Qualification Test Plan

AV600X-CH

Product Manager	H/W Leader	System Engineer	Testing Engineer
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Version History			
Document Release	**Date**	**Change Item**	**Remarks**
V1.0	12/29/2022	Preliminary release	

System Configuration	
Motherboard	OXY5741A EBX SBC
CPU	Intel® Xeon E2276ML (2.0Ghz, 25W, 12MB)
PCH	Intel Coffee Lake
RAM1	SO-DIMM DDR4 2400 16GB
RAM2	SO-DIMM DDR4 2400 16GB
GPU	Nvidia A1000 MXM 4GB GDDR6 CUDA Cores 2048
SATA	2.5” SATA 128GB SSD
DVI	2 x DVI output
LAN	2 x Intel® Gigabit Ethernet
I/O	4 x RS232/422/485 + 4 Bit DIO
POWER	DC-DC 9V to 36V (250W Max) MIL-STD-461
Dimension	325(D) x 250(W) x 100 (H) mm
Weight	8Kg(13.22lbs)
Chassis	Aluminum Alloy, Corrosion Resistant
Finish	Anodic aluminum oxide
Cooling	Natural Passive Conduction

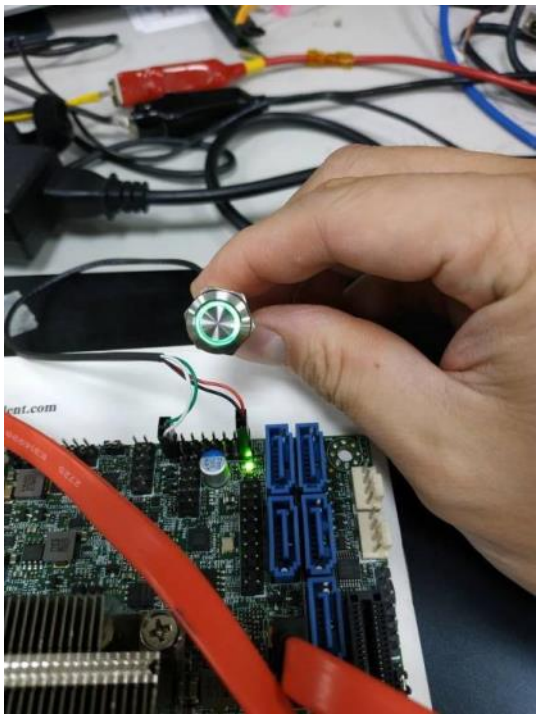
System Reliability/Environment Test table of Content

1 I/O FUNCTIONAL TEST

1-1 Power Button & LED

Test Method:

- Connect the POWER BUTTON & power LED,
- Testing the motherboard after pressing the power button.
- Make sure the workable LED light



1-2 X1, X2 (DVI)

DVI Function Test

DP Test							
Test Method	1. Use 800x600 1024x768 1280x720(or highest solution) and 16&32 bit to test display correctly. 2. Check display with test pattern 3. check display can nothas any cross-color, water wave, and ghost.						
resolution	800x600, 60Hz	800x600, 75Hz	1024x768, 60Hz	1024x768, 75Hz	1280x720, 60Hz	1280x720, 75Hz	1920x1080, 60Hz
DP1	PASS	PASS	PASS	PASS	PASS	PASS	PASS

Graphic Resolution test		
Monitor Model	ASUS 27” PB278Q , Maximum resolution：2560 x 1440 ASUS 23” PA238 , Maximum resolution：1920 x 1080	
Resolution	**DVI 1**	**DVI 2**
640 x 480	✓	✓
720 x 480	✓	✓
720 x 576	✓	✓
800 x 600	✓	✓
1024 x600	✓	✓
1024 x 768	✓	✓
1152 x 648	✓	✓
1152 x 864	✓	✓
1280 x 720	✓	✓
1280 x 768	✓	✓
1280 x 800	✓	✓

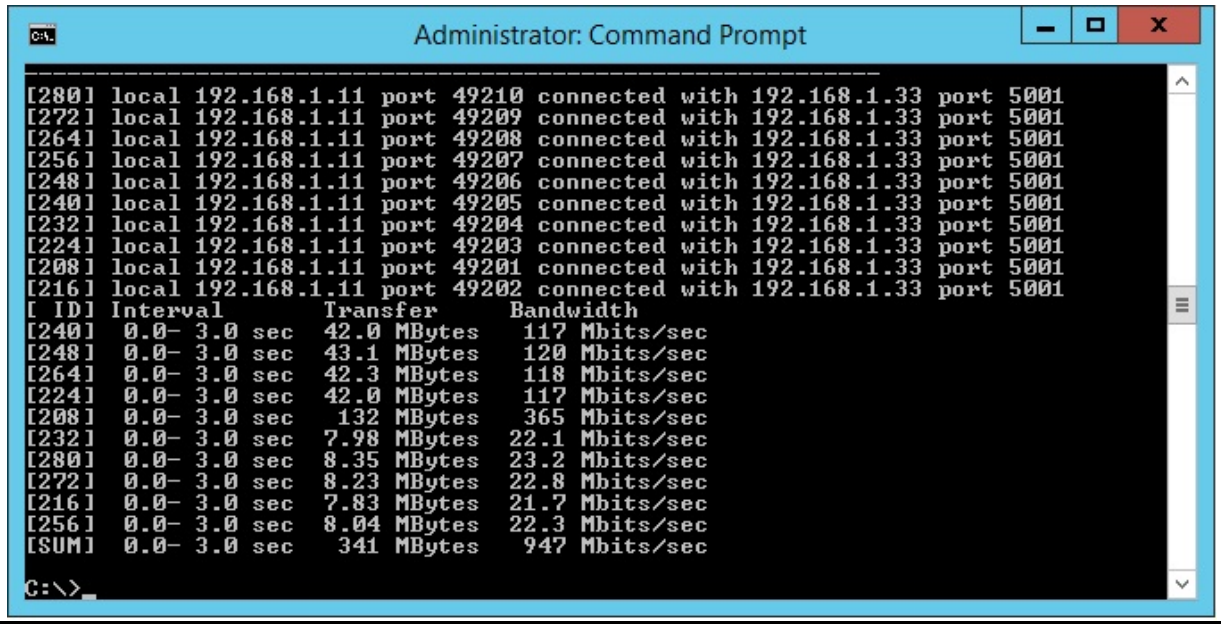
1280 x 1024	✓	✓
1366 x 768	✓	✓
1400 x 1050	✓	✓
1440 x 900	✓	✓
1600 x 900	✓	✓
1600 x 1200	✓	✓
1680 x 1050	✓	✓
1776 x 1000	✓	✓
1920 x 1080	✓	✓
1920 x1200	✓	✓
2560 x 1440	✓	✓

1-3 X3 (2 GbE LAN+ 3 USB 2.0)

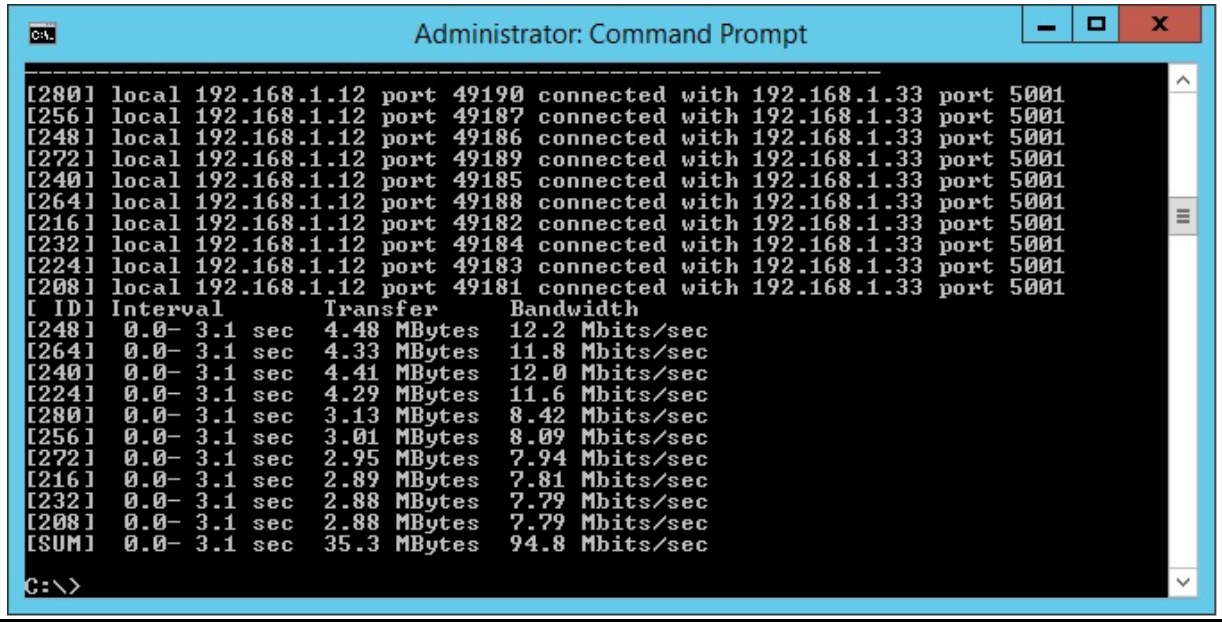
Test Method:

Check the LAN MAC ADDRESS on the MB, LAN SPEED and make sure that you can connect to the Internet

i350 LAN
i350 1Gb LAN-1

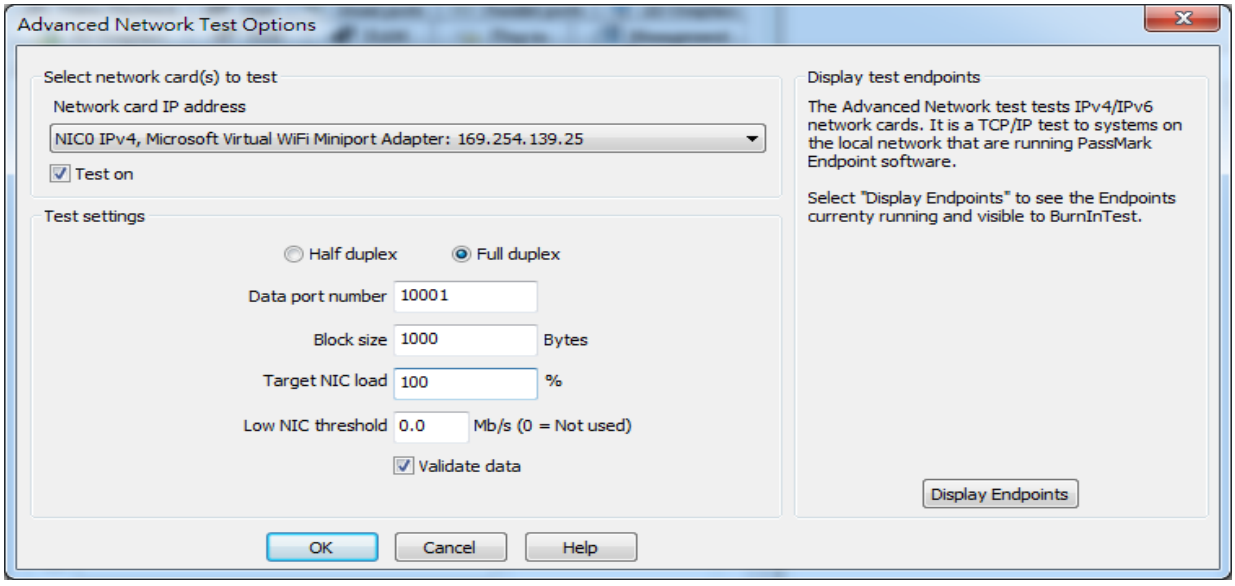


i350 LAN
i350 100Mb LAN-2



LAN STRESS

At least 12 hours

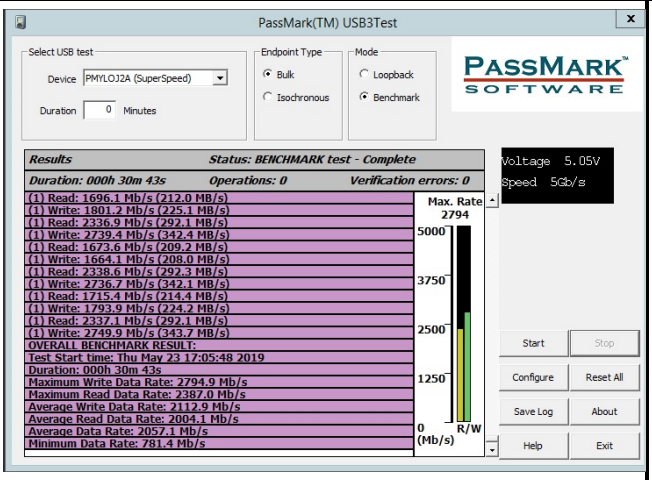


Test Method:

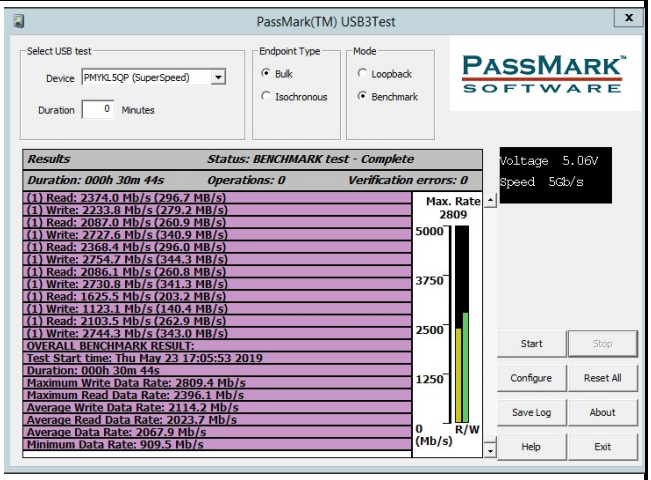
Check if we can detect the USB,2xpin header & real connector x2 with USB DEVICE

Loopback Plugs for USB 3.0 &USB2.0					
Software	**Comment / (unit)**	**connector**	**Read / Write** (Mb/s)	**Result**	**Note**
PassMark Software	PassMark USB3.0 test plug	USB3.0-1	2004/2112		
		USB3.0-2	2023/2114		
	PassMark USB2.0 test plug	USB2.0-1	393/360 (Mb/s)		

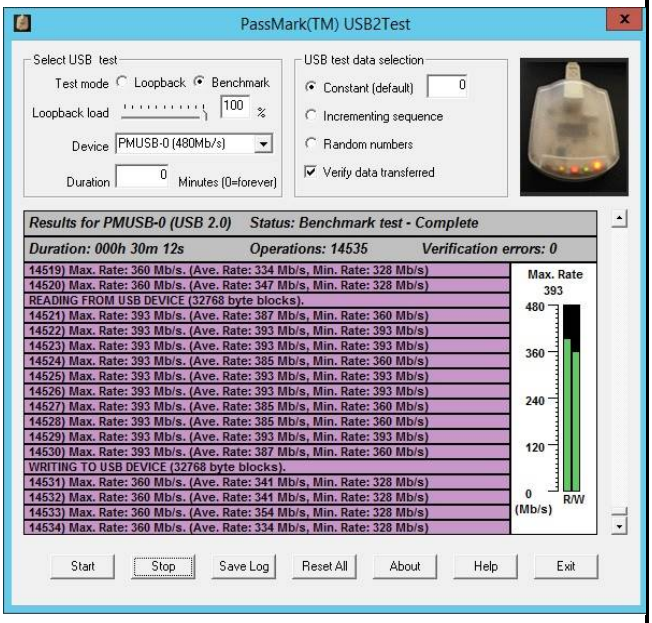
USB3.0-1



USB3.0-2



USB2.0-1



1-4 X4 (4 x RS232/422/485 + 4 Bit DIO)

Test Method:

RS-232/422/485 COM port test with all Models, Use BEAR CARD to test if RS232/ RS422/RS485 mode works under DOS

DOS mode commends

RS232

uart c1

uart c3 \i

uart c5 @2xx ixx \i

RS422

uart c1

uart c3 \i

uart c5 @2xx ixx \i

RS485

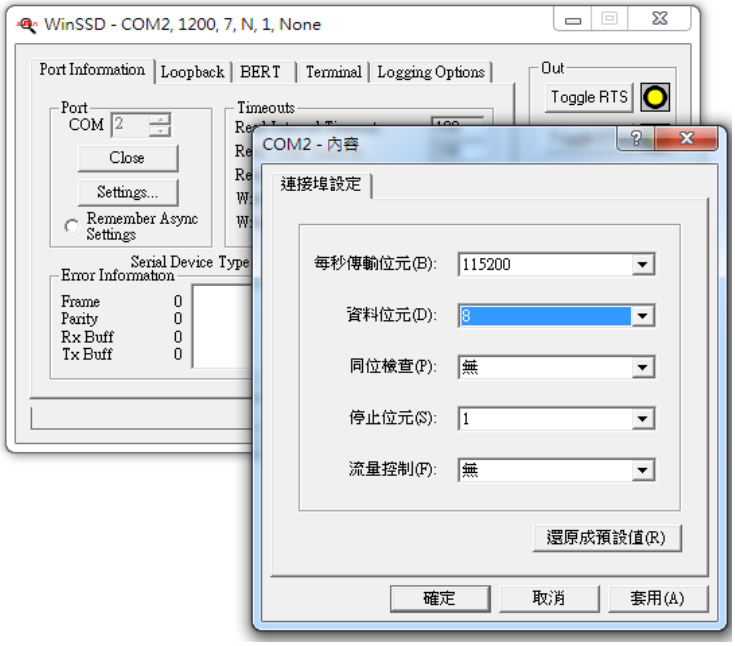
uart c1

uart c3 \i

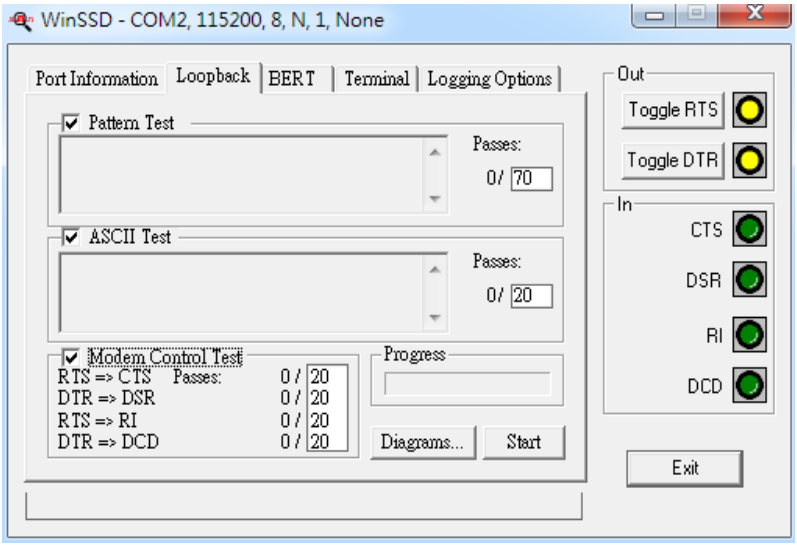
uart c5 @2xx ixx \i

Test under WINDOWS, using setup_pcommlite_1.6_12041917

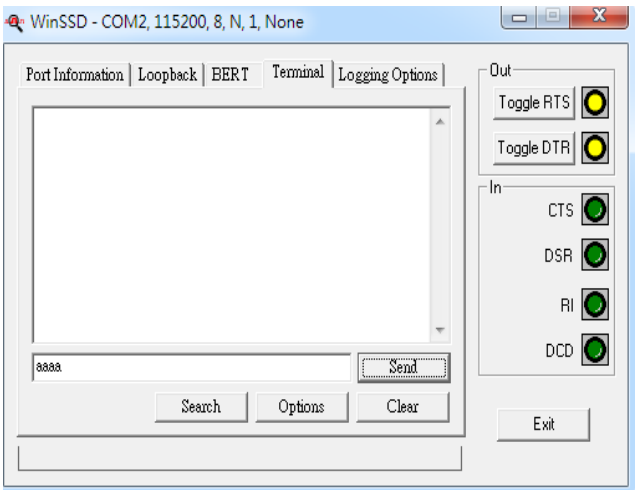
SeaCOM_v030602



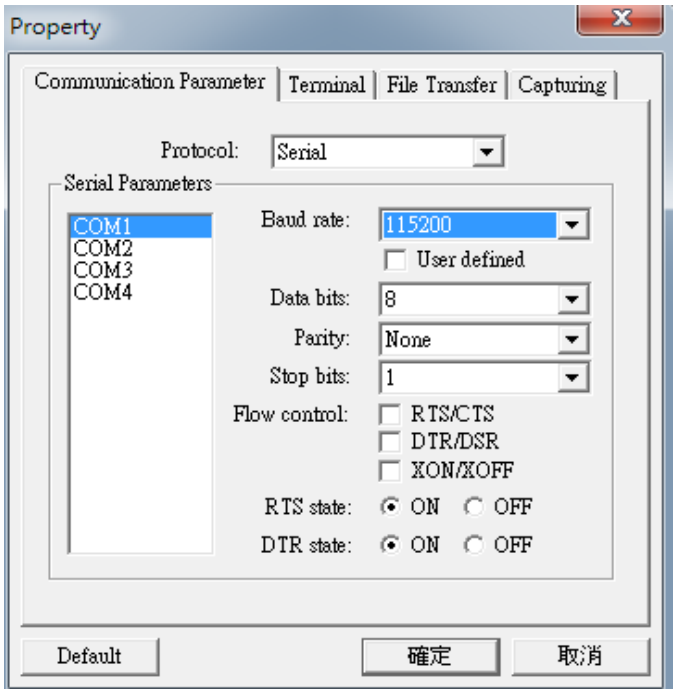
LOOPBACK

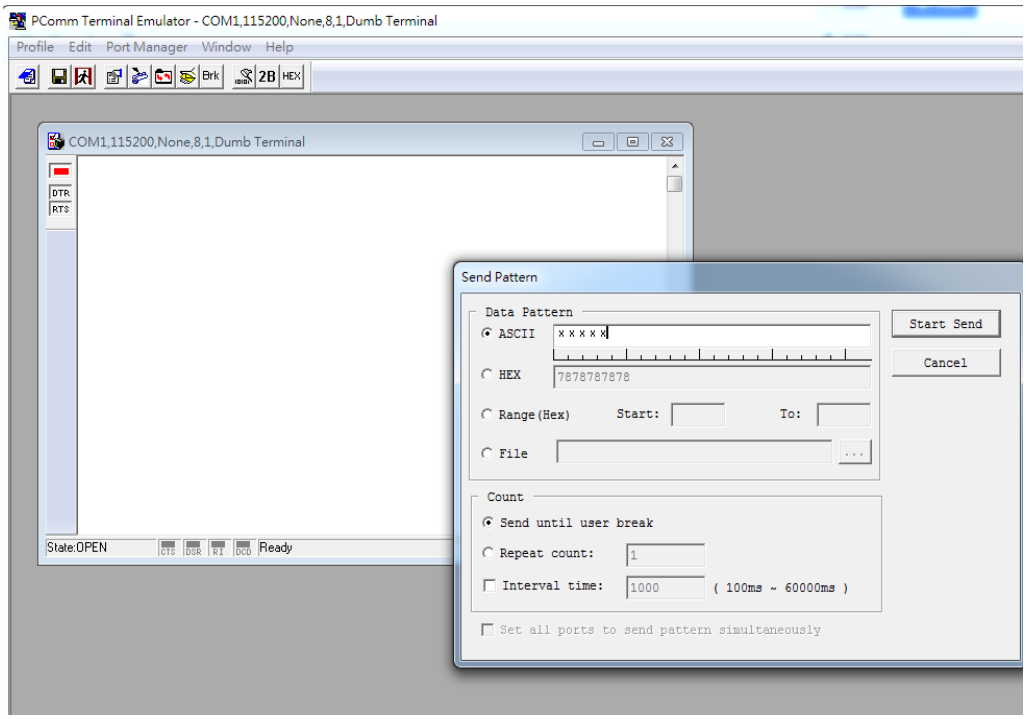


For transmission



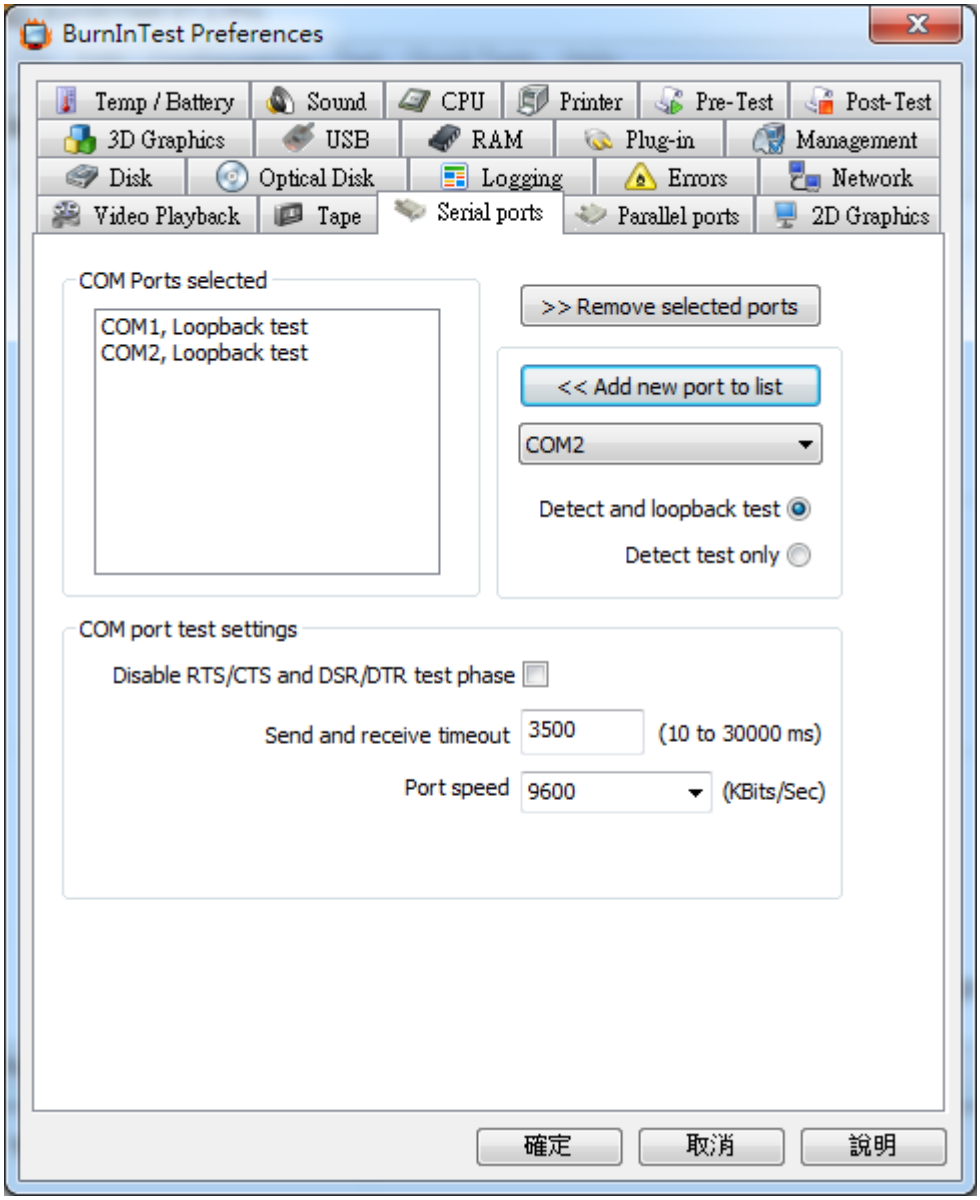
setup_pcommlite





COM PORT STRESS

At least 12 hours, port speed must be set to 115200

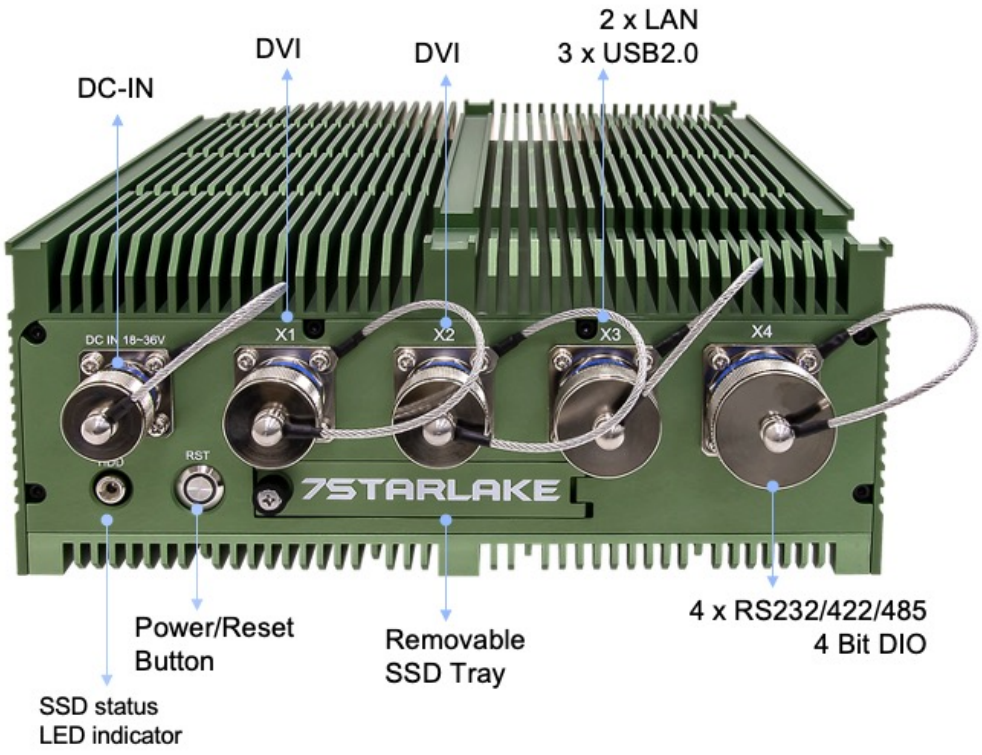


2 AV600X-CH D38999 CONNECTOR

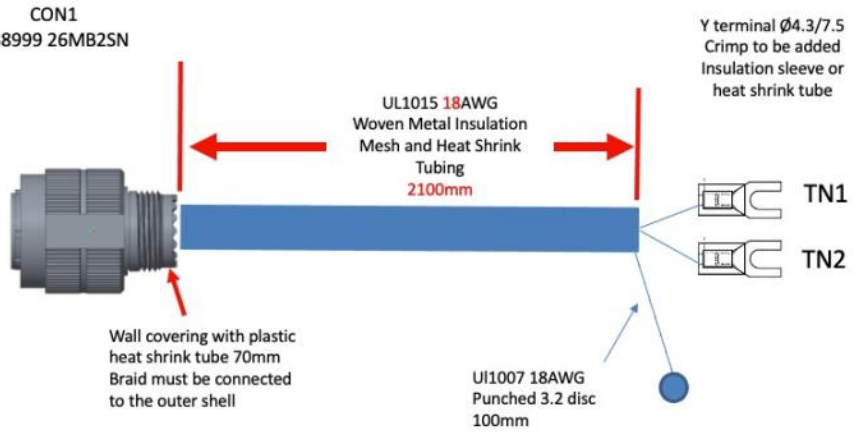
INDEX

DC-IN AMPHENOL 20FB2PN

1. X1 EXT DVI AMPHENOL 20FC35SN
2. X2 EXT DVI AMPHENOL 20FC35SN
3. X3 EXT LAN/USB AMPHENOL 20FD35SN
4. X4 EXT COM/DIO AMPHENOL 20FE35SN

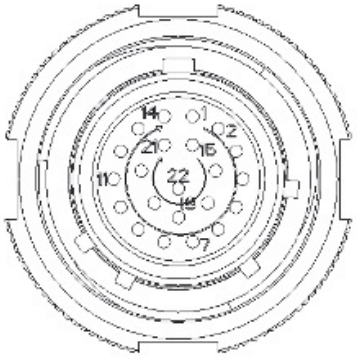


AV600X-CH EXT-DC-IN CABLE



	CON1	
Yellow	A	TN1
Black	B	TN2
Green	Shell	O Terminal

AV600X-CH X1/X2 : EXT-DVI CABLE

X1/X2		Pin define	DVI
	1	DPA_TN0	1
	2	DPA_TP0	2
	3	GND	3
	4	DPA_AUXP_CLK(p)	6
	5	DPA_AUXP_CLK(n)	7
	6	GND	3
	7	DPA_TN1	9
	8	DPA_TP1	10
	9	GND	11
	10	DPA_PWR	14
	11	Return GND	15
	12	AUX_SEL/DPA_DET	16
	13	DPA_TN2	17
	14	DPA_TP2	18
	15	GND	19
	16	CLOCK Shield	22
	17	DPA_TP3	23
	18	DPA_TN3	24
	19	GND	shell

CON1
D38999/26FC35PN

CON2
DVI CONNECTOR (MALE)

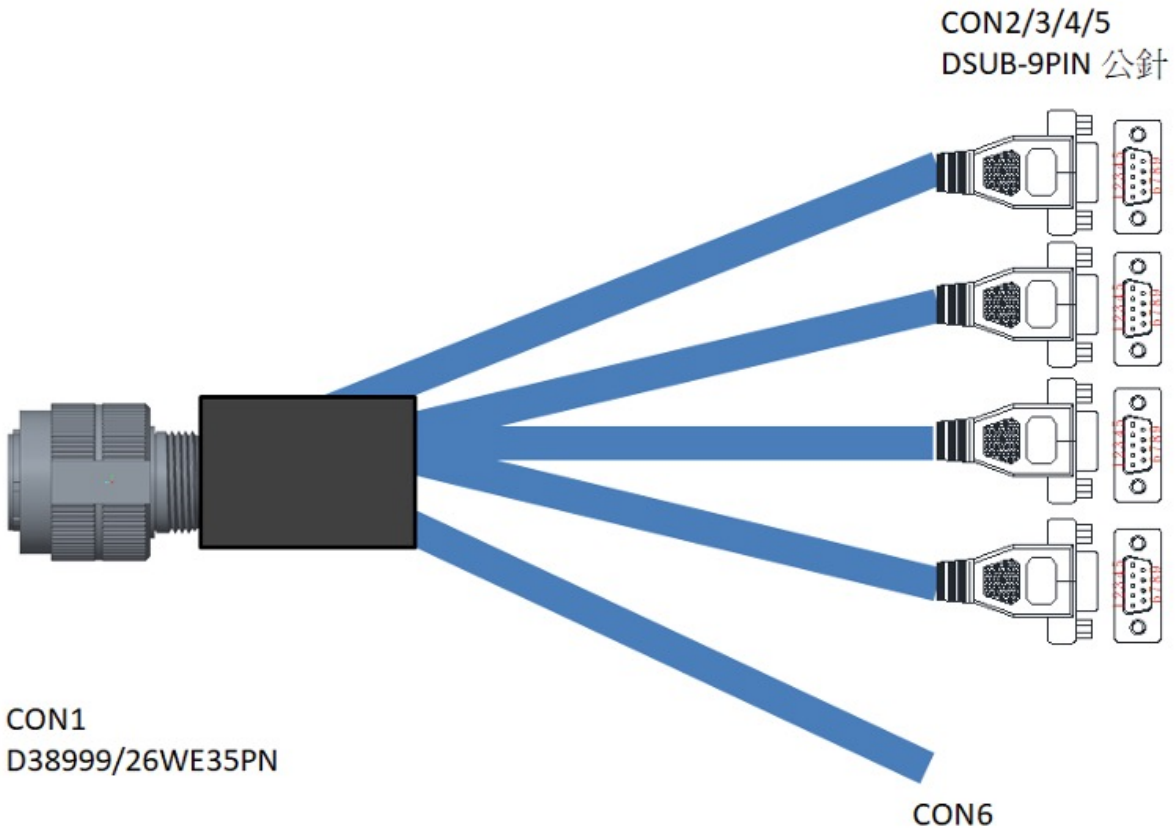
AV600X-CH X3: EXT-LAN and USB CABLE

X3	D38999	Pin define	CON2	CON3	CON4	CON5
	1	WHITE / ORANGE	1			
	2	ORANG	2			
	3	WHITE / GREEN	3			
	4	BLUE	4			
	5	WHITE / BLUE	5			
	6	GREEN	6			
	7	WHITE / BROWN	7			
	8	BROWN	8			
	9	WHITE / ORANGE		1		
	10	ORANG		2		
	11	WHITE / GREEN		3		
	12	BLUE		4		
	13	WHITE / BLUE		5		
	14	GREEN		6		
	15	WHITE / BROWN		7		
	16	BROWN		8		
	17					
	18					
	19					
	20	Vcc			1	
	21	Date-			2	
	22	Date+			3	
	23	GND			4	
	24	Vcc			1	
	25	Date-			2	
	26	Date+			3	
	27	GND			4	
	28	Shell				
	29	Vcc				1
	30	Date-				2
	31	Date+				3
	32	GND				4
	33	Vcc				1
	34	Date-				2
	35	Date+				3
	36	GND				4
	37	Shell				

AV600X-CH X4: EXT-COMx4 and DIO CABLE

CON1	CON2	CON3	CON4			CON1	CON5	CON6	
1	1			DCD		28	1		DCD
2	2			RX		29	2		RX
3	3			TX		30	3		TX
4	4			DTR		31	4		DTR
5	5			GND		32	5		GND
6	6			DSR		33	6		DSR
7	7			RTS		34	7		RTS
8	8			CTS		35	8		CTS
9	9			RI		36	9		RI
10		1		DCD		37			
11		2		RX		38			
12		3		TX		39			
13		4		DTR		40			
14		5		GND		41		1	DIO0(IN)
15		6		DSR		42		2	DIO1(IN)
16		7		RTS		43		3	DIO2(IN)
17		8		CTS		44		4	DIO3(IN)
18		9		RI		45		5	DIO0(OUT)
19			1	DCD		46		6	DIO1(OUT)
20			2	RX		47		7	DIO2(OUT)
21			3	TX		48		8	DIO3(OUT)
22			4	DTR		49		9	3.3V
23			5	GND		50		10	GND
24			6	DSR		51			
25			7	RTS		52			
26			8	CTS		53			
27			9	RI		54			
						55			

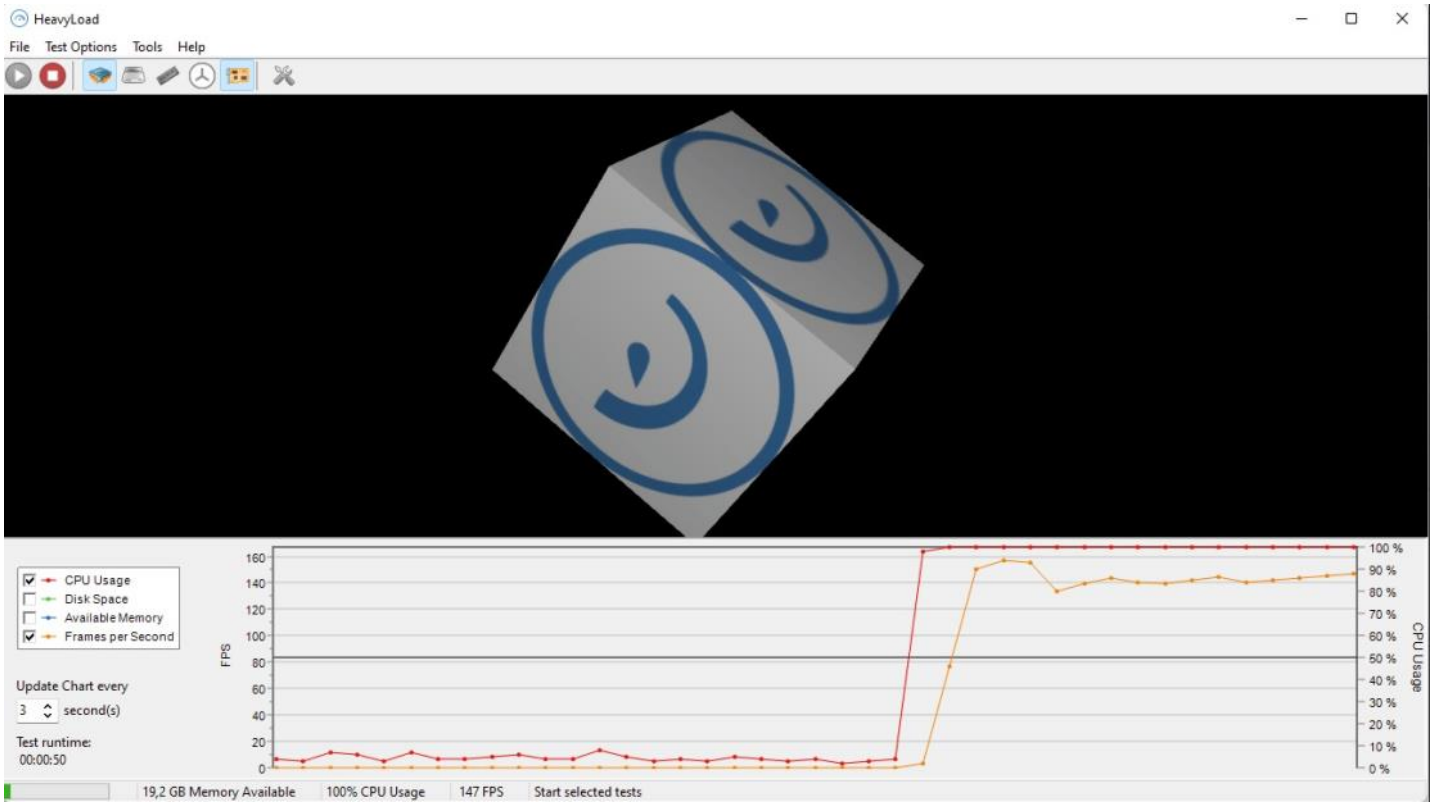
AV600X-CH X4: EXT-COMx4 and DIO CABLE



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

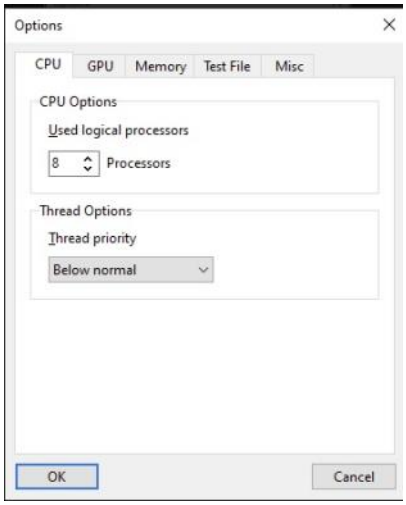
Used logical processors

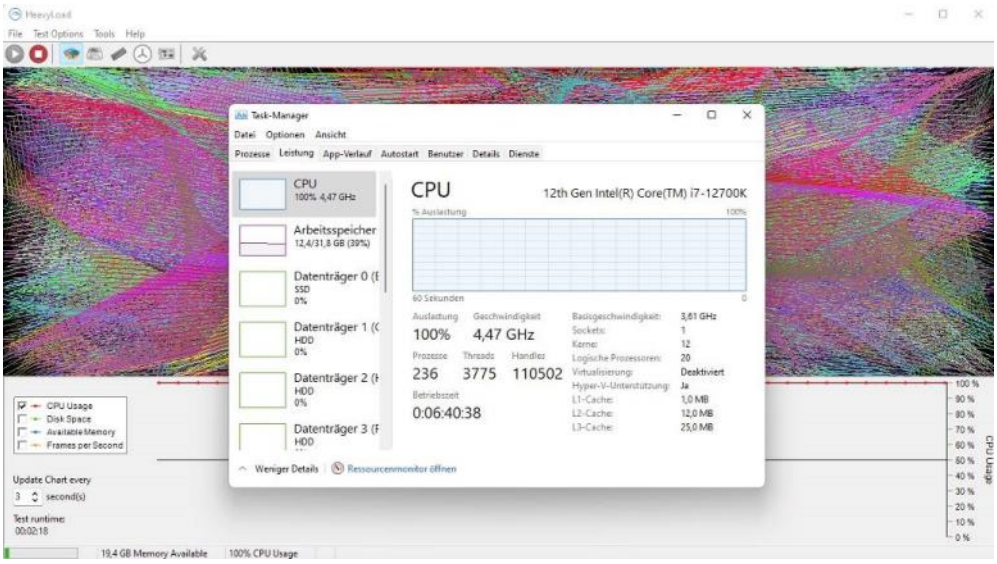
Allows to set the number of used logical processors for the CPU stress test if the system has more than one. The default number is set to the maximum amount of available processors (physical and virtual cores) on your system.

Thread Options

Thread priority

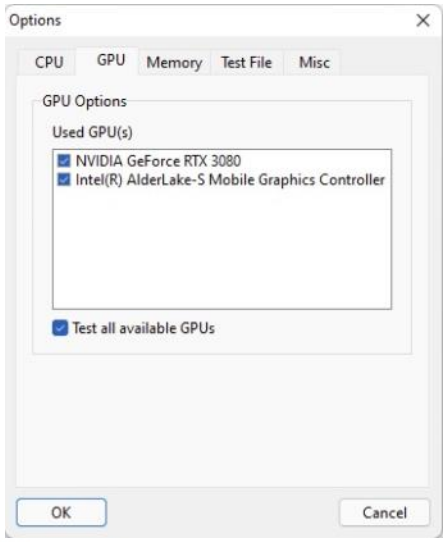
Allows to define the priority at which the threads are running. This can be used to precisely control the system utilization of HeavyLoad. "Idle" means the CPU will only be used if no other threads are using it. Choosing a higher priority will result in the stress threads having a higher priority than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





Stress GPU

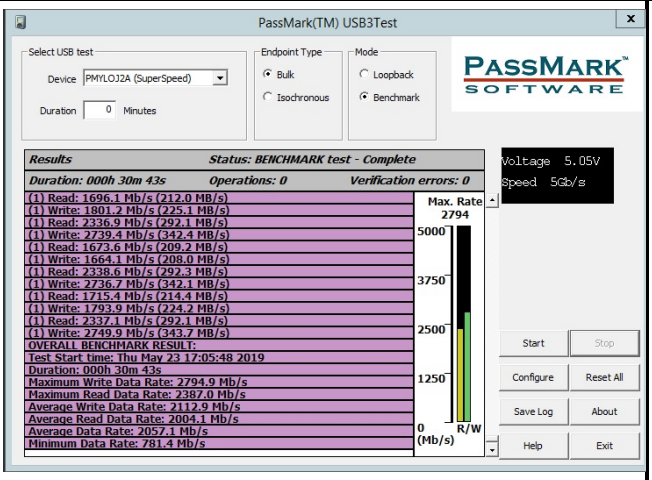
HeavyLoad you can utilize your graphics card processor to capacity. HeavyLoad employs a 3D rendered graphic to simulate a high load on the GPU.



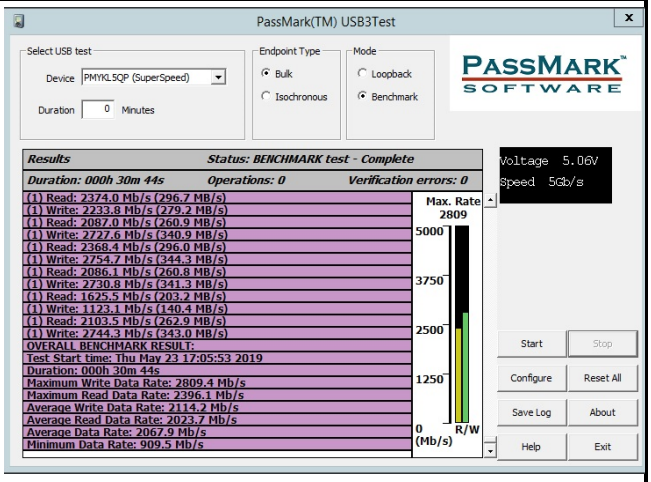
4 USB PERFORMANCE

Loopback Plugs for USB 3.0 &USB2.0					
Software	**Comment / (unit)**	**connector**	**Read / Write** (Mb/s)	**Result**	**Note**
PassMark Software	PassMark USB3.0 test plug	USB3.0-1	2004/2112		
		USB3.0-2	2023/2114		
	PassMark USB2.0 test plug	USB2.0-1	393/360 (Mb/s)		

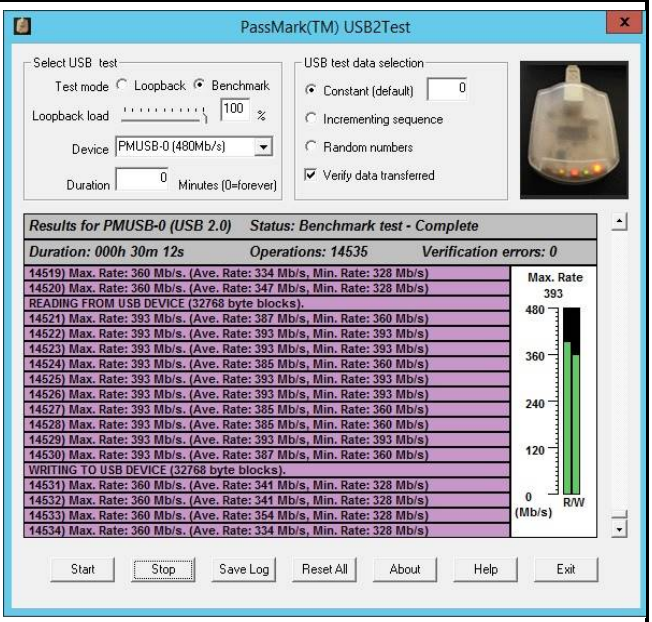
USB3.0-1



USB3.0-2



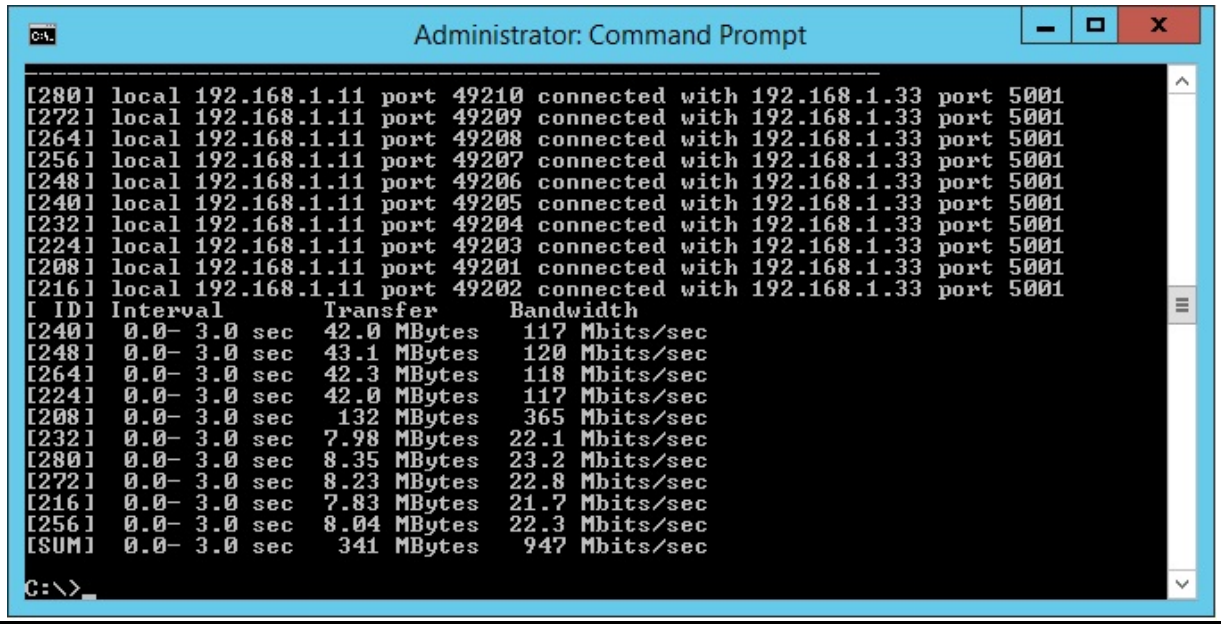
USB2.0-1



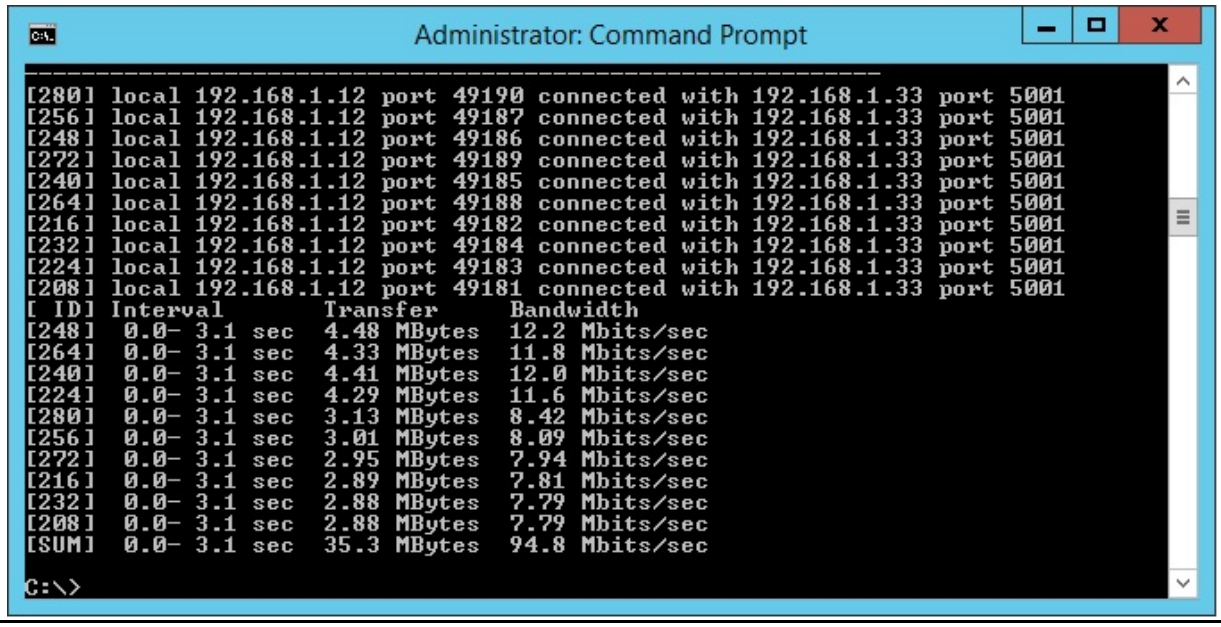
5 LAN PERFORMANCE

Test Method	LAN Speed must working follow setting speed in OS.	
	i350 LAN-1	i350 LAN-2
iperf test speed (Mbps)	947 Mb/s	94.8 Mb/s

i350 LAN
i350 1Gb LAN-1



i350 LAN
i350 100Mb LAN-2

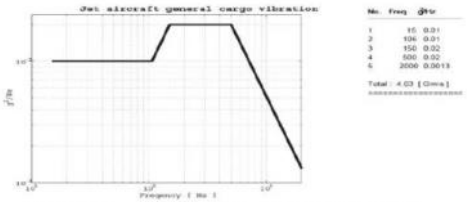
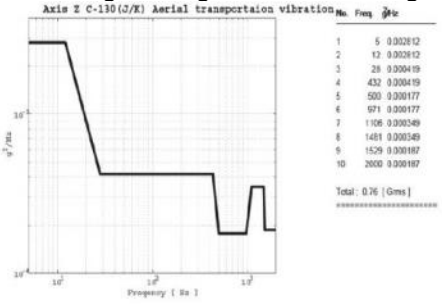
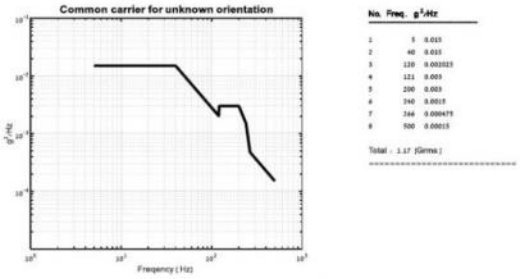
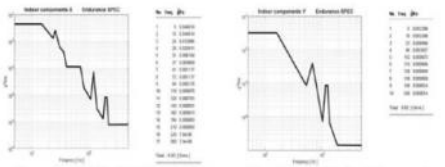
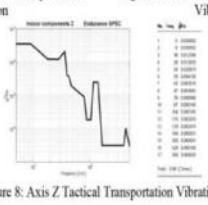


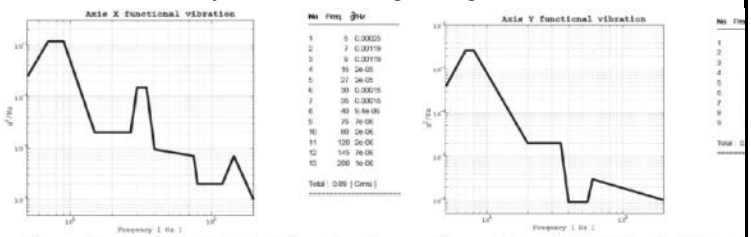
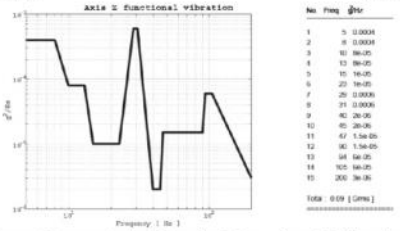
6 MIL-STD-810G ENVIRONMENTAL ENGINEERING CONSIDERATIONS AND LABORATORY TESTS

The AV600X-CH shall be tested under the environmental conditions as defined by MIL-STD-810F and MIL-HDBK-454, as detailed in Table 1

Table 1: List of Tests

#	Test		
		Spec' as Internal Equipment	**Conditions**
1	Low Pressure (Altitude)	MIL-STD-810G, Method 500.5 & Procedure I, Storage	Altitude not operational Storage/Air Transport -- The system shall not be damaged nor its performance degraded during and after exposure to environment of 15,000 feet altitude and exposed to +71°C and -33°C (absolute pressure of 55KPa),
		MIL-STD-810G, Method 500.5 & Procedure I, Storage	Altitude not operational Storage/Ground Transport -- The system shall not be damaged nor its performance degraded during and after exposure to environment of -400m to 2500m altitude and exposed to +71°C and -20°C
		MIL-STD-810G, Method 500.5 & Procedure II, Operating mode	Altitude operation ground -- The system shall not be damaged nor its performance degraded during and after exposure to -200÷2500[m] ground operation and exposed to +55°C and -20°C
2	High Temperature	MIL-STD-810G, Method 501.5, Procedure I& II Storage & Operation	High Temperature Storage -- +71°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
3	Low Temperature	MIL-STD-810G, Method 502.5, Procedure I& II Storage & Operation	Low Temperature Storage -- -33°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
4	Humidity	MIL-STD-810G, Method 507.5, Procedure II (Aggravated), Constant high Humidity – B1	exposure to 10 cycles of 95% relative humidity at temperatures of 30 °C to 60 °C.
5	Salt Fog	MIL-STD-810G, Method 509.5	5% NaCl @35˚C, 95% relative humidity24hrs of exposure followed by 24hrs Drying less than 50% relative humidity, 2 cycles
6	Sand & Dust	MIL-STD-810G, Method 501.5	The system shall survive without any damage or degradation of performance and should operate to specification during and after exposure to blowing dust test according to MIL-STD-810G/510.5/I. Test parameters: • Dust particle size: <150µm. • Dust concentration: 10.6 gr/m3 • Wind speed: 8.9 m/s.
7	Immersion	Method 512.5	The system shall survive without any damage or degradation of performance and should operate to specification after exposure to sealing test according to IEC 60529/ IP65.

<table>
<tr><th>#</th><th>Test</th><th>Spec' as Internal Equipment</th><th>Conditions</th></tr>
<tr><td></td><td></td><td></td><td>Packaged components by commercial aircraft -- Test duration: 20 minutes per axis (x,y,z) to simulate 20 landings and takeoffs. This test shall be performed using reusable dedicated ruggedized package for spare parts.
 
Figure 3: Jet Cargo Aircraft Vibration</td></tr>
<tr><td>8</td><td>Vibrations</td><td>MIL-STD-810G/514.6</td><td>C-130(J/K) aircraft -- Test duration 400 minutes per axis (x,y,z), simulating 120 flight hours including 20 landings and takeoffs.
 
<table>
<tr><th colspan="2">Sine Tones (Dwell)</th></tr>
<tr><td>68</td><td>0.5</td></tr>
<tr><td>102</td><td>0.8</td></tr>
<tr><td>136</td><td>0.25</td></tr>
<tr><td>204</td><td>0.4</td></tr>
<tr><td>272</td><td>0.1</td></tr>
<tr><td>306</td><td>0.2</td></tr>
<tr><td>408</td><td>0.2</td></tr>
</table>
Figure 4: For unknown orientation axis- C-130(J\K) Aerial Transportation Vibrati</td></tr>
<tr><td>8</td><td>Vibrations</td><td></td><td>Ground Transportation (Packaged) – Common Carrier -- MIL-STD-810H method 514.8 category 4. Test duration: 190 minutes per axis to simulate 5000 km of driving distance. This test shall be performed using reusable dedicated ruggedized package for spare parts.
 
Figure 5: Common Carrier Vibration Profile for unknown orienta</td></tr>
<tr><td></td><td></td><td></td><td> 
Figure 6: Axis X Tactical Transportation Vibration
Figure 7: Axis Y Tactical Transportation Vibration
 
Figure 8: Axis Z Tactical Transportation Vibration
Tactical Transportation – Not Operational -- Test duration: 100 minutes per axis to simulate 500,000 km driving distance. Coordinate system according to Figure 1</td></tr>
</table>

<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>9</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 Functi Vibration
 
Figure 11: Axis Z Tactical Functional Vibration</td></tr>
<tr><td>10</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>
Transit Drop (Packaged Components) -- All components shall survive without any damage or degradation of performance and should operate to specification after exposure to transit drops experienced during logistic transportation according to MIL-STD 810G CH1 method 516.6 procedure IV table 516.7-VII. This test shall be performed using reusable dedicated ruggedized package for spare parts.

Bench Handling -- Large components shall survive without any damage or degradation of performance and should operate to specification after exposure to bench handling shocks according to MIL-STD 810G method 516.6/ VI.</td></tr>
</table>

6-1 LOW PRESSURE (ALTITUDE) TEST

6-1-1 Requirements

Perform the Low Pressure (Altitude) test in accordance with MIL-STD-810G Method 500.5 Procedures I with the following parameters:

Storage (Air-Transport)

Temperature Range	-33°C to +71°C	**Altitude**	15000 feet
Pressure	55Kpa		

Storage (Ground-Transport)

Temperature Range	-20°C to +71°C	**Ground**	-400+2500[m]

Operation Ground

Temperature Range	-20°C to +55°C	**Ground**	-200+2500[m]

6-1-2 Test Procedure –Storage (Non-Operating)

Step 1. At ambient condition perform a visual and functional test per [Subject]

Step 2. Document the results.

Step 3. Insert the AV600X-CH in the test facility.

Step 4. Prepare the AV600X-CH in its storage configuration.

Step 5. At completion of the test adjust the chamber air temperature to ambient conditions until temperature stabilization of the AV600X-CH

Step 6. Document the results.

6-1-3 Test Procedure –Operating

Step 1. At ambient condition perform a visual and functional test per [Subject]

Step 2. Document the results.

Step 3. Insert the AV600X-CH in the test facility.

Step 4. Prepare the AV600X-CH in its storage configuration.

Step 5. At completion of the test adjust the chamber air temperature to ambient conditions until temperature stabilization of the AV600X-CH.

Step 6. Document the results.

6-2 HIGH TEMPERATURE TEST

6-2-1 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 +71°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

6-2-2 Test Procedure –Storage (Non-Operating)

Step 1. At ambient condition perform a visual and functional test per [Subject]

Step 2. Document the results.

Step 3. Insert the AV600X-CH in the test facility.

Step 4. Prepare the AV600X-CH in its storage configuration.

Step 5. Expose the AV600X-CH to 7 cycles (duration of 24 hours each cycle) of storage high temperature as described.

Step 6. At completion of the test adjust the chamber air temperature to ambient conditions until temperature stabilization of the AV600X-CH.

Step 7. Perform a visual and functional test per [Subject].

Step 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
71	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

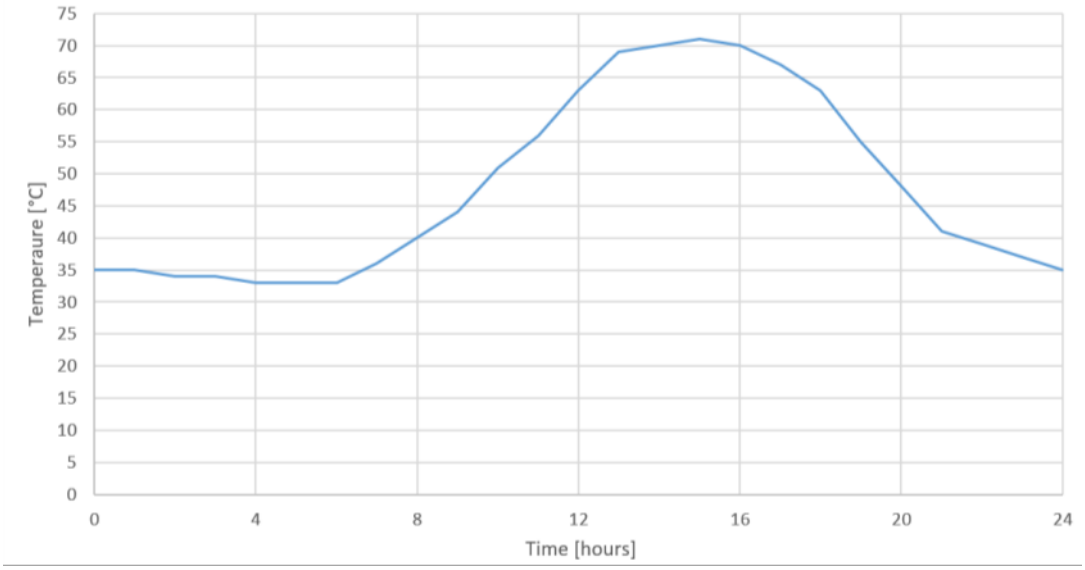


Figure 1: Storage High Temperature One Cycle Profile

6-2-3 Test Procedure –Operating

Step 1. At ambient condition perform a visual and functional test per [Subject]

Step 2. Document the results.

Step 3. Insert the AV600X-CH in the test facility.

Step 4. Prepare the AV600X-CH in its operational configuration.

Step 5. Locate thermocouples on the AV600X-CH.

Step 6. Turn ON the AV600X-CH

Step 7. .

Step 8. Expose the AV600X-CH to 3 cycles (duration of 24 hours each cycle) of operation high temperature as describe in Table 3.

Step 9. At the maximum temperature of each one of the 3 cycles, perform functional test per [Subject] as shown.錯誤! 找不到參照來源。

Step 10. Document the results.

Step 11. At completion of the test switch OFF the AV600X-CH.

Step 12. Adjust the chamber air temperature to ambient conditions until temperature stabilization of the AV600X-CH.

Step 13. Perform a visual and functional test per [Subject]

Step 14. 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
48	17.00

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

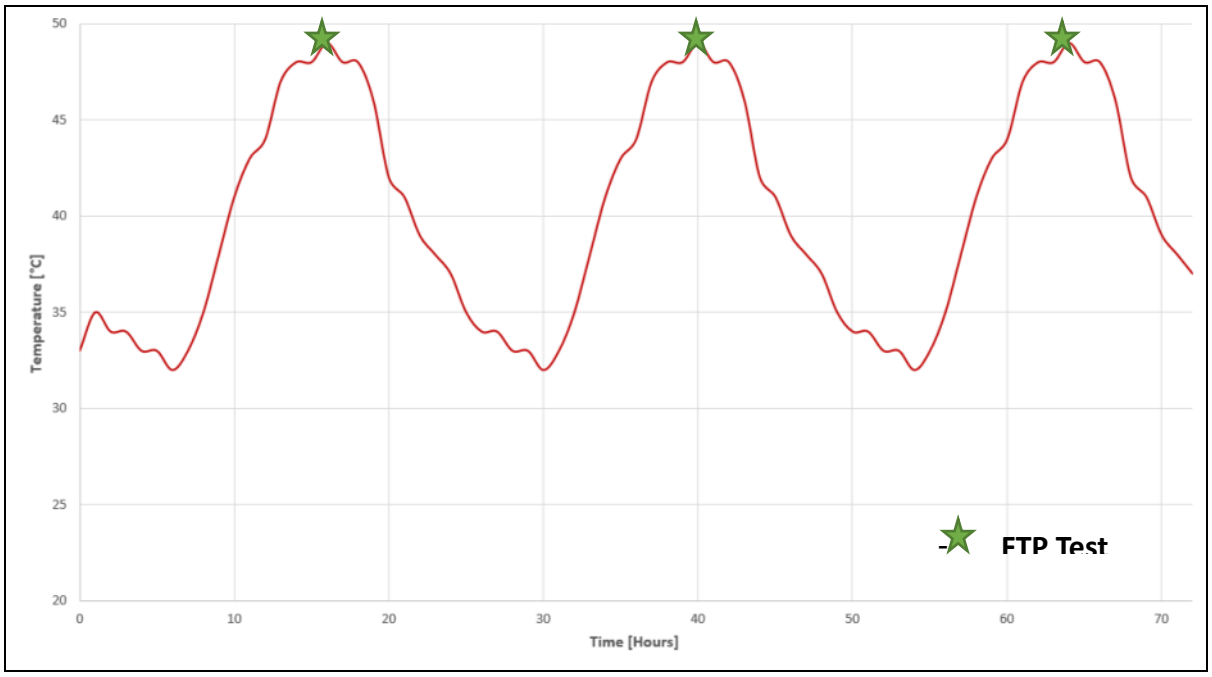


Figure 2: Operation High Temperature Test Profile

6-2-4 Acceptance Criteria

Storage:

Visual- No evidence of damage shell be seen.

Functional -No degradation of performance.

Operation:

Visual- No evidence of damage shell 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:

Temperature	**Storage**: **-33**°C **Operation** **-20**°C		Duration	**Storage**: 72 hours after stabilization **Operation**: temperature rise time (-33°C~25°C) and should be tested at 0°C and 25°C	
Item condition	Unpacked		Max. Change Rate	**2**	°C/min

6-3-2 Test Procedure

Step 1. At ambient condition perform a visual and functional test per **[Subject]**

Step 2. Document the results.

Step 3. Insert the AV600X-CH in the test facility.

Step 4. Prepare the AV600X-CH in its operation configuration.

Step 5. Locate thermocouples on the AV600X-CH.

Step 6. With the AV600X-CH not operating adjust the chamber temperature to -33°C with temperature change rate not exceed of 3°C/min.

Step 7. After AV600X-CH stabilization maintain the chamber temperature at -33°C for dwell duration of 72 hours.

Step 8. After 4 hours dwell operate the AV600X-CH maintain the condition for 2 hours dwell duration.

Step 9. Perform a functional test per [Subject]. Document the results.

Step 10. At completion of the test switch OFF the AV600X-CH.

Step 11. Adjust the chamber air temperature to ambient conditions until temperature stabilization of the AV600X-CH with temperature change rate not exceed of 3°C/min.

Step 12. Perform visual and functional tests per [Subject]

Step 13. 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

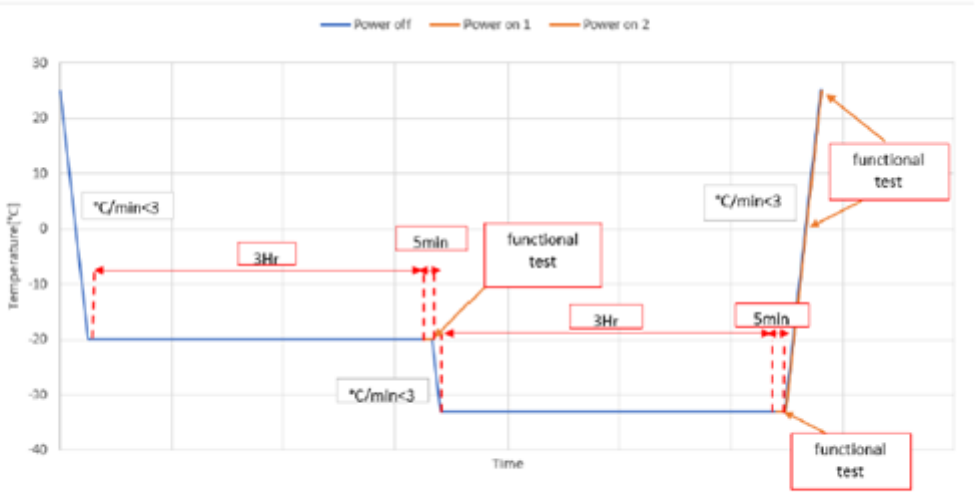


Figure 2: Low Temperature Operational Cycle

6-3-3 Acceptance Criteria

Visual- No evidence of damage shell be seen.

Functional -No degradation of performance.

6-4 HUMIDITY TEST

6-4-1 Requirements

Perform the humidity test in accordance with MIL-STD-810G Method 507.5Procedure II Aggravated cycle with the following parameters:

Temperature Range	+30°C to +60°C	**Humidity**	95±5%RH
Cycle Duration	24 hours	**Cycles**	**10**
Item condition	Unpacked		

6-4-2 Test Procedure

Step 1. At ambient condition perform a visual and functional test per [Subject]

Step 2. Document the results.

Step 3. Insert theAV600X-CH in the test facility.

Step 4. Prepare the AV600X-CH in its operation configuration.

Step 5. With the AV600X-CH not operating adjust the chamber temperature with relative humidity of 50±5 %RH, duration of 24 hours.

Step 6. Adjust the chamber relative humidity to minimum 95%RH, maintain this condition thru the next steps below (steps 7-13).

Step 7. Reduce the chamber temperature to +30°C.

Step 8. With duration of 2 hours reduce the chamber temperature to +60°.

Step 9. Maintain the chamber temperature at+60°C for additional 6 hours.

Step 10. With duration of 8 hours decrease the chamber temperature to +30°C.

Step 11. Maintain the chamber temperature at+30°C for additional 8 hours.

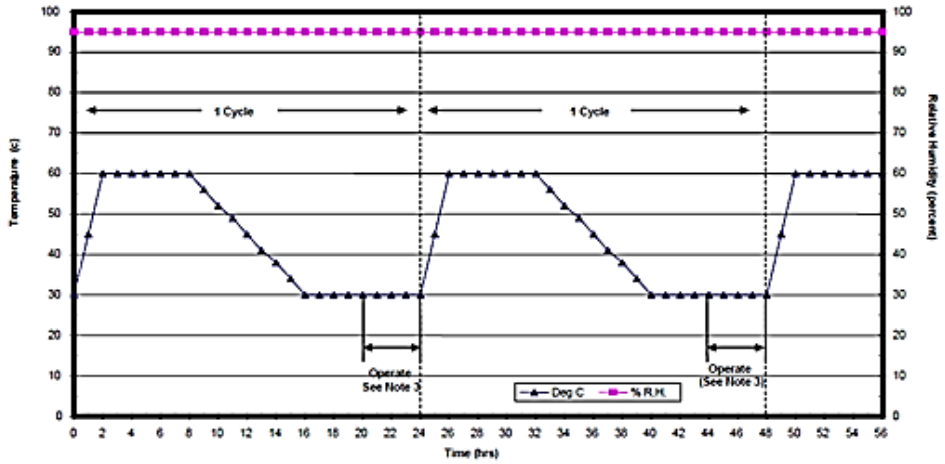
Step 12. Repeat steps 8 thru 11 for a total of 10 cycles.

Step 13. During the end of the fifth and ten cycles operate the AV600X-CH and perform a functional test per [Subject]

Step 14. Adjust the chamber air temperature to ambient conditions until temperature stabilization of the AV600X-CH.

Step 15. Perform a visual and functional test per [Subject].

Step 16. Document the results.



Aggravated temperature-humidity cycle.

NOTES:

1. Maintain the relative humidity at 95 ±4 percent at all times except that during the descending temperature periods the relative humidity may drop to as low as 85 percent.
2. A cycle is 24 hours.
3. Perform operational checks near the end of the fifth and tenth cycles.

Time	Temp.		RH
	°C	°F	Percent
0000	30	86	Constant at 95 percent
0200	60	140	
0800	60	140	
1600	30	86	
2400	30	86	
0200	60	140	
0800	60	140	
1600	30	86	
2400	30	86	

Figure 3: Humidity Test Profile

6-4-3 Acceptance Criteria

Visual- No evidence of damage and corrosion shell be seen.

Functional -No degradation of performance.

6-5 SALT FOG TEST

6-5-1 Requirements

Perform the salt fog test in accordance with MIL-STD-Method 509.5 with the following parameters:

Item Condition	Unpacked Non-Operational	**Salt Solution Concentration**	5±1%
Salt Fog PH	6.5 to 7.2	**Salt Fog Fallout Rate**	1-3 ml/80cm²/h
Humidity Condition	95%	**Temperature**	35°C

6-5-2 Test Procedure

Step 1. At ambient condition perform a visual and functional test per [Subject]

Step 2. Document the results.

Step 3. Install the AV600X-CH (mechanical mockup unit is allowed) in the salt fog test chamber with all cables connected. Connector caps may be used instead of the cables.

Step 4. Adjust the test chamber temperature to +35°C±2°C and condition the AV600X-CH for at least two hours before introducing the salt fog.

Step 5. Expose the AV600X-CH to a 5%±1% concentration of salt spray at a temperature of +35°C±2°C for a period of 24 hours.

Step 6. Remove the AV600X-CH from the test chamber and allow it to dry at standard ambient atmosphere for 24 hours. Minimize handling the AV600X-CH during the drying period.

Step 7. Repeat Steps 3 to 6 once again.

Step 8. Perform a visual and functional test [Subject]

Step 9. Document the results.

6-5-3 Acceptance Criteria

Visual- No evidence of damage and corrosion shell be seen.

Functional -No degradation of performance.

6-6 SAND & DUST TEST

6-6-1 Requirements

Perform the Sand & Dust test in accordance with MIL-STD-Method 510.5 with the following parameters:

Dust particle	< 150um.	**Dust Concentration**	10.6 gr/m3
Wind Speed	8.9 m/s		

6-6-2 Test Procedure

Step 1.	Step 1. At ambient condition perform a visual and functional test per [Subject]
Step 2.	Step 2. Document the results.
Step 3.	Step 3. Insert theAV600X-CH in the test facility.
Step 4.	Step4. Prepare the AV600X-CH in its operation configuration.
Step 5.	Step 5. Blowing dust at 25oC for 6 hours , and an additional 6 hours at 49oC (Climatic Category A1)
Step 6.	Step 6. Perform a visual and functional test [Subject]
Step 7.	Step 7. Document the results

6-6-3 Acceptance Criteria

Visual- No evidence of damage and corrosion shell be seen.

Functional -No degradation of performance.

6-7 IMMERSION TEST

6-7-1 Requirements

Perform the blowing rain test in accordance MIL-STD-810G Method 512.5 Procedure I with the following parameters:

Water Depth:	Perform the test according to IP65 requirements.	**Item condition**	Unpacked Non-Operation
Duration	**2** min		

6-7-2 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 per [Subject]
Step 3. Weigh the AV600X-CH.
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 AV600X-CH of more than 10°C.
Step 7. Record the water temperature and the AV600X-CH 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 AV600X-CH 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 AV600X-CH.
Step 12. Open the AV600X-CH 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 per [Subject]
Step 14. Document the results.

6-7-3 Acceptance Criteria

Visual
No evidence of water penetration shell be seen inside the AV600X-CH. No evidence of damage shell be seen.
Functional
No degradation of performance.

6-8 VIBRATION TEST

6-8-1 Requirements

Perform the vibration test in accordance with MIL-STD-810G Method 514.6 category 7. Packaged components by commercial aircraft that it is non-operational in reusable ruggedized packaging -- with the following parameters:

6-8-2 Test Procedure

Test duration: 20 minutes per axis (x,y,z) to simulate 20 landings and takeoffs.

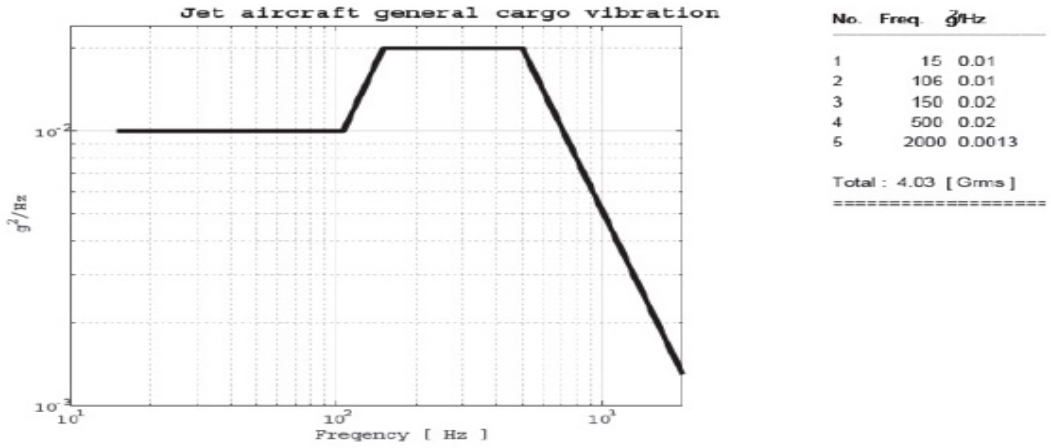


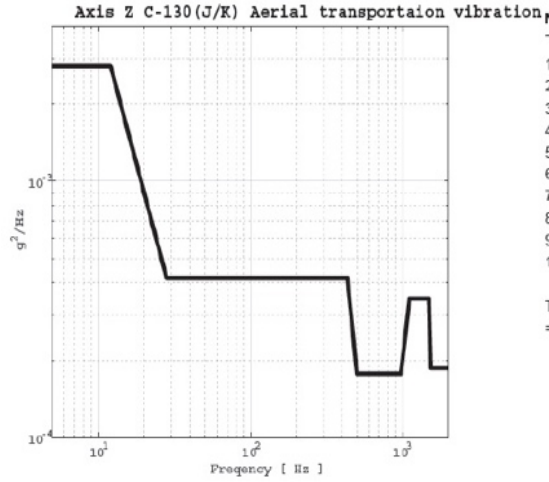
Figure 3: Jet Cargo Aircraft Vibration

6-8-3 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:

6-8-4 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

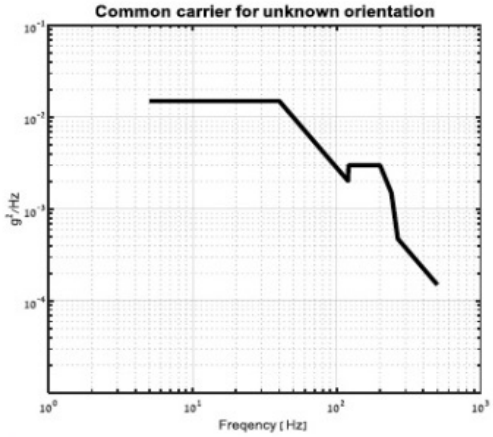
Figure 4: For unknown orientation axis- C-130(J\K) Aerial Transportation Vibration

6-8-5 Requirements

Perform the vibration test in accordance with MIL-STD-810G Method 514.8 category 4. Ground Transportation (Packaged) – Common Carrier -- with the following parameters:

6-8-6 Test Procedure

Test duration: 190 minutes per axis to simulate 5000 km of driving distance. This test shall be performed using reusable dedicated ruggedized package for spare parts.



No.	Freq.	g²/Hz
1	5	0.015
2	40	0.015
3	120	0.002025
4	121	0.003
5	200	0.003
6	240	0.0015
7	266	0.000475
8	500	0.00015

Total : 1.17 [Grms]

Figure 5: Common Carrier Vibration Profile for unknown orientation

6-8-7 Requirements

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

6-8-8 Test Procedure

Test duration: 100 minutes per axis to simulate 500,000 km driving distance. Coordinate system according to Figure 1.

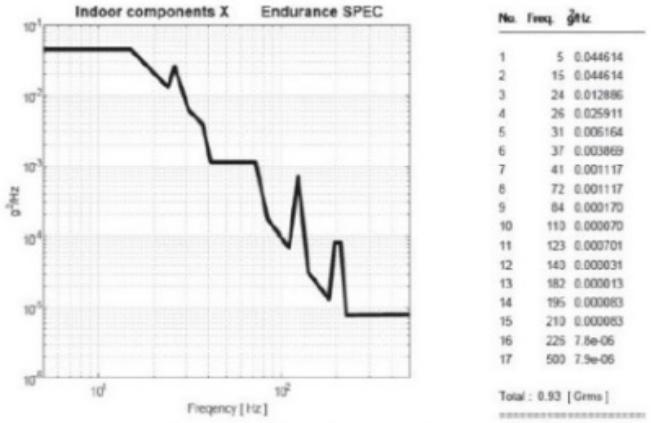


Figure 6: Axis X Tactical Transportation Vibration

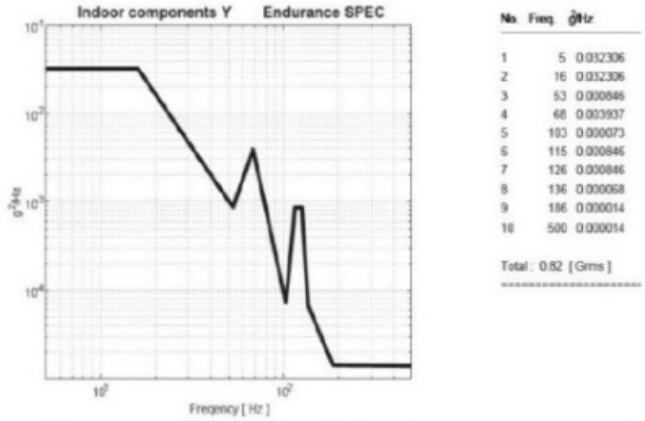


Figure 7: Axis Y Tactical Transportation Vibration

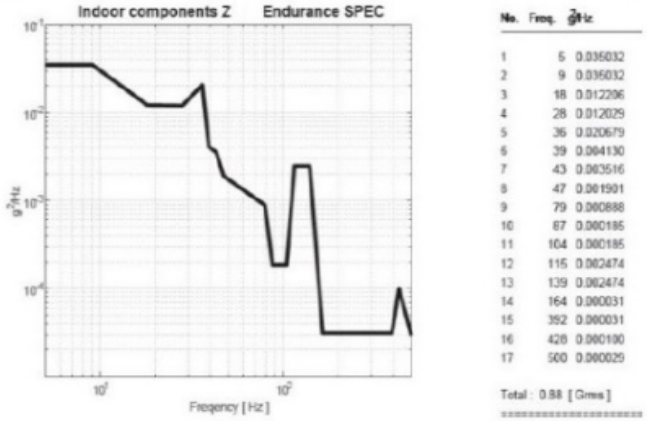


Figure 8: Axis Z Tactical Transportation Vibration

6-8-9 Requirements

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

6-8-10 Test Procedure

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

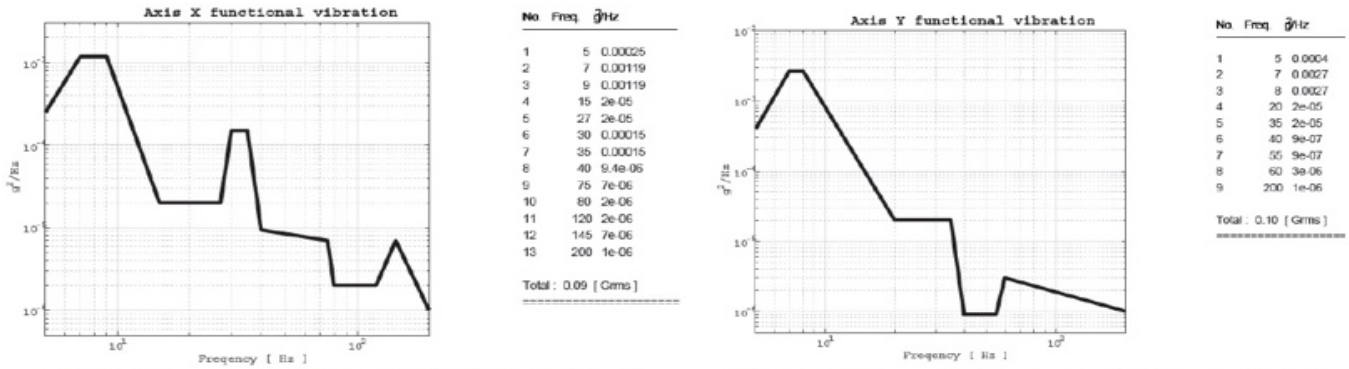


Figure 9: Axis X Tactical Functional Vibration

Figure 10: Axis Y Tactical Functional Vibration

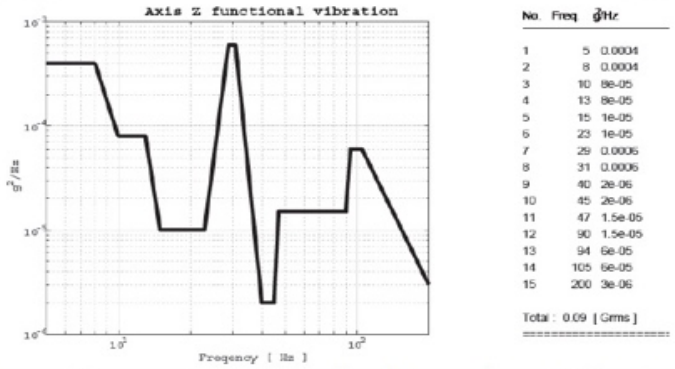


Figure 11: Axis Z Tactical Functional Vibration

6-8-11 Acceptance Criteria

Visual- No evidence of damage and corrosion shell be seen.

Functional -No degradation of performance.

6-9 SHOCK TEST

6-9-1 Requirements

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

6-9-2 Test Procedure

Test parameters:

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

6-9-3 Acceptance Criteria

Visual- No evidence of damage and corrosion shell be seen.

Functional -No degradation of performance.

6-10 TRANSIT DROP TEST

6-10-1 Requirements

Perform the transit drop test in accordance with MIL-STD-810G Method 516.6 Procedure IV with the following parameters:

Item Condition	Packed	**Height**	122 cm
Total Drops	26	**Impact Surface**	Wood

6-10-2 Test Procedure

Step 1. At ambient condition perform a visual and functional test per **[Subject]**

Step 2. Document the results.

Step 3. Install the AV600X-CH in its transit case.

Step 4. Adjust the drop facility to height of 122 cm.

Step 5. Assemble the AV600X-CH on the drop facility.

Step 6. Preform 26 drops – one drop on each face, edge and corner.

Step 7. At completion of the test perform a visual and functional test per **[Subject]**

Step 8. Document the results.

6-10-3 Acceptance Criteria

Visual- No evidence of damage shell be seen.

Functional -No degradation of performance.

6-11 BENCH HANDLING TEST

6-11-1 Requirements

Perform the bench handling test in accordance with MIL-STD-810G Method 516.6 Procedure VI with the following parameters:

Height	100mm / 45°	**Impact Surface**	Solid Wood
Item condition	Unpacked – Non-Operation	**Total Drops**	12

6-11-2 Test Procedure

Step 1. At ambient condition perform a visual and functional test per **[Subject]**

Step 2. Document the results.

Step 3. Configure the item as it would be for servicing – on the base face.

Step 4. Using one edge as a pivot, lift the opposite edge of the chassis until one of the following conditions occur (whichever occurs first).

Step 5. The chassis forms an angle of 45° with the horizontal bench top.

Step 6. The lifted edge of the chassis has been raised 10 cm above the horizontal bench top.

Step 7. The lifted edge of the chassis is just below the point of perfect balance.

Step 8. Let the chassis drop back freely to the horizontal bench top. Repeat, using other practical edges of the same horizontal face as pivot points, for a total of four drops.

Step 9. Repeat step 2 thru step 3 with the AV600X-CH resting on 2 other side faces (Flat faces, without connectors) until it has been dropped for a total of four times on each face. The AV600X-CH shall not be operating.

Step 10. Perform a visual and functional test per **[Subject]**

Step 11. Document the results.

6-11-3 Acceptance Criteria

Visual- No evidence of damage shell be seen.

Functional -No degradation of performance.

7 MIL-STD-461F EQUIREMENTS FOR THE CONTROL OF ELECTROMAGNETIC INTERFERENCE CHARACTERISTICS OF SUBSYSTEMS AND EQUIPMENT

The AV600X-CH shall be tested under the ELECTROMAGNETIC INTERFERENCE CHARACTERISTICS as defined by MIL-STD-461F, as detailed in Table 1

Table 4: List of Tests

#	Test	
		Spec' as Equipment Conditions
1	CE102	Conducted emissions, power leads, 10KHz to 10MHz
2	CS101	Conducted susceptibility, power leads, 30Hz to 150KHz
3	CS114	Conducted susceptibility, bulk cable injection, 10KHz to 200MHz, curves 3&4
4	CS115	Conducted susceptibility, bulk cable injection, impulse excitation
5	CS116	Conducted susceptibility, damped sinusoidal transients, cables and power leads, 10KHz to 100MHz
6	RE102	Radiated emissions, electric filed, 10KHz to 18GHz
7	RS103	Radiated susceptibility, electric filed, 2Mhz to 18GHz, 50V/m

7-1 RE102 TEST Requirements Perform the Radiated emissions, electric filed test in accordance with MIL-STD-461F the following parameters:**10KHz to 18GHz**

7-1-1 Test Procedure

Limit

Electric field emissions shall not be radiated in excess of those shown in Figures RE102-1 through RE102-4. Above 30 MHz, the limits shall be met for both horizontally and vertically polarized fields.

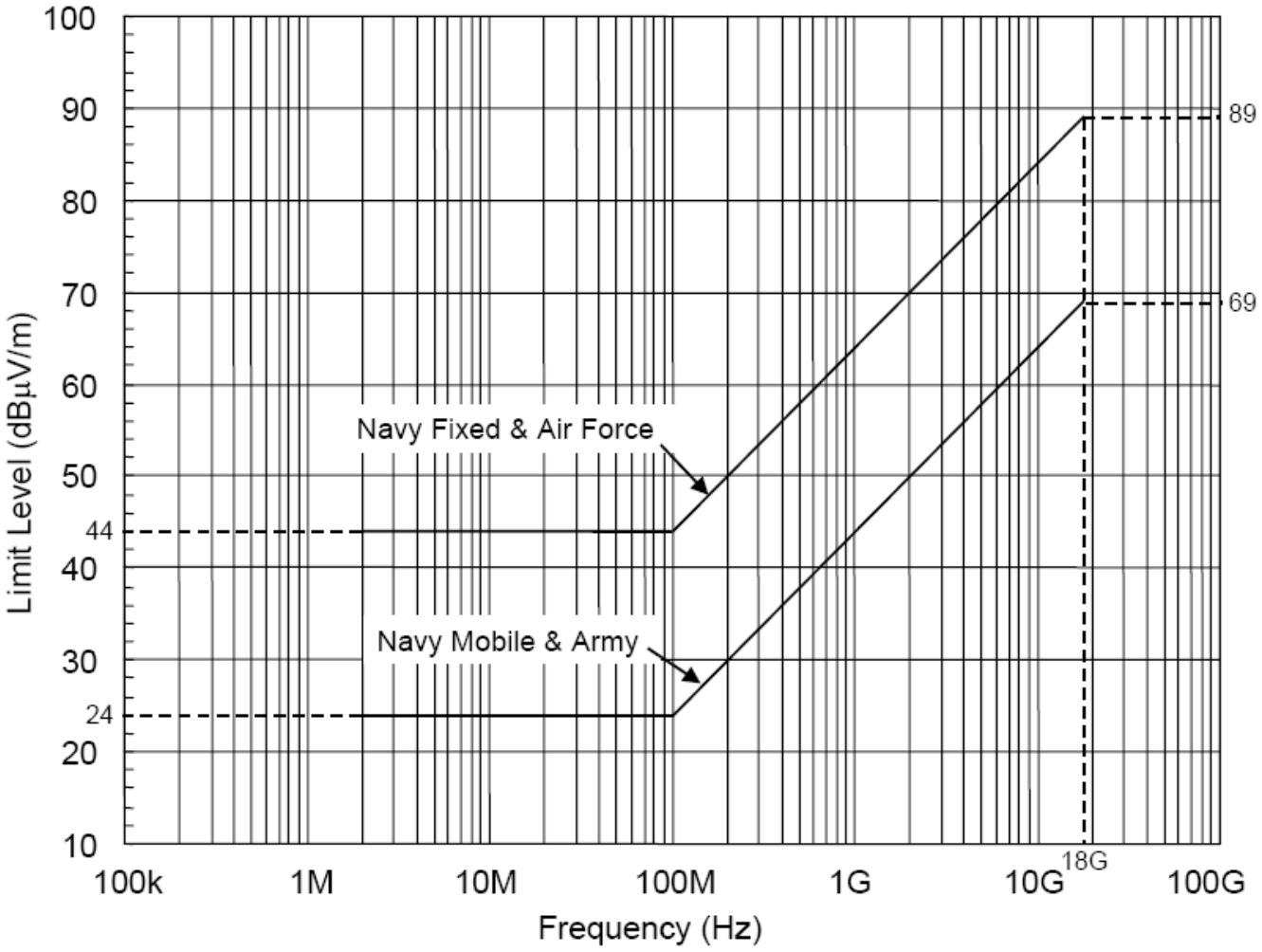
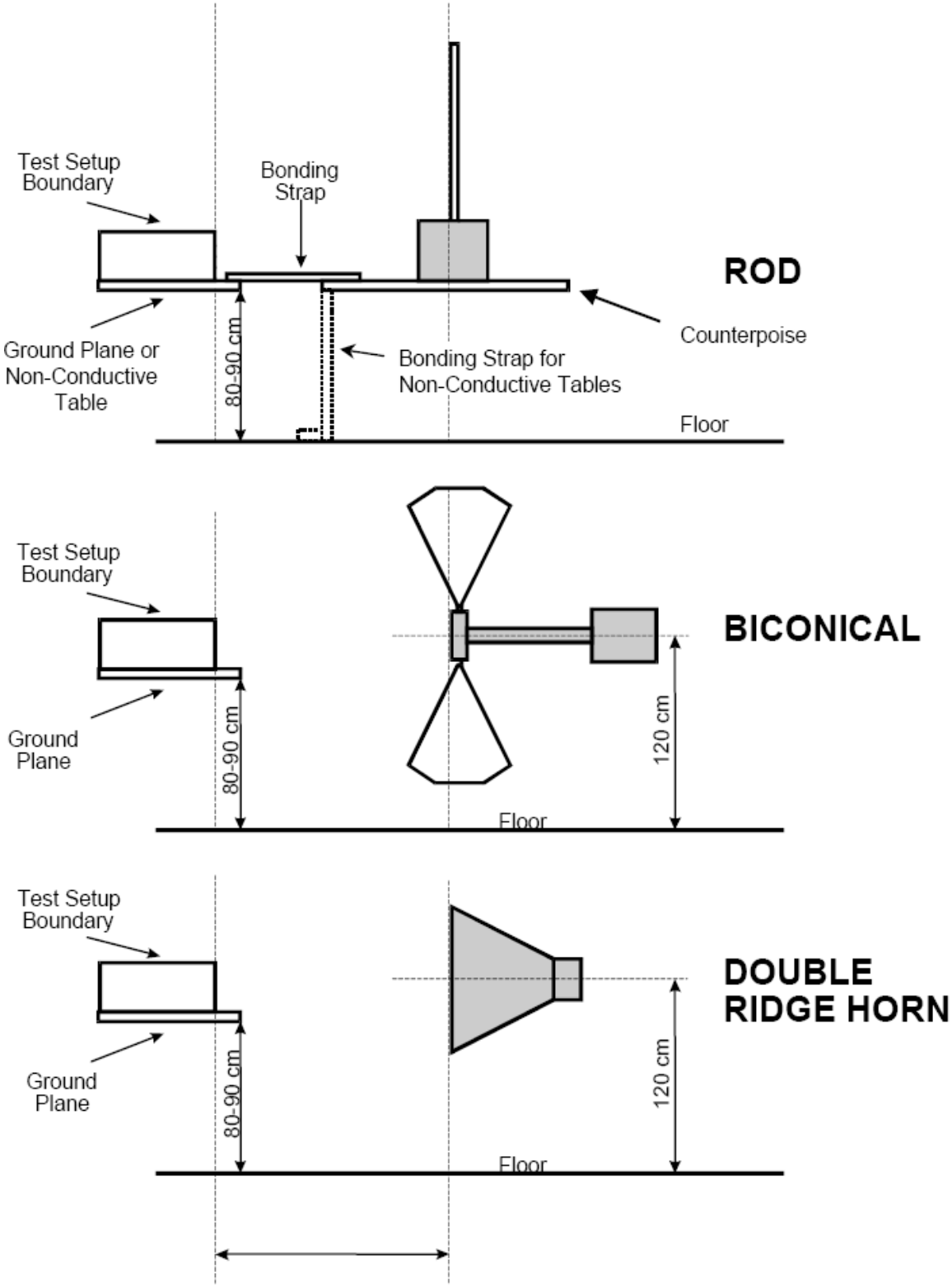
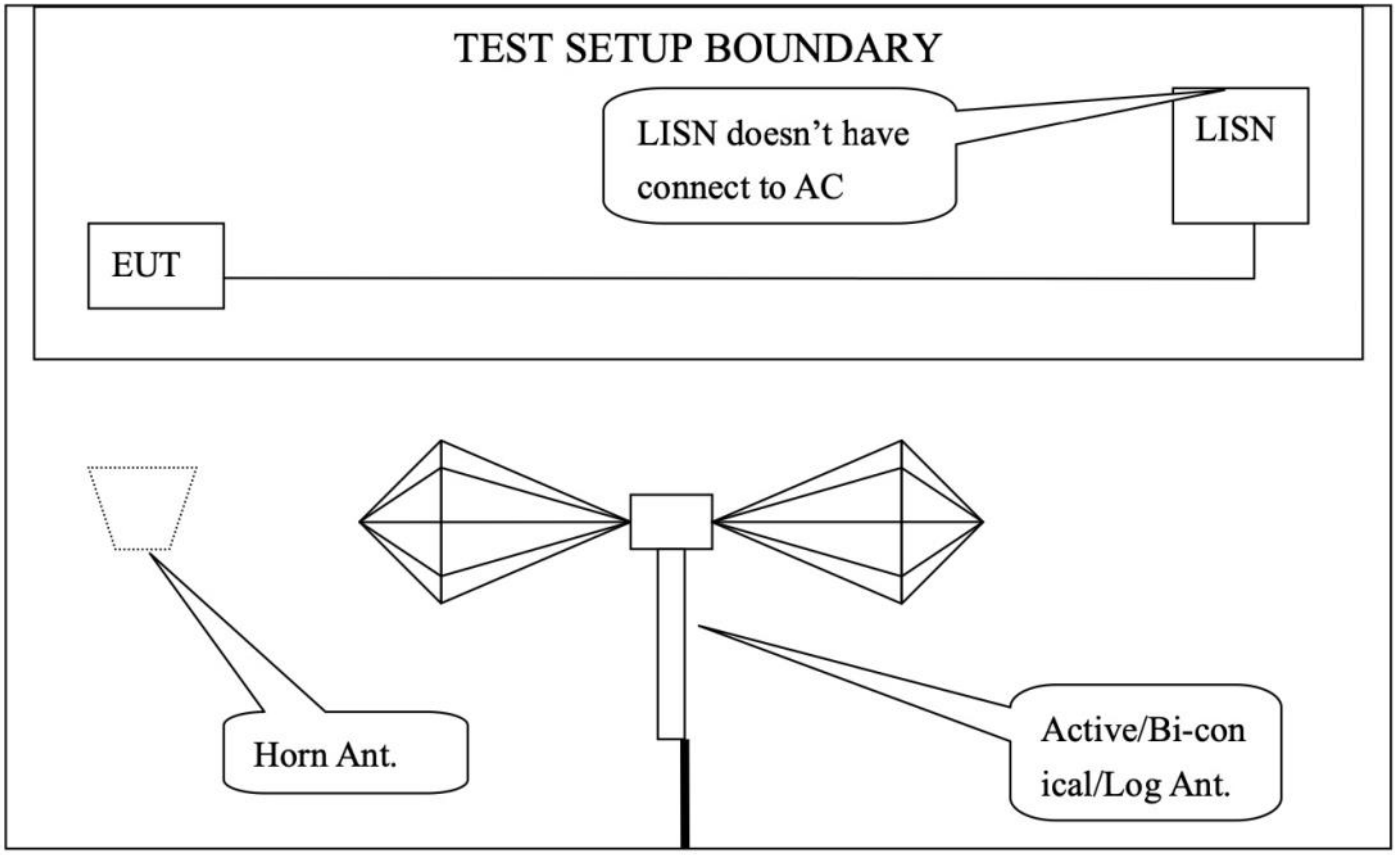


FIGURE RE102-4. RE102 limit for ground applications.

7-1-2 Test Configuration




TEST SETUP BOUNDARY
LISN doesn't have connect to AC
LISN
EUT
Horn Ant.
Active/Bi-conical/Log Ant.

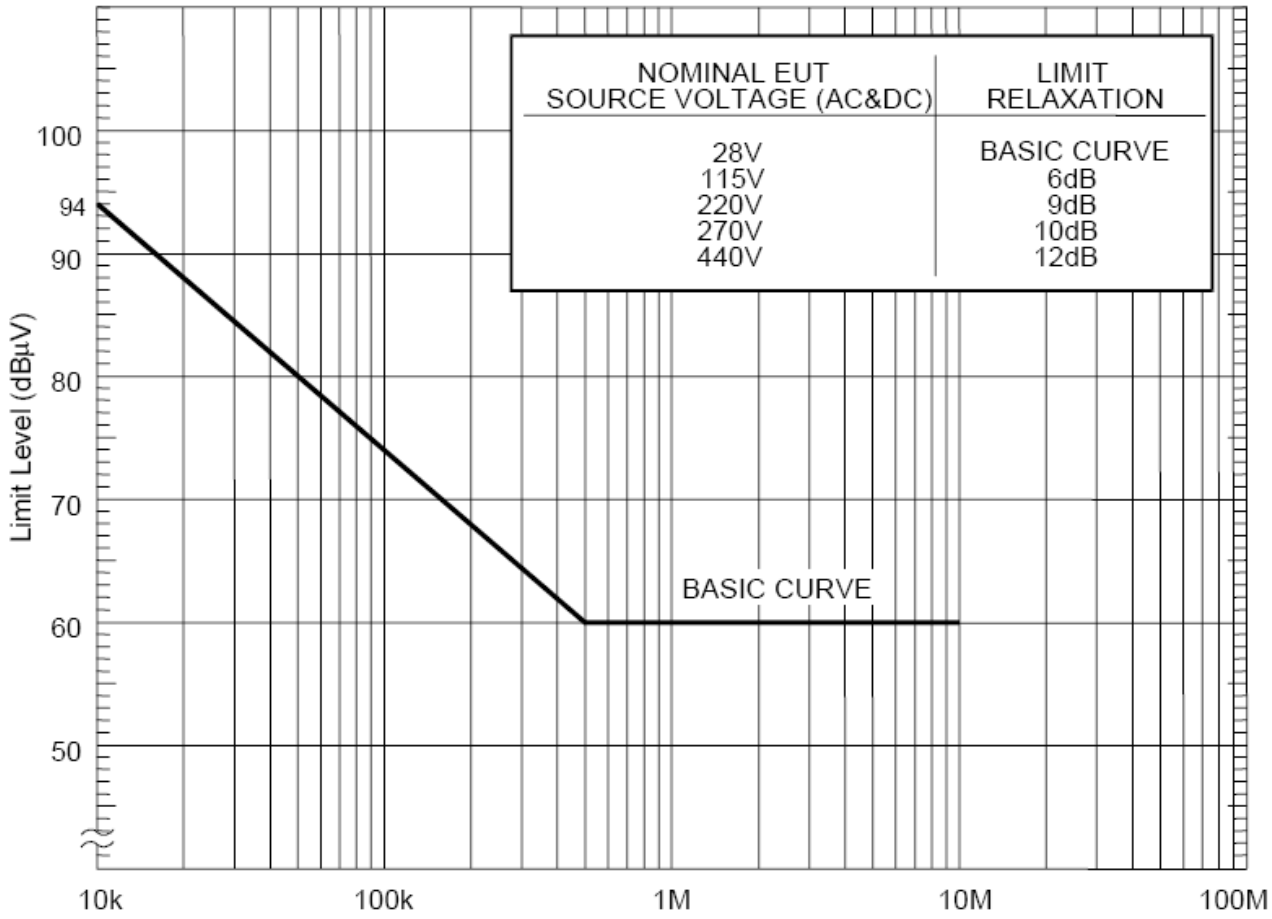
7-2 CE102 TEST

7-2-1 Requirements

Perform the Conducted emissions, power leads test in accordance with MIL-STD-461F the following parameters:**10KHz to 10MHz**

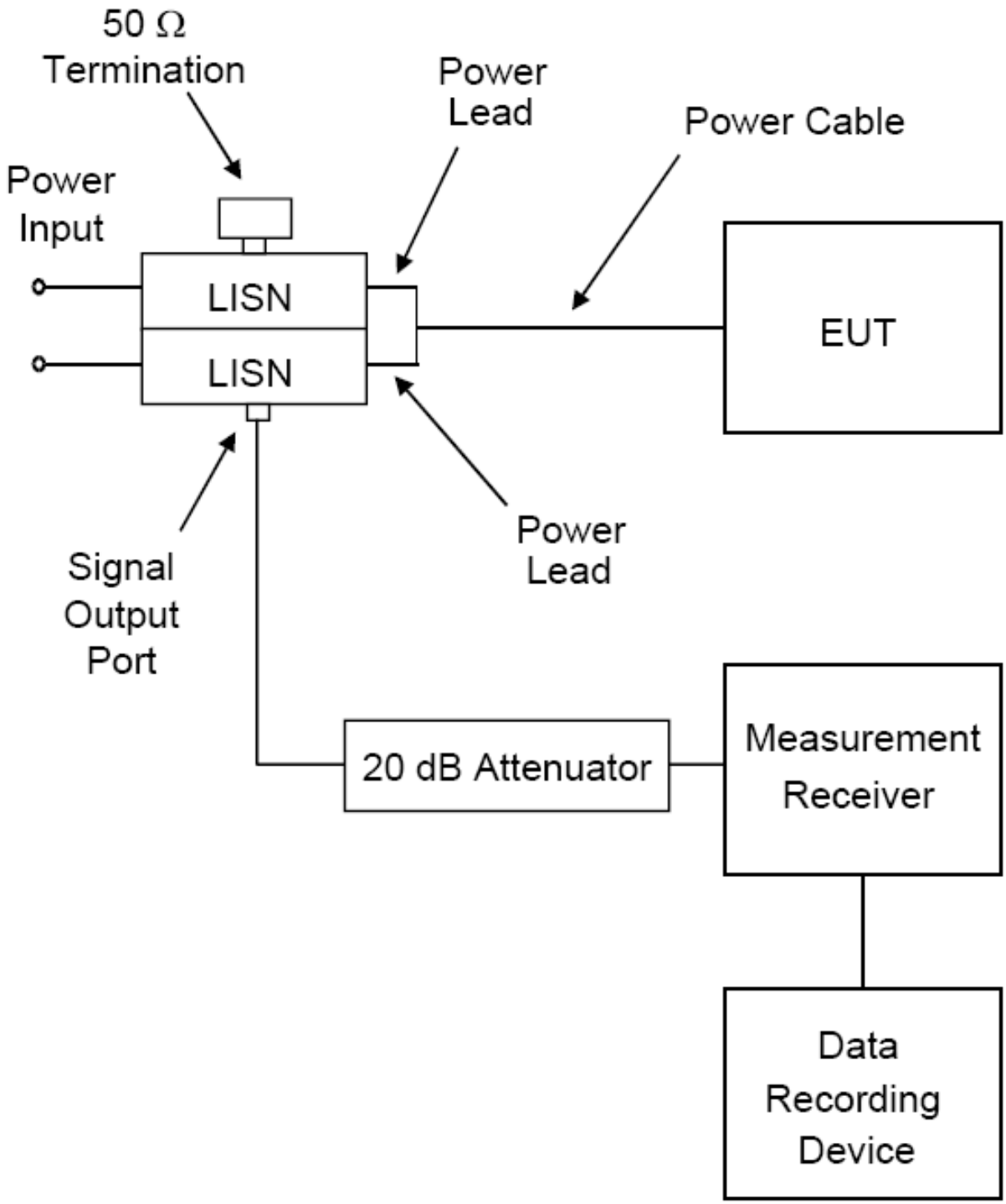
7-2-2 Test Procedure

Conducted emissions on power leads shall not exceed the applicable values shown on Figure
CE102-1.



The magnetic emission of EUT representative of its type shall be tested by the method(s) according to MIL STD 461E/F.

7-2-3 Test Configuration



Conducted emissions on power leads shall not exceed the applicable values shown on Figure CE102-1.

7-3 CS101 TEST

7-3-1 Requirements

Perform the Conducted susceptibility, power leads test in accordance with MIL-STD-461F the following parameters:**30Hz to 150KHz**

7-3-2 Test Procedure

Limit

The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem
specification, when subjected to a test signal with voltage levels as specified in Figure CS101-1.
The requirement is also met when the power source is adjusted to dissipate the power level
shown in Figure CS101-2 in a 0.5 ohm load and the EUT is not susceptible.

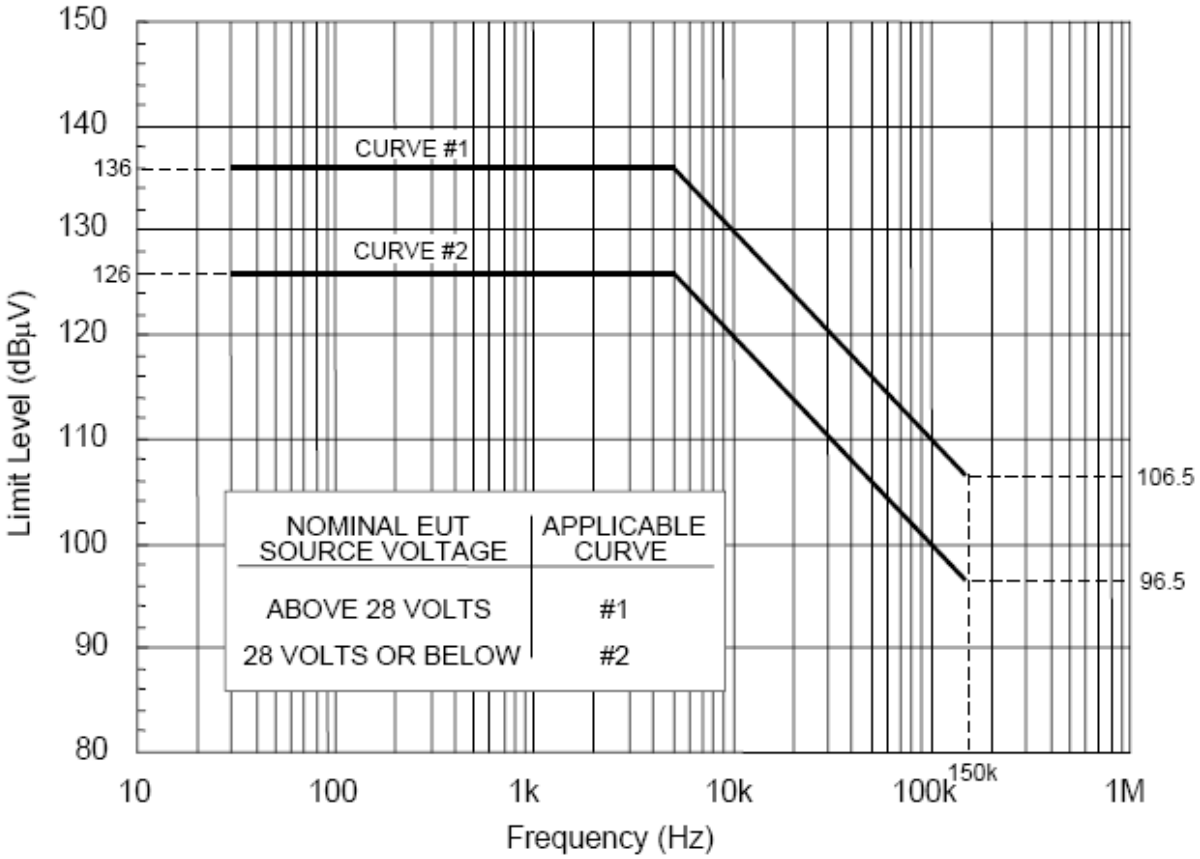


FIGURE CS101-1. CS101 voltage limit for all applications.

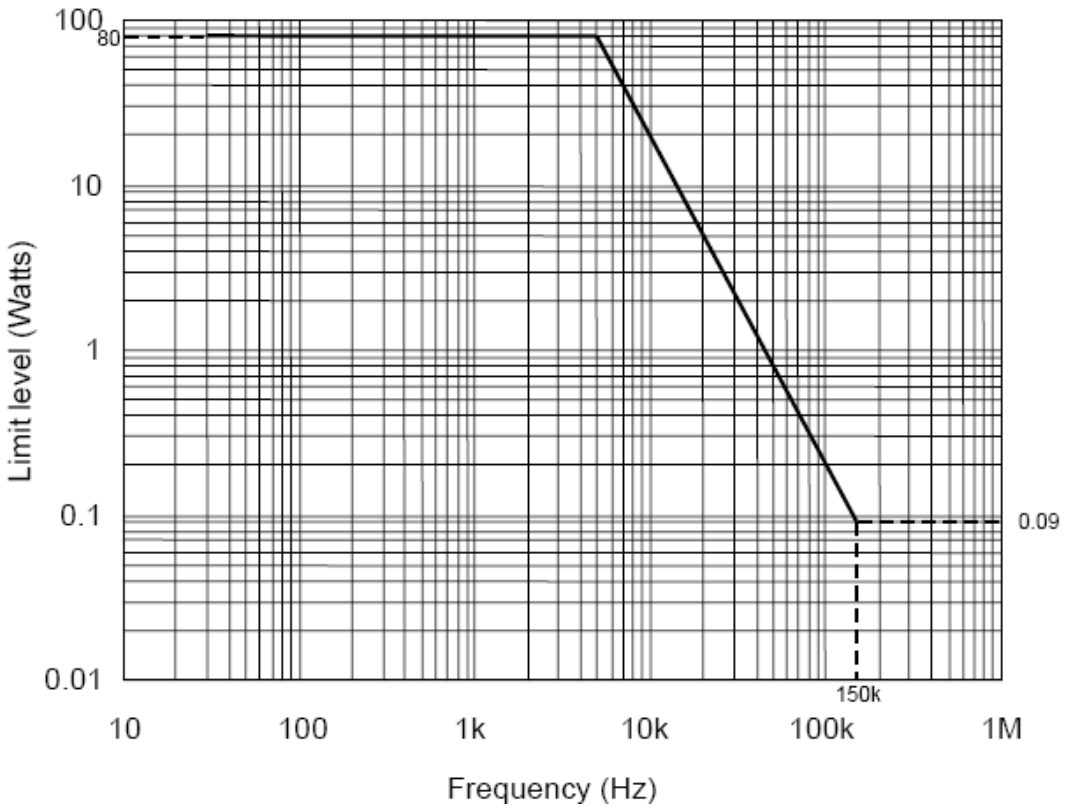


FIGURE CS101-2. CS101 power limit for all applications.

Classification Of Functional Status

All classifications are for the total device/system functional status.

Class A: all functions of a device/system perform as designed during and after exposure to disturbance.

Class B: all functions of a device/system perform as designed during exposure. However, one or more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed.

Class C: one or more functions of a device/system do not perform as designed during exposure but return automatically to normal operation after exposure is removed.

Class D: one or more functions of a device/system do not perform as designed during exposure and do not return to normal operation until exposure is removed and the device/system is reset by simple “operator/use” action.

Class E: one or more functions of a device/system do not perform as designed during and after exposure and cannot be returned to proper operation without repairing or replacing the device/system.

7-3-3 Test Configuration

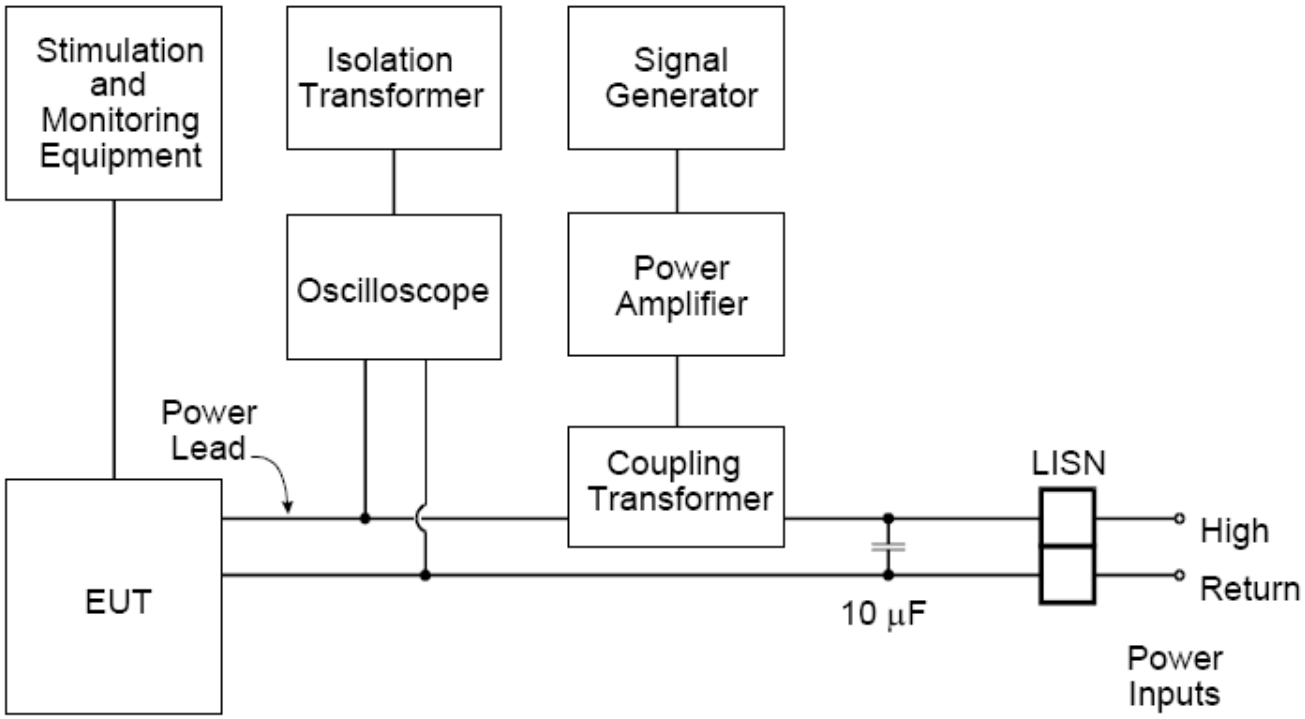


FIGURE CS101-4. Signal injection, DC or single phase AC

7-4 CS114 TEST

7-4-1 Requirements

Perform the Conducted susceptibility, bulk cable injection test in accordance with MIL-STD-461F the following parameters:**10KHz to 200MHz, curves 3&4**

Limit

The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem
specification, when subjected to a test signal with voltage levels as specified in Figure CS114.
The requirement is also met when the power source is adjusted to dissipate the power level
shown in Figure CS114 and the EUT is not susceptible.

7-4-2 Test Procedure

The CS114 test is used to verify the ability of the EUT to withstand RF signals coupled onto EUT associated cabling

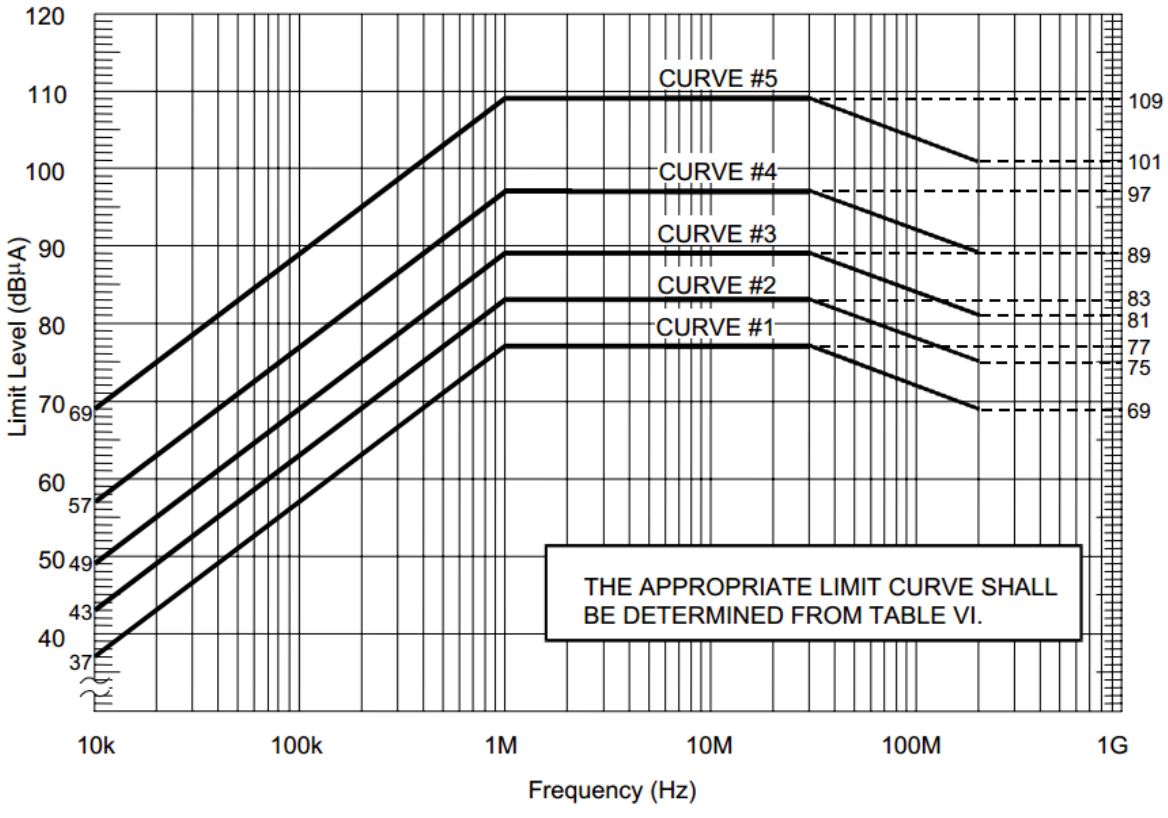
Frequency Range: 10KHz(4 KHz) – 200MHz

Dwell Time: The grater of 3 seconds or EUT response time per frequency

Frequency Step: max 5% (4KHz-1MHz), max 1% (1MHz-30MHz), max 0.1% (30MHz-200MHz)

Unit: Current (dBuA)

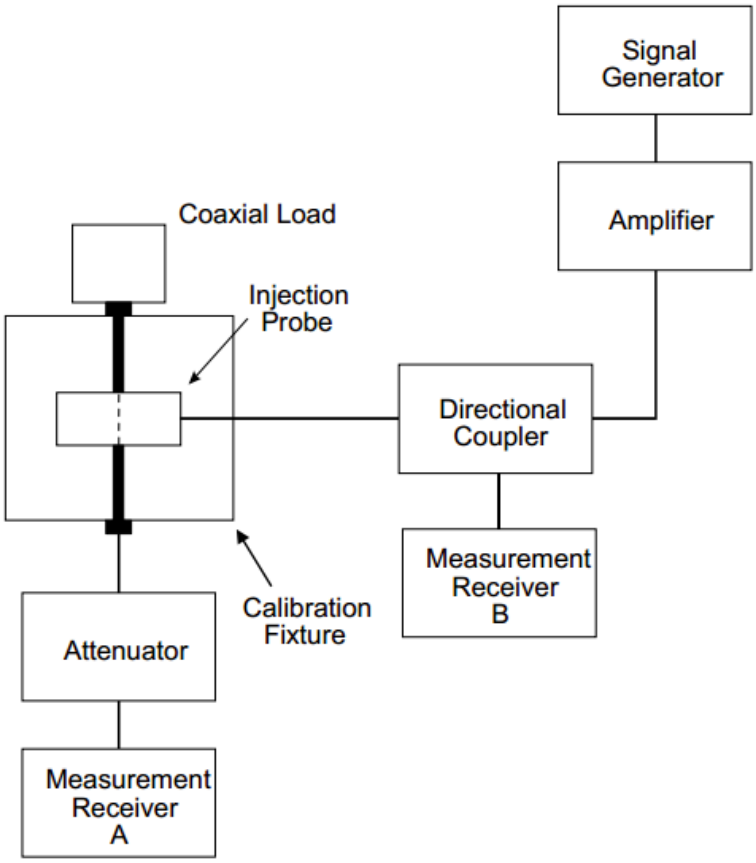
Modulation: 1KHz, 50% Duty Cycle, Pulse Modulation



Classification Of Functional Status

All classifications are for the total device/system functional status.
Class A: all functions of a device/system perform as designed during and after exposure to
disturbance.
Class B: all functions of a device/system perform as designed during exposure. However, one or
more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed.
Class C: one or more functions of a device/system do not perform as designed during exposure
but return automatically to normal operation after exposure is removed.
Class D: one or more functions of a device/system do not perform as designed during exposure
and do not return to normal operation until exposure is removed and the device/system is reset by simple “operator/use” action.
Class E: one or more functions of a device/system do not perform as designed during and after
exposure and cannot be returned to proper operation without repairing or replacing the device/system.

7-4-3 Test Configuration



7-5 CS115 TEST

7-5-1 Requirements

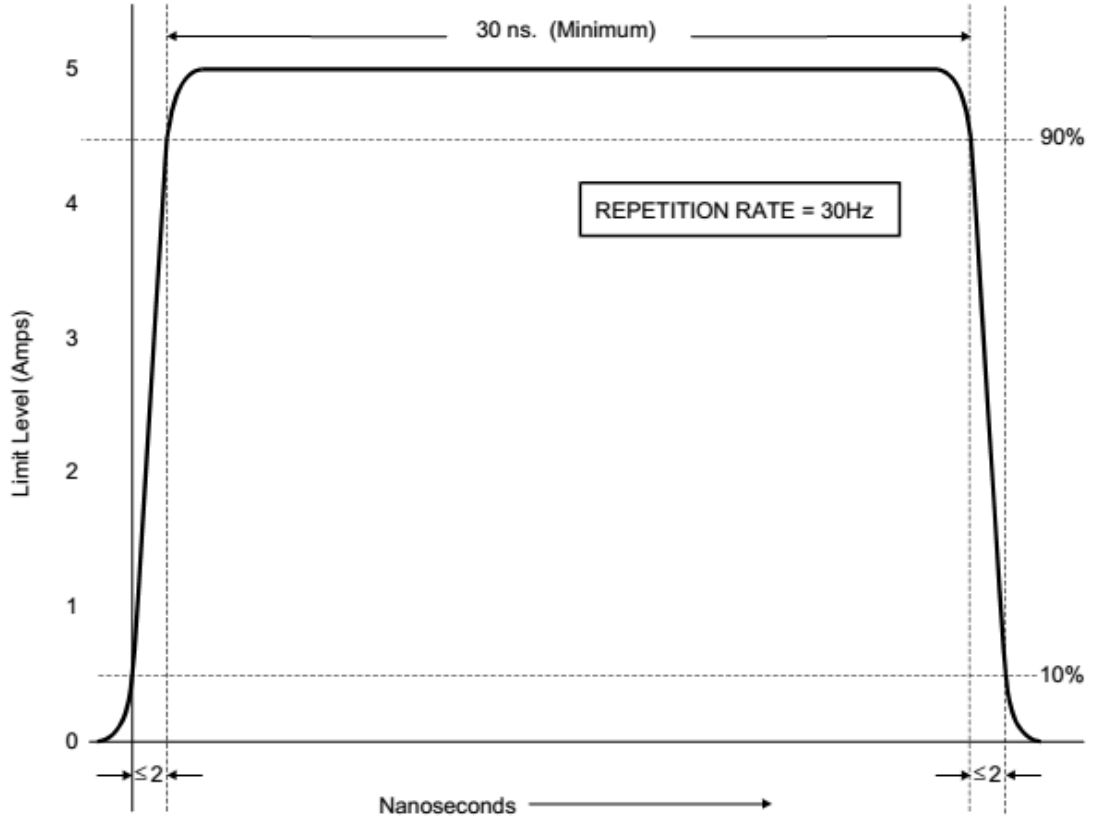
Perform the Conducted susceptibility, bulk cable injection test in accordance with MIL-STD-461F the following parameters: **impulse excitation**

Limit

The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem
specification, when subjected to a test signal with voltage levels as specified in Figure CS115.
The requirement is also met when the power source is adjusted to dissipate the power level
shown in Figure CS115 and the EUT is not susceptible.

7-5-2 Test Procedure

The CS115 test is used to verify the ability of the EUT to withstand impulse signals coupled onto EUT associated cabling
Frequency Range: Broadband
Unit: Current (A)
Signal: Impulse
Test duration: 1 minute per application


30 ns. (Minimum)
5
4
3
2
1
0
90%
10%
REPETITION RATE = 30Hz
Limit Level (Amps)
≤2
≤2
Nanoseconds

Classification Of Functional Status

All classifications are for the total device/system functional status.

Class A: all functions of a device/system perform as designed during and after exposure to
disturbance.

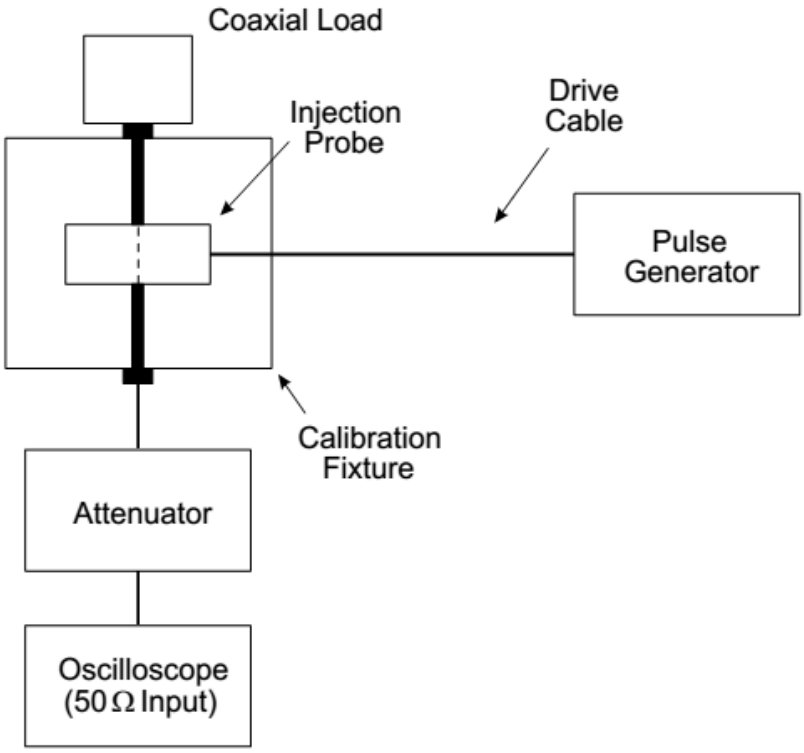
Class B: all functions of a device/system perform as designed during exposure. However, one or
more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed.

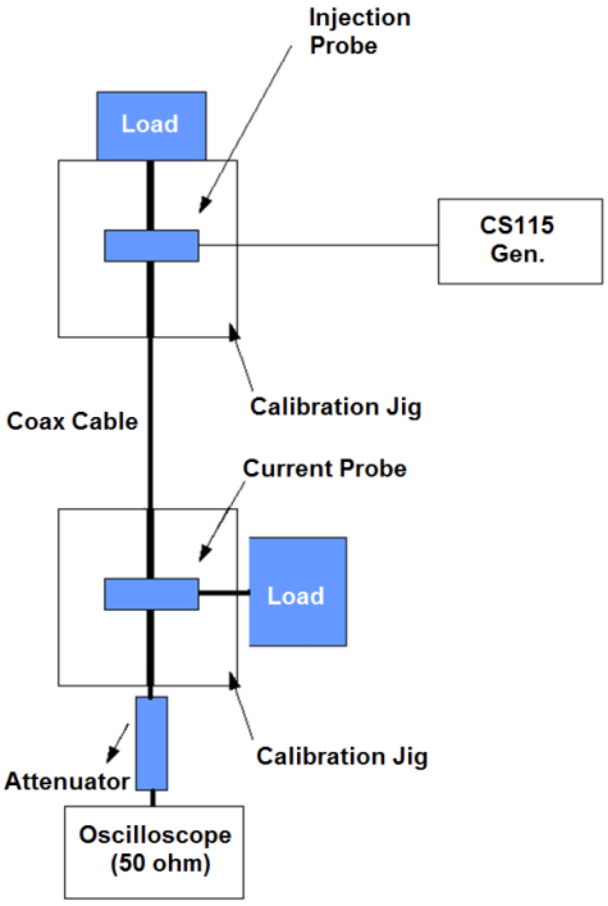
Class C: one or more functions of a device/system do not perform as designed during exposure
but return automatically to normal operation after exposure is removed.

Class D: one or more functions of a device/system do not perform as designed during exposure
and do not return to normal operation until exposure is removed and the device/system is reset by simple “operator/use” action.

Class E: one or more functions of a device/system do not perform as designed during and after
exposure and cannot be returned to proper operation without repairing or replacing the device/system.

7-5-3 Test Configuration




Injection
Probe
Load
CS115
Gen.
Calibration Jig
Coax Cable
Current Probe
Load
Calibration Jig
Attenuator
Oscilloscope
(50 ohm)

7-6 CS116 TEST

7-6-1 Requirements

Perform the Conducted susceptibility, damped sinusoidal transients, cables and power leads test in accordance with MIL-STD-461F the following parameters:**10KHz to 100MHz**

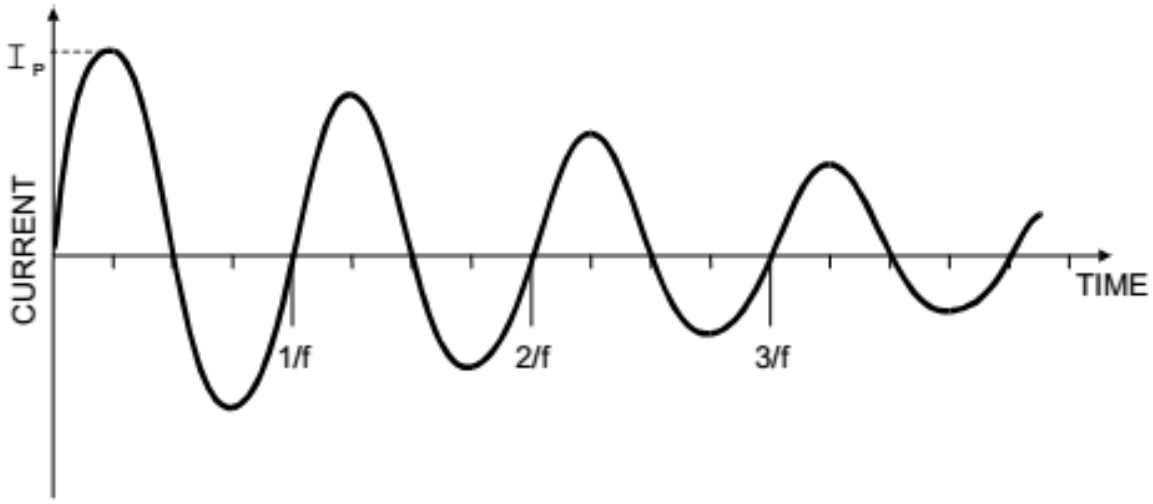
Limit

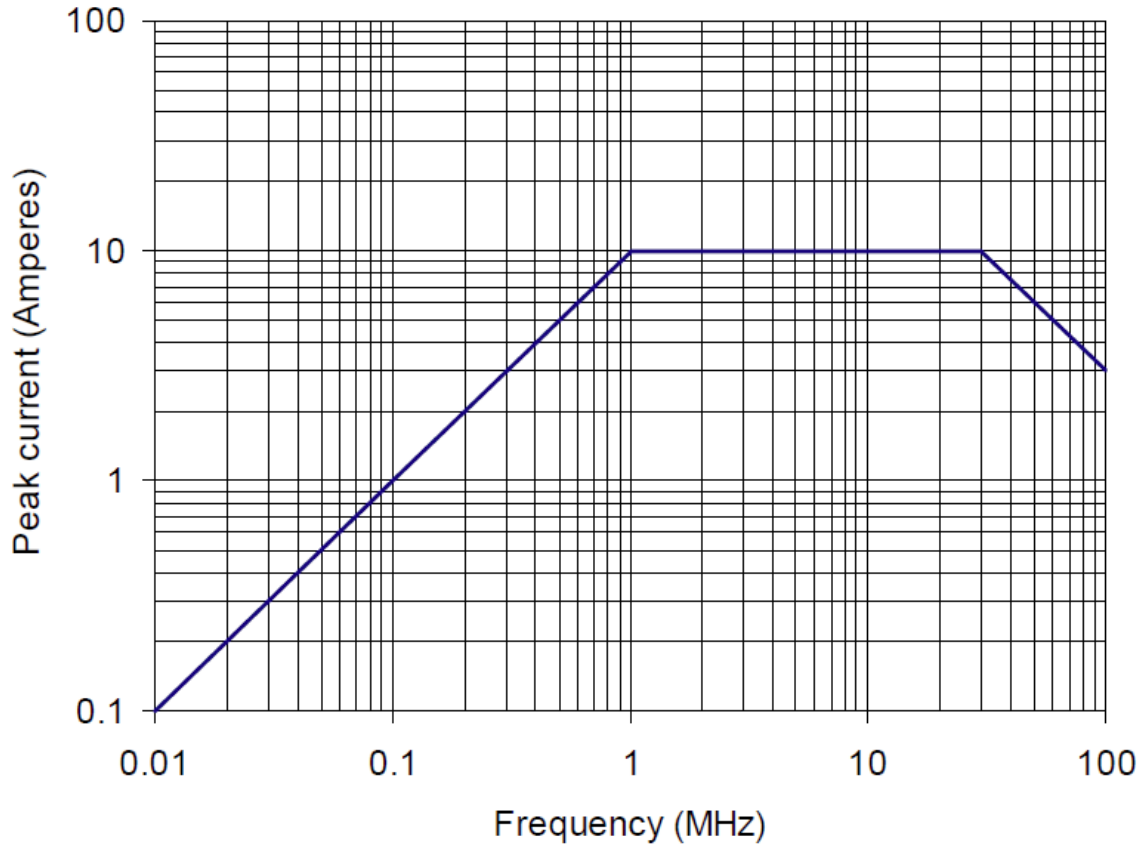
The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem
specification, when subjected to a test signal with voltage levels as specified in Figure CS116.
The requirement is also met when the power source is adjusted to dissipate the power level
shown in Figure CS116 and the EUT is not susceptible.

7-6-2 Test Procedure

The CS116 test is used to verify the ability of the EUT to withstand damped sinusoidal transients coupled onto EUT associated cables and power leads.

Frequency Range: 10KHz-100MHz
Unit: Current (A)
Interference Signal: Damped Sinusoidal Transients
Test Duration: 5 minutes per applcation





Test Frequencies: 10 kHz, 100 kHz, 1 MHz, 10 MHz, 30 MHz, 100 MHz as a minimum

Classification Of Functional Status

All classifications are for the total device/system functional status.

Class A: all functions of a device/system perform as designed during and after exposure to disturbance.

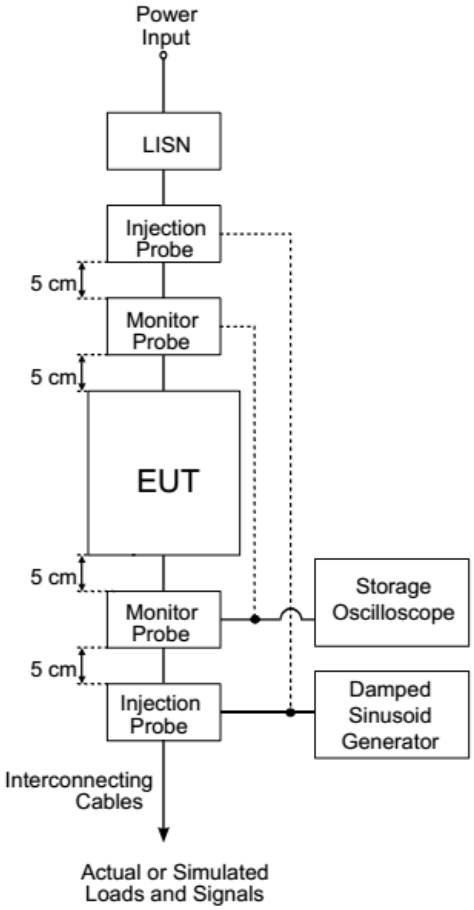
Class B: all functions of a device/system perform as designed during exposure. However, one or more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed.

Class C: one or more functions of a device/system do not perform as designed during exposure but return automatically to normal operation after exposure is removed.

Class D: one or more functions of a device/system do not perform as designed during exposure and do not return to normal operation until exposure is removed and the device/system is reset by simple “operator/use” action.

Class E: one or more functions of a device/system do not perform as designed during and after exposure and cannot be returned to proper operation without repairing or replacing the device/system.

7-6-3 Test Configuration



Tested port	Polarity	Frequency (MHz)	Pulse Level (A)	Injected Current Level (A)
Shielded Power Cable	Positive	0,01	0,1	35,3
	Positive	0,1	1	32,2
	Positive	1	10	53,3
	Positive	10	10	5,7
	Positive	30	10	6,7
	Positive	100	3	2,1
	Negative	0,01	0,1	35,8
	Negative	0,1	1	32,6
	Negative	1	10	53,8
	Negative	10	10	5,8
	Negative	30	10	6,6
	Negative	100	3	2,0

7-7 RS103 TEST

7-7-1 Requirements

Perform the Radiated susceptibility, electric filed test in accordance with MIL-STD-461F the following parameters:**2Mhz to 18GHz, 50V/m**

7-7-2 Test Procedure

Limit

The EUT shall not exhibit any malfunction, degradation of performance, or deviation from. specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to the radiated electric fields listed in Table VII and modulated as specified below. Up to 30 MHz, the requirement shall be met for vertically polarized fields. Above 30 MHz, the requirement shall be met for both horizontally and vertically polarized fields. Circular polarized fields are not acceptable.

		LIMIT LEVEL (VOLTS/METER)							
PLATFORM / FREQ. RANGE		AIRCRAFT (EXTERNAL OR SAFETY CRITICAL)	AIRCRAFT INTERNAL	ALL SHIPS (ABOVE DECKS) AND SUBMARINES (EXTERNAL)*	SHIPS (METALLIC) (BELOW DECKS)	SHIPS (NON-METALLIC) (BELOW DECKS)	SUBMARINES (INTERNAL)	GROUND	SPACE
2 MHz ↓ 30 MHz	A	200	200	200	10	50	5	50	20
	N	200	200	200	10	50	5	10	20
	AF	200	20	-	-	-	-	10	20
30 MHz ↓ 1 GHz	A	200	200	200	10	10	10	50	20
	N	200	200	200	10	10	10	10	20
	AF	200	20	-	-	-	-	10	20
1 GHz ↓ 18 GHz	A	200	200	200	10	10	10	50	20
	N	200	200	200	10	10	10	50	20
	AF	200	60	-	-	-	-	50	20
18 GHz ↓ 40 GHz	A	200	200	200	10	10	10	50	20
	N	200	60	200	10	10	10	50	20
	AF	200	60	-	-	-	-	50	20

KEY: A = Army
N = Navy
AF = Air Force

* For equipment located external to the pressure hull of a submarine but within the superstructure, use SHIPS (METALLIC)(BELOW DECKS)

Classification Of Functional Status

All classifications are for the total device/system functional status.
Class A: all functions of a device/system perform as designed during and after exposure to
disturbance.
Class B: all functions of a device/system perform as designed during exposure. However, one or
more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed.
Class C: one or more functions of a device/system do not perform as designed during exposure

but return automatically to normal operation after exposure is removed.
Class D: one or more functions of a device/system do not perform as designed during exposure
and do not return to normal operation until exposure is removed and the device/system is reset by simple “operator/use” action.
Class E: one or more functions of a device/system do not perform as designed during and after
exposure and cannot be returned to proper operation without repairing or replacing the device/system.

7-7-3 Test Configuration

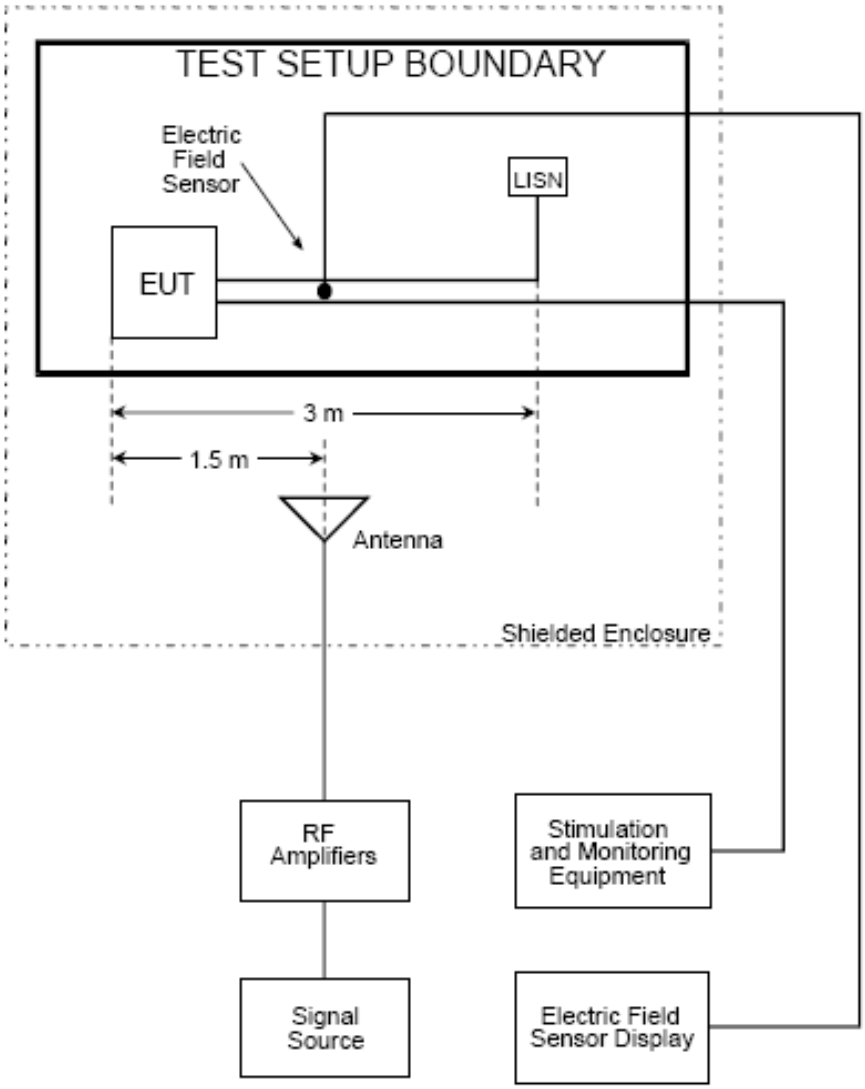


FIGURE RS103-1. Test equipment configuration.

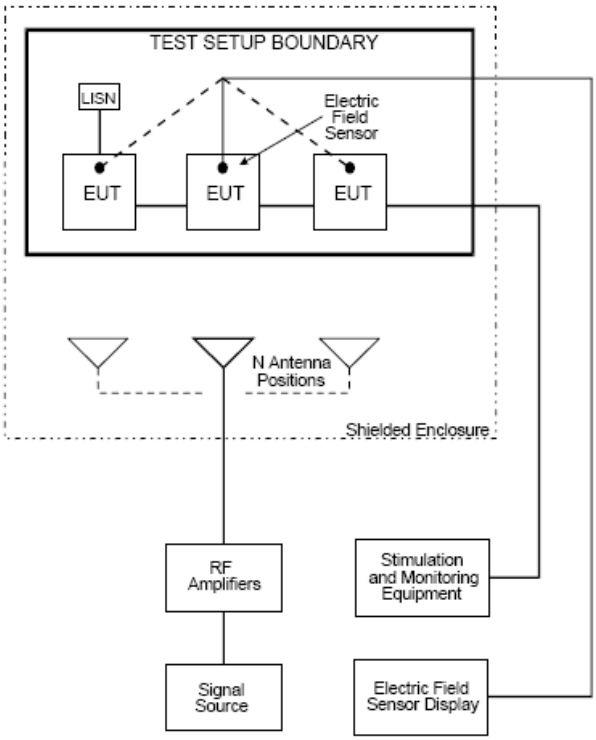


FIGURE RS103-2. Multiple test antenna locations for frequency > 200 MHz

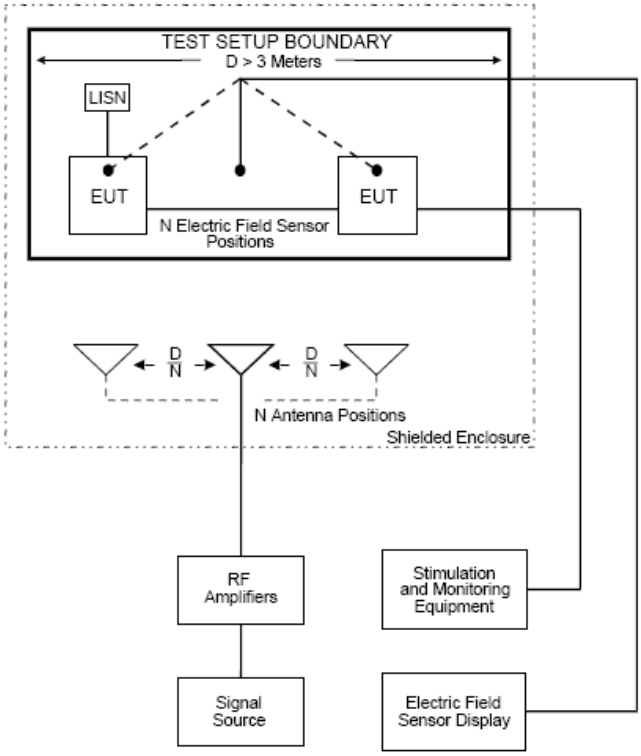


FIGURE RS103-3. Multiple test antenna locations for N positions, D > 3 meters