EUROFINS ELECTRICAL TESTING SERVICE (SHENZHEN) CO., LTD.

EMC TEST- REPORT

TEST REPORT NUMBER: EFGX24060174-IE-01-E01

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1 General Information

1.1 Notes

The results of this test report relate exclusively to the item tested as specified in chapter “Description of test item” and are not transferable to any other test items.

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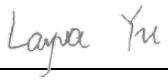
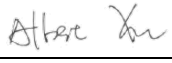
Operator:

2024-09-13		Layva Yu / Project Engineer	
Date	Eurofins-Lab.	Name / Title	Signature

Technical responsibility for area of testing:

2024-09-13		Albert Xu / EMC/RF Lab Manager	
Date	Eurofins	Name / Title	Signature

1.2 Testing laboratory

Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.
Room 20 of 2/F., 1/F., Building 2, Spring Block, Meishenghuigu Innovation Park, No.83, Dabao Road, Bao'an District, Shenzhen, Guangdong, China
Telephone : +86-755-82911867
Fax : +86-755-82910749

1.3 Details of approval holder

Name	:	Nemo Power Tools Limited
Address	:	21st Floor, CMA Building 64 Connaught Road Central Hong Kong
Telephone	:	./ .
Fax	:	./ .

1.4 Details of manufacturer

Name	:	Shenzhen WOTY energy Co.,Ltd
Address	:	Floor 4, Building C, Zhengchangda Digital Electronics Factory, Jian 'an Road, Tangwei Community, Fuhai Street, Bao 'an District, Shenzhen, China
Telephone	:	./ .
Fax	:	./ .

1.5 Application details

Date of receipt of test item	:	2024-06-11
Date of receipt of test sample	:	2024-06-11
Date of test	:	2024-06-12 to 2024-07-18
Date of issue	:	2024-09-13

1.6 EUT information

Product name	:	GHF Battery charger
Model name	:	RK20001, WEC-84WCAO-21000400AA
Brand name	:	GRABO, 沃泰能源 WOTY ENERGY
Sample ID	:	240612-03-001
Ratings	:	Input: 100-240VAC 2A, 50/60Hz; Output: DC 21V 4A, 84W
Test voltage	:	120V~ 60Hz and 230V~ 50Hz
Additional information	:	

1. Both 120V~ and 230V~ were evaluated and 230V~ as the worst emission to be recorded.
2. According to the declaration from the applicant, all models are identical except appearance and model name. Therefore model RK20001 was chosen to test full items.

(General disclaimer:
The above sample(s) and sample information was/were submitted and identified on behalf of the applicant. Eurofins assures objectivity and impartiality of the test, and fulfills the obligation of confidentiality for applicant's commercial information and technical documents.)

1.7 Test standards

Technical standard :

EN IEC 55014-1:2021

EN IEC 55014-2:2021

EN IEC 61000-3-2:2019+A1:2021

EN 61000-3-3:2013+A1:2019+A2:2021

BS EN IEC 55014-1:2021

BS EN IEC 55014-2:2021

BS EN IEC 61000-3-2:2019+A1:2021

BS EN 61000-3-3:2013+A1:2019+A2:2021

2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests performed. ☒

or

The deviations as specified were ascertained in the course of the tests performed. ☐

2.2 Test environment

Temperature	:	15	...	35°C
Relative humidity content	:	30	...	60%
Air pressure	:	86	...	106kPa

2.3 Test mode

TM1: Working

Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.
Room 20 of 2/F., 1/F., Building 2, Spring Block, Meishenghuigu Innovation Park,
No.83, Dabao Road, Bao'an District, Shenzhen, Guangdong, China

2.4 Test equipment utilized

EQUIPMENT ID	EQUIPMENT NAME	MODEL NO.	CAL. DUE DATE
23-2-13-01	EMI Test Receiver	ESR7	2025-03-25
23-2-13-02	Signal Analyzer	N9020B-544	2025-03-25
23-2-12-02	TRILOG Broadband Antenna	VULB9168	2026-06-02
23-2-10-01	Preamplifier	BBV9745	2025-03-25
23-2-13-05	EMI Test Receiver	ESR3	2025-03-25
23-2-13-06	LISN	NNLK 8127 RC	2025-03-25
23-2-10-16	Attenuator	VTSD 9561-F	2025-03-25
23-2-13-16	Harmonic&Flicker test system	100C-CTS-230	2025-03-27
23-2-13-17	Harmonic&Flicker test system	5001iX-CTS-400	2025-05-13
23-2-13-10	ESD Generator	NSG437	2025-03-27
23-2-13-11	Test Generator	compact NX5 bspt-1-300-16	2025-03-25
23-2-13-21	Switch Unit	variac NX-1-260-16	2025-03-25
23-2-13-09	Conducted Immunity Test Set	NSG4070C-35	2025-03-25
23-2-10-31	CDN	CDNM132S	2025-03-25
23-2-10-35	attenuator	DTS60-6dB-1G	2025-03-25
23-2-13-07	Signal Generator	N5171B-506	2025-03-25
23-2-13-08	Power meter	N1914A	2025-03-25
23-2-10-27	Broadband Amplifier	CBA1G-150D	2025-03-25
23-2-10-26	Average power sensor	E9301A	2025-03-25
23-2-10-75	Average power sensor	E9301A	2025-03-25
23-2-12-11	Antenna	STLP9129	N/A
23-2-10-69	PC	M4000E-16	N/A
23-2-10-70	LED Monitor	D18215FD0	N/A
23-2-10-71	PC	M4000E-16	N/A
23-2-10-72	LED Monitor	V193HQV	N/A
23-2-10-73	PC	T4099V-00	N/A
23-2-10-74	LED Monitor	LS2224	N/A
23-2-18-001	Test software	CTS 4	N/A
23-2-18-002	Test software	NSG 4070 control program	N/A
23-2-18-003	Test software	iec.control	N/A
23-2-18-005	Test software	TS+VER2.1-JS32-CE	N/A
23-2-18-006	Test software	TS+VER2.1-JS35-RS	N/A
23-2-18-007	Test software	TS+VER2.1-JS32-RE	N/A

2.5 System Measurement Uncertainty

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.56dB; Vertical: 4.55dB;
Uncertainty for Conducted Emission 150kHz-30MHz	1.96dB
Uncertainty for Harmonic test	2.96%
Uncertainty for Flicker test	3.76%
Uncertainty for CS test	28%(CDN), 45%(EM Clamp) K=2
Uncertainty for RS test	25%, K=2
Uncertainty for ESD test	The immunity measurement system uncertainty is within standard requirement and is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.
Uncertainty for EFT test	
Uncertainty for Surges test	
Uncertainty for Voltage Dips, Voltage Variations and Short Interruptions Test	

2.6 Test results

☒ 1st test ☐ test after modification ☐ production test

Test item	Sub clause	Required	Test passed	Test failed
Conducted Emission	Clause 4.3.2 & 4.3.3 of EN IEC 55014-1	☒	☒	☐
Disturbance power	Clause 4.3.4.4 of EN IEC 55014-1	☐	☐	☐
Radiated disturbance (30MHz to 1000MHz)	Clause 4.3.4 of EN IEC 55014-1	☒	☒	☐
Radiated disturbance (1000MHz to 6000MHz)	Clause 4.3.5 of EN IEC 55014-1	☐	☐	☐
Magnetic field (equipment using IPT)	Clause 4.3.2 of EN IEC 55014-1	☐	☐	☐
Discontinuous disturbance	Clause 4.4.2 of EN IEC 55014-1	☐	☐	☐
Harmonic Current Emissions	EN IEC 61000-3-2	☒	☒	☐
Voltage Changes, Voltage Fluctuations and Flicker	EN 61000-3-3	☒	☒	☐
Electrostatic Discharge	Clause 5.1 of EN IEC 55014-2 & IEC 61000-4-2	☒	☒	☐
Electrical Fast Transients	Clause 5.2 of EN IEC 55014-2 & IEC 61000-4-4	☒	☒	☐
Injected currents (RF continues conducted)	Clause 5.3 & 5.4 of EN IEC 55014-2 & IEC 61000-4-6	☒	☒	☐
Radio frequency electromagnetic fields	Clause 5.5 of EN IEC 55014-2 & IEC 61000-4-3	☒	☒	☐
Surge immunity	Clause 5.6 of EN IEC 55014-2 & IEC 61000-4-5	☒	☒	☐
Voltage dips and Interruption	Clause 5.7 of EN IEC 55014-2 & IEC 61000-4-11	☒	☒	☐

Note:

1. The click rate was less than 5, and the click duration was less than 10ms. So it is deemed to comply with Discontinuous disturbance test.

3 Emission Test

3.1 Radiated disturbance

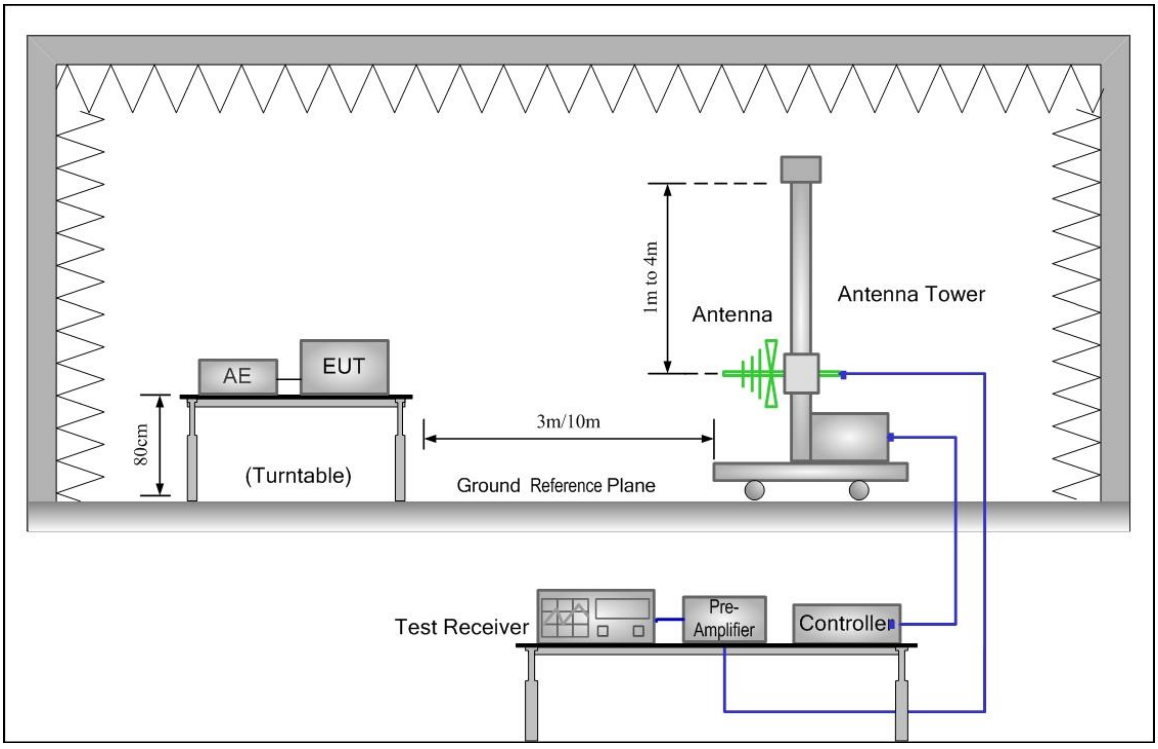
This clause lays down the general requirements for the measurement of Radiated disturbance produced at the space of apparatus.

3.1.1 Limits

Frequency range	Peak limits at 3m	Quasi-peak limits at 3m	Average limits at 3m
MHz	dB (μV/m)	dB (μV/m)	dB (μV/m)
30 to 230	/	40	/
230 to 1000	/	47	/
1000 to 3000	70	/	50
3000 to 6000	74	/	54
At transitional frequencies the lower limit applies.			

Note 1: Result Level= Read Level + Corrector Factor
Note 2: Below 1GHz: Corrector factor = Antenna Factor + Cable Loss - Amplifier Gain.
Note 3: Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain.
Note 4: Radiated disturbance test in the frequency range from 1 GHz to 6 GHz is not required as the highest clock frequency (Fx) of EUT is less than 108MHz.

3.1.2 Measurement procedure



1. The radiated emissions test was conducted in a semi-anechoic chamber. The EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was

placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

2. Before get the final emission results with quasi-peak(QP) detector, a pre-scan was performed with the peak(PK) detector to find out the maximum emission data plots of the EUT.

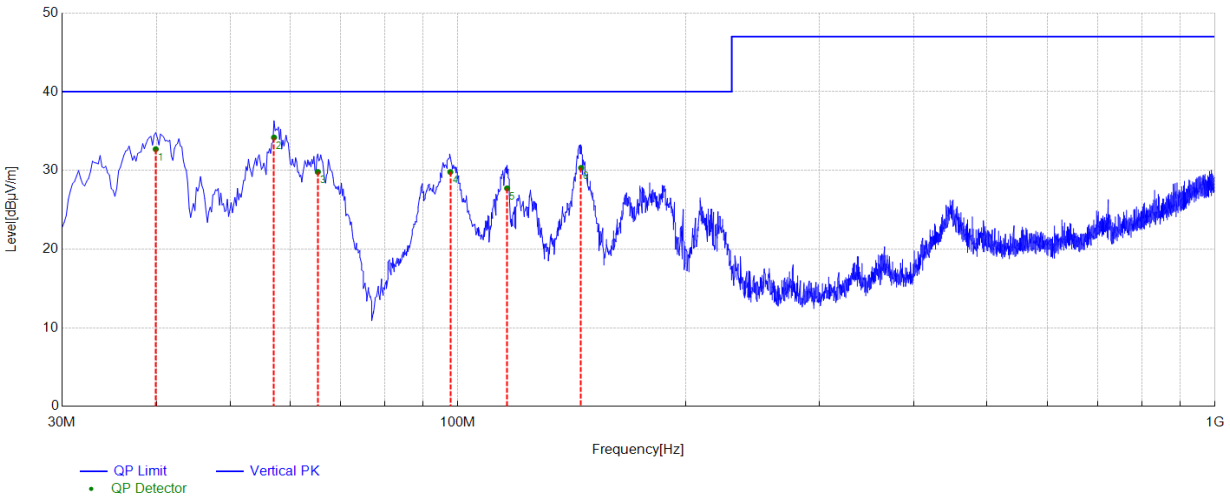
3. The frequencies of maximum emission were determined in the final radiated emissions measurement, the physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization. Test was performed at 3 m distance.

3.1.3 Test environment

Temperature	: 24.5 °C
Relative humidity content	: 57.8 %
Air pressure	: 101.5 kPa

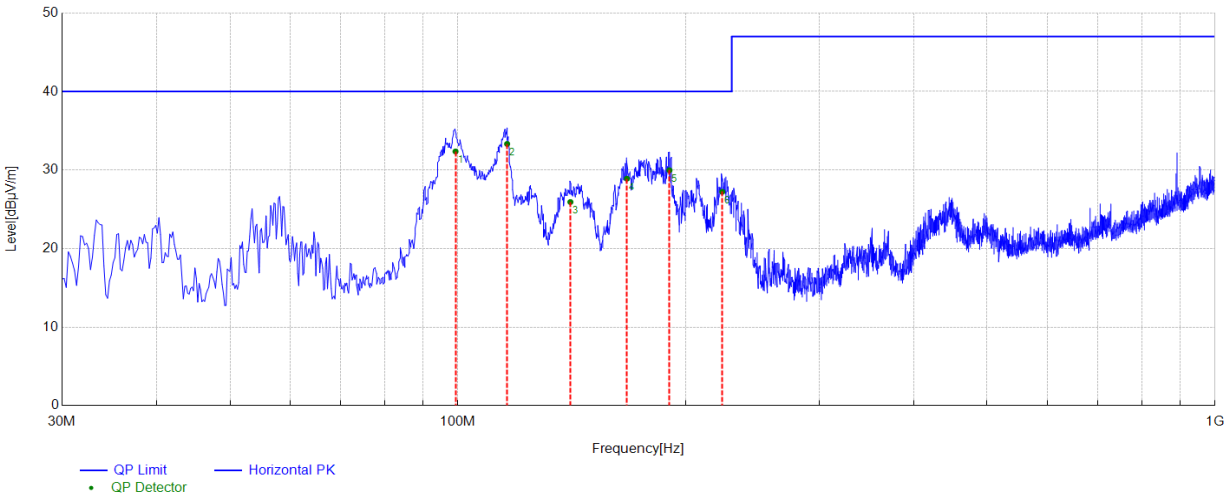
3.1.4 Results

Vertical Polarity Test Data



Final Data List									
NO.	Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	39.8960	-16.18	32.70	40.00	7.30	100	73	Vertical	PASS
2	57.1654	-16.84	34.19	40.00	5.81	100	322	Vertical	PASS
3	65.3151	-17.69	29.81	40.00	10.19	100	265	Vertical	PASS
4	97.7195	-20.18	29.80	40.00	10.20	100	258	Vertical	PASS
5	116.1532	-18.34	27.73	40.00	12.27	100	14	Vertical	PASS
6	145.4531	-16.42	30.33	40.00	9.67	100	56	Vertical	PASS

Horizontal Polarity Test Data



Final Data List									
NO.	Freq. [MHz]	Factor [dB/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	99.2719	-20.02	32.37	40.00	7.63	200	55	Horizontal	PASS
2	116.1532	-18.34	33.33	40.00	6.67	200	214	Horizontal	PASS
3	140.7962	-16.68	25.93	40.00	14.07	200	256	Horizontal	PASS
4	167.1854	-16.47	28.90	40.00	11.10	200	97	Horizontal	PASS
5	190.2761	-18.82	29.98	40.00	10.02	200	231	Horizontal	PASS
6	223.4567	-19.39	27.23	40.00	12.77	100	97	Horizontal	PASS

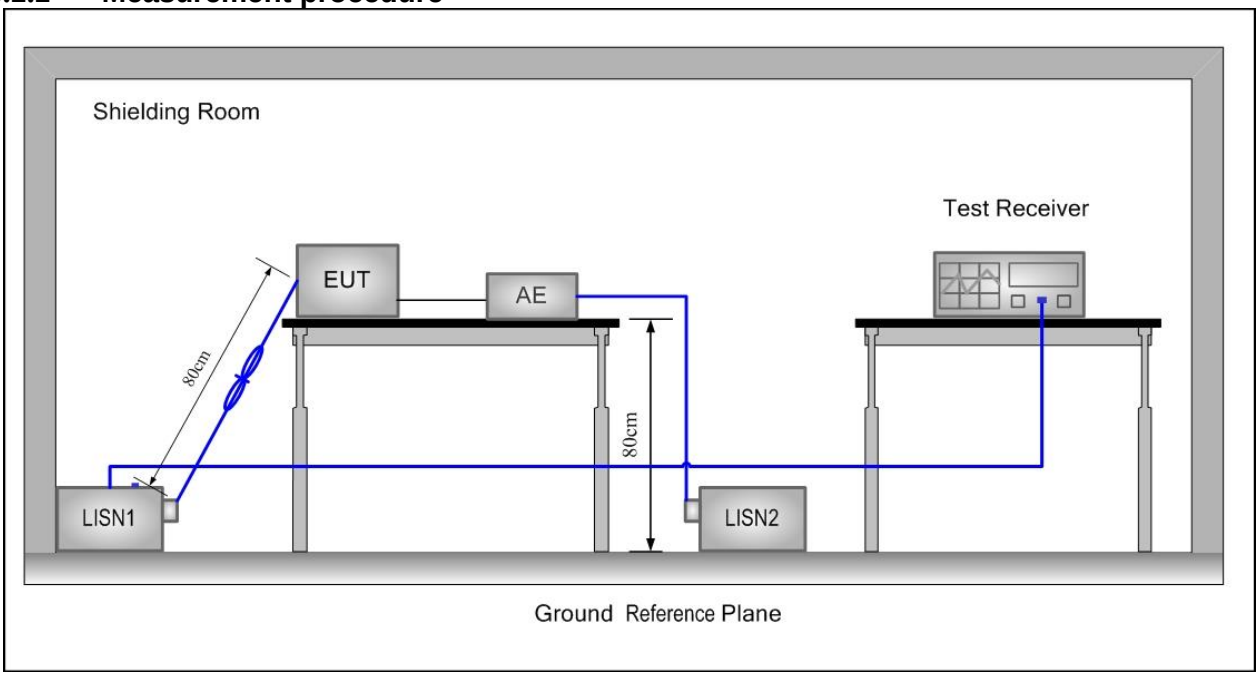
3.2 Conducted Emission

This clause lays down the general requirements for the measurement of disturbance voltage produced at the terminals of apparatus.

3.2.1 Limits

Frequency range MHz	At mains terminals dB (μV)	
	Quasi-peak Limit	Average Limit
0.15 to 0.50	66 to 56	59 to 46
0.50 to 5	56	46
5 to 30	60	50
Note1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 30 MHz. Note2: The lower limit is applicable at the transition frequency.		

3.2.2 Measurement procedure



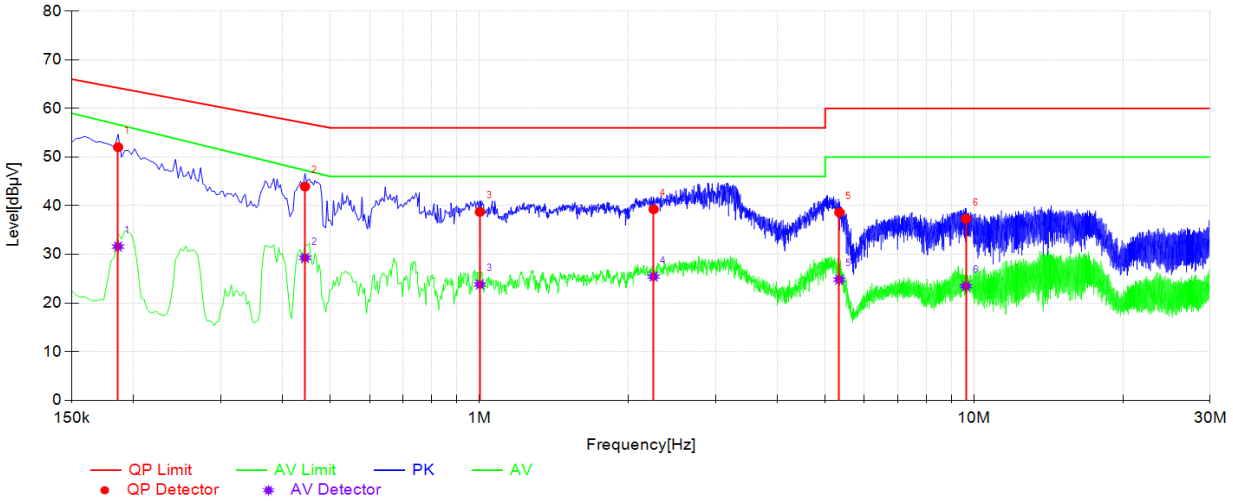
1. The mains terminal disturbance voltage was measured with the EUT in a shielded room.
2. The EUT was connected to AC power source through a LISN (Line Impedance Stabilization Network) which provides a (50 μH + 5 Ω) || 50 Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN, which was bonded to the ground reference plane in the same way as the LISN for the unit being measured.
3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.
4. Before get the final emission results with quasi-peak(QP) detector and average(AV) detector, a pre-scan was performed with the peak(PK) and average(AV) detector to find out the maximum emission data plots of the EUT.

3.2.3 Test environment

Temperature	: 25.1 °C
Relative humidity content	: 57.3 %
Air pressure	: 101.5 kPa

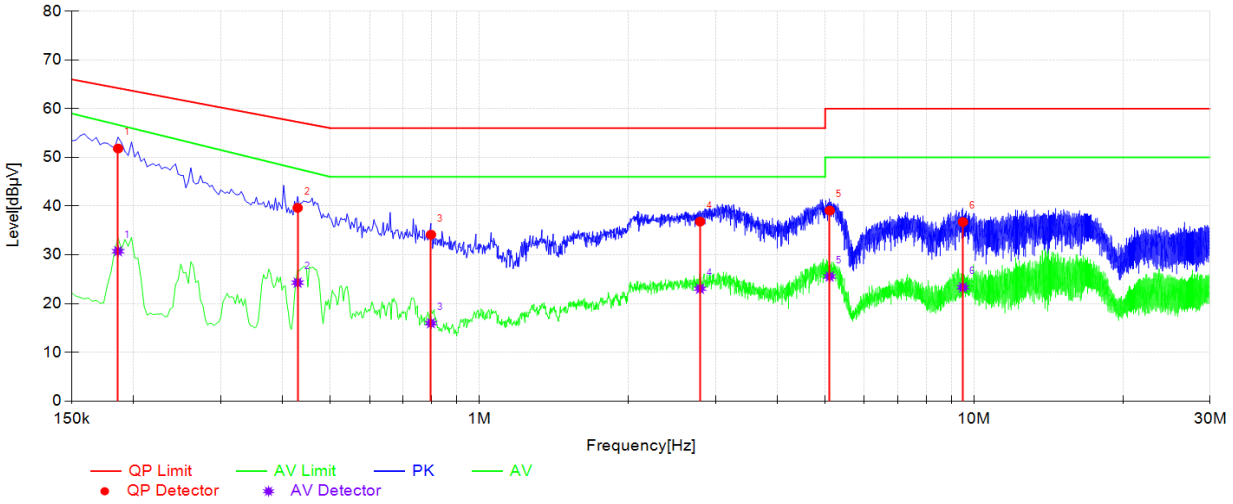
3.2.4 Results -Measurement Data

Live line test data



Final Data List										
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type	Verdict
1	0.186	10.25	52.03	64.21	12.18	31.60	56.68	25.08	L1	PASS
2	0.444	10.25	43.94	56.99	13.05	29.30	47.28	17.98	L1	PASS
3	1.002	10.26	38.73	56.00	17.27	23.82	46.00	22.18	L1	PASS
4	2.25	10.28	39.27	56.00	16.73	25.43	46.00	20.57	L1	PASS
5	5.34	10.35	38.63	60.00	21.37	24.81	50.00	25.19	L1	PASS
6	9.627	10.44	37.30	60.00	22.70	23.47	50.00	26.53	L1	PASS

Neutral line test data



Final Data List										
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type	Verdict
1	0.186	10.25	51.83	64.21	12.38	30.76	56.68	25.92	N	PASS
2	0.429	10.25	39.65	57.27	17.62	24.31	47.65	23.34	N	PASS
3	0.798	10.26	34.15	56.00	21.85	15.99	46.00	30.01	N	PASS
4	2.793	10.33	36.83	56.00	19.17	23.06	46.00	22.94	N	PASS
5	5.106	10.41	39.10	60.00	20.90	25.57	50.00	24.43	N	PASS
6	9.495	10.44	36.76	60.00	23.24	23.34	50.00	26.66	N	PASS

3.3 Disturbance power

This clause lays down the general requirements for the measurement of disturbance power produced at the terminals of apparatus.

3.3.1 limits

Table 7 – Disturbance power limits – 30 MHz to 300 MHz

Frequency range	General		Tools					
			$P \leq 700$ W		700 W < $P \leq 1\,000$ W		$P > 1\,000$ W	
1	2	3	4	5	6	7	8	9
MHz	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW
30 to 300	Increasing linearly with the frequency from:							
	45 to 55	35 to 45	45 to 55	35 to 45	49 to 59	39 to 49	55 to 65	45 to 55
Key P = rated power of the motor only.								

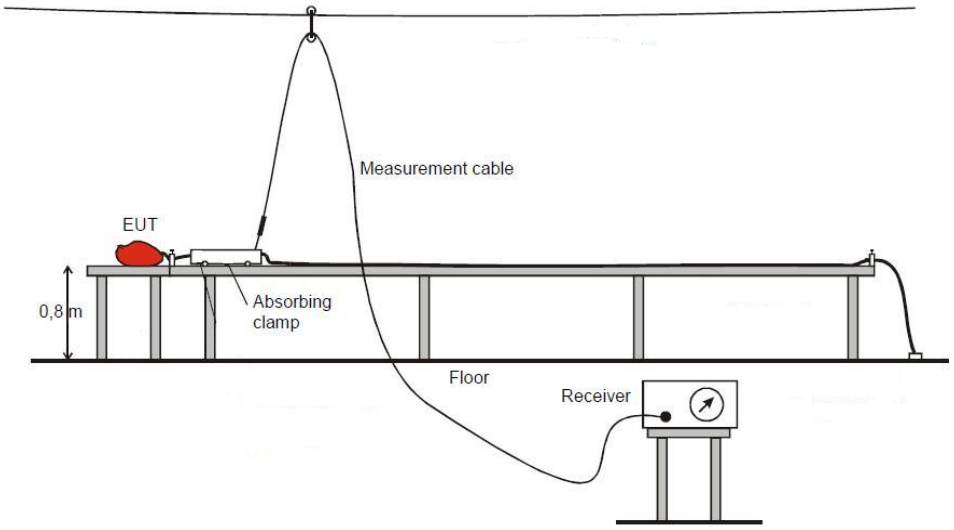
Table 8 – Reduction applicable to Table 7 limits

Frequency range	General		Tools					
			$P \leq 700$ W		700 W < $P \leq 1\,000$ W		$P > 1\,000$ W	
1	2	3	4	5	6	7	8	9
MHz	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW
200 to 300	Increasing linearly with the frequency from:							
	0 to 10	0	0 to 10	0	0 to 10	0	0 to 10	0
NOTE This table only applies if method a) specified in 4.3.4.2 is followed.								

Note: Increasing linearly with the frequency from.

If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.

3.3.2 Measurement procedure



The test configuration corresponds to the standard EN IEC 55014-1. The equipment under test is placed on a non metallic table with 0,8 m high. The lead to be measured is stretched horizontally in a straight line, to permit variation in position of the absorbing clamp along the lead to find the maximum indication. The lead shall be at least length of 6 meter. Before get the final emission results with quasi-peak(QP) detector and average(AV) detector, a pre-scan was performed with the peak(PK) detector to find out the maximum emission data plots of the EUT. The absorbing clamp is placed around the lead.

3.3.3 Test environment

Temperature	:	°C
Relative humidity content	:	%
Air pressure	:	kPa

3.3.4 Results

N/A

Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.
Room 20 of 2/F., 1/F., Building 2, Spring Block, Meishenghuigu Innovation Park,
No.83, Dabao Road, Bao'an District, Shenzhen, Guangdong, China

3.4 Harmonic current emission

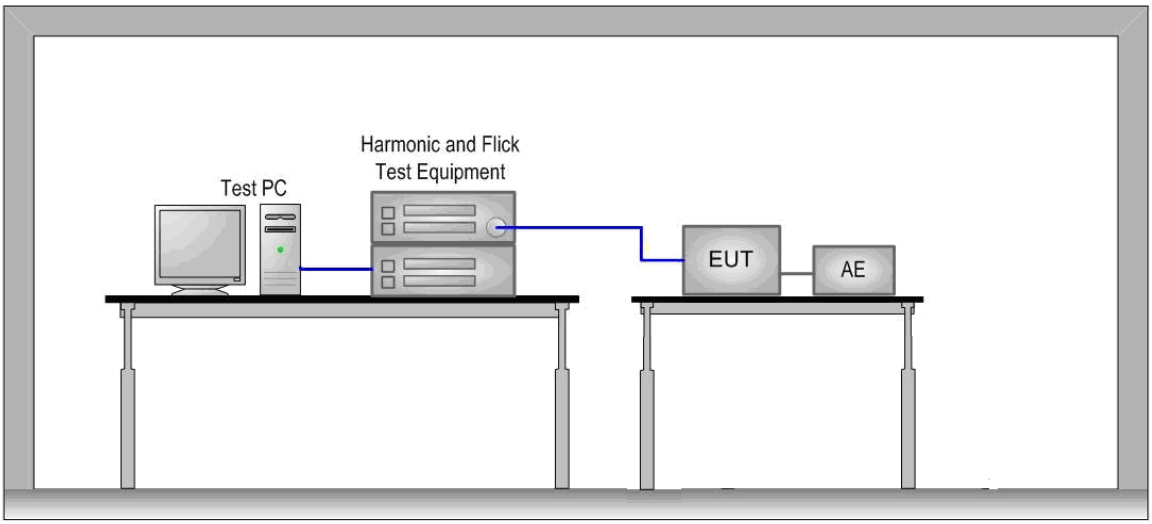
This part deals with the limitation of harmonic currents injected into the public supply system.

3.4.1 Limits

Table 1 – Limits for Class A equipment

Harmonic order h	Maximum permissible harmonic current A
Odd harmonics	
3	2,30
5	1,14
7	0,77
9	0,40
11	0,33
13	0,21
$15 \leq h \leq 39$	$0{,}15\frac{15}{h}$
Even harmonics	
2	1,08
4	0,43
6	0,30
$8 \leq h \leq 40$	$0{,}23\frac{8}{h}$

3.4.2 Measurement procedure



The equipment under test is placed on a wooden table with a height of 0,8 m in the EMC lab. For each harmonic order, measure the 1,5 s smoothed r.m.s. harmonic current in each DFT time window and calculate the arithmetic average of the measured values from the DFT time windows, over the entire observation

period. Each harmonic order, all 1.5 s smoothed r.m.s. harmonic current values and the average values for the individual harmonic currents, taken over the entire test observation period shall be less than or equal to the applicable limits.

3.4.3 Test environment

Temperature	: 24.5 °C
Relative humidity content	: 57.5 %
Air pressure	: 101.5 kPa

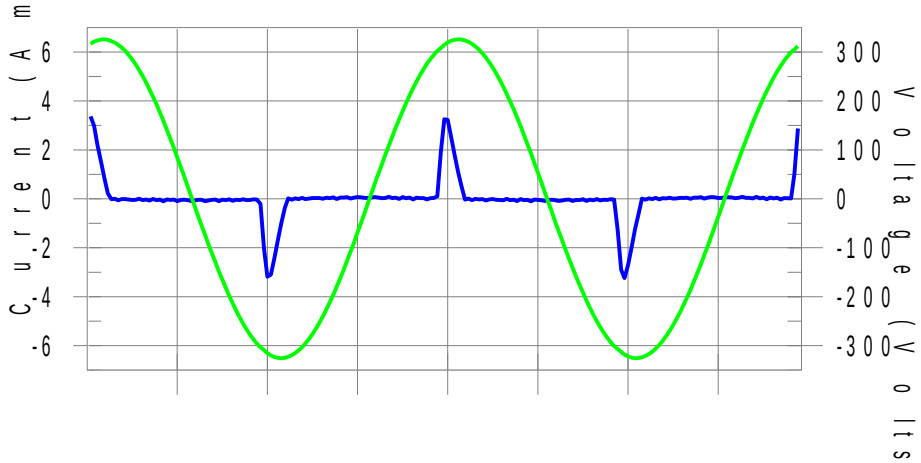
3.4.4 Results

Harmonics – Class-A

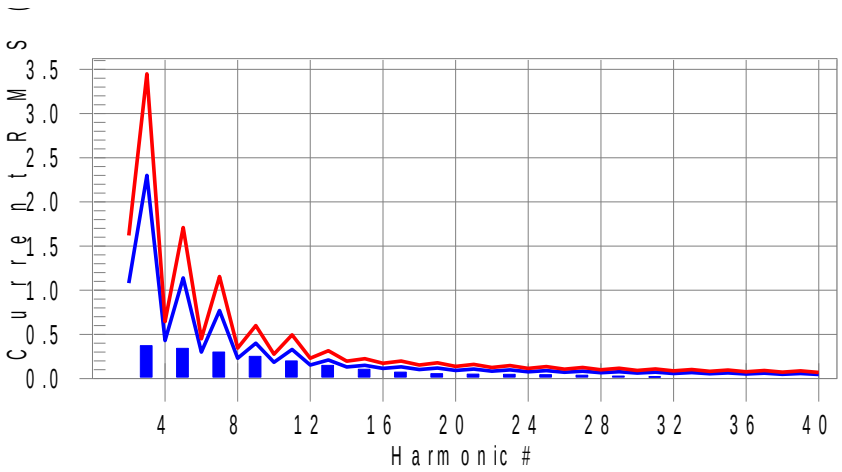
EUT: / **Tested by: /**
Test category: Class-A (European limits) **Test Margin: 100**
Test duration (min): 2.5

Test Result: Pass **Source qualification: Normal**

Current & voltage waveforms



Harmonics and Class A limit line **European Limits**



Test result: Pass **Worst harmonics H15-51.9% of 150% limit, H13-71.1% of 100% limit**

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No.83, Dabao Road, Bao'an District, Shenzhen, Guangdong, China

Current Test Result Summary (Run time)

Test category: Class-A (European limits) **Test Margin: 100**
Test duration (min): 2.5

Test Result: Pass **Source qualification: Normal**
THC(A): 0.708 **I-THD(%): 178.2** **POHC(A): 0.101** **POHC Limit(A): 0.251**

Highest parameter values during test:

V_RMS (Volts):	230.20	Frequency(Hz):	50.00
I_Peak (Amps):	3.431	I_RMS (Amps):	0.827
I_Fund (Amps):	0.397	Crest Factor:	4.161
Power (Watts):	88.3	Power Factor:	0.490

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.007	1.080	0.7	0.009	1.620	0.5	Pass
3	0.372	2.300	16.2	0.375	3.450	10.9	Pass
4	0.007	0.430	1.7	0.008	0.645	1.3	Pass
5	0.342	1.140	30.0	0.346	1.710	20.2	Pass
6	0.007	0.300	2.4	0.008	0.450	1.7	Pass
7	0.300	0.770	39.0	0.306	1.155	26.5	Pass
8	0.007	0.230	3.1	0.008	0.345	2.2	Pass
9	0.251	0.400	62.9	0.259	0.600	43.2	Pass
10	0.007	0.184	3.8	0.008	0.276	2.8	Pass
11	0.199	0.330	60.4	0.209	0.495	42.2	Pass
12	0.007	0.153	4.3	0.008	0.230	3.4	Pass
13	0.149	0.210	71.1	0.160	0.315	50.9	Pass
14	0.006	0.131	4.6	0.008	0.197	3.9	Pass
15	0.106	0.150	70.4	0.117	0.225	51.9	Pass
16	0.006	0.115	4.9	0.008	0.173	4.4	Pass
17	0.073	0.132	55.5	0.083	0.198	42.1	Pass
18	0.005	0.102	5.0	0.007	0.153	4.7	Pass
19	0.056	0.118	46.9	0.063	0.178	35.3	Pass
20	0.005	0.092	N/A	0.007	0.138	N/A	Pass
21	0.050	0.107	46.6	0.054	0.161	33.6	Pass
22	0.004	0.084	N/A	0.006	0.125	N/A	Pass
23	0.048	0.098	49.2	0.051	0.147	34.8	Pass
24	0.004	0.077	N/A	0.006	0.115	N/A	Pass
25	0.044	0.090	49.4	0.047	0.135	35.1	Pass
26	0.004	0.071	N/A	0.005	0.107	N/A	Pass
27	0.038	0.083	45.1	0.042	0.125	33.7	Pass
28	0.004	0.066	N/A	0.006	0.099	N/A	Pass
29	0.029	0.078	37.1	0.033	0.116	28.6	Pass
30	0.003	0.061	N/A	0.004	0.092	N/A	Pass
31	0.020	0.073	27.5	0.024	0.109	22.2	Pass
32	0.003	0.058	N/A	0.005	0.086	N/A	Pass
33	0.014	0.068	20.7	0.016	0.102	16.1	Pass
34	0.002	0.054	N/A	0.003	0.081	N/A	Pass
35	0.013	0.064	19.7	0.014	0.096	14.8	Pass
36	0.002	0.051	N/A	0.003	0.077	N/A	Pass
37	0.014	0.061	22.4	0.015	0.091	16.1	Pass
38	0.002	0.048	N/A	0.003	0.073	N/A	Pass
39	0.014	0.058	23.9	0.014	0.087	16.3	Pass
40	0.002	0.046	N/A	0.002	0.069	N/A	Pass

Voltage Source Verification Data (Run time)

Test category: Class-A (European limits) **Test Margin: 100**
Test duration (min): 2.5

Test Result: Pass **Source qualification: Normal**

Highest parameter values during test:

Voltage (Vrms):	230.20	Frequency(Hz):	50.00
I_Peak (Amps):	3.431	I_RMS (Amps):	0.827
I_Fund (Amps):	0.397	Crest Factor:	4.161
Power (Watts):	88.3	Power Factor:	0.490

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.070	0.460	15.17	OK
3	0.452	2.071	21.82	OK
4	0.050	0.460	10.77	OK
5	0.102	0.921	11.10	OK
6	0.016	0.460	3.54	OK
7	0.150	0.690	21.66	OK
8	0.014	0.460	2.98	OK
9	0.129	0.460	28.03	OK
10	0.013	0.460	2.86	OK
11	0.096	0.230	41.72	OK
12	0.015	0.230	6.62	OK
13	0.089	0.230	38.90	OK
14	0.009	0.230	3.72	OK
15	0.056	0.230	24.47	OK
16	0.008	0.230	3.55	OK
17	0.059	0.230	25.44	OK
18	0.008	0.230	3.43	OK
19	0.047	0.230	20.57	OK
20	0.032	0.230	13.83	OK
21	0.045	0.230	19.47	OK
22	0.008	0.230	3.33	OK
23	0.046	0.230	19.92	OK
24	0.006	0.230	2.79	OK
25	0.047	0.230	20.21	OK
26	0.006	0.230	2.66	OK
27	0.043	0.230	18.83	OK
28	0.007	0.230	3.13	OK
29	0.041	0.230	17.77	OK
30	0.005	0.230	2.04	OK
31	0.029	0.230	12.48	OK
32	0.005	0.230	2.22	OK
33	0.023	0.230	10.06	OK
34	0.006	0.230	2.47	OK
35	0.019	0.230	8.23	OK
36	0.005	0.230	2.01	OK
37	0.022	0.230	9.41	OK
38	0.005	0.230	2.26	OK
39	0.024	0.230	10.23	OK
40	0.019	0.230	8.26	OK

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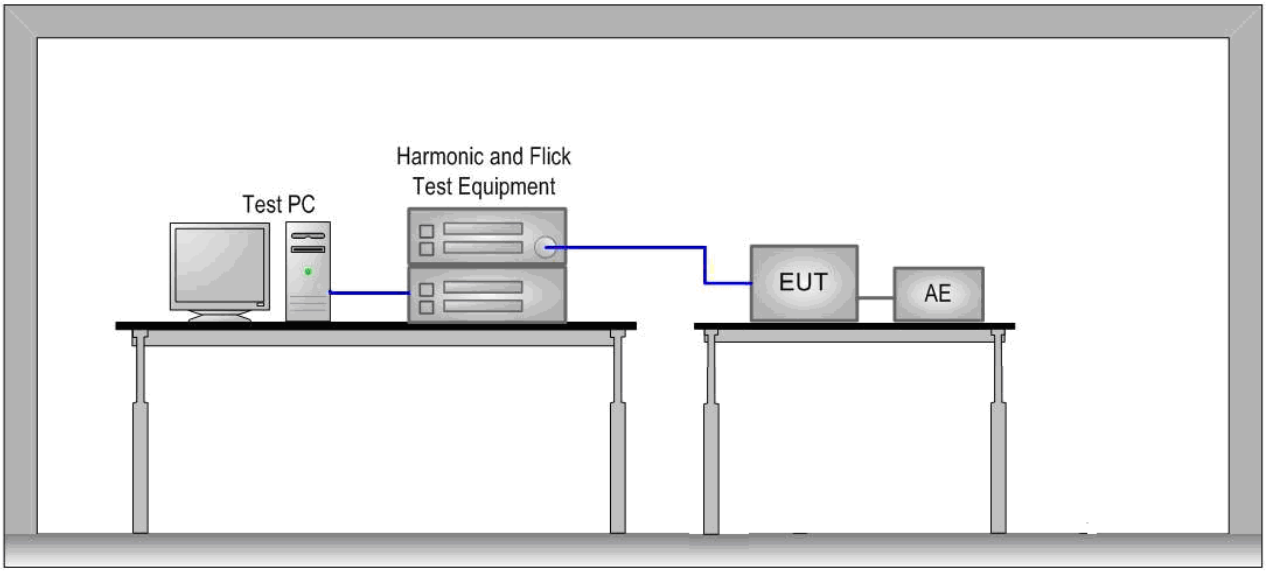
3.5 Voltage Changes, Voltage Fluctuations and Flicker

This part is concerned with the limitation of voltage fluctuations and flicker impressed on the public low-voltage system.

3.5.1 Limits

Value	Limit
Pst	1,0
Plt	0,65
dt	3,3%
dc	3,3%
dmax	4,0%

3.5.2 Measurementest procedure



The equipment under test is placed on a wooden table with a height of 0,8 m in the EMC lab. The voltage fluctuations and flicker were measured at the supply terminals of the EUT.

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3.5.3 Test environment

Temperature	:	24.5 °C
Relative humidity content	:	57.8 %
Air pressure	:	101.5 kPa

3.5.4 Results

Parameter values recorded during the test:

Vrms at the end of test (Volt):	**229.99**			
Highest dt (%):		**Test limit (%):**		
T-max (mS):	**0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**0.00**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.188**	**Test limit:**	**1.000**	**Pass**
Highest Plt (2 hr. period):	**0.082**	**Test limit:**	**0.650**	**Pass**

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4 Immunity Test

4.1 Performance Criteria Description in Clause 6 of EN IEC 55014-2

Criterion A:	The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. 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 from 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 (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however. 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, then either of these may be derived from the product description and documentation and from 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, or by any operation specified in the instructions for use.

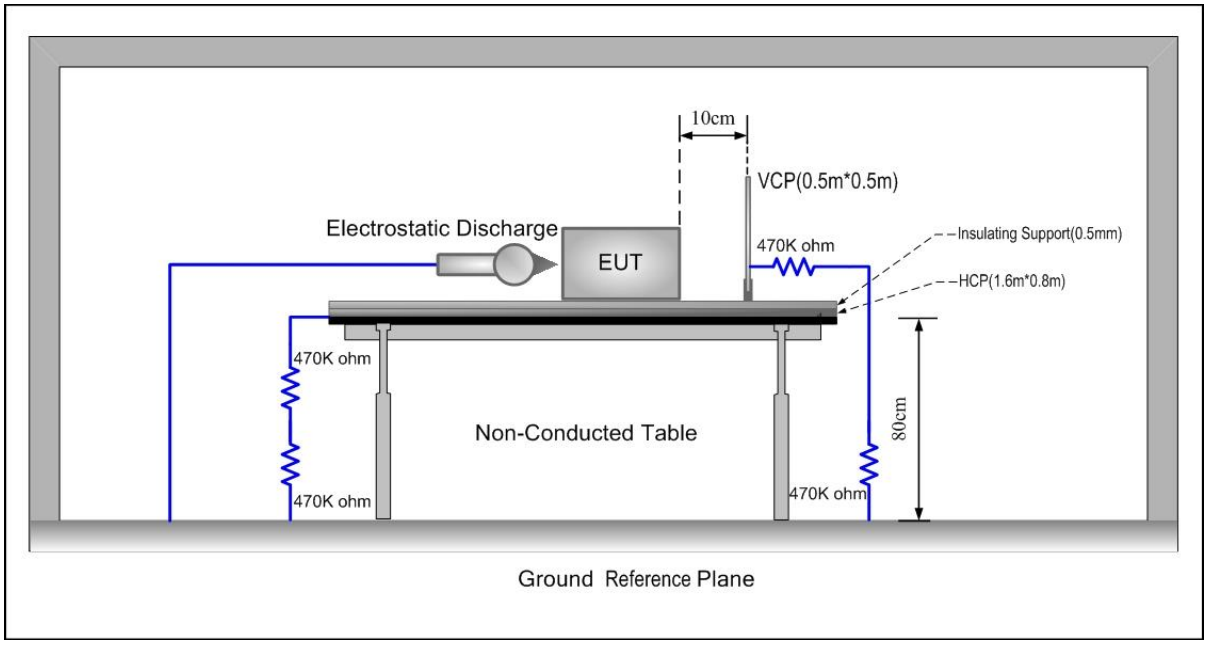
4.2 Classification of apparatus

Category I:	Apparatus containing no electronic control circuitry.
Category II:	Mains operated equipment containing electronic control circuitry with no clock frequency higher than 15 MHz.
Category III:	Battery operated equipment not included in Category I.
Category IV:	Mains operated equipment containing electronic control circuitry with a highest clock frequency greater than 15 MHz but lower than or equal to 200 MHz.
Category V:	Mains operated equipment containing electronic control circuitry with a highest clock frequency greater than 200 MHz.

The EUT belongs to Category **II**.

4.3 Electrostatic Discharge

4.3.1 Test Procedures



1. Contact discharge was applied only to conductive surfaces of the EUT. Air discharge was applied only to non-conducted surfaces of the EUT.
2. The EUT was put on a 0.8m high wooden table for table-top equipment or 0.1m high for floor standing equipment standing on the ground reference plane (GRP).
3. A horizontal coupling plane(HCP) 1.6m by 0.8m in size was placed on the table, and the EUT with its cables were isolated from the HCP by an insulating support thick than 0.5mm. The VCP 0.5m by 0.5m in size while HCP were constructed from the same material type and thickness as that of the GRP, and connected to the GRP via a 470kΩ resistor at each end. The distance between EUT and any of the other metallic surfaces excepted the GRP, HCP and VCP was greater than 1m.
4. During the contact discharges, the tip of the discharge electrode was touching the EUT before the discharge switch is operated. During the air discharges, the round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the ESD generator was removed from the EUT, the generator is then retriggered for a new single discharge. For ungrounded product, a discharge cable with two resistances was used after each discharge to remove remnant electrostatic voltage. 10 times of each polarity single discharge were applied to HCP and VCP.

4.3.2 Test environment

Temperature : 24.5 °C
Relative humidity content : 57.5 %
Air pressure : 101.5 kPa

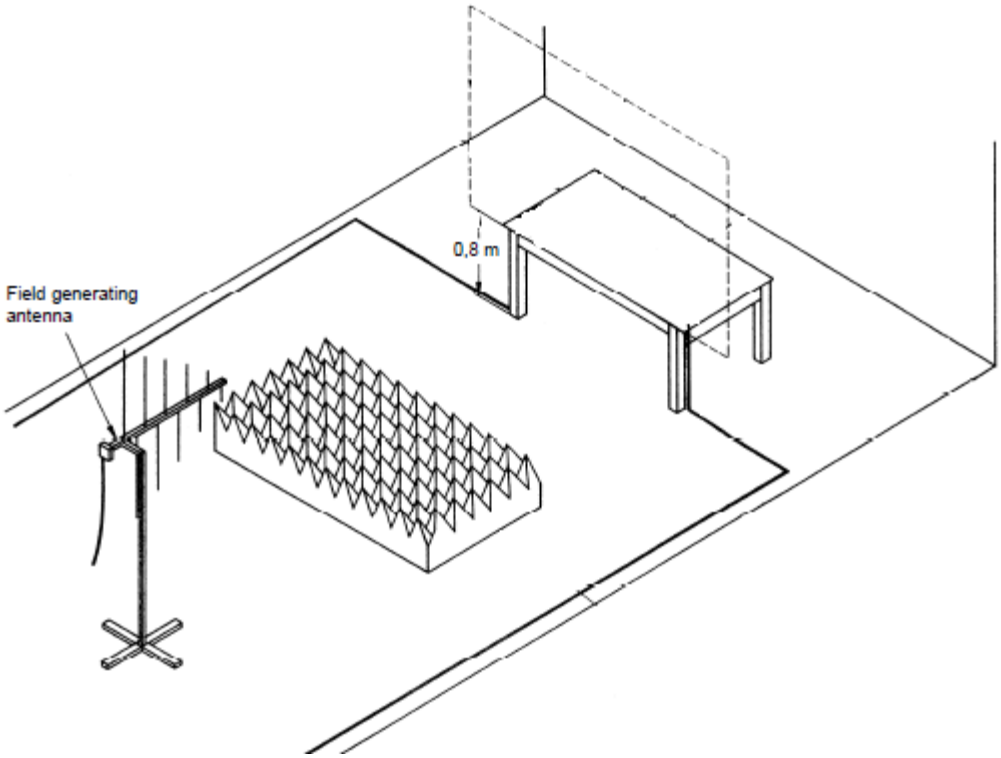
4.3.3 Results

Test point	Table (T) Floor (F)	Contact (C) Air (A)	Voltage (Kv)	Number of discharge	Polarity (+ / -)	Opinion
Air discharge	T	A	±2, ±4, ±8	Mini 20/point	+ / -	A
Direct discharge	T	C	±2, ±4	Mini 20/point	+ / -	A
HCP	T	C	±2, ±4	Mini 20/point	+ / -	A
VCP	T	C	±2, ±4	Mini 20/point	+ / -	A

A: no loss of function.
N/A: Not Applicable.

4.4 Radio frequency electromagnetic fields

4.4.1 Measurement procedure



1. The EUT was placed on 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP. The tests normally shall be performed with the generating antenna facing each of four sides of the EUT. When equipment can be used in different orientations (e.g. vertical or horizontal) the test shall be performed on all possible sides of the EUT.
2. The tests are carried out with a field strength by 3 V/m (measured in the unmodulated field) with amplitude modulated signal by a depth of 80 % by a sinusoidal audio signal of 1 kHz. The logarithmic step was 1% and the dwell time was 3s dependent of the EUT cycle time.

4.4.2 Test environment

Temperature : 24.5 °C
Relative humidity content : 57.5 %
Air pressure : 101.5 kPa

4.4.3 Results

Frequency Range	Field Strength	Modulation	Antenna Polarity	Opinion
80MHz-6GHz	3V/m	80% AM 1kHz	Horizontal	A
80MHz-6GHz	3V/m	80% AM 1kHz	Vertical	A

A: no loss of function.

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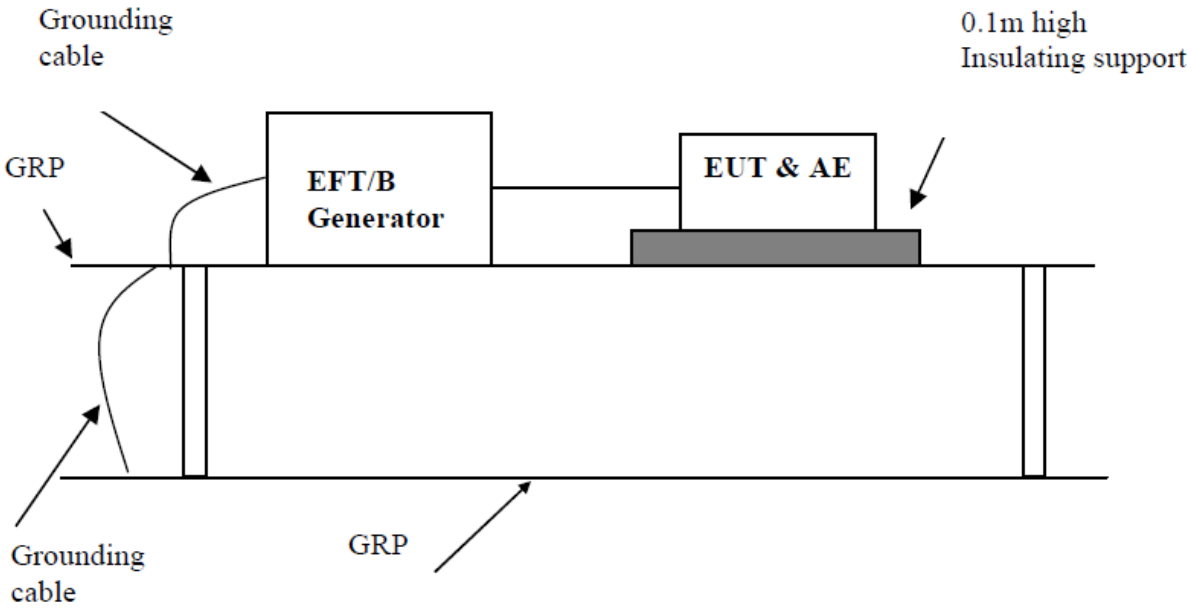
4.5 Electrical Fast Transients

4.5.1 Measurement procedure



1. The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0,1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.
2. The GRP shall project beyond the EUT and the clamp by at least 0.1m on all sides. The distance between the EUT and any other of the metallic surface except the GRP was greater than 0.5m. All cables to the EUT was placed on the insulation support 0.1m above GRP. Cables not subject to EUT was routed as far as possible from cable under test to minimize the coupling between the cables.
3. The length of signal and power cable between the EUT and EFT generator was 0.5m. If the cable is a non-detachable supply cable more than 0.5m, the excess length of this cable shall be folded to avoid a flat coil and situated at a distance of 0.1m above the GRP.

4.5.2 Test environment

Temperature : 24.5 °C
Relative humidity content : 57.4 %
Air pressure : 101.5 kPa

4.5.3 Results

Test port	Voltage (kV)	Polarity (+ / -)	Duration (s or min)	Waveform Tr / Th	Repetition Frequency (kHz)	Opinion
a.c. port, L	1	+/-	2 min	5/50 ns	5	A
a.c. port, N	1	+/-	2 min	5/50 ns	5	A
a.c. port, PE	1	+/-	2 min	5/50 ns	5	N/A
a.c. port, L+N	1	+/-	2 min	5/50 ns	5	A
a.c. port, L+PE	1	+/-	2 min	5/50 ns	5	N/A
a.c. port, N+PE	1	+/-	2 min	5/50 ns	5	N/A
a.c. port, L+N+PE	1	+/-	2 min	5/50 ns	5	N/A

A: no loss of function.
B: the appliance could not work normal during test, but after test it would recover automatically.
N/A: Not Applicable.

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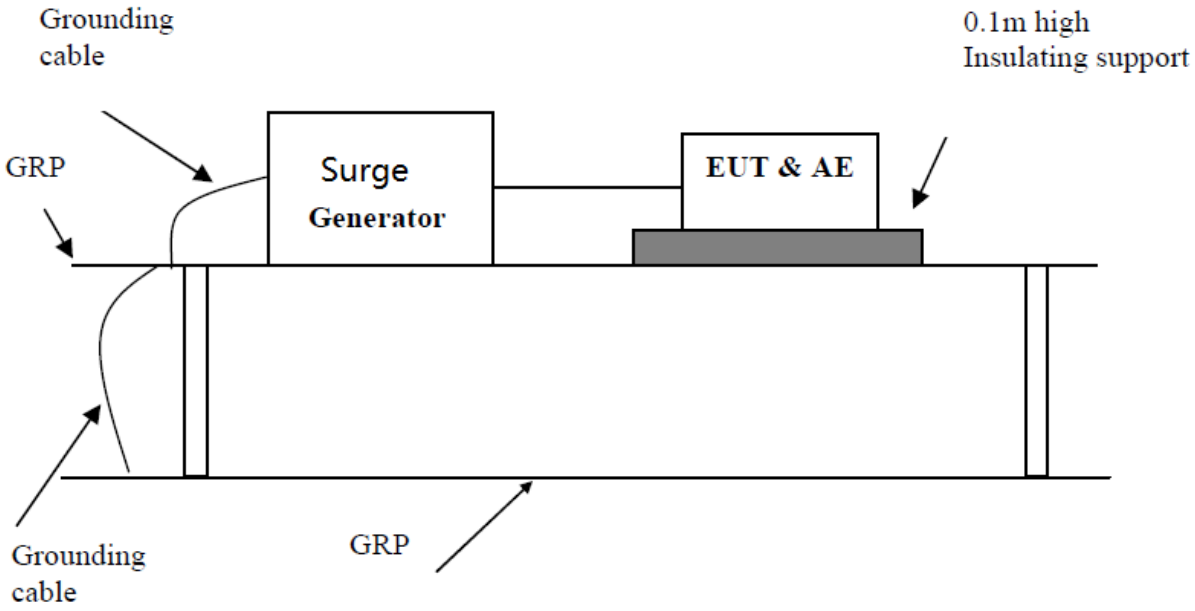
4.6 Surge Immunity

4.6.1 Measurement procedure



1. The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0,1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.
2. The 1,2/50 μs surge was to be applied to the EUT power supply terminals via the capacitive coupling network .Decoupling networks were required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines and to provide sufficient decoupling impedance to the surge wave so that the specified wave may be applied on the lines under test.
3. The positive pulses are applied 90° relative to the phase angle of the a.c. line voltage to the equipment under test, and the negative pulses are applied 270° relative to the phase angle of the a.c. line voltage to the equipment under test.

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4.6.2 Test environment

Temperature : 24.4 °C
Relative humidity content : 57.5 %
Air pressure : 101.5 kPa

4.6.3 Results

Test port	Polarity (+ / -)	Voltage (kV)	Voltage Waveform	Current Waveform	Repetition Rate	Number of pulses	Opinion
a.c. port, L-N	+/-	1.0	1.2/50 μs	8/20 μs	1 per min	5 /point	A
a.c. port, L-PE	+/-	2.0	1.2/50 μs	8/20 μs	1 per min	5 /point	N/A
a.c. port, N-PE	+/-	2.0	1.2/50 μs	8/20 μs	1 per min	5 /point	N/A

A: no loss of function.
N/A: Not Applicable.

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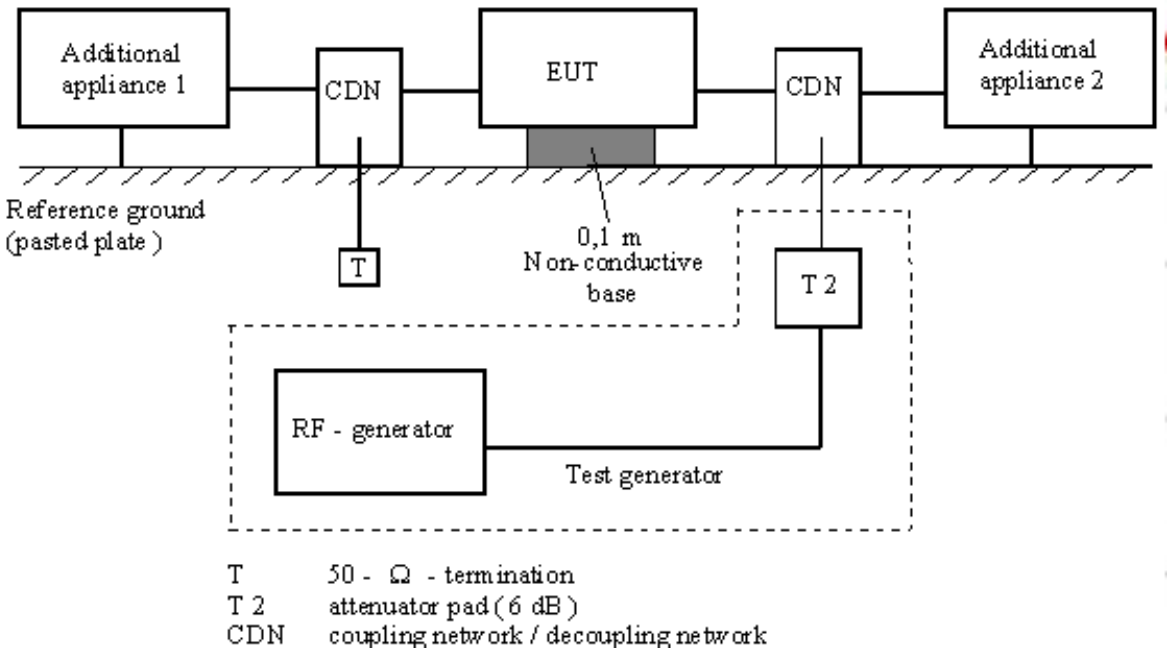
4.7 Injected currents(RF continues conducted)

4.7.1 Measurement procedure



1. The EUT was placed on an insulating support of 0.1m height above a ground reference Plane, arranged and connected to satisfy its functional requirement. All cables exiting the EUT was supported at a height of at least 30 mm above the ground reference plane.
2. The coupling and decoupling devices were required, they were located between 0,1 m and 0,3 m from the EUT. This distance was to be measured horizontally from the projection of the EUT on to the ground reference plane to the coupling and decoupling device.
3. The frequency range was swept from 150 kHz to 80 MHz, using the signal levels established during the setting process, and with the disturbance signal 80 % amplitude modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or to change coupling devices as necessary. Where the frequency was swept incrementally, the step size do not exceed 1 % of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency was not less than the time necessary for the EUT to be exercised and to respond, and was not less than 3s.

4.7.2 Test environment

Temperature : 24.5 °C
Relative humidity content : 57.6 %
Air pressure : 101.5 kPa

4.7.3 Results

Test port	Voltage (e.m.f.)	Modulation	Frequency Range	Opinion
AC power line	3V	80% AM1 kHz	150 kHz - 230 MHz	A

A: no loss of function.
N/A: Not Applicable.

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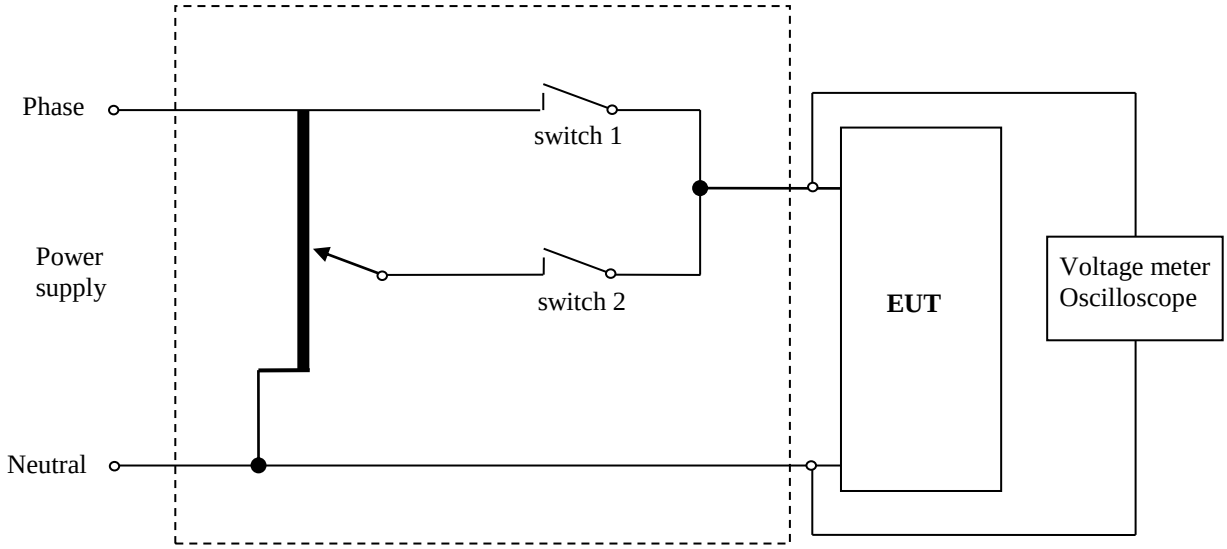
4.8 Voltage dips and Interruption

4.8.1 Measurement procedure



1. The EUT was placed on a ground reference plane(GRP) insulated by an insulating support 0,1 m thick and the GRP was placed on a 0.8m high wooden table for table-top equipment. For floor standing equipment, the EUT was placed on a 0.1m high wooden support above the GRP.
2. The test was performed with the EUT connected to the test generator with the shortest power supply cable as specified by the EUT manufacturer. Voltage change shall occur at zero crossing.
3. The EUT was tested for each selected combination of test level and duration with a sequence of three dips /interruptions with intervals of 10 s minimum. Each representative mode of operation was tested.

4.8.2 Test environment

Temperature : 24.5 °C
Relative humidity content : 57.5 %
Air pressure : 101.5 kPa

4.8.3 Results

Reduction of supply voltage	Test level in % U_T	Duration in parts of period (in ms)	Opinion
100 %	0	0.5 (10 ms)	A
60 %	40	10 (200 ms)	A
30 %	70	25 (500 ms)	A

A: no loss of function.
B: the appliance could not work normal during test, but after test it would recover automatically.
N/A: Not Applicable.

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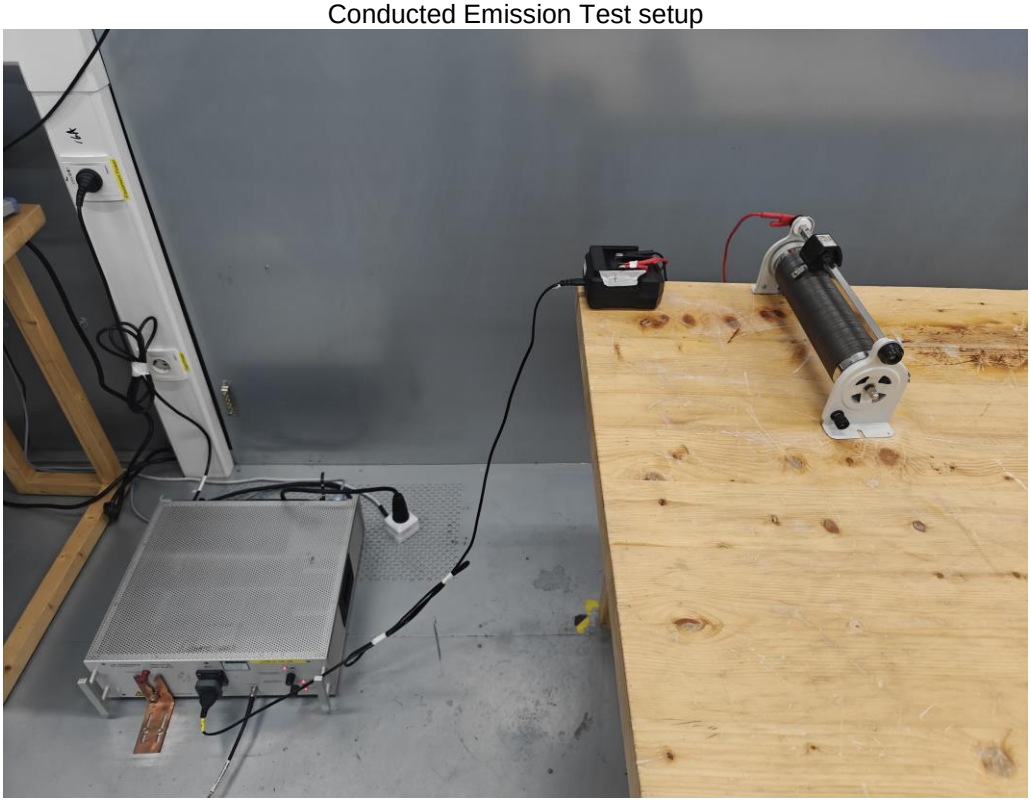
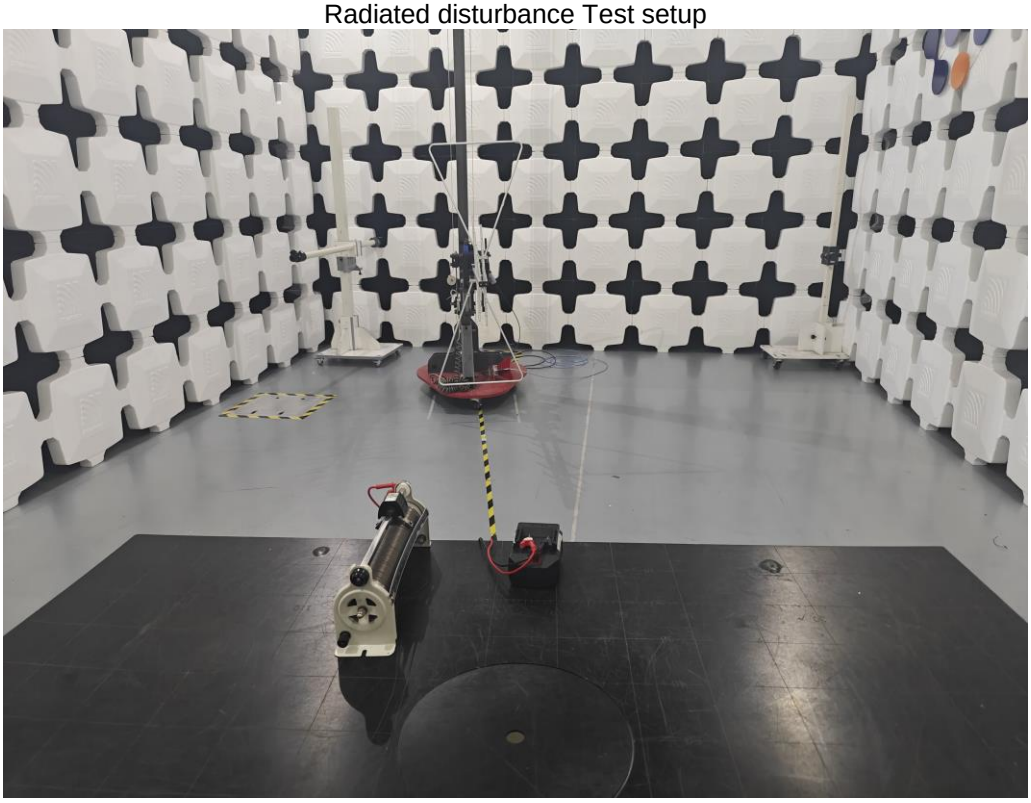
5 Test setup Photos

Conducted Emission Test setup



Radiated disturbance Test setup



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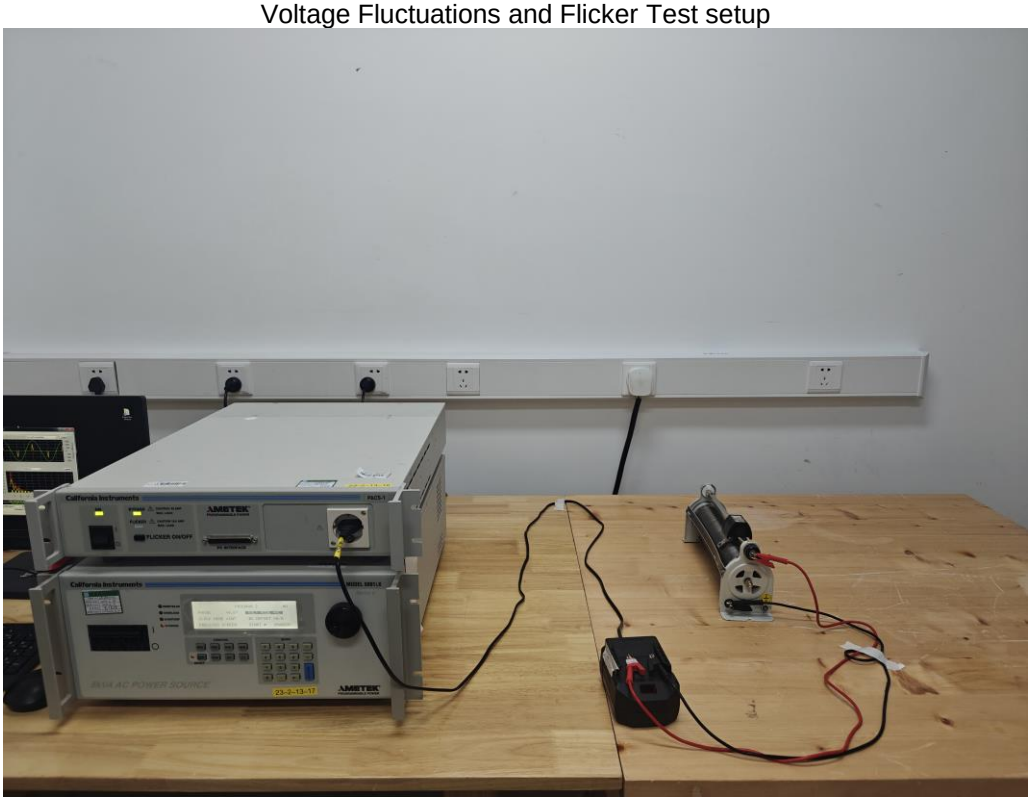
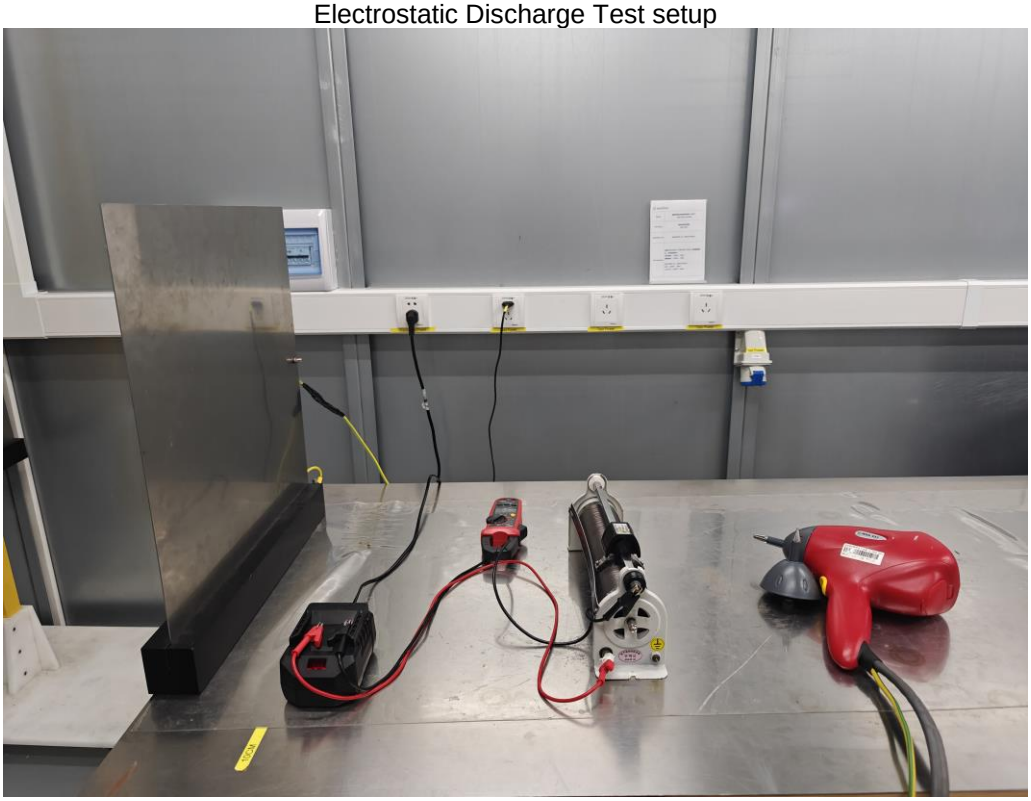
Voltage Fluctuations and Flicker Test setup



Electrostatic Discharge Test setup



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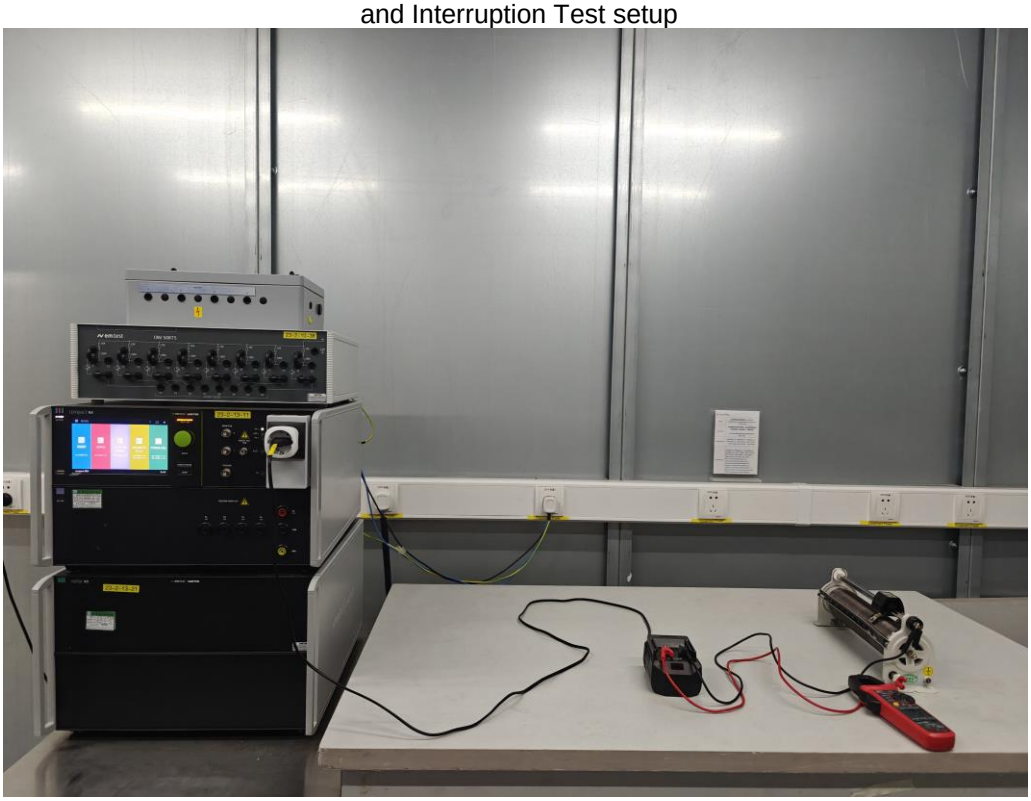
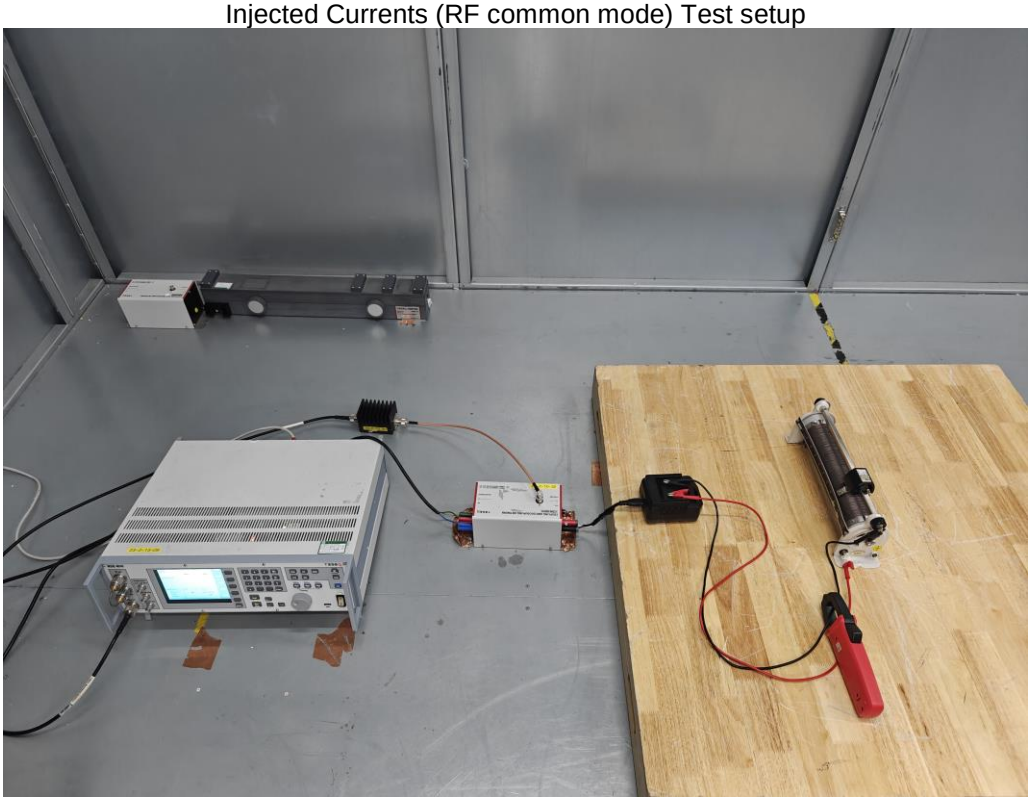
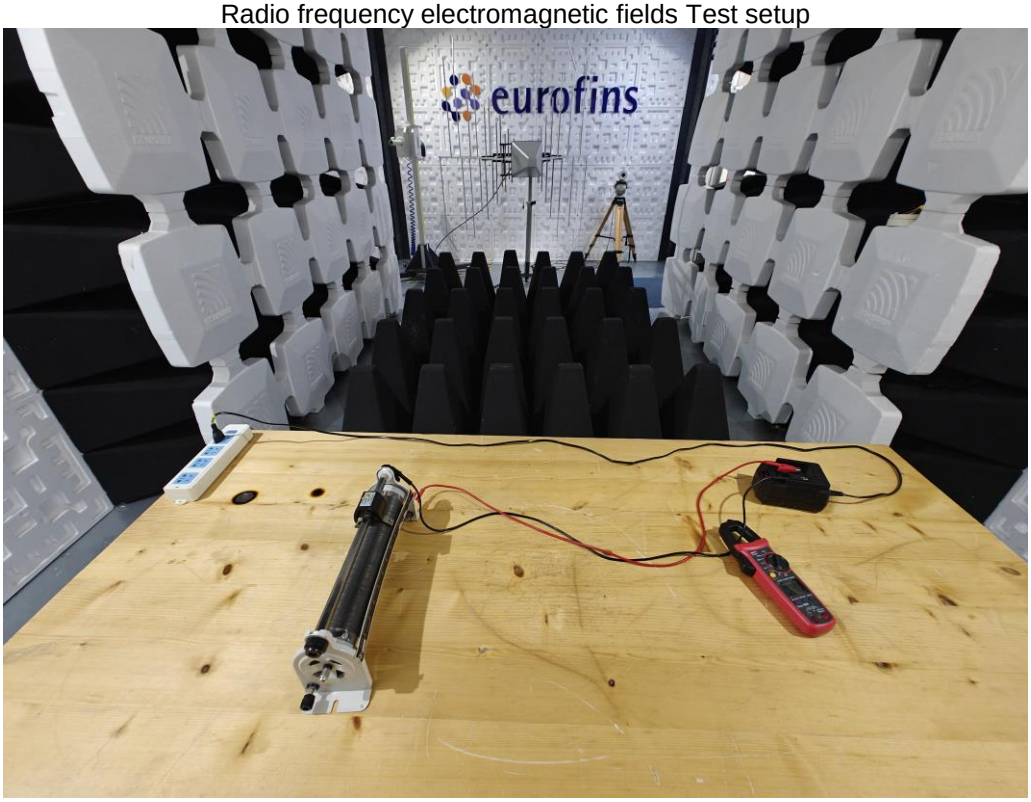
Electrical Fast Transients Immunity/ Surge Immunity/ Voltage DIPS and Interruption Test setup



Injected Currents (RF common mode) Test setup

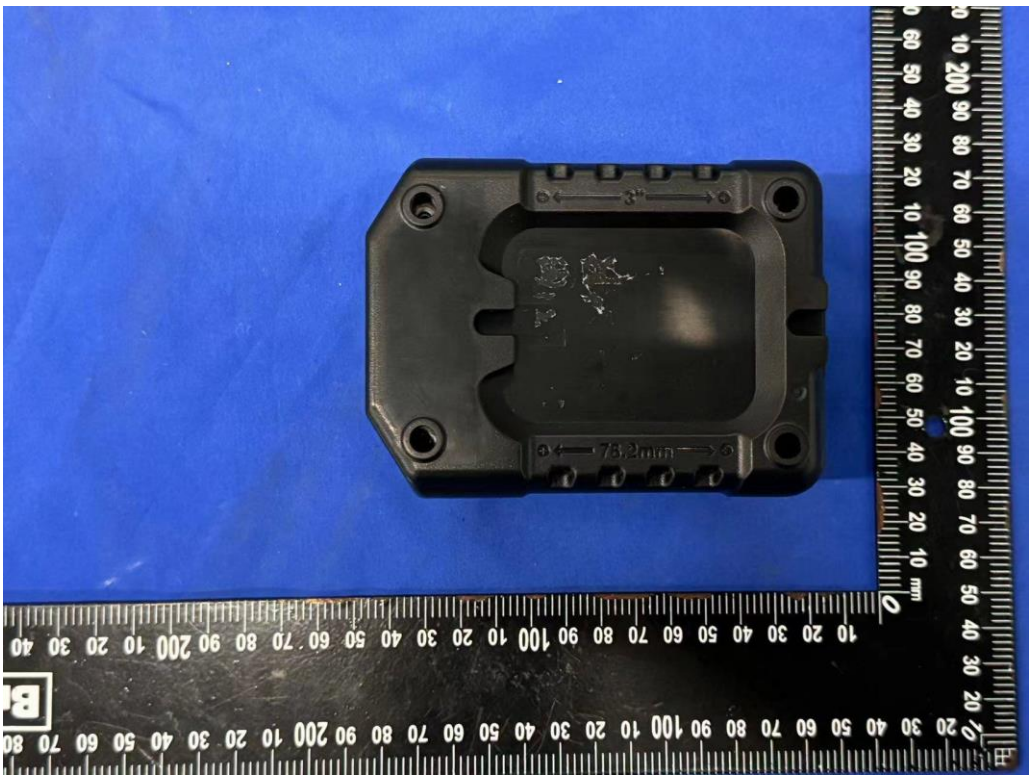


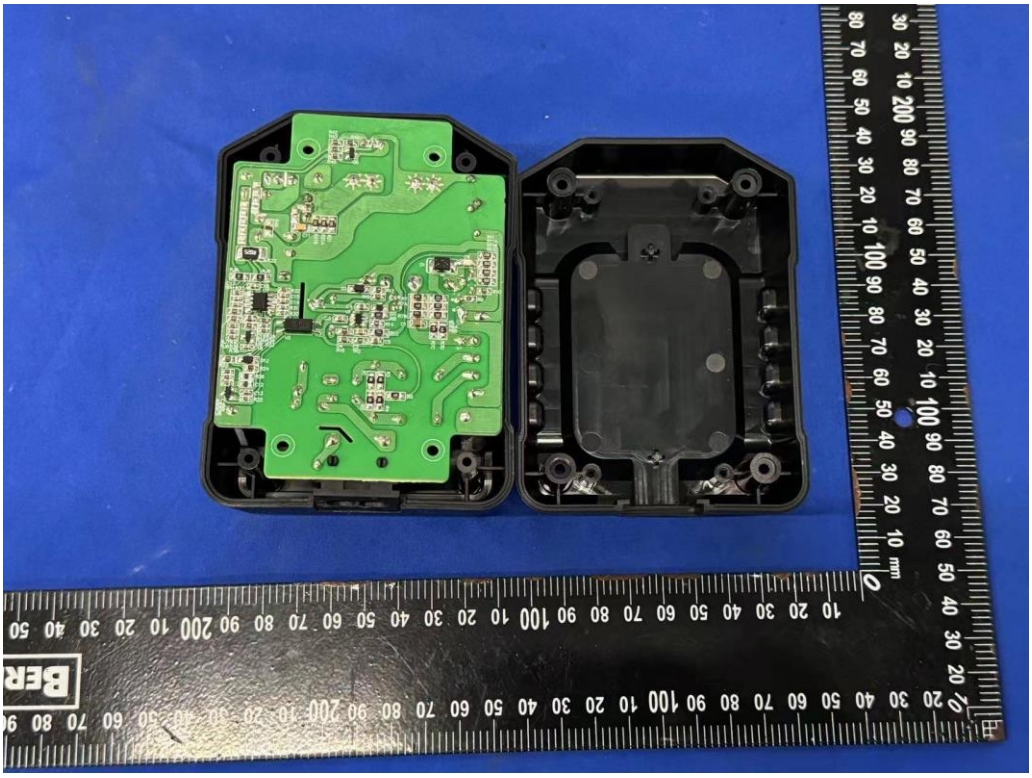
Radio frequency electromagnetic fields Test setup

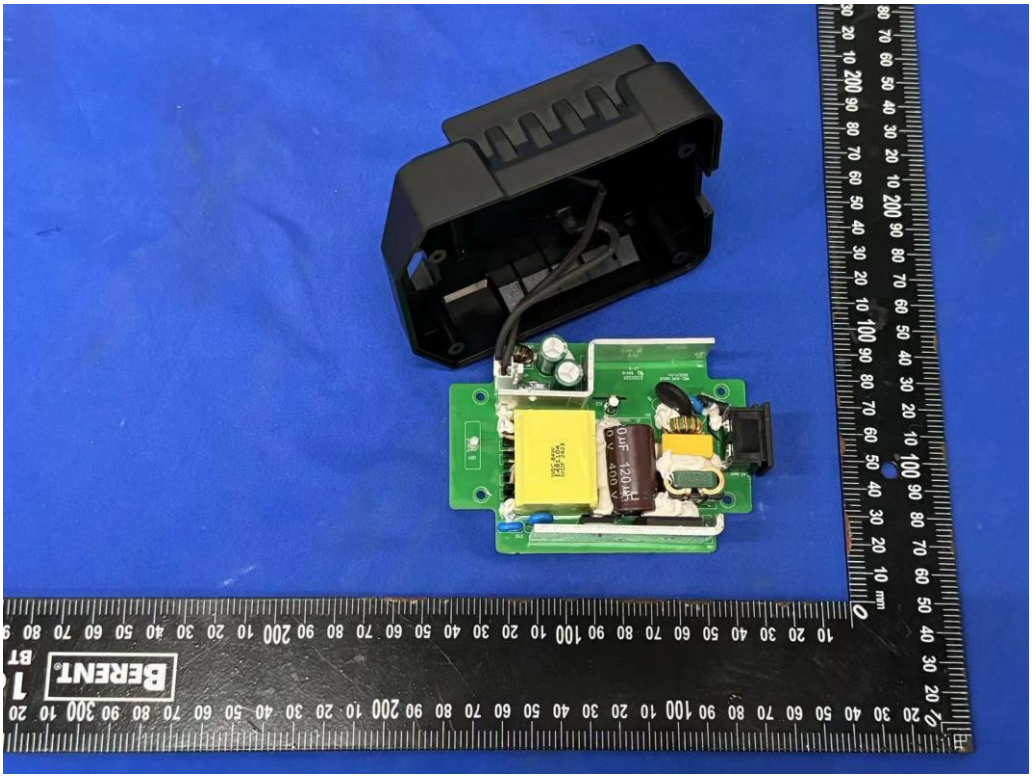


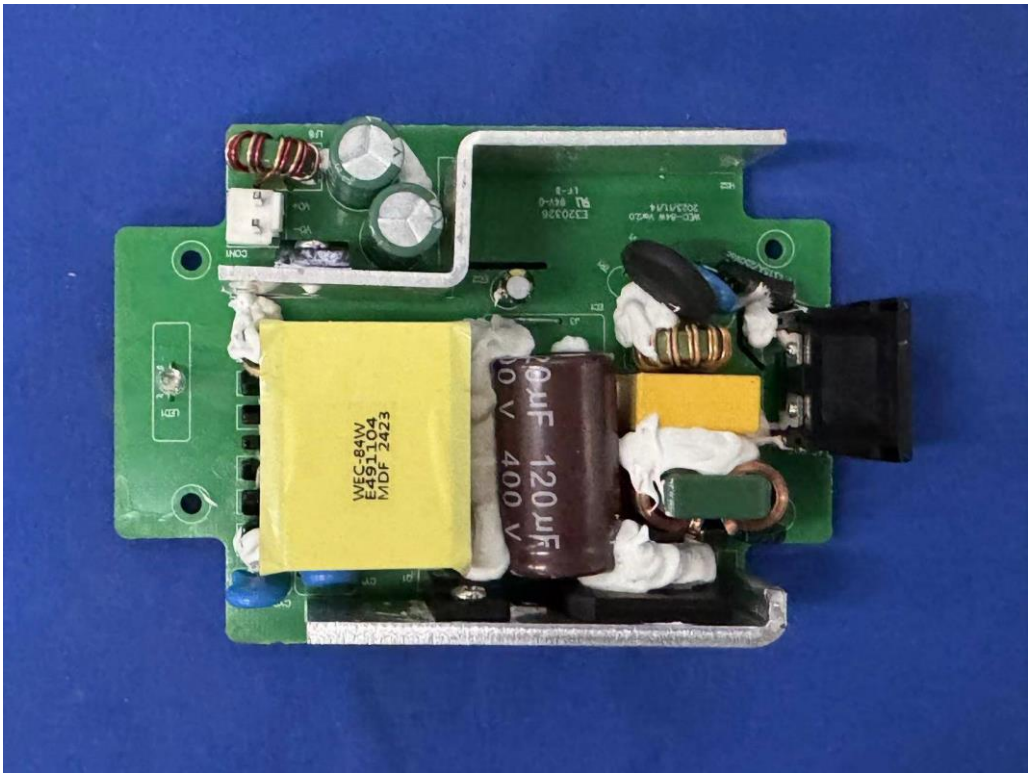
Eurofins Electrical Testing Service (Shenzhen) Co., Ltd.
Room 20 of 2/F., 1/F., Building 2, Spring Block, Meishenghuigu Innovation Park,
No.83, Dabao Road, Bao'an District, Shenzhen, Guangdong, China

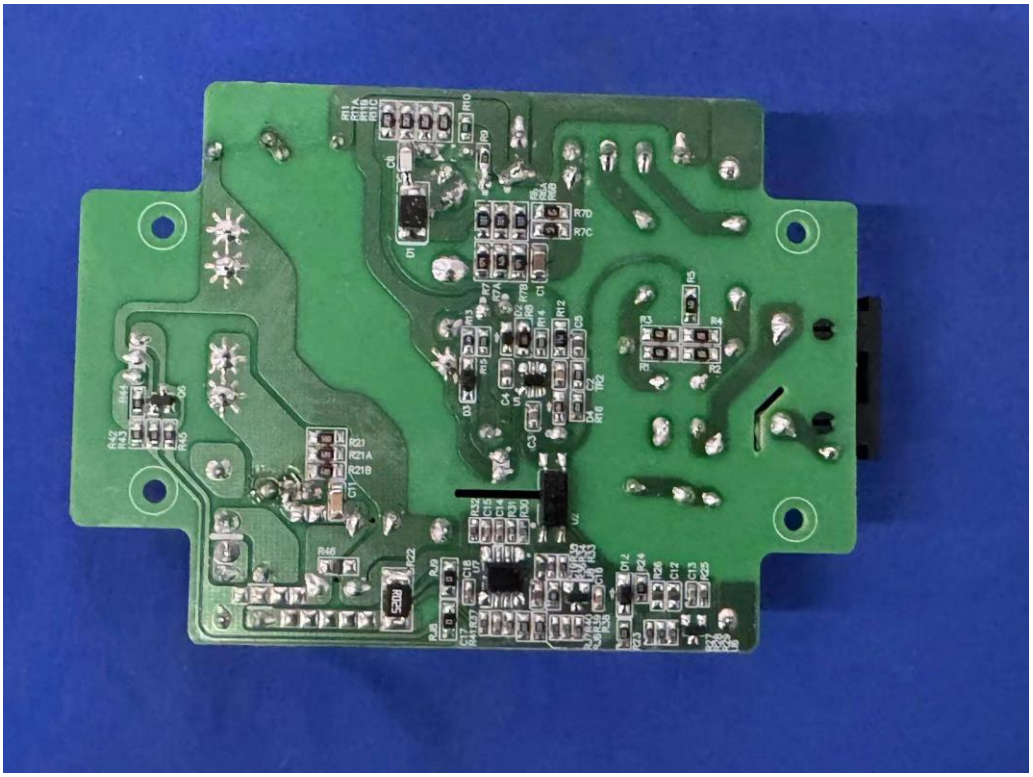
6 EUT Photos











---End of Report---