EMC Test Report

According to

Test Standard	:	EN IEC 61000-6-4:2019, IEC 61000-6-4:2018 EN IEC 61000-6-2:2019, IEC 61000-6-2:2016 EN IEC 61000-3-11:2019, IEC 61000-3-11:2017 EN 61000-3-12:2011, IEC 61000-3-12:2011
Equipment	:	MPPT SOLAR INVERTER
Model Number	:	VM IV-5600
Serial model	:	--
Applicant：	:	Voltronic Power Technology Corp. No. 406, Xinhu 1st Road, Neihu District, Taipei, Taiwan, R.O.C.
Test date	:	Mar 2, 2021 ~ Mar 5, 2021
Issue date	:	Mar 16, 2021

Statement:

- The test result is applied to test equipment unit (EUT) only.
- Without written approval of SERTC Testing Center Co., Ltd the test report shall not be reproduced except in full.

Rack Chiang

Rack Chiang/ /Approved Signatory

Testing Laboratory
3625

SERTC Testing Center Co., Ltd
No.230, Sec. 2, Fengshi Rd., Fengyuan Dist., Taichung City 420, Taiwan, R.O.C.

History of this test report

Report No.	Version	Description	Issue Date
21109CEAE1	Rev.1.0	Initial issue of report	Mar 16,2021

Contents

1. General Description

1.1 Application category

■New application	This document is new applicant.
□Copy report	This document originally test result as : ・Issue unit： ・Report number：
□Application for change	Addition of series or others. ・Original Report number：

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 61000-6-4:2019 IEC 61000-6-4:2018	Conducted Emission Measurement 150k-30MHz	Complied
	Radiated Emission Measurement 30M-1GHz	Complied
EN 61000-3-12:2011 IEC 61000-3-12:2011	Harmonic Current Emission Measurement	Complied
EN IEC 61000-3-11:2019 IEC 61000-3-11:2017	Voltage Fluctuation and Flicker Emission Measurement	Complied
EN IEC 61000-6-2:2019, IEC 61000-6-2:2016		
EN 61000-4-2:2009 IEC 61000-4-2:2008	Electrostatic discharge Test (ESD)	Complied
EN 61000-4-3:2006+A2:2010 IEC 61000-4-3:2006+A1:2007+A2:2010	Radiated electromagnetic field immunity Test (RS)	Complied
EN 61000-4-4:2012 IEC 61000-4-4:2012	Electrical fast transient / burst immunity Test (EFT)	Complied
EN 61000-4-5:2014+A1:2017 IEC 61000-4-5:2014+A1:2017	Surge immunity Test	Complied
EN 61000-4-6:2014 IEC 61000-4-6:2013	Immunity to conducted disturbances, induced by radio-frequency fields (CS)	Complied
EN 61000-4-8:2010 IEC 61000-4-8:2009	Power frequency magnetic field immunity Test (PFM)	Complied
IEC 61000-4-34:2009 EN 61000-4-34:2007+A1:2009	Voltage dips, short interruptions Test	Complied

1.3 Basic Description of Equipment under Test

Equipment	MPPT SOLAR INVERTER
Trade Name	N/A
Model Number	VM IV-5600
Serial model	--
Power Supply Type	Battery Input: 48Vdc. AC Input:230V. PV:400Vdc. AC Output: 230V/50Hz Max, 5600VA/5600W, 1 § +PE
Highest Operating Frequency	48MHz
Function description	The EUT is an engineer sample of the MPPT SOLAR INVERTER. Please refer to the user's manual for the details.

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

No.	Port Type	Quantity
1	AC input port	1
2	AC output port	1
3	DC port(+,-)	1
4	PV port(+,-)	1
5	RJ45 (RS-232/RS-485) port	2
6	Micro USB port	1
7	Dry contact	1

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 61000-6-2 and EN 61000-6-4

Conducted Emission for AC main power	
Test Mode 1	Charge and normal mode, full load
Test Mode 2	Stored Energy mode, full load
Test Mode 3	PV mode, full load
Radiated Emissions for below 1GHz	
Test Mode 1	Charge and normal mode, full load
Test Mode 2	Stored Energy mode, full load
Test Mode 3	PV mode, full load
Harmonic and Flicker Emissions	
Test Mode 1	Charge and normal mode, near full load
Immunity Test (ESD, RS, EFT, SURGE, CS, PFM, DIP)	
Test Mode 1	Charge and normal mode, near 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:

a. Connect the Dummy Load to the EUT.

b. Connect the EUT to the appropriate power source through power filter or other LISN in different site for each test item.

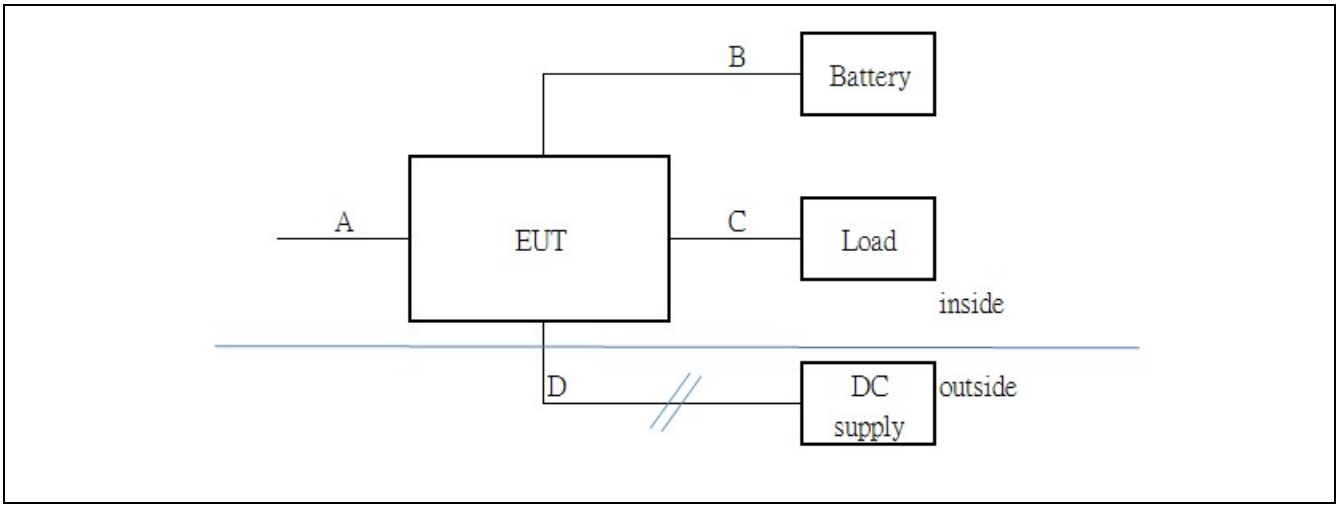
c. Set the Dummy Load at the assigned condition.

d. According to the setup methods designated by its manufacturer, set the EUT in the operating condition.

e. Repeat and keep the setup steps listed above before and during all tests.

2.3 Layout of the Setup

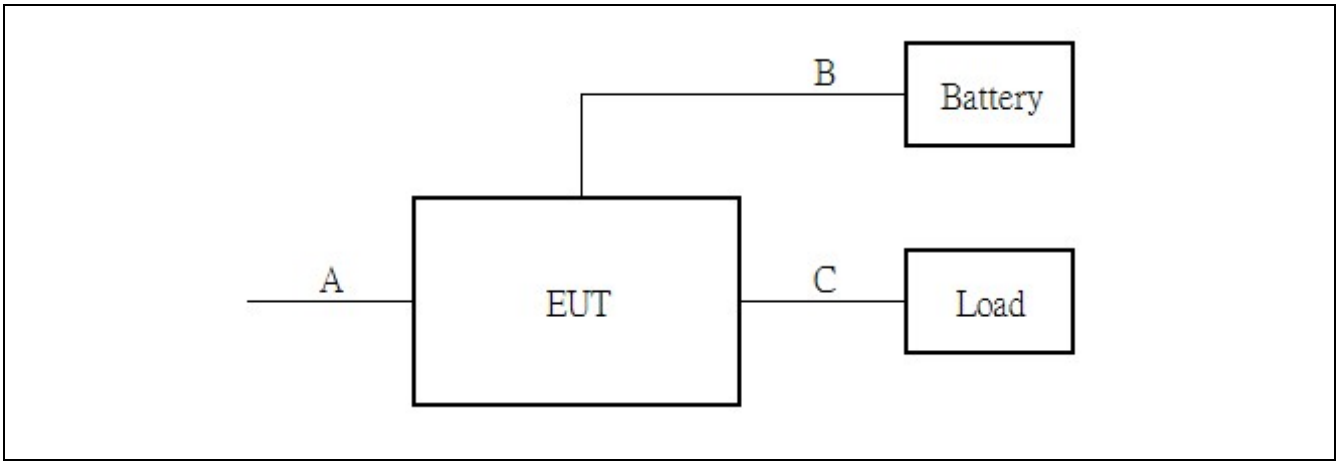
PV mode for Radiated emission and conducted emission test



The Support Units:

No.	Link Peripheral	Manufacturer	Model No.	FCC ID	Description of connected
For Local					
1	Main AC input	--	--	--	A , non-shield cable Length 1.8m
2	Battery pack	--	--	--	B, non-shield cable Length 0.5 m
3	Light bulb load	--	--	--	C, non-shield cable Length 1.0 m
4	DC supply unit	--	--	--	D, non-shield cable Length 10 m

Charge mode and Stored energy mode for all test



The Support Units:

No.	Link Peripheral	Manufacturer	Model No.	FCC ID	Description of connected
For Local					
1	Main AC input	--	--	--	A , non-shield cable Length 1.8m
2	Battery pack	--	--	--	B, non-shield cable Length 0.5 m
3	Light bulb load	--	--	--	C, non-shield cable Length 1.0 m

2.4 Test software

The EUT no needs to control by others software.

2.5 Immunity Testing Performance Criteria Definition

a) **Performance criterion A:** The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. If the performance level is not specified by the manufacturer, this may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

b) **Performance criterion B:** The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test degradation of performance is allowed but no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

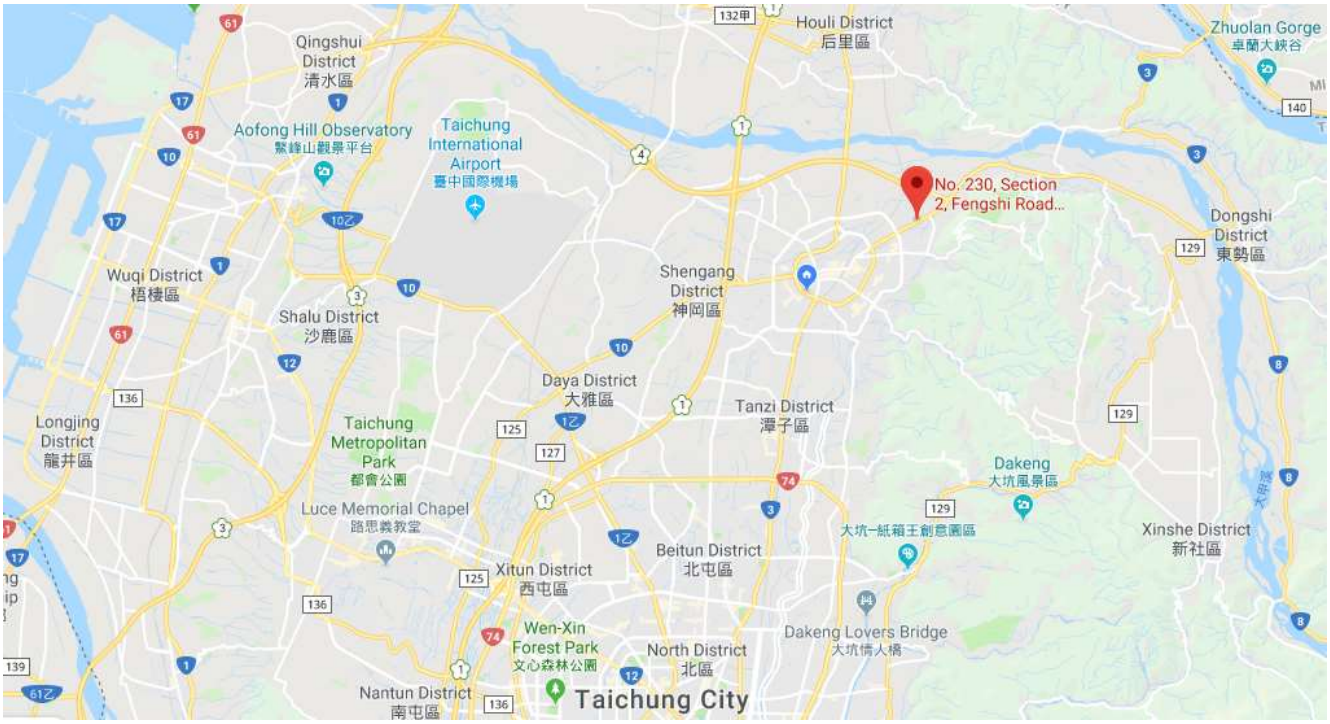
c) **Performance criterion C**: Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls.

2.6 General Information of Test

Location of test laboratory

SERTC testing Laboratory	Accrediations
Address: No. 230, Sec. 2, Fengshi Rd., Fengyuan Dist., Taichung City 420, Taiwan, R.O.C. Tel: +886-04-25253313 Fax:+886-04-25252320	TAF No. 3625

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.

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 European Standard IEC61000-6-4. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position producing maximum conducted emissions.

Table 1 Conducted Emission Limits(dBμV):

Frequency range (MHz)	AC main port		DC port	
	Quasi Peak	Average	Quasi Peak	Average
0.15 to0.50	79	66	89	76
0.50 to5	73	60	83	70
5. to 30.	73	60	83	70
Note 1: The lower limits shall apply at the transition frequencies. Note 2:The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5MHz.				

Table 2 - Limits of conducted common mode (asymmetric mode) disturbance in the frequency range 0.15 MHz to 30 MHz (dBμV).

Frequency range (MHz)	Wired network port			
	Voltage		Current	
	Quasi Peak	Avg.	Quasi Peak	Avg.
0.15 to 0.5	97~ 87	84~74	53~43	40~30
0.5 to 5	87	74	43	30
5 to 30	87	74	43	30
Note 1: The limits decrease linearly with the logarithm of the frequency in the range 0.15 to 0.5 MHz. Note 2 : The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150Ω to the telecommunication under test (conversion factor is 20 $\log_{10}$ 150/1 = 44dB).				

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 theuser'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 to0.15 metersabove 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 2nd 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 scanthe signal from 150kHz to 30MHz by using the receiver through the Maximum-Peak detector to determine those frequencies associated with higher emission levelsfor each measured line.

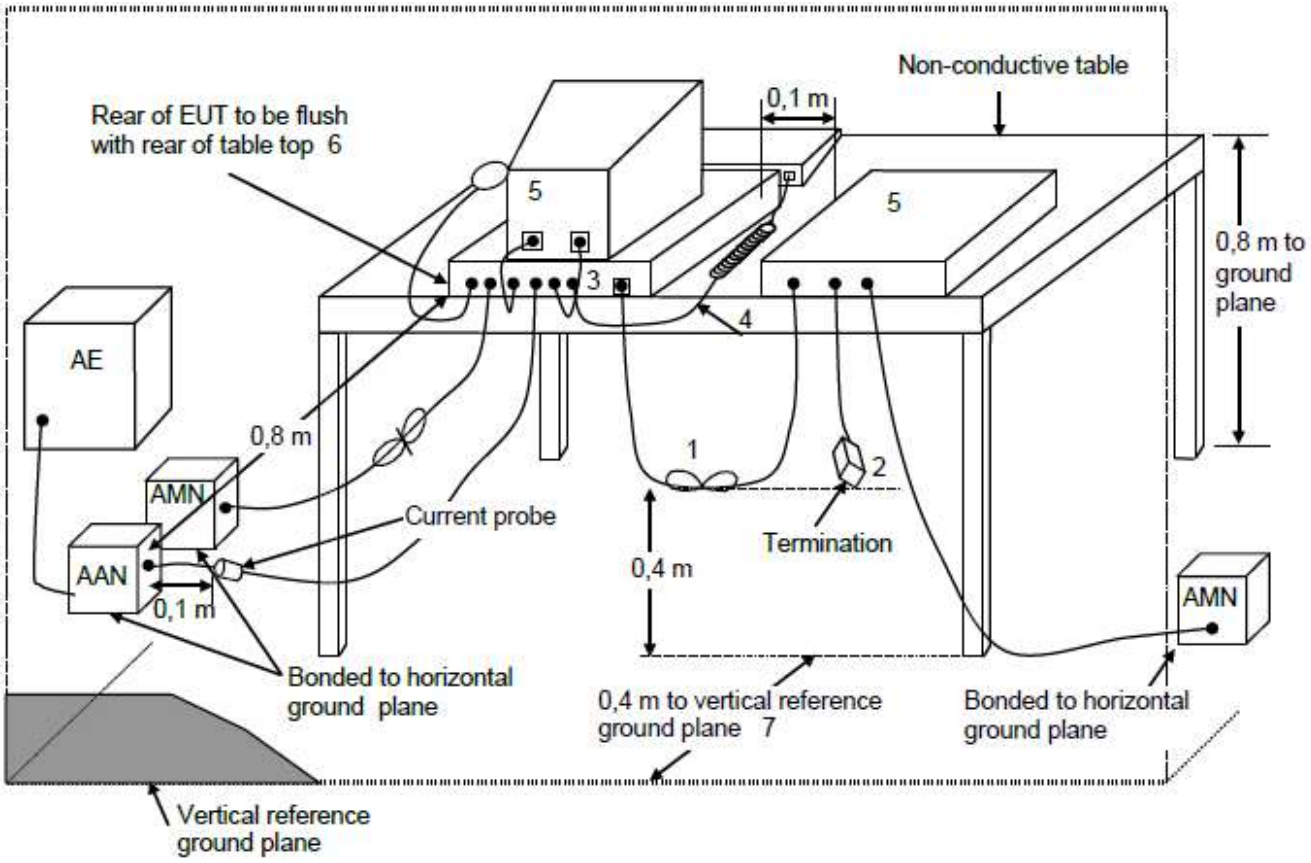
h. Then measurethe maximum level of conducted disturbance for each frequency found from step g. by using the receiver through the Quasi-Peak and Average detectors per CISPR 16-1.

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.

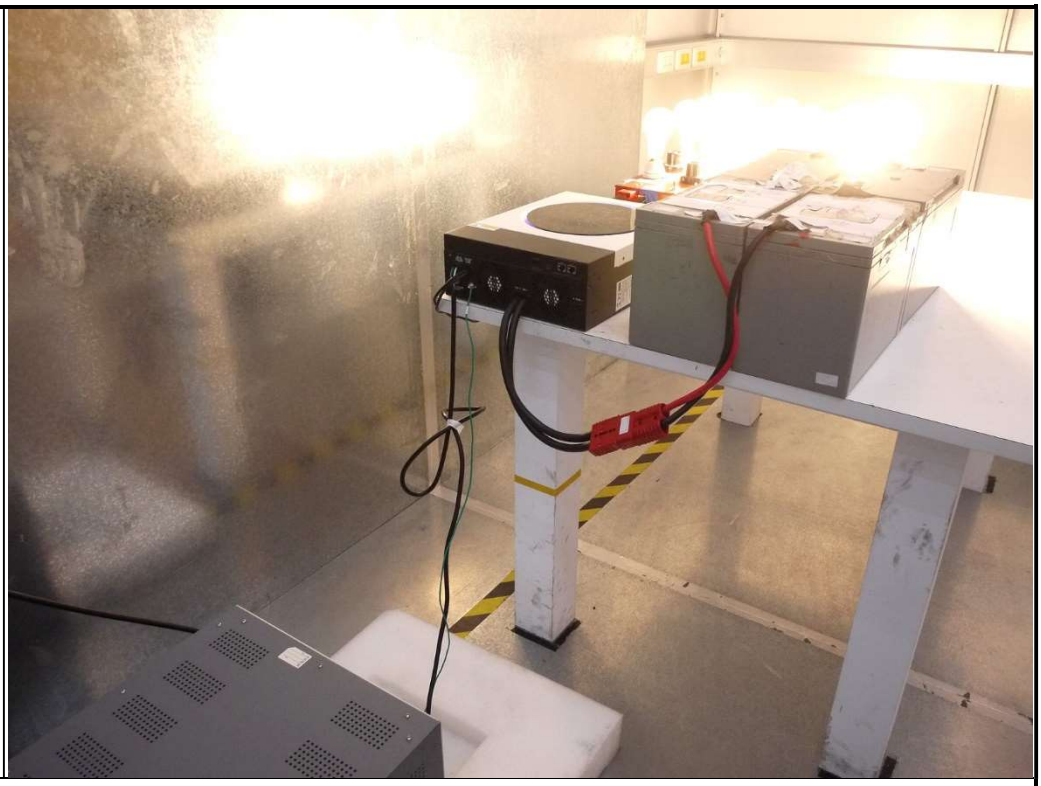
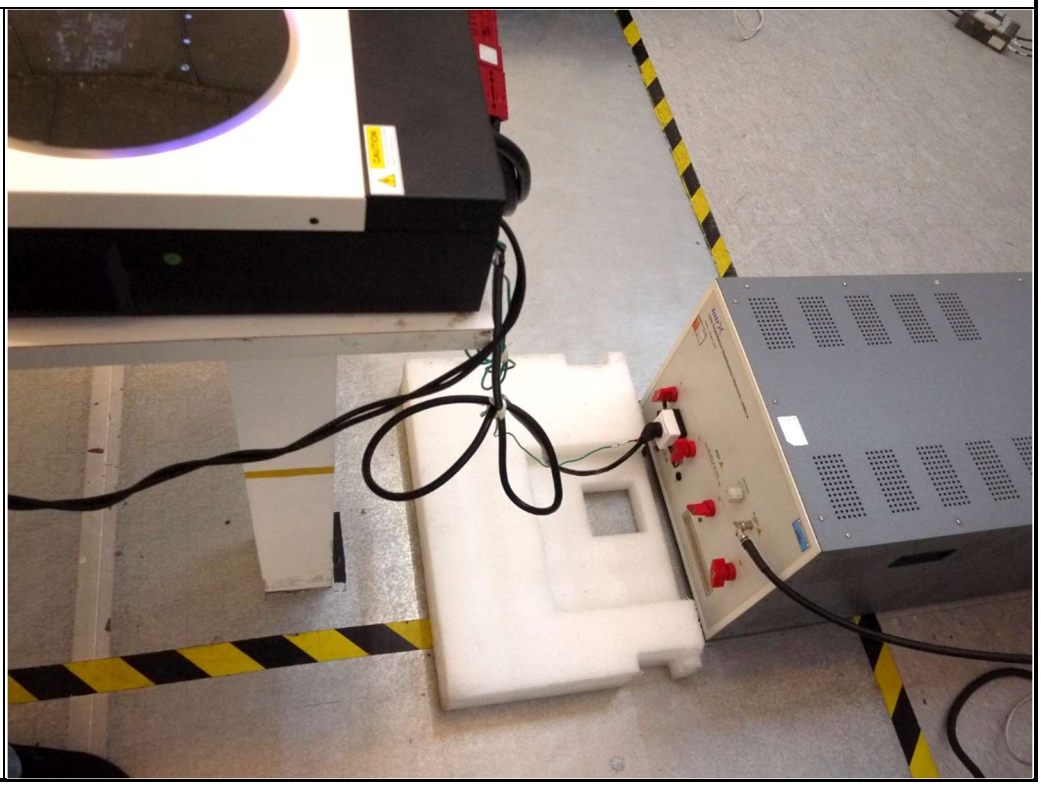
k. If the peak emission level is lower than the specified Average limit, then the emission values presented will be the peak value only. Otherwise, accurate Q.P. or Average values will be measured and presented.

3.3 Test Configurations

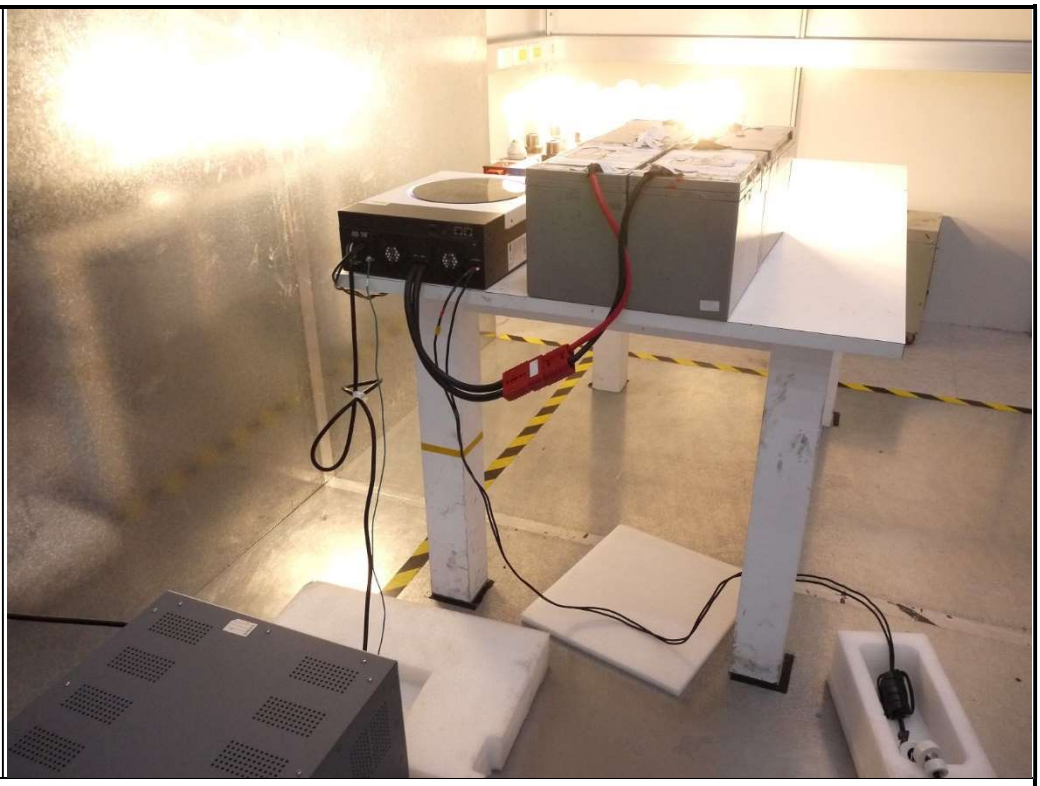


Example measurement arrange for table-top EUT

3.4 Photographs of the Test Configurations – Charge mode and stored energy mode

Front View	
Rear View	

3.5 Photographs of the Test Configurations – PV mode

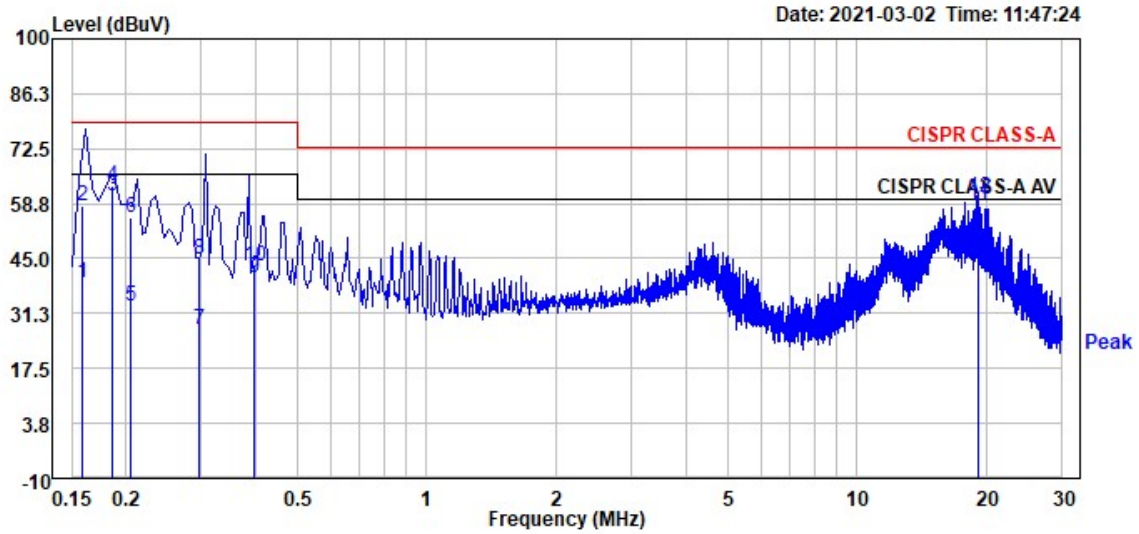
Front View	
Rear View	

3.6 Test Results and data

Conducted Emission for Power Port Test Data

Test Mode	Mode 1	Pol/Phase	Line1
Test Frequency	0.15 MHz ~ 30 MHz	Test Voltage	230Vac/50Hz
Test Date	Mar02,2021	Test Engineer	Dylan
Temperature	23 °C	Relative Humidity	54%

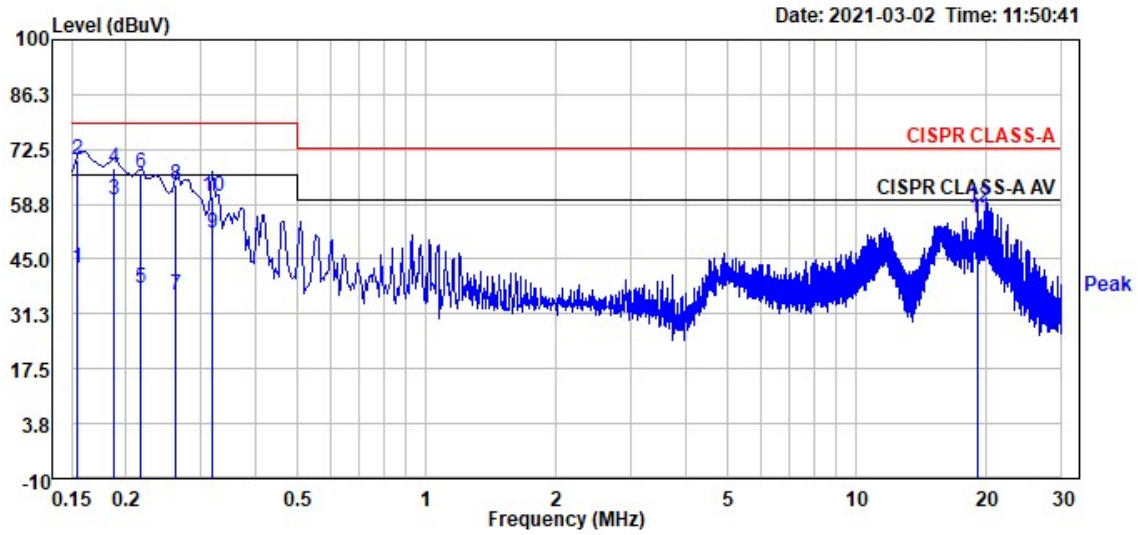
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed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



		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.158	28.51	10.23	38.74	66.00	-27.26	line1	Average
2		0.158	48.07	10.23	58.30	79.00	-20.70	line1	QP
3		0.186	50.55	10.22	60.77	66.00	-5.23	line1	Average
4		0.186	52.91	10.22	63.13	79.00	-15.87	line1	QP
5		0.206	23.01	10.21	33.22	66.00	-32.78	line1	Average
6		0.206	44.90	10.21	55.11	79.00	-23.89	line1	QP
7		0.296	17.16	10.21	27.37	66.00	-38.63	line1	Average
8		0.296	34.68	10.21	44.89	79.00	-34.11	line1	QP
9		0.398	30.10	10.20	40.30	66.00	-25.70	line1	Average
10		0.398	32.93	10.20	43.13	79.00	-35.87	line1	QP
11	PP	19.182	46.73	11.78	58.51	60.00	-1.49	line1	Average
12	QP	19.182	48.63	11.78	60.41	73.00	-12.59	line1	QP

Test Mode	Mode 1	Pol/Phase	Neutral
Test Frequency	0.15 MHz ~ 30 MHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	23 °C	Relative Humidity	54%

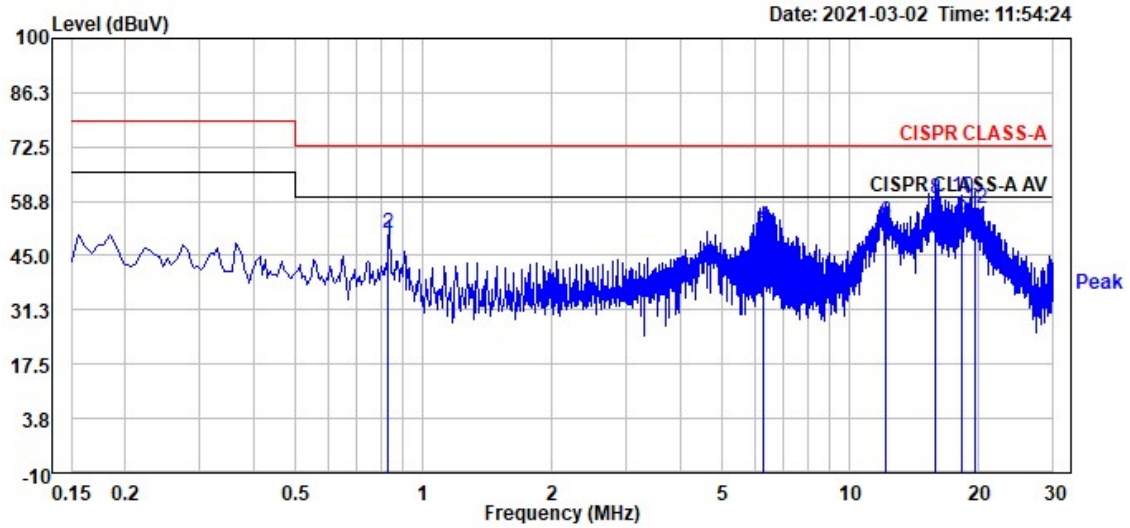
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed 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	32.30	10.23	42.53	66.00	-23.47	neutral	Average
2 QP	0.155	59.48	10.23	69.71	79.00	-9.29	neutral	QP
3	0.187	49.60	10.22	59.82	66.00	-6.18	neutral	Average
4	0.187	57.44	10.22	67.66	79.00	-11.34	neutral	QP
5	0.217	27.62	10.22	37.84	66.00	-28.16	neutral	Average
6	0.217	56.27	10.22	66.49	79.00	-12.51	neutral	QP
7	0.261	25.71	10.22	35.93	66.00	-30.07	neutral	Average
8	0.261	53.36	10.22	63.58	79.00	-15.42	neutral	QP
9	0.318	41.42	10.21	51.63	66.00	-14.37	neutral	Average
10	0.318	50.64	10.21	60.85	79.00	-18.15	neutral	QP
11 PP	19.239	43.01	12.38	55.39	60.00	-4.61	neutral	Average
12	19.239	45.69	12.38	58.07	73.00	-14.93	neutral	QP

Test Mode	Mode 2	Pol/Phase	Line 1
Test Frequency	0.15 MHz ~ 30 MHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	23 °C	Relative Humidity	54%

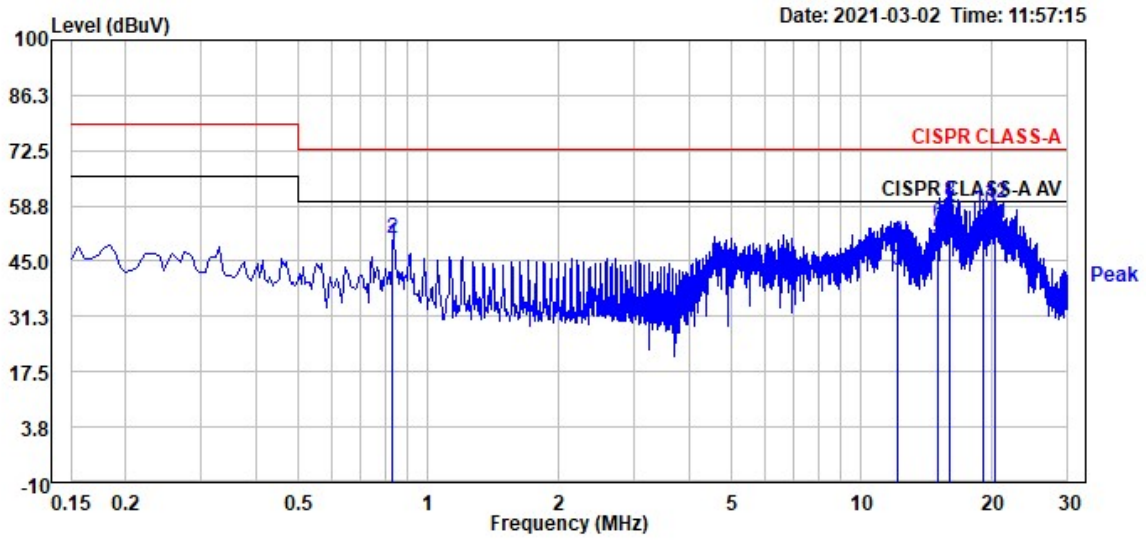
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed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



		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.830	38.76	10.22	48.98	60.00	-11.02	line1	Average
2		0.830	40.44	10.22	50.66	73.00	-22.34	line1	QP
3		6.272	40.21	10.57	50.78	60.00	-9.22	line1	Average
4		6.272	41.91	10.57	52.48	73.00	-20.52	line1	QP
5		12.145	39.30	11.09	50.39	60.00	-9.61	line1	Average
6		12.145	42.64	11.09	53.73	73.00	-19.27	line1	QP
7		15.959	42.30	11.47	53.77	60.00	-6.23	line1	Average
8		15.959	47.89	11.47	59.36	73.00	-13.64	line1	QP
9	PP	18.398	42.39	11.70	54.09	60.00	-5.91	line1	Average
10	QP	18.398	48.00	11.70	59.70	73.00	-13.30	line1	QP
11		19.709	40.11	11.82	51.93	60.00	-8.07	line1	Average
12		19.709	44.91	11.82	56.73	73.00	-16.27	line1	QP

Test Mode	Mode 2	Pol/Phase	Neutral
Test Frequency	0.15 MHz ~ 30 MHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	David
Temperature	23 °C	Relative Humidity	54%

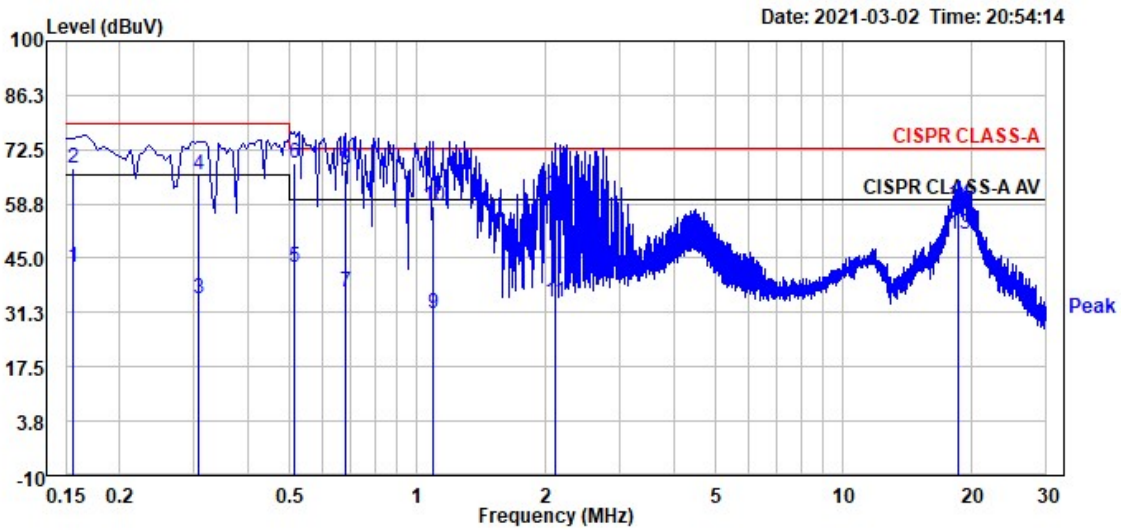
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed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



		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.830	38.96	10.24	49.20	60.00	-10.80	neutral	Average
2		0.830	40.25	10.24	50.49	73.00	-22.51	neutral	QP
3		12.170	31.22	11.44	42.66	60.00	-17.34	neutral	Average
4		12.170	38.19	11.44	49.63	73.00	-23.37	neutral	QP
5		15.116	38.62	11.83	50.45	60.00	-9.55	neutral	Average
6		15.116	42.70	11.83	54.53	73.00	-18.47	neutral	QP
7	PP	15.992	43.21	11.95	55.16	60.00	-4.84	neutral	Average
8	QP	15.992	47.86	11.95	59.81	73.00	-13.19	neutral	QP
9		19.245	40.28	12.38	52.66	60.00	-7.34	neutral	Average
10		19.245	45.27	12.38	57.65	73.00	-15.35	neutral	QP
11		20.458	41.75	12.53	54.28	60.00	-5.72	neutral	Average
12		20.458	46.71	12.53	59.24	73.00	-13.76	neutral	QP

Test Mode	Mode 3	Pol/Phase	Line1
Test Frequency	0.15 MHz ~ 30 MHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	23 °C	Relative Humidity	54%

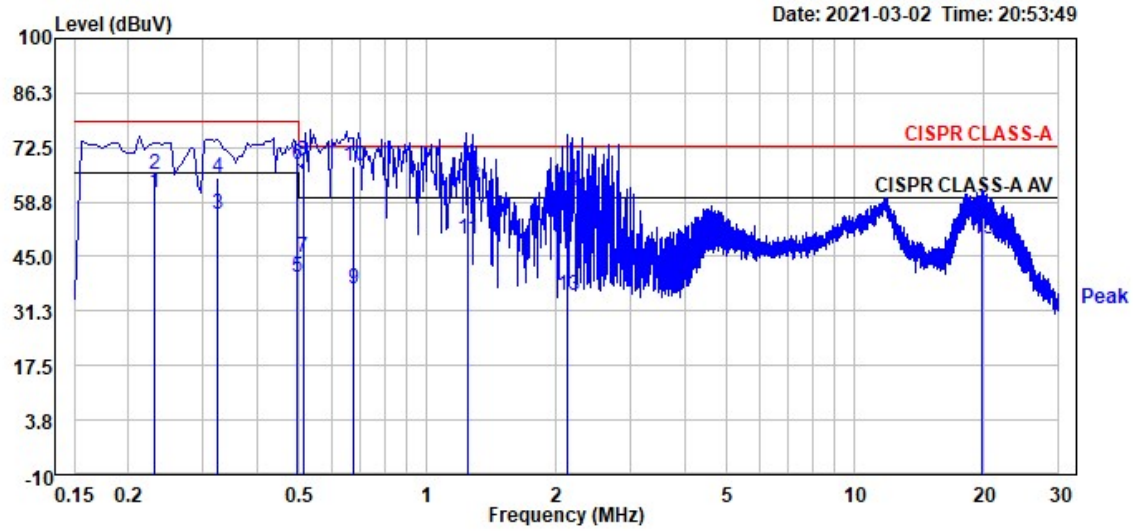
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.
4. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the EUT shall be deemed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



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.156	32.47	10.23	42.70	66.00	-23.30	line1	Average
2	0.156	57.76	10.23	67.99	79.00	-11.01	line1	QP
3	0.308	24.48	10.20	34.68	66.00	-31.32	line1	Average
4	0.308	55.83	10.20	66.03	79.00	-12.97	line1	QP
5	0.514	32.38	10.20	42.58	60.00	-17.42	line1	Average
6 PP	0.514	58.87	10.20	69.07	73.00	-3.93	line1	QP
7	0.678	26.06	10.22	36.28	60.00	-23.72	line1	Average
8	0.678	57.35	10.22	67.57	73.00	-5.43	line1	QP
9	1.089	20.79	10.24	31.03	60.00	-28.97	line1	Average
10	1.089	47.84	10.24	58.08	73.00	-14.92	line1	QP
11	2.114	23.60	10.31	33.91	60.00	-26.09	line1	Average
12	2.114	50.62	10.31	60.93	73.00	-12.07	line1	QP
13 AV	18.597	39.56	11.71	51.27	60.00	-8.73	line1	Average
14	18.597	46.82	11.71	58.53	73.00	-14.47	line1	QP

Test Mode	Mode 3	Pol/Phase	Neutral
Test Frequency	0.15 MHz ~ 30 MHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	23 °C	Relative Humidity	54%

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 AV	0.231	50.97	10.22	61.19	66.00	-4.81	neutral	Average
2	0.231	55.62	10.22	65.84	79.00	-13.16	neutral	QP
3	0.323	45.45	10.21	55.66	66.00	-10.34	neutral	Average
4	0.323	54.82	10.21	65.03	79.00	-13.97	neutral	QP
5	0.498	29.65	10.21	39.86	66.00	-26.14	neutral	Average
6	0.498	58.09	10.21	68.30	79.00	-10.70	neutral	QP
7	0.513	34.59	10.22	44.81	60.00	-15.19	neutral	Average
8 PP	0.513	58.83	10.22	69.05	73.00	-3.95	neutral	QP
9	0.671	26.68	10.23	36.91	60.00	-23.09	neutral	Average
10	0.671	57.63	10.23	67.86	73.00	-5.14	neutral	QP
11	1.247	39.25	10.28	49.53	60.00	-10.47	neutral	Average
12	1.247	52.44	10.28	62.72	73.00	-10.28	neutral	QP
13	2.132	24.64	10.35	34.99	60.00	-25.01	neutral	Average
14	2.132	51.19	10.35	61.54	73.00	-11.46	neutral	QP
15	19.808	36.79	12.46	49.25	60.00	-10.75	neutral	Average
16	19.808	42.29	12.46	54.75	73.00	-18.25	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 IEC 61000-6-4. 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.

Required highest frequency for radiated measurement

Highest internal frequency (F_x)	Highest measured frequency
Fx ≤ 108 MHz	1 GHz
108 MHz < F_x≤ 500 MHz	2 GHz
500 MHz < F_x≤1GHz	5 GHz
F_x>1GHz	5 x $F_x$up to a maximum of 6 GHz
NOTE 1 Where the highest internal frequency is not known, tests are performed up to 6 GHz. NOTE 2 Fx is defined in 3.1.10.	

Where the F_x is unknown, the radiated emission measurements shall be performed up to 6 GHz.

Table 1 – Limits for radiated disturbance at a measuring distance of 10 m (dB(μV/m))

Frequency range(MHz)	Limit
	Quasi-peak
30 to 230	40
230 to 1000	47
Note: Allowed measurement distances: 3 m, 5 m, 10 m or 30 mFor equipment meeting the size criterion defined in 3.1.11, the measurements may be performed at the 3 m distance. Note this size criterion is currently under discussion.	

Where a different measurement distance is chosen, other than the reference distance defined in the limit column of Table 1, the limits shall be offset based upon the following formula:

new limit = defined limit – 20 log (measurement distance/reference distance)

The unit of metres shall be used for distance and dB(μV/m) for the limits.
With regard to each table clause, the measurements shall be performed at only one distance.

Table 2 – Limits for radiated disturbance at a measuring distance of 3 m (dB (μV/m))

Frequency range (GHz)	Limit	
	Avg.	Peak
1 to 3	56	76
3 to 6	60	80
NOTE The lower limit applies at the transition frequency.		

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 planeand3 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 to0.15 meters above the reference ground planeand3 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.

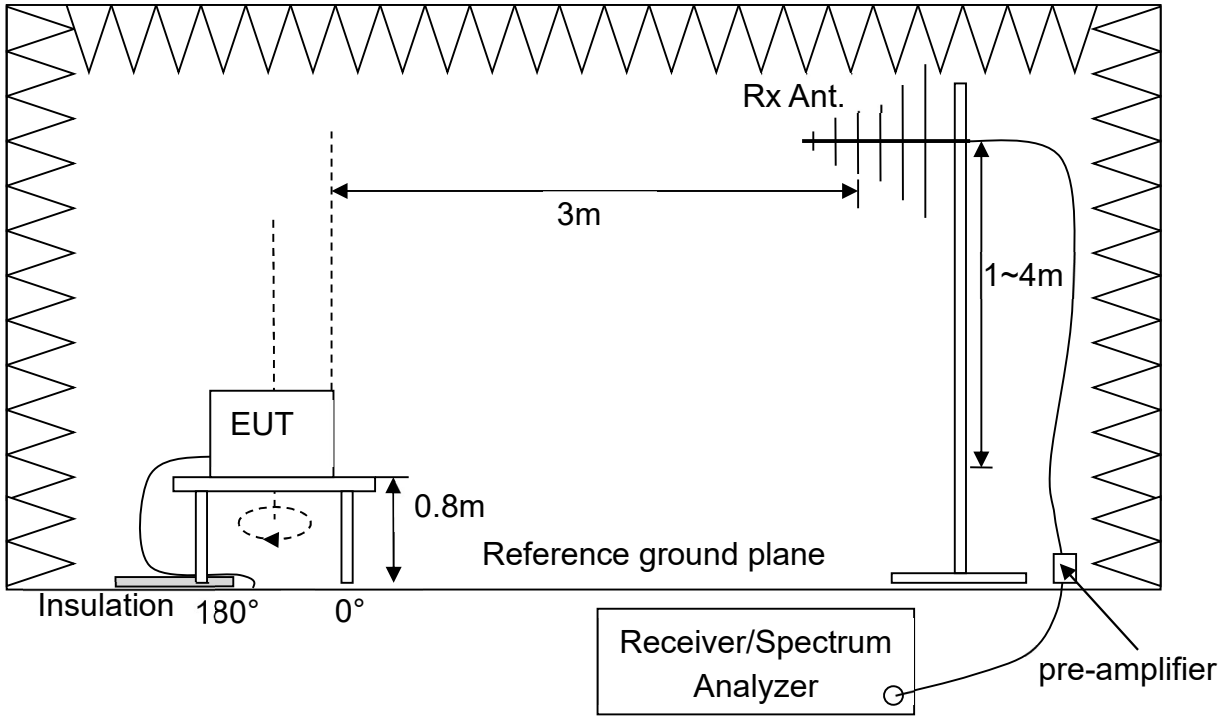
h. Record frequency, azimuth angle of the turntable, height, and polarization of the receiving antenna and compare the maximum level with the required limit.

i. Change the receiving antenna to another polarization to measure radiated emission by following step d. to h. again.

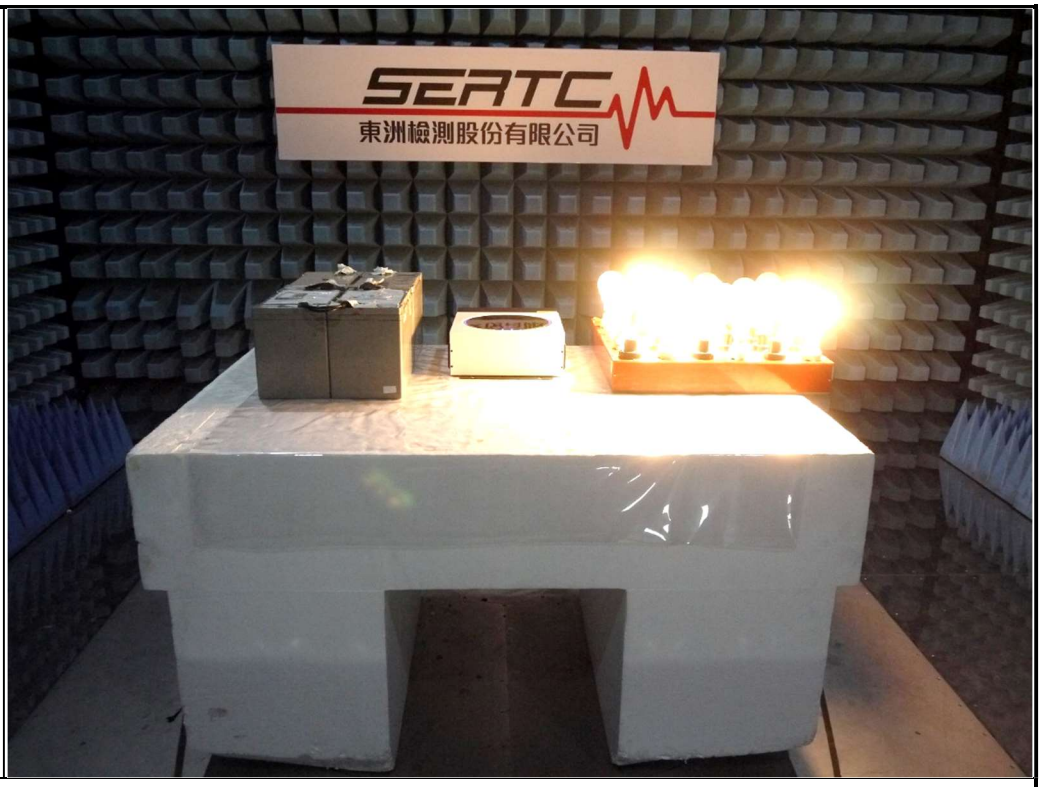
j. If the peak emission level measured from step e. is 4dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate Q.P. value will be measured and presented.

4.3 Test Configurations

Below 1GHz measurement



4.4 Photographs of the Test Configurations– Charge mode and stored energy mode

Front View	
Rear View	

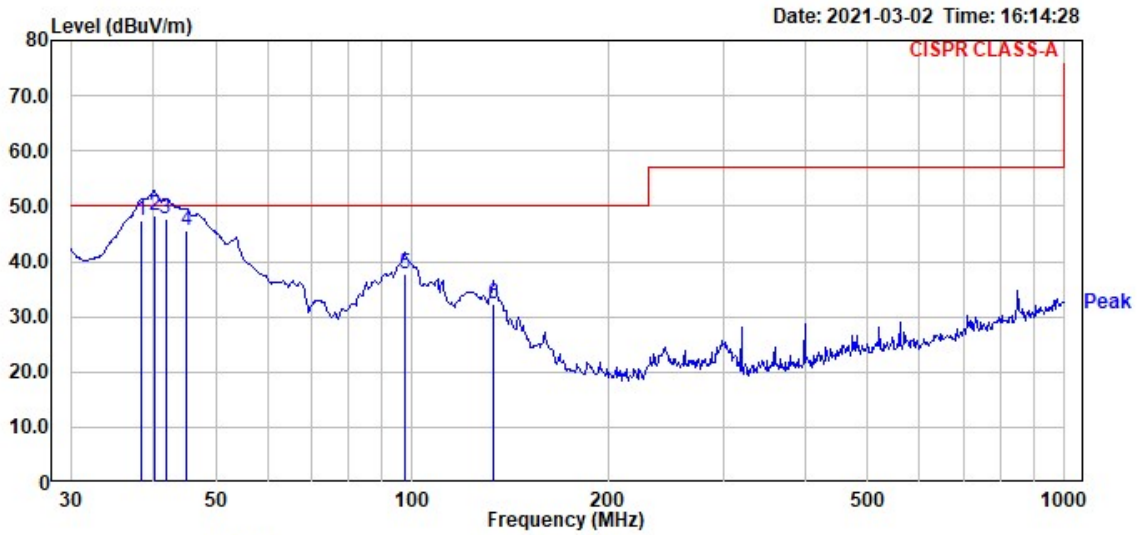
4.5 Photographs of the Test Configurations– PV mode

Front View	
Rear View	

4.6 Test Results and data

Test Mode	Mode1	Pol/Phase	Vertical
Test Frequency	30 MHz ~ 1GHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	21 °C	Relative Humidity	43%

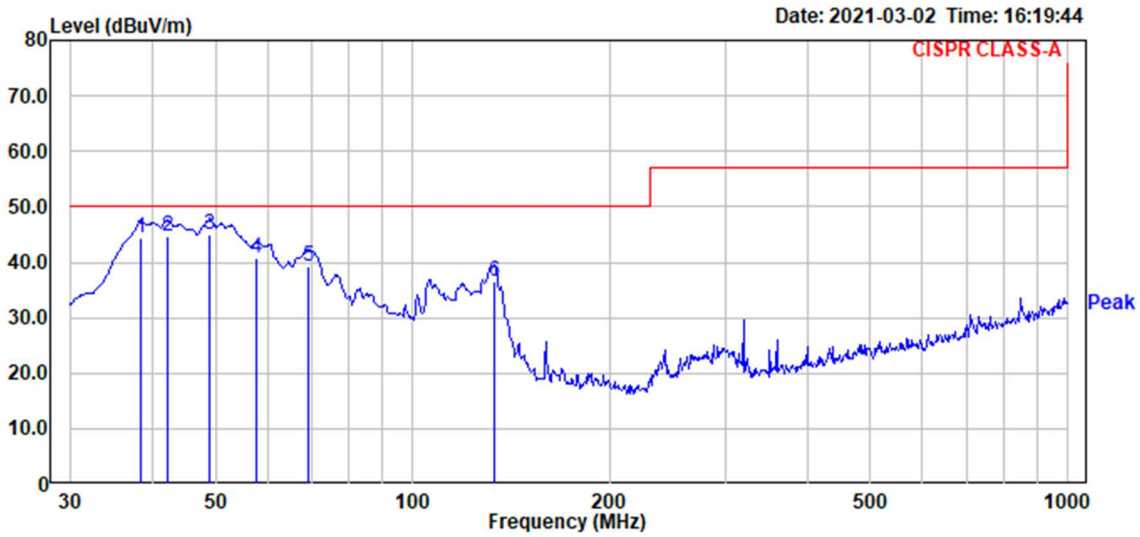
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	38.346	58.04	-10.66	47.38	50.00	-2.62	vertical	QP
2	40.276	60.72	-12.39	48.33	50.00	-1.67	vertical	QP
3	41.874	61.25	-13.42	47.83	50.00	-2.17	vertical	QP
4	45.058	61.40	-15.74	45.66	50.00	-4.34	vertical	QP
5	97.456	54.21	-16.46	37.75	50.00	-12.25	vertical	QP
6	133.619	44.44	-12.04	32.40	50.00	-17.60	vertical	QP

Test Mode	Mode 1	Pol/Phase	Horizontal
Test Frequency	30 MHz ~ 1GHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	21 °C	Relative Humidity	43%

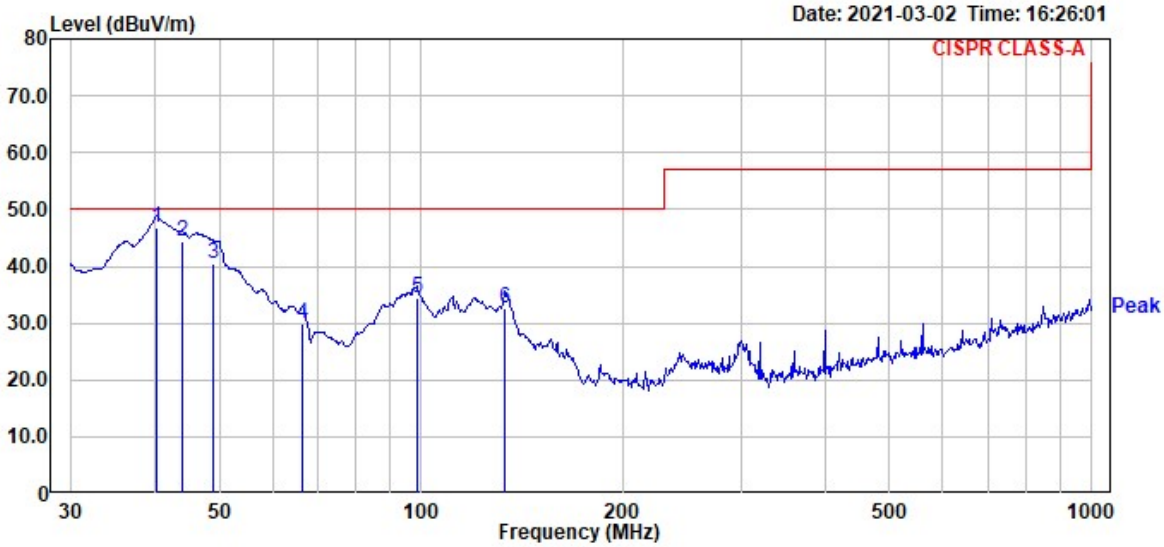
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	38.346	54.92	-10.66	44.26	50.00	-5.74	horizontal	QP
2	42.154	58.33	-13.60	44.73	50.00	-5.27	horizontal	QP
3	49.014	62.63	-17.76	44.87	50.00	-5.13	horizontal	QP
4	57.796	59.55	-18.67	40.88	50.00	-9.12	horizontal	QP
5	69.357	57.19	-18.02	39.17	50.00	-10.83	horizontal	QP
6	133.619	48.52	-12.04	36.48	50.00	-13.52	horizontal	QP

Test Mode	Mode 2	Pol/Phase	Vertical
Test Frequency	30 MHz ~ 1GHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	21 °C	Relative Humidity	43%

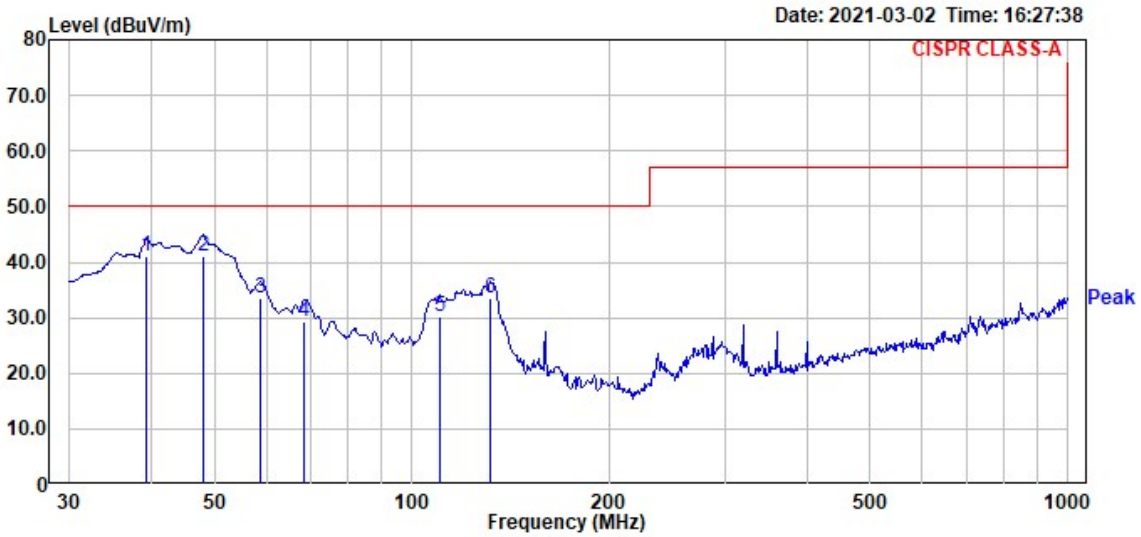
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	40.276	59.30	-12.39	46.91	50.00	-3.09	vertical	QP
2	43.964	59.53	-15.17	44.36	50.00	-5.64	vertical	QP
3	49.014	58.21	-17.76	40.45	50.00	-9.55	vertical	QP
4	66.499	48.06	-18.08	29.98	50.00	-20.02	vertical	QP
5	98.487	50.54	-16.14	34.40	50.00	-15.60	vertical	QP
6	133.619	44.55	-12.04	32.51	50.00	-17.49	vertical	QP

Test Mode	Mode 2	Pol/Phase	Horizontal
Test Frequency	30 MHz ~ 1GHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	21 °C	Relative Humidity	43%

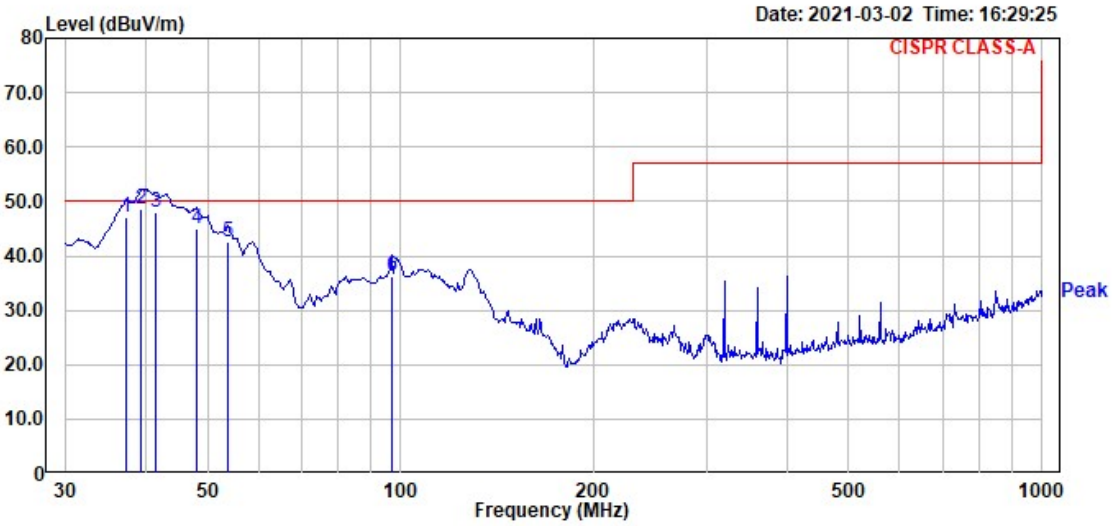
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	39.299	52.60	-11.44	41.16	50.00	-8.84	horizontal	QP
2	47.994	58.42	-17.35	41.07	50.00	-8.93	horizontal	QP
3	58.819	52.17	-18.61	33.56	50.00	-16.44	horizontal	QP
4	68.391	47.19	-17.89	29.30	50.00	-20.70	horizontal	QP
5	110.182	43.32	-13.11	30.21	50.00	-19.79	horizontal	QP
6	131.758	45.47	-11.89	33.58	50.00	-16.42	horizontal	QP

Test Mode	Mode 3	Pol/Phase	Vertical
Test Frequency	30 MHz ~ 1GHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	21 °C	Relative Humidity	43%

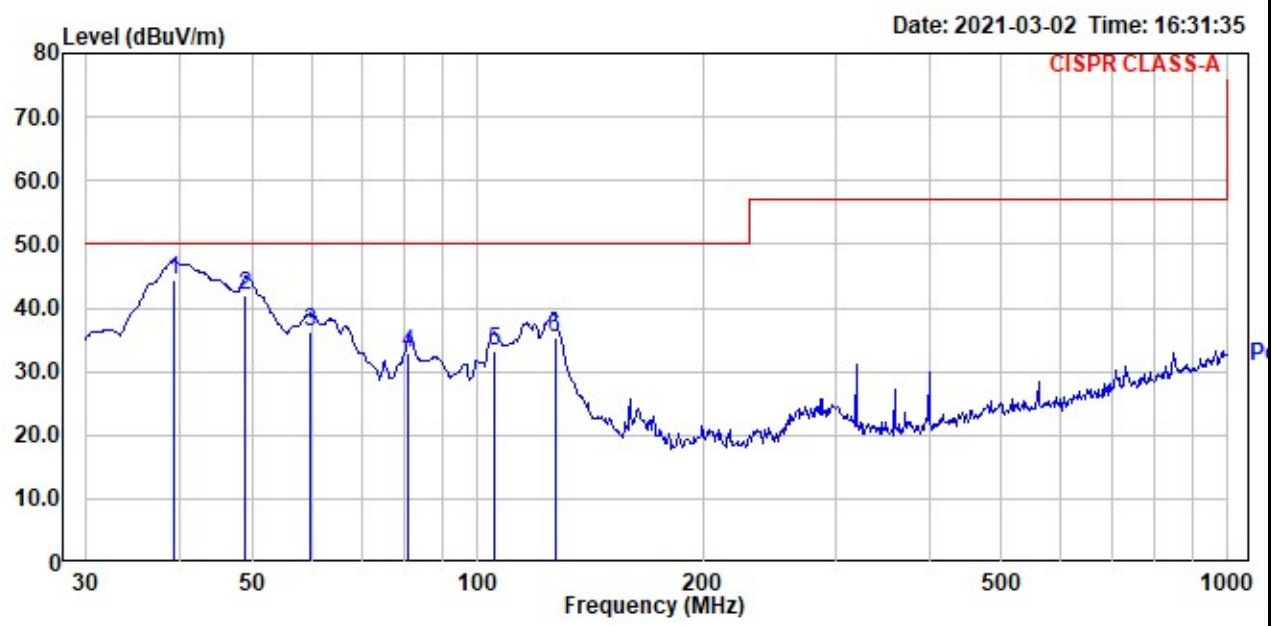
Note:
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + antenna factor – gain of pre-amplifier.
3. Q.P is abbreviation of quasi-peak.



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	37.285	57.01	-9.90	47.11	50.00	-2.89	vertical	QP
2	39.437	60.05	-11.58	48.47	50.00	-1.53	vertical	QP
3	41.584	61.39	-13.27	48.12	50.00	-1.88	vertical	QP
4	47.994	62.19	-17.35	44.84	50.00	-5.16	vertical	QP
5	53.882	61.16	-18.67	42.49	50.00	-7.51	vertical	QP
6	96.775	52.81	-16.67	36.14	50.00	-13.86	vertical	QP

Test Mode	Mode 3	Pol/Phase	Horizontal
Test Frequency	30 MHz ~ 1GHz	Test Voltage	230Vac/50Hz
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	21 °C	Relative Humidity	43%

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	39.299	55.96	-11.44	44.52	50.00	-5.48	horizontal	QP
2	49.014	59.74	-17.76	41.98	50.00	-8.02	horizontal	QP
3	59.649	54.56	-18.40	36.16	50.00	-13.84	horizontal	QP
4	80.927	51.34	-18.45	32.89	50.00	-17.11	horizontal	QP
5	105.272	47.21	-14.11	33.10	50.00	-16.90	horizontal	QP
6	126.772	47.13	-11.77	35.36	50.00	-14.64	horizontal	QP

5. Harmonic Current Emission Measurement

5.1 Limits for Emission Measurement

Table 2 – Current emission limits for equipment other than balanced three-phase equipment

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %						Admissible harmonic parameters %	
	I_3	I_5	I_7	I_9	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
33	21,6	10,7	7,2	3,8	3,1	2	23	23
66	24	13	8	5	4	3	26	26
120	27	15	10	6	5	4	30	30
250	35	20	13	9	8	6	40	40
≥350	41	24	15	12	10	8	47	47
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and $PWHC$ in the same way as odd order harmonics. Linear interpolation between successive R_{sce} values is permitted.								
[a] I_{ref} = reference current; I_h = harmonic current component.								

Table 3 – Current emission limits for balanced three-phase equipment

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %				Admissible harmonic parameters %	
	I_5	I_7	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
33	10,7	7,2	3,1	2	13	22
66	14	9	5	3	16	25
120	19	12	7	4	22	28
250	31	20	12	7	37	38
≥350	40	25	15	10	48	46
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and $PWHC$ in the same way as odd order harmonics. Linear interpolation between successive R_{sce} values is permitted.						
[a] I_{ref} = reference current; I_h = harmonic current component.						

Table 4 – Current emission limits for balanced three-phase equipment under specified conditions (a, b, c)

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %				Admissible harmonic parameters %	
	I_5	I_7	I_{11}	I_{13}	THC / I_{ref}	$PWHC/ I_{ref}$
33	10,7	7,2	3,1	2	13	22
≥120	40	25	15	10	48	46
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and $PWHC$ in the same way as odd order harmonics. Linear interpolation between both R_{sce} values is permitted.						
[a] I_{ref} = reference current; I_h = harmonic current component.						

Table 5 – Current emission limits for balanced three-phase equipment under specified conditions (d, e, f)

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %											Admissible harmonic parameters %	
	I_5	I_7	I_{11}	I_{13}	I_{17}	I_{19}	I_{23}	I_{25}	I_{29}	I_{31}	I_{35}	I_{37}	THC / I_{ref}	$PWHC/ I_{ref}$
33	10,7	7,2	3,1	2	2	1,5	1,5	1,5	1	1	1	1	13	22
≥250	25	17,3	12,1	10,7	8,4	7,8	6,8	6,5	5,4	5,2	4,9	4,7	35	70
For R_{sce} equal to 33, the relative values of even harmonics up to order 12 shall not exceed 16/h %. The relative values of all harmonics from I_{14} to I_{40} not listed above shall not exceed 1 % of I_{ref} For R_{sce}≥ 250, the relative values of even harmonics up to order 12 shall not exceed 16/h %. The relative values of all harmonics from I_{14} to I_{40} not listed above shall not exceed 3 % of I_{ref}. Linear interpolation between both R_{sce} values is permitted.														
[a] I_{ref} = reference current; I_h = harmonic current component.														

Test requirement:

Emission tests shall be conducted with the user's operation controls or automatic programs set to the mode expected to produce the maximum total harmonic current (THC) under normal operating conditions. This defines the equipment set-up during emission tests and not a requirement to conduct searches for worst-case emissions.

5.2 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 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 in the shielded room.

d. Decide the classification of the EUT as following:

For equipment not complying with the harmonic current emission limits corresponding to Rsce = 33, the manufacturer shall

• determine the minimum value of Rsce for which the limits given in relevant Table 2, Table 3, Table 4 or Table 5 are not exceeded,

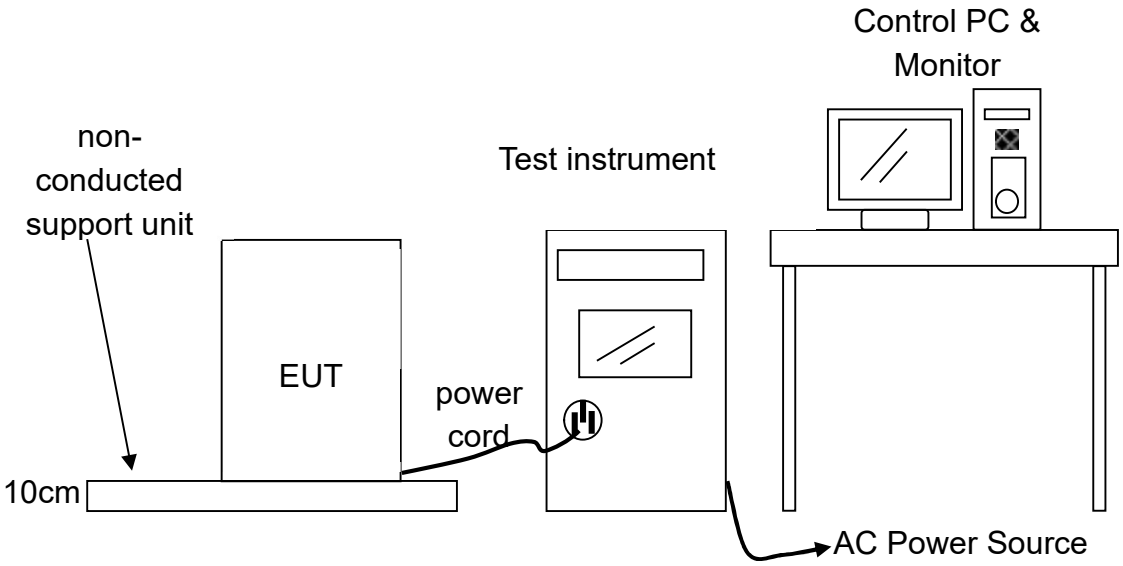
• declare the value of the short-circuit power Ssc corresponding to this minimum value of Rsce (see 3.14) in the instruction manual,

• and instruct the user to determine, in consultation with the distribution network operator if necessary, that the equipment is connected only to a supply of that Ssc value or more. For that purpose, the statement in the instruction manual shall be: "This equipment complies with IEC 61000-3-12 provided that the short-circuit power Ssc is greater than or equal to xx at the interface point between the user's supply and the public system. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a short-circuit power Ssc greater than or equal to xx." where xx is the value of Ssc corresponding to the minimum value of Rsce for which the limits given in the relevant Table 2, 3, 4 or 5 are not exceeded.,

e. Connects the EUT's power source to the mains power supplied by the test instrument. Turn on the EUT.

f. Operating the EUT as required and measuring the harmonic current emissions on the current carrying lines of EUT's power source.

5.3 Test Configurations



5.4 Photographs of the Test Configurations

Front View	

5.5 Test Results and data

Test Mode	Mode1	**Final Test Result**	Pass
Basic Standard	IEC61000-3-12	**Test Voltage**	230Vac/50Hz
Test Date	Mar 03,2021	**Test Engineer**	David
Temperature	19 °C	**Relative Humidity**	63%
Test frequency	50Hz	**Test time**	3 minutes
Max watts	5.059kW	**Ref. Max Current**	22.394A
Classification	Table 2	**Rsce**	33

Test information			
	Average	Peak	Limit
THC	422.083mA	428.238mA	5.151A
POHC	0.000A	0.000A	5.151A
Voltage Crest Factor	1.615	2.254	N/A
Current Crest Factor	1.63	2.103	N/A

Harmonic results							
Harmonic	Status	Avg (A)	Avg L(A)	Avg %ofL	Peak (A)	Peak L(A)	Peak %ofL
1	PASS	22.3701	No Limit	N/A	22.3925	No Limit	N/A
2	PASS	0.284871	1.79151	15.9012	0.293719	2.68726	10.93
3	PASS	0.153316	4.83708	3.16961	0.170257	7.25561	2.34655
4	PASS	0.311421	0.895755	34.7664	0.318141	1.34363	23.6777
5	PASS	0.165948	2.39614	6.92561	0.183094	3.59422	5.09414
6	PASS	0.155004	0.59717	25.9564	0.166721	0.895755	18.6124
7	PASS	0.163581	1.61236	10.1454	0.175521	2.41854	7.25733
8	PASS	0.076217	0.447877	17.0173	0.08733	0.671816	12.9991
9	PASS	0.191175	0.850967	22.4656	0.221797	1.27645	17.3761
10	PASS	0.057974	0.358302	16.1801	0.078735	0.537453	14.6496
11	PASS	0.161092	0.69421	23.205	0.188712	1.04131	18.1225
12	PASS	0.045123	0.298585	15.1123	0.056294	0.447877	12.569
13	PASS	0.142631	0.447877	31.846	0.159304	0.671816	23.7125
14	PASS	0.063176	No Limit	N/A	0.077179	No Limit	N/A
15	PASS	0.087536	No Limit	N/A	0.128487	No Limit	N/A

Test Mode	Mode1	Final Test Result	Pass
Basic Standard	IEC61000-3-12	Test Voltage	230Vac/50Hz
Test Date	Mar 03,2021	Test Engineer	David
Temperature	19 °C	Relative Humidity	63%
Test frequency	50Hz	Test time	3 minutes
Max watts	5.059kW	Ref. Max Current	22.394A
Classification	Table 2	Rsce	33

Harmonic results							
Harmonic	Status	Avg (A)	Avg L(A)	Avg %ofL	Peak (A)	Peak L(A)	Peak %ofL
16	PASS	0.068909	No Limit	N/A	0.083158	No Limit	N/A
17	PASS	0.075331	No Limit	N/A	0.094823	No Limit	N/A
18	PASS	0.084567	No Limit	N/A	0.11316	No Limit	N/A
19	PASS	0.072992	No Limit	N/A	0.084545	No Limit	N/A
20	PASS	0.079144	No Limit	N/A	0.093045	No Limit	N/A
21	PASS	0.117209	No Limit	N/A	0.145918	No Limit	N/A
22	PASS	0.076316	No Limit	N/A	0.087461	No Limit	N/A
23	PASS	0.080004	No Limit	N/A	0.106584	No Limit	N/A
24	PASS	0.073903	No Limit	N/A	0.087841	No Limit	N/A
25	PASS	0.090025	No Limit	N/A	0.111531	No Limit	N/A
26	PASS	0.092297	No Limit	N/A	0.111925	No Limit	N/A
27	PASS	0.066586	No Limit	N/A	0.096	No Limit	N/A
28	PASS	0.051532	No Limit	N/A	0.068635	No Limit	N/A
29	PASS	0.061452	No Limit	N/A	0.075641	No Limit	N/A
30	PASS	0.063778	No Limit	N/A	0.084566	No Limit	N/A
31	PASS	0.05336	No Limit	N/A	0.068052	No Limit	N/A
32	PASS	0.044652	No Limit	N/A	0.053746	No Limit	N/A
33	PASS	0.05436	No Limit	N/A	0.061731	No Limit	N/A
34	PASS	0.042188	No Limit	N/A	0.056034	No Limit	N/A
35	PASS	0.051248	No Limit	N/A	0.062988	No Limit	N/A
36	PASS	0.043692	No Limit	N/A	0.068179	No Limit	N/A
37	PASS	0.048822	No Limit	N/A	0.060895	No Limit	N/A
38	PASS	0.038329	No Limit	N/A	0.051312	No Limit	N/A
39	PASS	0.059517	No Limit	N/A	0.071708	No Limit	N/A
40	PASS	0.03659	No Limit	N/A	0.045218	No Limit	N/A

6. Voltage Fluctuations and Flickers Emission Measurement

6.1 Limits for Emission Measurement

- the short-term flicker indicator, P_{st}, shall not be greater than 1.0;
- the long-term flicker indicator, P_{lt}, shall not be greater than 0.65;
- the relative steady-state voltage change, d_c, shall not exceed 3.3%;
- the voltage change with time, d(t), during a voltage change shall not exceed 3.3% for more than 500ms.
- the maximum relative voltage change, d_{max}, shall not exceed
    a) 4% without additional conditions;
    b) 6% for equipment which is switched manually
    c) 7% for equipment which is attended whilst in use

6.2 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 theuser'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 in the shielded room.

d. Decide the type of EUT to define the d_{max} limit and its corresponding test methods described in the relative standard.

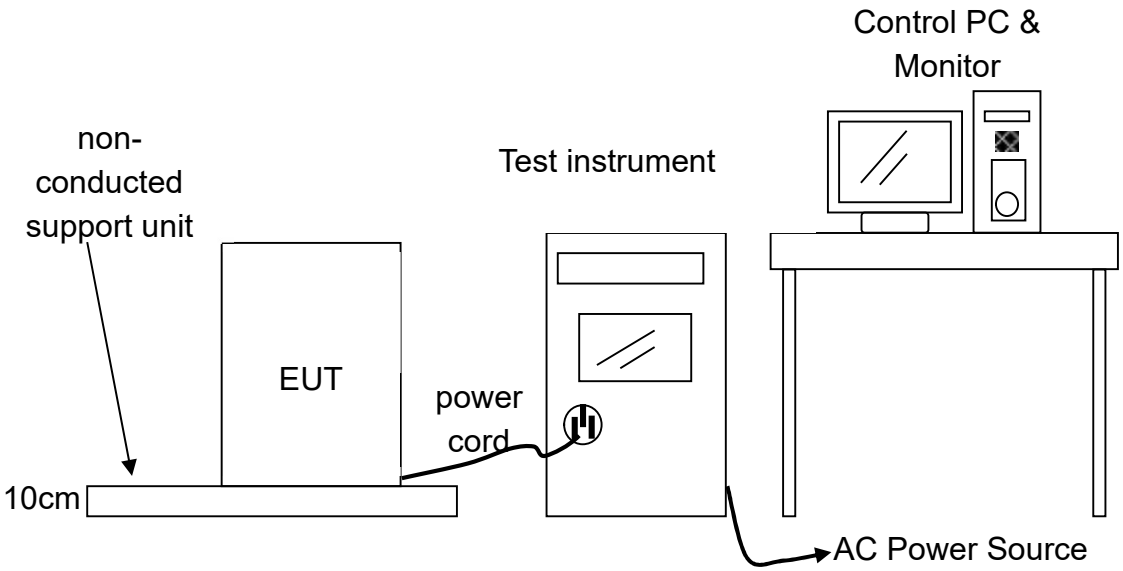
e. Maintain the supply voltage to be ±2% of the EUT's rated voltage and also the frequency to be 50Hz ±0.5%.

f. Connects the EUT's power source to the mains power supplied by the test instrument.

g. Operating the EUT as required and measuring the voltage fluctuation and flickersof EUT's power source.

h. Verify the fluctuations of the test supply voltage to be less than 0.4 before and after the test.

6.3 Test Configurations



6.4 Photographs of the Test Configurations

Front View	

6.5 Test Results and data

Test Mode	Mode1	**Final Test Result**	Pass
Basic Standard	IEC61000-3-11	**Test Voltage**	230V/400V,3phase
Test Date	Mar 03,2021	**Test Engineer**	Dylan
Temperature	19 °C	**Relative Humidity**	63%
Test frequency	50Hz	**PST Test time**	10 minutes
Class	Voltage	**Mode**	Normal (4%)
PLT	1 PSTs		

Limitation		DC (%)	Dmax (%)	Tmax (s)	PST	PLT
		4	3.3	0.5	10 minutes	1 PSTs
Test results						
PST no.	Status	DC (%)	Dmax (%)	Tmax (s)	PST	PLT
1	Pass	0.00764	0.2236	0.00000	0.08331	0.08331

7. Electrostatic Discharge (ESD) Immunity Test

7.1 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℃ to 35℃;
- 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.

7.2 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.			

7.3 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 470kΩ resister 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.

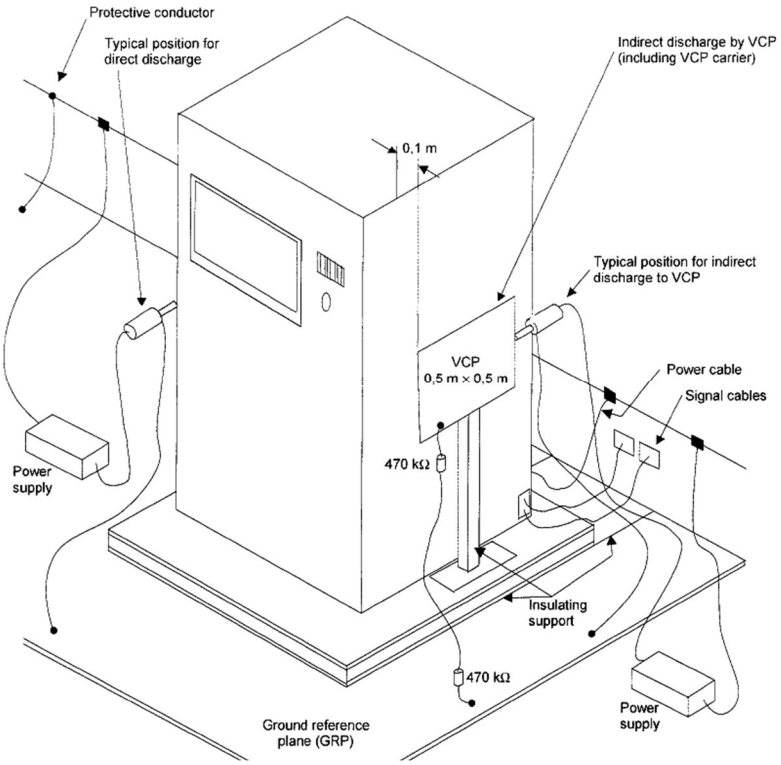
h. Select appropriate points of the EUT for contact discharge and put marks on it to indicate the tested point(s). Then start the contact discharge with the tip of the discharge electrode to touch the EUT before the discharge switch is operated.

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.

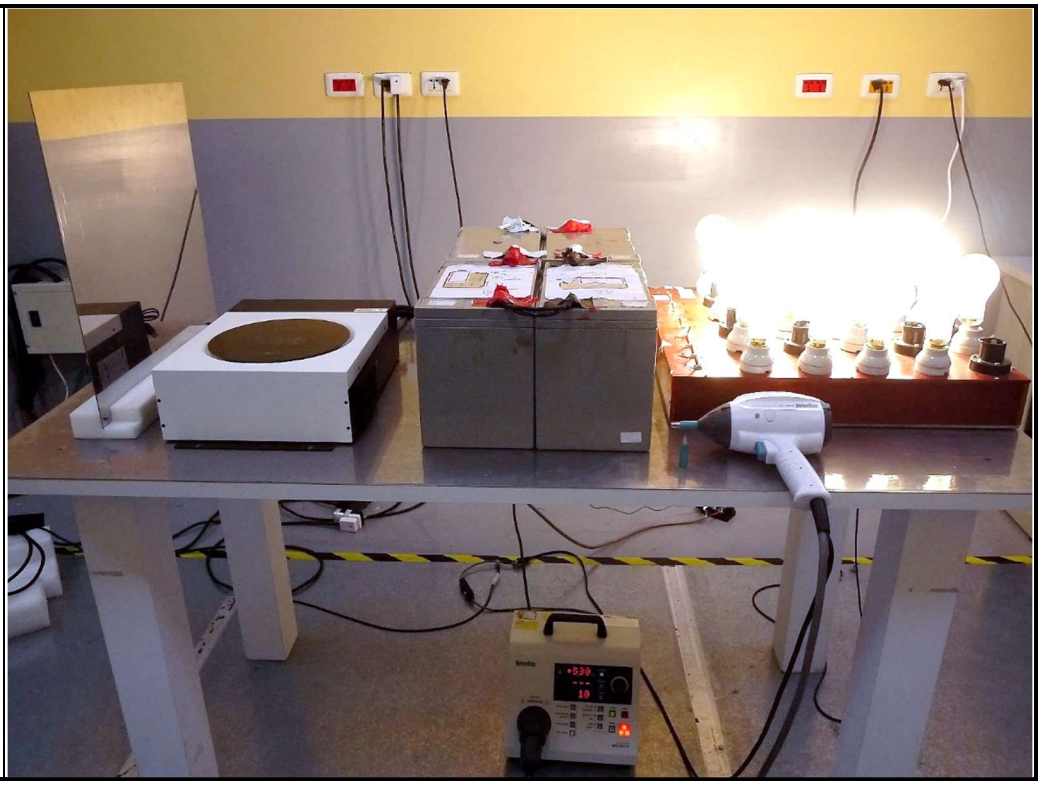
j. The indirect HCP discharge test is applied at the front edge of each HCP opposite the center point of each unit of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.

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.

7.4 Test Configurations



7.5 Photographs of the Test Configurations

Front View	

7.6 Test Results

Test Mode	Mode 1	Final Test Result	Pass
Test Date	Mar03,2021	Test Engineer	David
Temperature	22 °C	Relative Humidity	57%
Atmospheric Pressure	1005 hPa		

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

		Contact Discharge							
		10 times / each							
Voltage		2 KV		4 KV		6 KV		8 KV	
No\ Point\Polarity		+	–	+	–	+	–	+	–
	HCP Right	---	---	A	A	---	---	---	---
	HCP Left	---	---	A	A	---	---	---	---
	HCP Rear	---	---	A	A	---	---	---	---
	HCP Front	---	---	A	A	---	---	---	---
	VCP Right	---	---	A	A	---	---	---	---
	VCP Left	---	---	A	A	---	---	---	---
	VCP Rear	---	---	A	A	---	---	---	---
	VCP Front	---	---	A	A	---	---	---	---
A	Screw	---	---	A	A	---	---	---	---
B	RJ45 shield	---	---	A	A	---	---	---	---
C	GND screw	---	---	A	A	---	---	---	---
D	Fuse holder	---	---	A	A	---	---	---	---

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

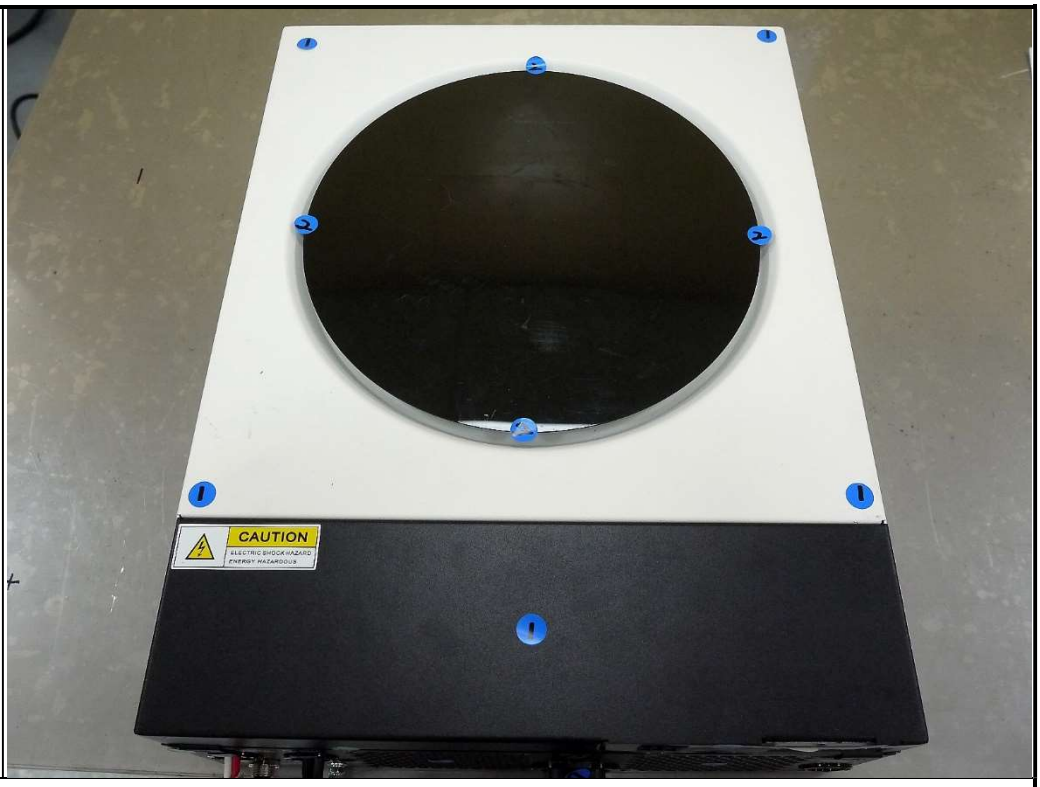
		AIR Discharge							
		10 times / each							
Voltage		2 KV		4 KV		8 KV		15 KV	
No\Point\Polarity		+	—	+	—	+	—	+	—
1	Enclosure	A	A	A	A	A	A	---	---
2	Screen edge	A	A	A	A	A	A	---	---
3	Switch	A	A	A	A	A	A	---	---
4	USB port	A	A	A	A	A	A	---	---
5	AC input	A	A	A	A	A	A	---	---
6	AC output	A	A	A	A	A	A	---	---
7	DC output	A	A	A	A	A	A	---	---
8	Vents	A	A	A	A	A	A	---	---

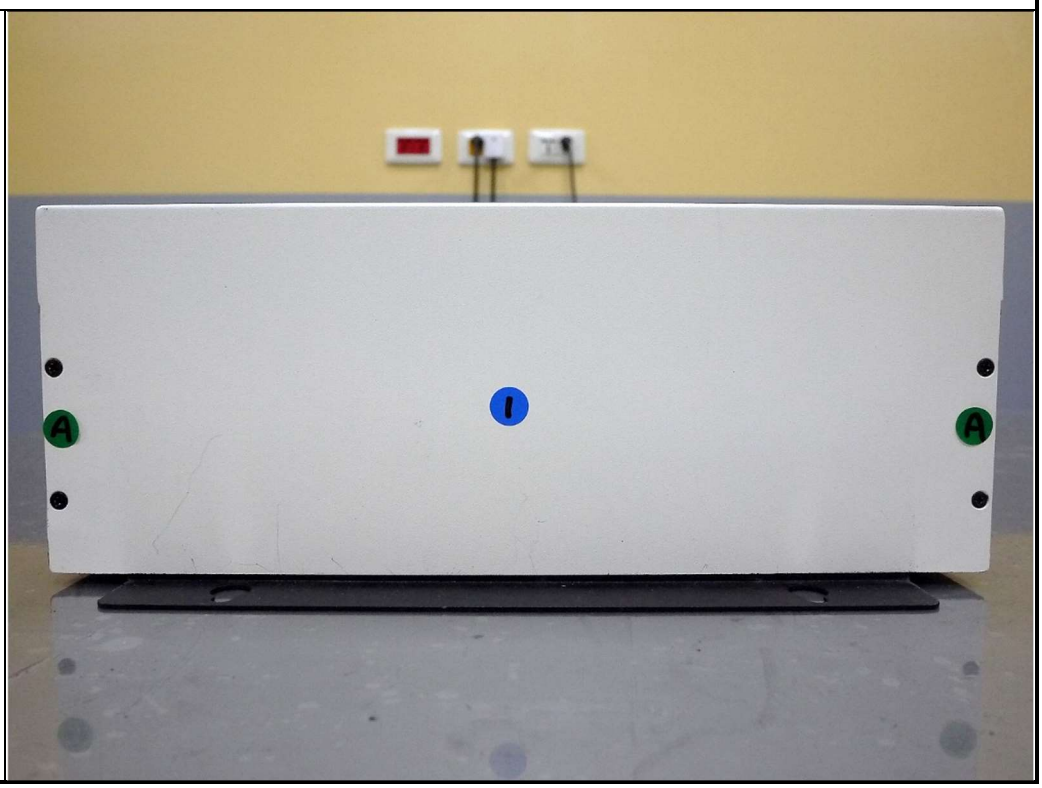
Note: “A” means the EUT function is normal working during the test.

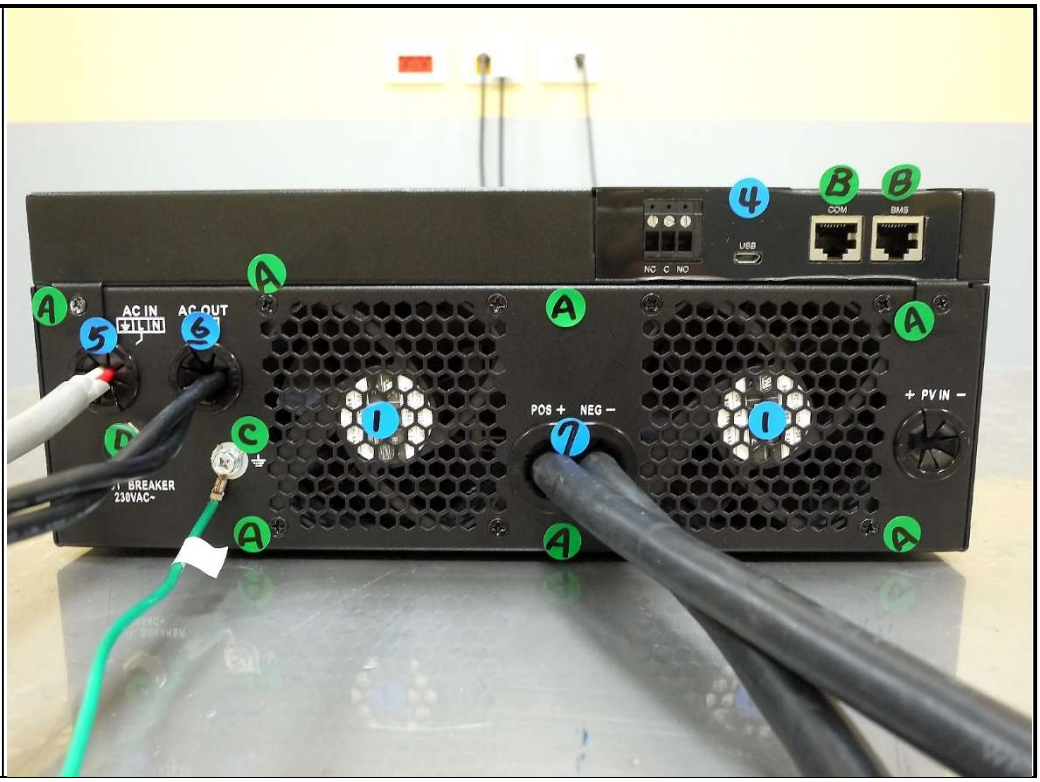
Observation of Performance during Test

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

7.7 Photographs of the Test Points on the EUT for ESD Test

View 1	
View 2	

View 3	
View 4	

View 5	

8. Radiated Electromagnetic Field (RS) Immunity Test

8.1 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*10-3 decades/s. The sensitive frequencies or frequencies of dominant interest may be discretely analyzed.

8.2 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.	

8.3 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 theuser'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 2meters 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 inthe test frequency range and with the specified modulation type.

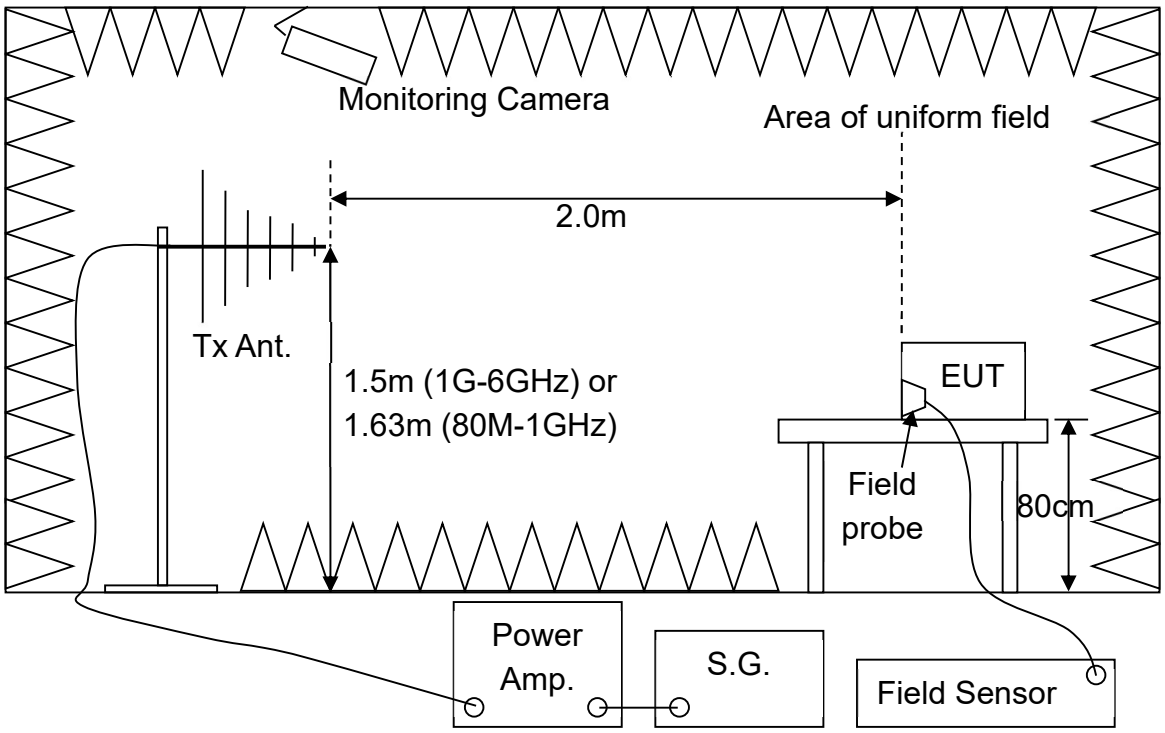
h. The transmitting antenna is normally facing each of the four sides of the EUT with two polarizations (Vertical and Horizontal) to perform the test.

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.

8.4 Test Configurations



8.5 Photographs of the Test configurations

Front View	

8.6 Test Result and Data

Test Mode	Mode 1	Final Test Result	Pass
Test Date	Mar 02,2021	Test Engineer	Dylan
Temperature	20°C	Relative Humidity	46 %
Atmospheric Pressure	1005 hPa		

Pass performance criteria	A
Required performance criteria	A
Basic Standard	IEC 61000-4-3
Product Standard	IEC 61000-6-2
Frequency Range	80~1000 MHz, 1400M-6000MHz
Modulation	80% AM1kHz modulation
Dwell time	3 S
Frequency Step Size	1 %

Frequency (MHz)	AntennaPolarization	Face	Field strength (V/m)	Result
80~1000	Vertical	Front	10	A
80~1000	Vertical	Rear	10	A
80~1000	Vertical	Left	10	A
80~1000	Vertical	Right	10	A
80~1000	Horizontal	Front	10	A
80~1000	Horizontal	Rear	10	A
80~1000	Horizontal	Left	10	A
80~1000	Horizontal	Right	10	A

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

Frequency (MHz)	AntennaPolarization	Face	Field strength (V/m)	Result
1400-6000	Vertical	Front	3	A
1400-6000	Vertical	Rear	3	A
1400-6000	Vertical	Left	3	A
1400-6000	Vertical	Right	3	A
1400-6000	Horizontal	Front	3	A
1400-6000	Horizontal	Rear	3	A
1400-6000	Horizontal	Left	3	A
1400-6000	Horizontal	Right	3	A

Observation of Performance during Test

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

9. Electrical fast transient / burst (EFT) 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. 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, andbonded to, the ground reference plane.

e. All cables to the EUT shall be placed on the insulation support 0.1 m above the groundreference plane. Cables not subject to electrical fast transients shall be routed as far aspossible 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 andsituated 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.

9.2 Test Severity Levels

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

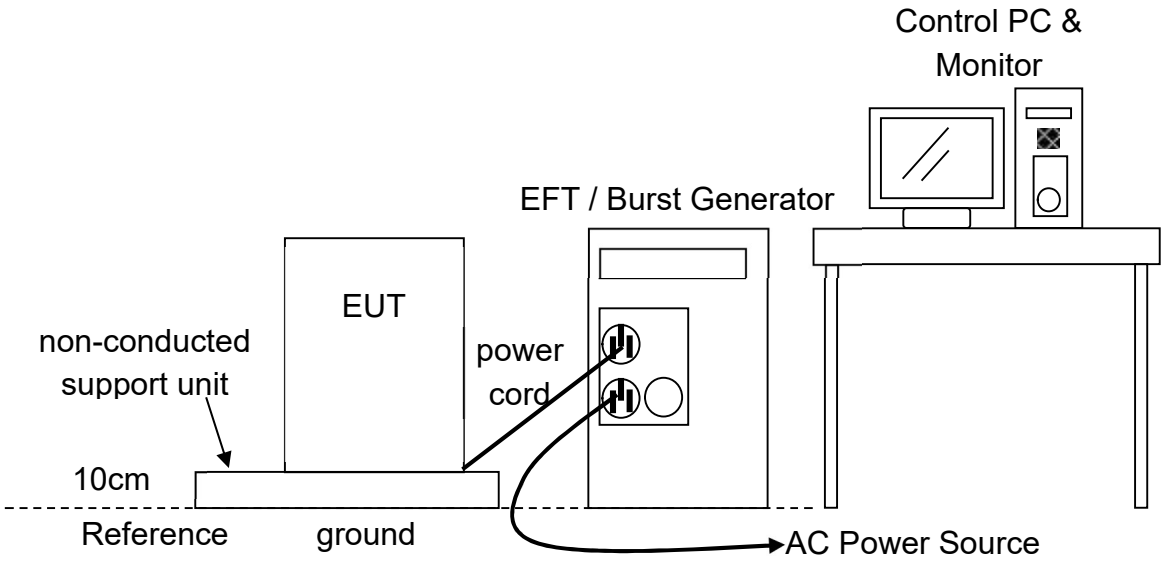
Open circuit output test voltage ± 10%

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

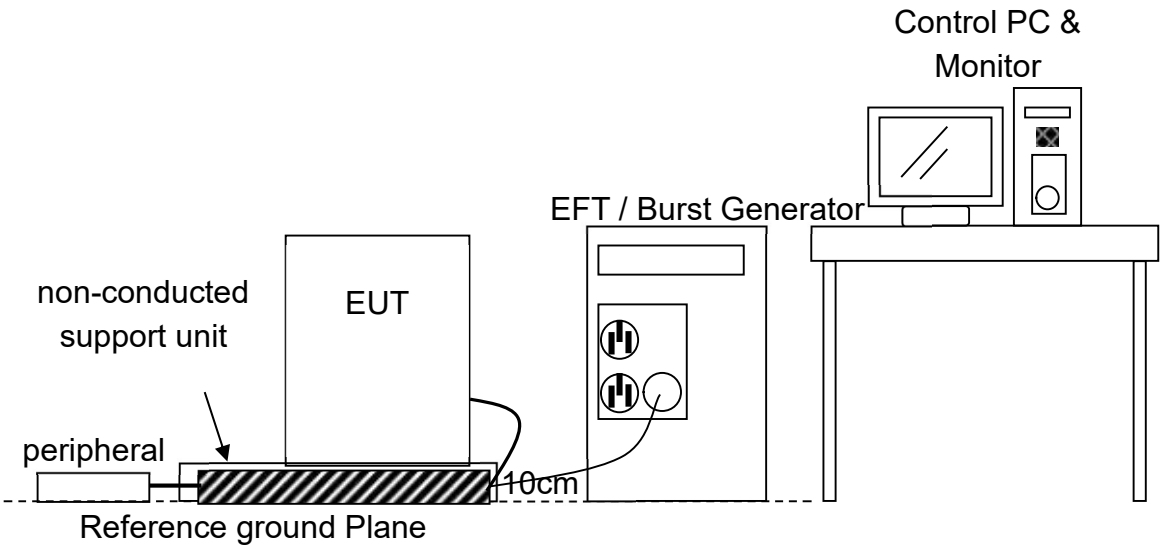
Remark : " X " is an open level. The level is subject to negotiation between the user and manufacturer or is specified by the manufacturer.

9.3 Test Configurations

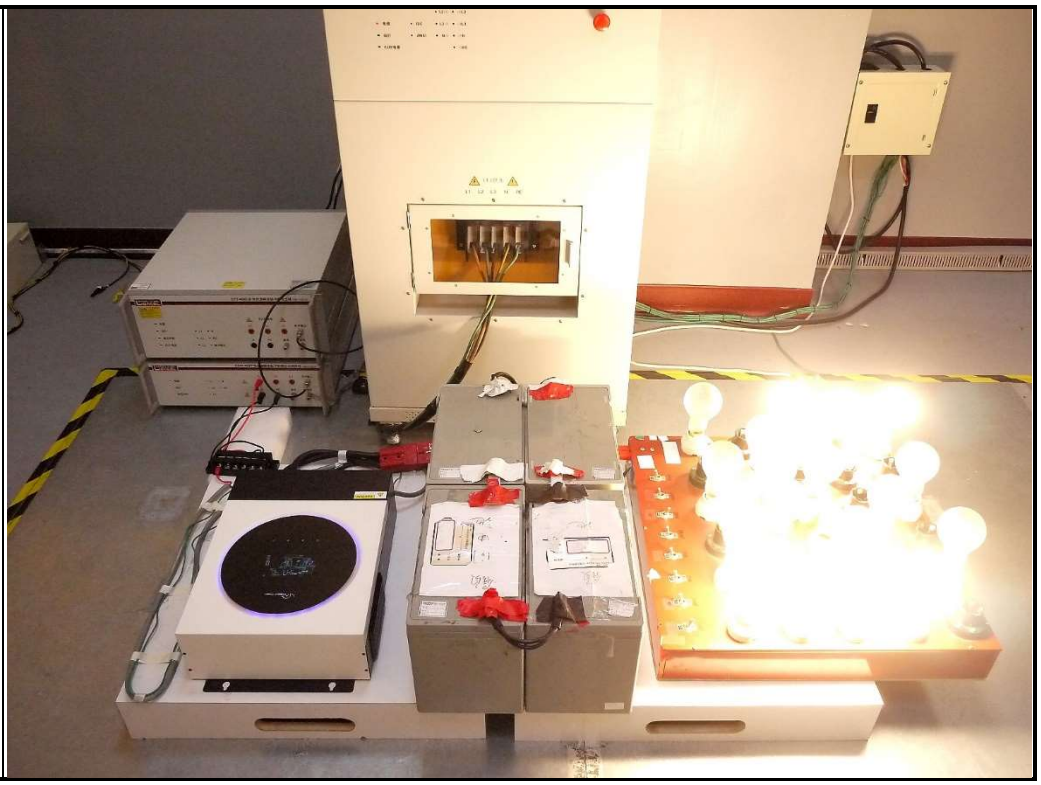
Power supply port Test



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



9.4 Photographs of the Test Configurations

Front View	

9.5 Test Result and Data

Test Mode	Mode1	**Final Test Result**	Pass
Test Date	Mar04,2021	**Test Engineer**	David
Temperature	21°C	**Relative Humidity**	57%
Atmospheric Pressure	1005 hPa		

Pass performance criteria	A
Required performance criteria	B
Basic Standard	IEC 61000-4-4
Product Standard	IEC 61000-6-2
Test Voltage	On AC input power port -±2.0 KV On AC output power port -
Pulse	5/50 ns
Burst	15m/300ms
Repetition Rate	5 kHz
Test time	1 min/each condition

	For AC input power port					
Phase	**1kV**		**2 kV**		**kV**	
	+	**—**	**+**	**—**	**+**	**—**
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.

10. Surge 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 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.

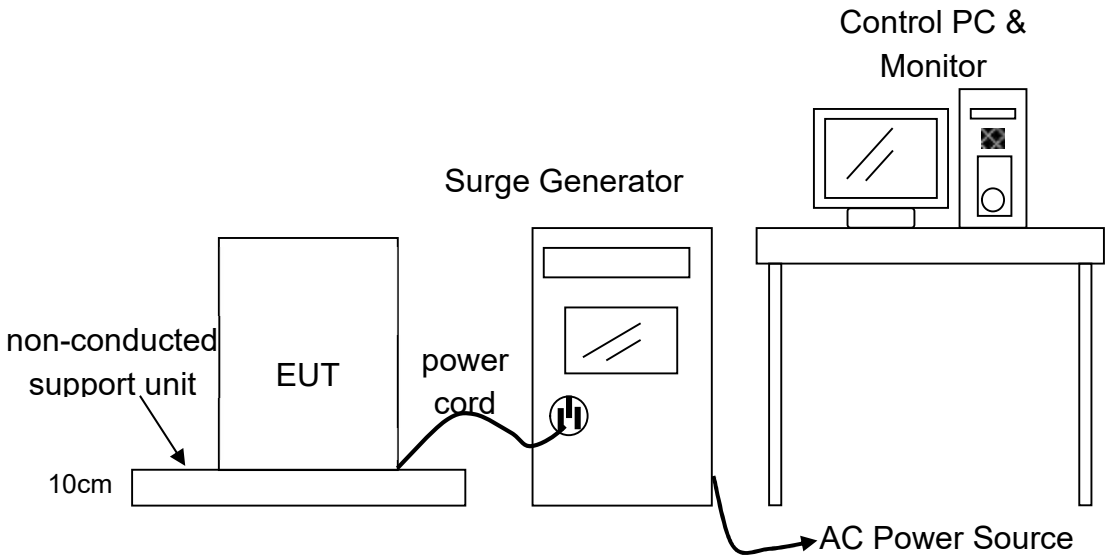
10.2 Test Severity Level

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

[a] "X" and be any level, above, below or in between the others. The level shall be specified in the dedicated equipment specification.

[b] For symmetrical interconnection lines the test can be applied to multiple lines simultaneously with respect to ground, i.e. "lines to ground".

10.3 Test Configurations



10.4 Photographs of the Test Configurations

Front View	

10.5 Test Result and Data

Test Mode	Mode 1	**Final Test Result**	Pass
Test Date	Mar04,2021	**Test Engineer**	David
Temperature	21°C	**Relative Humidity**	57%
Atmospheric Pressure	1005 hPa		

Pass performance criteria	A
Required performance criteria	B
Basic Standard	IEC 61000-4-5
Product Standard	IEC 61000-6-2
Test Voltage	On AC input power port --± 0.5 kV, ± 1.0 kV, ±6KV On AC output power port --± 0.5 kV, ± 1.0 kV, ± 2.0 kV, ±6KV
Waveform	On Power Supply --1.2/50μs(8/20μs)
Repetition rate	60 sec
Test time	5 time/each condition

For AC input power port						
Voltage	**Phase**	**Polarity**	**0°**	**90°**	**180°**	**270°**
0.5kV, 1kV	**L1-N**	**+**	A	A	A	A
		—	A	A	A	A
0.5kV, 1kV,2kV	**L1-PE**	**+**	A	A	A	A
		—	A	A	A	A
0.5kV, 1kV,2kV	**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:

Observation of Performance during Test

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

11. Conducted disturbances (CS) Immunity Test

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. 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 inthe 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.

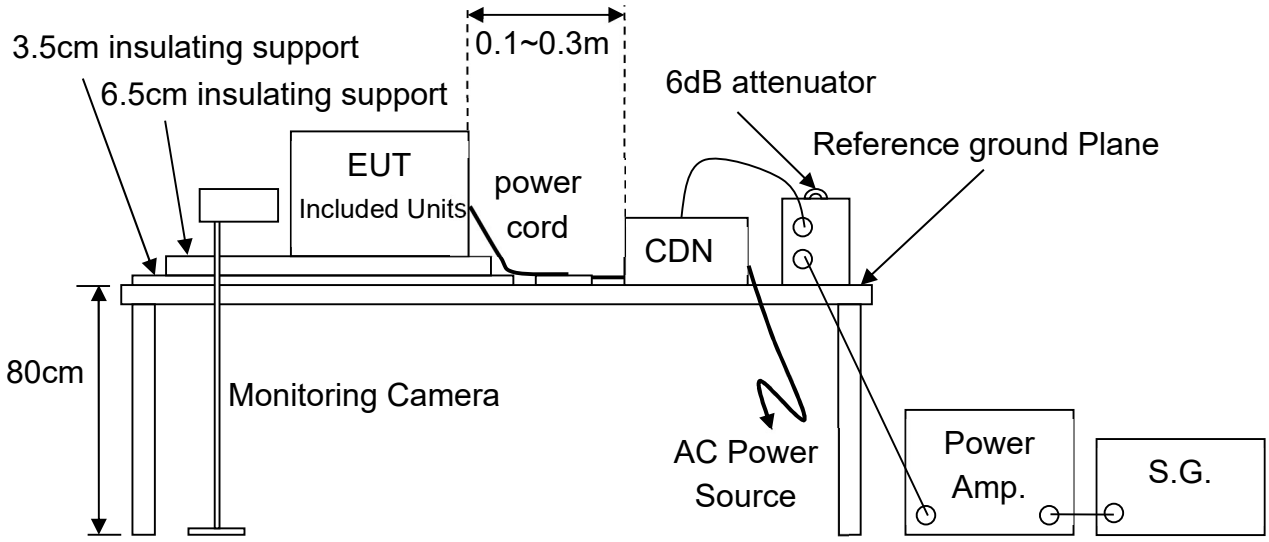
k. Record the performance of the EUT.

11.2 Test Severity Levels

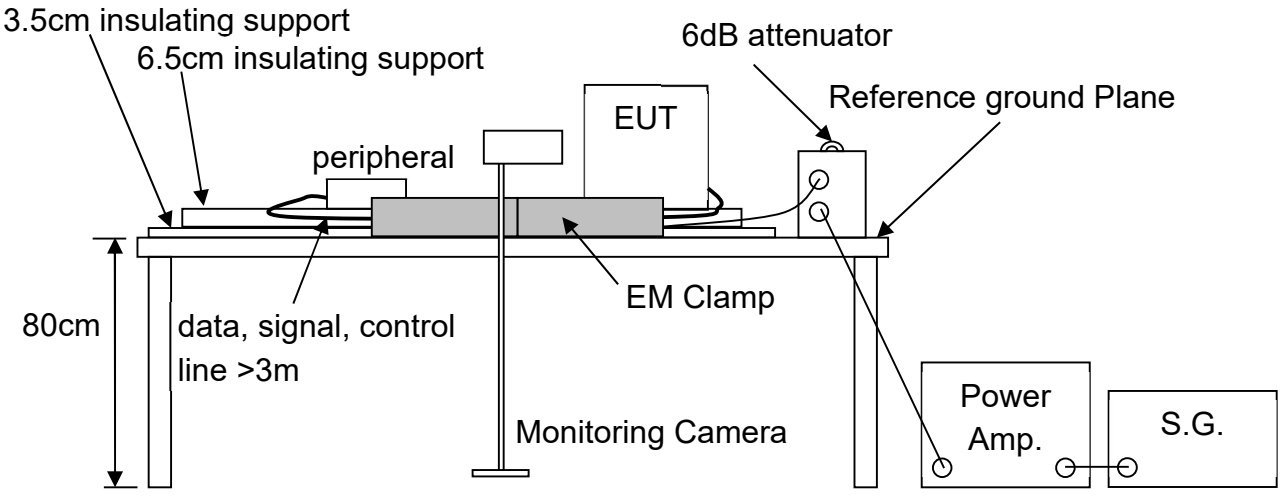
Level	Voltage Level (e.m.f.)
1	1 V
2	3 V
3	10 V
x	Specified
NOTE - x is an open class. This level can be specified in the product specification.	

11.3 Test Configurations

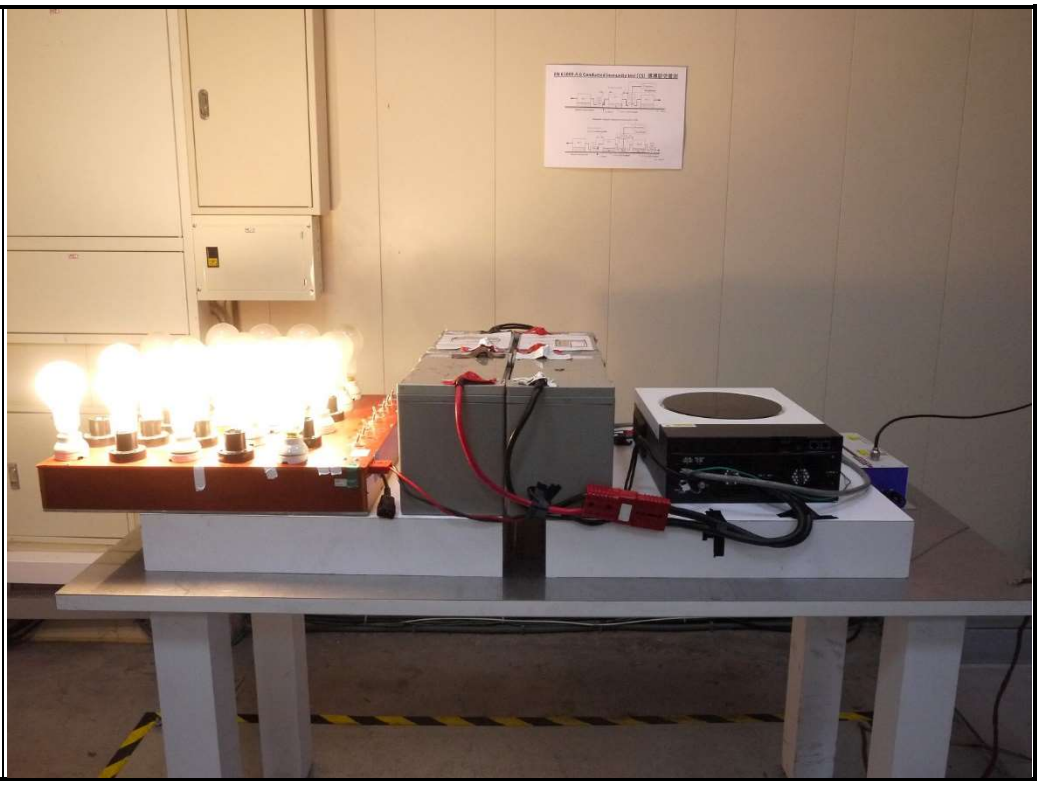
Power supply and LAN port Test



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



11.4 Photographs of the Test Configurations

Front View	

11.5 Test Result and Data

Test Mode	Mode1	Final Test Result	Pass
Test Date	Mar 04,2021	Test Engineer	Dylan
Temperature	23°C	Relative Humidity	54%
Atmospheric Pressure	1005 hPa		

Pass performance criteria	A
Required performance criteria	A
Basic Standard	IEC 61000-4-6
Product Standard	IEC 61000-6-2
Frequency Range	0.15~-80MHz
Modulation	AM 80% , 1KHz sine wave
Dwell time	3 S
Frequency Step Size	1 %
Coupling mode	CDN

For AC input power port			
Frequency	Test Mode	Voltage(V)	Result
0.15 ~ 80MHz	Power(M3)	10	A

Observation of Performance during Test

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

12. Power frequency magnetic field (PFM) Immunity Test

12.1 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 ±3dB.

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 Guass Meter to calibrate the specified test level at the center of the induction coil.

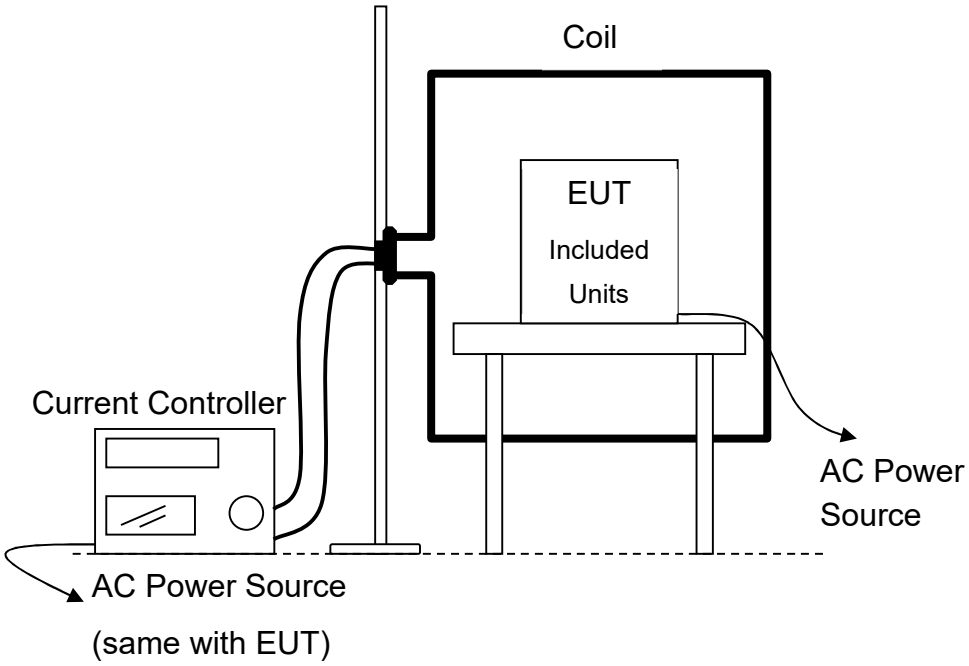
i. Perform the test with the specified magnetic field by rotating the induction coil to three different orientations to generate X, Y and Z directed magnetic field sequentially.

j. Record the performance of the EUT.

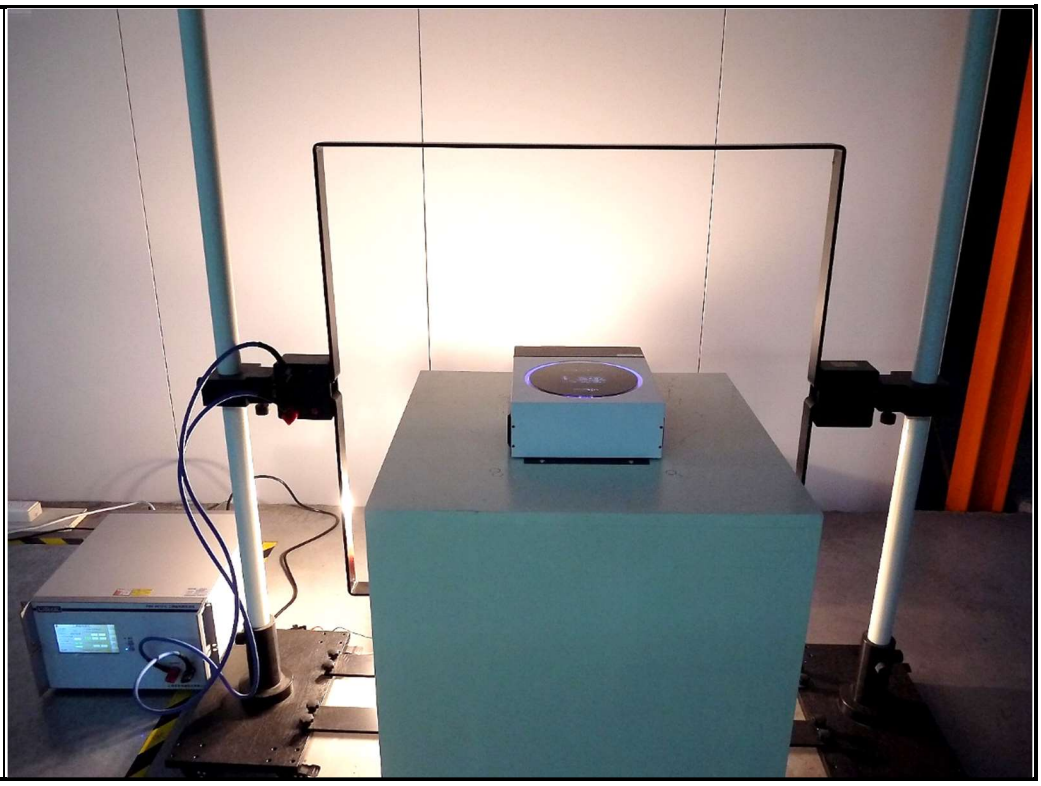
12.2 Test Severity Levels

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

12.3 Test Configurations



12.4 Photographs of the Test Configurations

Front View	

12.5 Test Result and Data

Test Mode	Mode 1	**Final Test Result**	Pass
Test Date	Mar 03,2021	**Test Engineer**	David
Temperature	19°C	**Relative Humidity**	63%
Atmospheric Pressure	1006 hPa		

Pass performance criteria	A
Required performance criteria	A
Basic Standard	IEC 61000-4-8
Product Standard	IEC 61000-6-2
Power FrequencyMagnetic Field	50Hz, 30A/m

Coil Orientation	Testing duration	Results
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.

13. Voltage Dips and Voltage Interruptions Immunity

13.1 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 above the ground reference plane 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. The test shall be performed with the EUT connected to the test Generator with the shortest power supply cable as specified by the manufacturer.

e. If any, tests on the three-phase EUT are accomplished by using three sets of equipment mutually synchronized.

f. During the tests, the main voltage for testing is monitored within an accuracy of 2% and the zero crossing control of the generators must have an accuracy of ±10°.

g. The EUT shall be tested for each selected combination of test level and duration with a sequence of three dips/interruptions with intervals of 10 sec. minimum (between each test event). Each representative mode of operation shall be test.

h. Abrupt changes in supply voltage shall occur at zero crossings of the voltage and additional angles preferably selected from 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° on each phase.

i. Connect the EUT's power source to the appropriate power through the test generator and perform the specified test level.

j. Record the performance of the EUT.

13.2 Test severity

a. Source voltage and frequency : AC 230V / 50Hz, Single phase.

b. Test of interval : 10 sec.

c. Level and duration : Sequence of 3 dips/interrupts.

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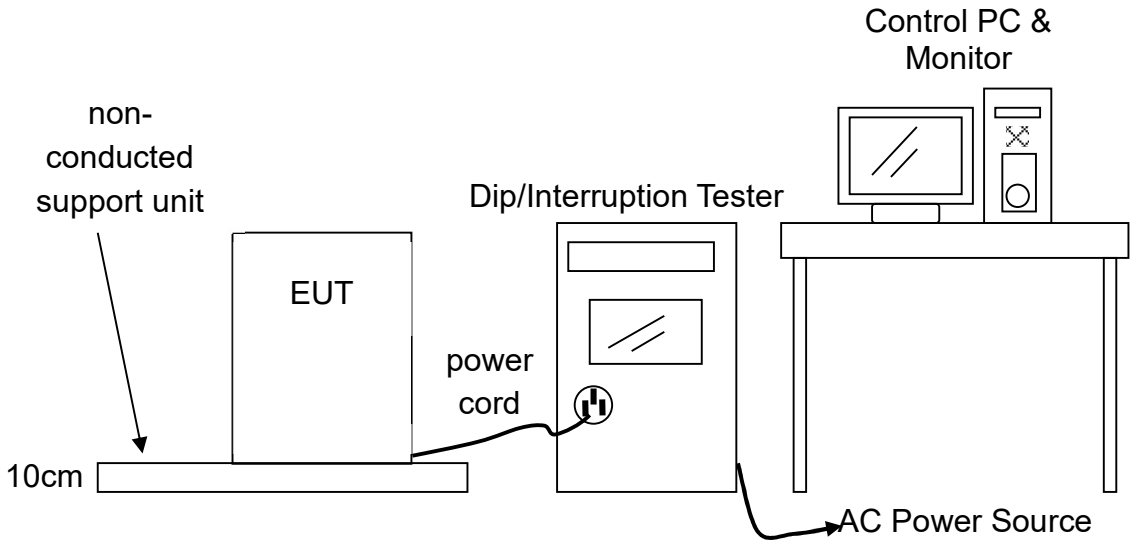
Voltage dips and Interrupt reduction (%)	Test Duration (period)	Required performance criteria
>95%	250	C
30%	25	C
60%	10	C
>95%	1	B

13.3 Test Configurations



13.4 Photographs of the Test Configurations

Front View	

13.5 Test Result and data

Test Mode	Mode 1	Final Test Result	Pass
Test Date	Mar 03,2021	Test Engineer	David
Temperature	19°C	Relative Humidity	63%
Atmospheric Pressure	1006 hPa		

Pass performance criteria	Afor voltage interruption, A/A/A for voltage dips
Required performance criteria	C for voltage interruption, C/C/B for voltage dips
Basic Standard	IEC 61000-4-34
Product Standard	IEC 61000-6-2

Voltage(UT): AC 230V 50 Hz Interval(s) : 10s Times : 3

Test mode	Test level reduction %	Durations (period)	Result
Voltage interruptions	>95%	250	A
Voltage dips	30%	25	A
	60%	10	A
	>95%	1	A

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

The EUT has DC battery backup system, so the working status would follow manufacturer specification to definition.

Observation of Performance during Test

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

(2) Voltage at 0% interruption 250 cycles, The EUT was switch to battery mode, when stop the disturbance the function is can self-recovery.

14. List of Measuring Equipment

Conducted Emission					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
EMI test receiver	R&S	ESR7	102004	5/11/2020	5/10/2021
LISN	INTRX	LIN63-4	1803001	3/5/2020	3/4/2021
Coaxial Cable	SUHNER	RG214	C001-1358175	07/16/2020	07/15/2021
Attenuator	JYEBAO	FAT-NM5NF5T6G2W10	ATT002	9/24/2020	9/23/2021
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	5/11/2020	5/10/2021
Loop antenna	SCHWARZBECK	FMZB 1519B	00013	4/28/2020	4/27/2021
Amplifier	ITGA	ITPA-301	1701010003 30014	3/5/2020	3/4/2021
Bi-conical antenna	SunAR	JB1	A030818	3/24/2020	3/23/2021
Attenuator	JYEBAO	FAT-NM5NF5T62GW6	ATT001	3/24/2020	3/23/2021
Coaxial cable	SUHNER	SUCOFLEX 104	MY371154	7/16/2020	7/15/2021
Coaxial cable	SUHNER	SUCOFLEX 104	803600	7/16/2020	7/15/2021
Coaxial cable	SUHNER	SUCOFLEX 104	801734	7/16/2020	7/15/2021
test software	Audix	E3	20180316b	NA	NA

Harmonic and Flicker Emissions, DIP					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Power source	N4L	N4A30	91J-12901	2/18/2021	2/18/2022
Voltage dip simulator	EMCLioncel	VDS-1103	0201101	2/18/2021	2/17/2022
Adjust power module	EMCLioncel	RGL-232	0201101	2/18/2021	2/17/2022
Flicker Impedance Network	N4L	IMP323	91G-12804	12/8/2020	12/7/2021
power Analyzer	N4L	PPA5531	166-05417	12/8/2020	11/7/2021
Test software	N4L	IEC_Soft	2.6	NA	NA

ESD					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
ESD Simulator	NoiseKen	ESS-S3011A	ESS1848144	2/23/2021	2/22/2022
ESD Gun	NoiseKen	GT-30RA	ESS1848164	2/23/2021	2/22/2022

RS					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Signal generator	Keysight	N5171B	MY57281132	3/5/2020	3/4/2021
Electric field probe	Narda	EP 601	711WX80850	3/22/2019	3/21/2022
Power sensor	Keysight	U2004A	MY57420018	3/5/2020	3/4/2021
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	2/17/2021	2/16/2022
Coupling Decoupling Networks	EMCLioncel	EFT-433CB	180803	2/17/2021	2/16/2022
EMC clamp	EMCLioncel	EFTC	18071802	2/17/2021	2/16/2022

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	2/18/2021	2/17/2022
coupling Device Network	EMCLioncel	CDN-5310P	0180302	2/18/2021	2/17/2022

CS					
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
Signal generator	Keysight	N5171B	MY57281132	3/5/2020	3/4/2021
Power Amplifier	fflight communication	NTWPA-4K0100	18103215	NA	NA
100W attunator	JPT	JPTATT-03-6	ATT17001	3/11/2020	3/10/2021
Couple device network	EMC Liconcel	CDN-M5-32	181001	3/11/2020	3/10/2021
Couple device network	EMC Liconcel	CDN-M3-16	181103	3/11/2020	3/10/2021
Couple device network	EMC Liconcel	CDN-M2-16	018074	3/11/2020	3/10/2021
EM Clamp	FRANKONIA	EMCL-20	18101672-0113	3/11/2020	3/10/2021
Couple device network	FRANKONIA	CDN-RJ45	A3100032/2013	-	-
Power sensor	Keysight	U2004A	MY57420018	3/5/2020	3/4/2021
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	2/18/2020	2/17/2021
Magnetic coil	EMCLioncel	PMF-801C-A	180903	2/18/2020	2/17/2021

Note:NA mean is no calibration required.

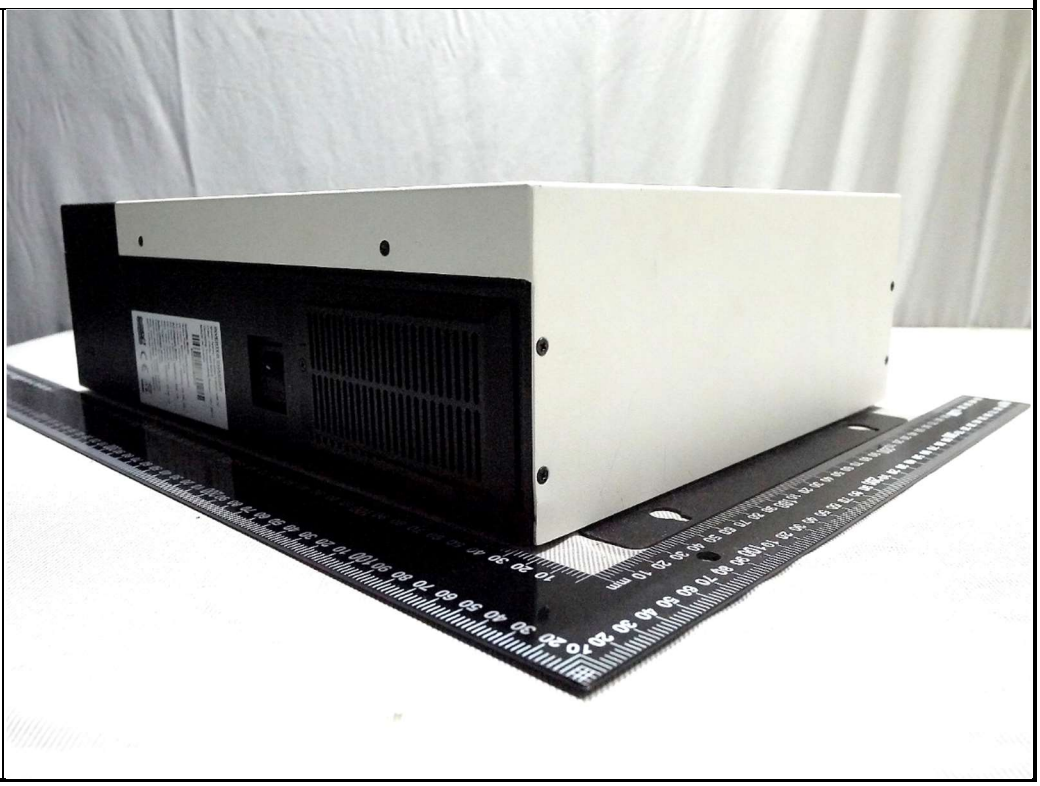
15. Measurement Uncertainty

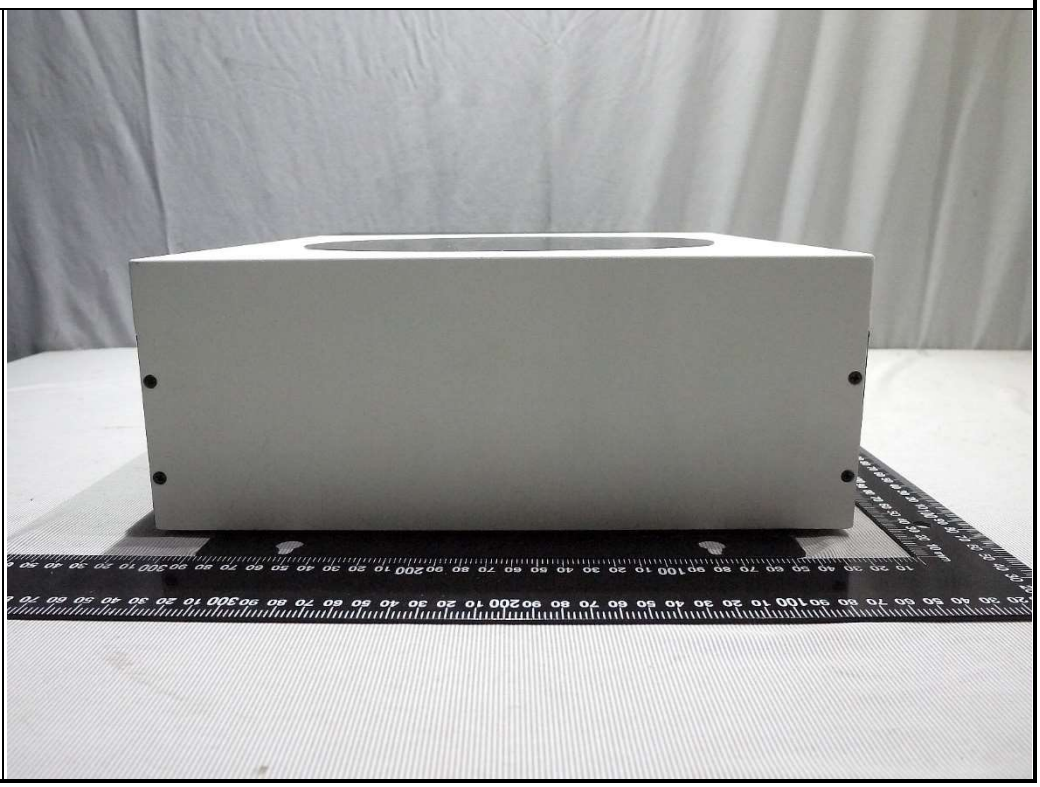
The assessed measurement uncertainty with a suitable coverage factor K to ensure 95% confidence level for the normal distribution are shown as below, the values are in table.

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	± 3.47dB
Radiated Emission	30 MHz ~ 1,000 MHz	Vertical / Horizontal	± 4.4 dB
	1,000 MHz ~ 6,000 MHz	Vertical / Horizontal	± 5.99 dB
Electromagnetic Susceptibility			
Measurement		**Item**	**Uncertainty**
Electrostatic Discharges (ESD)		--	Rise time Tr ± 12.7% ns Peak current Ip ± 3.46% A Current at 30 ns ± 3.46% ns Current at 60 ns ± 3.46% ns
Radiated RF electromagnetic Fields (Level Setting)		--	± 2.48dB
Electrical Fast Transients and bursts		--	CDN V peak ± 9.4% V Rise time ±4.8% ns Clamp V peak ±8.6% V Rise time ±3.06% ns
Surges		--	V peak = ± 8.6% V Rise time = ± 8.3% ns
Conducted Disturbances, induced by RF fields		--	M2/M3/M5 ± 1.144 dB Clamp ± 2.094 dB
Power-frequency Magnetic Field		--	Current ± 3.69 % A Magnetic file ± 1%
Voltage Dips, Interruptions, and variations		--	± 10% V

16. Attachment 1 – Photographs of EUT

View 1	
View 2	

View 3	 AC IN L1 L2 L3 N PE AC OUT L1 L2 L3 N PE INPUT BREAKER 230VAC~ POS + NEG − + PV IN − COM BMS USB NC C NO
View 4	

View 5