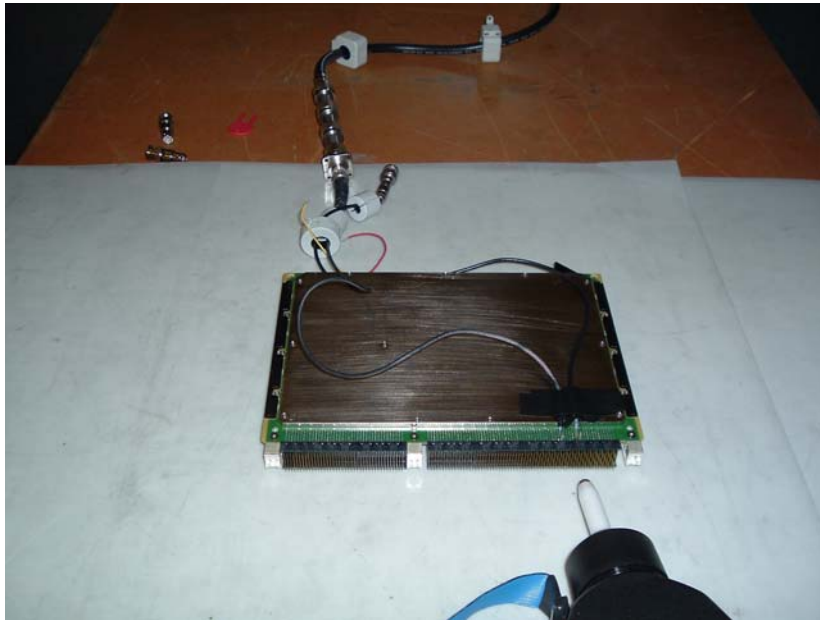
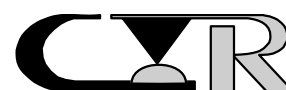


Fig. 42 ESD Test module



Fig. 43 ESD Test Set-up



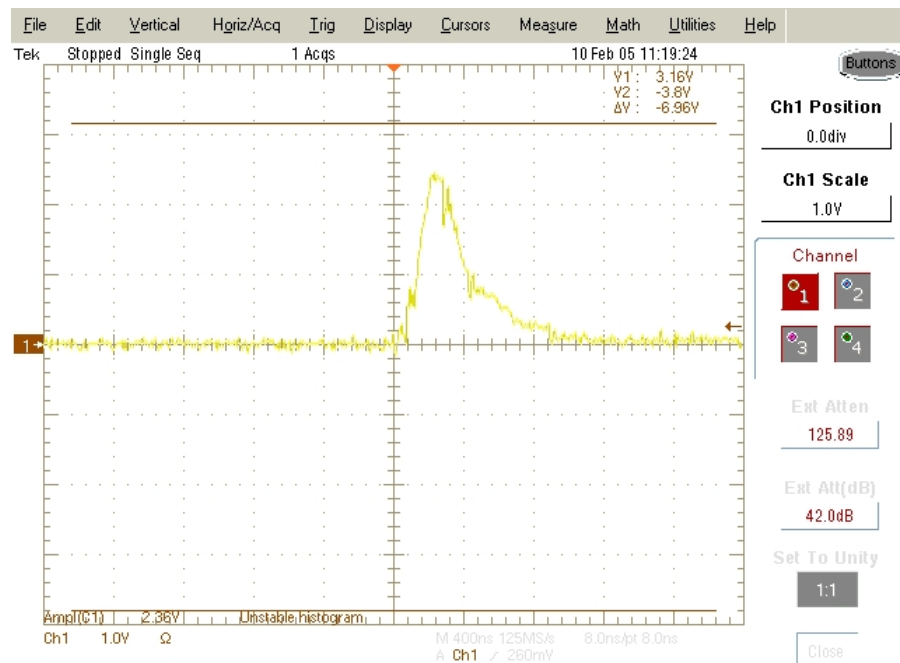


Fig. 44 Initial voltage response (2.4 V peak)

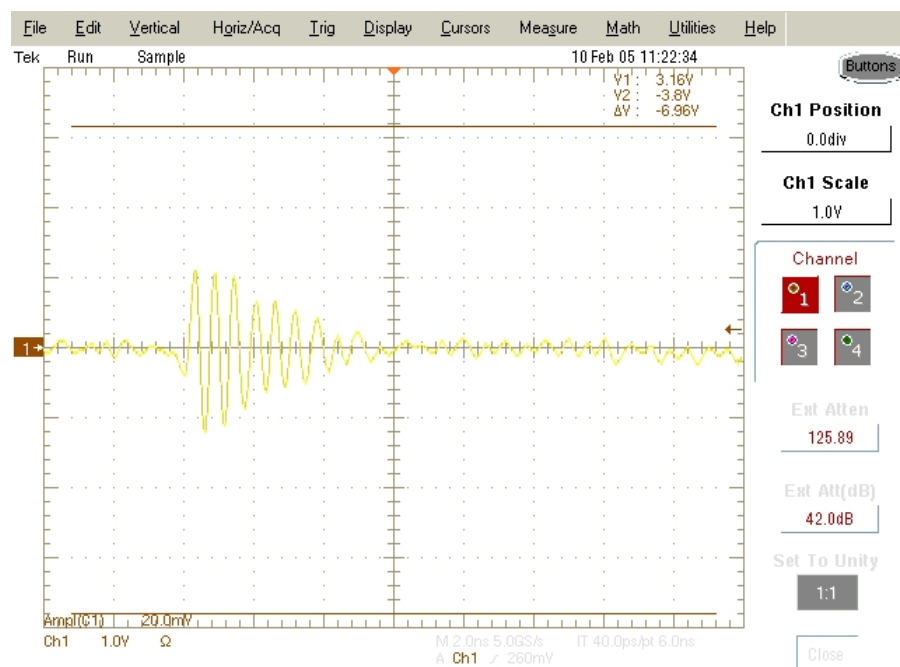


Fig. 45 Initial voltage response (1 V peak)

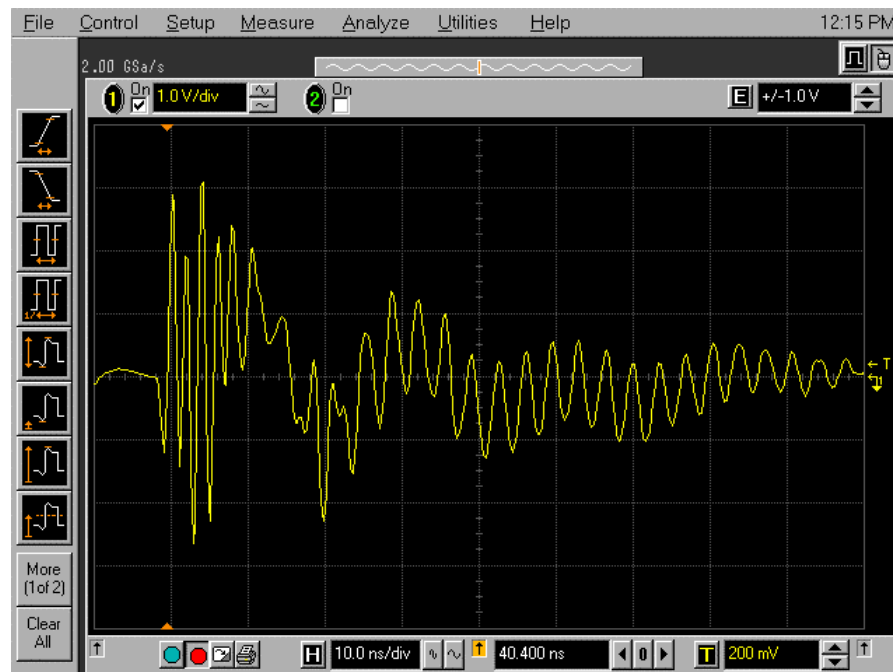


Fig. 46 Voltage response after 200 durability cycles (2.5 V peak)

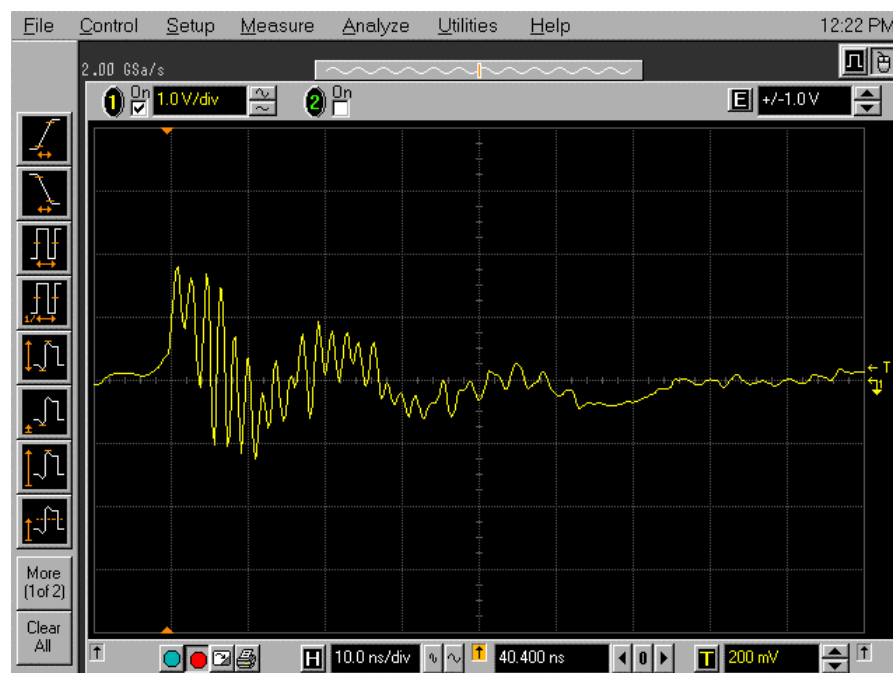
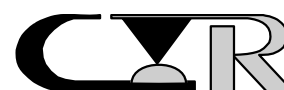


Fig. 47 Voltage response after 200 durability cycles (1.8 V peak)



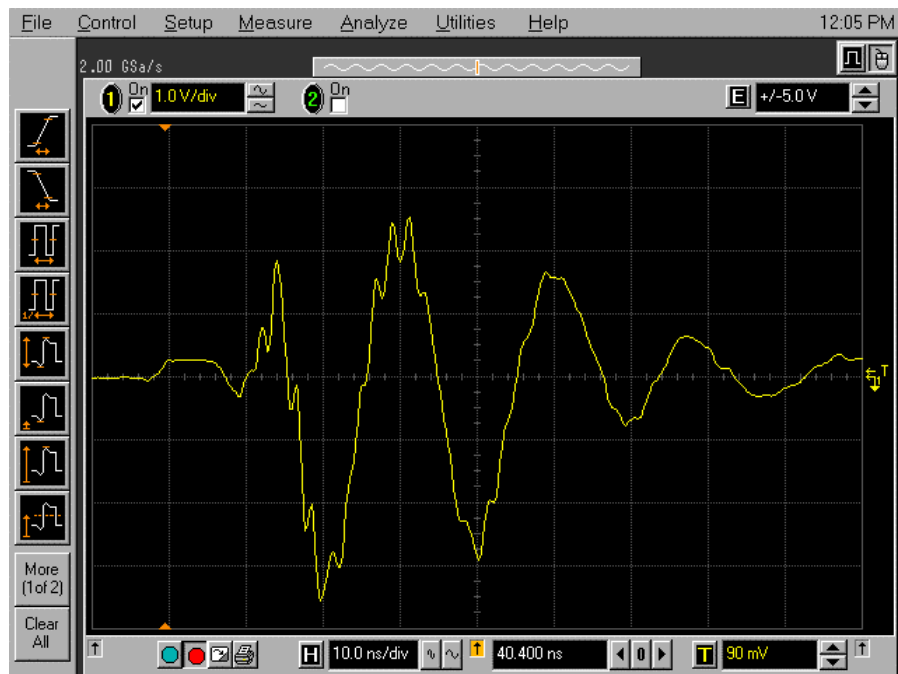
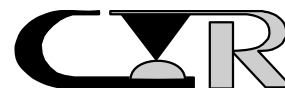


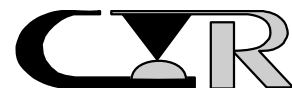
Fig. 48 Voltage response after 500 durability cycles (3.4 V peak)



Fig. 49 Voltage response after 500 durability cycles (2.5 V peak)



GROUP G TESTING (Current Overload)



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: TBD

PART DESCRIPTION: connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 2-10-05

COMPLETE DATE: 2-15-05

ROOM AMBIENT: 23 °C

RELATIVE HUMIDITY: 28 %

EQUIPMENT ID#: 673, 529

LOW LEVEL CIRCUIT RESISTANCE (LLCR)

PURPOSE:

To evaluate contact resistance characteristics of the contact systems under conditions where applied voltages and currents do not alter the physical contact interface and will detect oxides and films that degrade electrical stability. It is also sensitive to and may detect the presence of fretting corrosion induced by mechanical or thermal environments as well as any significant loss of contact pressure.

PROCEDURE:

The test was performed in accordance with EIA 364, TP 23 with the following conditions:

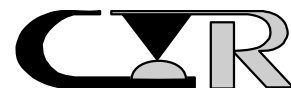
Test Current : 10ma
Open Circuit Voltage : 20mv
No. of Positions Tested : Varied according to blade type

REQUIREMENTS:

Low level circuit resistance shall be measured and recorded prior to and after each environment, in this case current overload. Failure is defined as LLCR increase of 25% over initial values.

RESULTS:

The LLCR data follows:



Product: Ground Blade

File #: 2046900
9

Descripti VITA 46 Module
on: Qual

Open circuit 20mv
voltage:

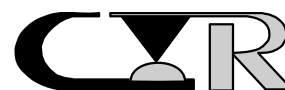
Current: 10ma

Delta values
units: milliohms

Temp °C	23	23
R.H. %	28	30
Date:	10Feb05	15Feb05
Pos. ID	Initial	Overloa d

1	12.6	-0.3
2	14.2	-2.1
3	12.5	-0.1
4	12.6	0.2

MAX	14.2	0.2
MIN	12.5	-2.1
AVG	13.0	-0.6
STD	0.8	1.0
Open	0	0



Product: Single Contact
(Blue)
Description: VITA 46 Module
on: Qual
Open circuit voltage: 20mv

File #: 2046901
0

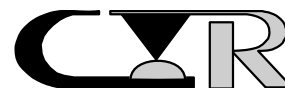
Current: 10ma

Delta values
units: milliohms

Temp °C	23	23
R.H. %	28	30
Date:	10Feb05	15Feb05
Pos. ID	Initial	Overload

1	32.9	0.2
2	29.7	0.6
3	26.0	0.3
4	24.6	-0.1
5	22.8	2.7

MAX	32.9	2.7
MIN	22.8	-0.1
AVG	27.2	0.8
STD	4.1	1.1
Open	0	0



Product: Double Contact (Green)

File #: 2046901
1

Descripti VITA 46 Module

on: Qual

Open circuit 20mv
voltage:

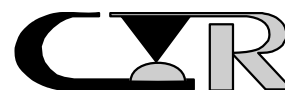
Current: 10ma

Delta values
units: milliohms

Temp °C	23	23
R.H. %	28	30
Date:	10Feb05	15Feb05
Pos. ID	Initial	Overloa d

1	36.1	1.8
2	33.9	-0.1
3	31.7	-0.7
4	10.4	2.2
5	13.7	0.2

MAX	36.1	2.2
MIN	10.4	-0.7
AVG	25.2	0.7
STD	12.1	1.3
Open	0	0



PROJECT NO.: 204690

SPECIFICATION: VITA 46

PART NO.: TBD

PART DESCRIPTION: Connector

SAMPLE SIZE: 1

TECHNICIAN: MAG

START DATE: 2-14-05

COMPLETE DATE: 2-14-05

ROOM AMBIENT: 23 °C

RELATIVE HUMIDITY: 20 %

EQUIPMENT ID#: 611

Current Overload

PURPOSE:

The purpose is to simulate the aging process relative to the stresses induced by overload.

PROCEDURE:

1. The test was performed in accordance with IEC 60512-3.

2. Test Conditions:

Apply a current of 150 % of rated load for 5 minutes, then 125 % for 2 hours on each sample.

Power Contact (one contact tested) rated at 8 Amps; test at 12 Amps and 10 Amps

Single Contact (5 contacts) rated at 1 Amp; test at 1.5 and 1.25 Amps

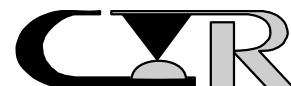
Double Contact (5 contacts) rated at 1 Amp; test at 1.5 and 1.25 Amps

REQUIREMENTS:

LLCR measurements shall be taken at the beginning and at the completion of the test.

RESULTS:

See the LLCR section above for the post test results (passed).



CONCLUSIONS

The following conclusions were drawn from the test results:

- The VITA 46 module format with 7-row MultiGig RT-2 connectors is capable of withstanding harsh environments typical of military and aerospace applications.
- The test vehicle was representative of future VITA 46 circuit cards, thus there is confidence that the test results are representative for the environments tested.
- The test vehicle provided substantial performance verification coverage, thus providing confidence in the results.
- The performance verification results portray a robust and dependable connector system, both initially and over the harsh environments tested. For example, the initial LLCR measurements are very consistent, and measurements after environmental exposure did not increase (or decrease) significantly.
- Test configurations should be as representative as possible, e.g. enclosures simulating chassis for salt fog testing.
- The testing documented in this report is not intended to cover all possible environmental tests or combinations of tests. Further testing for program-specific requirements may be required.

