

TEST REPORT

Product: Lithium Battery

**Model No.: XDLP12-50, XDLP12-100, XDLP12-170, XDLP12-200, XDLP12-300,
XDLP24-100, XDLP24-150, XDLP24-200, XDLP36-100, XDLP48-100, XDLP48-200**

Trade mark: 

Report No.: TCT201201E008

Issued Date: Dec. 08, 2020

Issued for:

Beijing XD Battery Technology Co., Ltd

No.3 Building, No.27 Yard, Yongwang Road, Daxing district, Beijing, China

Issued By:

Shenzhen TCT Testing Technology Co., Ltd.

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1. Test Certification

Product:	Lithium Battery
Model No.:	XDLP12-50,XDLP12-100, XDLP12-170,XDLP12-200, XDLP-12-300, XDLP24-100, XDLP24-170,XDLP24-200, XDLP36-100, XDLP48-100, XDLP48-200
Applicant:	Beijing XD Battery Technology Co., Ltd
Address:	No.3 Building, No.27 Yard, Yongwang Road, Daxing district, Beijing, China
Manufacturer:	Beijing XD Battery Technology Co., Ltd
Address:	No.3 Building, No.27 Yard, Yongwang Road, Daxing district, Beijing, China
Test Voltage:	DC 14.6 V From DC Power Supply, DC 12.8 V
Date of Test:	Dec. 01, 2020 ~ Dec. 08, 2020
Applicable Standards:	EN 61000-6-3:2007+A1:2011+AC:2012 EN 61000-6-1:2007

The above equipment has been tested by Shenzhen TCT Testing Technology Co., Ltd. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:

Zak

Date:

Dec. 08, 2020

Zak

Check By:

Howie

Date:

Dec. 08, 2020

Howie

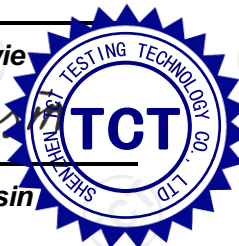
Approved By:

Tomsin

Date:

Dec. 08, 2020

Tomsin



2. Test Result Summary

Emission		
Test Method	Item	Result
EN 61000-6-3:2007 +A1:2011+AC:2012	Conducted Emission at Mains Terminals	N/A
	Discontinuous Disturbance	N/A
	Conducted Emission at Telecommunication/Network Port	N/A
	Radiated Emission	Pass
EN61000-3-2:2014	Harmonic Current Emissions	N/A
EN 61000-3-3:2013	Voltage Fluctuations & Flicker	N/A

Immunity (EN 61000-6-1:2007)		
Test Method	Item	Result
EN 61000-4-2:2009	Electrostatic Discharge (ESD)	Pass
EN 61000-4-3:2006 + A1:2008 + A2:2010	Radio-frequency Electromagnetic Field Amplitude Modulated (RS)	Pass
EN 61000-4-4:2012	Electrical Fast Transients (EFT)	N/A
EN 61000-4-5:2014+A1:2017	Surges	N/A
EN 61000-4-6:2014+AC:2015	Radio-frequency Continuous Conducted (CS)	N/A
EN 61000-4-8: 2010	Power-frequency Magnetic Fields (PFMF)	N/A
EN 61000-4-11:2004+A1:2017	Voltage Dips & Voltage Interruptions	N/A

Note:

1. Pass: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.
5. The information of measurement uncertainty is available upon the customer's request.

3. EUT Description

Product Name:	Lithium Battery
Model No.:	XDLP12-100
Product Parameter:	Battery Capacity: DC 12.8 V, 100 Ah
DC Line:	<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:
Control Line:	<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:

Model(s) List

No.	Model Number	Tested With
1	XDLP12-100	<input checked="" type="checkbox"/>
Other models	XDLP12-200, XDLP-12-300, XDLP12-400, XDLP12-500, XDLP12-600, XDLP12-700, XDLP12-800	<input type="checkbox"/>

Note: XDLP12-100 is tested model, other models are derivative models. The models are identical in circuit and PCB layout, only different on the model names. So the test data of XDLP12-100 can represent the remaining models.

4. Test Methodology

4.1. Decision of Final 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 Mode
Mode 1: Charging
Mode 2: Discharging

4.2. EUT System Operation

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

5. Setup of Equipment under Test

5.1. Description of Support Units

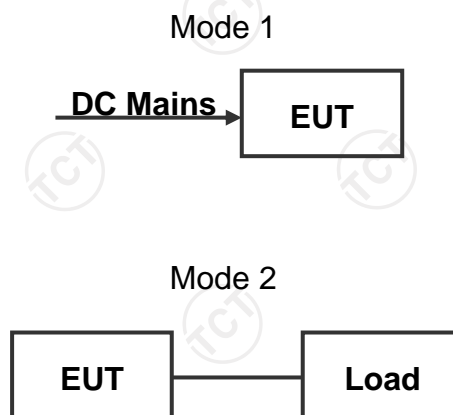
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

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.

5.2. Configuration Of System Under Test



(EUT: Lithium Battery)

6. Facilities and Accreditations

6.1. Facilities

All measurement facilities used to collect the measurement data are located at TCT Lab. The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 32. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

6.2. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

No.	Item	MU
1.	Temperature	$\pm 0.1^{\circ}\text{C}$
2.	Humidity	$\pm 1.0\%$
3.	Spurious Emissions, Conducted	$\pm 2.56\text{ dB}$
4.	All Emissions, Radiated	$\pm 4.28\text{ dB}$

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of $k=2$.

7. Emission Test

7.1. Conducted Emission at Mains Terminals

7.1.1. Test Specification

Test Requirement:	EN 61000-6-3
Test Method:	CISPR 32
Frequency Range:	150 kHz to 30 MHz

7.1.2. Limits

Frequency (MHz)	dB(uV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: Limits decrease linearly with the logarithm of the frequency.

7.1.3. Test Instruments

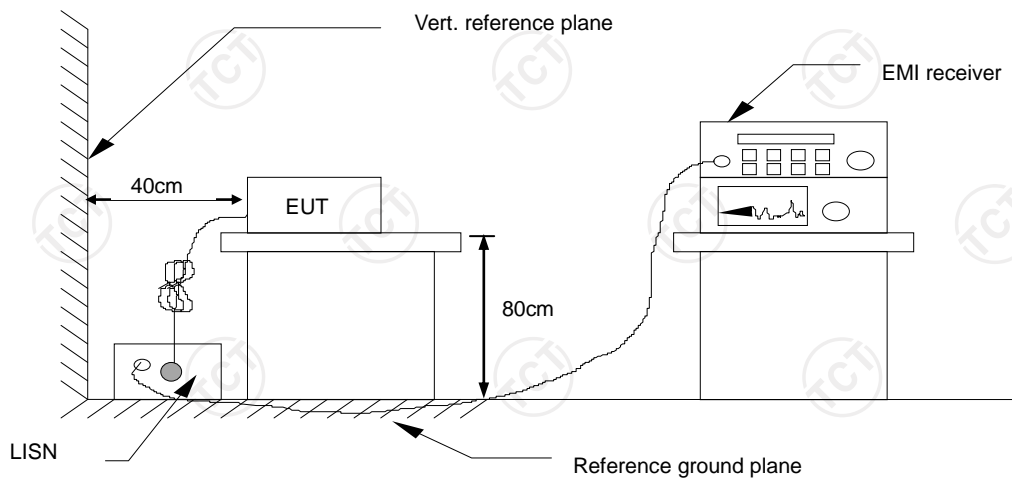
Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESPI	101402	Jul. 27, 2021
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 11, 2021
Attenuator	N/A	10dB	164080	Sep. 02, 2021
Coaxial Cable	TCT	CE-05	N/A	Sep. 02, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

7.1.4. Test Method

The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.

7.1.5. Block Diagram of Test Setup



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

7.1.6. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

7.2. Discontinuous Disturbance

7.2.1. Test Specification

Test Requirement:	EN 61000-6-3
Test Method:	CISPR 14-1
Frequency Range:	150 kHz to 30 MHz

7.2.2. Limits

The click limit L_q is determined from the formula:

$$L_q = L + \Delta L$$

which the limits L for continuous disturbance shall be increased (see table 1):

which corresponding to the click rate N shall be calculated the amount ΔL by

$$\Delta L = 44 \text{ dB for } N < 0,2$$

$$\Delta L = [20 \log(30/N)] \text{ dB for } 0,2 \leq N < 30$$

Table 1

Frequency (MHz)	At mians terminals		At load terminals and additional terminals	
	Quasi-peak dB(uV)	Average dB(uV)	Quasi-peak dB(uV)	Average dB(uV)
0.15 - 0.35	66-56	59-46	80	70
0.35 - 5.0	56	46	74	64
5.0 - 30.0	60	50	74	64

7.2.3. Test Instruments

Discontinuous Disturbance Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Clicker	Schwarzbeck	DIA1512D	21554	Sep. 02, 2021
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 11, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibration can be traced to international system unit (SI).

7.2.4. Test Method

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

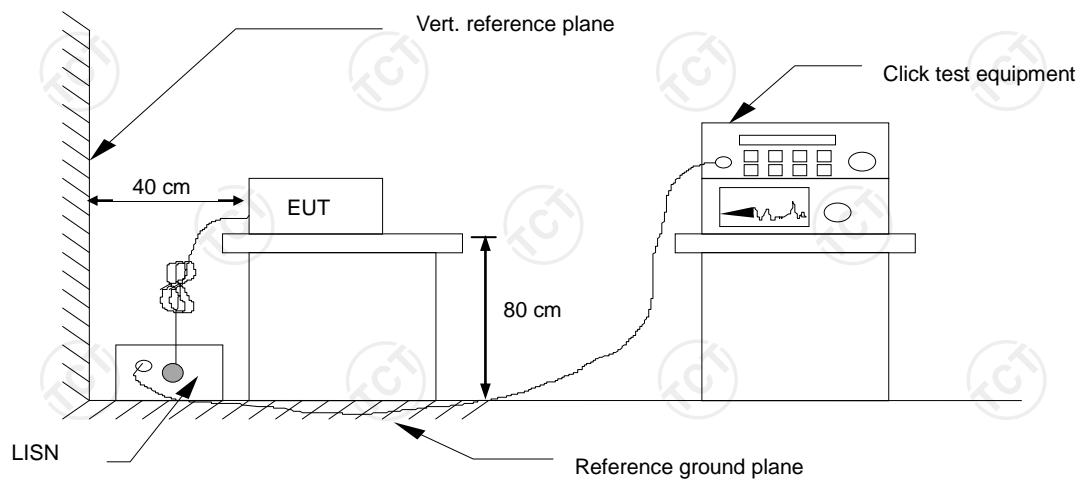
should be 0.8 m apart from the LISN, where the mains cable supplied by the manufacturer is longer than 1m, the excess should be folded at the center into a bundle no longer than 0.4 m, Details please refer to test setup photography.

At first, determining N by measuring the Clicks, calculating the limit.

Then, use the Upper quartile method to confirm EUT is fulfilled the requirement of standard or not.

The amplitude of the clicks shall be evaluated only at the following restricted number of Frequency: 150 kHz; 500 kHz; 1.4 MHz and 30 MHz.

7.2.5. Block Diagram of Test Setup



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

7.2.6. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

7.3. Conducted Emission at Telecommunication/Network Port

7.3.1. Test Specification

Test Requirement:	EN 61000-6-3
Test Method:	CISPR 32
Frequency Range:	150 kHz to 30 MHz

7.3.2. Limits

Frequency (MHz)	Voltage limits dB(uV)		Current limits dB(uA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	84 - 74	74 - 64	40 - 30	30 - 20
0.5 - 30.0	74	64	30	20

Note:

1. The limits decrease linearly with the logarithm of the frequency in the range 0,15 MHz to 0.5 MHz.
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 150 Ω to the telecommunication port under test (conversion factor is $20 \log_{10} 150 / I = 44$ dB).

7.3.3. Test Instruments

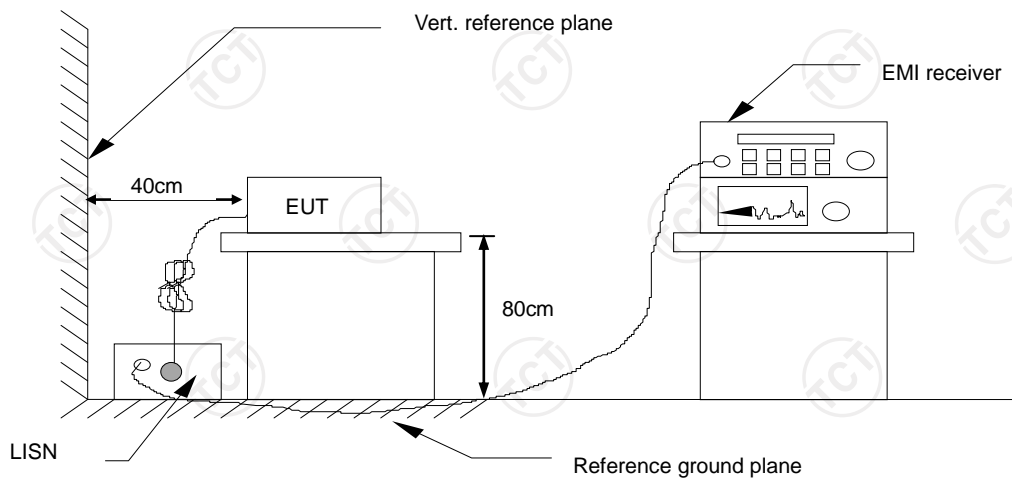
Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESPI	101402	Jul. 27, 2021
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 11, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

7.3.4. Test Method

All power was connected to the system through Artificial Mains Network (AMN). All tested telecommunications lines were connected to an Impedance Stabilization Network (ISN) and conducted voltage measurements on telecommunications lines were made at the output of the ISN. Where an ISN was not appropriate or available measurements were made using a Capacitive Voltage Probe and Current probe.

7.3.5. Block Diagram of Test Setup



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

7.3.6. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

7.4. Radiated Emission

7.4.1. Test Specification

Test Requirement:	EN 61000-6-3
Test Method:	CISPR 32
Frequency Range:	30 MHz to 6000 MHz
Measurement Distance:	3 m
Antenna Polarization:	Horizontal & Vertical

7.4.2. Limits

Below 1 GHz

Frequency (MHz)	dB(uV/m) (At 3m)
30 - 230	40
230 - 1000	47

Above 1 GHz

Frequency (GHz)	Average dB(uV/m) (At 3m)	Peak dB(uV/m) (At 3m)
1 - 3	50	70
3 - 6	54	74

7.4.3. Test Instruments

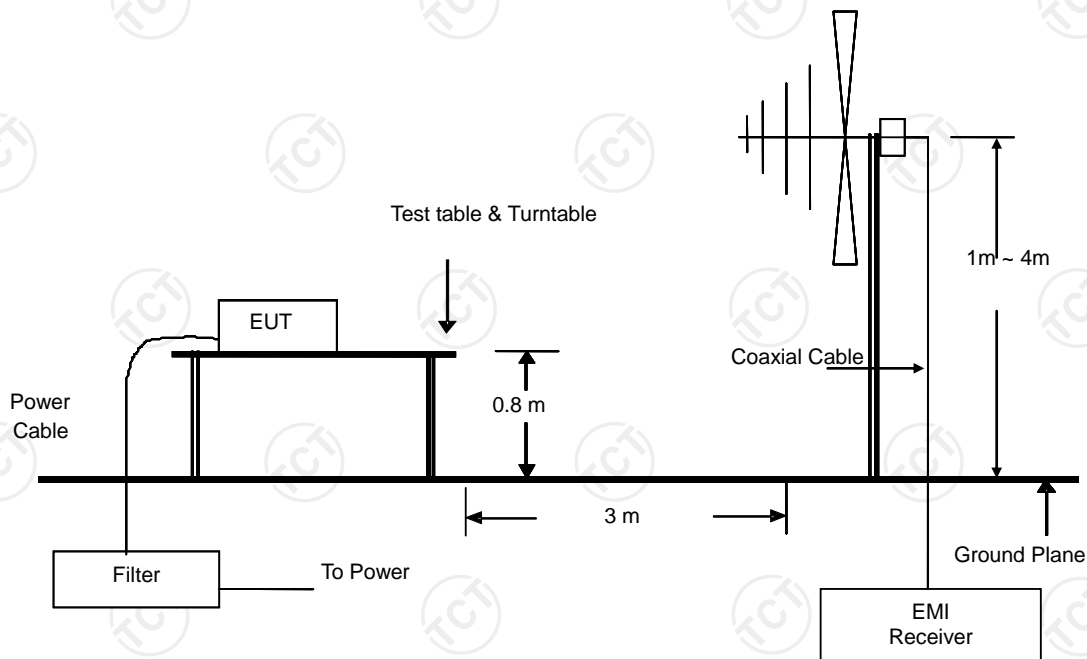
Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESIB7	100197	Jul. 27, 2021
Spectrum Analyzer	R&S	FSQ40	200061	Sep. 11, 2021
Amplifier	HP	8447D	2727A05017	Sep. 02, 2021
Amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 02, 2021
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 04, 2022
Coaxial Cable	TCT	RE-01	N/A	Jul. 27, 2021
Coaxial Cable	TCT	RE-high-04	N/A	Sep. 02, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

7.4.4. Test Method

Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. Block Diagram of Test Setup

7.4.5. Block Diagram of Test Setup



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

7.4.6. Test Results

Test Environment:	Temp.: 25 °C	Humid.: 55 %	Press.: 96 kPa
Test Mode:	Mode 1, Mode 2		
Test Voltage:	DC 14.6 V From DC Power Supply, DC 12.8 V		
Test Result:	Pass		

Note:

Freq. = Emission frequency in MHz

Reading level (dBµV/m) = Receiver reading

Corr. Factor (dB) = Antenna Factor + Cable Loss - AMP Factor

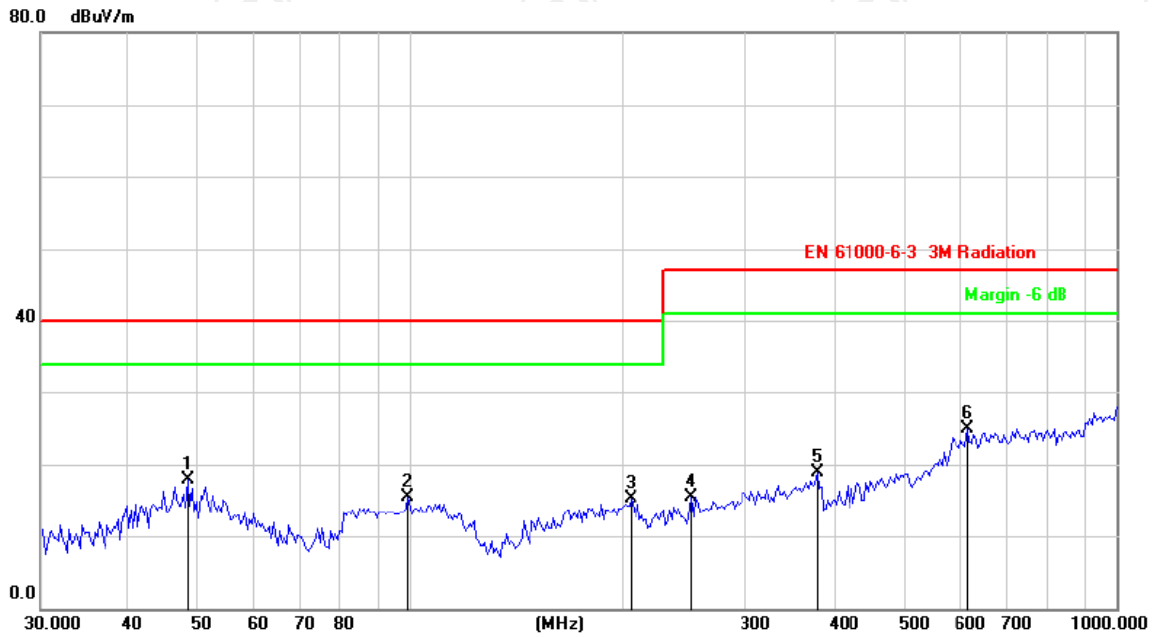
Measurement (dBµV/m) = Reading level (dBµV/m) + Corr. Factor (dB)

Limit (dBµV/m) = Limit stated in standard

Margin (dB) = Measurement (dBµV/m) – Limit (dBµV/m)

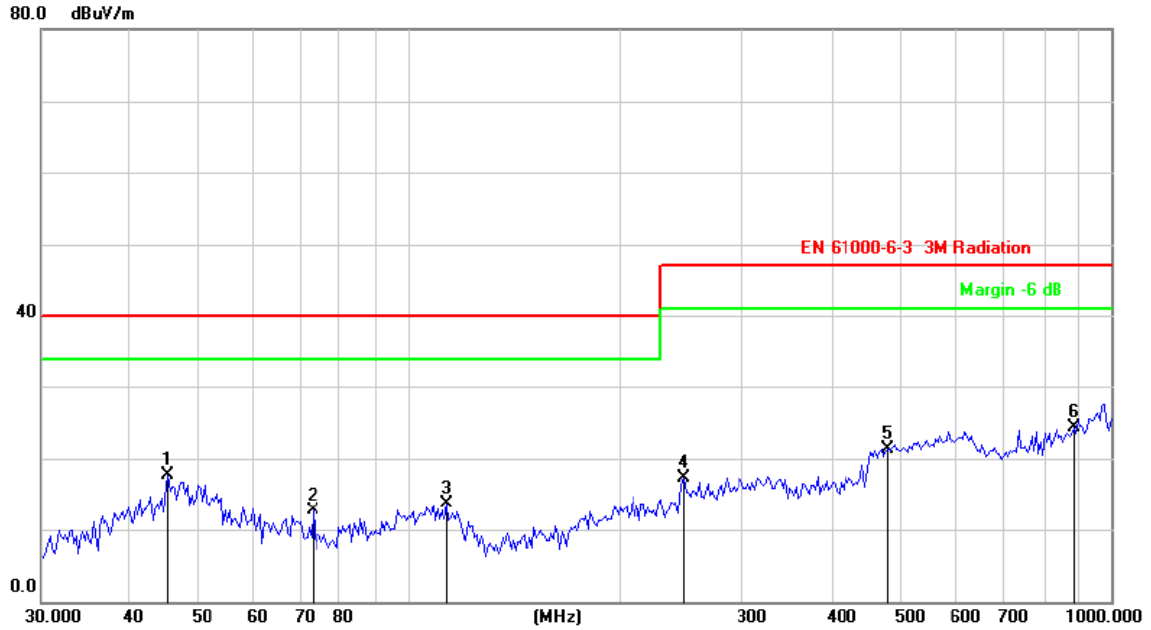
* is meaning the worst frequency has been tested in the test frequency range

Please refer to following diagram for individual
Mode: Charging



Site: Polarization: **Horizontal** Temperature: 25
 Limit: EN 61000-6-3 3M Radiation Power: Humidity: 55 %
 Note: DC 14.6V From DC Power Supply

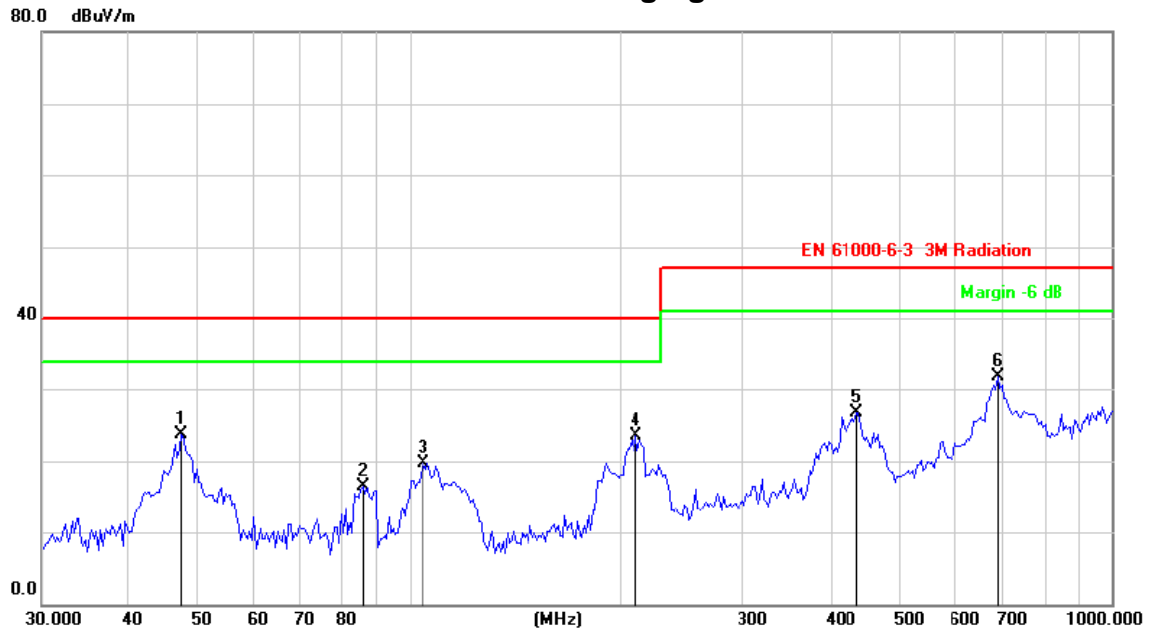
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		48.3780	29.81	-12.00	17.81	40.00	-22.19			peak
2		99.0690	29.21	-13.63	15.58	40.00	-24.42			peak
3		205.7458	28.68	-13.33	15.35	40.00	-24.65			peak
4		250.4858	27.47	-11.92	15.55	47.00	-31.45			peak
5		376.5227	28.23	-9.33	18.90	47.00	-28.10			peak
6	*	615.7743	30.10	-5.27	24.83	47.00	-22.17			peak



Site: Polarization: **Vertical** Temperature: 25
 Limit: EN 61000-6-3 3M Radiation Power: Humidity: 55 %
 Note: DC 14.6V From DC Power Supply

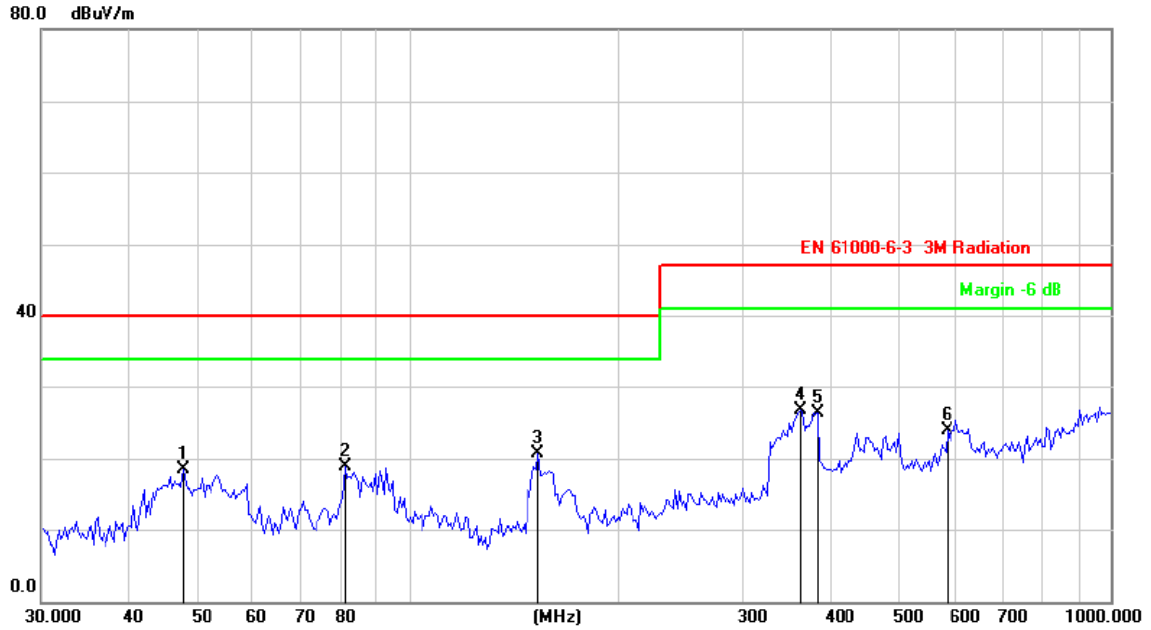
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	45.4130	29.89	-12.10	17.79	40.00	-22.21	peak		
2		73.2331	28.51	-15.74	12.77	40.00	-27.23	peak		
3		113.2200	26.99	-13.35	13.64	40.00	-26.36	peak		
4		246.9901	29.44	-12.08	17.36	47.00	-29.64	peak		
5		481.5112	29.36	-8.08	21.28	47.00	-25.72	peak		
6		887.3978	26.64	-2.41	24.23	47.00	-22.77	peak		

Mode: Discharging



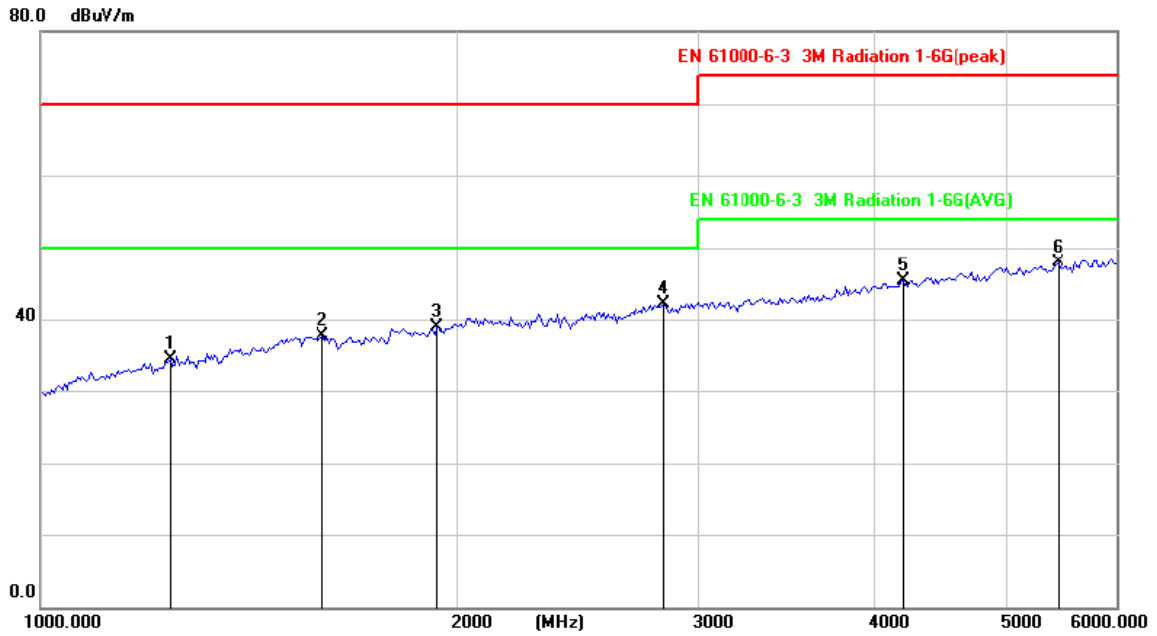
Site: Polarization: **Horizontal** Temperature: 25
 Limit: EN 61000-6-3 3M Radiation Power: DC 12.8V Humidity: 55 %
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		47.3688	35.68	-12.04	23.64	40.00	-16.36	peak		
2		86.0795	32.20	-15.79	16.41	40.00	-23.59	peak		
3		104.7978	33.03	-13.24	19.79	40.00	-20.21	peak		
4		210.1294	36.73	-13.28	23.45	40.00	-16.55	peak		
5		433.3396	35.20	-8.55	26.65	47.00	-20.35	peak		
6	*	689.0510	37.06	-5.19	31.87	47.00	-15.13	peak		



Site: Polarization: **Vertical** Temperature: 25
 Limit: EN 61000-6-3 3M Radiation Power: DC 12.8V Humidity: 55 %
 Note:

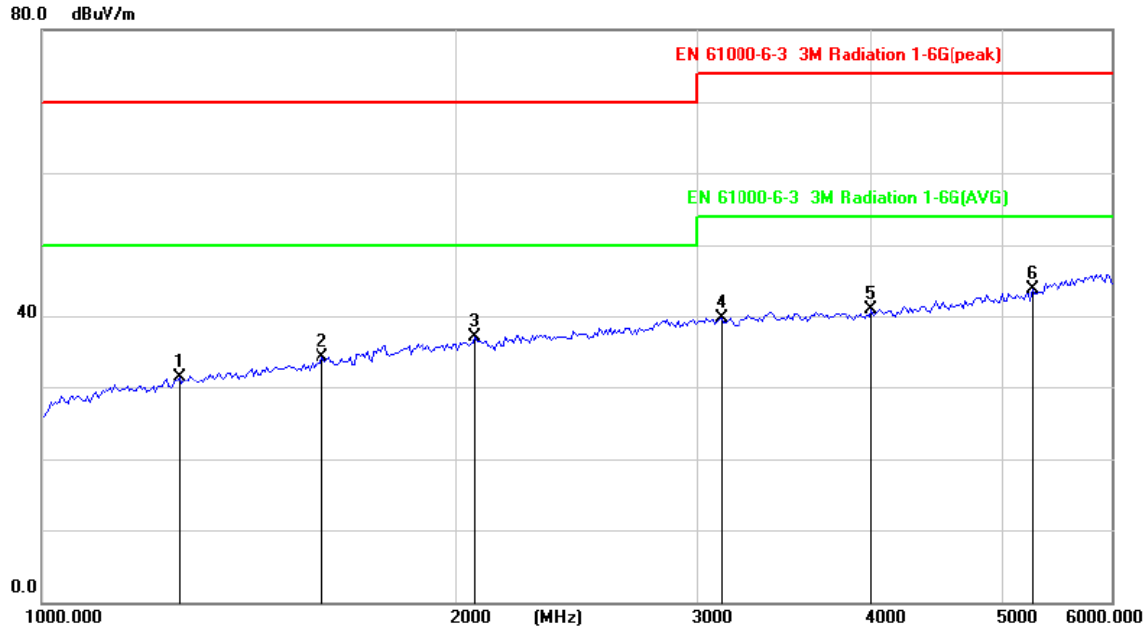
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Antenna Height cm	Table Degree	Comment
1		47.7028	30.49	-12.04	18.45	40.00	-21.55	peak		
2		81.3739	34.75	-15.89	18.86	40.00	-21.14	peak		
3	*	153.1627	36.21	-15.51	20.70	40.00	-19.30	peak		
4		360.9775	35.97	-9.32	26.65	47.00	-20.35	peak		
5		381.8519	35.64	-9.25	26.39	47.00	-20.61	peak		
6		586.2172	29.34	-5.39	23.95	47.00	-23.05	peak		



Site: _____ Polarization: **Horizontal** Temperature: 25
 Limit: EN 61000-6-3 3M Radiation 1-6G(peak) Power: DC 12.8V Humidity: 55 %
 Note: _____

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		1240.410	50.56	-16.11	34.45	70.00	-35.55	peak		
2		1600.605	53.34	-15.59	37.75	70.00	-32.25	peak		
3		1936.126	53.51	-14.57	38.94	70.00	-31.06	peak		
4		2822.752	54.47	-12.33	42.14	70.00	-27.86	peak		
5		4205.025	54.23	-8.95	45.28	74.00	-28.72	peak		
6	*	5445.614	53.80	-5.98	47.82	74.00	-26.18	peak		





Site: _____ Polarization: **Vertical** Temperature: 25
 Limit: EN 61000-6-3 3M Radiation 1-6G(peak) Power: DC 12.8V Humidity: 55 %
 Note: _____

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1		1258.354	47.54	-15.98	31.56	70.00	-38.44	peak			
2		1600.605	49.88	-15.59	34.29	70.00	-35.71	peak			
3		2065.395	51.33	-14.26	37.07	70.00	-32.93	peak			
4		3121.308	51.49	-11.79	39.70	74.00	-34.30	peak			
5		4013.249	50.19	-9.24	40.95	74.00	-33.05	peak			
6	*	5253.547	50.21	-6.50	43.71	74.00	-30.29	peak			



7.5. Harmonic Current Emissions

7.5.1. Test Specification

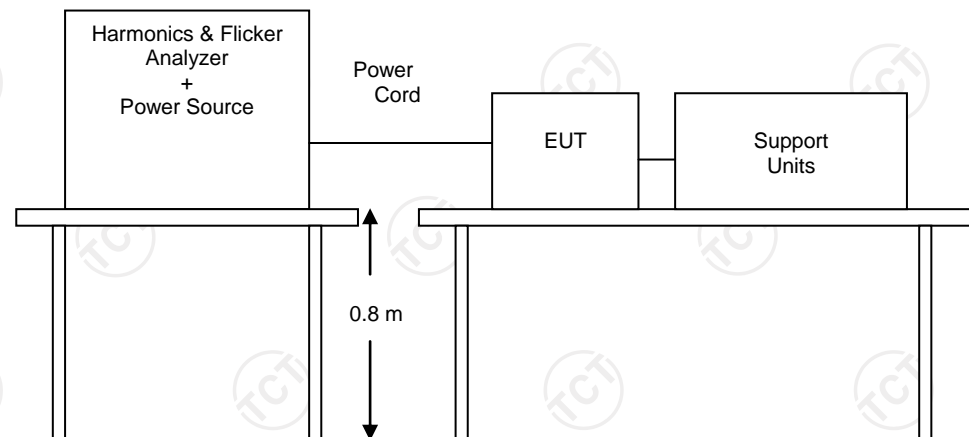
Test Requirement:	EN 61000-3-2
Test Method:	EN 61000-3-2
Limits:	Class A

7.5.2. Test Instruments

Harmonic Test Equipment				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
AC Power Supply	KIKUSUI	PCR4000M	UC002552	Sep. 11, 2021
Harmonic/Flicker Analyzer	KIKUSUI	KHA1000	UD002324	Sep. 11, 2021
Multi Outlet Unit	KIKUSUI	OT01-KHA	UF003026	Sep. 11, 2021
Line Impedance Network	KIKUSUI	LIN1020JF	UC001738	Jul. 27, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

7.5.3. Block Diagram of Test Setup



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

7.5.4. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

7.6. Flicker and Voltage Fluctuation

7.6.1. Test Specification

Test Requirement:	EN 61000-3-3
Test Method:	EN 61000-3-3

7.6.2. Limits

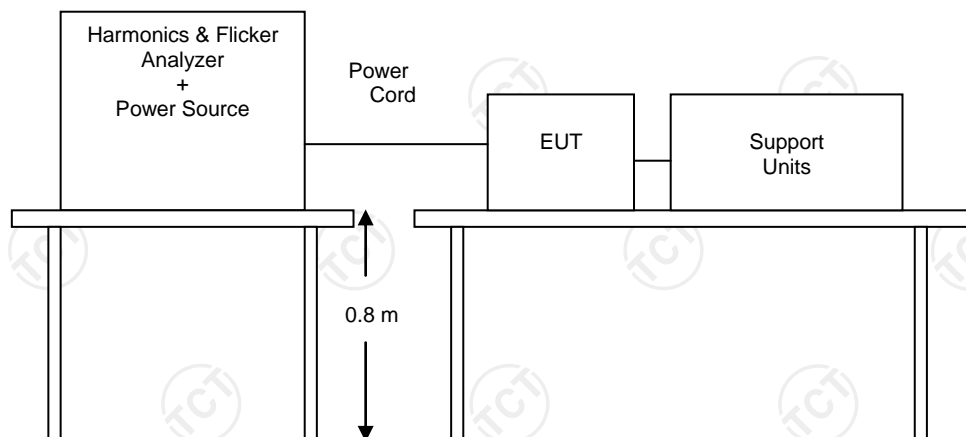
Test Item	Limit	Note
Pst	1.0	Pst means short-term flicker indicator
Plt	0.65	Plt means long-term flicker indicator
Tdt (ms)	500	Tdt means maximum time that dt exceeds 3 %.
dmax (%)	4/6/7	Dmax means maximum relative voltage change.
dc (%)	3.3	Dc means relative steady-state voltage change.

7.6.3. Test Instruments

Flicker Test Equipment				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
AC Power Supply	KIKUSUI	PCR4000M	UC002552	Sep. 11, 2021
Harmonic/Flicker Analyzer	KIKUSUI	KHA1000	UD002324	Sep. 11, 2021
Multi Outlet Unit	KIKUSUI	OT01-KHA	UF003026	Sep. 11, 2021
Line Impedance Network	KIKUSUI	LIN1020JF	UC001738	Jul. 27, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

7.6.4. Block Diagram of Test Setup



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

7.6.5. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

8. Immunity Test

8.1. General Performance Criteria Description

Criterion A:	The apparatus 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 apparatus 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, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.
Criterion B:	The apparatus 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 apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. 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 apparatus if used as intended.
Criterion C:	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

8.2. Electrostatic Discharge (ESD)

8.2.1. Test Specification

Test Requirement:	EN 61000-6-1
Test Method:	EN 61000-4-2
Storage capacitor:	150 pF
Discharge resistor:	330 ohm
Discharge Voltage:	Contact Discharge: ± 4 kV Air Discharge: ± 8 kV HCP/VCP: ± 4 kV
Polarity:	Positive & Negative
Number of Discharge:	Air Discharge: Minimum 20 times at each test point Contact Discharge: Minimum 50 times at each test point
Discharge Mode:	1 time/s
Performance Criterion:	B

8.2.2. Test Instruments

Immunity Shielded Room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Electrostatic Discharge Generator	HAEFELY	PESD300	H012056	Sep. 17, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

8.2.3. Test Method

1. Air Discharge:

The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 20 times for each pre-selected test point. This procedure was repeated until all the air discharge completed.

2. Contact Discharge:

The test was applied on accessible metallic parts of the EUT. The generator was re-triggered for a new single discharge and repeated 50 times for each pre-selected test point. The tip of the discharge electrode was touching the EUT before the discharge switch was operated.

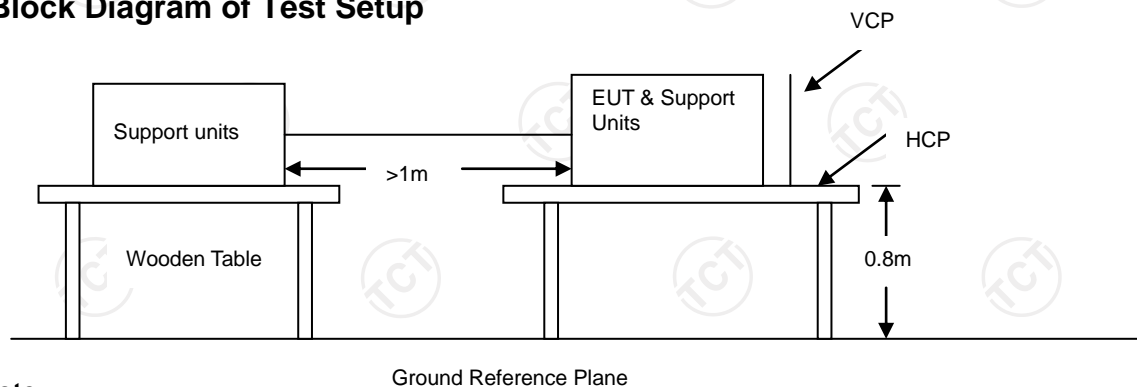
3. Indirect discharge for horizontal coupling plane:

At least 10 single discharges (in the most sensitive polarity) were applied to the horizontal coupling plane, at points on each side of the EUT. The discharge electrode positions vertically at a distance of 0.1 m from the EUT and with the discharge electrode touching the coupling plane.

4. Indirect discharge for vertical coupling plane:

At least 10 single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5 m X 0.5 m, was placed parallel to, and positioned at a distance of 0.1 m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

8.2.4. Block Diagram of Test Setup



Note:

1. Table-top Equipment

The configuration consisted of a wooden table 0.8 meters high standing on the **Ground Reference Plane**. 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** (1.6 m x 0.8 m) was placed on the table and attached to the **GRP** by means of a cable with 940 k 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.

8.2.5. Test Results

Test Environment:	Temp.: 25 °C	Humid.: 55 %	Press.: 96 kPa
Test Mode:	Mode 1, Mode 2		
Test Voltage:	DC 14.6 V From DC Power Supply, DC 12.8 V		
Test Result:	Pass		

Test points:	I: Please refer to red arrows as below plots
	II: Please refer to yellow arrows as below plots

Direct Discharge

Discharge Voltage (KV)	Type of discharge	Test points	Performance Criterion	Observation	Results
± 8	Air	I	B	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	Pass
± 4	Contact	II	B	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	Pass

Indirect Discharge

Discharge Voltage (KV)	Illuminated area of the EUT surface	Test points	Performance Criterion	Observation	Results
± 4	Top/ Bottom /Front/Back /Left/Right	HCP	B	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	Pass
± 4	Front/ Back/Left /Right	VCP	B	Note <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3	Pass

Note:

1. There was no change compared with initial operation during and after the test. No unintentional response was found during the test.
2. The function stopped during the test, but can be recoverable by itself operation after the test.
3. The function stopped during the test, but can be recoverable manually after the test.

Test point as follows:



8.3. Radio-frequency Electromagnetic Field Amplitude Modulated (RS)

8.3.1. Test Specification

Test Requirement:	EN 61000-6-1
Test Method	EN 61000-4-3
Frequency Range:	80 MHz -2700 MHz
Test level:	80 -1000 MHz, 3 V/m (unmodulated), 1400 -2000 MHz, 3 V/m (unmodulated), 2000 -2700 MHz, 1 V/m (unmodulated),
Modulation:	1 kHz, 80 % AM, sine wave
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal & Vertical
Antenna Height:	1.5 m
Performance Criterion:	A

8.3.2. Test Instruments

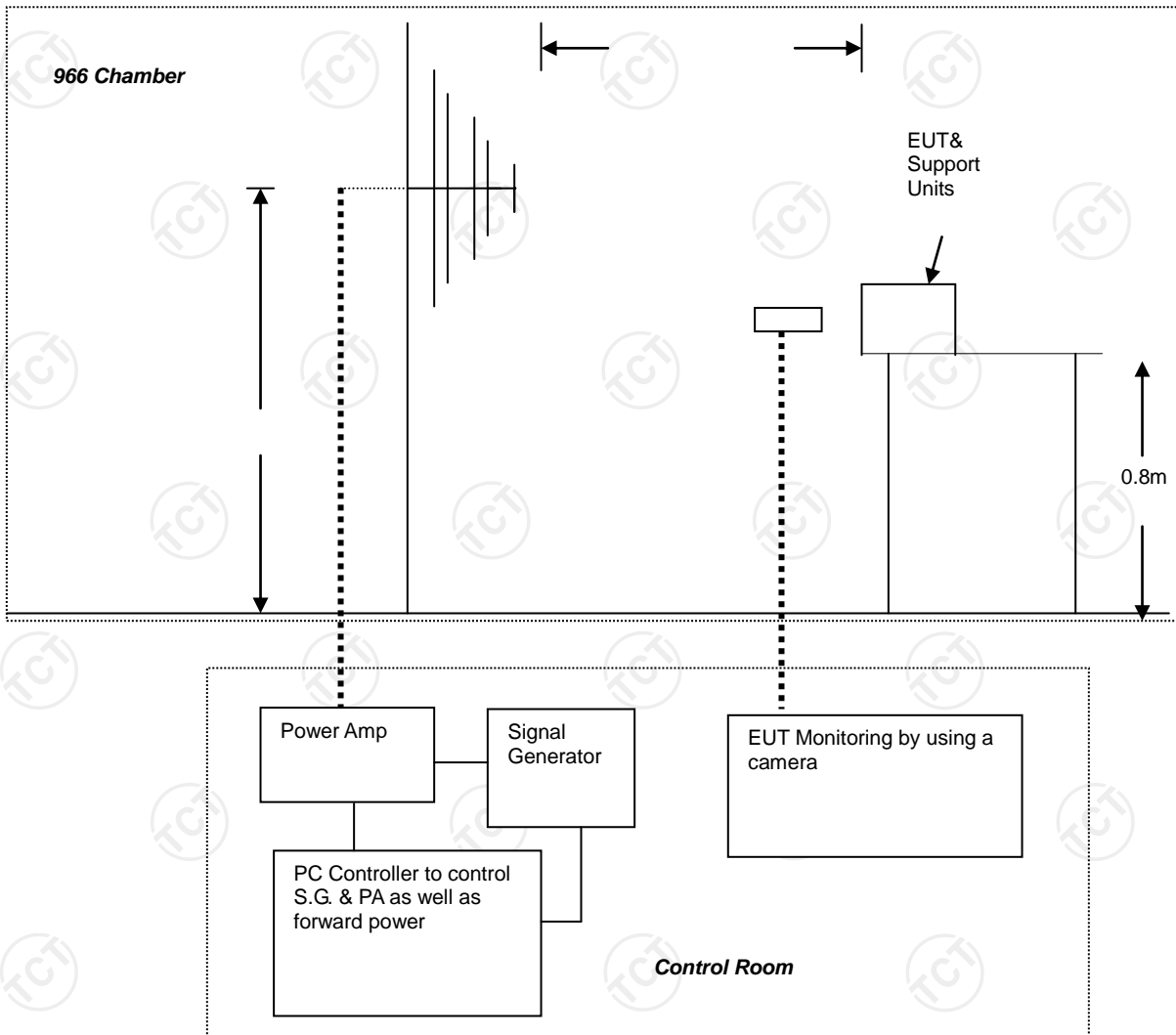
966 RS Chamber				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Signal Generator	Maconi	2022D	119246/003	Sep. 02, 2021
Power Amplifier	M2S	A00181-1000	9801-112	Sep. 02, 2021
Power Amplifier	M2S	AC8113/ 800-250A	9801-179	Sep. 02, 2021
Power Antenna	SCHAFFNER	CBL6140A	1204	Sep. 02, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

8.3.3. Test Method

1. The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
2. The frequency range is swept from 80 MHz to 2700 MHz, with the signal 80% amplitude modulated with a 1 kHz sine-wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s, where the frequency range is swept incrementally; the step size was 1% of preceding frequency value.
3. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond and was not less than 0.5 s.
4. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.
5. The EUT was performed in a configuration to actual installation conditions, a video camera and/or a audio monitor were used to monitor the performance of the EUT.

8.3.4. Block Diagram of Test Setup



Note:

1. Table-top Equipment

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

2. 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.

8.3.5. Test Results

Test Environment:	Temp.: 25 °C	Humid.: 55 %	Press.: 96 kPa
Test Mode:	Mode 1, Mode 2		
Test Voltage:	DC 14.6 V From DC Power Supply, DC 12.8 V		
Test Result:	Pass		

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

Frequency (MHz)	Polarity	Position	Field Strength (V/m)	Performance Criterion	Observation
1400 ~ 2000	V&H	Front	3	A	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
1400 ~ 2000	V&H	Rear	3	A	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
1400 ~ 2000	V&H	Left	3	A	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
1400 ~ 2000	V&H	Right	3	A	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3

Frequency (MHz)	Polarity	Position	Field Strength (V/m)	Performance Criterion	Observation
2000 ~ 2700	V&H	Front	1	A	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
2000 ~ 2700	V&H	Rear	1	A	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
2000 ~ 2700	V&H	Left	1	A	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3
2000 ~ 2700	V&H	Right	1	A	Note <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3

Note:

1. There was no change compared with initial operation during and after the test. No unintentional response was found during the test.
2. The function stopped during the test, but can be recoverable by itself operation after the test.
3. The function stopped during the test, but can be recoverable manually after the test.

8.4. Electrical Fast Transient (EFT)

8.4.1. Test Specification

Test Requirement:	EN 61000-6-1
Test Method:	EN 61000-4-4
Test Level:	Signal ports: ± 0.5 kV (peak) Input and output DC power ports: ± 0.5 kV (peak) Input and output AC power ports: ± 1 kV (peak)
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave-shape:	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	2 minutes per level & polarity
Performance Criterion:	B

8.4.2. Test Instruments

Immunity Shield Room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Fast Transient Burst Simulator	Prima	EFT61004BG	PR12074375	Sep. 11, 2021
Capacitive coupling folder	Prima	EFT-CLAMP	N/A	Sep. 11, 2021
Single-phase transformer	Prima	JMB-3KVA	L12121902-2	Sep. 11, 2021

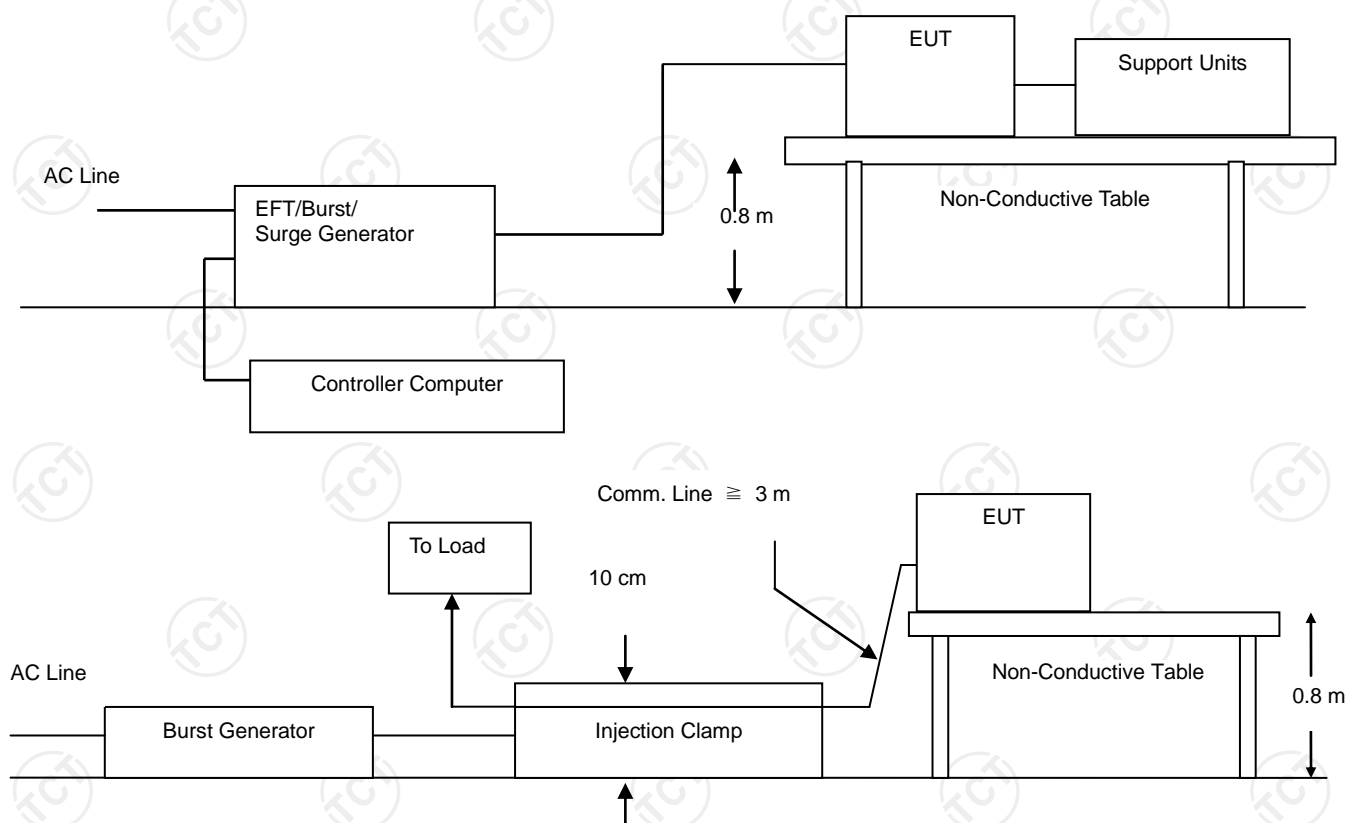
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

8.4.3. Test Method

1. The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1 m + 0.01 m thick. The ground reference plane was 1 m*1 m metallic sheet with 0.65 mm minimum thickness.
2. This reference ground plane was project beyond the EUT by at least 0.1 m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5 m.
3. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables.

4. The length of the signal and power lines between the coupling device and the EUT is 0.5 m.
5. The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal.
6. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes.

8.4.4. Block Diagram of Test Setup



Note:

1. Table-top Equipment

The configuration consisted of a wooden table (0.8 m high) standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25 mm thick and 2.5 m square) connected to the protective grounding system. A minimum distance of 0.5 m was provided between the EUT and the walls of the laboratory or any other metallic structure.

2. Floor-standing Equipment

The EUT installed in a representative system as described in section 7 of IEC 61000-4-4 and its cables were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25 mm thick and 2.5 m square) connected to the protective grounding system.

8.4.5. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

8.5. Surges

8.5.1. Test Specification

Test Requirement:	EN 61000-6-1
Test Method:	EN 61000-4-5
Test Level:	Input and output DC power ports: Line to line: ± 0.5 kV, Line to ground: ± 0.5 kV Input and output AC power ports: Line to line: ± 1 kV, Line to ground: ± 2 kV
Polarity:	Positive & Negative
Wave-Shape:	1.2/50 us(8 /20 us)
Generator Source Impedance:	2 ohm between networks 12 ohm between network and ground
Test Interval:	60 s between each surge
Number of Tests:	5 positive, 5 negative at 0°, 90°, 180°, 270°.
Performance Criterion:	B

8.5.2. Test Instruments

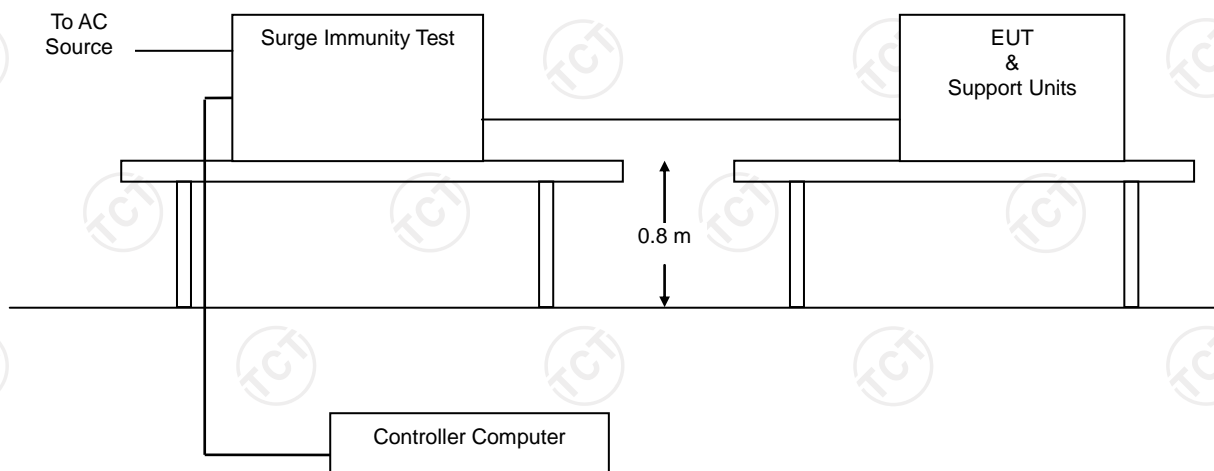
Immunity Shield Room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Lightning Surge Generator	Prima	SUG61005BG	PR12125534	Sep. 11, 2021
Single-phase transformer	Prima	JMB-3KVA	L12121902-2	Sep. 11, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

8.5.3. Test Method

1. For line-to-line coupling mode, provide a 1 kV 1.2/50 us voltage surge (at open-circuit condition) and 8/20 us current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2 kV.
2. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test.
3. Different phase angles are done individually.
4. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

8.5.4. Block Diagram of Test Setup



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

8.5.5. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

8.6. Radio-frequency Continuous Conducted (CS)

8.6.1. Test Specification

Test Requirement:	EN 61000-6-1
Test Method	EN 61000-4-6
Frequency Range:	0.15 MHz - 80 MHz
Test Level:	Signal ports: 1 V r.m.s. (unmodulated) Input and output d.c. power ports: 3 V r.m.s. (unmodulated) Input and output a.c. power ports: 3 V r.m.s. (unmodulated)
Modulation:	1 kHz, 80 % AM, sine wave
Performance Criterion:	A

8.6.2. Test Instrument

CS Test				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Conducted Disturbances Test System	Schloder	CDG 6000-75	126B1290	Sep. 11, 2021
CDN	Schloder	CDN M2+M3-16	A2210281	Sep. 11, 2021
Attenuator	PE	PE7017-6	N/A	Jul. 27, 2021
EM-Clamp	Schloder	EMCL-20	132A1194	Sep. 11, 2021

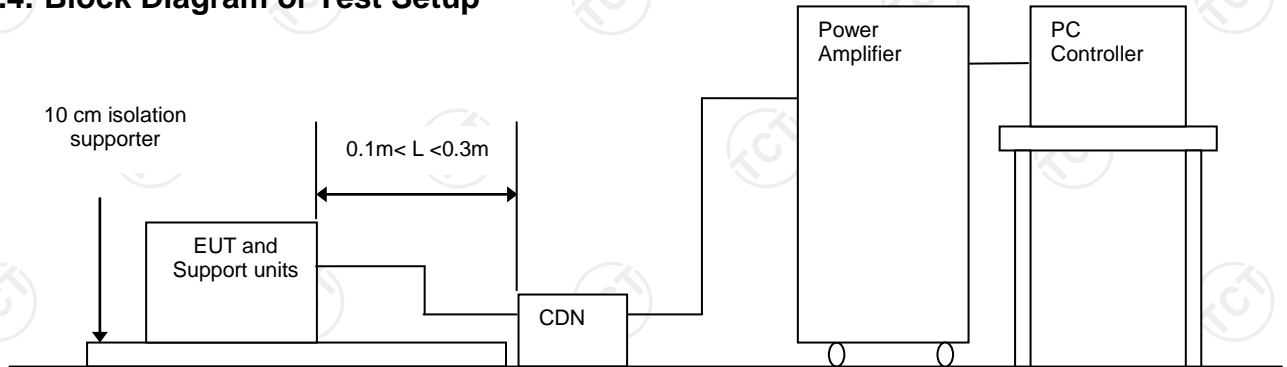
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

8.6.3. Test Method

1. The EUT are placed on an insulating support 0.1 m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3 m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).
2. The disturbance signal described below is injected to EUT through CDN.
3. The EUT operates within its operational mode(s) under intended climatic conditions after power on.
4. The frequency range is swept from 0.15 MHz to 80 MHz using 3 V signal level, and with the disturbance signal 80 % amplitude modulated with a 1 kHz sine wave.

5. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

8.6.4. Block Diagram of Test Setup



Note:

Table-Top and Floor-Standing Equipment

The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. 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.

8.6.5. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

8.7. Power-frequency Magnetic Field (PFMF)

8.7.1. Test Specification

Test Requirement:	EN 61000-6-1
Test Method:	EN 61000-4-8
Frequency:	50/60 Hz
Test level:	3 A/m
Observation Time:	5 minutes
Performance criterion:	A

8.7.2. Test Instrument

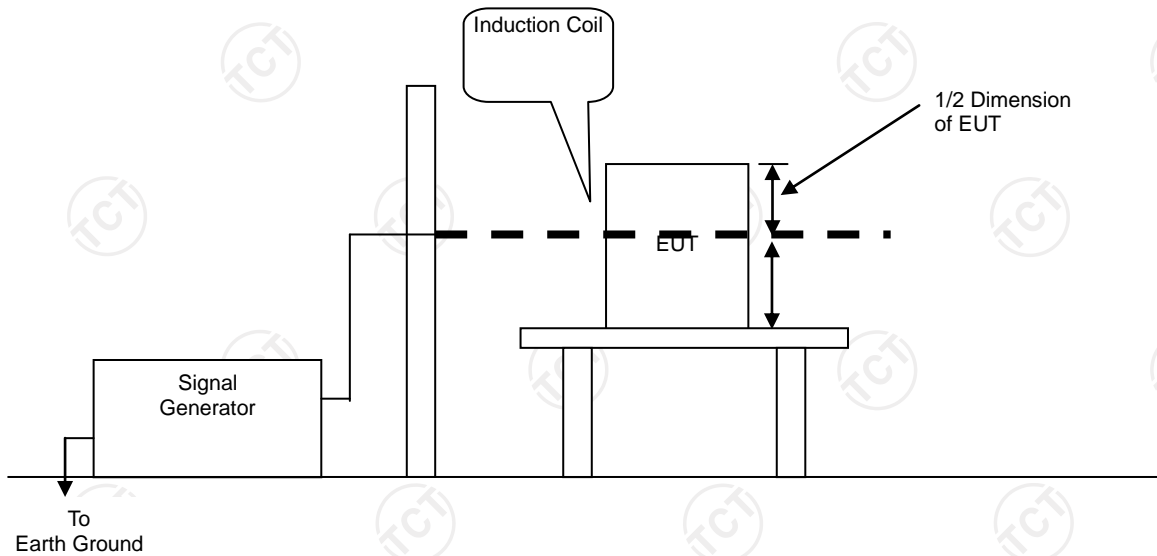
Immunity Shield Room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Power Frequency Magnetic Field Generator	EVERFINE	EMS61000-8K	G121941CS13411 14	Sep. 02, 2021
Adjustable Magnetic Field Coil	EVERFINE	MFC-4	G1242BBS134111 4	Sep. 02, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

8.7.3. Test Method

1. 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.
2. the equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
3. the power supply, input and output circuits shall be connected to the sources of power supply, control and signal.
4. 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.

8.7.4. Block Diagram of Test Setup

**Note:****1. Table-top 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.

2. 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.

8.7.5. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

8.8. Voltage Dip & Voltage Interruptions

8.8.1. Test Specification

Test Requirement:	EN 61000-6-1
Test Method	EN 61000-4-11
Test Level:	Test specification(50Hz) 0 % of UT (Supply Voltage) for 0.5 period 0% of UT (Supply Voltage) for 1 period 70 % of UT (Supply Voltage) for 25 periods 0 % of UT (Supply Voltage) for 250 periods Test specification(60Hz) 70 % of UT (Supply Voltage) for 30 periods 0 % of UT (Supply Voltage) for 300 periods
Performance Criterion:	B&C

8.8.2. Test Instrument

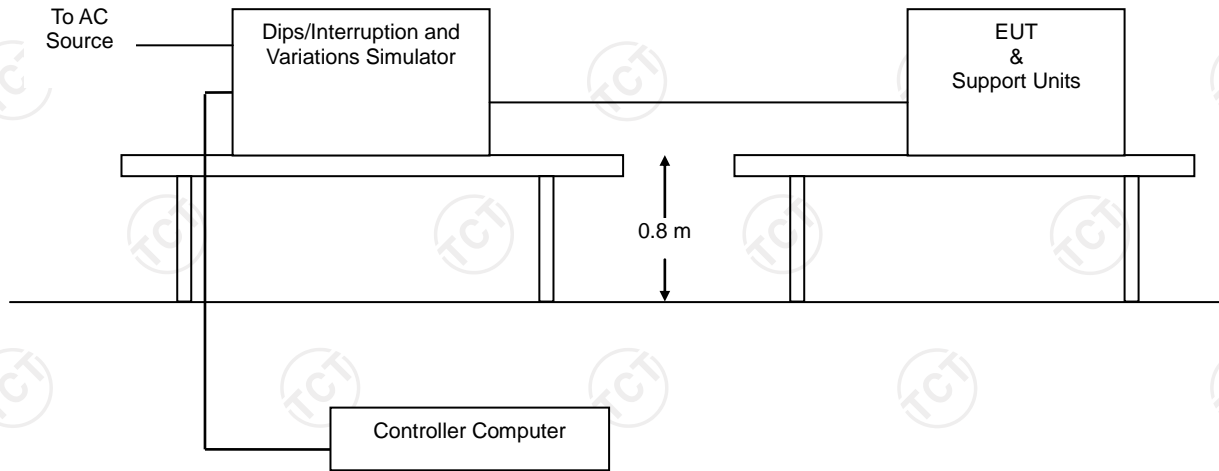
Immunity shielded room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Cycle Sag Simulator	Prima	DRP61011AG	PR12106201	Sep. 11, 2021
Single-phase transformer	Prima	JMB-3KVA	L12121902-2	Sep. 11, 2021

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

8.8.3. Test Method

1. The EUT and support units were located on a wooden table, 0.8 m away from ground floor.
2. Setting the parameter of tests and then perform the test software of test simulator.
3. Conditions changes to occur at 0 degree crossover point of the voltage waveform.
4. Recording the test result in test record form.

8.8.4. Block Diagram of Test Setup

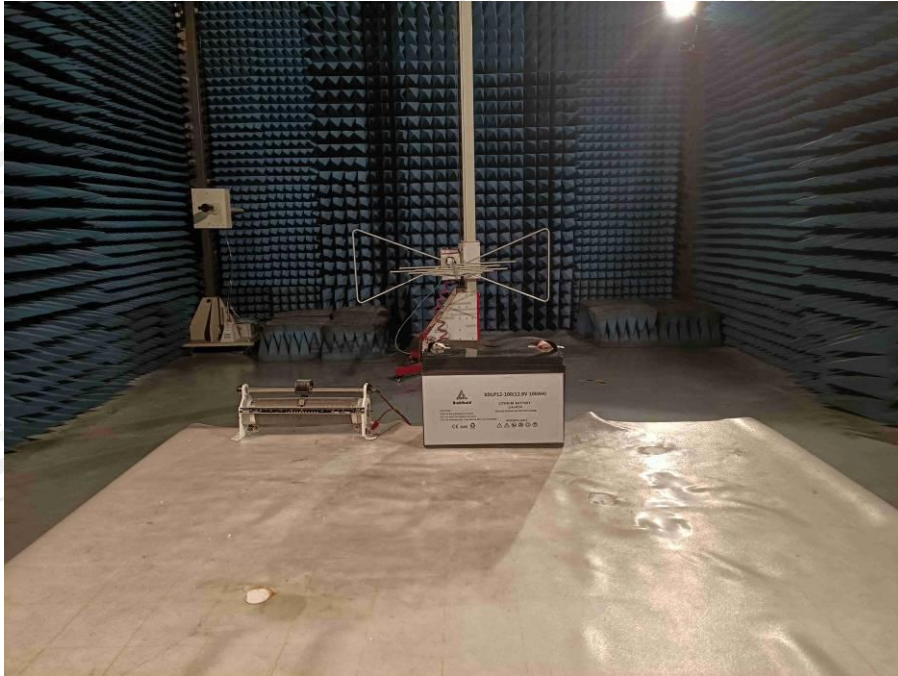


8.8.5. Test Results

Note: This test isn't applicable because the EUT doesn't have relative function.

9. Photographs of Test Configuration

Radiated Emission Test View

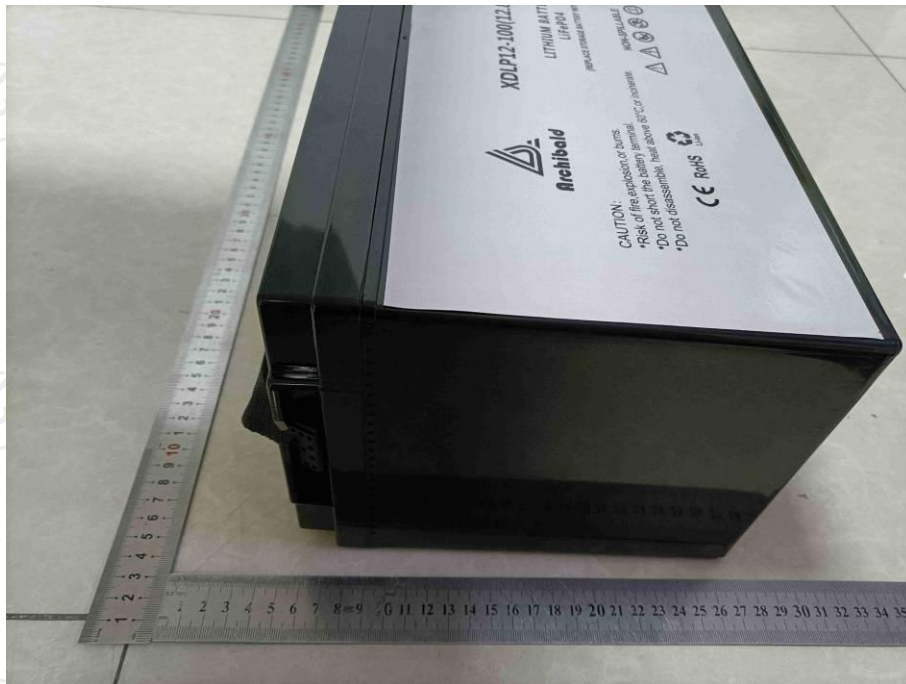


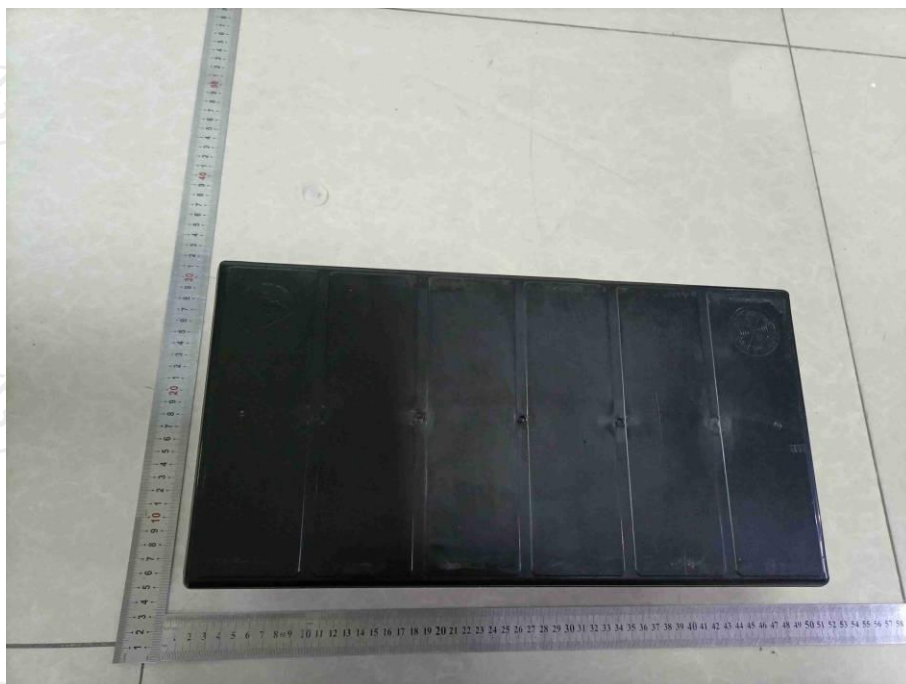
ESD Test View



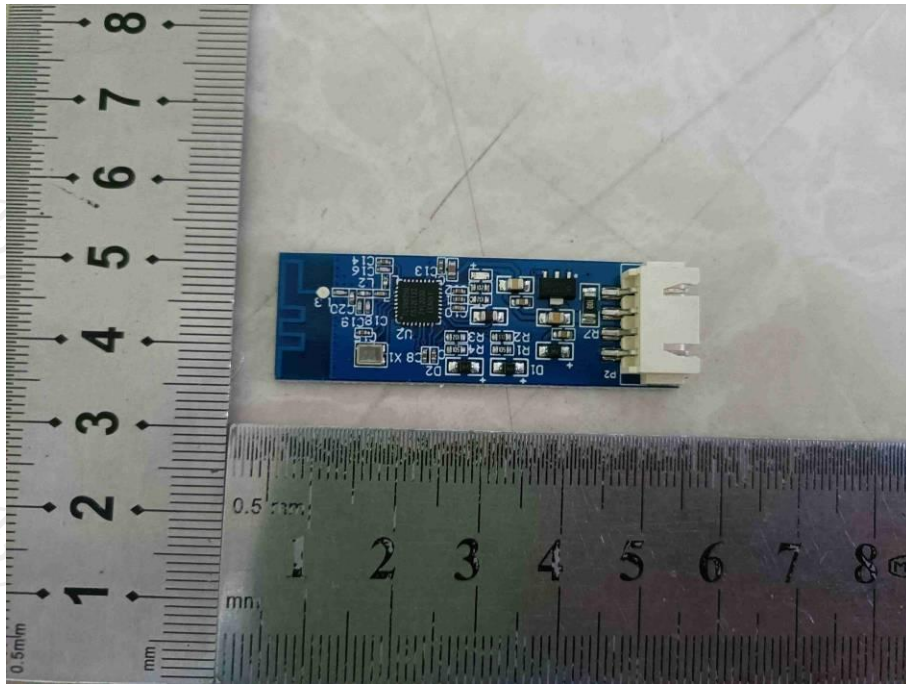
10. Photographs of EUT

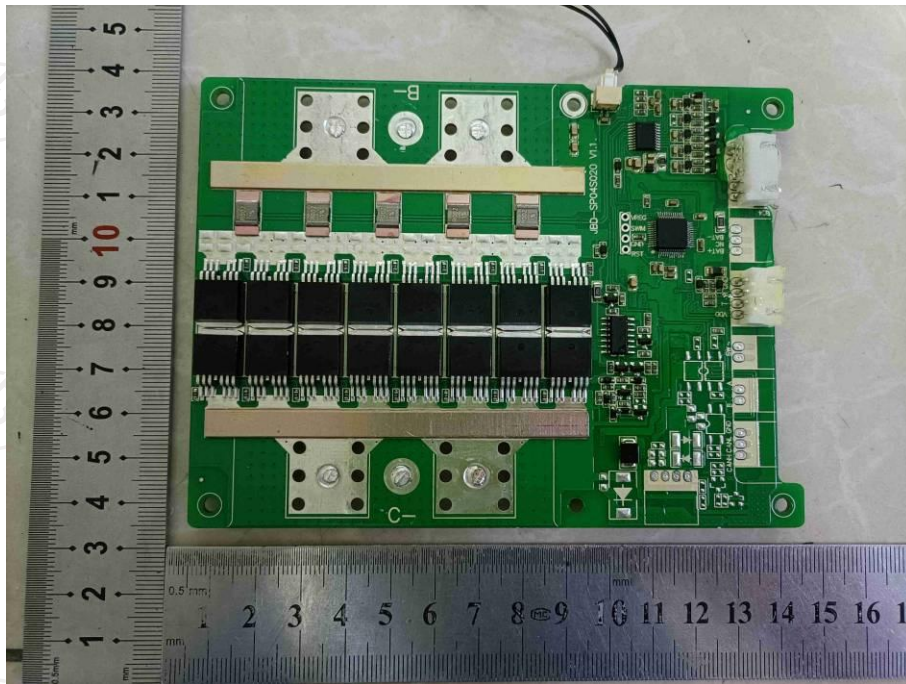
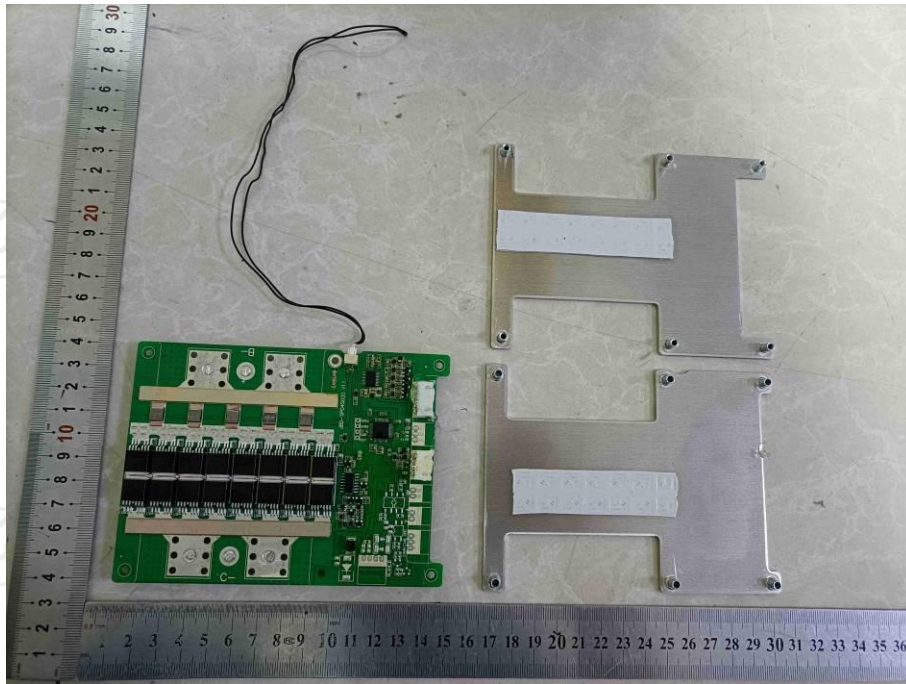


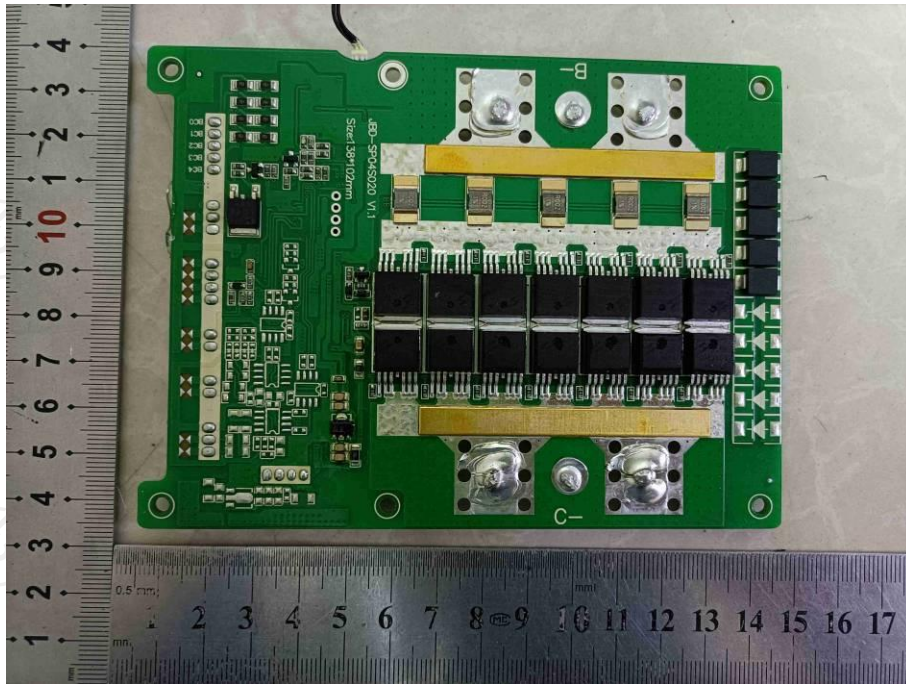












*******END OF REPORT*******