Qualification Test Plan

MIL-STD-810

AVR800-SHLY

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Qualification Test Plan AVR800-S4L4

Version History			
Document Release	**Date**	**Change Item**	**Remarks**
V1.0	07/28/2025	Preliminary release	

System Configuration	
Motherboard	Supermicro X13SEW-TF
CPU	Intel® Xeon SP Gold 5411N (1.9Ghz, 165W, 45MB)
PCH	Intel C741 Chipset
RAM1	Samsung DDR5 5600 64GB RDIMM ECC
RAM2	Samsung DDR5 5600 64GB RDIMM ECC
RAM3	Samsung DDR5 5600 64GB RDIMM ECC
RAM4	Samsung DDR5 5600 64GB RDIMM ECC
RAM5	Samsung DDR5 5600 64GB RDIMM ECC
RAM6	Samsung DDR5 5600 64GB RDIMM ECC
RAM7	Samsung DDR5 5600 64GB RDIMM ECC
RAM8	Samsung DDR5 5600 64GB RDIMM ECC
GPU	Nvidia Tesla L4 24GB GDDR6 7680 CUDA Cores
SATA 1	2.5” U.2 NVMe 8TB SSD PCIe Gen III x 4
SATA 2	2.5” U.2 NVMe 8TB SSD PCIe Gen III x 4
LAN 1	Intel® 10 Gigabit X550 Ethernet
LAN 2	Intel® 10 Gigabit X550 Ethernet
LAN3	Intel® 1 Gigabit i350 Ethernet
IPMI	1 GbE Dedicated IPMI LAN port
USB	4 x USB 2.0
VGA	VGA D-Sub Connector port (Aspeed AST2600 BMC)
POWER	DC-DC 18V to 36V (500W Max) MIL-STD-461
Dimension	450(D) x 316 (W) x 154 (H) mm
Weight	18Kg(39.68lbs)
Chassis	Aluminum Alloy, Corrosion Resistant
Finish	Anodic aluminum oxide
Cooling	Natural Passive convection/Conduction with IP65 Active Smart Fans
Ingress Protection	IP65

System Reliability/Environment Test table of Content

1 AVR800-S4L4 D38999 Connectors and ICD

INDEX

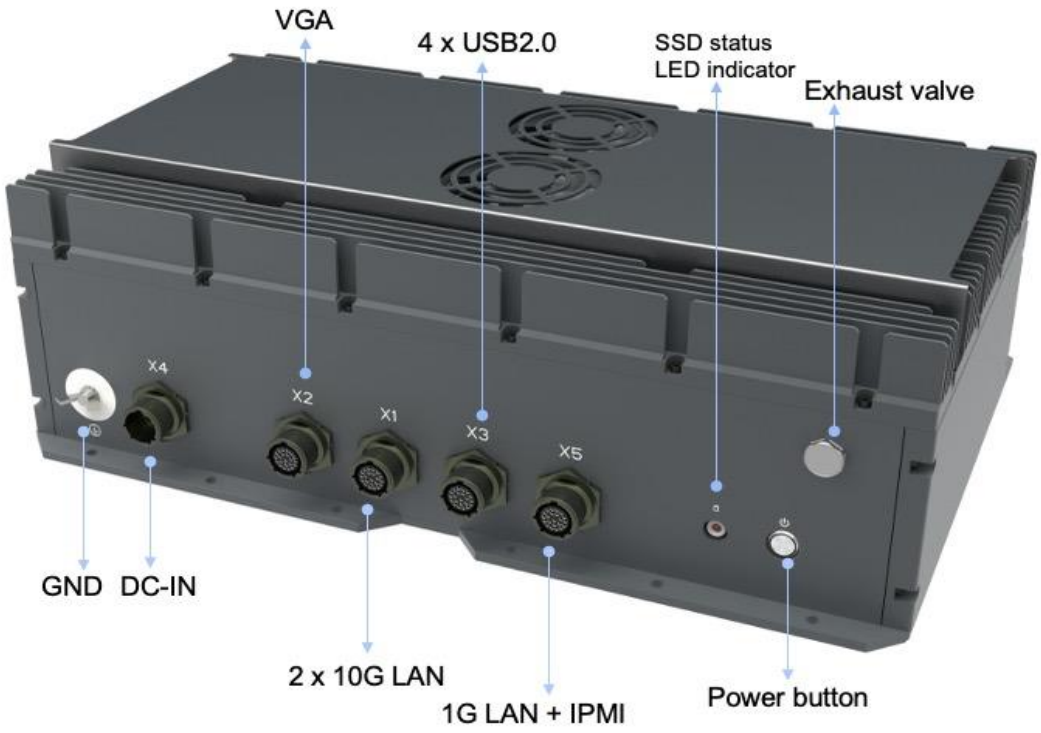
A) X1 2 x 10G LAN (AMPHENOL TV07RW13-35SN)

B) X2 VGA (AMPHENOL TV07RW-13-98S)

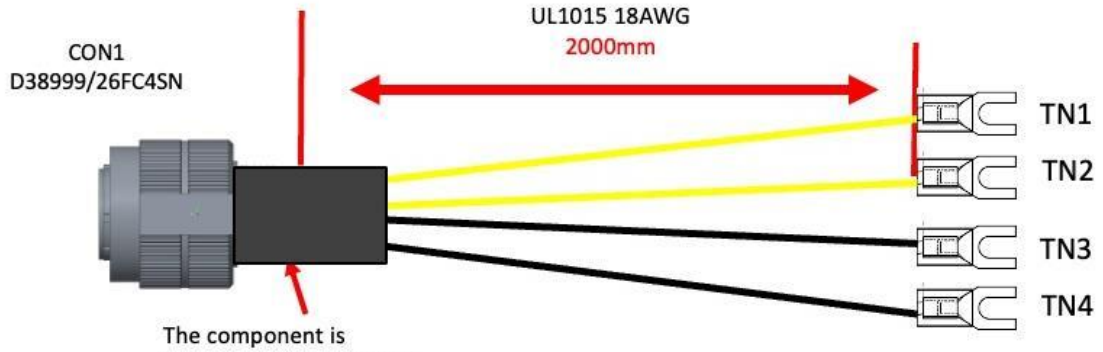
C) X3 4 x USB 2.0 (AMPHENOL TV07RW13-35SB)

D) X4 DC-IN (AMPHENOL TV07RW-13-04P)

E) X5 1G LAN + IPMI (AMPHENOL TV07RW13-35SN)



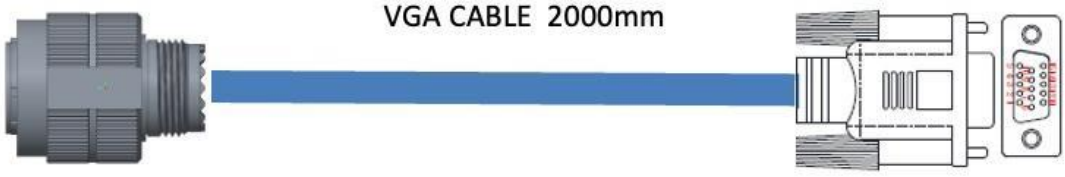
AV800-S4L4_1 EXT-DC-IN CABLE



The component is protected using adhesive-lined (dual wall) heat shrink tubing to ensure environmental sealing and strain relief.

	CON1	
Yellow	A	TN1
Yellow	B	TN2
Black	C	TN3
Black	D	TN4

AV800-S4L4_11 EXT VGA CABLE

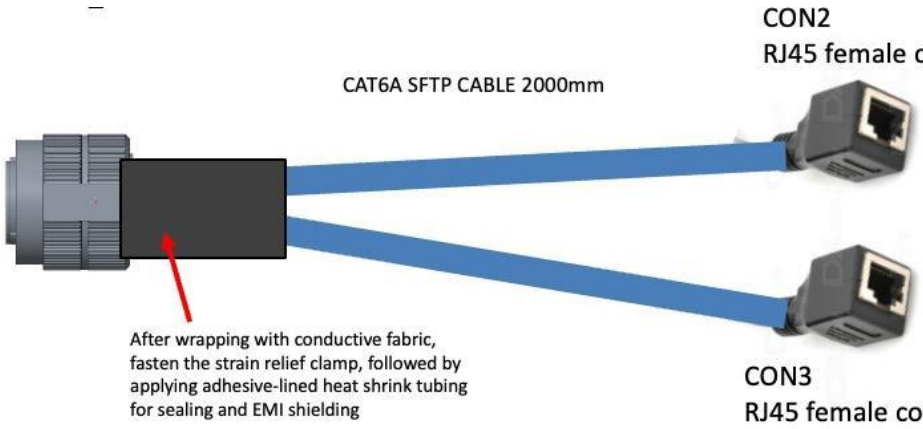


CON1
TVS06RF-13-98P

CON2
DSUB-15PIN Male Pin

CON1	CON2	
A	1	RED
B	2	GREEN
C	3	BLUE
D	5	GND
E	9	5V
F	11	Reserved
G	12	SDA
H	13	H-S
I	14	V-S
J	15	SCL

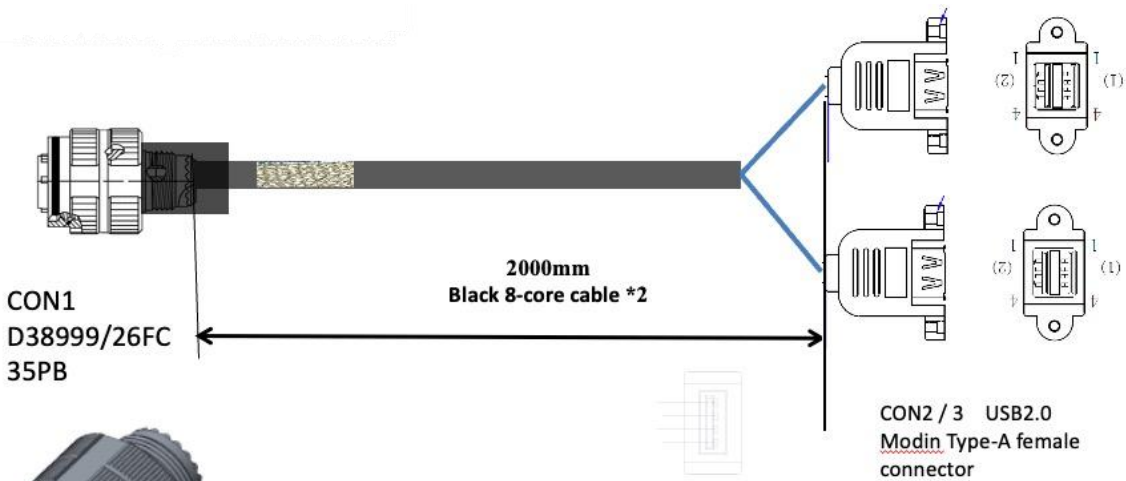
AV800-S4L4_15 EXT-10G LAN CABLE



CON1
D38999/26FC35PN

CON1	CON2		CON1	CON3
1	1	WHITE / ORANGE	8	1
2	2	ORANG	9	2
3	3	WHITE / GREEN	10	3
4	6	GREEN	11	6
5	4	WHITE / BLUE	12	4
6	5	BLUE	13	5
15	7	WHITE / BROWN	19	7
16	8	BROWN	20	8
7	SHELL	BLACK	14	SHELL
17	SHELL	BLACK	21	SHELL
18	SHELL	BLACK	22	SHELL

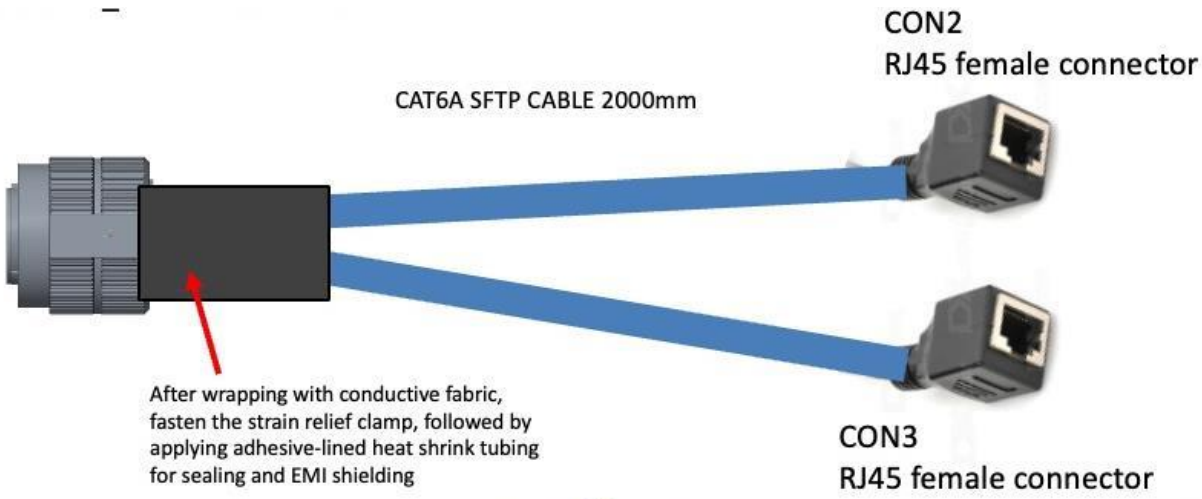
AV800-S4L4_13 EXT-USB CABLE



	CON1	CON2	CON3	
+5V	1	1		Red
D-	2	2		White
D+	3	3		Green
GND	4	4		Black
+5V	6		1	Red
GND	7		4	Black
D+	16		3	Green
D-	17		2	White
SHELL	15			
SHELL	18			

	CON1	CON4	CON5	
+5V	8	1		Red
D-	9	2		White
D+	10	3		Green
GND	11	4		Black
+5V	13		1	Red
GND	14		4	Black
D+	19		3	Green
D-	20		2	White
SHELL	21			
SHELL	22			

AV800-S4L4_17 EXT-1G LAN CABLE



CON1
D38999/26FC35PN

CON1	CON2		CON1	CON3
1	1	**WHITE / ORANGE**	8	1
2	2	**ORANG**	9	2
3	3	**WHITE / GREEN**	10	3
4	6	**GREEN**	11	6
5	4	**WHITE / BLUE**	12	4
6	5	**BLUE**	13	5
15	7	**WHITE / BROWN**	19	7
16	8	**BROWN**	20	8
7	SHELL	**BLACK**	14	SHELL
17	SHELL	**BLACK**	21	SHELL
18	SHELL	**BLACK**	22	SHELL

2 I/O Functional Tests

A) Power Button & LED/ X4 (DC-In)

Test Method:

Testing the motherboard after pressing the power button.

Make sure the System switches ON and the LED lights up. When the system is correctly connected to the DC input and receives a valid operating voltage within the 18–36V range.

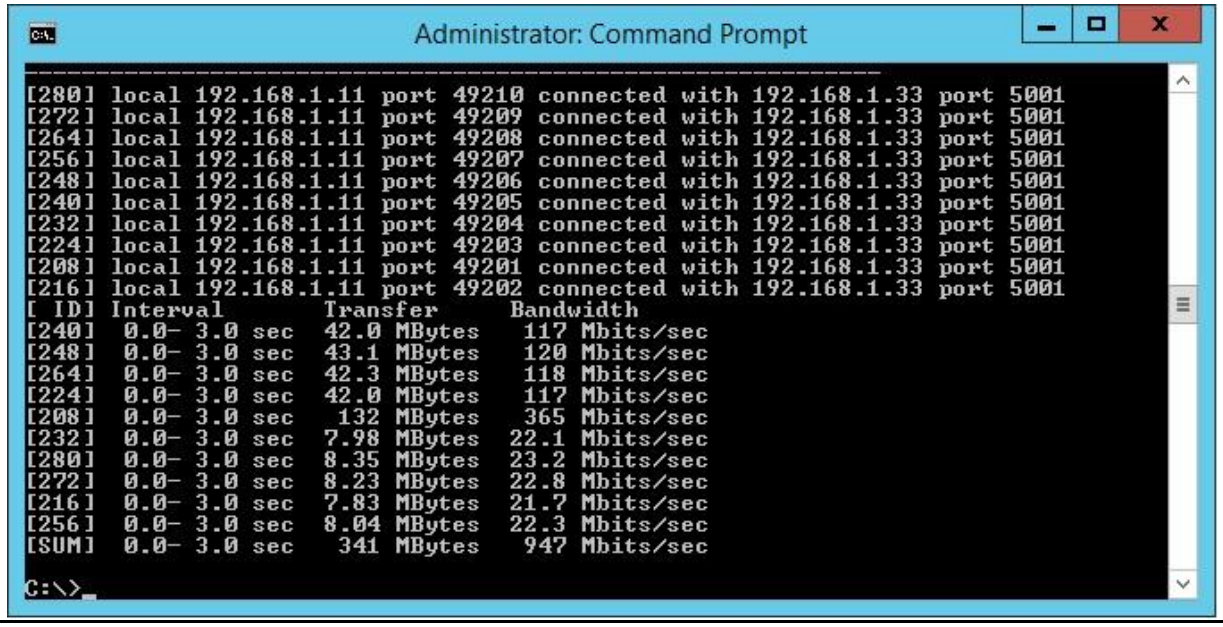
X1/X5 (1GbE / Dual 10GbE LAN)

Test Method:

Loopback the dual channels one to the other using external cable.

Check the LAN MAC ADDRESS on the MB, LAN SPEED and setup iPerf to test at 10Gb and 1Gb speeds.

X550 / i350 LAN
i350 1Gb LAN-1 to LAN-2
X550 10Gb LAN LAN-1 to LAN-2



B) X2 (VGA)

Test Method:

Connect the VGA cable and make sure the screen will be displayed and the color is normal.

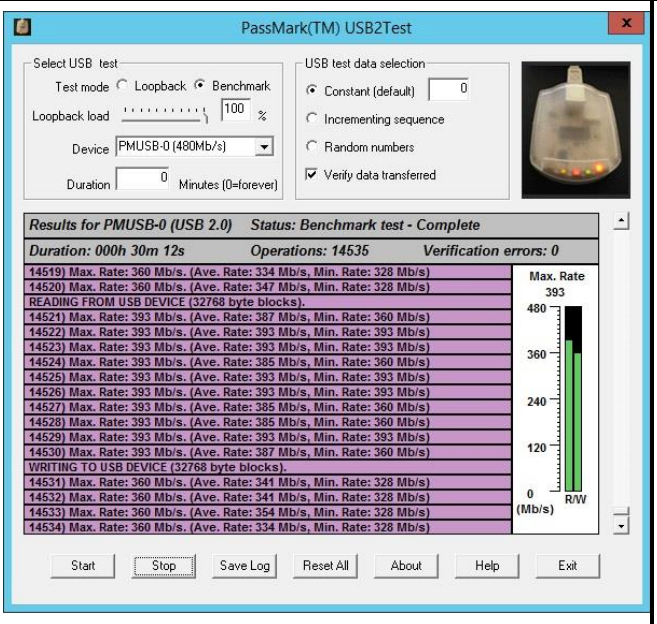
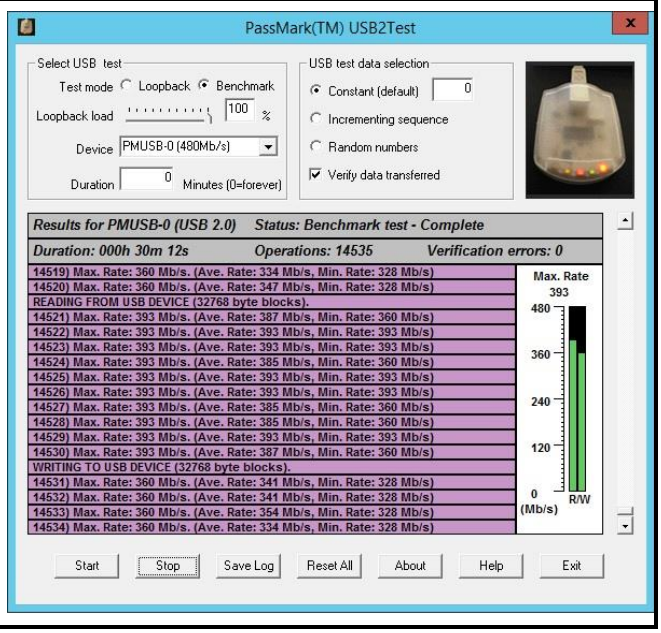
functional.

C) X3 (USB)

Test Method:

Check if we can detect the USB2.0 x4 with USB DEVICE TEST PLUG

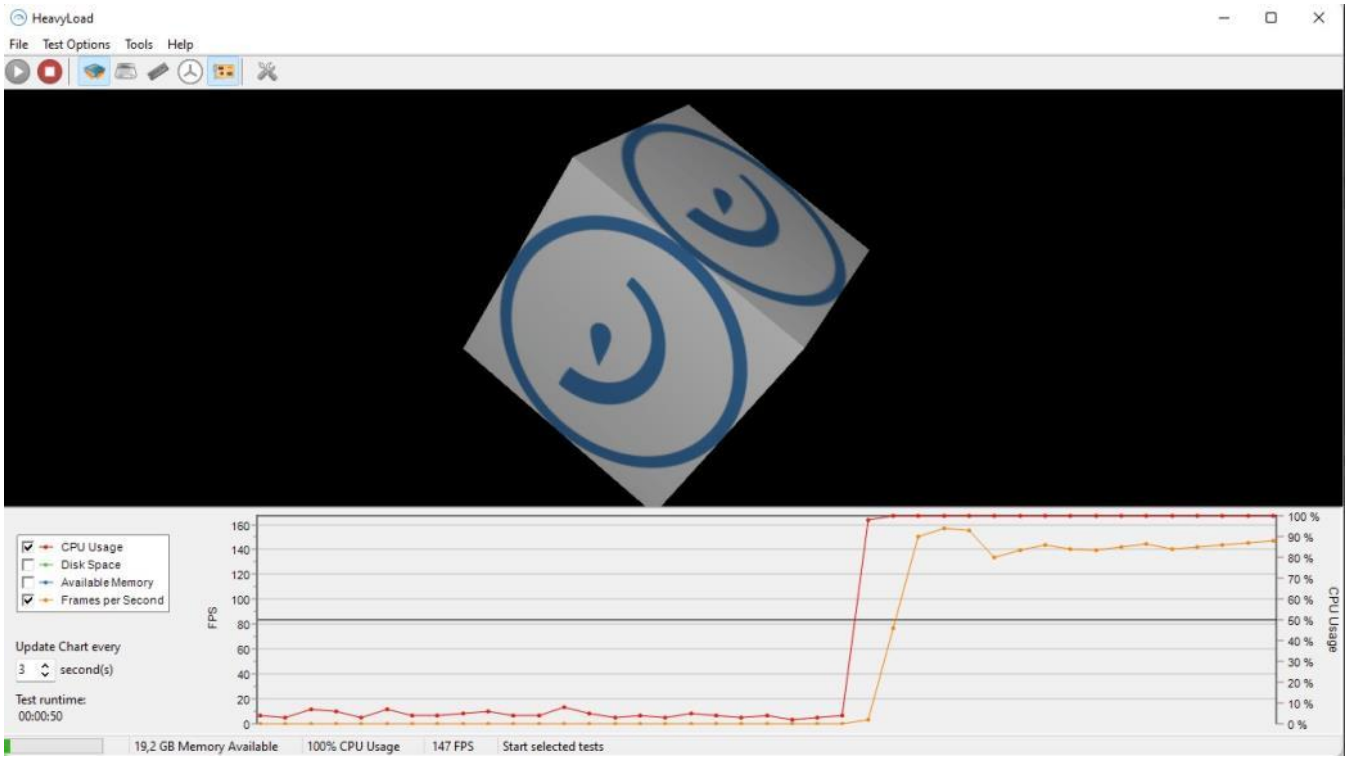
Loopback Plugs for USB2.0					
Software	**Comment / (unit)**	**connector**	**Read / Write** (Mb/s)	**Result**	**Note**
	PassMark USB2.0 test plug	USB2.0-1 USB2.0-2 USB2.0-3 USB2.0-4	393/360 (Mb/s)		

USB2.0-1, USB 2.0-2	USB2.0-3, USB 2.0-4
	

3 Stress CPU/GPU Test

HeavyLoad is intended to stress all resources of a PC (CPU, GPU, RAM, hard disk, network, operating system etc.) in order to test if it will run reliably under heavy load. This is useful for assessing important file or database servers before using them productively, or simply to ensure your new PC will not overheat or crash when used intensively.

The program also allows testing the behavior of systems under fading system resources (memory, disk space).



● Stress CPU

Use your processor or even a specific number of processor cores to full capacity. HeavyLoad performs complex calculations to simulate the load on your processor. 0~100%

CPU Options

Used logical processors

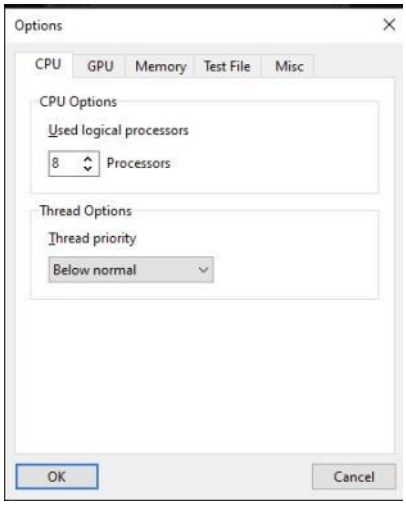
Allows to set the number of used logical processors for the CPU stress test if the system has more than one. The default number is set to the maximum amount of available processors (physical and virtual cores) on your system.

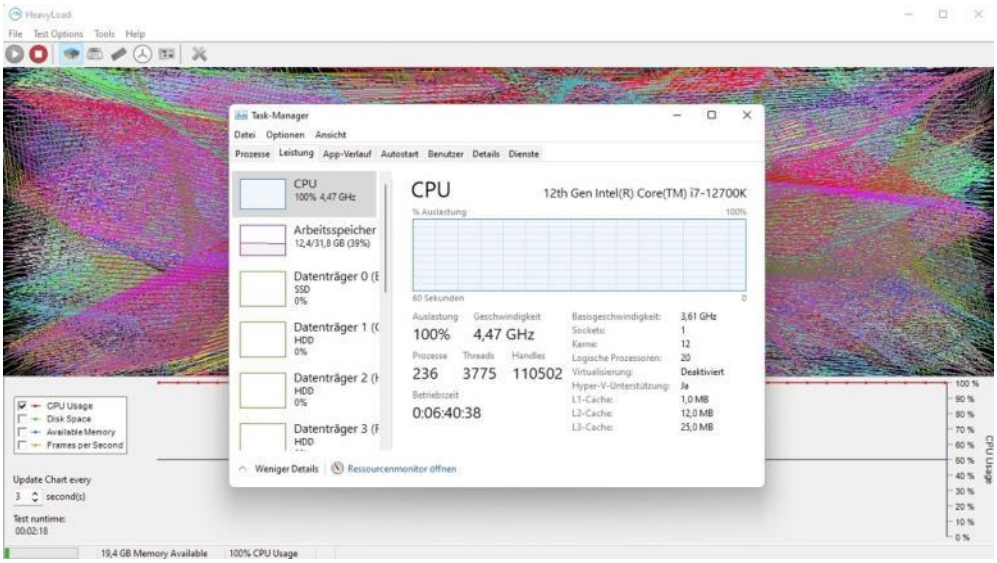
Thread Options

Thread priority

Allows to define the priority at which the threads are running. This can be used to precisely control the system utilization of HeavyLoad. "Idle" means the CPU will only be used if no other threads are using it. Choosing a higher priority will result in the stress threads having a higher priority than the thread of the user interface, which may result in the user interface being unresponsive during the

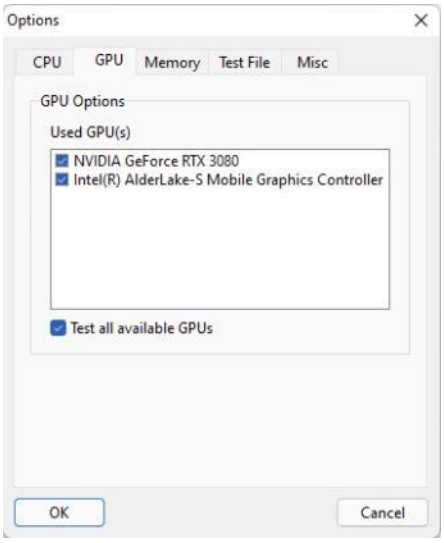
tests.





- **Stress GPU**

HeavyLoad you can utilize your graphics card processor to capacity. HeavyLoad employs a 3D rendered graphic to simulate a high load on the GPU.



These tests will be run with StressCPU and StressGPU to load the AVR800-S4L4 to approximately 70% load on both the CPU and the GPU.

4 Order of tests and usage of test units

4-1 Test units

Two test units will be allocated for parallel testing activities: one unit for MIL-STD-461 compliance verification and the second unit for MIL-STD-810 environmental qualification testing.

4-2 ESS and bonding

Bonding will be tested on both units (less than 2.5 milliOhm should be measured between X1/2/3/4/5 and the GND stud).
Both units should then undergo ESS, and have their bonding measured again.
Record the results.

4-3 Order of Tests

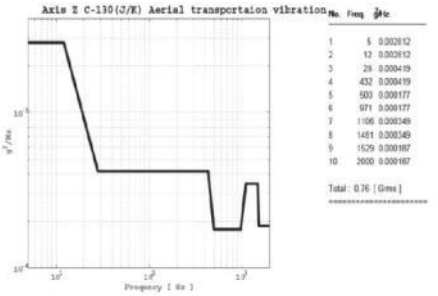
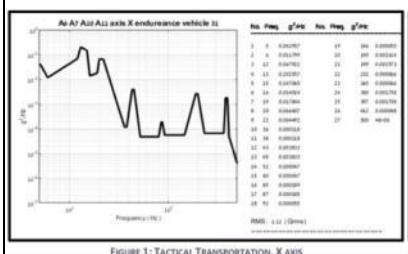
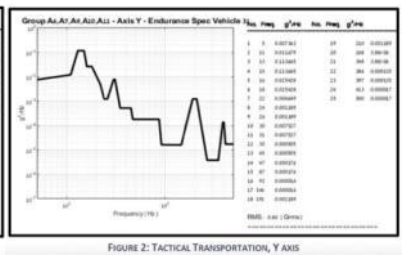
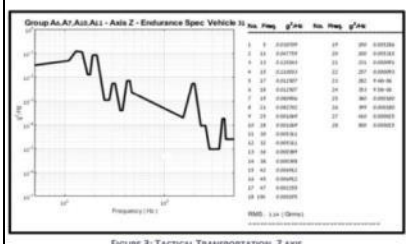
The tests will be carried out on the single unit in the following order

a) ESS/bonding.
b) MIL-STD-810

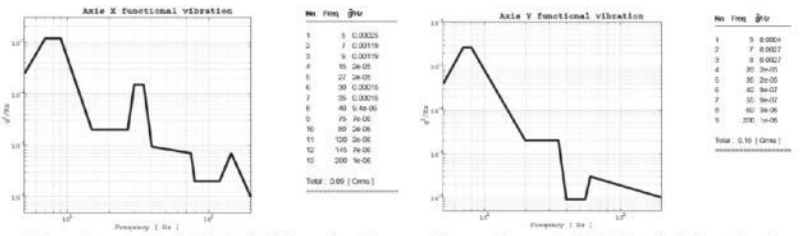
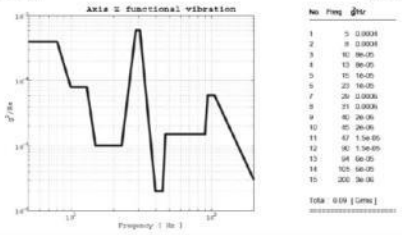
5 MIL-STD-810G TESTS

The AVR800-S4L4 shall be tested under the environmental conditions as defined by MIL-STD-810G according to the order as detailed in Table 1

Table 1: Order of Tests

#	Test		
		Spec' as Internal Equipment	**Conditions**
1	High Temperature	MIL-STD-810G, Method 501.5, Procedure I& II Storage & Operation	High Temperature Storage -- +74°C per MIL-STD-810G/501.5/I for 7 cycles High Temperature Operation -- +55°C per MIL-STD-810G/501.5/II for 3 cycles
2	Low Temperature	MIL-STD-810G, Method 502.5, Procedure I& II Storage & Operation	Low Temperature Storage -- -46°C for 72 hours Low Temperature operation -- The minimum steady operational temperature is -20°C with design goal of -33°C according to Figure 2. The system shall be in operational mode during temperature rise time (-33°C÷25°C) and should be tested at 0°C and 25°C
3	Vibrations	MIL-STD-810G/514.6	C-130(J/K) aircraft -- Test duration 400 minutes per axis (x,y,z), simulating 120 flight hours including 20 landings and takeoffs.  Figure 4: For unknown orientation axis- C-130(J\K) Aerial Transportation Vibration
	Vibrations	MIL-STD-810G/514.6	Tactical Transportation – Not Operational -- Test duration: The profiles are for 2hr test per axis. Coordinate system according to Figure 1.  FIGURE 1: TACTICAL TRANSPORTATION, X AXIS  FIGURE 2: TACTICAL TRANSPORTATION, Y AXIS  FIGURE 3: TACTICAL TRANSPORTATION, Z AXIS

Sine Tones (Dwell)	
68	0.5
102	0.8
136	0.25
204	0.4
272	0.1
306	0.2
408	0.2

<table>
<tr><th rowspan="2">#</th><th rowspan="2">Test</th><th colspan="2"></th></tr>
<tr><th>Spec' as Internal Equipment</th><th>Conditions</th></tr>
<tr><td>3</td><td>Vibrations</td><td>MIL-STD-810G/514.6</td><td>Functional Vibration -- Test duration: completion of functional test.
Coordinate system according to Figure 1.
 
Figure 9: Axis X Tactical Functional Vibration
Figure 10: Axis Y Tactical Functional Vibration
 
Figure 11: Axis Z Tactical Functional Vibration</td></tr>
<tr><td>4</td><td>Shock</td><td>MIL-STD-810G, Method 516.6</td><td>Road Transportation -- Test parameters:
<table><tr><th>Axis</th><th>G peak [g]</th><th>Duration [ms]</th><th>Pulse</th><th>Amount</th></tr><tr><td>XYZ</td><td>10</td><td>11</td><td>Sawtooth</td><td>3 in each direction (±)</td></tr></table></td></tr>
<tr><td>5</td><td>Immersion</td><td>Method 512.5</td><td>The system shall survive without any damage or degradation of performance and should operate to specification after exposure to sealing no water accumulation in the unit test according to IEC 60529/ IP65.</td></tr>
</table>

The systems axis coordinate orientation for vibration is according to Figure 1

Figure 1: AVR 800 with Coordinate system

6 MIL-STD-810G Test Procedure

6-1 HIGH TEMPERATURE TEST

6-1.1 Requirements

Perform the high temperature test in accordance with MIL-STD-810G Method 501.5 Procedures I & II with the following parameters:

Storage (Non-Operating)

Temperature Range	+33°C to +74°C	Cycle Duration	24 hrs.
Cycles	7	Item condition	Unpacked

Operation:

Temperature Range	+33°C to +55°C	Cycle Duration	24 hrs.
Cycles	3	Item condition	Unpacked

6-2 TEST PROCEDURE –STORAGE (NON-OPERATING)

1. At ambient condition perform a visual and functional test.
2. Document the results.
3. Insert the AVR800-S4L4 in the test facility.
4. Prepare the AVR800-S4L4 in its storage configuration.
5. Expose the AVR800-S4L4 to 7 cycles (duration of 24 hours each cycle) of storage high temperature as described.
6. At completion of the test adjust the chamber air temperature to ambient conditions until temperature stabilization of the AVR800-S4L4.
7. Perform a visual and functional test.
8. Document the results.

Table 2: Storage High Temperature One Cycle Profile

Temp [°C]	Time of day
35	01:00
34	02:00

34	03:00
33	04:00
33	05:00
33	06:00
36	07:00
40	08:00
44	09:00
51	10:00
56	11:00
63	12:00
69	13:00
70	14:00
74	15:00
70	16:00
67	17:00
63	18:00
55	19:00
48	20:00
41	21:00
39	22:00
37	23:00
35	24:00

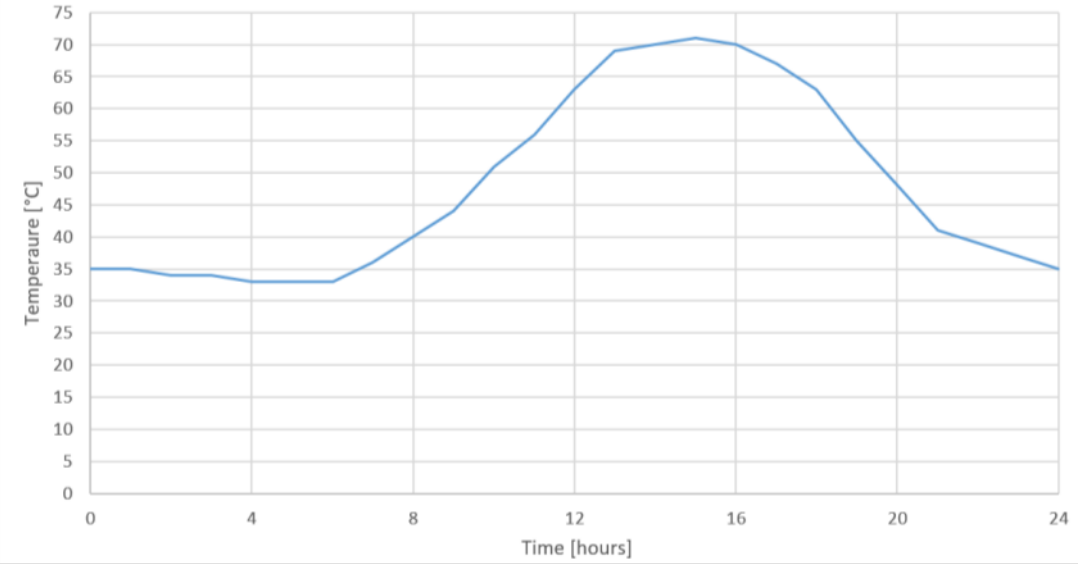


Figure 1: Storage High Temperature One Cycle Profile

6-2.1 Test Procedure – Operational

1. At ambient condition perform a visual and functional test
2. Document the results.
3. Insert the AVR800-S4L4 in the test facility.
4. Prepare the AVR800-S4L4 in its operational configuration.
5. Locate thermocouples on the AVR800-S4L4.
6. Turn ON the AVR800-S4L4.
7. Expose the AVR800-S4L4 to 3 cycles (duration of 24 hours each cycle) of operation high temperature as describe in Table 3.
8. At the maximum temperature of each one of the 3 cycles, perform functional test at 70% load.
9. Document the results.
10. At completion of the test switch OFF the AV800-S4L4.
11. Adjust the chamber air temperature to ambient conditions until temperature stabilization of the AVR800-S4L4.
12. Perform a visual and functional test.
13. Document the results

Table 3: Operation High Temperature One Cycle Profile

Temp [°C]	Time of day
35	1.00
34	2.00
34	3.00
33	4.00
33	5.00
32	6.00
33	7.00
35	8.00
38	9.00
41	10.00
43	11.00
44	12.00
47	13.00
50	14.00
52	15.00

55	16.00
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48	18.00
46	19.00
42	20.00
41	21.00
39	22.00
38	23.00
37	24.00

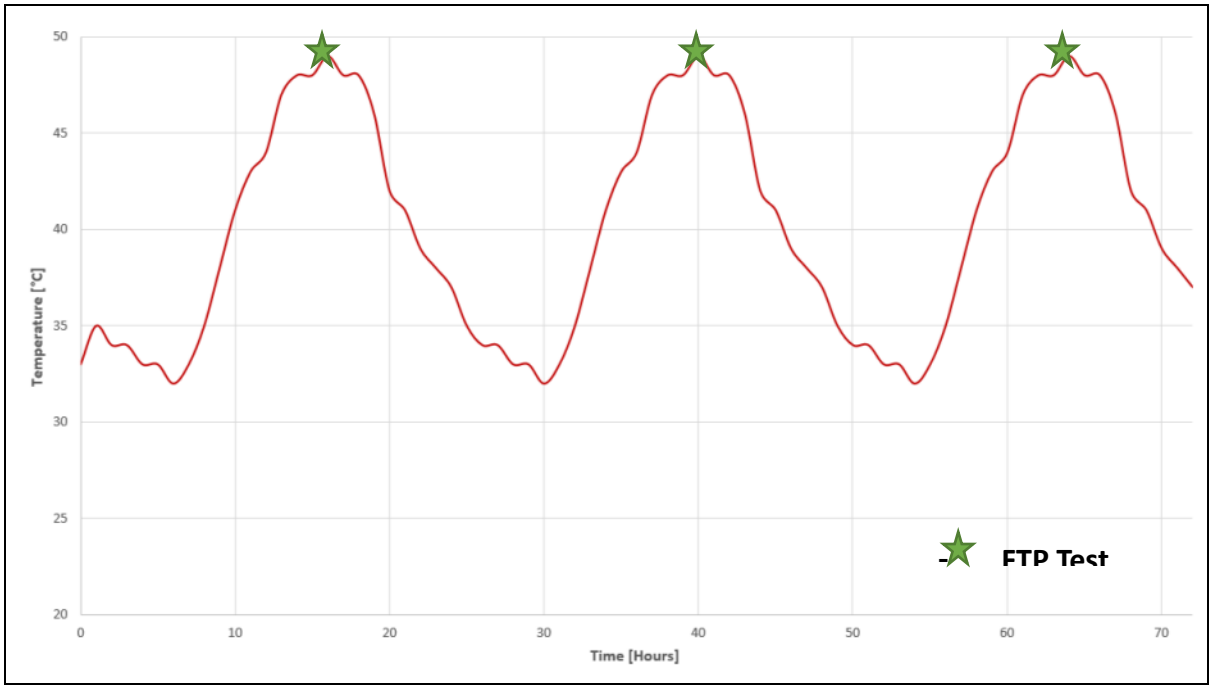


Figure 2: Operation High Temperature Test Profile

6-2.2 Acceptance Criteria

Storage:

Visual- No evidence of damage shall be seen.

Functional -No degradation of performance.

Operation:

Visual- No evidence of damage shall be seen.

Functional -No degradation of performance during exposure to high temperature.

6-3 LOW TEMPERATURE TEST

6-3.1 Requirements

Perform the low temperature test in accordance with MIL-STD-810G Method 502.5 Procedures I & II with the following parameters:

Storage (Non-Operating)

Temperature Range	-46°C	Cycle Duration	24 hrs.
Cycles	3	Item condition	Unpacked

Operation:

Temperature Range	-33°C	Cycle Duration	24 hrs.
Cycles	3	Item condition	Unpacked

Storage: 72 hours after stabilization

Operation: The minimum steady operational temperature is -20°C with design goal of -33°C. The system shall be in operational mode during temperature rise time (-33°C~25°C) and should be tested at 0°C and 25°C

Max. Change Rate: 2°C/min

6-3.2 Acceptance Criteria

Visual- No evidence of damage shall be seen.

Functional -No degradation of performance.

6-3.3 Storage Test Procedure

Step 1. At ambient condition perform a visual and functional test

Step 2. Document the results.

Step 3. Insert the AVR800-S4L4 in the test facility.

Step 4. Prepare the AVR800-S4L4 in its operation configuration.

Step 5. Locate thermocouples on the AVR800-S4L4.

Step 6. With the AVR800-S4L4 not operating adjust the chamber temperature to -46°C with temperature change rate not exceed of 3°C/min.

Step 7. After AVR800-S4L4 stabilization maintain the chamber temperature at -46°C for dwell duration of 72 hours.

Step 8. Adjust the chamber air temperature to ambient conditions until temperature stabilization of the AVR800-S4L4 with temperature change rate not exceed of 3°C/min.

Step 9. Perform visual and functional tests.

Step 10. Document the results.

6-3.4 Operational Test Procedure

1. At ambient condition perform a visual and functional test
2. Document the results.
3. Insert the AVR800-S4L4 in the test facility.
4. Prepare the AVR800-S4L4 in its operational configuration.
5. Locate thermocouples on the AVR800-S4L4.
6. Turn OFF the AVR800-S4L4.
7. Lower the temperature to -33C for a further 3 hours.
8. After stabilization, switch ON the AVR800-S4L4 and perform functional test at 70% load.
9. Switch OFF the AVR800-S4L4 and Document the results.
10. Lower the temperature to -20C for 3 hours as shown in Figure 2 below.
11. Switch ON the AVR800-S4L4 and perform functional test at 70% load and document results.
12. Adjust the chamber air temperature to ambient conditions until temperature stabilization of the AVR800-S4L4 while still operational.
13. Perform a visual and functional test.
14. Document the results

3.1.2.3.2. Low Temperature operation

The system shall survive without any damage or degradation of performance during and after exposure to low temperature per MIL-STD-810G/502.5/II.

The minimum steady operational temperature is -20°C with design goal of -33°C according to Figure 2. The system shall be in operational mode during temperature rise time (-33°C÷25°C) and should be tested at 0°C and 25°C

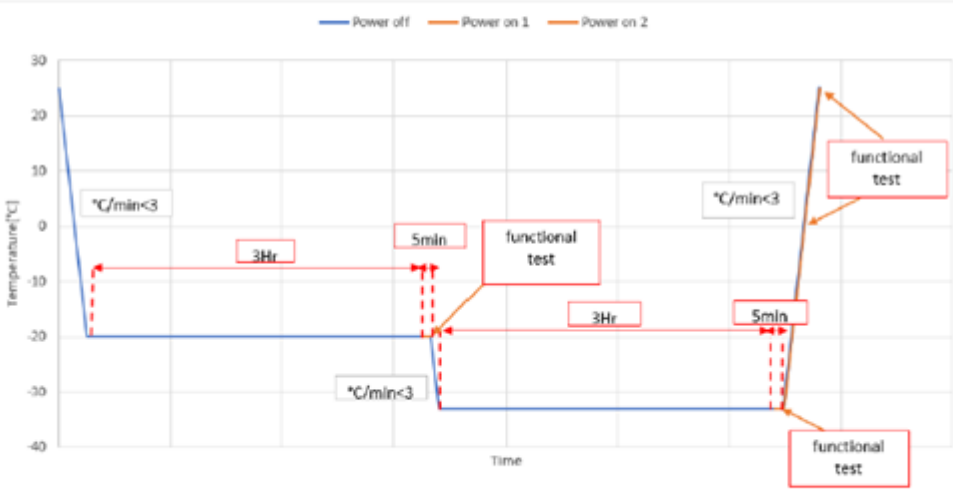


Figure 2: Low Temperature Operational Cycle

6-4 IMMERSION TEST

6-4.1 Requirements

Perform the immersion test according to IP65 requirements with the following parameters:

Water:	Sprayed by hose.	**Item condition**	Unpacked Non-Operation
Duration	3 min		

6-4.2 Test Procedure

Step 1. At ambient condition conduct a complete visual examination of the test item with special attention to sealed areas, gaskets/seals, and structural integrity, and document the results. Take photographs, if appropriate. Verify that no free water is present; if so, dry.
Step 2. At ambient condition perform functional test.
Step 3. Weigh the AVR800-S4L4.
Step 4. Document the results.
Step 5. Three times immediately before the test, open and close (or remove and replace) any doors, covers, etc., that would be opened during normal use to ensure any seals are functioning properly and are not adhering to the sealing (mating) surfaces.
Step 6. Ensure temperature differential between the water and the AVR800-S4L4 of more than 10°C.
Step 7. Record the water temperature and the AVR800-S4L4 temperature.
Step 8. Close all sealed areas and valves.
Step 9. The spraying with a hose on test item in water the surface of the water for duration of 3 minutes.
Step 10. Remove AVR800-S4L4 from the water, wipe the exterior surfaces dry (giving special attention to areas around seals and relief valves), be careful to not allow water to enter the test item while activating the manual valves.
Step 11. Weigh the AVR800-S4L4.
Step 12. Open the AVR800-S4L4 and examine the interior and contents for evidence of and quantity of any leakage and, if leakage occurred, for probable areas of entry.
Step 13. Perform functional test.
Step 14. Document the results.

6-4.3 Acceptance Criteria

Visual:

No evidence of water penetration shall be seen inside the AVR800-S4L4.
No evidence of damage shall be seen on the exterior.
Functional:
No degradation of performance.

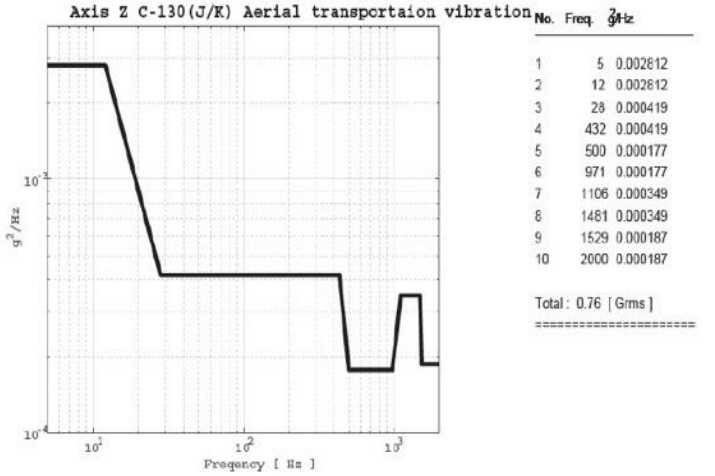
6-5 VIBRATION TEST

6-5.1 C-130 Requirements

Perform the vibration test in accordance with MIL-STD-810G Method 514.6 category 7. C-130(J/K) aircraft unpacked and in non-operating mode -- with the following parameters:

6-5.2 C-130 Test Procedure

Test duration 400 minutes per axis (x,y,z), simulating 120 flight hours including 20 landings and takeoffs.



Sine Tones (Dwell)	
68	0.5
102	0.8
136	0.25
204	0.4
272	0.1
306	0.2
408	0.2

Figure 4: For unknown orientation axis- C-130(J\K) Aerial Transportation Vibration

6-5.3 Tactical Transportation Requirements

Perform the vibration test in accordance with MIL-STD-810G Method 514.6 category 7. Tactical Transportation – unpacked, Not Operational – with the following parameters:

6-5.4 Tactical Transportation Test Procedure

Test duration: The profiles are for 2hr test per axis. These profiles replace the ones in section 7-8-9 in [1]. Coordinate system according to Figure1 (X Axis), Figure 2 (Y Axis), Figure 3 (Z Axis).

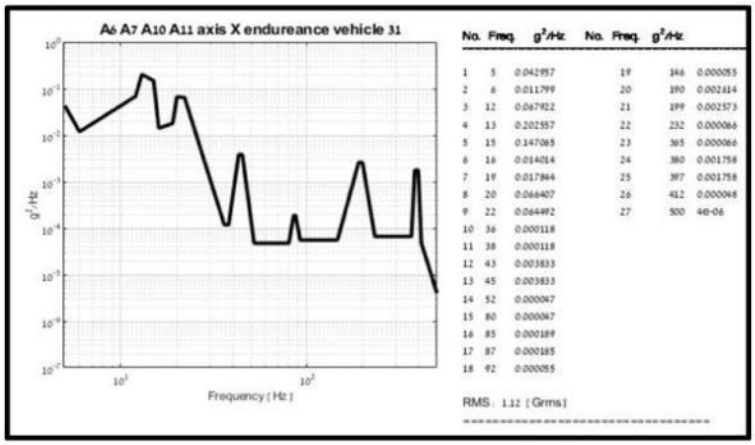


FIGURE 1: TACTICAL TRANSPORTATION, X AXIS

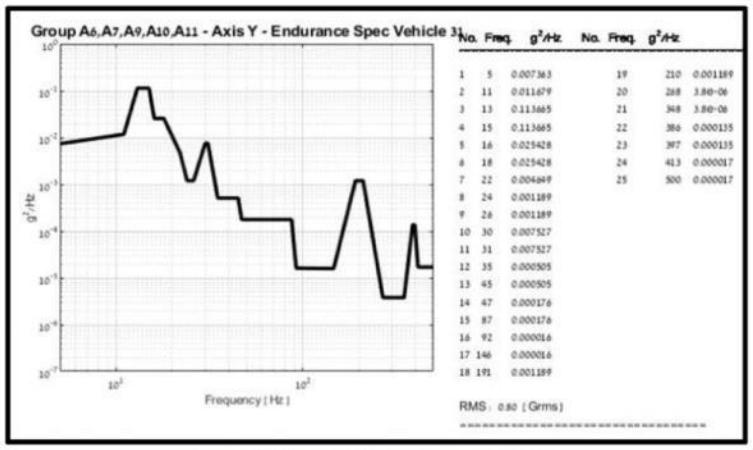


FIGURE 2: TACTICAL TRANSPORTATION, Y AXIS

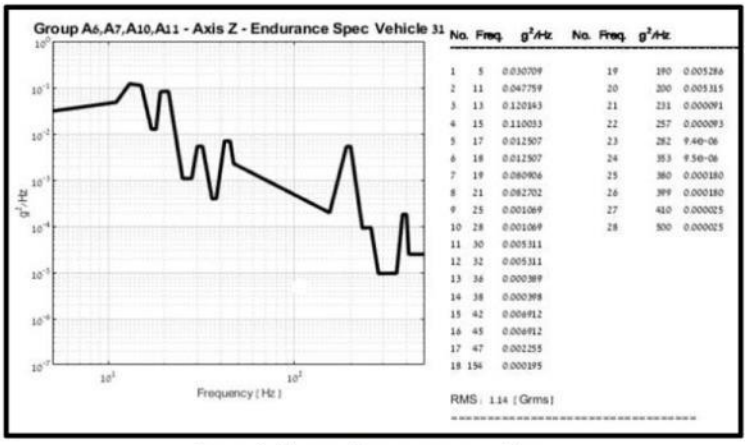


FIGURE 3: TACTICAL TRANSPORTATION, Z AXIS

6-5.5 Functional Vibration Requirements

Perform the vibration test in accordance with MIL-STD-810G Method 514.6 category 7. Functional Vibration– with the following parameters:

6-5.6 Functional Vibration Test Procedure

Test duration: completion of functional test. Coordinate system according to Figure 1.

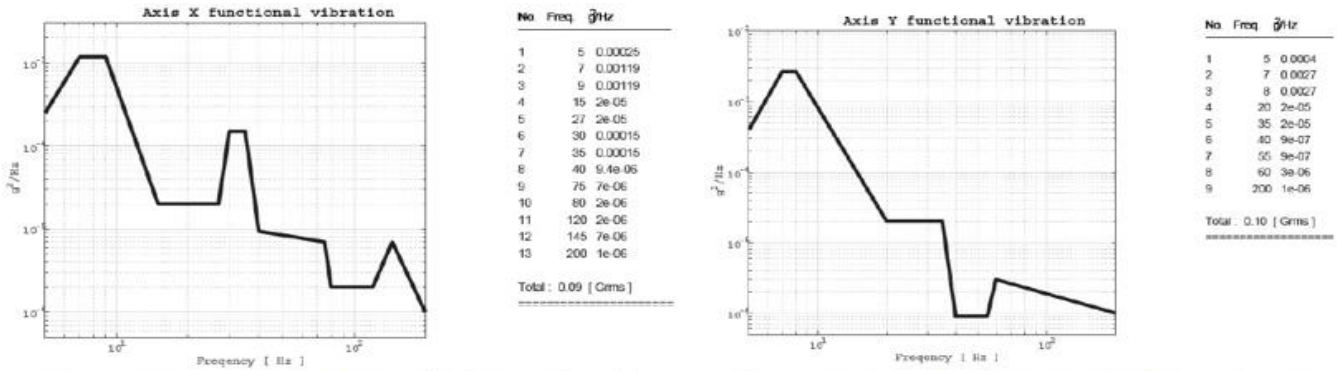


Figure 9: Axis X Tactical Functional Vibration

Figure 10: Axis Y Tactical Functional Vibration

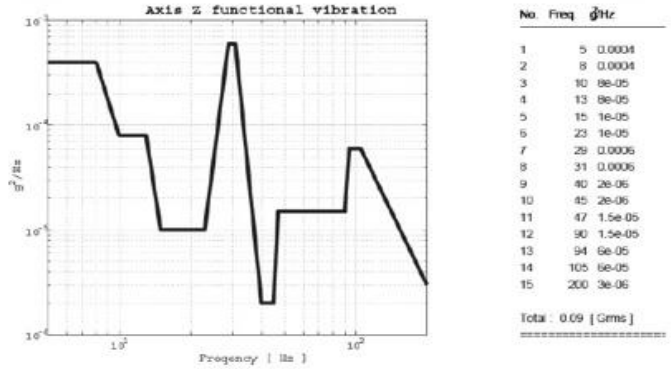


Figure 11: Axis Z Tactical Functional Vibration

6-6 Shock TEST

6-6.1 Road Transportation Requirements

Perform the Shock test in accordance with MIL-STD-810G Method 516.6. Road Transportation -- with the following parameters:

6-6.2 Road Transportation Test Procedure

Test parameters:

Axis	G peak [g]	Duration [ms]	Pulse	Amount
XYZ	10	11	Sawtooth	3 in each direction (±)

6-6.3 Acceptance Criteria

Visual- No evidence of damage shall be seen.
Functional -No degradation of performance.