

# EMC Test Report

According to

Test Standard : EN IEC 62040-2:2018  
IEC 62040-2:2016

Equipment : Uninterruptible power supply  
Model Number : BGM2200axxxx (a=nil or B, x=0-9, A-Z,"-",blank or nil)  
Serial model : --  
Applicant : American Power Conversion Holdings Inc., Taiwan Branch  
5F., No.189, Sec. 2, Jiuzong Rd., Neihu District, Taipei City,  
Taiwan

Received date : Feb 2, 2023  
Test date : Feb 2, 2023 ~ Mar 9, 2023  
Issue date : Oct 27, 2023

## Statement:

- The test result is applied to test equipment unit (EUT) only.
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Rack Chiang/ Approved Signatory

**SERTC Testing Center Co., Ltd**

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## History of this test report

Report No.	Version	Description	Issue Date
22312CEAE1	Rev.1.0	Initial issue of report	Oct 27, 2023

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## 1. General Description

### 1.1 Application category


<input checked="" type="checkbox"/> New application	This document is new applicant.
<input type="checkbox"/> Copy report	This document originally test result as: · Issue unit : · Report number :
<input type="checkbox"/> Application for change	Addition of series model or others.

### 1.2 Applied standards.

According to the specifications of the manufacturer and the requirements set in European Council EMC Directive 2014/30/EU, the applied standards to evaluate the compliance of the EUT are as following:

Applied Standards	Test Items	Results
EN IEC 62040-2:2018 IEC 62040-2:2016	Conducted Emission Measurement 150k-30MHz	<u>Complied</u>
	Radiated Emission Measurement 30M- 1GHz	<u>Complied</u>
EN 61000-3-2:2019+A1:2021 IEC 61000-3-2:2018+A1:2020	Harmonic Current Emission Measurement	<u>Complied</u>
EN 61000-3-3:2013+A2:2021 IEC 61000-3-3:2013+A1:2017+A2:2021	Voltage Fluctuation and Flicker Emission Measurement	<u>Complied</u>
IEC 62040-2:2016; EN IEC 62040-2:2018 (Category C1)		
EN 61000-4-2:2009 IEC 61000-4-2:2008	Electrostatic discharge Test (ESD)	<u>Complied</u>
EN IEC 61000-4-3:2020 IEC 61000-4-3:2020	Radiated electromagnetic field immunity Test (RS)	<u>Complied</u>
EN 61000-4-4:2012 IEC 61000-4-4:2012	Electrical fast transient / burst immunity Test (EFT)	<u>Complied</u>
EN 61000-4-5:2014+A1:2017 IEC 61000-4-5:2014+A1:2017	Surge immunity Test	<u>Complied</u>
EN 61000-4-6:2014 IEC 61000-4-6:2013	Immunity to conducted disturbances, induced by radio-frequency fields (CS)	<u>Complied</u>
EN 61000-4-8:2010 IEC 61000-4-8:2009	Power frequency magnetic field immunity Test (PFM)	<u>Complied</u>
EN 61000-2-2:2002 IEC 61000-2-2:2002	Immunity to Low-Frequency Signals	<u>Complied</u>

**1.3 Basic Description of Equipment under Test**

Equipment	Uninterruptible Power supply
Trade Name	
Model Number	BGM2200axxxx (a = nil or B, x=0-9, A-Z, "-", blank or nil)
Serial model	--
Power Supply Type	AC Input: L-N, 230V/50Hz, 1Ø3W
Power output	AC output: L-N 230V/50Hz, 1Ø3W
Highest Operating Frequency	48MHz
Use environment of EUT	First environment
Category of EUT	Category C1

**1.4 The I/O ports of EUT are listed below**

No.	Port Type	Quantity
1	AC input	1
2	AC output	6
3	USB Type A port	2
4	USB type C port	1
5	Communication port	1
6	RJ45 port	2

Note: The detail information shall refer to description on manufacturer's manual.

## 2. Test configuration of EUT

### 2.1 Test Manner

- a. During testing, the interface cables and equipment positions were varied according to Europe Standard EN IEC 62040-2.

Conducted Emission for AC main power	
Test Mode 1	AC mode + Full load
Test Mode 2	Battery mode + Full load
Radiated Emissions for below 1GHz	
Test Mode 1	AC mode + Full load
Test Mode 2	Battery mode + Full load
Immunity Test (ESD, RS, EFT, SURGE, CS, PFM, low frequency signal test)	
Test Mode 1	AC mode + Full load

### 2.2 General requirement of test

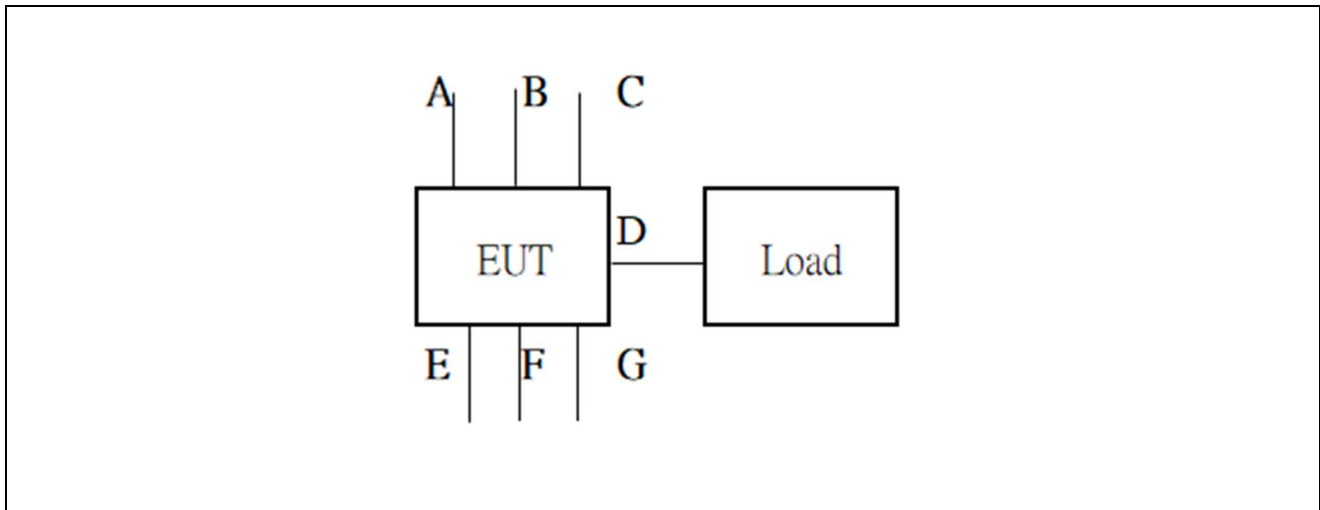
The EUT is an unique unit connected with other necessary accessories and support units listed in the next section. It has been tested against each standard after the following setup steps:

- Connect the Dummy Load to the EUT.
- Connect the EUT to the appropriate power source through power filter or other LISN in different site for each test item.
- Set the Dummy Load at the assigned condition.
- According to the setup methods designated by its manufacturer, set the EUT in the operating condition.
- Repeat and keep the setup steps listed above before and during all tests.



## 2.3 Layout of the Setup

EMI & EMS tests



The Support Units:

No	Link Peripheral	Manufacturer	Model No.	Description of connected
<b>For Local</b>				
1	AC POWER Cord	--	--	A, without shield cable Length 1.8 m
2	USB dummy cable	--	--	B, without shield cable Length 1 m
3	USB dummy cable	--	--	C, without shield cable Length 1.5 m
4	Light bulb	--	--	D, without shield cable Length 2 m
5	RJ45 dummy cable	--	--	E, without shield cable Length 1.8 m
6	RJ45 dummy cable	--	--	F, without shield cable Length 1.8 m
7	Data cable	--	--	G, without shield cable Length 2 m with core

The EUT connected description:



## 2.4 Test software

The EUT no needs to control by software.

## 2.5 Users Information requirements

The devices shall bear the following statements in a conspicuous location on the manuals for different category requirements:

C2 category:

**WARNING : This is a category C2 UPS product. In a residential environment, this product may cause radio interference, in which case the user may be required to take additional measures.**

C3 Category:

**WARNING: This is a product for commercial and industrial application in the second environment – installation restrictions or additional measures may be needed to prevent disturbances.**

## 2.6 Immunity Testing Performance Criteria Definition

	Criterion A	Criterion B
External and internal indications and metering	Change only during test	Change only during test
Control signals to external devices	No change	Change only temporarily in consistency with the actual UPS mode of operation
Mode of operation	No change	Change only temporarily
At all times, the UPS shall remain within the performance classification as declared by the UPS manufacturer (see IEC 62040-3:2011).		

## 2.7 General Information of Test

### Location of test laboratory

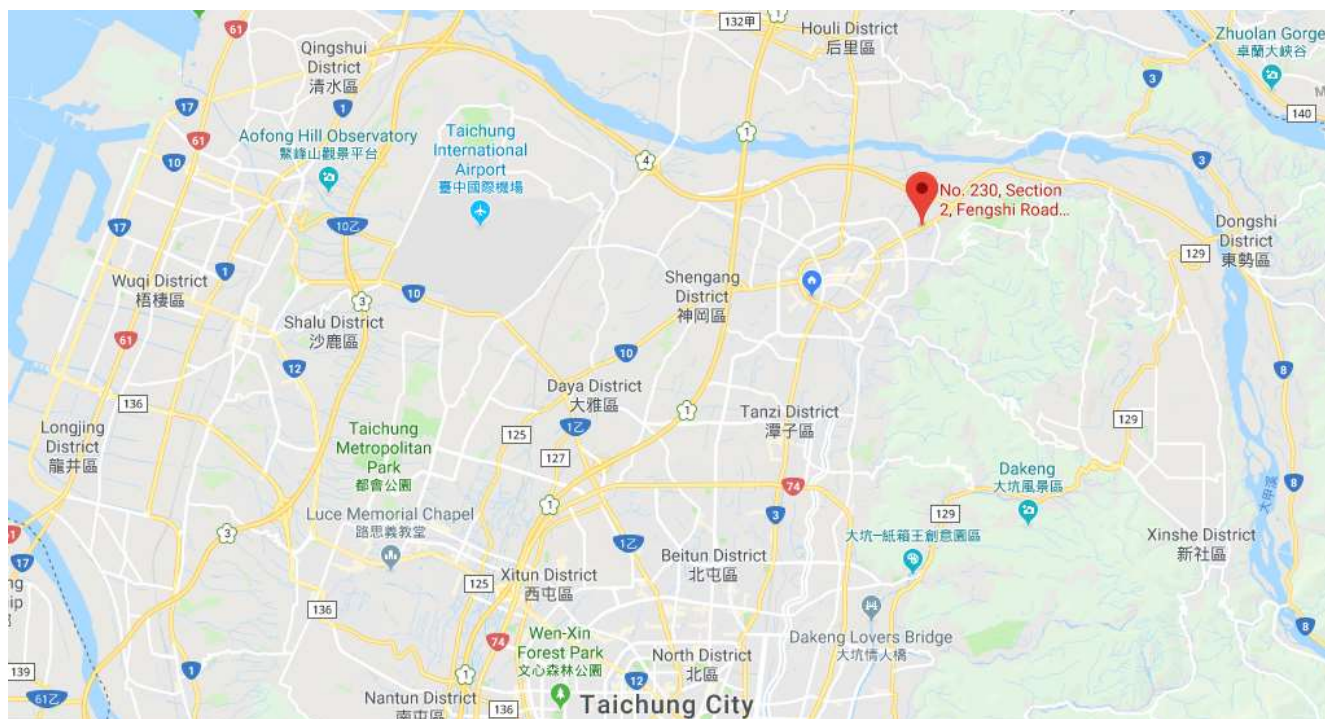
#### SERTC testing Laboratory

Address: No. 230, Sec. 2, Fengshi Rd., Fengyuan Dist., Taichung City 420, Taiwan, R.O.C.

Tel: +886-04-25253313

Fax: +886-04-25252320

The map shows location of the SERTC Testing Laboratory proximity to the Tai-Chung city as below:



## Test Facility

The test facility used for evaluating the conformance of the EUT with each standard in the present report meets what required in CISPR16-1-4,ANSI C63.4:2014+ANSI C63.4a:2017.

Test Room	Type of Test Room	Descriptions
CB1	3m semi-anechoic chamber	Complying with the NSA and the site VSWR requirements in documents CISPR 16-1-4 and ANSI C63.4:2014+ANSI C63.4a:2017, for the radiated emission measurements, and Radiated susceptibility test.
CB2	Shielding Room	For the conducted emission measurement.
TR1	Plane Grounding Site	For the conducted susceptibility test.
TR2	Plane Grounding Site	For the Current Harmonic / Voltage Flicker and other immunity tests.
TR3	Plane Grounding Site	For the Surge, Electrical fast transient and Power frequency magnetic field immunity test. Electrostatic discharge immunity test.
TR5	Plane Grounding Site	For the Surge, Electrical fast transient and Power frequency magnetic field immunity test. Electrostatic discharge immunity test.

### 3. Conducted Emission Measurement

#### 3.1 Limits for Emission Measurement

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 kHz and return leads of the EUT according to the methods defined in EN62040-2.

Limits of mains terminal interference voltage frequency range 0,15 MHz to 30 MHz for category C1 UPS and category C2 UPS equipment.

Frequency Range MHz	Limits dB(μV)			
	Category C1 UPS		Category C2 UPS	
	Quasi-peak	Average	Quasi-peak	Average
0,15 – 0,50	66 – 56 <sup>a</sup>	56 – 46 <sup>a</sup>	79	66
0,50 – 5 <sup>b</sup>	56	46	73	60
5 – 30	60	50	73	60
<sup>a</sup> The limit decreases linearly with the logarithm of the frequency.				
<sup>b</sup> The lower limit shall apply at the transition frequency.				

#### Network port limit

Frequency Range MHz	Limits dB(μV)			
	Category C1 UPS		Category C2 UPS	
	Quasi-peak	Average	Quasi-peak	Average
0,15 – 0,50	84 - 74 <sup>a</sup>	74 – 64 <sup>a</sup>	97 - 87	84 – 74
0,50 – 30	74	64	87	74
<sup>a</sup> The limit decreases linearly with the logarithm of the frequency.				

Limits of mains terminal interference voltage frequency range 0,15 MHz to 30 MHz for category C3 UPS equipment.

UPS rated output current  A	Frequency Range  MHz	Limits dB(μV)	
		Category C3 UPS	
		Quasi-peak	Average
>16 - 100	0,15 – 0,50 <sup>b</sup>	100	90
	0,50 – 5 <sup>b</sup>	86	76
	5 – 30	90 – 73 <sup>a</sup>	80 – 60 <sup>a</sup>
>100	0,15 – 0,50 <sup>b</sup>	130	120
	0,50 – 5 <sup>b</sup>	125	115
	5 – 30	115	105
<sup>a</sup> The limit decreases linearly with the logarithm of the frequency.			
<sup>b</sup> The lower limit shall apply at the transition frequency.			

### Network port

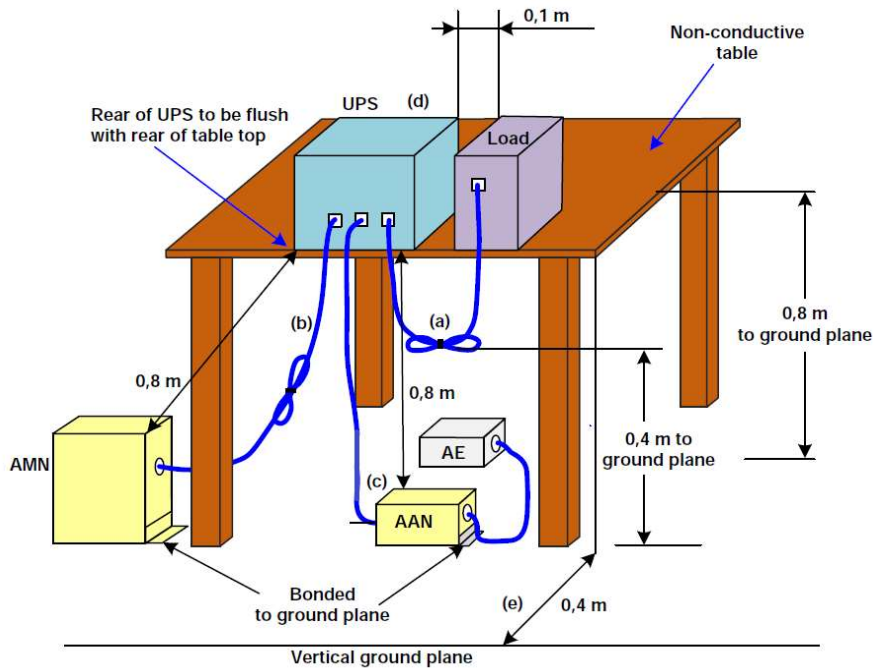
UPS rated output current  A	Frequency Range  MHz	Limits dB(μV)	
		Category C3 UPS	
		Quasi-peak	Average
>16 - 100	0,15 – 0,50	110 - 100 <sup>a</sup>	94 – 84 <sup>a</sup>
	0,50 – 30	100	84
>100	0,15 – 0,50	110 – 100 <sup>a</sup>	94 - 84 <sup>a</sup>
	0,50 – 30	100	84
<sup>a</sup> The limit decreases linearly with the logarithm of the frequency.			

### 3.2 Test Procedures

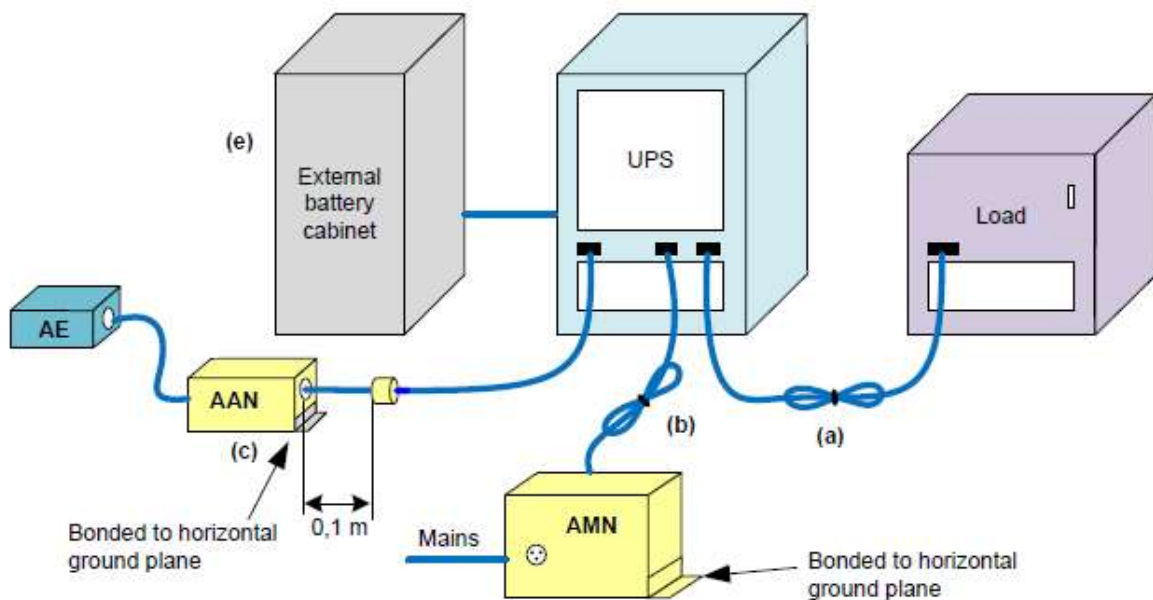
- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a wooden table with a height of 0.8 meters above the reference ground plane and 0.4 meters from the conducting wall of the shielded room. Also if the EUT is floor-standing equipment, it was placed on a non-conducted support with a height up to 0.15 meters above the reference ground plane.
- c. Connect the EUT's power source / telecommunication lines to the appropriate power mains / peripherals through the LISN / ISN.
- d. All the other peripherals are connected to the 2<sup>nd</sup> LISN, if any.
- e. The LISN / ISN was placed 0.8 meters from the EUT and at least 0.8 meters from other units and other metal planes.
- f. Measure the conducted emissions on each power line (Neutral Line and Line 1 – Hot side) of the EUT's power source by using the test receiver connected to the coupling RF output port of LISN.
- g. Rapidly scan the signal from 150kHz to 30MHz by using the receiver through the Maximum-Peak detector to determine those frequencies associated with higher emission levels for each measured line.
- h. Then measure the maximum level of conducted disturbance for each frequency found from step g. by using the receiver through the Quasi-Peak and Average detectors per CISPR 16-1.
- i. Record the level for each frequency and compare with the required limit.
- j. If required, measure the conducted emissions on telecommunication lines of EUT by using the test receiver connected to the coupling RF output port of ISN and repeat step g. to i.
- k. If the peak emission level is lower than the specified Average limit, then the emission values presented will be the peak value only. Otherwise, accurate Q.P. or Average values will be measured and presented.



## 3.3 Test Configurations

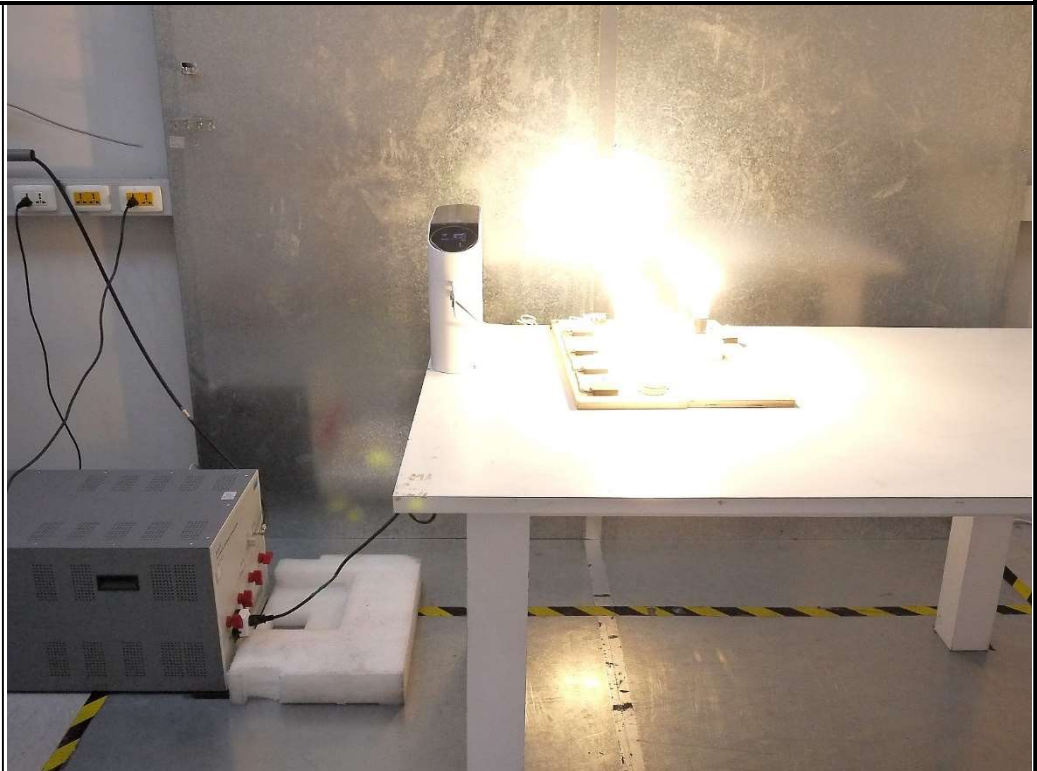
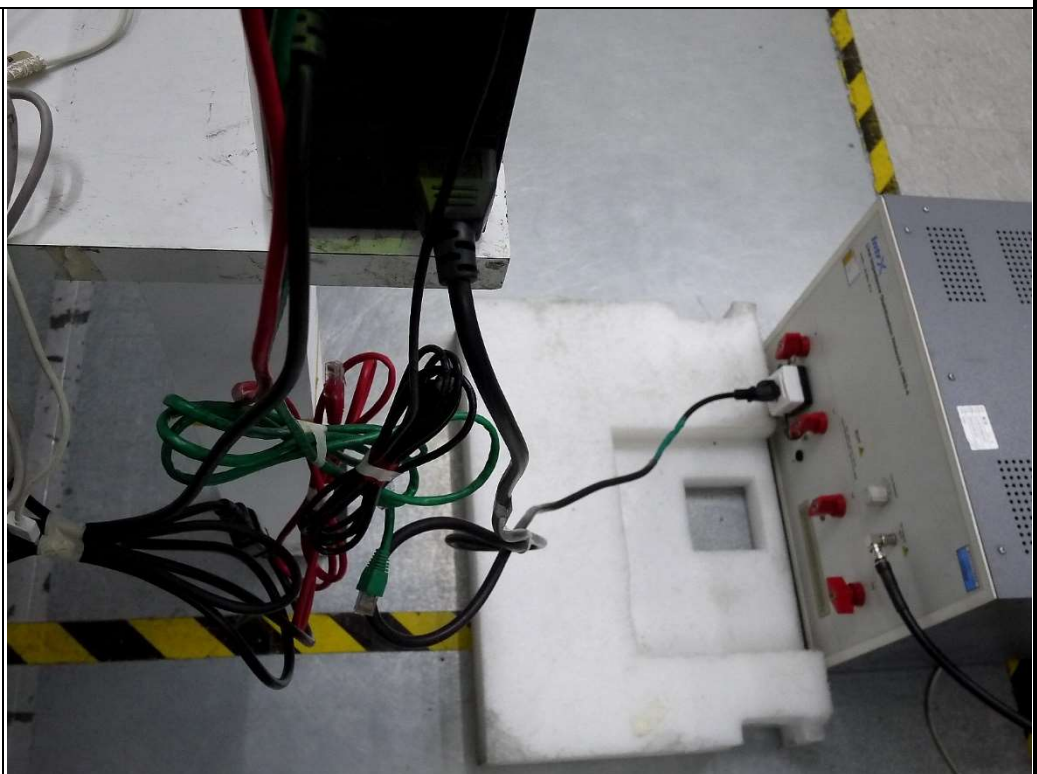


Example measurement arrange for table-top EUT



Example measurement arrange for floor stand EUT



**3.4 Photographs of the Test Configurations****View 1****View 2**

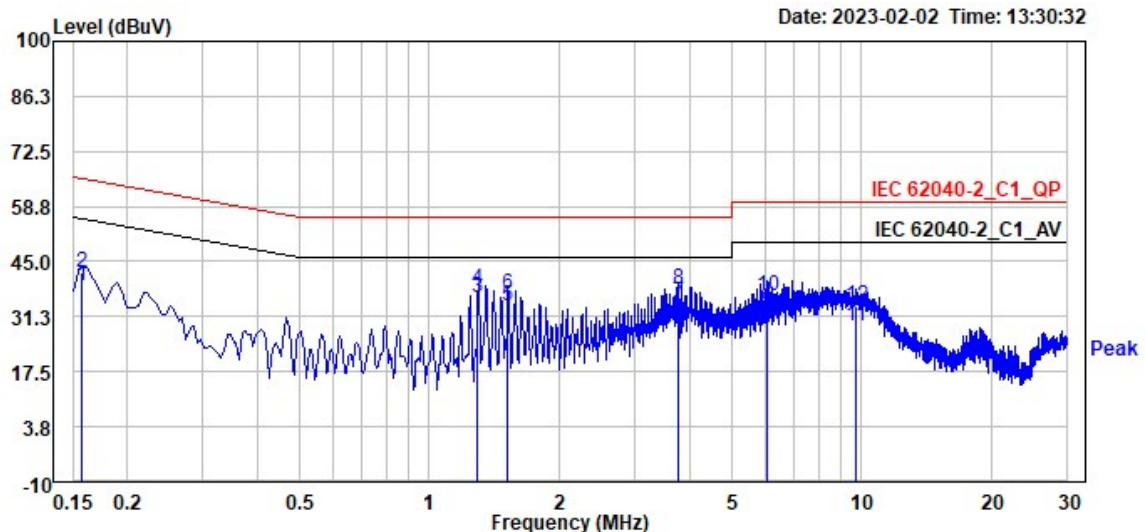
## 3.5 Test Results and data

### Conducted Emission for Power Port Test Data

Test Mode	Mode 1	Pol/Phase	Line1
Test Frequency	0.15MHz ~ 30MHz	Test Voltage	230Vac/50Hz
Test Date	Feb 2 ,2023	Test Engineer	David
Temperature	23 °C	Relative Humidity	56%

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed to meet both limits.

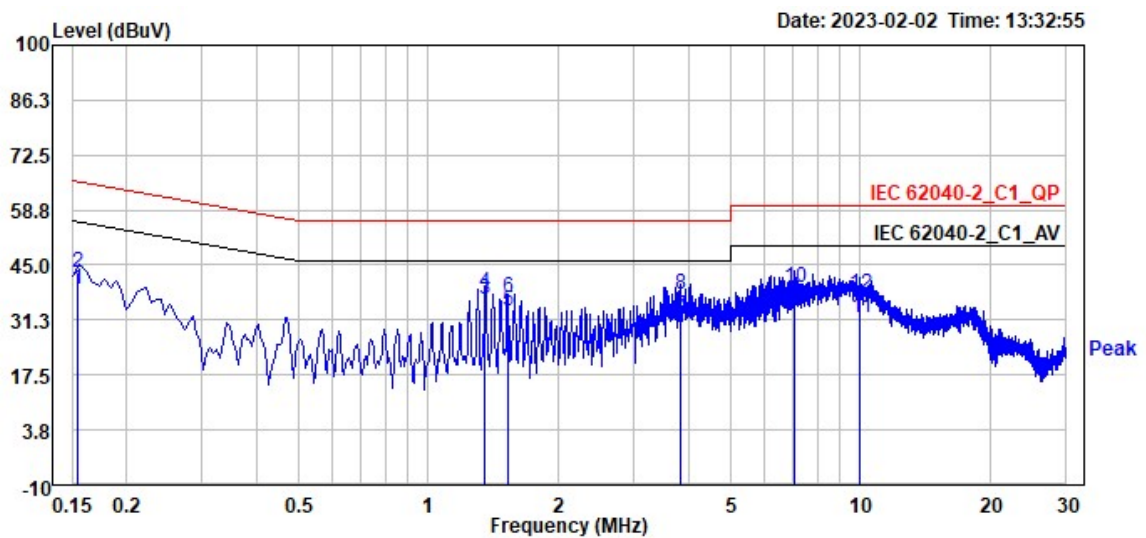


		Read		Limit	Over		
	Freq	Level	Factor	Level	Line	Limit	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	Remark
1	0.157	28.54	10.35	38.89	55.64	-16.75	line1
2	0.157	32.08	10.35	42.43	65.64	-23.21	line1
3 PP	1.298	25.54	10.39	35.93	46.00	-10.07	line1
4 QP	1.298	27.80	10.39	38.19	56.00	-17.81	line1
5	1.524	23.44	10.40	33.84	46.00	-12.16	line1
6	1.524	26.32	10.40	36.72	56.00	-19.28	line1
7	3.782	24.07	10.53	34.60	46.00	-11.40	line1
8	3.782	27.42	10.53	37.95	56.00	-18.05	line1
9	6.041	21.79	10.75	32.54	50.00	-17.46	line1
10	6.041	25.64	10.75	36.39	60.00	-23.61	line1
11	9.722	17.65	11.05	28.70	50.00	-21.30	line1
12	9.722	23.00	11.05	34.05	60.00	-25.95	line1

Test Mode	Mode 1	Pol/Phase	Neutral
Test Frequency	0.15MHz ~ 30MHz	Test Voltage	230Vac/50Hz
Test Date	Feb 2 ,2023	Test Engineer	David
Temperature	23 °C	Relative Humidity	56%

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed to meet both limits.



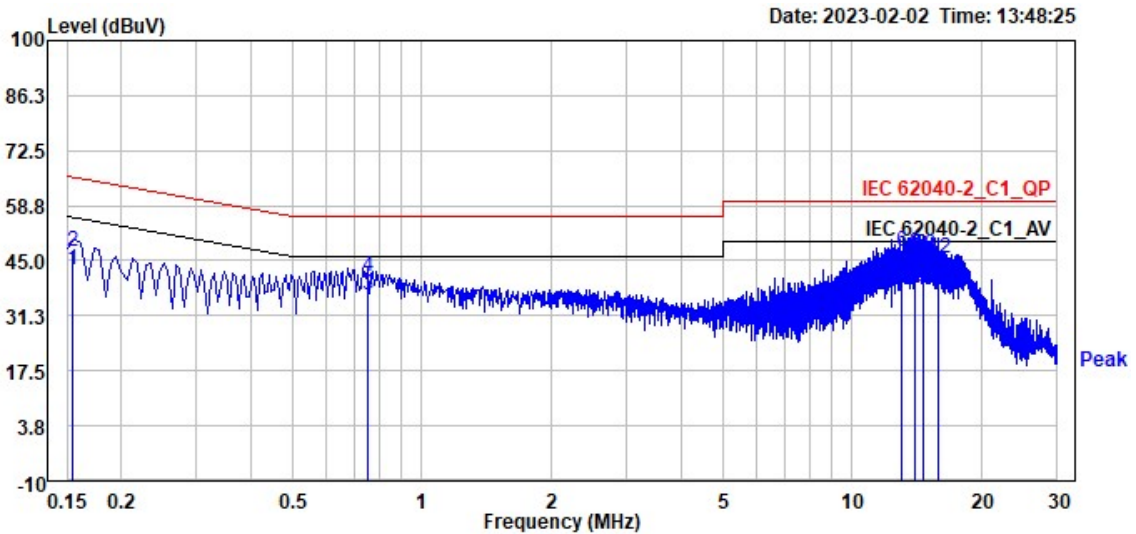
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.155	28.72	10.30	39.02	55.75	-16.73	neutral	Average
2	0.155	32.90	10.30	43.20	65.75	-22.55	neutral	QP
3 PP	1.355	26.20	10.37	36.57	46.00	-9.43	neutral	Average
4 QP	1.355	27.77	10.37	38.14	56.00	-17.86	neutral	QP
5	1.526	23.28	10.38	33.66	46.00	-12.34	neutral	Average
6	1.526	26.32	10.38	36.70	56.00	-19.30	neutral	QP
7	3.843	21.88	10.56	32.44	46.00	-13.56	neutral	Average
8	3.843	26.98	10.56	37.54	56.00	-18.46	neutral	QP
9	7.064	23.74	10.95	34.69	50.00	-15.31	neutral	Average
10	7.064	28.46	10.95	39.41	60.00	-20.59	neutral	QP
11	10.025	20.70	11.29	31.99	50.00	-18.01	neutral	Average
12	10.025	26.18	11.29	37.47	60.00	-22.53	neutral	QP



Test Mode	Mode 2	Pol/Phase	Line1
Test Frequency	0.15MHz ~ 30MHz	Test Voltage	24Vdc
Test Date	Feb 2 ,2023	Test Engineer	David
Temperature	23 °C	Relative Humidity	56%

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed to meet both limits.

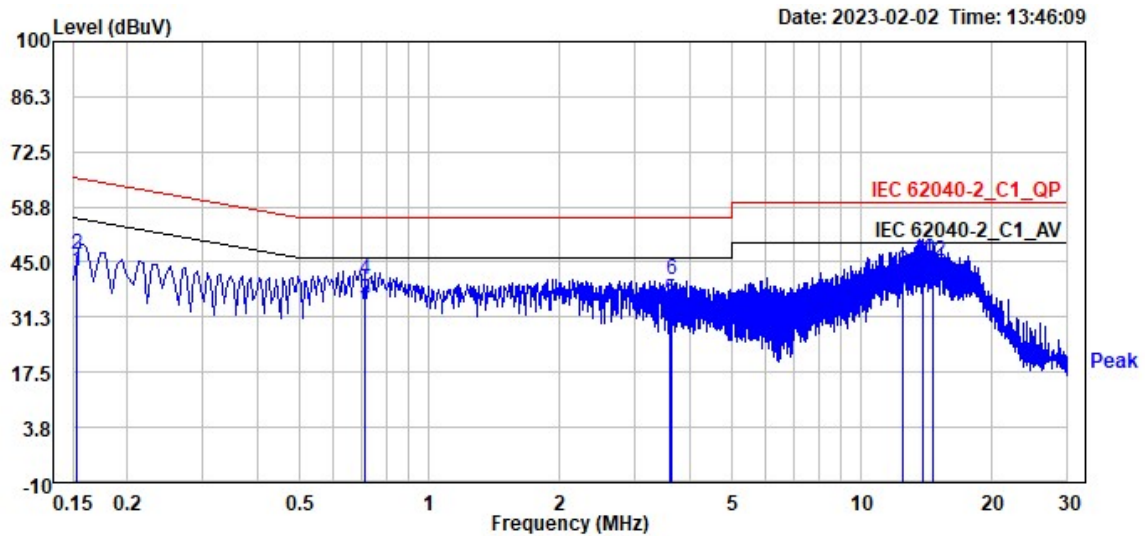


	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.154	32.49	10.35	42.84	55.78	-12.94	line1	Average
2	0.154	36.75	10.35	47.10	65.78	-18.68	line1	QP
3 PP	0.751	25.86	10.36	36.22	46.00	-9.78	line1	Average
4	0.751	30.66	10.36	41.02	56.00	-14.98	line1	QP
5	13.103	28.58	11.36	39.94	50.00	-10.06	line1	Average
6 QP	13.103	36.09	11.36	47.45	60.00	-12.55	line1	QP
7	14.019	27.98	11.45	39.43	50.00	-10.57	line1	Average
8	14.019	35.50	11.45	46.95	60.00	-13.05	line1	QP
9	14.633	26.60	11.51	38.11	50.00	-11.89	line1	Average
10	14.633	35.00	11.51	46.51	60.00	-13.49	line1	QP
11	15.866	25.61	11.62	37.23	50.00	-12.77	line1	Average
12	15.866	33.81	11.62	45.43	60.00	-14.57	line1	QP

Test Mode	Mode 2	Pol/Phase	Neutral
Test Frequency	0.15MHz ~ 30MHz	Test Voltage	24Vdc
Test Date	Feb 2 ,2023	Test Engineer	David
Temperature	23 °C	Relative Humidity	56%

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed to meet both limits.



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.153	32.48	10.30	42.78	55.84	-13.06	neutral	Average
2	0.153	36.57	10.30	46.87	65.84	-18.97	neutral	QP
3	0.713	25.12	10.32	35.44	46.00	-10.56	neutral	Average
4	0.713	30.25	10.32	40.57	56.00	-15.43	neutral	QP
5 PP	3.625	25.17	10.54	35.71	46.00	-10.29	neutral	Average
6 PK	3.636	30.23	10.54	40.77	56.00	-15.23	neutral	Peak
7	12.530	24.18	11.63	35.81	50.00	-14.19	neutral	Average
8	12.530	31.24	11.63	42.87	60.00	-17.13	neutral	QP
9	13.889	26.39	11.81	38.20	50.00	-11.80	neutral	Average
10 QP	13.889	33.78	11.81	45.59	60.00	-14.41	neutral	QP
11	14.615	25.27	11.91	37.18	50.00	-12.82	neutral	Average
12	14.615	33.23	11.91	45.14	60.00	-14.86	neutral	QP

## 4. Radiated Emission Measurement

### 4.1 Limits for Emission Measurement

The EUT shall meet the limits of below Table when measured at the measuring distance R in accordance with the methods described in EN 62040-2. If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the highest reading shall be recorded, with the exception of any brief isolated high reading, which shall be ignored.

#### Limits for radiated disturbances at a measuring distance of 10m

Frequency (MHz)	Category C1 UPS	Category C2 UPS	Category C3 UPS
	Quasi-peak (dB $\mu$ V/m)	Quasi-peak (dB $\mu$ V/m)	Quasi-peak (dB $\mu$ V/m)
30 to 230	30	40	50
230 to 1000	37	47	60

Note 1- The lower limit shall apply at the transition frequency.

Note 2- Additional provisions may be required for cases where interference occurs.

**NOTE 1** The test distance is 10 m. If the emission measurement at 10 m cannot be made because of high, ambient noise levels or for other reasons, measurements are made at a closer distance, for example 3 m. An inverse proportionality factor of 20 dB per decade is used to normalize the measured data to the specified distance for determining compliance.

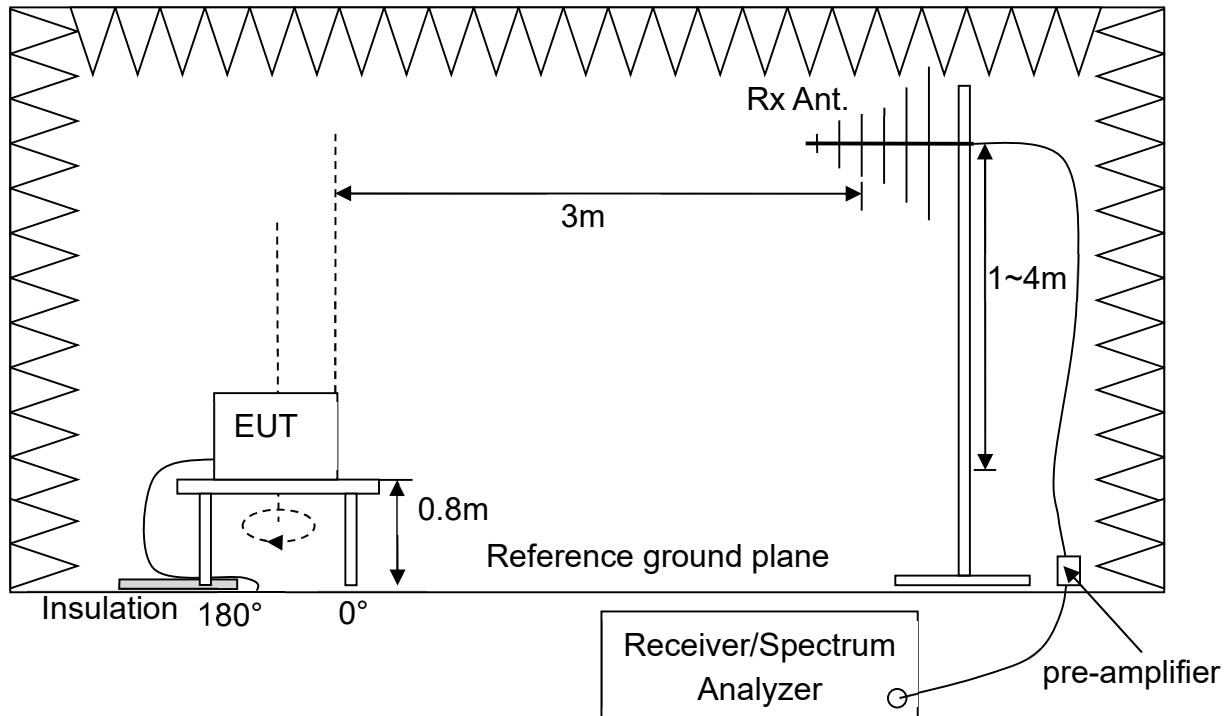
## 4.2 Test Procedures

### Below 1GHz measurement

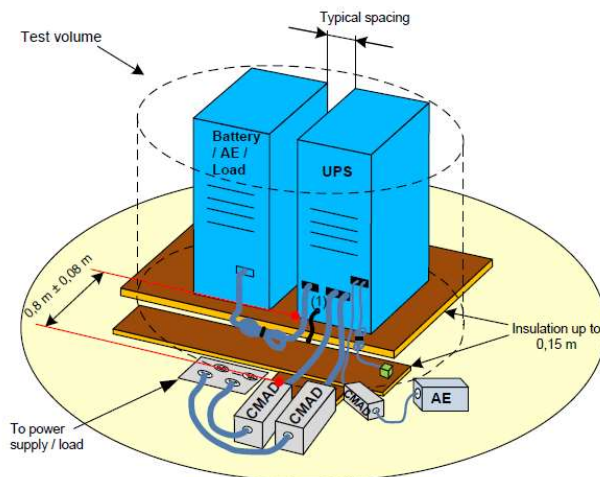
- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a rotatable table with a height of 0.8 meters above the reference ground plane and 3 meters away from the interference receiving antenna in the semi-anechoic chamber.
- c. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height up to 0.15 meters above the reference ground plane and 3 meters away from the interference-receiving antenna in the semi-anechoic chamber.
- d. Rapidly sweep the signal from 30MHz to 1GHz by using the spectrum through the Maximum-peak detector.
- e. Rotate the EUT from 0° to 360° and position the receiving antenna at heights from 1 to 4 meters above the reference ground plane continuously to determine at least three frequencies associated with higher emission levels and record them.
- f. Then measure each frequency found from step e. by using the spectrum with rotating the EUT and positioning the receiving antenna height to determine the maximum level.
- g. Finely tune the antenna and turntable around the recorded position of each frequency found from step f. by using the receiver through the Quasi-Peak detector per CISPR 16-1 to find out where the maximum level occurred.
- h. Record frequency, azimuth angle of the turntable, height, and polarization of the receiving antenna and compare the maximum level with the required limit.
- i. Change the receiving antenna to another polarization to measure radiated emission by following step d. to h. again.
- j. If the peak emission level measured from step e. is 4dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate Q.P. value will be measured and presented.

## 4.3 Test Configurations

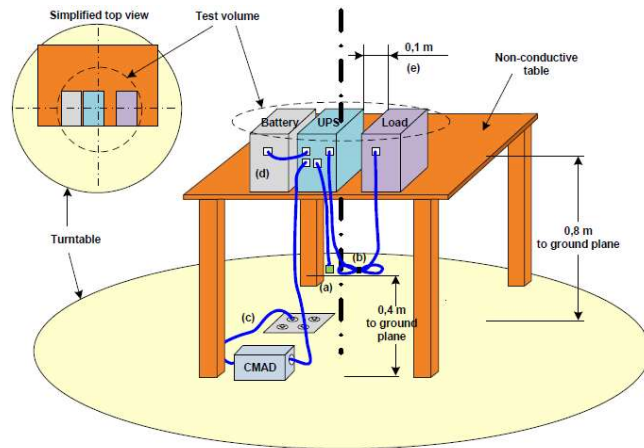
Below 1GHz measurement



Example measurement distance

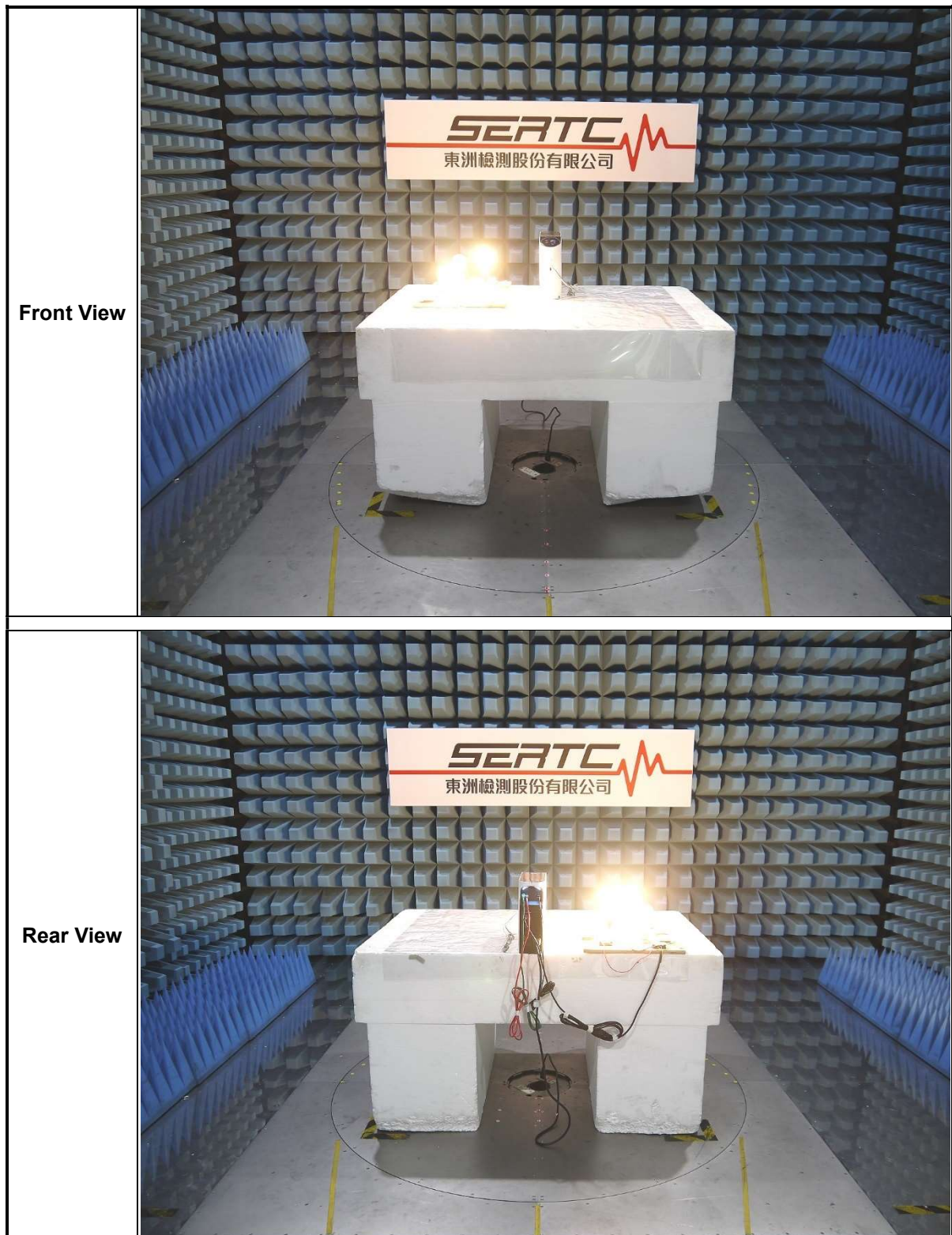






Example measurement arrange for floor stand and table top EUT

#### 4.4 Photographs of the Test Configurations(30M~1GHz)

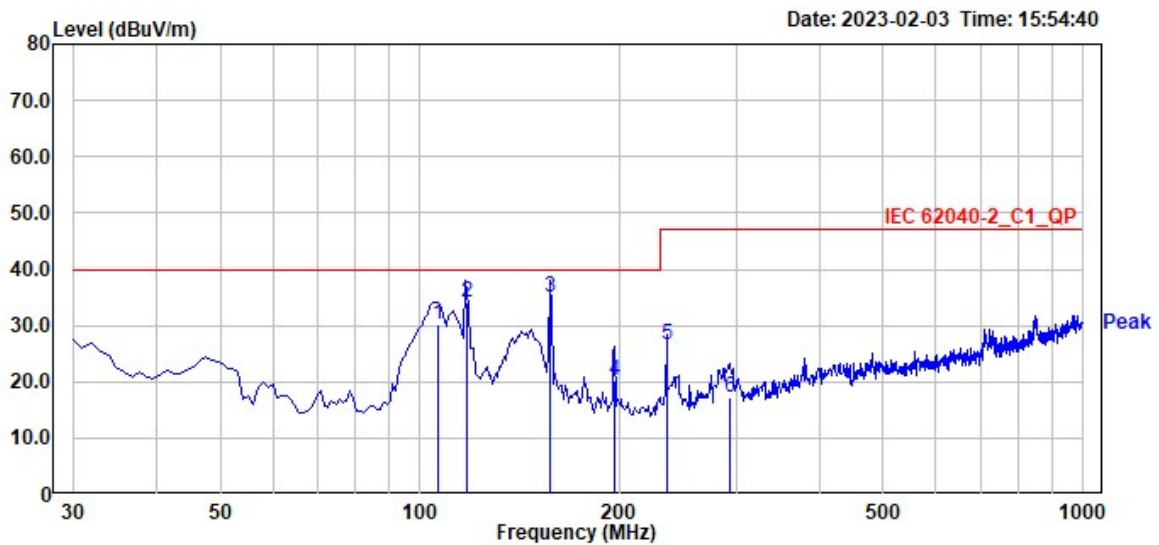


## 4.5 Test Results and data(30MHz~1GHz)

Test Mode	Mode 1	Pol/Phase	VERTICAL
Test Frequency	30MHz ~ 1GHz	Test Voltage	230Vac/50Hz
Test Date	Feb 3, 2023	Test Engineer	Dylan
Temperature	22 °C	Relative Humidity	44%

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.

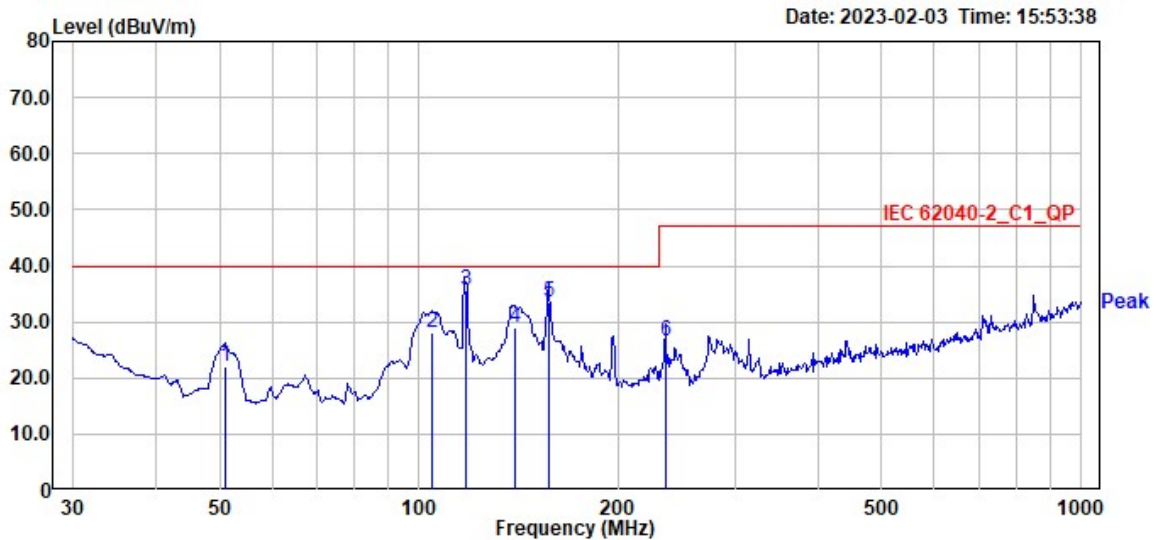


	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	106.630	44.14	-13.88	30.26	40.00	-9.74	vertical	QP
2	117.999	46.25	-12.20	34.05	40.00	-5.95	vertical	QP
3	157.410	48.41	-13.43	34.98	40.00	-5.02	vertical	QP
4	196.840	33.44	-13.21	20.23	40.00	-19.77	vertical	QP
5	235.640	40.37	-13.84	26.53	47.00	-20.47	vertical	QP
6	293.840	28.95	-11.77	17.18	47.00	-29.82	vertical	QP

Test Mode	Mode 1	Pol/Phase	HORIZONTAL
Test Frequency	30MHz ~ 1GHz	Test Voltage	230Vac/50Hz
Test Date	Feb 3, 2023	Test Engineer	Dylan
Temperature	22 °C	Relative Humidity	44%

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.



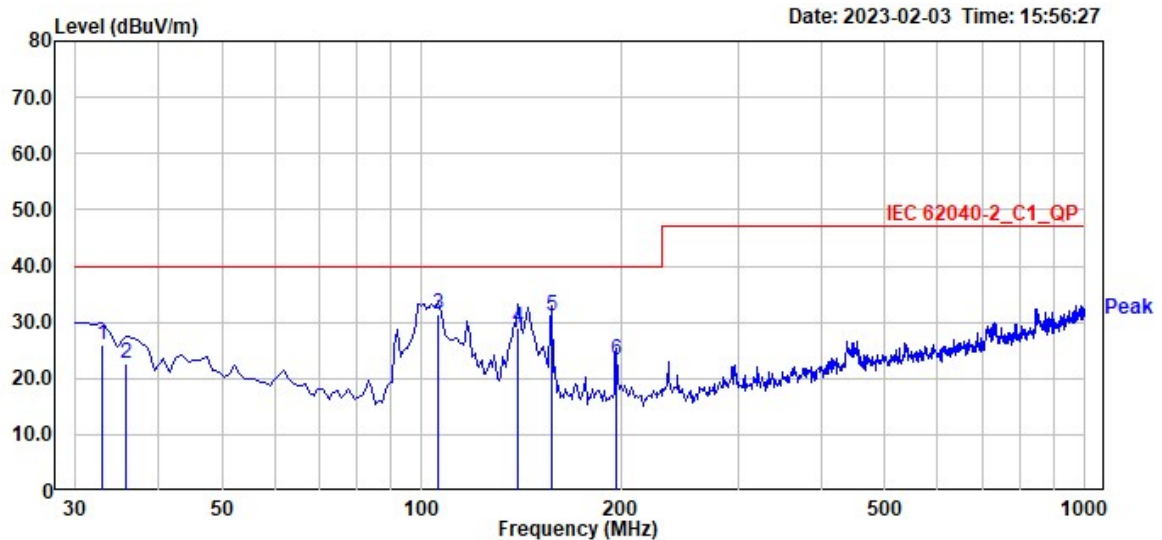
	Read Freq	Level	Factor	Level	Limit	Over	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	50.942	40.39	-18.25	22.14	40.00	-17.86	horizontal	QP
2	104.536	42.17	-14.22	27.95	40.00	-12.05	horizontal	QP
3	118.013	47.73	-12.20	35.53	40.00	-4.47	horizontal	QP
4	139.361	41.38	-12.54	28.84	40.00	-11.16	horizontal	QP
5	157.507	47.06	-13.42	33.64	40.00	-6.36	horizontal	QP
6	235.816	40.36	-13.83	26.53	47.00	-20.47	horizontal	QP



Test Mode	Mode 2	Pol/Phase	VERTICAL
Test Frequency	30MHz ~ 1GHz	Test Voltage	24Vdc
Test Date	Feb 3, 2023	Test Engineer	Dylan
Temperature	22 °C	Relative Humidity	44%

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.

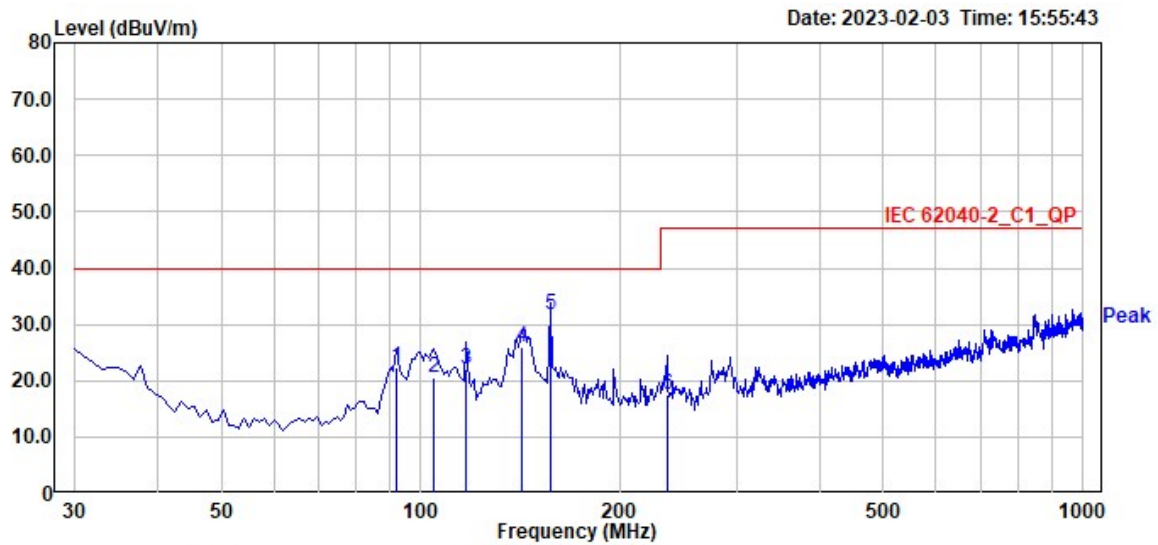


	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	32.910	32.98	-6.95	26.03	40.00	-13.97	VERTICAL	QP
2	35.820	31.78	-9.19	22.59	40.00	-17.41	VERTICAL	QP
3	105.660	45.48	-14.08	31.40	40.00	-8.60	VERTICAL	QP
4	139.610	41.70	-12.58	29.12	40.00	-10.88	VERTICAL	QP
5	157.070	44.48	-13.46	31.02	40.00	-8.98	VERTICAL	QP
6	196.840	36.48	-13.21	23.27	40.00	-16.73	VERTICAL	QP

Test Mode	Mode 2	Pol/Phase	HORIZONTAL
Test Frequency	30MHz ~ 1GHz	Test Voltage	24Vdc
Test Date	Feb 3, 2023	Test Engineer	Dylan
Temperature	22 °C	Relative Humidity	44%

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	92.080	40.21	-17.82	22.39	40.00	-17.61	HORIZONTAL	QP
2	104.690	34.70	-14.17	20.53	40.00	-19.47	HORIZONTAL	QP
3	117.300	34.28	-12.27	22.01	40.00	-17.99	HORIZONTAL	QP
4	142.520	38.87	-12.80	26.07	40.00	-13.93	HORIZONTAL	QP
5	157.070	45.25	-13.46	31.79	40.00	-8.21	HORIZONTAL	QP
6	235.640	31.39	-13.84	17.55	47.00	-29.45	HORIZONTAL	QP

## **5. Electrostatic Discharge (ESD) Immunity Test**

### **5.1 Specifications of Immunity Test Requirement**

- a. In the case of air discharge testing the climatic conditions shall be within the following ranges:
  - ambient temperature: 15°C to 35°C;
  - relative humidity : 30% to 60%;
  - atmospheric pressure : 86 KPa (860 mbar) to 106 KPa (1060 mbar).
- b. Test programs and software shall be chosen so as to exercise all normal modes of operation of the EUT. The use of special exercising software is encouraged, but permitted only where it can be shown that the EUT is being comprehensively exercised.
- c. The test voltage shall be increased from the minimum to the selected test severity level, in order to determine any threshold of failure. The final severity level should not exceed the product specification value in order to avoid damage to the equipment.
- d. The test shall be performed with both air discharge and contact discharge. On reselected points at least 10 single discharges (in the most sensitive polarity) shall be applied on air discharge. On reselected points at least 10 single discharges (in the most sensitive polarity) shall be applied on contact discharge.
- e. For the time interval between successive single discharges an initial value of one second is recommended. Longer intervals may be necessary to determine whether a system failure has occurred.
- f. In the case of contact discharges, the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.
- g. In the case of painted surface covering a conducting substrate, the following procedure shall be adopted :
  - If the coating is not declared to be an insulating coating by the equipment manufacturer, then the pointed tip of the generator shall penetrate the coating so as to make contact with the conducting substrate.
  - Coating declared as insulating by the manufacturer shall only be submitted to the air discharge.
  - The contact discharge test shall not be applied to such surfaces.
- h. In the case of air discharges, the round discharge tip of the discharge electrode shall be approached as fast as possible (without causing mechanical damage) to touch the EUT . After each discharge, the ESD generator (discharge electrode) shall be removed from the EUT. The generator is then retriggered for a new single discharge. This procedure shall be repeated until the discharges are completed. In the case of an air discharge test, the discharge switch, which is used for contact discharge, shall be closed.

**5.2 Test Severity Levels**

Contact Discharge		Air Discharge	
Level	Test Voltage (KV) of Contact discharge	Level	Test Voltage (KV) of Air Discharge
1	±2	1	±2
2	±4	2	±4
3	±6	3	±8
4	±8	4	±15
X	Specified	X	Specified
Remark: "X" is an open level.			

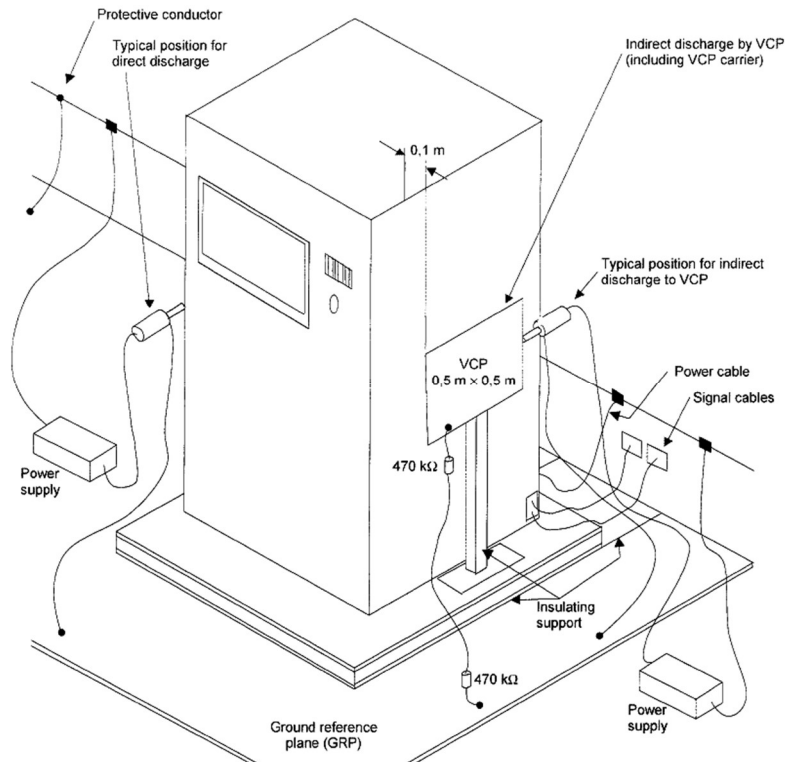


### 5.3 Test Procedures

- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a wooden table with a height of 0.8 meters above the ground reference plane in the shielded room. Also a HCP (Horizontal Coupling Plane) which was connected to the ground reference plane via a cable with a 470k $\Omega$  resistor located at each end was placed on the wooden table and isolated with the EUT by an insulating support 0.5mm thick. The ground reference plane shall project beyond the EUT or HCP by at least 0.5m on all sides.
- c. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 0.1 meters above the ground reference plane in the shielded room. The ground reference plane shall project beyond the EUT by at least 0.5m on all sides.
- d. Keep the EUT 1m away from all other metallic walls in the shielded room as the minimum distance.
- e. The static electricity discharges shall be applied only to those points and surfaces of the EUT which are accessible to persons during normal use. Contact discharge is the preferred test method and it is applied to the conductive surfaces of EUT and coupling planes. Air discharge shall be used where contact discharge cannot be performed and it is applied to the insulating surfaces of EUT.
- f. The discharge return cable of the generator shall be kept at a distance of at least 0.2m from the EUT whilst the discharge is being applied.
- g. The time interval between successive single discharges was at least 1 second.
- h. Select appropriate points of the EUT for contact discharge and put marks on it to indicate the tested point(s). Then start the contact discharge with the tip of the discharge electrode to touch the EUT before the discharge switch is operated.
- i. Use the round discharge tip of the discharge electrode to scan the EUT to select the points for air discharge. Then start the air discharge by approaching the discharge electrode as fast as possible to touch the EUT. After each discharge, the ESD generator shall be removed from the EUT.
- j. The indirect HCP discharge test is applied at the front edge of each HCP opposite the center point of each unit of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.

- k. The indirect VCP (Vertical Coupling Plane) discharge test is applied to the center of one vertical edge of the coupling plane. The VCP, of dimensions 0.5m×0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. It shall be applied with sufficient different positions such that the four faces of the EUT are completely illuminated.

## 5.4 Test Configurations



## 5.5 Photographs of the Test Configurations



## 5.6 Test Results

Test Mode	Mode 1	Final Test Result	Pass
Test Date	Feb 3, 2023	Test Engineer	David
Temperature	24 °C	Relative Humidity	51 %
Atmospheric Pressure	997.5 hPa		

Pass performance criteria	A
Required performance criteria	B
Basic Standard	IEC 61000-4-2
Product Standard	EN IEC 62040-2
Test Voltage	±2 / ±4 / ±8 KV for air discharge, ±2 / ±4 / ±6 KV for contact discharge

		Contact Discharge							
		10 times / each							
Voltage		2 KV		4 KV		6 KV		8 KV	
No\ Point\ Polarity		+	—	+	—	+	—	+	—
	VCP Front	---	---	A	A	---	---	A	A
	VCP Right	---	---	A	A	---	---	A	A
	VCP Left	---	---	A	A	---	---	A	A
	VCP Rear	---	---	A	A	---	---	A	A
	HCP Front	---	---	A	A	---	---	A	A
	HCP Right	---	---	A	A	---	---	A	A
	HCP Left	---	---	A	A	---	---	A	A
	HCP Rear	---	---	A	A	---	---	A	A
A	Screw	---	---	A	A	---	---	A	A
B	USB	---	---	B	B	---	---	B	B

Note: "A" means the EUT function is normal working during the test.

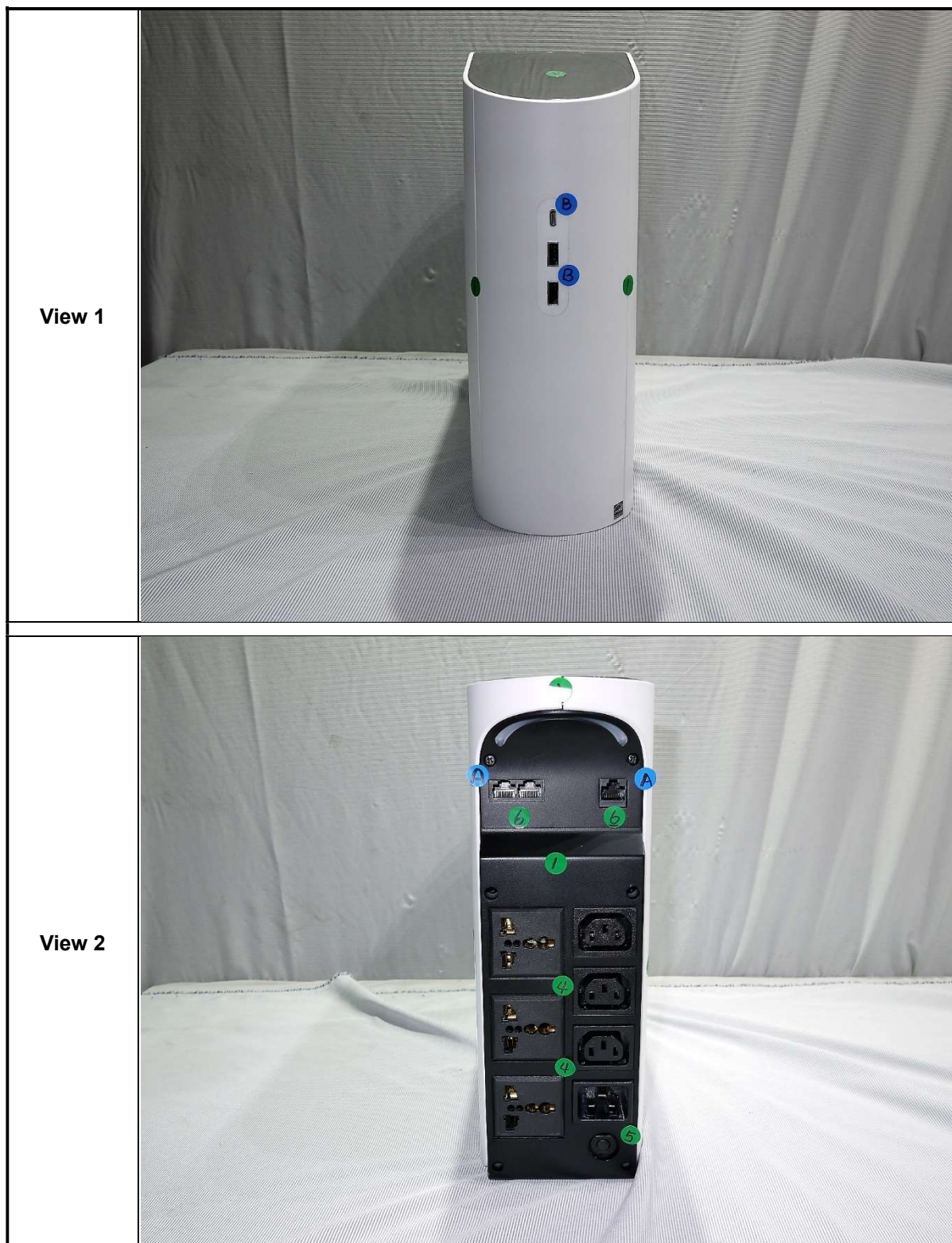
		AIR Discharge							
		10 times / each							
Voltage		2 KV		4 KV		8 KV		10 KV	
No\Point\Polarity		+	—	+	—	+	—	+	—
1	Enclosure	A	A	A	A	A	A	A	A
2	Panel	A	A	A	A	A	A	A	A
3	Button	A	A	A	A	A	A	A	A
4	AC output	A	A	A	A	A	A	A	A
5	Power input	A	A	A	A	A	A	A	A
6	RJ 45 port	A	A	A	A	A	A	B	B

Note: "A" means the EUT function is normal working during the test.

## Observation of Performance during Test

- (1) Normal operation condition specified by manufacturer during the test.
- (2) During testing air discharge 10kV at Point 6 cause EUT status change from AC mode to DC mode and LED turn off, it can auto recovery after test, it judges criteria B.

## 5.7 Photographs of the Test Points on the EUT for ESD Test





**View 3**



**View 4**



**View 5**



## 6. Radiated Electromagnetic Field (RS) Immunity Test

### 6.1 Test Requirement

- a. The equipment to be tested is placed in the center of the enclosure on a wooden table. The equipment is then connected to power and signal leads according to pertinent installation instructions.
- b. The antenna which is enabling the complete frequency range of 80-1000 MHz is placed 2m away from the equipment. The required field strength is determined by placing the field strength meter(s) on top of or directly alongside the equipment under test and monitoring the field strength meter via a remote field strength indicator outside the enclosure while adjusting the continuous-wave to the applicable antennae.
- c. The test is normally performed with the antenna facing the most sensitive side of the EUT. The polarization of the field generated by the bucolical antenna necessitates testing each position twice, once with the antenna positioned vertically and again with the antenna positioned horizontally. The circular polarization of the field from the log-spiral antenna makes a change of position of the antenna unnecessary.
- d. At each of the above conditions, the frequency range is swept 80-1000 MHz, pausing to adjust the R.F. signal level or to switch oscillators and antenna. The rate of sweep is in the order of  $1.5 \times 10^{-3}$  decades/s. The sensitive frequencies or frequencies of dominant interest may be discretely analyzed.

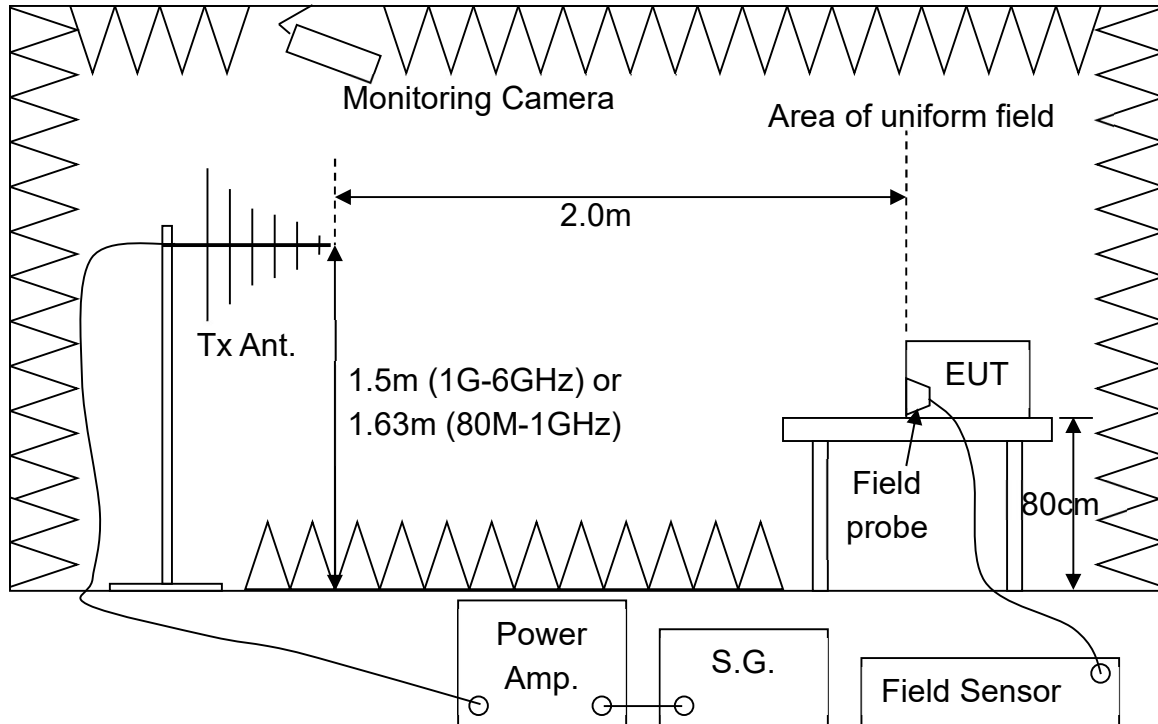
### 6.2 Test Severity Level

Frequency Band : 80-6000 MHz	
Level	Test field strength (V/m)
1	1
2	3
3	10
X	Specified
Remark: "X" is an open class.	

### 6.3 Test Procedures

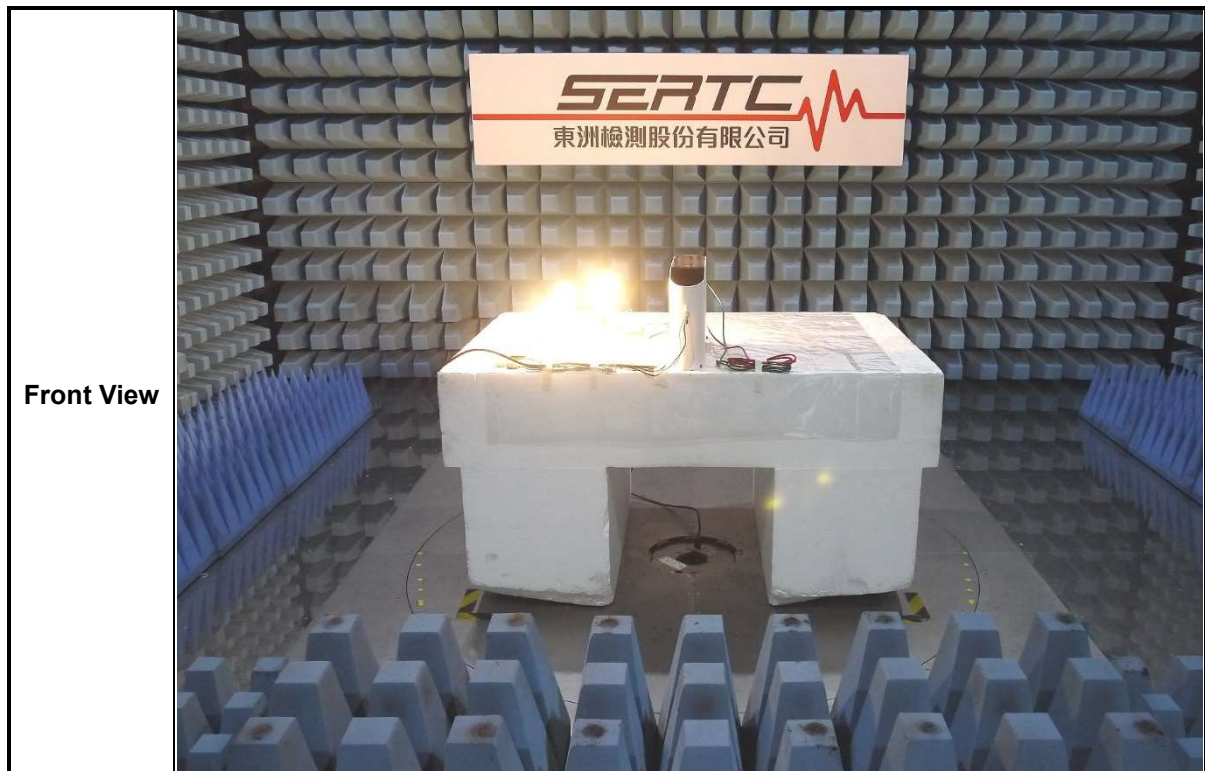
- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a wooden table with a height of 0.8 meters and 2 meters away from the transmitting antenna in the fully anechoic chamber.
- c. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 0.1 meters and 2 meters away from the transmitting antenna in the fully anechoic chamber. Also if the floor-standing equipment which is capable of being stood on a non-conducting 0.8m high platform may be so arranged.
- d. All EUT's individual faces shall be fully enclosed by the "uniform area" and its wires shall be arranged parallel to the uniform area of the field.
- e. Before testing the EUT, the intensity of the established field strength is checked by placing the field sensor at a calibration grid point to give the calibrated field strength to measure the EUT.
- f. After the calibration has been verified, the test field can be generated using the values obtained from the calibration.
- g. Perform the test with the specified immunity level in the test frequency range and with the specified modulation type.
- h. The transmitting antenna is normally facing each of the four sides of the EUT with two polarizations (Vertical and Horizontal) to perform the test.
- i. The dwell time at each frequency shall be not less than the time necessary for the EUT to be exercised and be able to respond.
- j. The sensitive frequencies of EUT shall be analyzed separately, if any.
- k. Record the performance of the EUT.

## 6.4 Test Configurations



If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 0.1 meters

## 6.5 Photographs of the Test configurations



## 6.6 Test Result and Data

<b>Test Mode</b>	Mode 1	<b>Final Test Result</b>	Pass
<b>Test Date</b>	Feb 7, 2023	<b>Test Engineer</b>	Dylan
<b>Temperature</b>	21 °C	<b>Relative Humidity</b>	58 %
<b>Atmospheric Pressure</b>	993.2 hPa		

<b>Pass performance criteria</b>	A
<b>Required performance criteria</b>	A
<b>Basic Standard</b>	IEC 61000-4-3
<b>Product Standard</b>	EN IEC 62040-2
<b>Frequency Range</b>	80~1000 MHz
<b>Modulation</b>	AM 80% , 1KHz sine wave
<b>Dwell time</b>	3 S
<b>Frequency Step Size</b>	1 %

<b>Frequency (MHz)</b>	<b>Antenna Polarization</b>	<b>Face</b>	<b>Field strength (V/m)</b>	<b>Result</b>
80~1000	Vertical	Front	3	A
80~1000	Vertical	Rear	3	A
80~1000	Vertical	Left	3	A
80~1000	Vertical	Right	3	A
80~1000	Horizontal	Front	3	A
80~1000	Horizontal	Rear	3	A
80~1000	Horizontal	Left	3	A
80~1000	Horizontal	Right	3	A

Note: "A" means the EUT function is normal working during the test.

## Observation of Performance during Test

(1) Normal operation condition specified by manufacturer during the test.

## **7. Electrical fast transient / burst (EFT) Immunity Test**

### **7.1 Test Procedure**

- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a non-conducted support with a height 0.1 meters above the ground reference plane. Also the ground reference plane is placed on a wooden table with a height of 0.8 meters in the shielded room. The ground reference plane shall project beyond the EUT by at least 0.1m on all sides.
- c. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 0.1 meters above the ground reference plane in the shielded room. The ground reference plane shall project beyond the EUT by at least 0.1m on all sides.
- d. The test generator and the coupling/decoupling network shall be placed directly on, and bonded to, the ground reference plane.
- e. All cables to the EUT shall be placed on the insulation support 0.1 m above the ground reference plane. Cables not subject to electrical fast transients shall be routed as far as possible from the cable under test to minimize the coupling between the cables.
- f. Keep the EUT 0.5m away from all other conductive structures, except the ground reference plane beneath the EUT as the minimum distance. Also if any, the minimum distance between the coupling clamp and all other conductive structures, except the ground reference plane beneath the coupling clamp and EUT shall be 0.5m.
- g. Keep the length of the power and signal lines, if required, between the coupling device and the EUT to be 0.5m. If a non-detachable supply cable more than 0.5m long, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0,1 m above the ground reference plane.
- h. Connect the EUT's power source to the appropriate power through the coupling devices and perform the specified test level.
- i. If any, connect all the I/O signal, data and control lines between EUT and accessories/support units through the coupling devices and perform the specified test level.
- j. Record the performance of the EUT.

## 7.2 Test Severity Levels

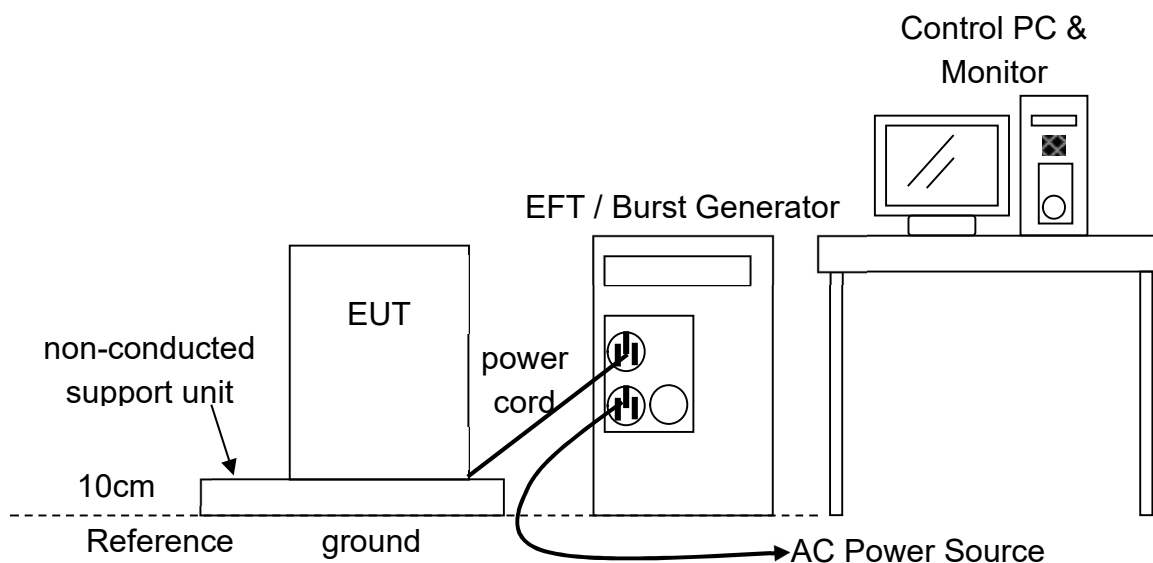
The following test severity levels are recommended for the fast transient/burst test :

Open circuit output test voltage $\pm 10\%$		
Level	On Power Supply	On I/O signal, data and control line
1	0.5 KV	0.25 KV
2	1.0 KV	0.50 KV
3	2.0 KV	1.00 KV
4	4.0 KV	2.00 KV
X	Specified	Specified

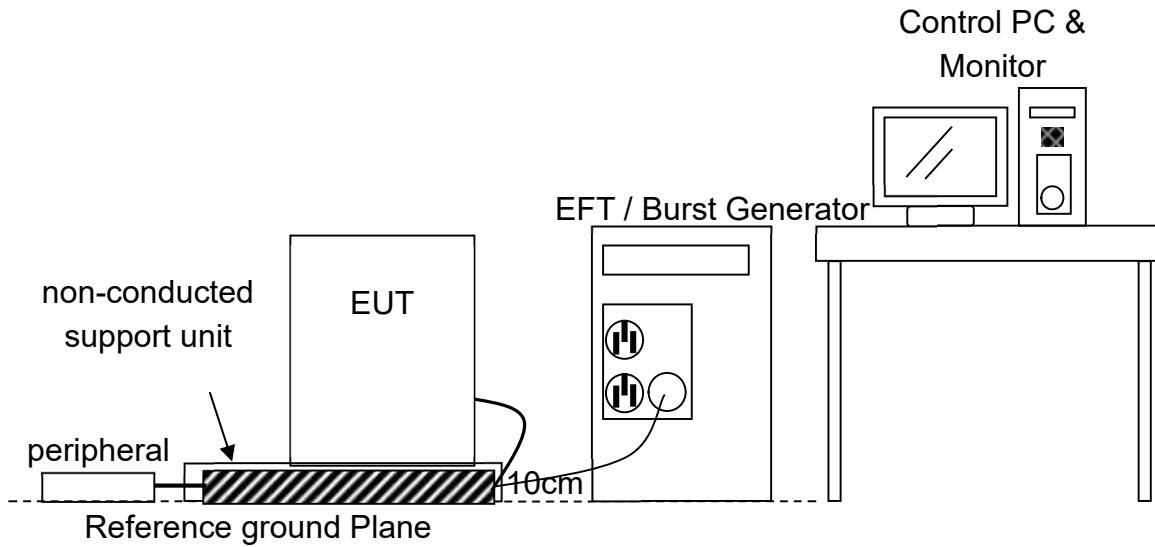
Remark : “ X ” is an open level. The level is subject to negotiation between the user and manufacturer or is specified by the manufacturer.

## 7.3 Test Configurations

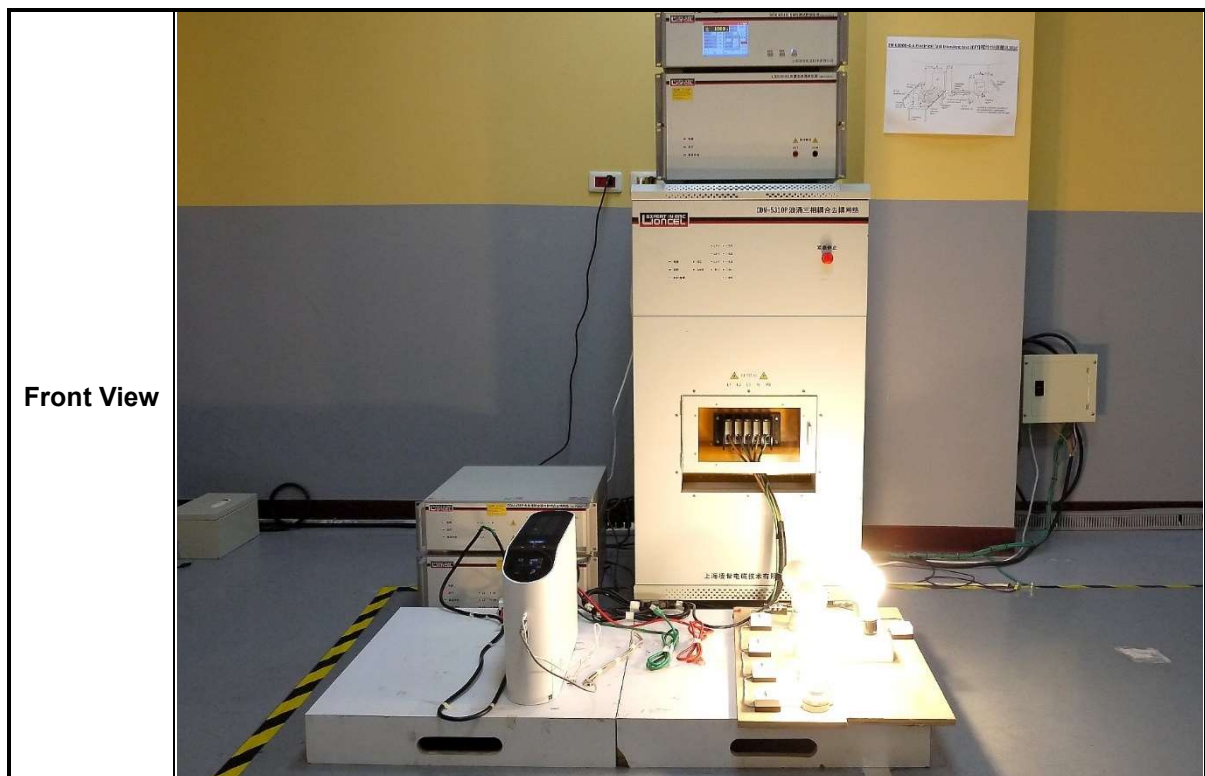
### Power supply port Test



## I/O signal, data and control port Test (if any)



## 7.4 Photographs of the Test Configurations





## 7.5 Test Result and Data

Test Mode	Mode 1	Final Test Result	Pass
Test Date	Feb 3, 2023	Test Engineer	Dylan
Temperature	24 °C	Relative Humidity	51 %
Atmospheric Pressure	997.5 hPa		

Pass performance criteria	A
Required performance criteria	B
Basic Standard	IEC 61000-4-4
Product Standard	EN IEC 62040-2
Test Voltage	On AC input power port - $\pm 4.0\text{KV}$ (customer's requirement) On AC output power port - $\pm 4.0\text{KV}$ (customer's requirement)
Pulse	5/50 ns
Burst	15m/300ms
Repetition Rate	5 kHz
Test time	1 min/each condition

Phase	For AC input power port					
	<u>2 kV</u>		<u>4 kV</u>		<u> kV</u>	
	+	—	+	—	+	—
L1	-	-	A	A		
N	-	-	A	A		
PE	-	-	A	A		
L1-N	-	-	A	A		
L1-PE	-	-	A	A		
N-PE	-	-	A	A		
L1-N-PE	-	-	A	A		

Phase	For AC output power port					
	<u>2 kV</u>		<u>4 kV</u>		<u> kV</u>	
	+	—	+	—	+	—
L1	-	-	A	A		
N	-	-	A	A		
PE	-	-	A	A		
L1-N	-	-	A	A		
L1-PE	-	-	A	A		
N-PE	-	-	A	A		
L1-N-PE	-	-	A	A		

Note: "A" means the EUT function is normal working during the test.

### **Observation of Performance during Test**

(1) Normal operation condition specified by manufacturer during the test.

## **8. Surge Immunity Test**

### **8.1 Test Procedure**

- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a wooden table with a height of 0.8 meters in the shielded room.
- c. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 0.1 meters above the ground reference plane in the shielded room.
- d. For the surge test applied to EUT's power supply and unshielded unsymmetrical interconnection lines, if required, the capacitive coupling network are used.
- e. If any, the surge test applied to the unshielded symmetrically interconnection lines of EUT, the gas arrestors coupling network are used.
- f. Keep the interconnection line, if required, or power cord between the EUT or its power source and the coupling / decoupling network to be 2m in length (or shorter).
- g. The surges have to be applied synchronized to the voltage phase at the zero-crossing and the peak value of the a.c. voltage wave (positive and negative).
- h. All lower levels including the selected test level shall be satisfied and the test voltage has to be increased by steps up to the specified test level.
- i. Connect the EUT's power source to the appropriate power through the coupling devices and perform the specified test level.
- j. If any, connect all the interconnection lines between EUT and accessories/support units through the coupling devices and perform the specified test level.
- k. Record the performance of the EUT.

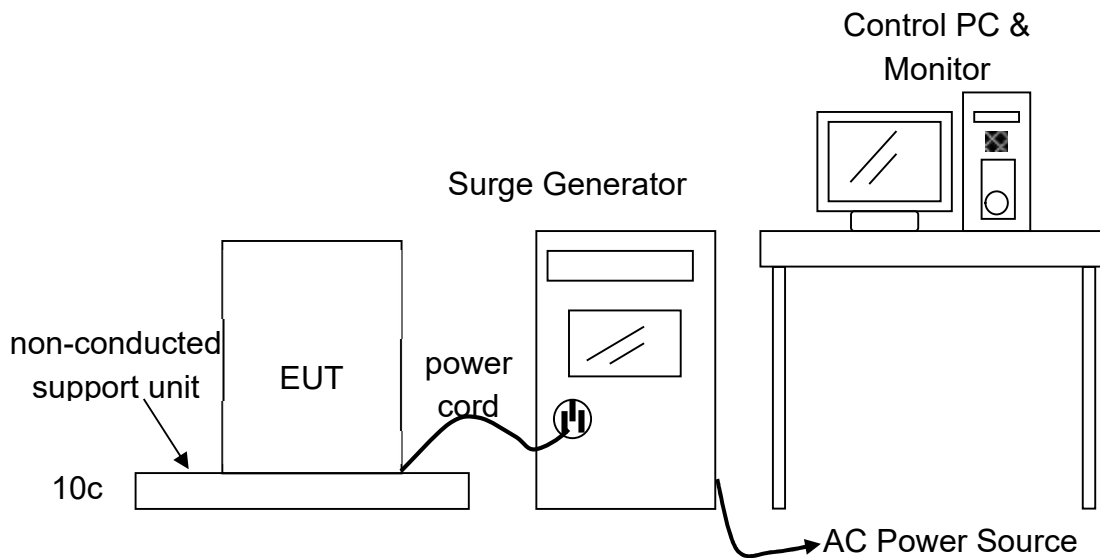
## 8.2 Test Severity Level

Level	Open-circuit test voltage (kV)	
	Line-to-line	Line-to-ground <sup>b</sup>
1	---	0.5
2	0.5	1.0
3	1.0	2.0
4	2.0	4.0
X <sup>a</sup>	Special	Special

<sup>a</sup> "X" can be any level, above, below or in between the others. The level shall be specified in the dedicated equipment specification.

<sup>b</sup> For symmetrical interconnection lines the test can be applied to multiple lines simultaneously with respect to ground, i.e. "lines to ground".

## 8.3 Test Configurations



#### 8.4 Photographs of the Test Configurations



## 8.5 Test Result and Data

<b>Test Mode</b>	Mode 1	<b>Final Test Result</b>	Pass
<b>Test Date</b>	Mar 9 ,2023	<b>Test Engineer</b>	David
<b>Temperature</b>	23 °C	<b>Relative Humidity</b>	50%
<b>Atmospheric Pressure</b>	1017 hPa		

<b>Pass performance criteria</b>	A
<b>Required performance criteria</b>	B for Power Port
<b>Basic Standard</b>	IEC 61000-4-5
<b>Product Standard</b>	EN IEC 62040-2
<b>Test Voltage</b>	On AC input power port --±6kV (Customer's requirement)
<b>Waveform</b>	On Power Supply --1.2/50µs(8/20µs)
<b>Repetition rate</b>	60 sec
<b>Test time</b>	5 time/each condition

For AC input power port						
Voltage	Phase	Polarity	0°	90°	180°	270°
6.0kV	L1-N	+	A	A	A	A
		—	A	A	A	A
		—	A	A	A	A
6.0kV	L1-PE	+	A	A	A	A
		—	A	A	A	A
6.0kV	N-PE	+	A	A	A	A
		—	A	A	A	A

Note: "A" means the EUT function is normal working during the test.

"B" means the following description:

\*Coupling using capacitors maintains waveform integrity, but may have filtering effects on fast.

\*Test method reported herein was performed according to the method specified by applicant.

## Observation of Performance during Test

(1) Normal operation condition specified by manufacturer during the test.



## **9. Conducted disturbances (CS) Immunity Test**

### **9.1 Test Procedure**

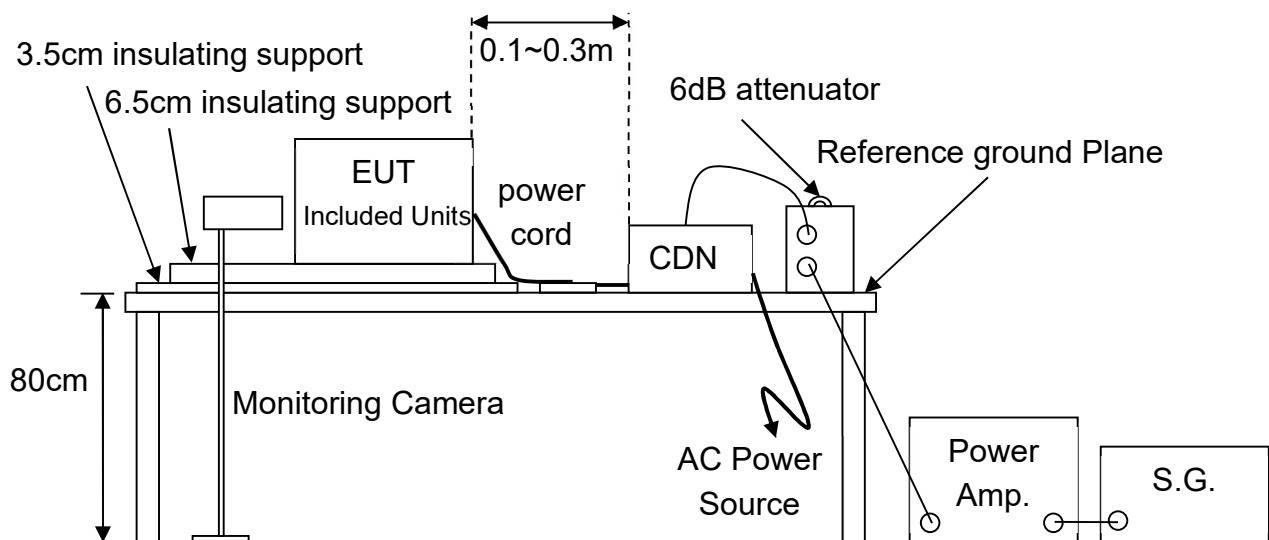
- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a non-conducted support with a height 0.1 meters above the ground reference plane. Also the ground reference plane is placed on a wooden table with a height of 0.8 meters in the shielded room.
- c. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 0.1 meters above the ground reference plane in the shielded room.
- d. Decide the injection methods and test points according to the relative standard.
- e. All relevant cables shall be provide with the appropriate coupling and decoupling devices at a distance between 0.1m and 0.3m from the projected geometry of the EUT on the ground reference plane.
- f. All cables connected to each Auxiliary Equipment (AE), other than those being connected to the EUT, shall not be bundled nor wrapped and shall be kept between 30mm and 50mm above the ground reference plane.
- g. The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn while the other non-excited RF input ports of the coupling devices are terminated by a 50 load resistor.
- h. Perform the test with the specified immunity level in the test frequency range and with the specified modulation type.
- i. The dwell time at each frequency shall be not less than the time necessary for the EUT to be exercised and be able to respond.
- j. The sensitive frequencies of EUT and harmonics or frequencies of dominant interest shall be analyzed separately, if any.
- k. Record the performance of the EUT.

## 9.2 Test Severity Levels

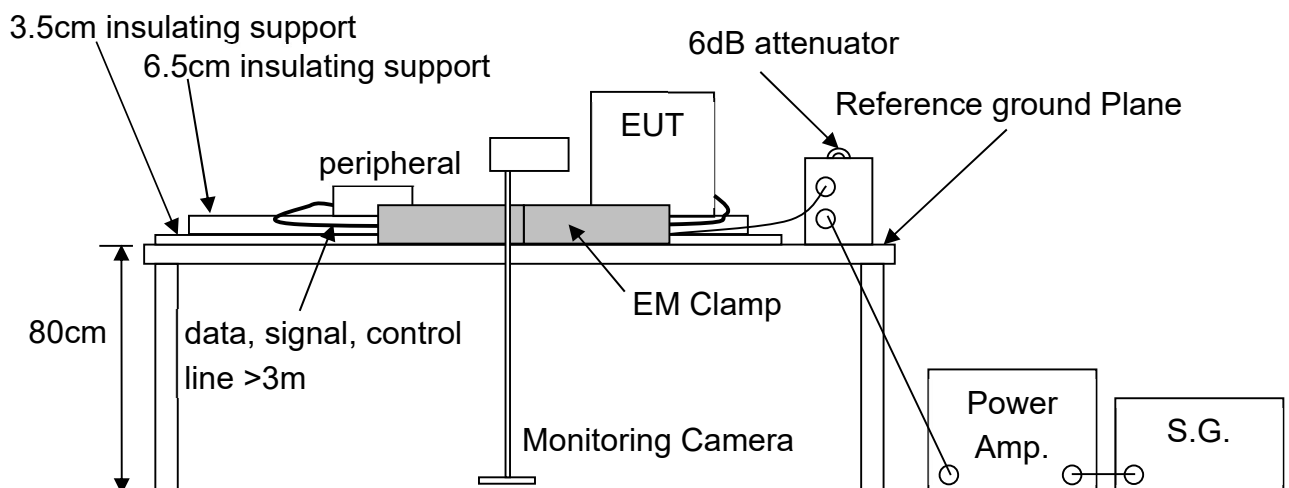
Level	Voltage Level ( e.m.f. )
1	1 V
2	3 V
3	10 V
x	Specified
NOTE - x is an open class. This level can be specified in the product specification.	

## 9.3 Test Configurations

### Power supply and LAN port Test



### I/O signal, data and control port Test (if any)



#### 9.4 Photographs of the Test Configurations



## 9.5 Test Result and Data

<b>Test Mode</b>	Mode1	<b>Final Test Result</b>	Pass
<b>Test Date</b>	Feb 6,2023	<b>Test Engineer</b>	Dylan
<b>Temperature</b>	18 °C	<b>Relative Humidity</b>	69 %
<b>Atmospheric Pressure</b>	995.5 hPa		

<b>Pass performance criteria</b>	A
<b>Required performance criteria</b>	A
<b>Basic Standard</b>	IEC 61000-4-6
<b>Product Standard</b>	EN IEC 62040-2
<b>Frequency Range</b>	0.15~ 80MHz
<b>Modulation</b>	AM 80%, 1KHz sine wave
<b>Dwell time</b>	3 S
<b>Frequency Step Size</b>	1 %
<b>Coupling mode</b>	CDN-M5 for AC power ports

For AC input power port			
Frequency	Test Mode	Voltage(V)	Result
0.15 ~ 80MHz	Power(M3)	3	A

For AC output power port (if cable > 3m)			
Frequency	Test Mode	Voltage(V)	Result
0.15 ~ 80MHz	EM-Clamp	3	NA

## Observation of Performance during Test

(1) Normal operation condition specified by manufacturer during the test.

## **10. Power frequency magnetic field (PFM) Immunity Test**

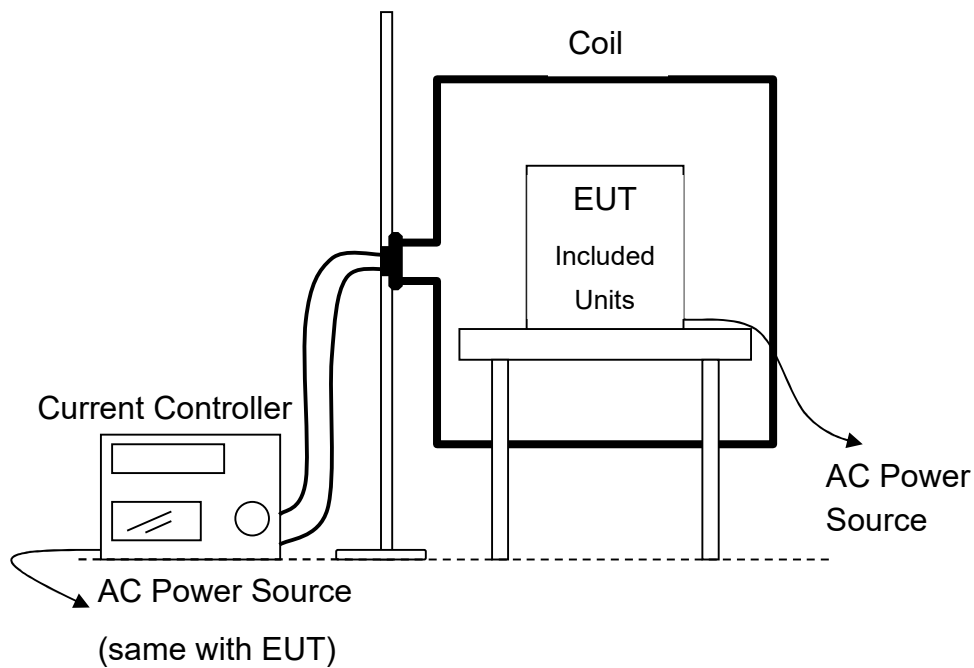
### **10.1 Test Procedure**

- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. If the EUT is tabletop equipment, it was placed on a wooden table with a height 0.8 meters.
- c. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 0.1 meters above the ground reference plane (minimum size is 1m 1m) in the shielded room.
- d. For the tabletop equipment, the induction coil with a square form in 1m side (or diameter) is used and shall enclose the EUT placed at its center. For the floor-standing equipment, the induction coil shall be able to envelop the EUT and made of conductors of relatively small cross-section.
- e. The dimensions of induction coil shall be able to keep the magnetic fields over the whole volume of the EUT with an acceptable variation of  $\pm 3\text{dB}$ .
- f. The test generator shall be placed at less than 3m distance from the induction coil.
- g. Keep all cables of EUT to be exposed to the magnetic field for 1m of their length.
- h. Before the test, maintain the electromagnetic field value of the test environment to be at least 20dB lower than the selected test level. Then tune up the currents of the test generator and use the Gauss Meter to calibrate the specified test level at the center of the induction coil.
- i. Perform the test with the specified magnetic field by rotating the induction coil to three different orientations to generate X, Y and Z directed magnetic field sequentially.
- j. Record the performance of the EUT.

## 10.2 Test Severity Levels

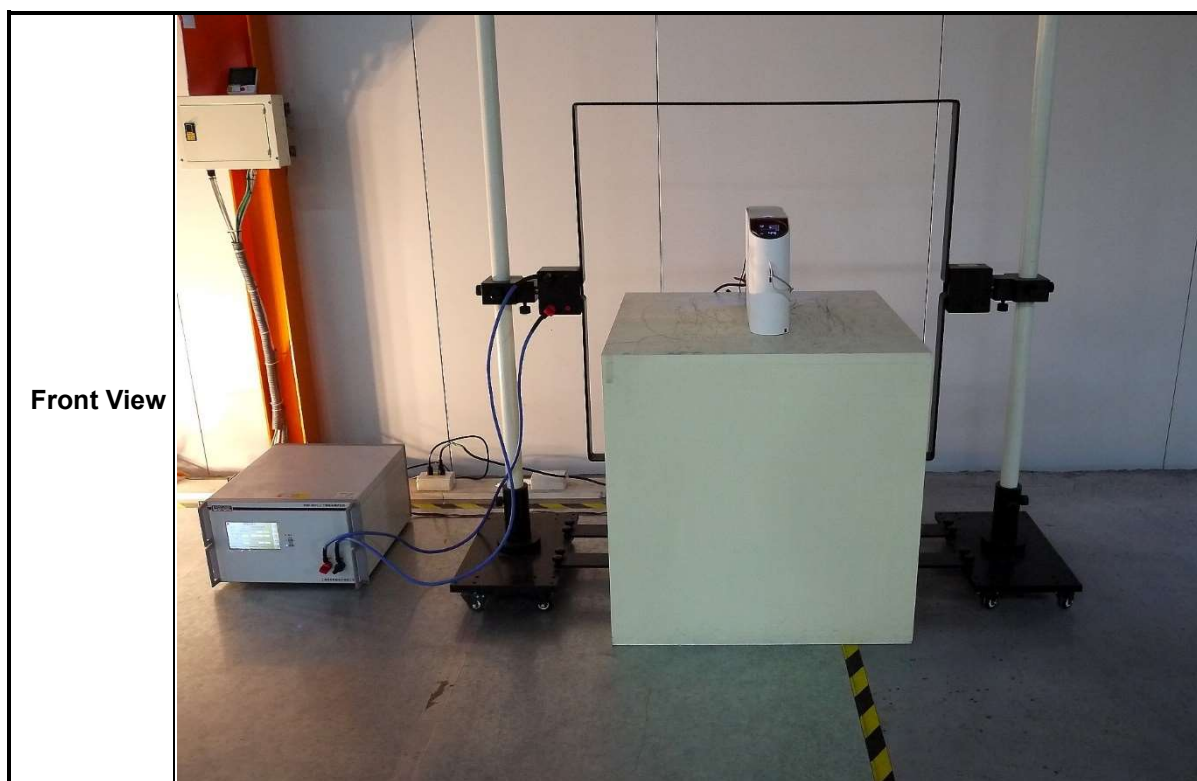
Level	Magnetic field strength (A/m)
1	1
2	3
3	10
4	30
5	100
X <sup>1)</sup>	special
NOTE 1 "X" is an open level. This level can be given in the product specification.	

## 10.3 Test Configurations





#### 10.4 Photographs of the Test Configurations



**10.5 Test Result and Data**

<b>Test Mode</b>	Mode 1	<b>Final Test Result</b>	Pass
<b>Test Date</b>	Feb 3 ,2023	<b>Test Engineer</b>	David
<b>Temperature</b>	20 °C	<b>Relative Humidity</b>	68 %
<b>Atmospheric Pressure</b>	997.5 hPa		

<b>Pass performance criteria</b>	A
<b>Required performance criteria</b>	A
<b>Basic Standard</b>	IEC 61000-4-8
<b>Product Standard</b>	EN IEC 62040-2
<b>Power Frequency Magnetic Field</b>	<u>50</u> Hz, <u>3</u> A/m

<b>Coil Orientation</b>	<b>Testing duration</b>	<b>Results</b>
X-axis	1.0 Min	A
Y-axis	1.0 Min	A
Z-axis	1.0 Min	A

Note: "A" Mean the EUT function is normal working during the test.

**Observation of Performance during Test**

(1) Normal operation condition specified by manufacturer during the test.

## **11. Immunity to low-frequency signals**

### **11.1 Test procedure**

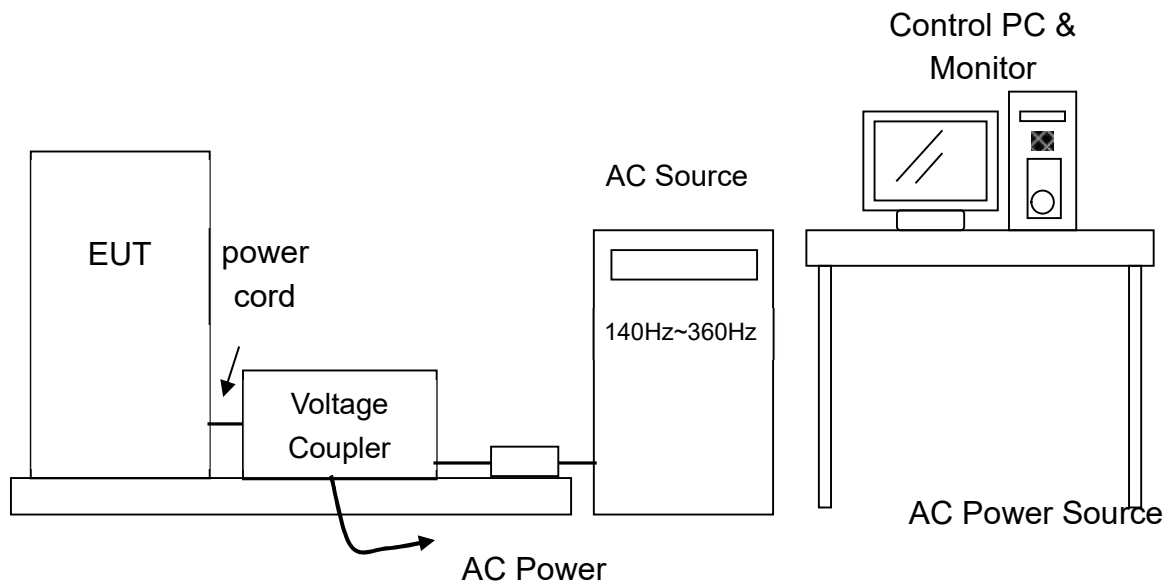
- a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- b. The test is performed with a single sinusoidal disturbing voltage of 10V, at a frequency which is slowly varied from 140Hz to 360Hz.
- c. Record the performance of the EUT.

### **11.2 Test severity**

Single sinusoidal voltage of 10V

<b>Disturbing Voltage (V)</b>	<b>Frequency Slowly Varied (Hz)</b>	<b>Required performance criteria</b>
10	140Hz to 360Hz	A

## 11.3 Test Configurations



## 11.4 Photographs of the Test Configurations



**11.5 Test Result and data**

<b>Test Mode</b>	Mode 1	<b>Final Test Result</b>	Pass
<b>Test Date</b>	Feb 2, 2023	<b>Test Engineer</b>	David
<b>Temperature</b>	23 °C	<b>Relative Humidity</b>	53 %
<b>Atmospheric Pressure</b>	997 hPa		

<b>Pass performance criteria</b>	A
<b>Required performance criteria</b>	A
<b>Basic Standard</b>	IEC 61000-2-2
<b>Product Standard</b>	EN IEC 62040-2

Disturbing Voltage (V)	Frequency Slowly Varied (Hz)	Required performance criteria	Result
10	140Hz to 360Hz	A	A

Note: "A" means the EUT function is normal working during the test.

**Observation of Performance during Test**

- (1) Normal operation condition specified by manufacturer during the test.

## 12. List of Measuring Equipment

Conducted Emission					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Receiver	R&S	ESHS10	835499/012	11/1/2022	10/31/2023
LISN	INTRX	LIN63-4	1803001	3/3/2022	3/2/2023
Coaxial Cable	SUHNER	RG214	C001-1358175	6/22/2022	6/21/2023
Attenuator	JYEBAO	FAT-NM5NF5T6G2W10	ATT002	10/24/2022	10/23/2023
test software	Audix	E3	20180316b	NA	NA

Radiated Emission below 1GHz					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
EMI test receiver	R&S	ESR7	102004	5/3/2022	5/2/2023
Amplifier	ITGA	ITPA-301	170101000330014	3/3/2022	3/2/2023
Bi-conical antenna	SunAR	JB1	A030818	4/6/2022	4/5/2023
Attenuator	JYEBAO	FAT-NM5NF5T62GW6	ATT001	4/6/2022	4/5/2023
Coaxial cable	SUHNER	SUCOFLEX 104	MY371154	6/22/2022	6/21/2023
Coaxial cable	SUHNER	SUCOFLEX 104	803600	6/22/2022	6/21/2023
Coaxial cable	SUHNER	SUCOFLEX 104	801734	6/22/2022	6/21/2023
test software	Audix	E3	20180316b	NA	NA

Harmonic and Flicker Emissions, DIP, IEC 61000-2-2					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Power source	N4L	N4A30	91J-12901	4/15/2022	4/14/2023
Flicker Impedance Network	N4L	IMP323	91G-12804	4/15/2022	4/14/2023
power Analyzer	N4L	PPA5531	166-05417	4/15/2022	4/14/2023
Test software	N4L	IEC_Soft	2.6	NA	NA

DIP					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Power source	N4L	N4A30	91J-12901	2/16/2022	2/15/2023
Voltage drop simulator	EMCLioncel	VDS-1103	21101	2/16/2022	2/15/2023
Adjust power module	EMCLioncel	RGL-232	21101	2/16/2022	2/15/2023



ESD					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
ESD Simulator	NoiseKen	ESS-S3011A	ESS1848144	2/11/2022	2/10/2023
ESD Gun	NoiseKen	GT-30RA	ESS1848164	2/11/2022	2/10/2023

RS					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Signal generator	Keysight	N5171B	MY57281132	3/3/2022	3/2/2023
Electric field probe	Narda	EP 601	711WX80850	2/26/2022	2/25/2023
Power sensor	Keysight	U2004A	MY57420018	3/3/2022	3/2/2023
Power Amplifier	fflight communication	NTWPA-0810200E	18103222	NA	NA
Power Amplifier	fflight communication	NTWPA-106050	18113274	NA	NA
Bi-log Antenna	SunAR	ATL80M1G	351399	NA	NA
Double log antenna	Schwarzbeck	STLP9149	627	NA	NA
test software	Audix	I2	20181211	NA	NA

EFT					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
EFT Burst Generator	EMCLioncel	EFT-406CB	180803	2/16/2022	2/15/2023
Coupling Decoupling Networks	EMCLioncel	CDN-433CB	180803	2/16/2022	2/15/2023
EMC clamp	EMCLioncel	EFTC	18071802	2/16/2022	2/15/2023

SURGE					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Surge controller	EMCLioncel	SCU-614A+	0180202	NA	NA
Surge generator	EMCLioncel	LSG-510CB+	0171101	2/17/2022	2/16/2023
coupling Device Network	EMCLioncel	CDN-5310P	0180302	2/17/2022	2/16/2023

CS					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Signal generator	Keysight	N5171B	MY57281132	3/3/2022	3/2/2023
Power Amplifier	fflight communication	NTWPA-4K0100	18103215	NA	NA
100W attunator	JPT	JPTATT-03-6	ATT17001	3/21/2022	3/20/2023
Couple device network	EMC Liconcel	CDN-M5-32	181001	4/22/2022	4/21/2023
Couple device network	EMC Liconcel	CDN-M3-16	181103	4/22/2022	4/21/2023
Couple device network	EMC Liconcel	CDN-M2-16	018074	4/22/2022	4/21/2023
EM Clamp	FRANKONIA	EMCL-20	18101672-0113	4/22/2022	4/21/2023
Power sensor	Keysight	U2004A	MY57420018	3/3/2022	3/2/2023
test software	Audix	I2	20181211	NA	NA

PFM					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
power frequency magnetic	EMCLioncel	PMF-801C-C	180801	2/18/2022	2/17/2023
Magnetic coil	EMCLioncel	PMF-801C-A	180903	2/18/2022	2/17/2023

Note: NA means no calibration required.

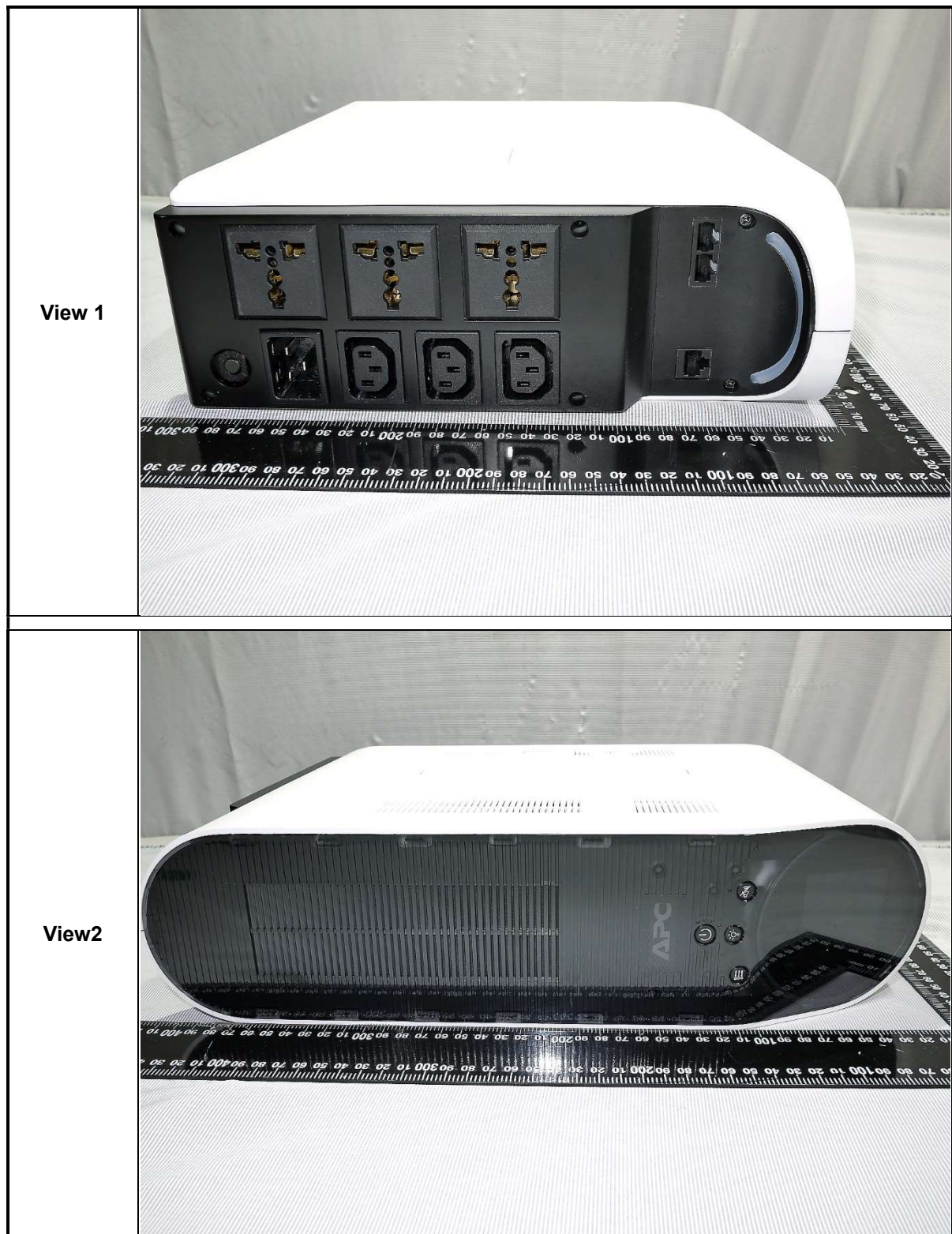
### 13. Measurement Uncertainty

The assessed measurement uncertainty with a suitable coverage factor K to ensure 95% confidence level for the normal distribution are shown as below, the values are in table.

Please note that the test facility, environment and personal training minimize uncertainty of measurement due to the factor, the test results to determine refer to standard requirement, the measurement uncertainty values are not considered into the test data to determine the results.

Electromagnetic Interference			
Measurement Item	Measurement Frequency	Polarization	Uncertainty
Conducted Emission	150 kHz ~ 30 MHz	LINE / NEUTRAL	$\pm 3.43\text{dB}$
Radiated Emission	30 MHz ~ 1,000 MHz	Vertical / Horizontal	$\pm 4.56\text{ dB}$
Electromagnetic Susceptibility			
Measurement	Item	Uncertainty	
Electrostatic Discharges (ESD)	--	Rise time $T_r \pm 13.86\% \text{ ns}$ Voltage peak $\pm 3.47\%$ Peak current $I_p \pm 3.58\% \text{ A}$ Current at 30 ns $\pm 3.7\% \text{ ns}$ Current at 60 ns $\pm 3.7\% \text{ ns}$	
Radiated RF electromagnetic Fields (Level Setting)	--	$\pm 2.65\text{dB}$	
Electrical Fast Transients and bursts	--	CDN & Clamp $V_{\text{peak}} \pm 11.04\% \text{ V}$ Rise time $\pm 8.82\% \text{ ns}$ Pulse width $\pm 6.39\% \text{ ns}$	
Surges	--	$V_{\text{peak}} = \pm 13\% \text{ V}$ Rise time $= \pm 14.54\% \text{ us}$ Duration $= \pm 1.36\% \text{ us}$	
Conducted Disturbances, induced by RF fields	--	$M2/M3/M5 \pm 1.28 \text{ dB}$ Clamp $\pm 3.68 \text{ dB}$	
Power-frequency Magnetic Field	--	Current $\pm 1.18\% \text{ A}$ Magnetic field $\pm 1\%$	
Voltage Dips, Interruptions, and variations	--	$\pm 0.87\% \text{ V}$	

## 14. Attachment –Photographs of EUT





View 3



View 4

