

## Category 1 – Basic Transportation

### i Objective

To ensure product can withstand typical vibrations experienced in common transportation processes and road conditions from manufacturer to storage installation. This procedure is not intended to test for field transportation.

### ii Test Conditions

Conditions are defined from figures 514.4-1 through 514.4-3, representing 2000 miles of US road transportation.

Test Duration (per axis)	Level in g's / Freq	Number of Cycles	Axis	Samples used
2hrs	514.4-2	1	Transverse	1
2hrs	514.4-1	1	Vertical	1
2hrs	514.4-3	1	Longitudinal	1

Records of pre test conditions, both functional and visual inspection to be recorded. Sample to be inspected and functionally tested after all vibration tests are conducted. The unit should not fail during the vibration tests. Refer to I-4.10,11,12.

### **Results**

Test conditions are covered by Single Axis Vibration Test Procedure 69314. Results are given in appendix A.

**PASS**

**Category 9 – Shipboard Vibration****iii Objective**

Designed to simulate the conditions experienced in shipboard applications, where vibration is experienced through the ship superstructure.

**iv Test Conditions**

As no measured data is available, the test levels are taken from figure 514.4-15. Frequency sweep from 1hz to 50hz Random vibration at full load

Test Duration (per axis)	Level in g's / Freq	Number of Cycles	Axis	Samples used
2 hrs	514.4-15	1	Transverse	1
2 hrs	514.4-15	1	Vertical	1
2 hrs	514.4-15	1	Longitudinal	1

Records of pre test conditions, both functional and visual inspection to be recorded. Sample to be inspected and functionally tested after all vibration tests are conducted. The unit should not fail during the vibration tests. Refer to I-4.10,11,12.

***Results***

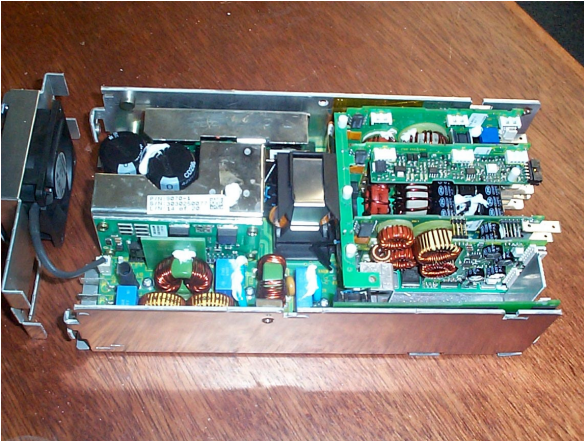
Test conditions are covered by Highly Accelerated Life Test (HALT) procedure. The summary of results is shown in Appendix B.

**PASS**

## Appendix A – Vibration Summary Report

### OBJECTIVE

To subject 5 off Vega 650 units to vibration testing to include a sweep test, resonance search and endurance at resonance.



### TEST PROCEDURE

The unit tested was Vega 650 V603JBQ, pictured above, which contained the following issue pcbs and was fitted with C1, E1 (with option), H3/3 (with option) modules and a 100mA primary option.

Converter :	Converter pcb	11421 issue 2
	C1 pcb	12169 issue 1
	E1 pcb	11487 issue 1
	H3/3 pcb	11479 issue 1
	Primary opt	11363 issue 1

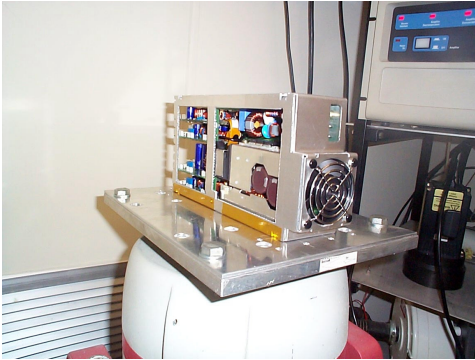
A cut away cover was fitted during the testing for visibility and to hold down the ovp pcb.

The unit was subjected to the following test with the unit mounted in each of the three planes as indicated below .

#### Plane 1 :



#### Plane 2 :

**Plane 3 :**

The unit was mounted onto a 3mm flat or right angle aluminium plate using the 4 off M4 customer fixings. The plate was in turn mounted to the vibration table. Mechanical inspection and Electrical testing was performed after the sweep test and after endurance testing. The following tests were performed :

Sweep test from 10Hz to 500Hz to 10Hz for 10 cycles.

Resonance search at 2.2g between 10Hz and 500Hz .

Endurance testing at 2.2g for 1 hour at each of two selected frequencies .

The resonance search was performed with a stroboscope. The frequencies selected were worst case and the test was conducted on each of the three planes indicated in Fig. 1 .

The unit was ATE tested after the sweep test and after each endurance at resonance test in each plane.

**TEST RESULTS****Unit 1**, serial number 2030340003

Resonant frequencies :      Plane 1 – 98Hz, 116Hz  
    Plane 2 – 82Hz, 110Hz  
    Plane 3 – 89Hz, 119Hz

ATE after sweep test : Pass

ATE after endurance at resonance : Pass

**Unit 2**, serial number 2030340004

Resonant frequencies :      Plane 1 – 92Hz, 120Hz  
    Plane 2 – 85Hz, 119Hz  
    Plane 3 – 87Hz, 118Hz

ATE after sweep test : Pass

ATE after endurance at resonance : Pass

**Unit 3**, serial number 2030340005

Resonant frequencies :      Plane 1 – 96Hz, 112Hz  
    Plane 2 – 83Hz, 115Hz  
    Plane 3 – 91Hz, 118Hz

ATE after sweep test : Pass

ATE after endurance at resonance : Fail

**Unit 4**, serial number 2030340006

Resonant frequencies :      Plane 1 – 101Hz, 121Hz  
    Plane 2 – 79Hz, 104Hz  
    Plane 3 – 89Hz, 115Hz

ATE after sweep test : Pass

ATE after endurance at resonance : Pass

**Unit 5**, serial number 2030340007

Resonant frequencies :      Plane 1 – 92Hz, 116Hz  
    Plane 2 – 82Hz, 112Hz  
    Plane 3 – 87Hz, 115Hz

ATE after sweep test : Fail (unit repaired for endurance testing)

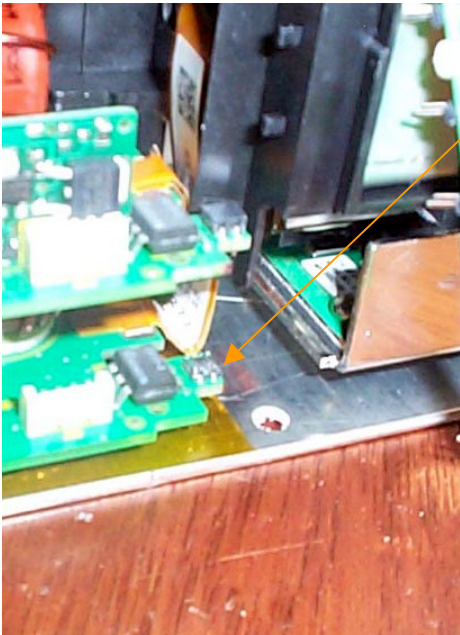
ATE after endurance at resonance : Pass

**INVESTIGATION INTO FAILURES****Unit 3 – failure following endurance testing.**

Three failures were observed :

1). The plastic housing ovp connector on the C1 module had failed resulting in loss of connection to the ovp pcb. On investigation the E1 module had been assembled incorrectly resulting in the pcb not being square to the IMS which is mounted to the chassis (approx 2mm out of square). This resulted in an undue force being exerted on the C1 module ovp connector resulting in premature failure. The assembly problem was traced to a build up of solder in one of the flow solder

pallets which has since been removed. Instructions are in place for the cleaning of flow solder pallets and operators have been made aware.



2). The adhesive on the choke L2 of the C1 module had broken away from the base plate. L2 is part number 33215 which is made in-house. This is still being investigated, looking at cleanliness of the base plate and type of adhesive.

3). The adhesive on the choke L103 of the H3/3 module had broken. L103 is part number 32440T manufactured in the Far East. Investigation as above.

#### **Unit 5 - failure after sweep test.**

Magamp L1 on C1 module had shorted to one of the eyelets on the baseplate. This is a problem which has been solved by ensuring there is a gap between winding and eyelets prior to gluing.

#### **CONCLUSION**

Three of the five units passed the test without any problems. One of the failed units had a problem which has been solved with a process change. The other failed unit had a build fault on one of the modules which should not happen again. This unit also had some adhesive failures which had not caused any electrical failure but which is being investigated.



**Appendix B – HALT Test Results Summary****1.1. Test Procedure.**

The test procedure is detailed in Lambda UK document 69272 issue 1: *Highly Accelerated Life Test (HALT) Procedure*.

Deviations from this procedure are noted below:

- Lower and Upper Destruct Limits also found.

Table 1. Test Sample Unit Details

No	Configuration	Serial Number	Build Date	Loading
1	V6FFS 15/15H3/3F 5E2F 3B1F	1111111671	May 2001	585W, 185AT
2	V6FFS 12B3F 5E2F 12/8H3/3F	1111111709	May 2001	612W, 204AT
3	V6FFS 12B3F 5E2F 12/8H3/3F	1111111710	May 2001	612W, 204AT
4	V6FFS 12B3F 5E2F 12/8H3/3F	1111111711	May 2001	612W, 204AT
5	V6FSS 5B1F 24E5H 15/15H2/3F		May 2002	526W, 107AT
6	V6FSS 5B1F 24E5H 15/15H2/3F		May 2002	526W, 107AT
7	V6FSS 5B1F 24E5H 15/15H2/3F		May 2002	526W, 107AT
8	V4FSL 50.5CC5S 12B3S	2023100144	Nov 2002	450W, 95AT

Table 2. Tests performed on Test Sample Unit Details

No	LOL	UOL	LDL	UDL	Thermal	Vibration	Combined
1						X	
2					X		X
3		X		X			
4	X		X				
5	X		X				
6		X		X			
7							X
8							X

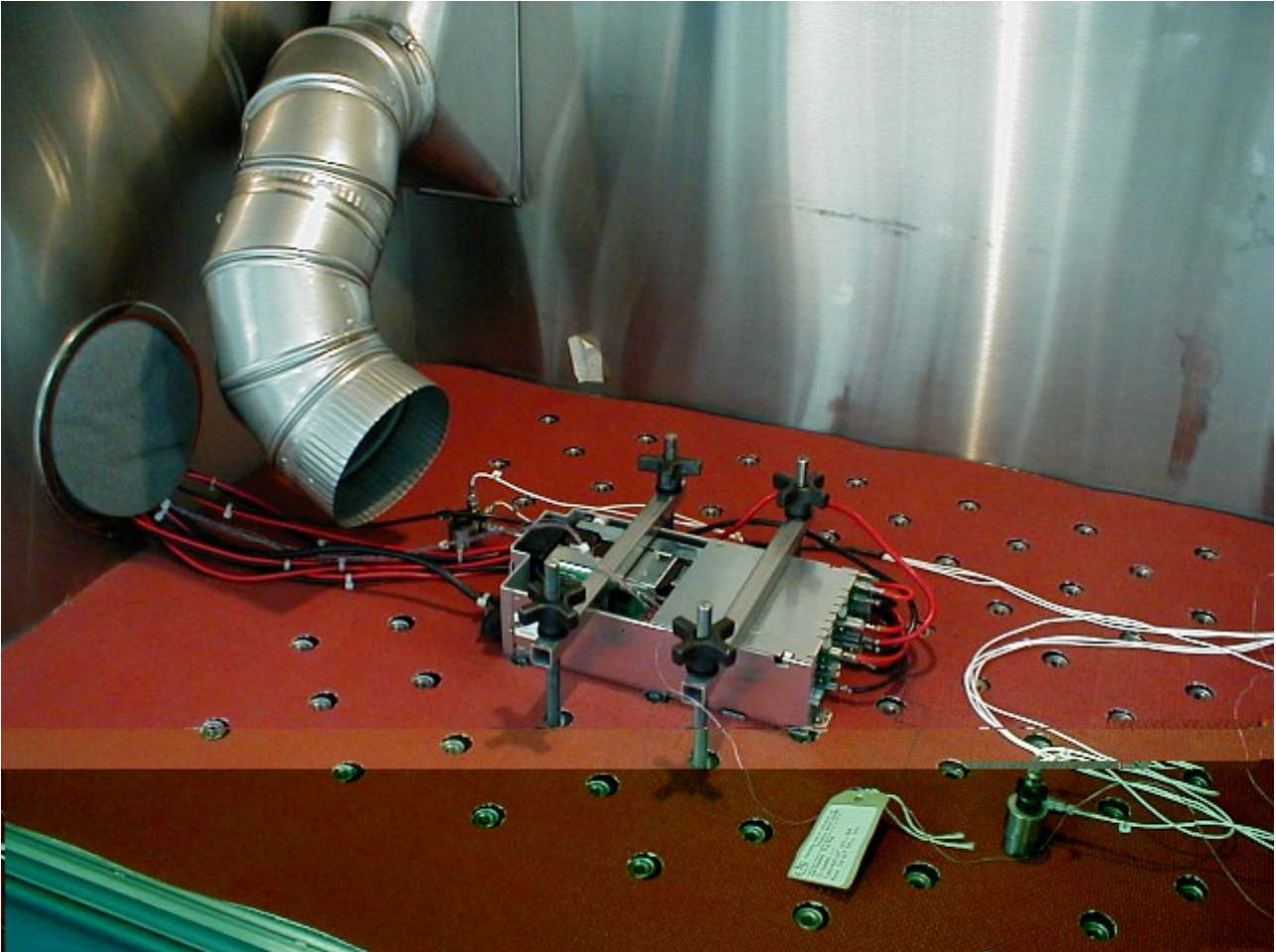
## Notes:

LOL = Lower Operating Limit

UOL = Upper Operating Limit

LDL = Lower Destruct Limit

UDL = Upper Destruct Limit



1.2. Combined Thermal Cycle with Vibration

Test Sample No's 7 and 8. The combined test is the same thermal cycle as given in **Error! Reference source not found.** with the initial vibration limit at 5 G rms, this is then increased in 5 G rms steps for each subsequent thermal cycle.

Table 3. Combined Test Results Unit 7

Level	Observations
5 G rms	Unit operated correctly
10 G rms	Unit operated correctly
15 G rms	Unit operated correctly
20 G rms	Unit operated correctly
25 G rms	Unit operated correctly
30 G rms	Unit operated correctly
35 G rms	Chamber accelerometer mounting failed, unit operated correctly.



Table 4. Combined Test Results Unit 8

<b>Level</b>	<b>Observations</b>
5 G rms	Unit operated correctly
10 G rms	Unit operated correctly
15 G rms	Unit operated correctly
20 G rms	Unit operated correctly
25 G rms	Unit operated correctly
30 G rms	Unit operated correctly