

EMC Test Report

For

Purism, SPC

Test Standards:	EN 55032 :2015 EN 55035 :2017
Product Description:	<u>Librem Mini</u>
Tested Model:	<u>LMv1-01</u>
Report No.:	<u>EC2005029E01</u>
Tested Date:	<u>2020-06-18 to 2020-06-22</u>
Issued Date:	<u>2020-06-22</u>
Tested By:	<u>Jerry Liu</u> Jerry Liu/ Engineer
Approved By:	<u>Anna Xie</u> Anna Xie / EMC Manager
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Note: The test results in this report apply exclusively to the tested model / sample. Without written approval of Hunan Ecloud Testing Technology Co., Ltd., the test report shall not be reproduced except in full.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2020.06.22	Valid	Original Report

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1. GENERAL INFORMATION

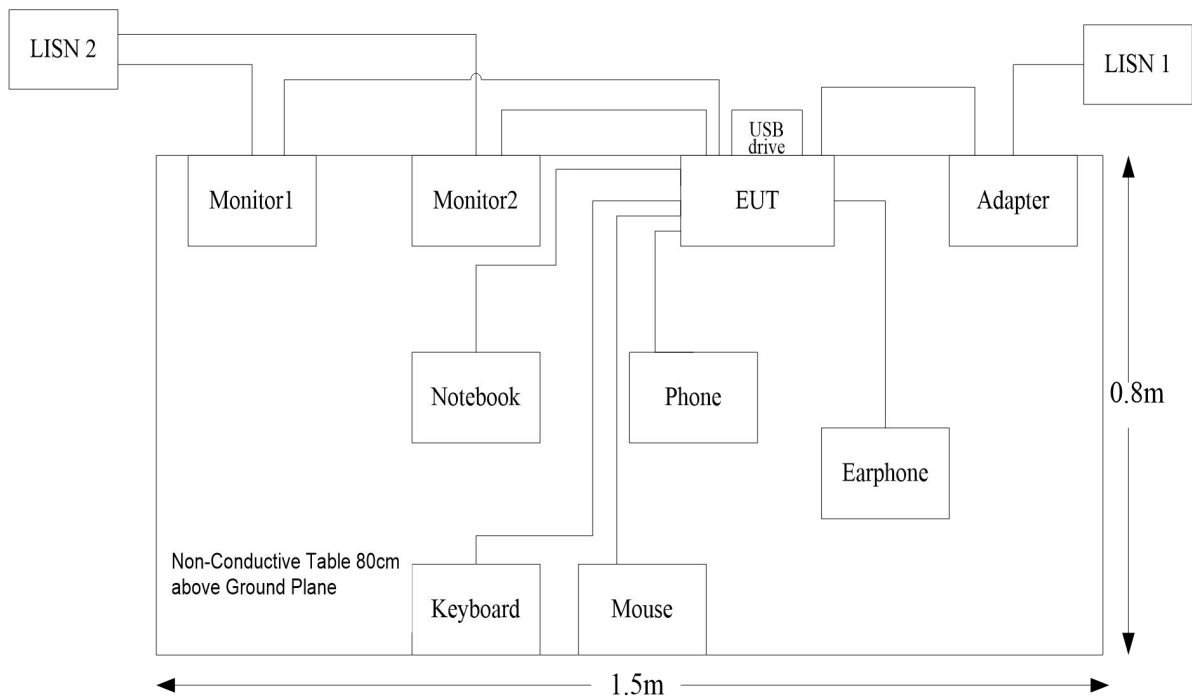
1.1 Product Description for Equipment Under Test (EUT)

Client Information	
Applicant:	Purism, SPC
Address of applicant:	One Market Street, 36th Floor, San Francisco, CA 94105, USA
Manufacturer:	Purism, SPC
Address of manufacturer:	One Market Street, 36th Floor, San Francisco, CA 94105, USA

General Description of EUT	
Product Name:	Librem Mini
Trade Name:	N/A
Model No.:	LMv1-01
Difference description	N/A
Test Voltage:	AC230V/50Hz
Adapter Information:	Model:ADS-40S1-19-3 19040E Input: 100-240V 50/60Hz 1.0A Output: 19V---2.1A 39.9W
Equipment Category:	Class B
Sample Reception Date:	2020.06.16

1.2 EUT Setup and Operation Mode

Block Configuration Diagram for Conducted Emissions



Test Mode List

Test Mode	Description	Remark
1	Video playing+ping	for all test

Special Cable List and Details

Cable Description	Length (m)	Shielded/ Unshielded	With / Without Ferrite	Comment
AC Line	1.2	Unshielded	/	From LISN to Adapter
DC Line	1.5	Unshielded	/	From Adapter to EUT
USB Cable	1.8	Unshielded	/	From EUT to keyboard
USB Cable	1.8	Unshielded	/	From EUT to mouse
HDMI Cable	1.5	Shielded	/	From EUT to monitor 1
DP Cable	1.8	Shielded	/	From EUT to monitor 2
Type-C Cable	1.0	Unshielded	/	From EUT to phone
RJ45	1.5	Unshielded	/	From EUT to notebook

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Mouse	Logitech	U0026	810-002149
Keyboard	Lenovo	TP0083A	PF-0P4YX1
Monitor 1	PHILIPS	243E9Q	243E9QHSW/93
Monitor 2	Dell	P2317H	CN-02J06R-74261-6C 1-0RWS-A00
Mobile	Honor	V8	/
Notebook	Lenovo	Xiaoxinchao5000	PF0QPQMH
Earphone	/	/	/
USB drive	/	/	/

1.3 Measurement Uncertainty

Measurement uncertainty			
Parameter	Frequency	Polarity	Measurement uncertainty
Conducted Emission	150kHz~30MHz	----	2.42dB
Radiated Emission	30MHz-200MHz	Horizontal	3.70dB
Radiated Emission	30MHz-200MHz	Vertical	3.84dB
Radiated Emission	200MHz-1000MHz	Horizontal	4.05dB
Radiated Emission	200MHz-1000MHz	Vertical	5.28dB

1.4 Test Facility

Site	Hunan Ecloud Testing Technology Co., Ltd.
Location	Building A1, Changsha E Center, No. 18 Xiangtai Avenue, Liuyang Economic and Technological Development Zone, Hunan, P.R.C

1.5 Test Equipment List and Details

Test Equipment for Conducted Emission					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
LISN	R&S	ENV216	102125	2020-01-08	2021-01-07
LISN	R&S	ENV432	101327	2020-01-08	2021-01-07
ISN	Schwarzbeck	NTFM 8158	0127	2020-01-08	2021-01-07
EMI Test Receiver	R&S	ESR3	102143	2020-01-16	2021-01-15
EMI Test Software	Audix	E3	N/A	N/A	N/A
Test Equipment for Radiated Emission					
Description	Manufacturer	Model	Serial	Cal Date	Due Date

			Number		
EMI Test Receiver	R&S	ESR-3	102144	2020-01-16	2021-01-15
Spectrum Analyzer	R&S	FSV 30	103728	2020-01-19	2021-01-18
Amplifier	Sonoma	310	363917	2020-01-15	2021-01-14
Amplifier	Schwarz beck	BBV 9718	327	2020-01-15	2021-01-14
Horn Antenna	Schwarz beck	BBHA 9120 D	1677	2020-02-14	2023-02-13
Broadband Antenna	Schwarz beck	VULB9168	9168-757	2018-08-31	2021-08-30
EMI Test Software	Audix	E3	N/A	N/A	N/A
Test Equipment for ESD					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
ESD Generator	Teseq	NSG 437	1121	2020-02-10	2021-02-09
Test Equipment for EFT/SURGE/DIPS					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Surge Generator	Teseq	NSG 3060-MF	4040	2020-01-09	2021-01-08
CDN	Teseq	CDN 3061-S16	3003	2020-01-09	2021-01-08
Capacitive Coupling Clamp	Teseq	CDN 3425	3041	2019-07-05	2021-07-14
EFT/DIPS Generator	Teseq	NSG 3040-MF	6033	2020-01-15	2021-01-14
Transformer	Teseq	INA6501	1002	2020-01-15	2021-01-14
CDN	Teseq	CDN 118	43182	2020-01-09	2021-01-08
CDN	Teseq	CDN 118	44682	2020-01-09	2021-01-08
CDN	Teseq	INA 185	44056	2020-01-09	2021-01-08
CDN	Teseq	INA 185	44059	2020-01-09	2021-01-08
Test Equipment for CS					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
CS Generator	Teseq	NSG 4070B-80	45341	2020-01-15	2021-01-14
6dB Attenuator	Teseq	ATN 6075	32154	2020-01-08	2021-01-07
CDN	Teseq	CDN M016	45065	2020-01-08	2021-01-07
CDN	Teseq	CDN T800	42821	2020-01-08	2021-01-07
Test Equipment for RS					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Signal generator	R&S	SMB100A	113825	2020-01-08	2021-01-07
Power Meter	R&S	NRP2	105581	2020-01-08	2021-01-07
Power Sensor	R&S	NRP-Z91	103778	2020-01-08	2021-01-07
Power Sensor	R&S	NRP-Z91	103779	2020-01-08	2021-01-07
Power Amplifier	R&S	BBA150	102377	2020-01-08	2021-01-07

Power Amplifier	R&S	BBA150	102376	2020-01-08	2021-01-07
Power Amplifier	R&S	BBA150	103014	2020-01-08	2021-01-07
Antenna	R&S	HL046E	100230	N/A	N/A
Antenna	Schwarzbeck	STLP 9149	9149-459	N/A	N/A
RS Test Software	Fala	EZ-RS	N/A	N/A	N/A

1.6 Performance Criteria for EMS

According Clause 8 of EN 55035,

• General

General performance criteria are defined in the following. These criteria shall be used during the testing of primary functions where no relevant annex is applicable.

When assessing the impact of a disturbance on a function, the assessment should take into consideration the impact of a disturbance on a function, the assessment should take into consideration the function's performance prior to the application of the disturbance and only identify as failures those changes in performance that are a result of the disturbance.

• Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operation state is allowed below a performance level specified by the manufacturer when the equipment is use as intended.

The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

• Performance criterion B

During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.

After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.

If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

• Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.

Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

2. SUMMARY OF TEST RESULTS

EN 55032:2015		
Emissions		
Test Standards	Description of Test Item	Result
EN 55032:2015	Conducted Emissions	Compliance
EN 55032:2015	Radiated Emissions	Compliance

EN 55035:2017		
Immunity		
Test Standards	Description of Test Item	Result
IEC 61000-4-2	Electrostatic Discharge	Compliance
IEC 61000-4-3	Continuous radiated disturbances	Compliance
IEC 61000-4-4	Electrical Fast Transients	Compliance
IEC 61000-4-5	Surges	Compliance
IEC 61000-4-6	Continuous conducted disturbances	Compliance
IEC 61000-4-8	Power Frequency Magnetic Field	N/A
IEC 61000-4-11	Voltage Dips and Interruptions	Compliance

*Note1: N/A means not applicable.

3. Conducted Emissions

3.1. Conducted Emission Limit

Requirements for conducted emissions from the AC mains power ports of Class B equipment

Frequency Range	Quasi Peak(dB μ V)	Average(dB μ V)
0.15-0.5	66-56	56-46
0.5-5	56	46
5-30	60	50

Note1 The lower limit shall apply at the transition frequencies.

Note2 The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.

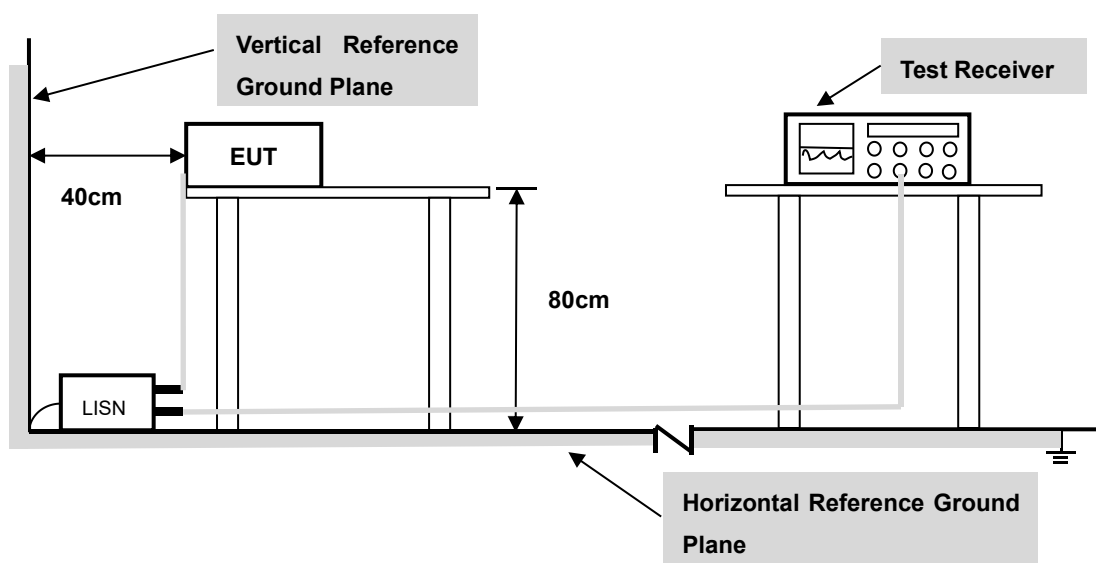
Requirements for asymmetric mode conducted emissions from Class B equipment

Frequency Range (MHz)	Coupling Device	Detector Type/ bandwidth	Class A voltage limits dB(μ V)
0.15~0.5	AAN	Quasi Peak / 9 kHz	87~74
0.5~30			74
0.15~0.5	AAN	Average / 9 kHz	74~64
0.5~30			64

Note1 The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Note2 The lower limit shall apply at the transition frequencies.

3.2 Block Diagram of Test Setup



3.3. Test Procedure

During the conducted emissions test, the adapter was connected to the main outlet of the first LISN and the other support equipments were connected to the outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination.

All data was recorded in the Quasi-peak and average detection mode.

3.4 Result Level & Over Limit Calculation

The Result Level is calculated by Reading Level adding the LISN Factor and the Cable Factor, The basic equation is as follows:

$$\text{Result Level} = \text{Reading Level} + \text{LISN Factor} + \text{Cable Factor}$$

The “**Over Limit**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a “Over Limit” of -6dB means the emission is 6dB below the maximum limit for Class B device. The equation for “Over Limit” calculation is as follows:

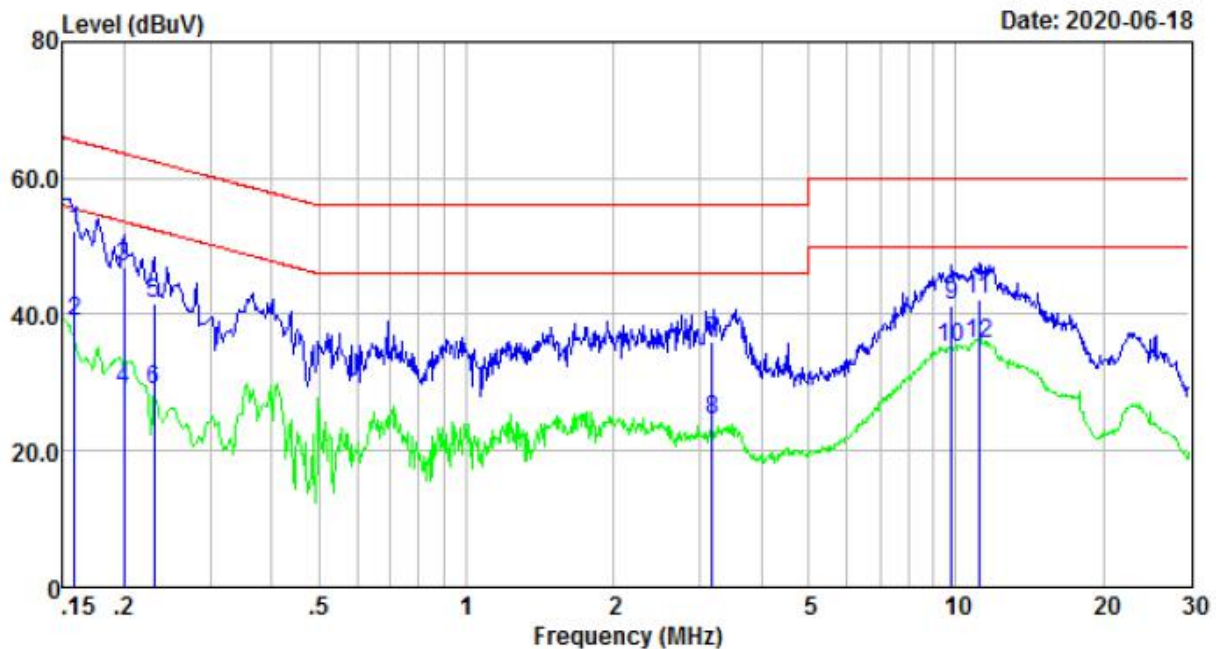
$$\text{Over Limit} = \text{Result Level} - \text{Limit}$$

3.5 Environmental Conditions

Temperature:	26° C
Relative Humidity:	53%RH
Atmospheric Pressure:	100.0kPa
Test Date:	2020.06.18
Tested By:	Jerry.Liu

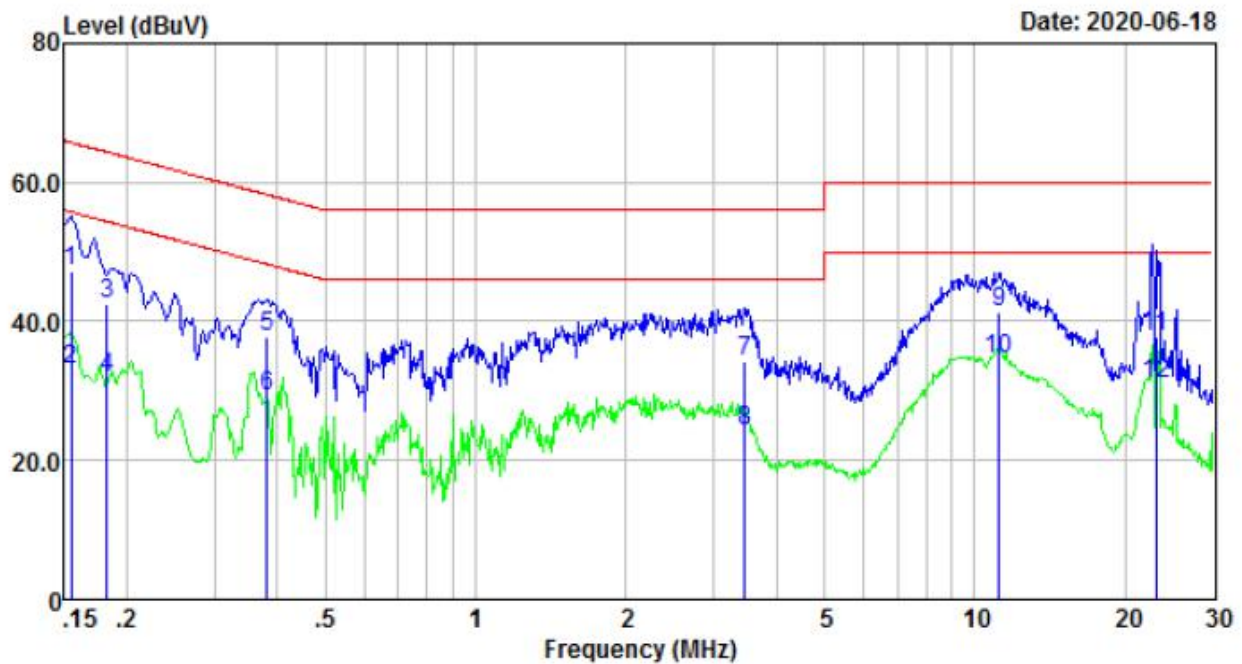
3.6 Test Data and Result

LINE



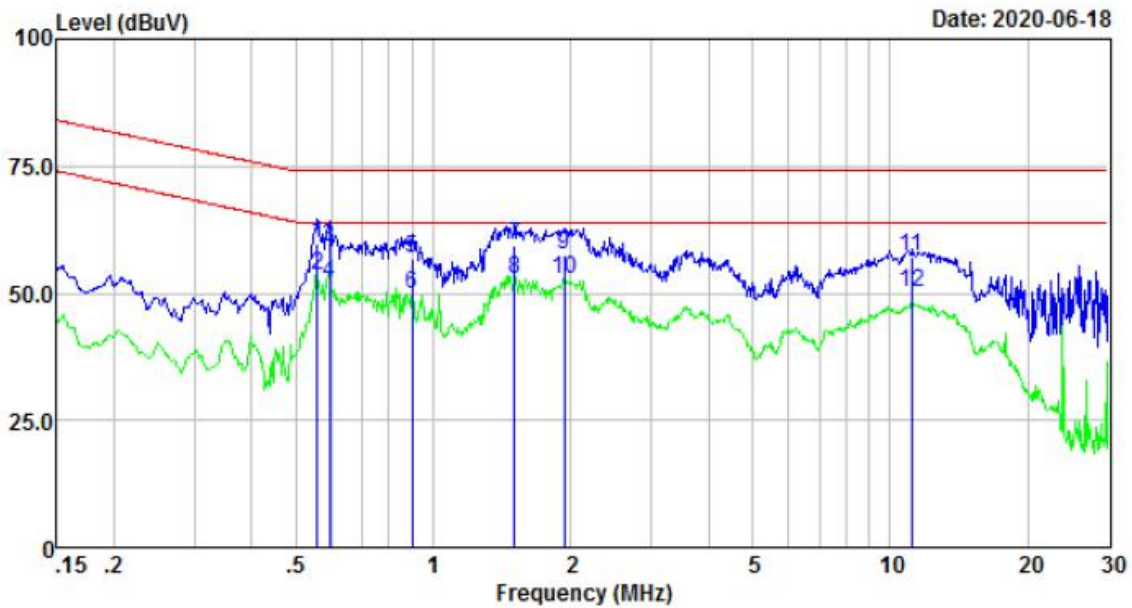
Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	Result level dBuV	Limit level dBuV	Over limit dB	Remark
0.158	42.70	9.54	0.02	52.26	65.56	-13.30	QP
0.158	29.30	9.54	0.02	38.86	55.56	-16.70	Average
0.200	37.50	9.55	0.03	47.08	63.62	-16.54	QP
0.200	19.30	9.55	0.03	28.88	53.62	-24.74	Average
0.230	32.10	9.55	0.03	41.68	62.44	-20.76	QP
0.230	19.30	9.55	0.03	28.88	52.44	-23.56	Average
3.181	26.30	9.61	0.03	35.94	56.00	-20.06	QP
3.181	14.80	9.61	0.03	24.44	46.00	-21.56	Average
9.809	31.40	9.85	0.09	41.34	60.00	-18.66	QP
9.809	25.30	9.85	0.09	35.24	50.00	-14.76	Average
11.120	32.30	9.90	0.10	42.30	60.00	-17.70	QP
11.120	25.80	9.90	0.10	35.80	50.00	-14.20	Average

NEUTRAL



Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	Result level dBuV	Limit level dBuV	Over limit dB	Remark
0.155	37.70	9.56	0.02	47.28	65.74	-18.46	QP
0.155	23.50	9.56	0.02	33.08	55.74	-22.66	Average
0.182	32.80	9.56	0.03	42.39	64.38	-21.99	QP
0.182	22.30	9.56	0.03	31.89	54.38	-22.49	Average
0.381	28.30	9.58	0.02	37.90	58.25	-20.35	QP
0.381	19.70	9.58	0.02	29.30	48.25	-18.95	Average
3.454	24.60	9.66	0.03	34.29	56.00	-21.71	QP
3.454	14.40	9.66	0.03	24.09	46.00	-21.91	Average
11.190	31.39	9.98	0.10	41.47	60.00	-18.53	QP
11.190	24.49	9.98	0.10	34.57	50.00	-15.43	Average
23.130	27.10	10.48	0.12	37.70	60.00	-22.30	QP
23.130	20.30	10.48	0.12	30.90	50.00	-19.10	Average

RJ45 Port:



Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	Result level dBuV	Limit level dBuV	Over limit dB	Remark
0.558	50.09	9.74	0.02	59.85	74.00	-14.15	QP
0.558	43.69	9.74	0.02	53.45	64.00	-10.55	Average
0.592	49.31	9.72	0.01	59.04	74.00	-14.96	QP
0.592	42.41	9.72	0.01	52.14	64.00	-11.86	Average
0.899	47.10	9.63	0.01	56.74	74.00	-17.26	QP
0.899	40.00	9.63	0.01	49.64	64.00	-14.36	Average
1.503	49.99	9.55	0.02	59.56	74.00	-14.44	QP
1.503	43.19	9.55	0.02	52.76	64.00	-11.24	Average
1.939	47.90	9.50	0.02	57.42	74.00	-16.58	QP
1.939	43.40	9.50	0.02	52.92	64.00	-11.08	Average
11.139	47.70	9.36	0.10	57.16	74.00	-16.84	QP
11.139	40.90	9.36	0.10	50.36	64.00	-13.64	Average

Note: 1. Result Level = Reading Level + LISN/ISN Factor + Cable loss

4. Radiated Emissions

4.1. Radiated Emission Limit

Requirements for radiated emissions at frequencies up to 1GHz for Class B equipment

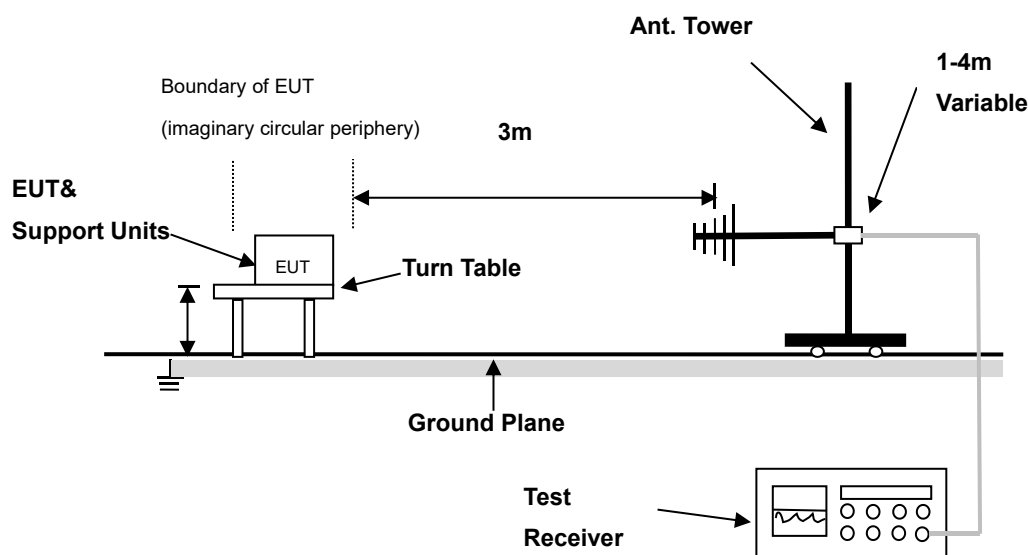
Frequency range (MHz)	Measurement		Class A limits dB(μ V/m)
	Distance (m)	Detector type/bandwidth	
30 ~ 230	3	Quasi Peak/120kHz	40
230 ~ 1000			47

Requirements for radiated emissions at frequencies above 1GHz for Class B equipment

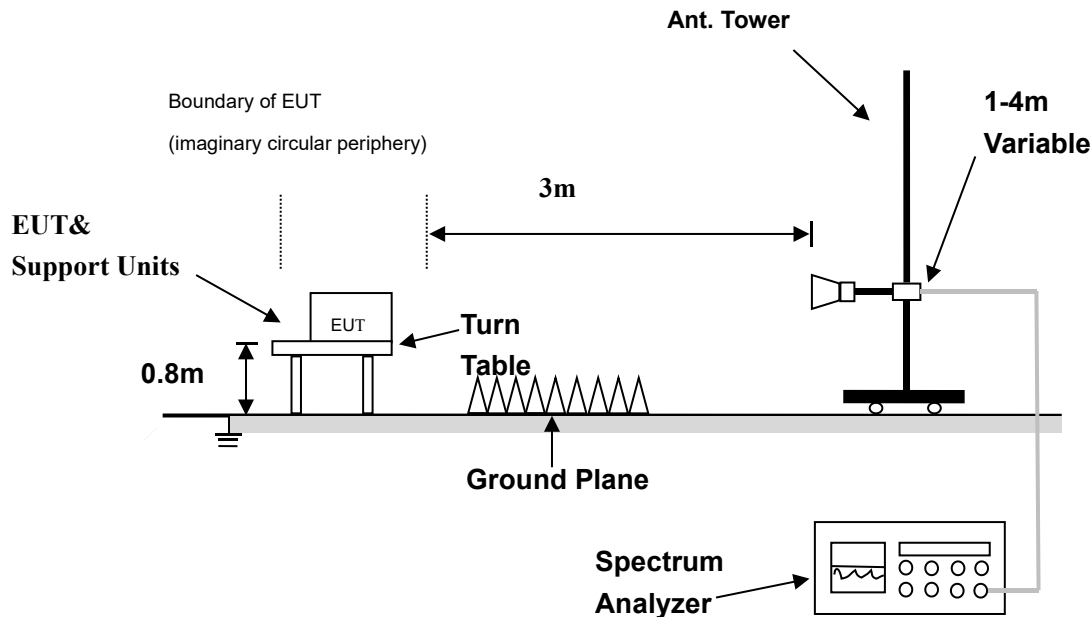
Frequency range (MHz)	Measurement		Class A limits dB(μ V/m)
	Distance (m)	Detector type/bandwidth	
1000 ~ 3000	3	Average/1MHz	50
3000 ~ 6000			54
1000 ~ 3000	3	Peak/1MHz	70
3000 ~ 6000			74

4.2. Block Diagram of Test Setup

Radiated Emissions Frequency: 30MHz to 1000MHz:



Radiated Emissions Frequency: 1000MHz to 6000MHz:



4.3 Test Procedure

- (1) The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual.
- (2) Support equipment, if needed, was placed as per EN 55032. All I/O cables were positioned to simulate typical actual usage as per EN 55032.
- (3) The EUT is placed on a turntable, which is 0.8 meter high above the ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna, which is mounted on an antenna tower. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.
- (4) Recorded at least the six highest emissions.

4.4 Result Level & Over Limit Calculation

The Result Level is calculated by Reading Level adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Result Level} = \text{Reading Level} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Over Limit**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB means the emission is 6dB below the maximum limit for Class B device. The equation for margin calculation is as follows:

$$\text{Over Limit} = \text{Result Level} - \text{Limit}$$

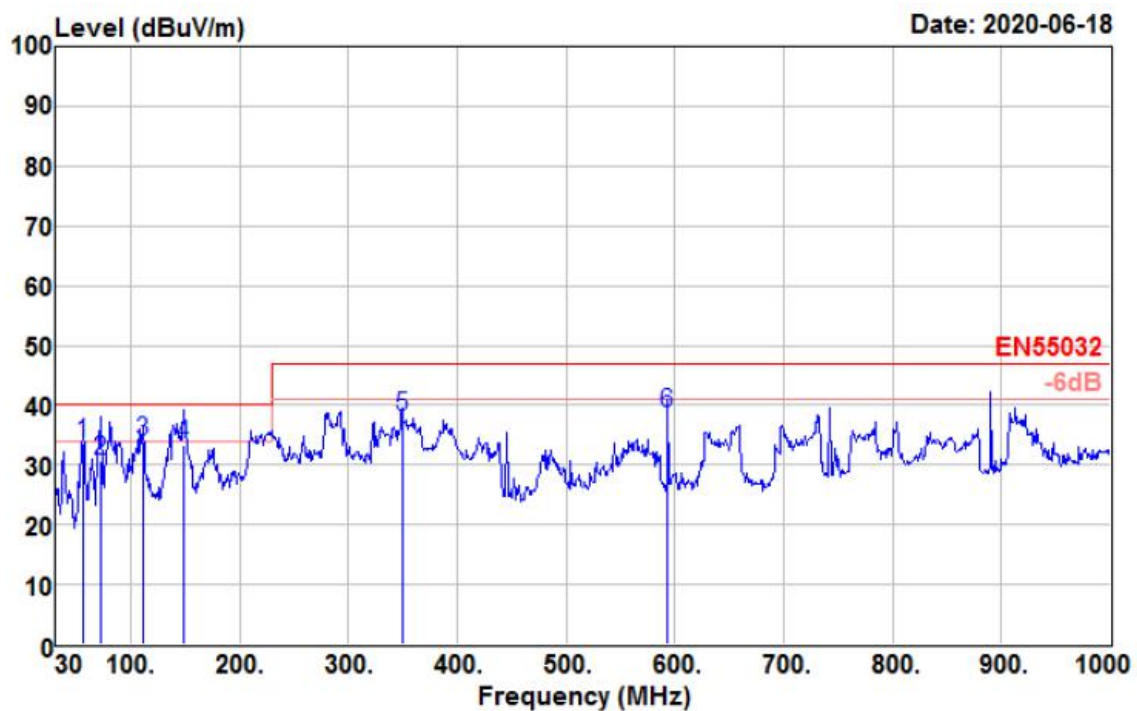
4.5 Environmental Conditions

Temperature:	22° C~24° C
Relative Humidity:	50%RH
Atmospheric Pressure:	100.0kPa
Test Date:	2020.06.18
Tested By:	Jerry.Liu

4.6 Test Data and Result

Below 1GHz:

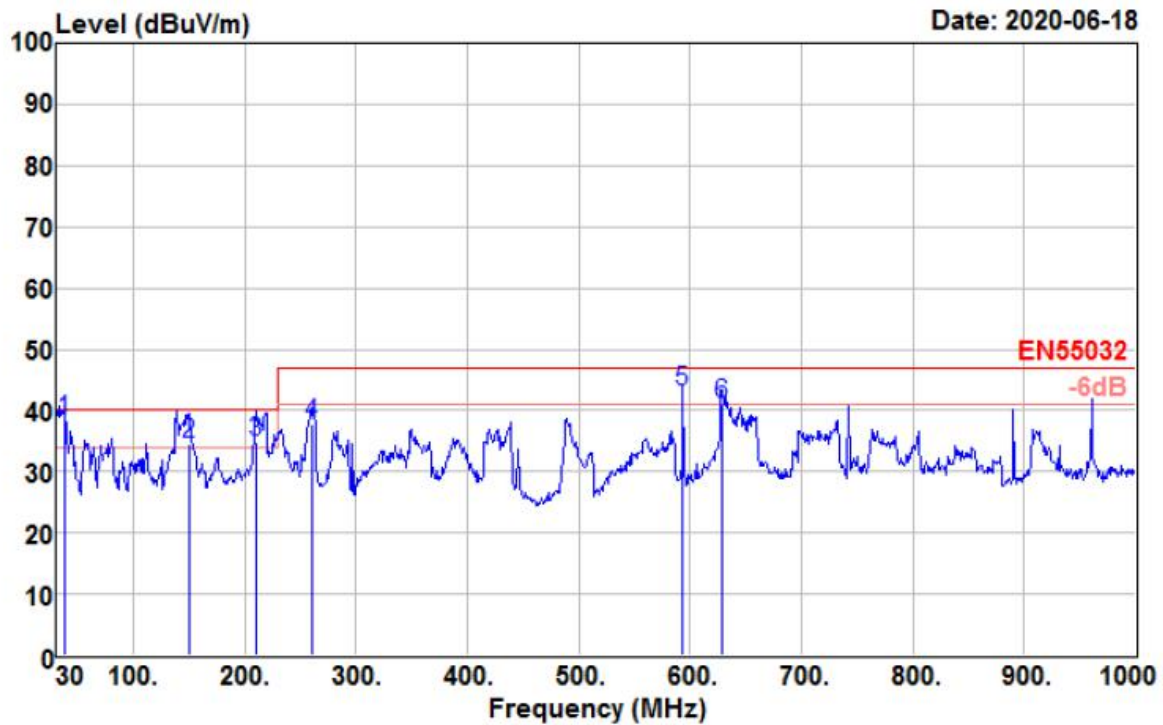
Horizontal:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
56.190	52.90	11.90	1.42	32.51	33.71	40.00	-6.29	QP
72.680	52.30	9.46	1.57	32.50	30.83	40.00	-9.17	QP
110.510	54.40	9.96	2.05	32.49	33.92	40.00	-6.08	QP
148.340	49.09	14.42	2.36	32.48	33.39	40.00	-6.61	QP
349.130	52.10	14.79	3.68	32.52	38.05	47.00	-8.95	QP
593.570	46.71	19.88	4.85	32.69	38.75	47.00	-8.25	QP

Below 1GHz:

Vertical:

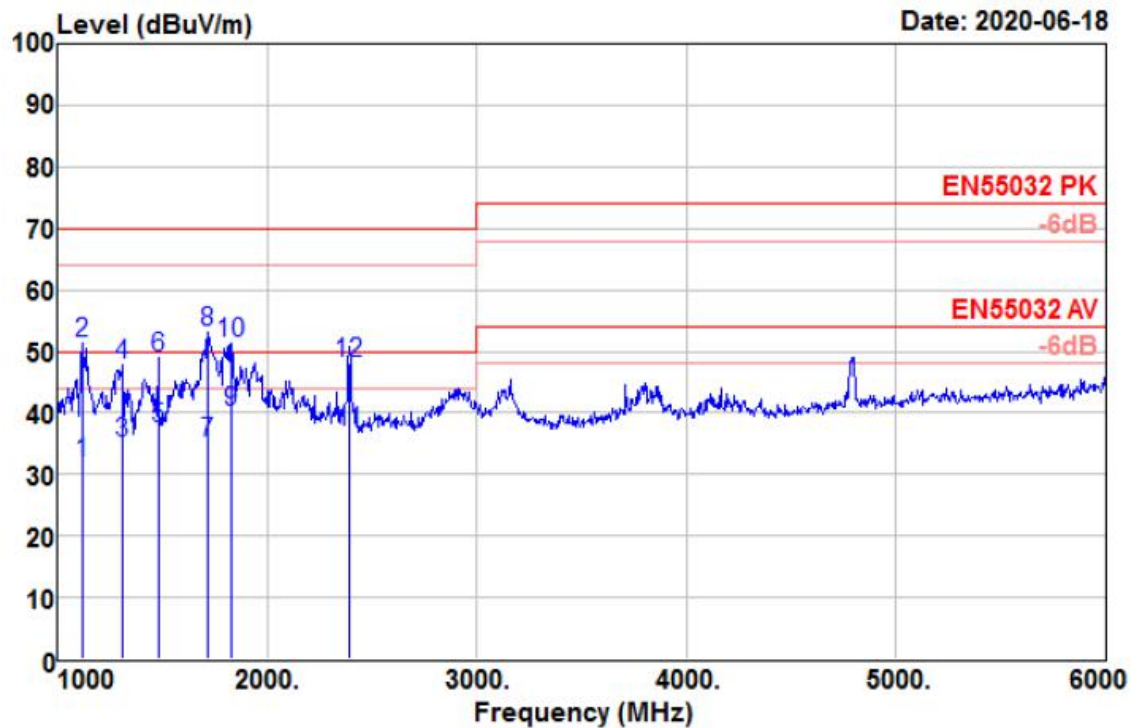


Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
37.760	57.30	12.41	1.20	32.47	38.44	40.00	-1.56	QP
149.310	50.30	14.47	2.36	32.48	34.65	40.00	-5.35	QP
209.450	53.40	11.07	2.80	32.47	34.80	40.00	-5.20	QP
259.890	53.89	13.32	3.16	32.48	37.89	47.00	-9.11	QP
593.570	51.11	19.88	4.85	32.69	43.15	47.00	-3.85	QP
628.490	48.31	20.40	4.98	32.68	41.01	47.00	-5.99	QP

Note: 1. Level = Reading Level +Antenna Factor + Cable loss – Preamp factor

Above 1GHz:

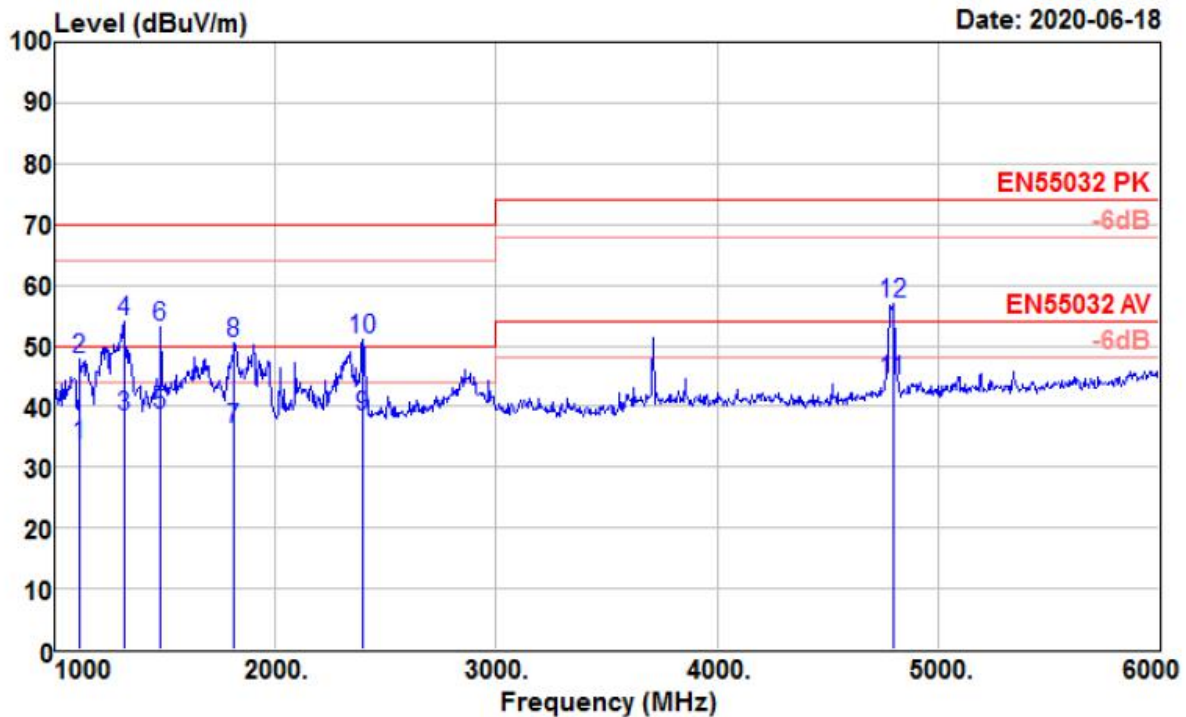
Horizontal:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
1120.000	40.09	24.14	2.76	35.23	31.76	50.00	-18.24	Average
1120.000	59.58	24.14	2.76	35.23	51.25	70.00	-18.75	Peak
1315.000	42.80	24.53	3.07	35.16	35.24	50.00	-14.76	Average
1315.000	55.49	24.53	3.07	35.16	47.93	70.00	-22.07	Peak
1480.000	44.30	24.86	3.27	35.10	37.33	50.00	-12.67	Average
1480.000	55.92	24.86	3.27	35.10	48.95	70.00	-21.05	Peak
1720.000	41.20	25.69	3.26	35.01	35.14	50.00	-14.86	Average
1720.000	59.29	25.69	3.26	35.01	53.23	70.00	-16.77	Peak
1830.000	45.69	26.09	3.41	34.96	40.23	50.00	-9.77	Average
1830.000	56.73	26.09	3.41	34.96	51.27	70.00	-18.73	Peak
2395.000	40.79	27.57	4.19	35.80	36.75	50.00	-13.25	Average
2395.000	52.09	27.57	4.19	35.80	48.05	70.00	-21.95	Peak

Above 1GHz:

Vertical



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
1115.000	42.11	24.13	2.75	35.24	33.75	50.00	-16.25	Average
1115.000	56.10	24.13	2.75	35.24	47.74	70.00	-22.26	Peak
1315.000	45.80	24.53	3.07	35.16	38.24	50.00	-11.76	Average
1315.000	61.41	24.53	3.07	35.16	53.85	70.00	-16.15	Peak
1480.000	45.50	24.86	3.27	35.10	38.53	50.00	-11.47	Average
1480.000	60.12	24.86	3.27	35.10	53.15	70.00	-16.85	Peak
1815.000	41.91	26.03	3.40	34.97	36.37	50.00	-13.63	Average
1815.000	55.93	26.03	3.40	34.97	50.39	70.00	-19.61	Peak
2395.000	42.39	27.57	4.19	35.80	38.35	50.00	-11.65	Average
2395.000	55.05	27.57	4.19	35.80	51.01	70.00	-18.99	Peak
4795.000	43.21	30.91	6.09	36.04	44.17	54.00	-9.83	Average
4795.000	55.89	30.91	6.09	36.04	56.85	74.00	-17.15	Peak

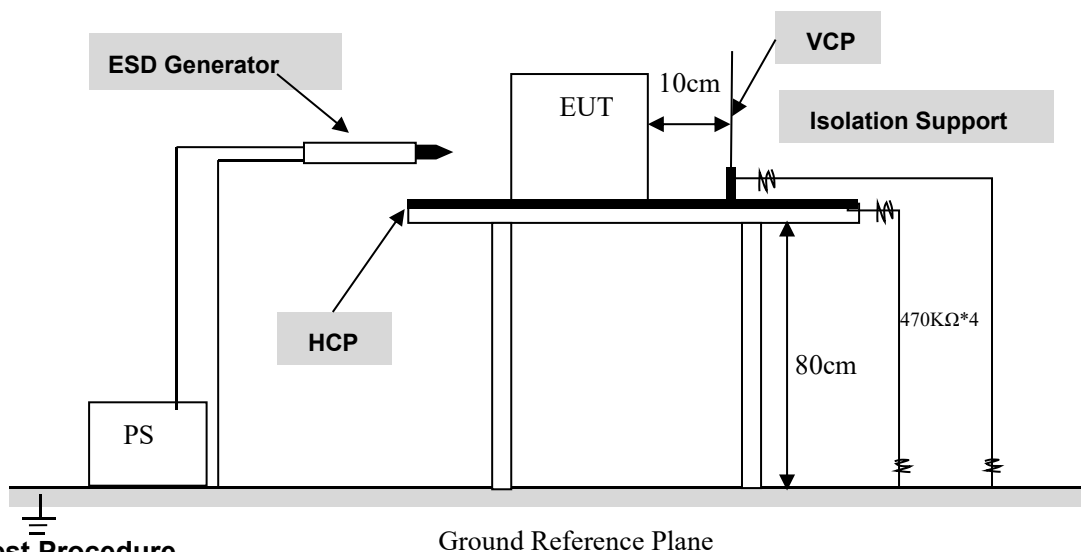
Note: 1. Level = Reading Level +Antenna Factor + Cable loss- Preamp factor

5. Electrostatic Discharge

5.1 ESD Immunity Requirements

Environmental Phenomenon	Port	Test Specification	Basic Standard	Performance criterion
Electrostatic discharge	Enclosure port	4kV(Contact Discharge)	IEC 61000-4-2	B
		8kV(Air Discharge)	IEC 61000-4-2	B

5.2 Block Diagram of Test Setup



5.3 Test Procedure

Air Discharges:

This test is done on a non-conductive surface. The round Discharges tip of the Discharges electrode shall be approached as fast as possible to touch the EUT. After each Discharge, the Discharges electrode shall be removed from the EUT. The generator is then re-triggered for a new single Discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air Discharges completed.

Contact Discharges:

All the procedure shall be same as Section 8.3.1 of IEC 61000-4-2, except that the tip of the Discharges electrode shall touch the EUT before the Discharges switch is operated.

Indirect Discharges for HCP

At least 20 single Discharges shall be applied to the horizontal coupling plane, at points on each side of the EUT. The Discharges electrode positions vertically at a distance of 0.1 m from the EUT and with the Discharges electrode touching the coupling plane.

Indirect Discharges for VCP

At least 20 single Discharges shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated

5.4 Environmental Conditions

Temperature:	23° C
Relative Humidity:	53%
Atmospheric Pressure:	100.3kPa
Test Date:	2020.06.19
Tested By:	Jerry.Liu

5.5 Test Data and Result

EN 61000-4-2 Test Points	Test Levels (kV)							
	-2	+2	-4	+4	-8	+8	-15	+15
Air Discharge								
Slot	A	A	A	A	A	A	/	/
Key	A	A	A	A	A	A		

EN 61000-4-2 Test Points	Test Levels (kV)							
	-2	+2	-4	+4	-6	+6	-8	+8
Contact Discharge								
Port	A	A	A	A	/	/	/	/
Surface	A	A	A	A	/	/	/	/
/	/	/	/	/	/	/	/	/

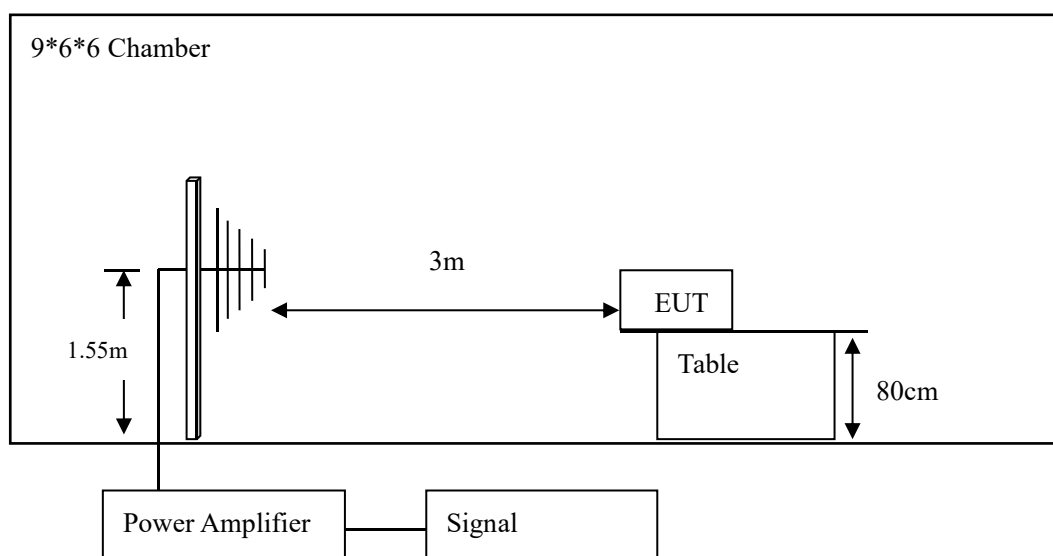
EN 61000-4-2 Test Points	Test Levels (kV)							
	Indirect Contact Discharge (HCP)				Indirect Contact Discharge (VCP)			
	-2	+2	-4	+4	-2	+2	-4	+4
Front Side	A	A	A	A	A	A	A	A
Back Side	A	A	A	A	A	A	A	A
Left Side	A	A	A	A	A	A	A	A
Right Side	A	A	A	A	A	A	A	A

6. Radio Frequency Electromagnetic Field

6.1 RS Immunity Requirements

Environmental Phenomenon	Port	Test Specification	Basic Standard	Performance criterion
Radio-frequency electromagnetic field Amplitude modulated	Enclosure port	80-1000MHz, 1800MHz, 2600MHz, 3500MHz, 5000MHz 3V/m(unmodulated, r.m.s) 80% AM(1kHz)	IEC 61000-4-3	A

6.2 Block Diagram of Test Setup



6.3 Test Procedure

Test is conducting under the description of IEC61000-4-3.

(1)The EUT was switched on and allowed to warm up to its normal operating condition.

(2)The EUT was exercised and monitored in the manner specified by the customer.

(3)All test instruments were PC controlled, via their IEEE 488.2 bus interfaces, and the test conducted in the following manner:

The testing frequencies were swept over the required frequency range, with a step frequency equal to 1% of fundamental. The sweep rate was 1.0×10^{-3} decades/s. For each frequency tested, the signal generator output level was adjusted automatically until the unmodulated field strength registered by the field monitor reached the desired level. This level was held constant for the specified dwell time.

(4)The EUT was continuously monitored during the test in accordance with the Pass / Fail criteria declared by the customer.

(5)The test was done in both horizontal and vertical antenna polarizations, and for all necessary sides of the EUT.

6.4 Environmental Conditions

Temperature:	24° C
Relative Humidity:	60%RH
Atmospheric Pressure:	99.7 kPa
Test Date:	2020.06.22
Tested By:	Jerry.Liu

6.5 Test Data and Result

Field Strength: 3V/m

Frequency step: 1% of fundamental

Dwell time: 1 second

Modulation: AM by 1kHz sine wave with 80% modulation depth

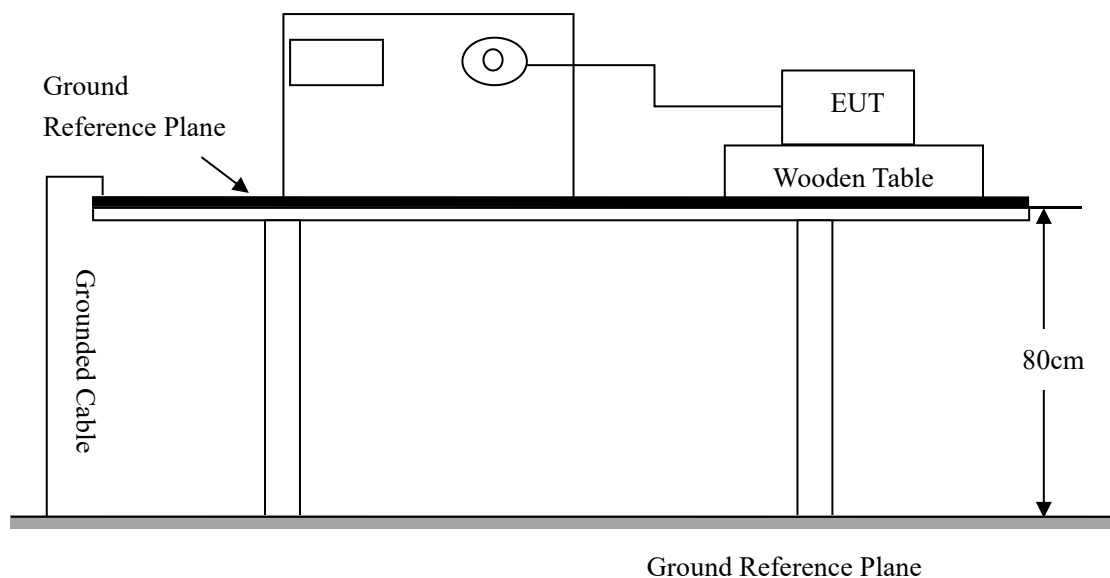
Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	A	A	A	A	A	A	A	A
1800,2600, 3500,5000	3	A	A	A	A	A	A	A	A

7. Electrical fast transients

7.1 EFT Immunity Requirements

Environmental Phenomenon	Port	Test Specification	Basic Standard	Performance criterion
Electrical fast transients	Input a.c. power. ports	1kV(peak) Tr/Th:5/50ns Repetition frequency:5kHz	IEC 61000-4-4	B
	Analogue/digital data ports	0.5kV(peak) Tr/Th:5/50ns Repetition frequency:5kHz		B

7.2 Block Diagram of Test Setup



7.3 Test Procedure

(1)The EUT was switched on and allowed to warm up to its normal operating condition.

(2)D.C./A.C. Power Line Test

The EFT/B test system has a built-in coupling/decoupling network which couples the generated EFT bursts into the EUT power supply lines connected to it. The EFT bursts were coupled to the selected lines (one at a time) of the EUT.

(3)I/O Signal & Control Line Test

The interference impulses were capacitively coupled to the EUT's signal cables.

(4)The EUT was monitored during the test in accordance with the Pass /Fail criteria declared by the customer.

(5)The test was performed with EFT bursts in the positive and negative polarities and repeated on all necessary lines.

7.4 Environmental Conditions

Temperature:	23° C
Relative Humidity:	62%RH
Atmospheric Pressure:	100.3kPa
Test Date:	2020.06.19
Tested By:	Jerry.Liu

7.5 Test Data and Result

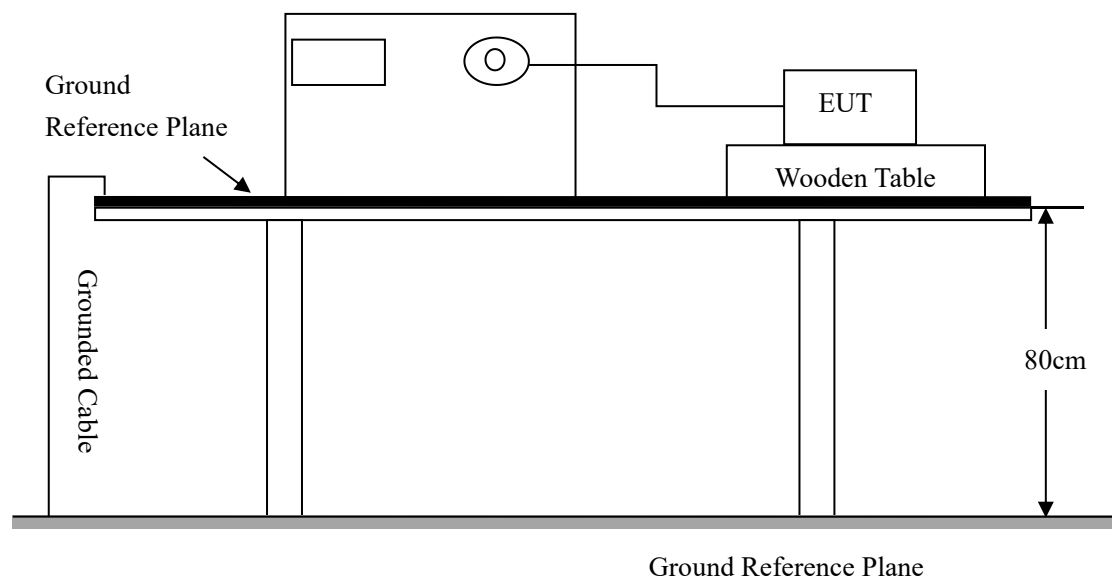
IEC61000-4-4 Test Points		Test Levels(kV)					
		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0
AC mains power input port	L	A	A	A	A	/	/
	N	A	A	A	A	/	/
	L+N	A	A	A	A	/	/
	PE	A	A	A	A	/	/
	L+PE	A	A	A	A	/	/
	N+PE	A	A	A	A	/	/
	L+N+PE	A	A	A	A	/	/
Single Port	RJ45	A	A	/	/	/	/

8. Surges

8.1 Surges Immunity Requirements

Environmental Phenomenon	Port	Test Specification	Basic Standard	Performance criterion
Surges	Input a.c. power ports	Tr/Th:1,2/50 μ s 1kV (line to line) 2kV(line to earth)	IEC 61000-4-5	B

8.2 Block Diagram of Test Setup



8.3 Test Procedure

- (1)The power supply to EUT was switched on and allowed to warm up to its normal operating condition.
- (2)The surge generator phase shifter was set to different angle.
- (3)The correct open-circuit test level was set with the surge generator disconnected from the coupling network.
- (4)The output of the generator was then reconnected back to the coupling network.
- (5)Five discharges, generated by the voltage surge generator, were made on each relevant line, for each polarity, at each test level, with the relevant discharge interval.
- (6)The EUT was observed during, and checked after the test to determine the result.

8.4 Environmental Conditions

Temperature:	23° C
Relative Humidity:	62%RH
Atmospheric Pressure:	100.3kPa
Test Date:	2020.06.19
Tested By:	Jerry.Liu

8.5 Test Data and Result

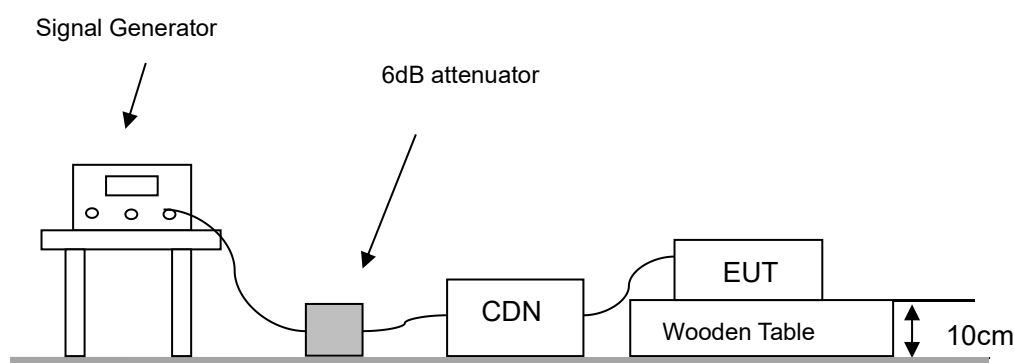
IEC61000-4-5		Test Levels(kV)					
Test Points		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0
AC mains power input port	L-N	A	A	A	A	/	/
	L-PE	A	A	A	A	A	A
	N-PE	A	A	A	A	A	A
Signal port	/	/	/	/	/	/	/

9. Radio-Frequency Continuous Conducted

9.1 CS Immunity Requirements

Environmental Phenomenon	Port	Test Specification	Basic Standard	Performance criterion
Radio-frequency continuous conducted	Input a.c. power ports	0,15~10MHz,3V 10~30MHz,3~1V 30~80MHz,1V	IEC 61000-4-6	A
	Analogue/digital data ports	0,15~10MHz,3V 10~30MHz,3~1V 30~80MHz,1V	IEC 61000-4-6	A

9.2 Block Diagram of Test Setup



9.3 Test Procedure

(1)The EUT was switched on and allowed to warm up to its normal operating condition.

(2)The EUT are placed on an insulating support 0.1 m high above a ground reference plane. CDN(coupling and decoupling device) is placed on the ground plane about 0.3 m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).

(3)The frequency range is swept from 150 kHz to 80 MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1 kHz sine wave.

(4)The rate of sweep shall not exceed 1.5×10^{-3} decades/s. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

(5)The EUT was continuously monitored during the test in accordance with the PASS/FAIL criteria declared by the customer.

9.4 Environmental Conditions

Temperature:	23° C
Relative Humidity:	60%RH
Atmospheric Pressure:	100.3kPa
Test Date:	2020.06.19
Tested By:	Jerry.Liu

9.5 Test Data and Result

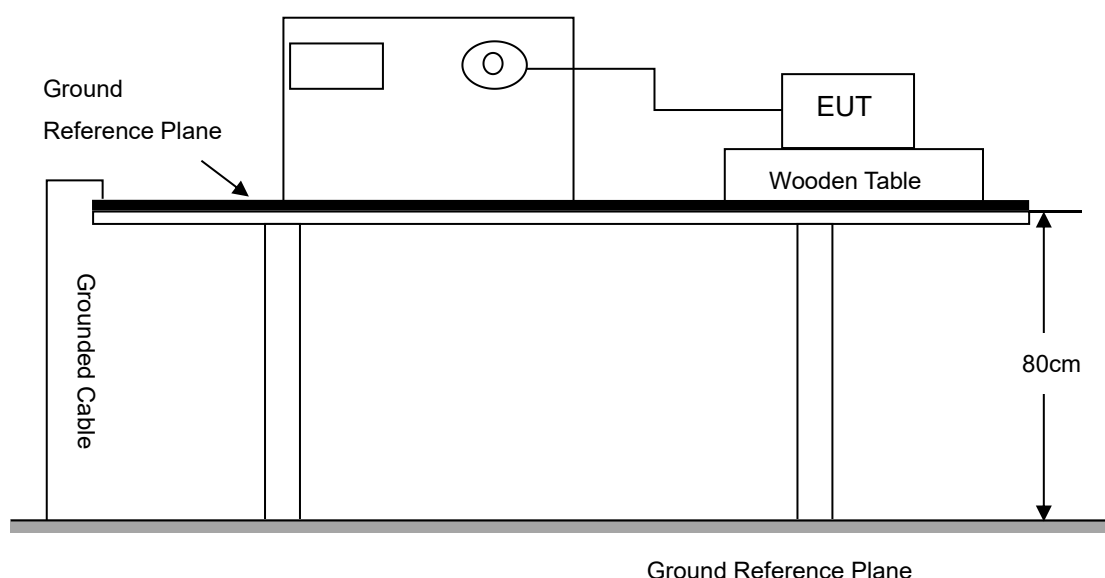
IEC61000-4-6 Test Point	Frequency Range (MHz)	Strength (Vrms)	Modulation	Result
Power Line	0.15~10	3	AM	A
	10~30	3~1		A
	30~80	1		A
RJ45 Port	0.15~10	3	AM	A
	10~30	3~1		A
	30~80	1		A

10. Voltage Dips and Interruptions Test Result

10.1 DIPS Immunity Requirements

Environmental Phenomenon	Port	Test Specification	Basic Standard	Performance criterion
Voltage Dips	Input a.c. power port	>95% reduction 0,5 period	IEC61000-4-11	B
		30% reduction 25 period		C
Voltage interruptions		>95% reduction 250 period		C

10.2 Block Diagram of Test Setup



10.3 Test Procedure

- (1)The interruption is introduced at selected phase angles with specified duration.
- (2)Record any degradation of performance.

10.4 Environmental Conditions

Temperature:	23° C
Relative Humidity:	60%RH
Atmospheric Pressure:	100.3kPa
Test Date:	2020.06.19
Tested By:	Jerry.Liu

10.5 Test Data and Result

Environmental Phenomenon	Test Level $\%U_T$	Reduction (%)	Duration (periods)	Result
Voltage Dips	<5	>95	0.5	A
	70	30	25	A
Voltage interruptions	<5	>95	250	C

EXHIBIT A – PHOTOGRAPHS OF TEST SETUP

Conducted Emission Test Setup (AC mains)



Conducted Emission Test Setup (RJ45 Port)



Radiated Emission Test Setup(30MHz-1000MHz)



Radiated Emission Test Setup(1000MHz-6000MHz)



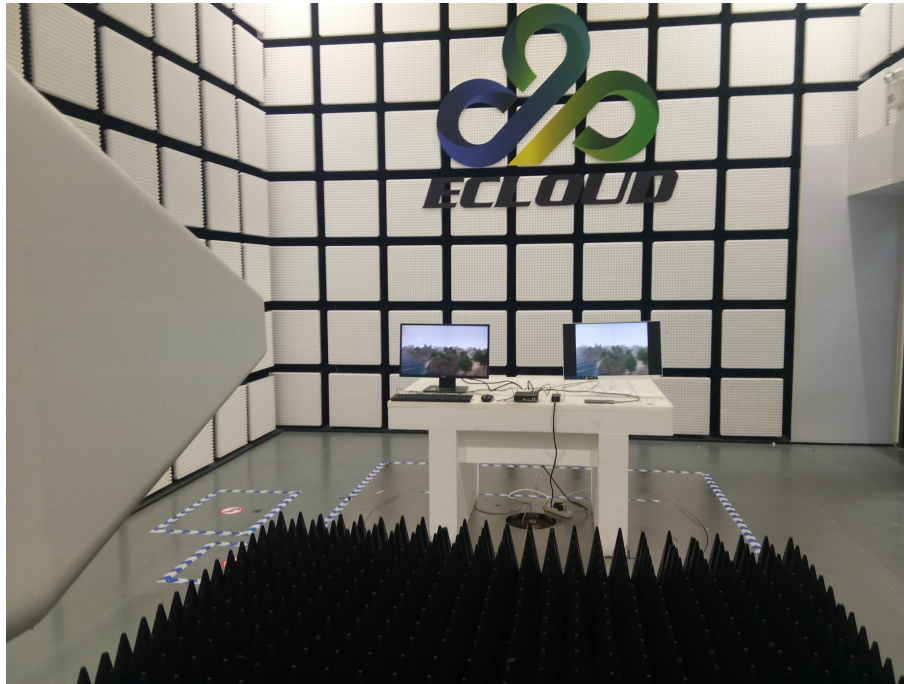
IEC 61000-4-2 ESD Immunity Test View



IEC 61000-4-3 RS Immunity Test View (Below 1GHz)



IEC 61000-4-3 RS Immunity Test View(Above 1GHz)



IEC 61000-4-4 EFT Immunity Test View (AC mains)



IEC 61000-4-4 EFT Immunity Test View (RJ45 Port)



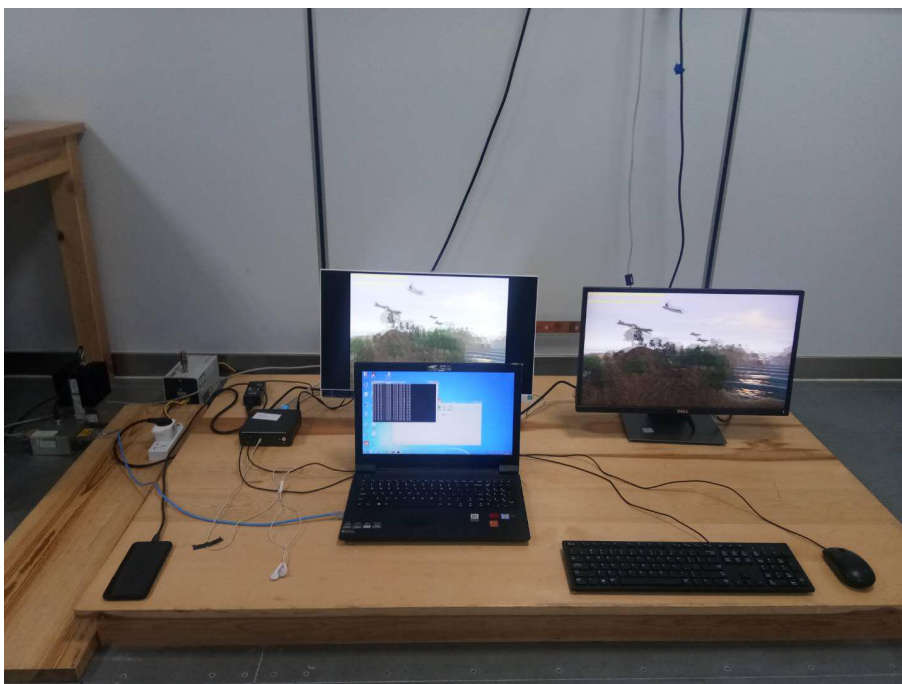
IEC 61000-4-5 Surge Immunity Test View (AC mains)



IEC 61000-4-6 CS Immunity Test View (AC mains)



IEC 61000-4-6 CS Immunity Test View(RJ45 Port)



IEC 61000-4-11 Dips Immunity Test View



EXHIBIT B – PHOTOGRAPHS OF EUT

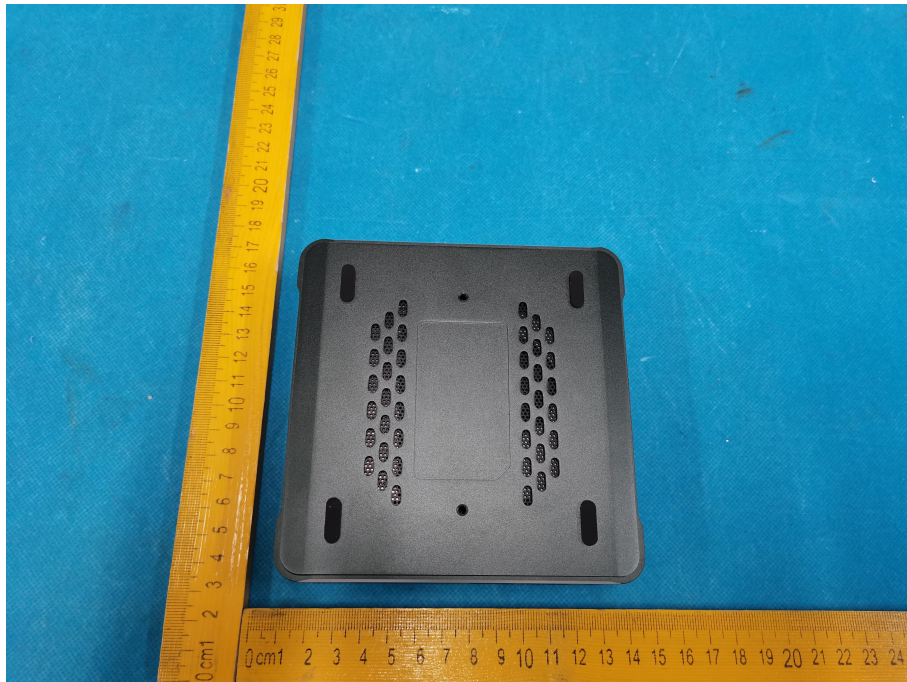
EUT All View



EUT Top View



EUT Bottom View



EUT Front View



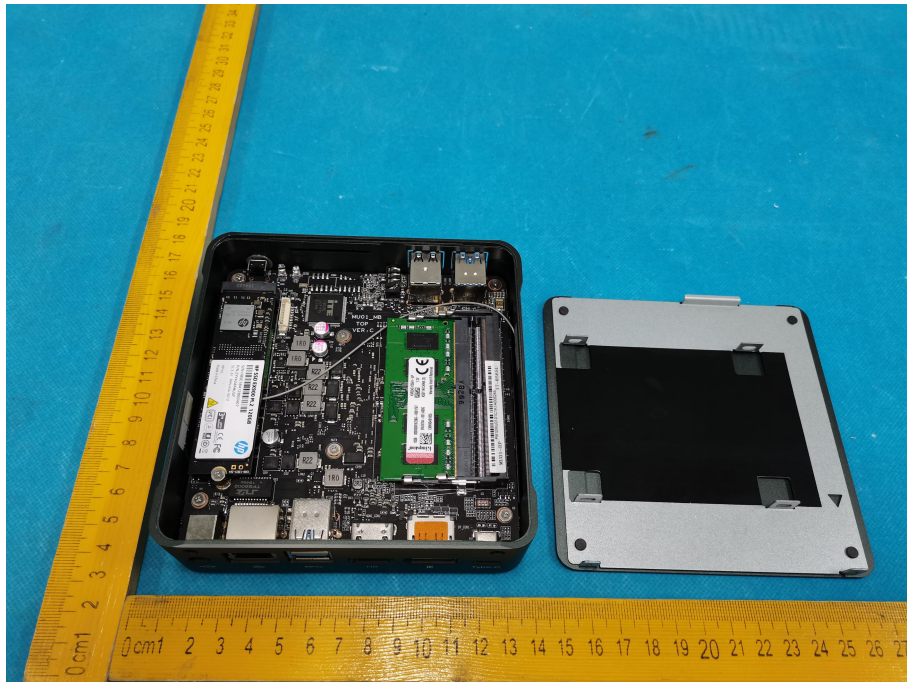
EUT Side View



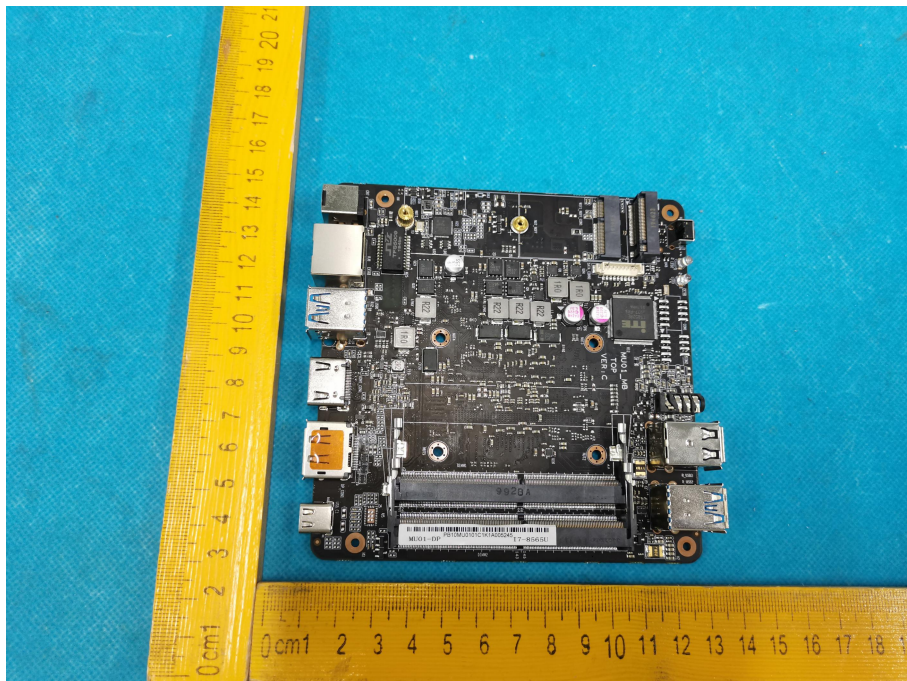
EUT Adapter View



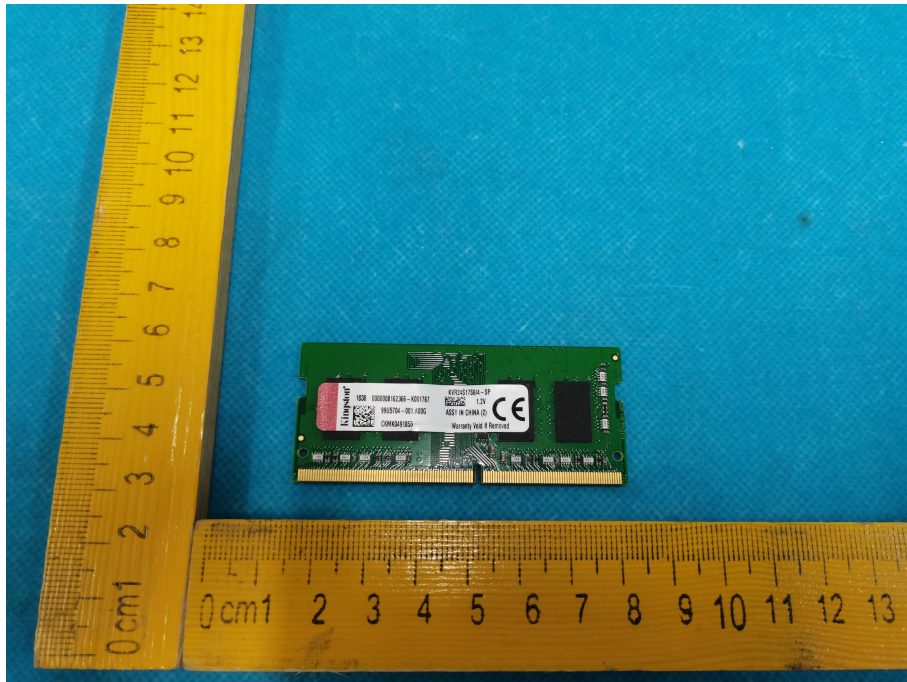
EUT Uncover View



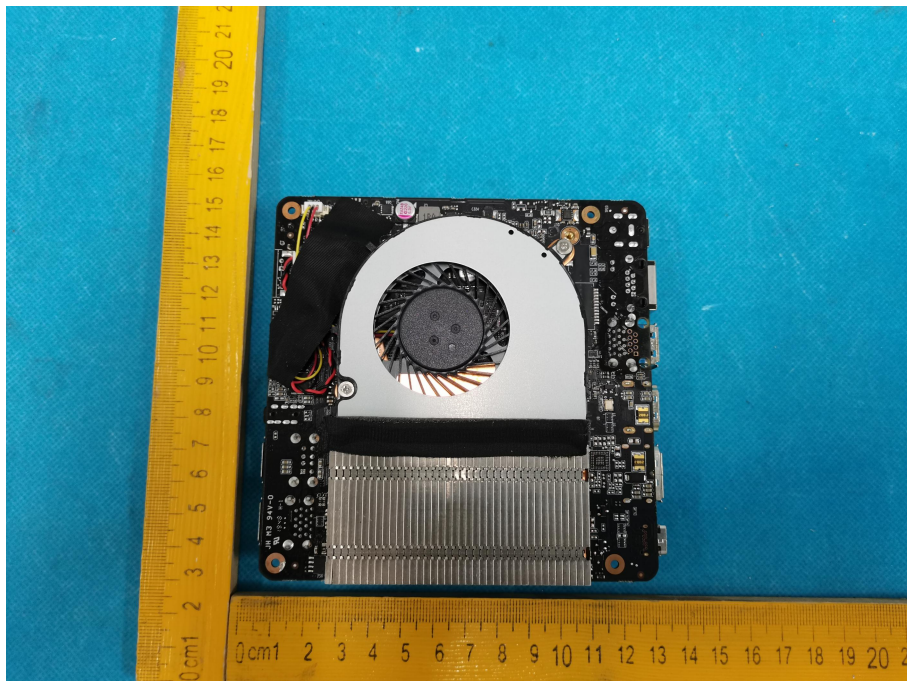
Main Board Top View



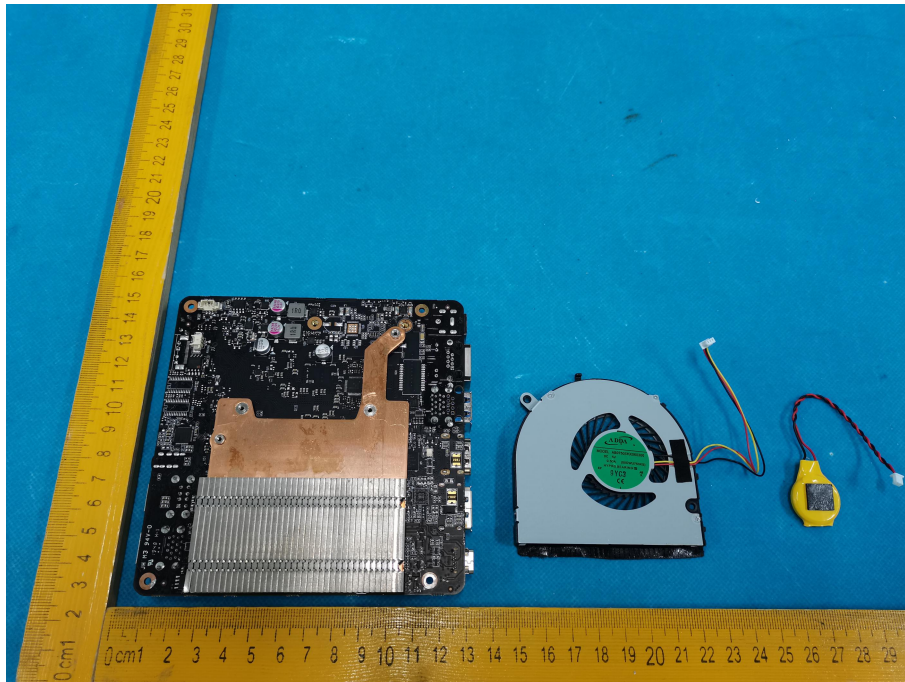
Main Board Bottom View



Main Board Top View



Main Board Bottom View



***** END OF REPORT *****