



# **CE EMC TEST REPORT**

for

**Product: Rechargeable Li-ion Battery System**

**Models: 204.8V/50Ah/10240WH, 307.2V/50Ah/15360WH, 409.6V/50Ah/20480WH,  
512V/50Ah/25600WH**

**Report No.: PNE230526296 02001**

Issued for

**Eitai(Xiamen) New Energy Technology Co., Ltd**

**Unit 2101 NO.8, Chengyi North Street, Software Park Phase III, High-tech Zone,  
Xiamen City, China**

Issued by

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## 1. TEST CERTIFICATION

Product:	Rechargeable Li-ion Battery System
Models:	204.8V/50Ah/10240WH, 307.2V/50Ah/15360WH, 409.6V/50Ah/20480WH, 512V/50Ah/25600WH
Trade Mark:	N/A
Applicant :	Eitai(Xiamen) New Energy Technology Co., Ltd
Address:	Unit 2101 NO.8, Chengyi North Street, Software Park Phase III, High-tech Zone, Xiamen City, China
Manufacturer:	Eitai(Xiamen) New Energy Technology Co., Ltd
Address:	Unit 2101 NO.8, Chengyi North Street, Software Park Phase III, High-tech Zone, Xiamen City, China
Test Date:	May. 22, 2023 to Jun. 05, 2023
Issued Date:	Jun. 07, 2023
Test Voltage:	DC 512V
Applicable Standards:	EN IEC 61000-6-3:2021 EN IEC 61000-6-1:2019 EN IEC 61000-3-2:2019/A1:2021 EN 61000-3-3:2013/A2:2021

The above equipment has been tested by Guangdong UTL Co., Ltd and found compliance with the requirements in the technical standards mentioned above. The test results presented in this report only relate to the product/system tested. The Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Engineer:

Manager:

*Kevin Huang*

Kevin Huang / Engineer



Andy Huang / Manager



## 2. TEST SUMMARY

EMISSION			
Standard	Item	Result	Remarks
EN IEC 61000-6-3:2021	Conducted emission (Mains Port)	N/A	N/A
	Radiated emission	PASS	Complied with the requirements
EN IEC 61000-3-2:2019/A1:2021	Harmonic current emissions	N/A	N/A
EN 61000-3-3:2013/A2:2021	Voltage fluctuations & flicker	N/A	N/A

IMMUNITY			
Standard	Item	Result	Remarks
EN 61000-4-2:2009	ESD	PASS	Complied with the requirements
EN IEC 61000-4-3:2020	RS	PASS	Complied with the requirements
EN 61000-4-4:2012	EFT	N/A	N/A
EN 61000-4-5:2014/A1:2017	Surge	N/A	N/A
EN 61000-4-6:2014	CS	N/A	N/A
EN 61000-4-8:2010	PFMF	PASS	Complied with the requirements
EN IEC 61000-4-11:2020	Voltage dips & voltage variations	N/A	N/A

Note: 1) The test result verdict is decided by the limit of test standard.

2) The information of measurement uncertainty is available upon the customer's request.

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber	3.60dB
Uncertainty for Conducted Emission.	1.18dB



### 3. TEST SITE

#### 3.1. TEST FACILITY

GUANGDONG UTL CO., LTD.

Address: Lianding testing building, No.18 center road of Yayuan Industrial Zone Nancheng District, Dongguan, Guangdong, China.

☆ CNAS Registration No.: CNAS L5998

☆ CBTL Registration No.: CBTL TL459

#### 3.2. LIST OF TEST AND MEASUREMENT INSTRUMENTS

##### 3.2.1. For conducted emission at the mains terminals test

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESPI	102090	Aug 14, 2023
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100158	Aug 14, 2023
Limiter	Rohde&Schwarz	ESH3-Z2	100046	Aug 14, 2023
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	102387	Mar 09, 2024

##### 3.2.2. For radiated emission test (30MHz-1GHz)

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESR7	101346	Mar 09, 2024
Bilog Antenna	SCHWARZBECK	VULB9168	9168-0872	Aug 20, 2023

##### 3.2.3. For radiated emission test (1GHz above)

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESR7	101346	Mar 09, 2024



Spectrum Analyzer	Rohde&Schwarz	FSVR40	100952	Aug 14, 2023
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1957	Aug 20, 2023
Microwave Broadband Amplifier	SCHWARZBECK	BBV 9718B	00024	Aug 14, 2023

### 3.2.4. For harmonic current emissions and voltage fluctuations/flicker test

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
Harmonics / Flicker Test System	Laplace	AC2000A	311349	Mar 09, 2024
AC Power Source	HTEC	HPF 5010	/	Mar 09, 2024

### 3.2.5. For electrostatic discharge immunity test

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
ESD Generator	Prima	ESD61002BG	PR14062751	Aug 15, 2023
ESD Generator	HAEFELY TEST AG	ONYX 16	173835	Aug 18, 2023

### 3.2.6. For radio frequency electromagnetic field immunity (R/S) test (AIT)

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
MXG analog signal generator	Agilent	N5181A	MY46240859	Sep. 01, 2023
Power Amplifier	Schaffner	CBA9433	T43574	Sep. 01, 2023
Power Amplifier	Schaffner	CBA9429	T43605	Sep. 01, 2023
Logarithmic-periodic Antenna	Schwarzbeck	VULP9118E	820	Sep. 03, 2024



Broadband Horn Antenna	Schwarzbeck	BBHA 9120LF	255	Sep. 03, 2024
Power meter	Agilent	E4419B	MY45102079	Sep. 01, 2023
Power sensor	Agilent	8481A	MY41097696	Sep. 01, 2023
Power sensor	Agilent	8481A	MY41097697	Sep. 01, 2023
RF Relay matrix	tsj	RFM-S621	04261	Sep. 01, 2023

**3.2.7. For electrical fast transient/burst immunity test**

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
EFT Generator	Prima	EFT61004BG	PR14084174	Aug 14, 2023
EFT Coupling Clamp	Prima	EFT-CLAMP	--	Aug 14, 2023
EFT Generator	HTEC	HCOMPACT 7	190306	Mar 09, 2024

**3.2.8. For surge immunity test**

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
Surge Generator	Prima	SUG61005BG	PR14075772	Aug 14, 2023
Surge Generator	HTEC	HCOMPACT 7	190306	Mar 09, 2024
Communication wave lightning strike generator	HTEC	HTSG 70	184702	Mar 09, 2024
Coupling network 8 lines	HTEC	HCN 8	185001	Mar 09, 2024

**3.2.9. For injected currents susceptibility test**

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
C/S Test System	SCHLODER	CDG-6000-25	19901991-0101	Mar 09, 2024



Coupling Decoupling Network	SCHLODER	CDN-M2+3	19901990-0201	Mar 09, 2024
6dB Aattenuator	SCHLODER	CDG 6050-100	3119	Mar 09, 2024

**3.2.10. For power frequency magnetic field immunity test**

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
Magnetic Field System	HTEC	HFMG 100	182803	Aug 14, 2023

**3.2.11. For voltage dips and short interruptions immunity test**

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
Dips Tester	Prima	DRP61011AG	PR14046273	Aug 14, 2023





#### 4. EUT DESCRIPTION

<b>Product</b>	Rechargeable Li-ion Battery System
<b>Model</b>	512V/50Ah/25600WH
<b>Series model</b>	204.8V/50Ah/10240WH, 307.2V/50Ah/15360WH, 409.6V/50Ah/20480WH
<b>Supplied Voltage</b>	DC 512V
<b>Power</b>	25.60KWh Max
<b>AC Lines</b>	<input type="checkbox"/> Shielded <input type="checkbox"/> Unshielded, <input type="checkbox"/> Detachable <input type="checkbox"/> Un-detachable <input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> Length:
<b>DC Lines</b>	<input type="checkbox"/> Shielded <input type="checkbox"/> Unshielded, <input type="checkbox"/> Detachable <input type="checkbox"/> Un-detachable <input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> Length:
<b>HDMI Lines</b>	<input type="checkbox"/> Shielded <input type="checkbox"/> Unshielded, <input type="checkbox"/> Detachable <input type="checkbox"/> Un-detachable <input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> Length:

#### I/O PORT

I/O PORT TYPES	Q'TY	TESTED WITH
AC Port	/	<input type="checkbox"/>
DC Port	1	<input checked="" type="checkbox"/>

#### Models Difference

It consists of several identical battery modules connected in series and is used through the main control box. A minimum of 2 modules needs to be connected in series, and up to 5 modules can be connected in series. Select the maximum specification model 512V/50Ah/25600WH to test and pass.

Model	Nominal capacity power	The battery module
204.8V/50Ah/10240WH	DC 204.8V, 50Ah, 10.24KWh	2
307.2V/50Ah/15360WH	DC 307.2V, 50Ah, 15.36KWh	3
409.6V/50Ah/20480WH	DC 409.6V, 50Ah, 20.48KWh	4
512V/50Ah/25600WH	DC 512V, 50Ah, 25.60KWh	5



## 5. TEST METHODOLOGY

### 5.1. TEST MODE

The EUT was tested together with the thereafter additional components, and a configuration, which produced the worst emission levels, was selected and recorded in this report.

The following test mode(s) were assessed.

	Test Items	Test Mode
Emission	Conducted Emission	N/A
	Radiated Emission	Charging/Discharging
	Harmonic current emissions	N/A
	Voltage fluctuations & flicker	N/A
Immunity	ESD	Charging/Discharging
	RS	Charging/Discharging
	EFT	N/A
	Surge	N/A
	C/S	N/A
	M/S	Charging/Discharging
	Dips	N/A

### 5.2. EUT SYSTEM OPERATION

1. Set up EUT with the support equipment.
2. Make sure the EUT work normally during the test.



## 6. SETUP OF EQUIPMENT UNDER TEST

### 6.1. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Equipment	Model	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1.	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: 1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

### 6.2. CONFIGURATION OF SYSTEM UNDER TEST

Charging:



Discharging:



(EUT:Rechargeable Li-ion Battery System )



## 7. EMISSION TEST

### 7.1. CONDUCTED EMISSION MEASUREMENT

#### 7.1.1. LIMITS

FREQUENCY (MHz)	Quasi-peak dB( $\mu$ V)	Average dB( $\mu$ V)
0.15 - 0.5	66-56	56-46
0.5 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1) The lower limit shall apply at the transition frequencies.

2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

#### 7.1.2. TEST PROCEDURES

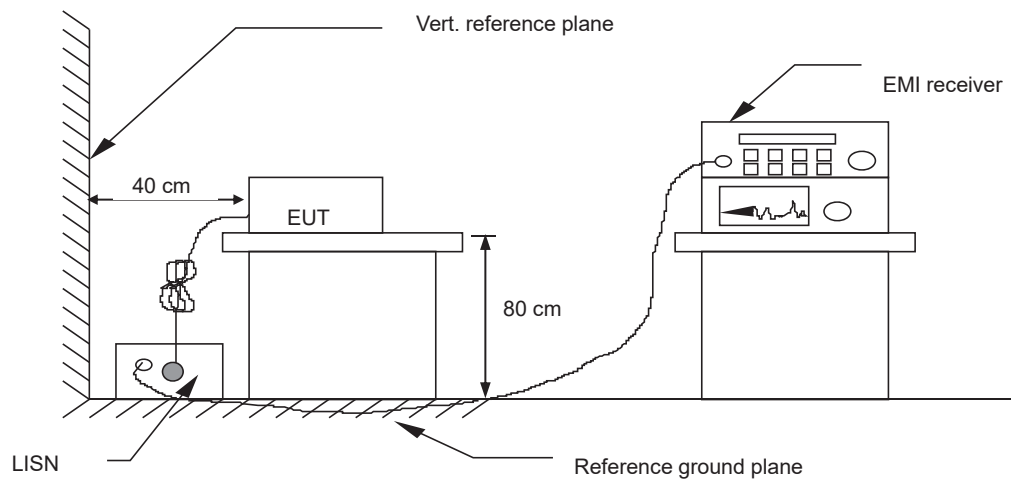
The EUT and Support equipment, if needed, was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane. When the EUT is floor standing equipment, it is placed on the ground plane, which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane. The EUT should be 0.8 m apart from the AMN, where the mains cable supplied by the manufacturer is longer than 1 m, the excess should be folded at the centre into a bundle no longer than 0.4 m, Details please refer to test setup photography.

The Receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes. During the above scans, the emissions were maximized by cable manipulation.

A scan was taken on both of the power lines, Line and neutral, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. The test data of the worst-case condition(s) was recorded.



### 7.1.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 7.1.4. TEST RESULT

N/A



## 7.2. RADIATED EMISSION MEASUREMENT

### 7.2.1. LIMITS

FREQUENCY (MHz)	Quasi-peak dB( $\mu$ V/m)
30 ~ 230	40
230 ~ 1000	47

Note: 1) The lower limit shall apply at the transition frequencies.

2) Emission level (dB $\mu$ V/m) = 20 log Emission level ( $\mu$ V/m).

### 7.2.2. TEST PROCEDURE

The equipment was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden turntable with a height of 0.8 meters is used which is placed on the ground plane. When the EUT is floor standing equipment, it is placed on the ground plane which has a 0.1 m non-conductive covering to insulate the EUT from the ground plane.

The antenna was placed at 3 meter away from the EUT. The antenna connected to the spectrum analyzer via a cable and at times a pre-amplifier would be used.

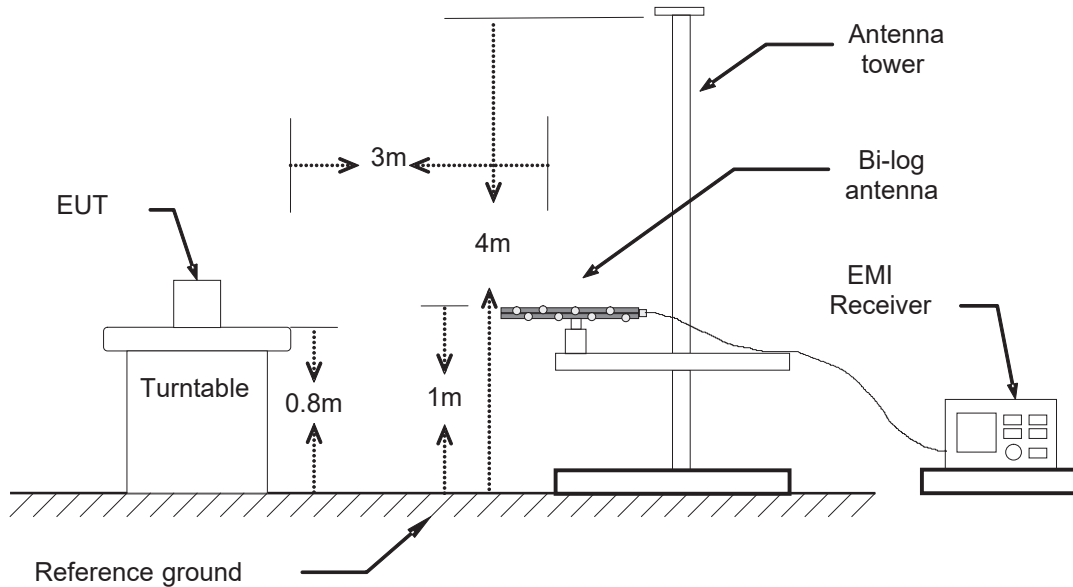
The analyzer / receiver quickly scanned from 30 MHz to 1000 MHz. The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

During the above scans, the emissions were maximized by cable manipulation. Each modes is measured, recorded at least the six highest emissions. The emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.

The test data of the worst-case condition(s) was recorded.



### 7.2.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration

### 7.2.4. TEST RESULT

<b>Product name</b>	Rechargeable Li-ion Battery System	<b>Antenna Distance</b>	3 m
<b>Model</b>	512V/50Ah/25600WH	<b>Antenna Pole</b>	Vertical / Horizontal
<b>Test Mode</b>	Charging/Discharging	<b>Detector Function</b>	Peak / Quasi-peak
<b>Environmental Conditions</b>	25.9°C, 60% RH, 101.56 kPa	<b>6 dB Bandwidth</b>	120 kHz
<b>Tested by</b>	Yann	<b>Test Result</b>	Pass

Note:

Freq. = Emission frequency in MHz

Reading level (dB $\mu$ V/m) = Receiver reading

Corr. Factor (dB) = Antenna factor + Cable loss

Measurement (dB $\mu$ V/m) = Reading level (dB $\mu$ V/m) + Corr. Factor (dB)

Limit (dB $\mu$ V/m) = Limit stated in standard

Over Limit (dB) = Measurement (dB $\mu$ V/m) – Limit (dB $\mu$ V/m)

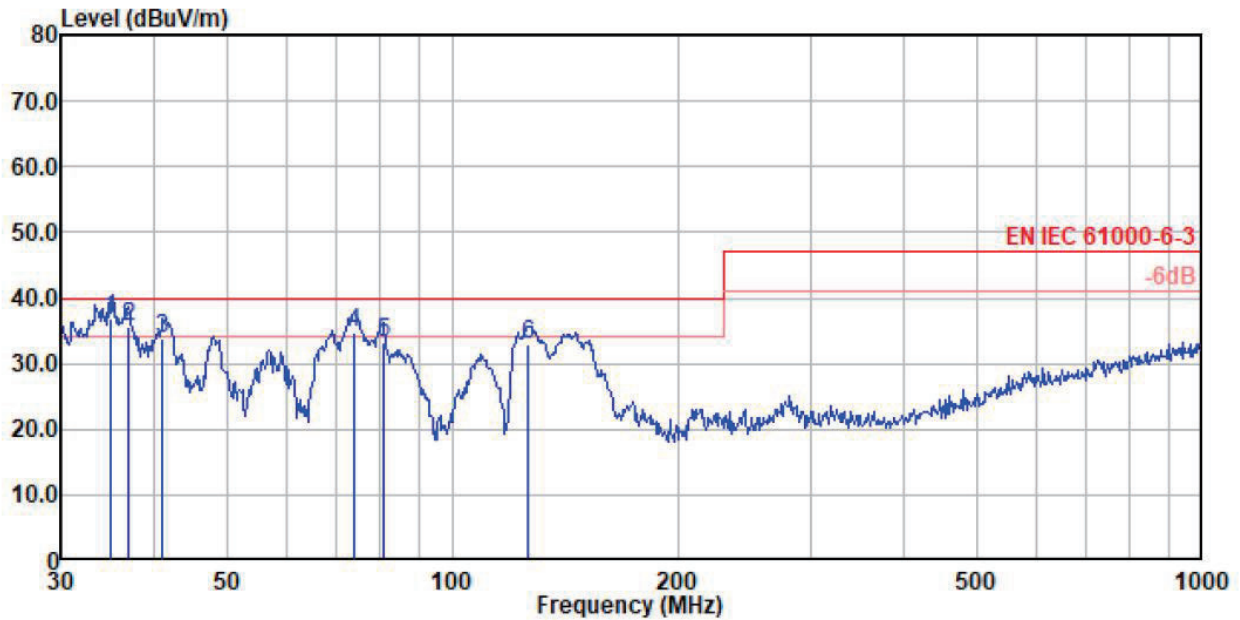
QP = Quasi-Peak

The highest frequency of the internal sources of the EUT was less than 108 MHz, so the measurement was only made up to 1 GHz.



Please refer to the following diagram:

Vertical: Charging

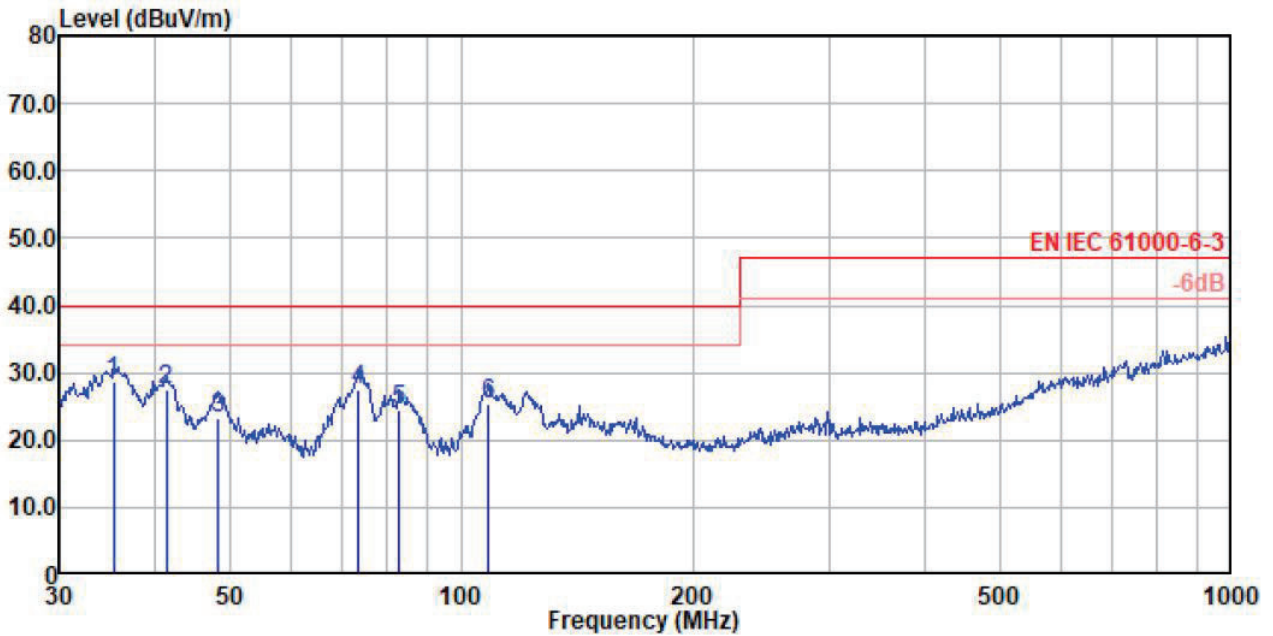


	Freq	Cable Loss	Factor	Level	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dBuV/m	dBuV	dBuV/m	dB	
1	35.005	3.38	15.73	36.82	21.09	40.00	-3.18	QP
2	36.895	3.31	15.98	35.60	19.62	40.00	-4.40	QP
3	40.988	3.00	16.21	33.91	17.70	40.00	-6.09	QP
4	73.876	4.11	14.20	34.69	20.49	40.00	-5.31	QP
5	80.644	5.07	14.61	33.25	18.64	40.00	-6.75	QP
6	125.886	1.46	12.98	32.77	19.79	40.00	-7.23	QP





Horizontal:

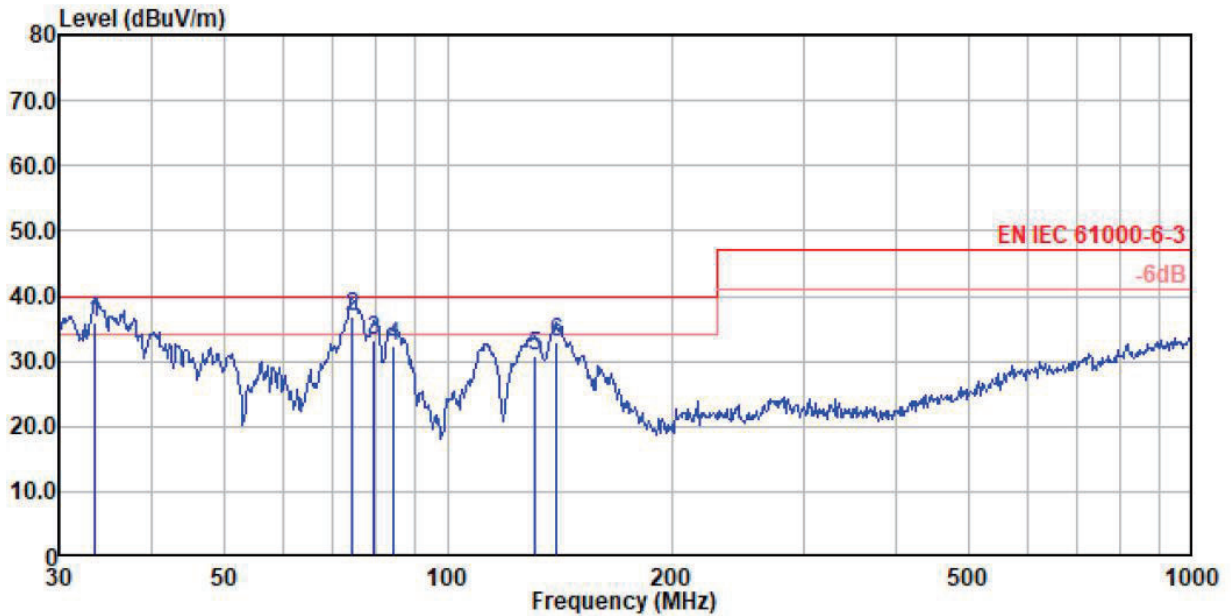


	Freq	Cable Loss	Factor	Level	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dBuV/m	dBuV	dBuV/m	dB	
1	35.251	3.37	15.91	28.55	12.64	40.00	-11.45	QP
2	41.277	2.94	16.12	27.32	11.20	40.00	-12.68	QP
3	48.332	1.79	14.80	23.18	8.38	40.00	-16.82	QP
4	73.359	4.01	13.91	27.47	13.56	40.00	-12.53	QP
5	82.938	4.16	12.66	24.44	11.78	40.00	-15.56	QP
6	108.267	2.55	12.38	25.36	12.98	40.00	-14.64	QP



Please refer to the following diagram:

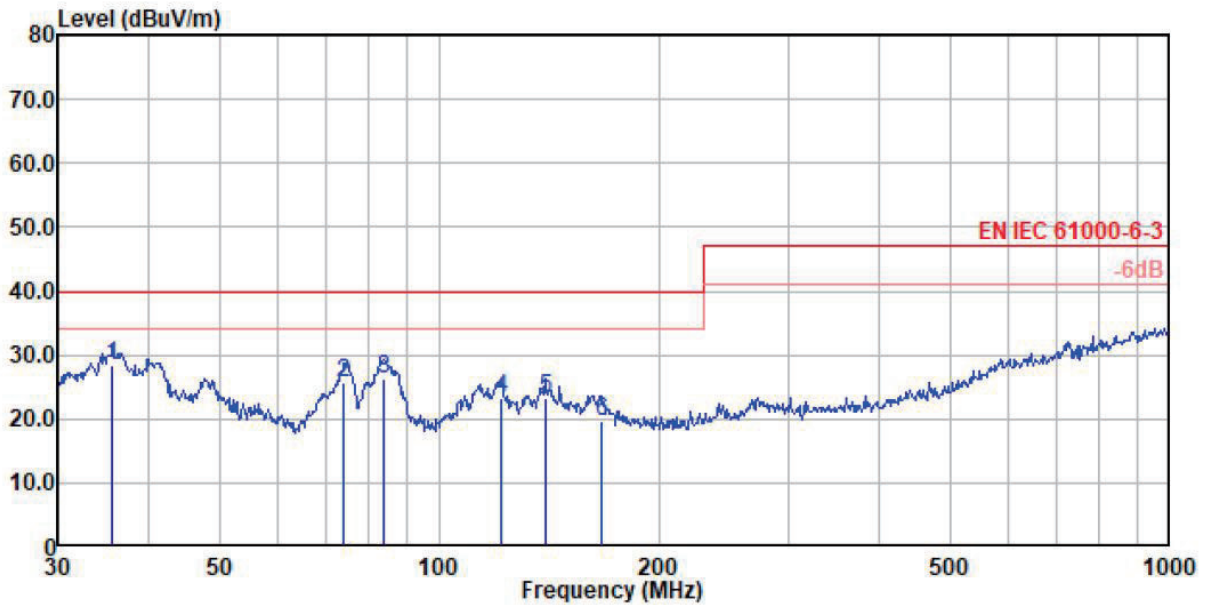
Vertical: Discharging



	Freq	Cable Loss	Factor	Level	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dBuV/m	dBuV	dBuV/m	dB	
1	33.445	3.36	15.45	35.86	20.41	40.00	-4.14	QP
2	74.396	4.21	14.26	36.71	22.45	40.00	-3.29	QP
3	79.521	5.23	14.87	33.29	18.42	40.00	-6.71	QP
4	84.110	3.70	12.93	32.40	19.47	40.00	-7.60	QP
5	130.837	1.48	13.71	30.78	17.07	40.00	-9.22	QP
6	139.361	1.54	15.04	32.85	17.81	40.00	-7.15	QP



Horizontal:



	Freq	Cable Loss	Factor	Level	Read Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dBuV/m	dBuV	dBuV/m	dB	
1	35.624	3.36	15.95	28.43	12.48	40.00	-11.57	QP
2	73.876	4.11	13.91	25.58	11.67	40.00	-14.42	QP
3	83.816	3.81	12.31	26.39	14.08	40.00	-13.61	QP
4	121.549	1.43	12.52	23.37	10.85	40.00	-16.63	QP
5	139.361	1.54	13.53	23.13	9.60	40.00	-16.87	QP
6	166.651	1.48	14.03	19.65	5.62	40.00	-20.35	QP



### 7.3. HARMONICS CURRENT MEASUREMENT

#### 7.3.1. LIMITS OF HARMONICS CURRENT MEASUREMENT

Limit for Class A equipment		Limit for Class D equipment		
Harmonics Order N	Max. permissible harmonics current A	Harmonics Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd harmonics		Odd Harmonics only		
3	2.30	3	3.4	2.30
5	1.14	5	1.9	1.14
7	0.77	7	1.0	0.77
9	0.40	9	0.5	0.40
11	0.33	11	0.35	0.33
13	0.21	13	0.30	0.21
15 ≤ n ≤ 39	0.15x(15/n)	15 ≤ n ≤ 39 (odd harmonics only)	3.85/n	0.15x(15/n)
Even harmonics				
2	1.08			
4	0.43			
6	0.30			
8 ≤ n ≤ 40	0.23x8/n			

Limit for Class C equipment	
Harmonics Order n	Max. permissible harmonics current expressed as a percentage of the input current at the fundamental frequency A
2	2
3	30xF
5	10
7	7
9	5
11 ≤ n < ≤ 39 (odd harmonics only)	3

F is the circuit power factor

Note: Class A, B, C and D are classified according to item 7.3.2. of this report

#### 7.3.2. TEST PROCEDURES

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce



the maximum harmonic. The classification of EUT is according to section 5 of EN IEC 61000-3-2.

The EUT is classified as follows:

**Class A:**

Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.

**Class B:**

Portable tools; Arc welding equipment which is not professional equipment.

**Class C:**

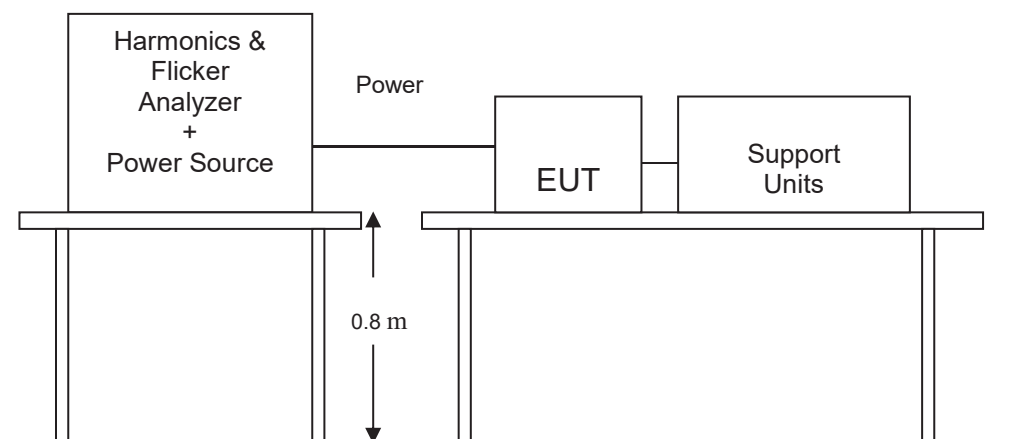
Lighting equipment

**Class D:**

Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors and television receivers.

The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.

### 7.3.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 7.3.4. TEST RESULT

N/A



## 7.4. VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

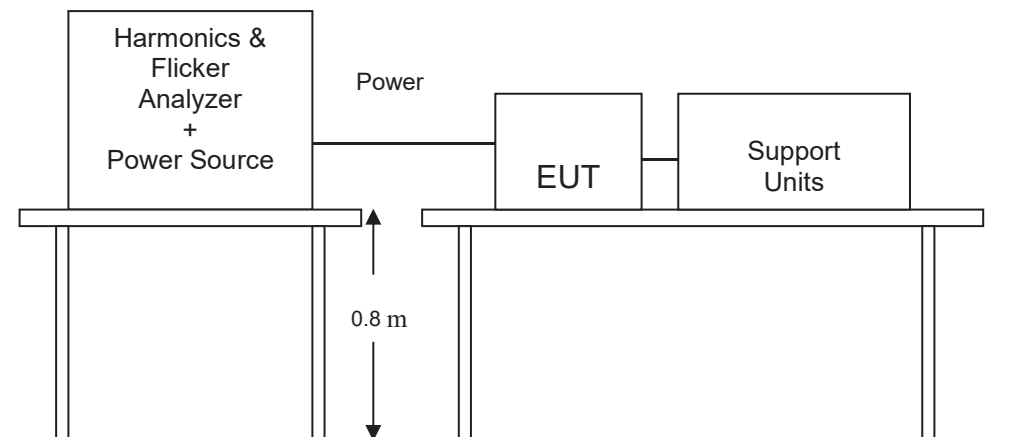
### 7.4.1. LIMITS OF VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

TEST ITEM	LIMIT	REMARK
$P_{st}$	1.0	$P_{st}$ means short-term flicker indicator.
$P_{lt}$	0.65	$P_{lt}$ means long-term flicker indicator.
$T_{dt}$ (ms)	500	$T_{dt}$ means maximum time that dt exceeds 3 %.
$d_{max}$ (%)	4/6/7 %	$d_{max}$ means maximum relative voltage change.
dc (%)	3.3 %	dc means relative steady-state voltage change

### 7.4.2. TEST PROCEDURE

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under full load operating conditions. During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

### 7.4.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 7.4.4. TEST RESULT

N/A



## 8. IMMUNITY TEST

### 8.1. GENERAL DESCRIPTION

Product Standard	EN IEC 61000-6-1	
	Test Type	Minimum Requirement
Basic Standard, Specification, and Performance Criterion required	EN 61000-4-2	Electrostatic Discharge – ESD: ±8 kV air Discharge, ±4 kV Contact Discharge, Performance Criterion B
	EN IEC 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80 MHz to 1 GHz, 3 V/m, 80 % AM(1 kHz), 1.4 GHz to 6 GHz, 3 V/m, 80 % AM(1 kHz), Performance Criterion A
	EN 61000-4-4	Electrical Fast Transient/Burst - EFT, Power line: ±1 kV, Signal line: ±0.5 kV, Performance Criterion B
	EN 61000-4-5	Surge Immunity Test: 1.2/50 μs Open Circuit Voltage, 8 /20 μs Short Circuit Current, Power Port ~ Line to line: ±1 kV, Line to ground: ±2 kV Signal Port : ±0.5 kV Performance Criterion B
	EN 61000-4-6	Conducted Radio Frequency Disturbances Test –CS: 0.15 ~ 80 MHz, 3 V r.m.s, 80 % AM, 1 kHz, Performance Criterion A
	EN 61000-4-8	Power frequency magnetic field immunity test 50 Hz, 3 A/m Performance Criterion A
	EN IEC 61000-4-11	Voltage Dips: i) 0% reduction for 0.5 period, Performance Criterion B ii) 70% reduction for 25 periods, Performance Criterion C Voltage Interruptions: 0% reduction for 250 periods, Performance Criterion C





## 8.2. GENERAL PERFORMANCE CRITERIA DESCRIPTION

<b>Criteria A:</b>	During and after the test the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a minimum 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. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.
<b>Criteria B:</b>	After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena 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. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.
<b>Criteria C:</b>	During and after testing, a temporary loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls or cycling of the power to the EUT by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.





### 8.3. ELECTROSTATIC Discharge Mode (ESD)

#### 8.3.1. TEST SPECIFICATION

<b>Basic Standard:</b>	EN 61000-4-2
<b>Discharge Mode Impedance:</b>	330 $\Omega$
<b>Charging Capacity:</b>	150 pF
<b>Discharge Mode Voltage:</b>	Air Discharge Mode: $\pm 8$ kV (Direct) Contact Discharge Mode: $\pm 4$ kV (Direct/Indirect)
<b>Polarity:</b>	Positive & Negative
<b>Number of Discharge Mode:</b>	10 (Air Discharge Mode for single polarity Discharge Mode) 25 (Contact Discharge Mode for single polarity Discharge Mode)
<b>Discharge Mode Mode:</b>	1 time/s
<b>Performance Criterion:</b>	B

#### 8.3.2. TEST PROCEDURE

The Discharge Modes shall be applied in two ways:

- a) Contact Discharge Modes to the conductive surfaces and coupling planes:  
50 Discharge Modes (25 with positive and 25 with negative polarity) shall be applied on each accessible metallic part of the enclosure, terminals are excluded. In case of a non-conductive enclosure, Discharge Modes shall be applied on the horizontal or vertical coupling planes. Test shall be performed at a maximum repetition rate of one Discharge Mode per second.
- b) Air Discharge Modes at slots and apertures and insulating surfaces:  
On those parts of the EUT where it is not possible to perform contact Discharge Mode testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air Discharge Mode method. This investigation should be restricted to those area normally handled by the user. A minimum of 10 single air Discharge Modes shall be applied to the selected test point for each such area.

The basic test procedure was in accordance with IEC 61000-4-2:

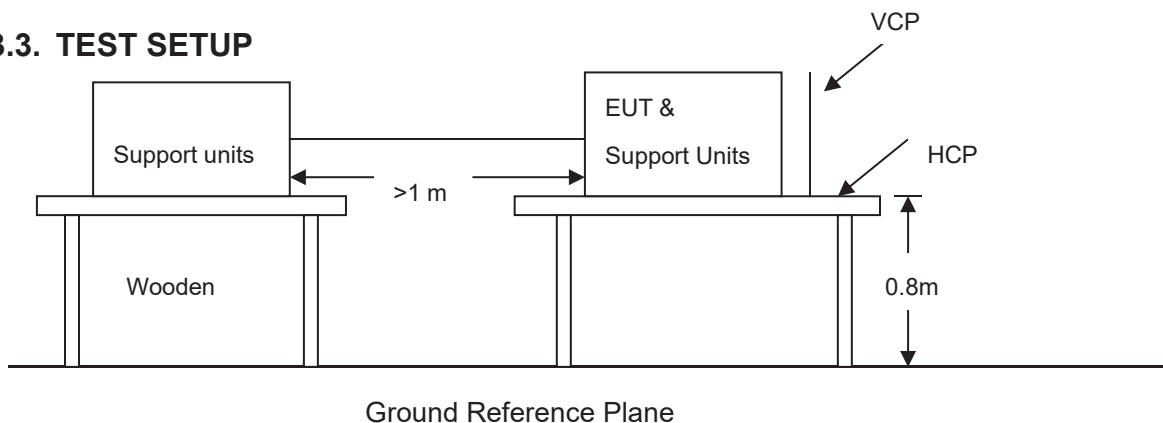
- a) The EUT was located 0.1 m minimum from all side of the HCP (dimensions 1.6 m x 0.8 m).
- b) The support units were located another table 30 cm away from the EUT, but direct



support unit was/were located at same location as EUT on the HCP and keep at a distance of 10cm with EUT.

- c) The time interval between two successive single Discharge Modes was at least 1 second.
- d) Contact Discharge Modes were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- e) Air Discharge Modes were applied with the round Discharge Mode tip of the Discharge Mode electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each Discharge Mode, the ESD generator was removed from the EUT and re-triggered for a new single Discharge Mode. The test was repeated until all Discharge Modes were complete.
- f) At least ten single Discharge Modes (in the most sensitive polarity) were applied at the front edge of each HCP opposite the center point of each unit of the EUT and 0.1 meter from the front of the EUT. The long axis of the Discharge Mode electrode was in the plane of the HCP and perpendicular to its front edge during the Discharge Mode.
- g) At least ten single Discharge Modes (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane (VCP) in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5 m x 0.5 m) was placed vertically to and 0.1 meter from the EUT.

### 8.3.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

Note:

#### 1) TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the ground reference plane (GRP). The GRP consisted of a sheet of aluminum at least 0.25 mm thick, and 2.5 meters square connected to the protective grounding system. A horizontal coupling plane (HCP) (1.6 m x 0.8 m) was placed on the table and attached to the GRP by means of a cable with 940k total impedance. The



equipment under test, was installed in a representative system as described in section 7 of EN

61000-4-2, and its cables were placed on the HCP and isolated by an insulating support of 0.5 mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

2) FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the ground reference plane by an insulating support of 0.1 meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25 mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

8.3.4. TEST RESULT

<b>Product</b>	Rechargeable Li-ion Battery System	<b>Environmental Conditions</b>	24.6°C, 54% RH, 101kPa
<b>Model</b>	512V/50Ah/25600WH	<b>Tested By</b>	Yann
<b>Test mode</b>	Discharging	<b>Test Result</b>	Pass

Contact Discharge Mode					
Test Points	Test Levels	Results			
	± 4 kV	Pass	Fail	Observation	Performance Criterion
HCP 2 Points	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	B
VCP 2 Points	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	B
Positive 1 Point	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	B
Negative 1 Point	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	B
Metal 4 Points	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	B
Switch 2 Points	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	B

- Note: 1) There was no change compared with initial operation during the test.  
 2) During the test and After the test, the EUT can resume to operate as intended without operator intervention.  
 3) During the test and After the test, During and after testing, the EUT needs to return to normal operation with operator intervention.



## 8.4. RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD (RS)

### 8.4.1. TEST SPECIFICATION

<b>Basic Standard:</b>	EN IEC 61000-4-3
<b>Frequency Range:</b>	80 MHz ~ 1000 MHz, 1.4-6GHz
<b>Field Strength:</b>	3 V/m
<b>Modulation:</b>	1 kHz Sine Wave, 80 %, AM Modulation
<b>Frequency Step:</b>	1 % of preceding frequency value
<b>Polarity of Antenna:</b>	Horizontal and Vertical
<b>Test Distance:</b>	3 m
<b>Antenna Height:</b>	1.5 m
<b>Performance Criterion:</b>	A

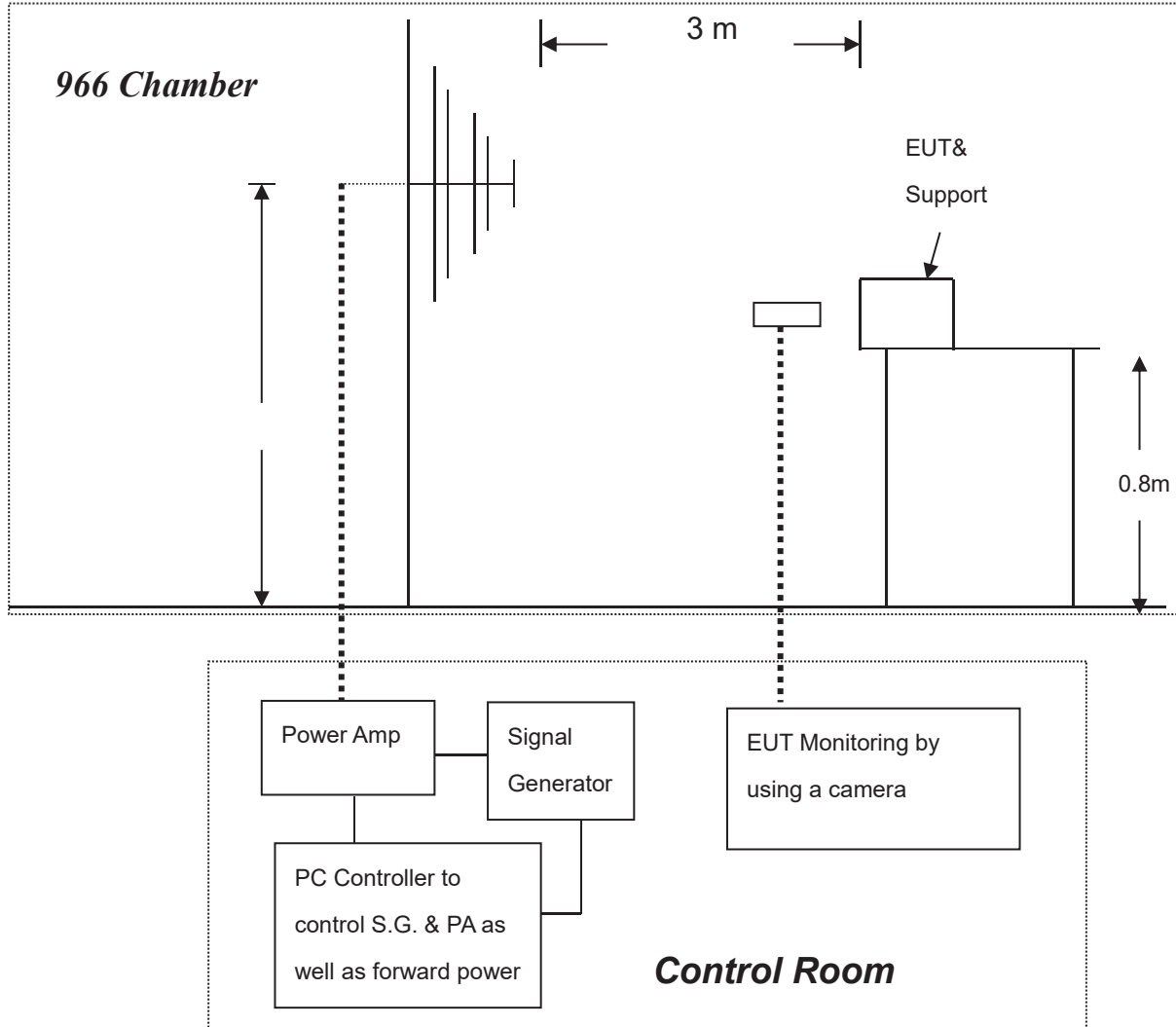
### 8.4.2. TEST PROCEDURE

The test procedure was in accordance with EN IEC 61000-4-3

- a) The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
- b) The frequency range is swept from 80 MHz to 1000 MHz, with the signal 80% amplitude modulated with a 1 kHz sine-wave. The rate of sweep did not exceed  $1.5 \times 10^{-3}$  decade/s, where the frequency range is swept incrementally, the step size was 1 % of preceding frequency value.
- c) The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- d) The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.



### 8.4.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

Note:

#### TABLETOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of EN IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

#### FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.



#### 8.4.4. TEST RESULT

<b>Product</b>	Rechargeable Li-ion Battery System	<b>Environmental Conditions</b>	24.2°C, 57 % RH, 101 kPa
<b>Model</b>	512V/50Ah/25600WH	<b>Tested By</b>	Yann
<b>Test mode</b>	Discharging	<b>Test Result</b>	Pass

Frequency (MHz)	Polarity	Position	Field Strength (V/m)	Observation	Performance Criterion
80 - 1000	V&H	Front	3	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	A
	V&H	Rear	3	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	A
	V&H	Left	3	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	A
	V&H	Right	3	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	A
1400-6000	V&H	Front	3	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	A
	V&H	Rear	3	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	A
	V&H	Left	3	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	A
	V&H	Right	3	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	A

Note: 1) There was no change compared with initial operation during the test.  
 2) During the test and After the test, the EUT can resume to operate as intended without operator intervention.  
 3) During the test and After the test, During and after testing, the EUT needs to return to normal operation with operator intervention.



## 8.5. ELECTRICAL FAST TRANSIENT (EFT)

### 8.5.1. TEST SPECIFICATION

<b>Basic Standard:</b>	EN 61000-4-4
<b>Test Voltage:</b>	Power Line: $\pm 1$ kV Signal/Control Line: $\pm 0.5$ kV
<b>Polarity:</b>	Positive & Negative
<b>Impulse Frequency:</b>	5 kHz
<b>Impulse Wave-shape:</b>	5/50 ns
<b>Burst Duration:</b>	15 ms
<b>Burst Period:</b>	300 ms
<b>Test Duration:</b>	2 mins
<b>Performance Criterion:</b>	B

### 8.5.2. TEST PROCEDURE

EUT is placed on a 0.1 m tall wooden table.

EUT operate at normal mode, the transient/burst was 5/50 ns in accordance with EN 61000-4-4, both positive and negative polarity burst waveform were applied.

The duration time of each test line was 2 minutes.

### 8.5.3. TEST SETUP

The EUT installed in a representative system as described in section 7 of EN 61000-4-4.

For the actual test configuration, please refer to the related item – photographs of the test configuration.

### 8.5.4. TEST RESULT

N/A



## 8.6. SURGE IMMUNITY TEST

### 8.6.1. TEST SPECIFICATION

<b>Basic Standard:</b>	EN 61000-4-5 Combination Wave
<b>Wave-Shape:</b>	1.2/50 $\mu$ s Open Circuit Voltage 8/20 $\mu$ s Short Circuit Current
<b>Test Voltage:</b>	Power Port ~ Line to line: $\pm 1$ kV, Line to ground: $\pm 2$ kV
<b>Surge Input/Output:</b>	Power Line: L-N / L-PE / N-PE
<b>Generator Source Impedance:</b>	2 $\Omega$ between networks 12 $\Omega$ between network and ground
<b>Polarity:</b>	Positive/Negative
<b>Phase Angle:</b>	0° /90° /180° /270°
<b>Pulse Repetition Rate:</b>	1 time / min
<b>Number of Tests:</b>	5 positive polarity pulses, and 5 negative polarity pulses
<b>Performance Criterion:</b>	B

### 8.6.2. TEST PROCEDURE

EUT is placed on a 0.1 m (table type equipment) / 0.8 m (floor type equipment) tall wooden table.

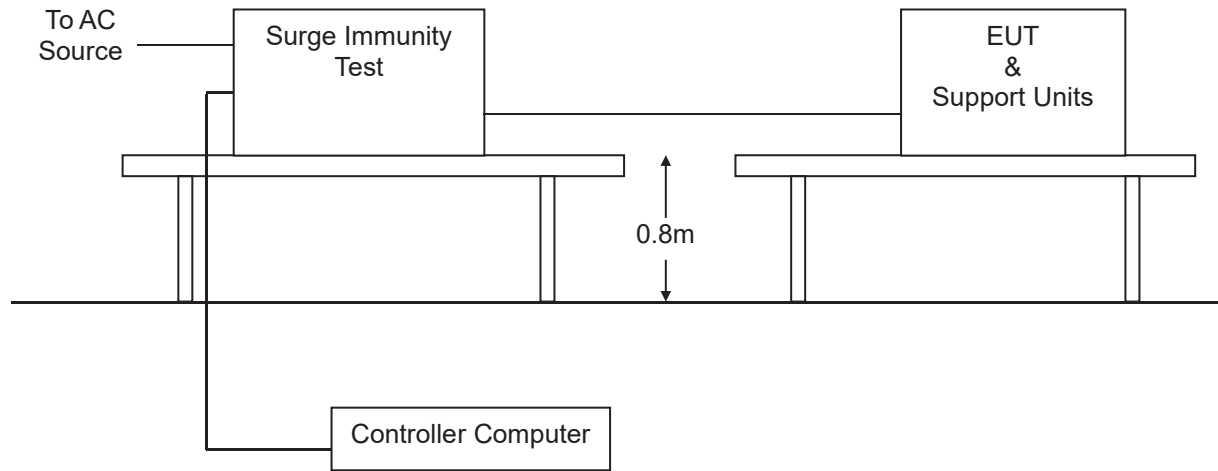
EUT operate at normal mode, two types of combination wave generator (1.2/50  $\mu$ s open-circuit voltage and 8/20  $\mu$ s short-circuit current) are applied to the EUT power supply terminals via the capacitive coupling network.

The power cord between the EUT and the coupling/decoupling network shall not exceed 2 m in length.





### 8.6.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 8.6.4. TEST RESULT

N/A



## 8.7. CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

### 8.7.1. TEST SPECIFICATION

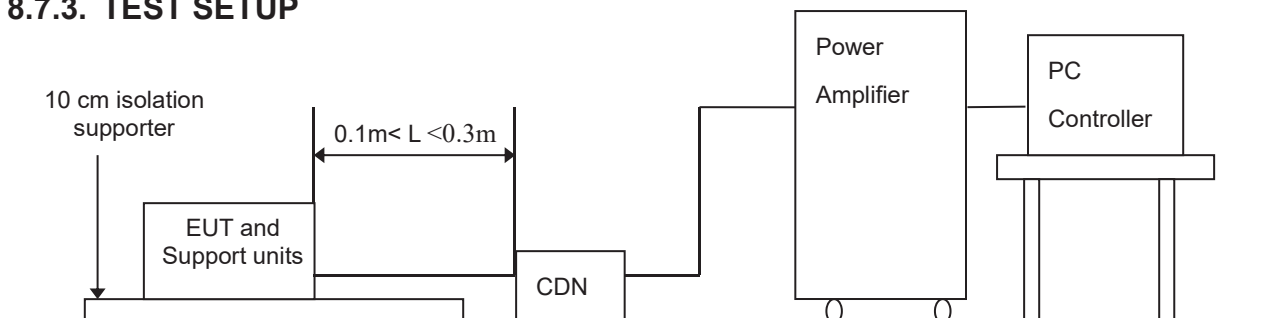
<b>Basic Standard:</b>	EN 61000-4-6
<b>Frequency Range:</b>	0.15 MHz ~80 MHz
<b>Field Strength:</b>	3 V
<b>Modulation:</b>	1 kHz Sine Wave, 80 %, AM Modulation
<b>Frequency Step:</b>	1 % of preceding frequency value
<b>Coupled cable:</b>	Power Mains, Shielded
<b>Coupling device:</b>	CDN-M3/2 (3 wires/2 wires)
<b>Performance Criterion:</b>	A

### 8.7.2. TEST PROCEDURE

The EUT shall be tested within its intended operating and climatic conditions.

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  $\Omega$  load resistor. The frequency range was swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal was modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate was  $1.5 \times 10^{-3}$  decades/s. Where the frequency range is swept incrementally, the step size was 1 % of preceding frequency value the dwell time of the amplitude modulated carrier at each frequency was 0.5 s.

### 8.7.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration

Note: 1) The EUT is setup 0.1 m above Ground Reference Plane

2) All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

### 8.7.4. TEST RESULT

N/A



## 8.8. POWER FREQUENCY MAGNETIC FIELD

### 8.8.1. TEST SPECIFICATION

<b>Basic Standard:</b>	EN 61000-4-8
<b>Frequency Range:</b>	50 Hz
<b>Field Strength:</b>	3 A/m
<b>Observation Time:</b>	5 minutes
<b>Inductance Coil:</b>	Rectangular type, 1 m x 1 m
<b>Performance Criterion:</b>	A

### 8.8.2. TEST PROCEDURE

The equipment is configured and connected to satisfy its functional requirements. It shall be placed on the GRP with the interposition of a 0.1 m-thick insulating support.

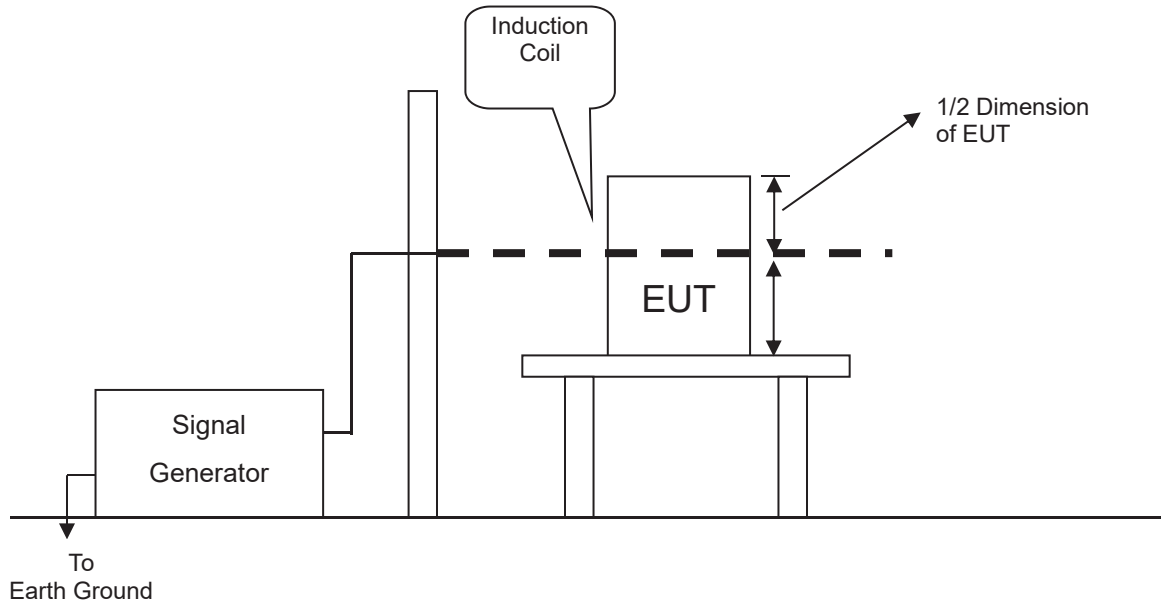
The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.

The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.

The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.



### 8.8.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration Note:

#### TABLETOP EQUIPMENT

The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

#### FLOOR-STANDING EQUIPMENT

The equipment shall be subjected to the test magnetic field by using induction coils of suitable dimensions. The test shall be repeated by moving and shifting the induction coils, in order to test the whole volume of the EUT for each orthogonal direction. The test shall be repeated with the coil shifted to different positions along the side of the EUT, in steps corresponding to 50 % of the shortest side of the coil. The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.



#### 8.8.4. TEST RESULT

<b>Product</b>	Rechargeable Li-ion Battery System	<b>Environmental Conditions</b>	24.2°C, 57 % RH, 101 kPa
<b>Model</b>	512V/50Ah/25600WH	<b>Tested By</b>	Yann
<b>Test mode</b>	Discharging	<b>Test Result</b>	Pass

Test Level (A/M)	Testing Duration	Coil Orientation	Performance Criterion
3	5 mins	X	A
3	5 mins	Y	A

Note: 1) There was no change compared with initial operation during the test.



## 8.9. VOLTAGE DIP & VOLTAGE INTERRUPTIONS

### 8.9.1. TEST SPECIFICATION

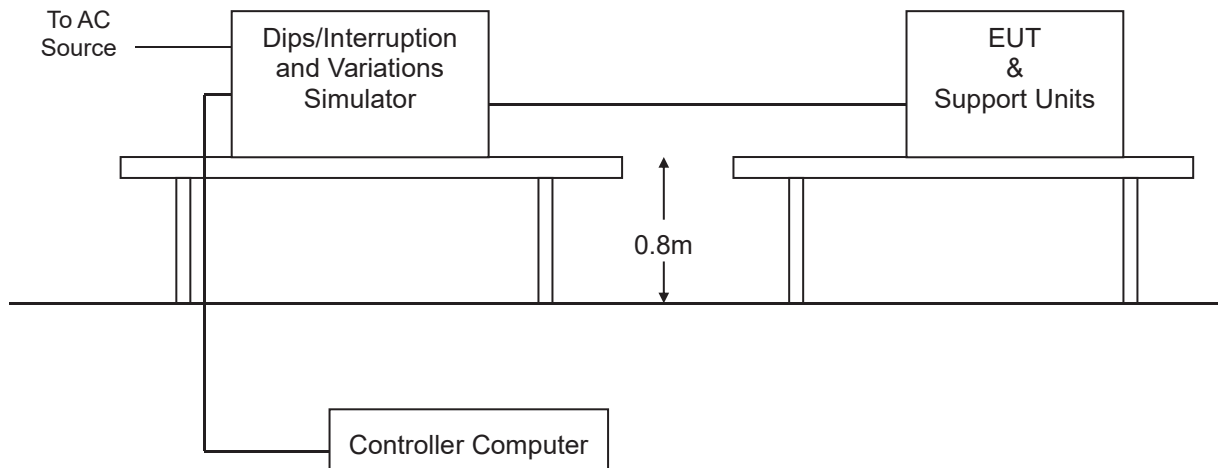
<b>Basic Standard:</b>	EN IEC 61000-4-11
<b>Test Duration Time:</b>	3 test events in sequence
<b>Interval Between Event:</b>	10 seconds
<b>Phase Angle:</b>	0°
<b>Test Cycle:</b>	3 times
<b>Performance Criterion:</b>	0% $U_T$ / 0.5 P, Criterion: B 70% $U_T$ / 25 P, Criterion: C 0% $U_T$ / 250 P, Criterion: C

### 8.9.2. TEST PROCEDURE

The EUT and support units were located on a wooden table, 0.8 m away from ground floor. Setting the parameter of tests and then perform the test software of test simulator. Changes to the voltage level shall occur at 0 degree crossing point in the a.c. voltage waveform.

Record the test result in test record form.

### 8.9.3. TEST SETUP



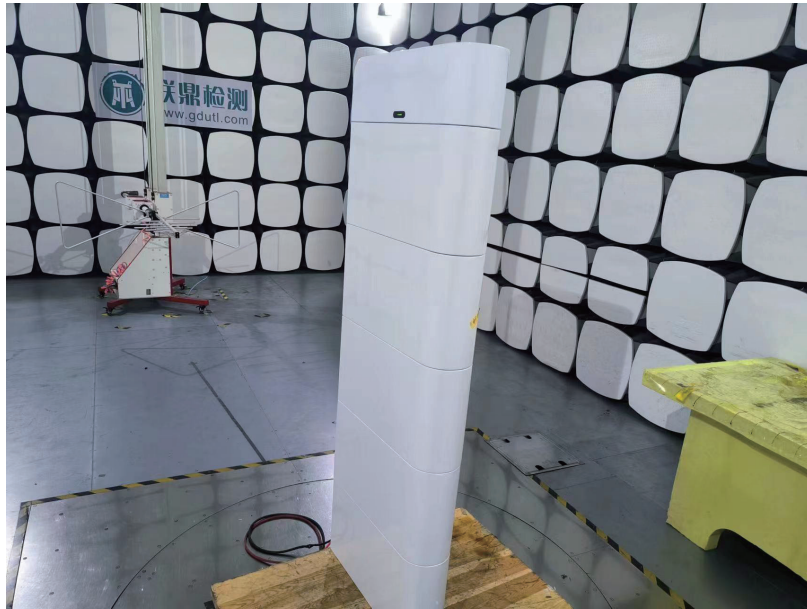
For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 8.9.4. TEST RESULT

N/A



## 9. PHOTOGRAPHS OF THE TEST CONFIGURATION RADIATED EMISSION TEST

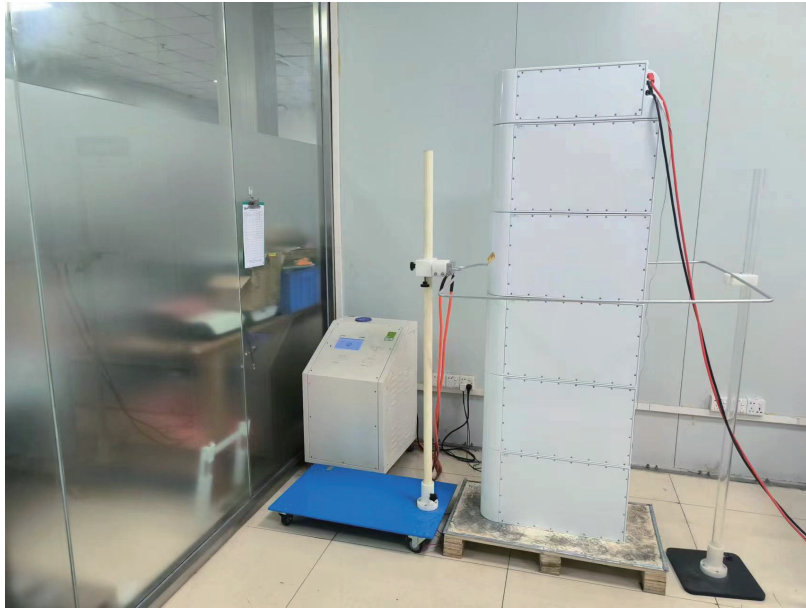


## ESD TEST





### PFMF TEST







## 10. PHOTOGRAPHS OF EUT



— End of report —