TEST REPORT

Applicant:	Nemo Power Tools Limited
Address:	21st Floor, CMA Building 64 Connaught Road Central Hong Kong
Manufacturer:	Nemo Power Tools(Huizhou) Co., Ltd
Address:	2/F, 4th Industrial Area, Luokeng Village, Xiaotie Zone, Xiaojinkou Town, Huicheng District, Huizhou City, Guangdong Province, China
EUT:	GRABO High Flow
Trade Mark:	GRABO
Model Number:	GHF-V1
Date of Receipt:	May. 16, 2024
Test Date:	May. 16, 2024 - May. 22, 2024
Date of Report:	May. 22, 2024
Prepared By:	Shenzhen DL Testing Technology Co., Ltd.
Address:	101-201, Comprehensive Building, Tongzhou Electronics Longgang Factory Area, No.1 Baolong Fifth Road, Baolong Community, Baolong Street, Longgang District, Shenzhen, China
Applicable Standards:	BS EN IEC 55014-1:2021 BS IEC 61000-3-2:2019+A1:2021, BS EN 61000-3-3:2013+A1:2019+A2:2021 BS EN IEC 55014-2:2021 BS EN 61000-4-2:2009, BS EN IEC 61000-4-3:2020, BS EN 61000-4-4:2012, BS EN 61000-4-5:2014+A1:2017, BS EN 61000-4-6:2014/AC:2015, BS EN IEC 61000-4-11:2020
Test Result:	Pass
Report Number:	DL-240516013ER

Prepared (Engineer):	HuiLian Xu
Reviewer (Supervisor):	Jack Bu
Approved (Manager):	Jade Yang

This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Shenzhen DL Testing Technology Co., Ltd.

TABLE OF CONTENT

1. VERSION

Version No.	Date	Description
00	May. 22, 2024	Original

2. TEST SUMMARY

EMC Emission				
Standard	Test Item	Limit	Result	Remark
BS EN IEC 55014-1	Conducted Emission at power ports	------	PASS	
	Conducted Emission at load terminals	------	N/A	
	Radiated Emission below 1GHz	------	PASS	
BS IEC 61000-3-2	Harmonic Current Emission	Class B	PASS	
BS EN 61000-3-3	Voltage Fluctuations & Flicker	------	PASS	
EMC Immunity				
Section BS EN IEC 55014-2	Test Item	Performance Criteria	Result	Remark
BS EN 61000-4-2	Electrostatic Discharge	B	PASS	
BS EN IEC 61000-4-3	RF electromagnetic field	A	PASS	
BS EN 61000-4-4	Fast transients	B	PASS	
BS EN 61000-4-5	Surges	B	PASS	
BS EN 61000-4-6	Injected Current	A	PASS	
BS EN IEC 61000-4-11	Volt. Interruptions Volt. Dips	C / C / C[NOTE (3)]	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2) The power consumption of EUT is less than 75W and no Limits apply.

(3) Voltage dip: 70% reduction – Performance Criteria B

Voltage Interruptions: 30% reduction – Performance Criteria C

(4) Test Facility: Shenzhen DL Testing Technology Co., Ltd.

Address: 101-201, Comprehensive Building, Tongzhou Electronics Longgang Factory Area, No.1 Baolong Fifth Road, Baolong Community, Baolong Street, Longgang District, Shenzhen, China

3. GENERAL INFORMATION

3.1 Description of Device (EUT)

EUT:	GRABO High Flow
Trade Mark:	GRABO
Model Number:	GHF-V1
Test Model:	GHF-V1
Model difference:	N/A
Power Supply:	Charging Input: 100-240V~ 50/60Hz 2A max 84W Charging Output: 21V⎓3.6-4.4A under load 4.5A max Battery: DC 18V
Work Frequency:	Below 15MHz

NOTE:

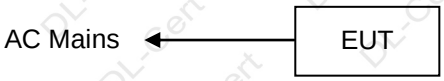
(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

(2) The EUT's all information provided by client.

3.2 Tested System Details

None.

3.3 Block Diagram of Test Set-up



3.4 Test Mode Description

Mode1. Charging Mode Mode2. On Mode

3.5 Test Auxiliary Equipment

None.

3.6 Test Uncertainty

Conducted Emission Uncertainty : ±2.56dB

Radiated Emission Uncertainty : ±3.24dB

4. TEST INSTRUMENT USED

For Conducted Emission Test (843 Shielded Room)

Equipment	Manufacturer	Model	Serial	Last Cal.	Next Cal.
843 Shielded Room	ChengYu	843 Room	843	Sep. 20, 2022	Sep. 19, 2025
EMI Receiver	R&S	ESR	101421	Nov. 04, 2023	Nov. 03, 2024
LISN	R&S	ENV216	102417	Nov. 04, 2023	Nov. 03, 2024
Clamp	COM-POWER	CLA-050	431072	Nov. 04, 2023	Nov. 03, 2024
3-Loop Antenna	DAZE	ZN30401	13021	Nov. 04, 2023	Nov. 03, 2024
ISN T8	Schwarzbeck	NTFM 8158	101135	Nov. 04, 2023	Nov. 03, 2024
ISN T5	Schwarzbeck	NTFM 8158	101136	Nov. 04, 2023	Nov. 03, 2024
843 Cable 1#	ChengYu	CE Cable	001	Nov. 04, 2023	Nov. 03, 2024
843 Cable 1#	ChengYu	CE Cable	002	Nov. 04, 2023	Nov. 03, 2024

For Radiated Emission Test (966 chamber)

Equipment	Manufacturer	Model	Serial	Last Cal.	Next Cal.
966 chamber	ChengYu	966 Room	966	Nov. 06, 2023	Nov. 05, 2026
Spectrum Analyzer	Agilent	E4408B	MY50140780	Nov. 04, 2023	Nov. 03, 2024
EMI Receiver	R&S	ESRP7	101393	Nov. 04, 2023	Nov. 03, 2024
Amplifier	Schwarzbeck	BBV9743B	00153	Nov. 04, 2023	Nov. 03, 2024
Amplifier	EMEC	EM01G8GA	00270	Nov. 04, 2023	Nov. 03, 2024
Broadband Trilog Antenna	Schwarzbeck	VULB9162	00306	Nov. 04, 2023	Nov. 03, 2024
Horn Antenna	Schwarzbeck	BBHA9120D	02139	Nov. 04, 2023	Nov. 03, 2024
966 Cable 1#	ChengYu	966	004	Nov. 04, 2023	Nov. 03, 2024
966 Cable 2#	ChengYu	966	003	Nov. 04, 2023	Nov. 03, 2024

For Harmonic & Flicker Test (EMS --- site)

Equipment	Manufacturer	Model	Serial	Last Cal.	Next Cal.
Harmonics, Flicker & power Analyser	LAPLACE INSTRUMENTS	AC2000A	311370	Nov. 04, 2023	Nov. 03, 2024
AC Power Supply	MToni	HPF5010	633659	Nov. 04, 2023	Nov. 03, 2024

For Electrostatic Discharge Immunity Test (EMS --- site)

Equipment	Manufacturer	Model	Serial	Last Cal.	Next Cal.
ESD Tester	SCHLODER	SESD 230	17352	Nov. 04, 2023	Nov. 03, 2024

For RF Field Strength Susceptibility Test (Keyway --- site)

Equipment	Manufacturer	Model	Serial	Last Cal.	Next Cal.
Signal Generator	HP	8648A	3625U00573	Apr. 11, 2024	Apr. 11, 2025
Amplifier	A&R	500A100	17034	Apr. 11, 2024	Apr. 11, 2025
Amplifier	A&R	100W/1000M1	17028	Apr. 11, 2024	Apr. 11, 2025
Audio Analyzer (20Hz~1GHz)	Panasonic	2023B	202301/428	Apr. 11, 2024	Apr. 11, 2025
Isotropic Field Probe	A&R	FP2000	16755	Apr. 11, 2024	Apr. 11, 2025
Antenna	EMCO	3108	9507-2534	Apr. 11, 2024	Apr. 11, 2025
Log-periodic Antenna	A&R	AT1080	16812	Apr. 11, 2024	Apr. 11, 2025

For EFT /B, Surge, Voltage Dips Interruptions Test (EMS --- site)

Equipment	Manufacturer	Model	Serial	Last Cal.	Next Cal.
Transient Comprehensive Immunity Test System	Graphtec	HVIP16T+HCOMPACT 5	192501+192202	Nov. 04, 2023	Nov. 03, 2024
Coupling Clamp	HTEC	001	0001	Nov. 04, 2023	Nov. 03, 2024

For Injected Currents Susceptibility Test (EMS --- site)

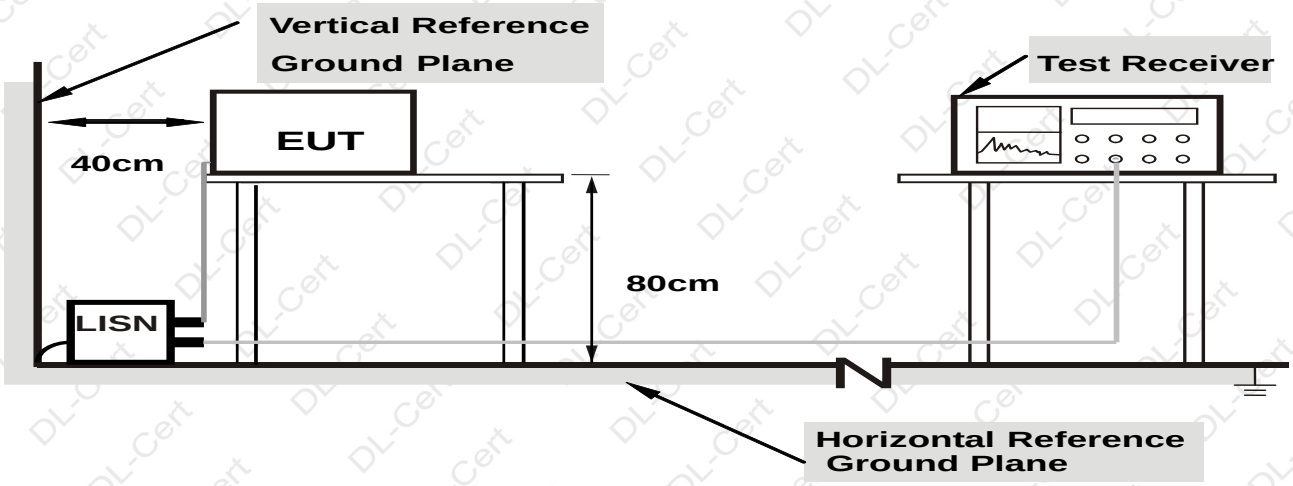
Equipment	Manufacturer	Model	Serial	Last Cal.	Next Cal.
C/S Test System	LIONCEL	RIS-6091-85	0191101	Nov. 04, 2023	Nov. 03, 2024
CDN	LIONCEL	CDN-M2-16	0191001	Nov. 04, 2023	Nov. 03, 2024
CDN	LIONCEL	CDN-M3-16	0191002	Nov. 04, 2023	Nov. 03, 2024
Injection Clamp	Frankonia	EMCL-20	18101728-0108	Nov. 04, 2023	Nov. 03, 2024

Other

Name	Manufacturer	Model	Software version
EMC Conduction Test System	FALA	EZ_EMC	EMC-CON 3A1.1
EMC radiation test system	FALA	EZ_EMC	FA-03A2
RF test system	MAIWEI	MTS8310	2.0.0.0
RF communication test system	MAIWEI	MTS8200	2.0.0.0

5. CONDUCTED EMISSION AT THE MAINS TERMINALS TEST

5.1 Block Diagram of Test Setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

5.2 Test Standard and Limit

BS EN IEC 55014-1

Frequency MHz	Limits dB(μV)			
	At mains terminals		At load terminals and additional terminals	
	Quasi-peak Level	Average Level	Quasi-peak Level	Average Level
0.15~0.50	66 ~ 56*	59 ~ 46*	80	70
0.50~5.00	56	46	74	64
5.00~30.00	60	50	74	64

Notes: 1. *Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

5.3 EUT Configuration on Test

The following equipment's are installed on conducted emission test to meet BS EN 55014-1 requirement and operating in a manner which tends to maximize its emission characteristics in a normal application.

5.4 Operating Condition of EUT

5.4.1 Setup the EUT and simulators as shown in Section 5.1.

5.4.2 Turn on the power of all equipment.

5.4.3 Let the EUT work in test modes and test it.

5.5 Test Procedure

The EUT is put on the ground and connected to the AC mains through a Artificial Mains Network (AMN). This provided a 50ohm coupling impedance for the tested equipments. Both sides of AC line are checked to find out the maximum conducted emission levels according to the **BS EN 55014-1** regulations during conducted emission test.

The bandwidth of the test receiver (R&S Test Receiver ESR) is set at 10KHz.

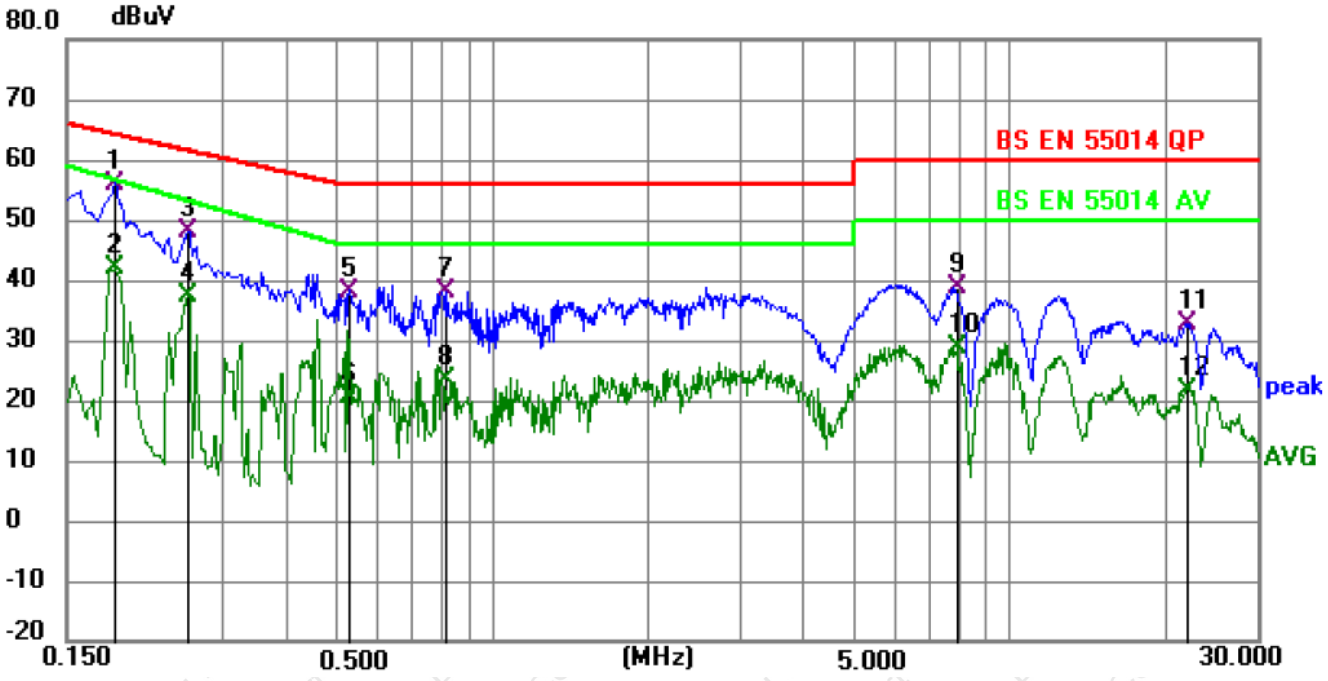
The frequency ranges from 150kHz to 30MHz is investigated.

5.6 Test Result

PASS

Please refer to the following page.

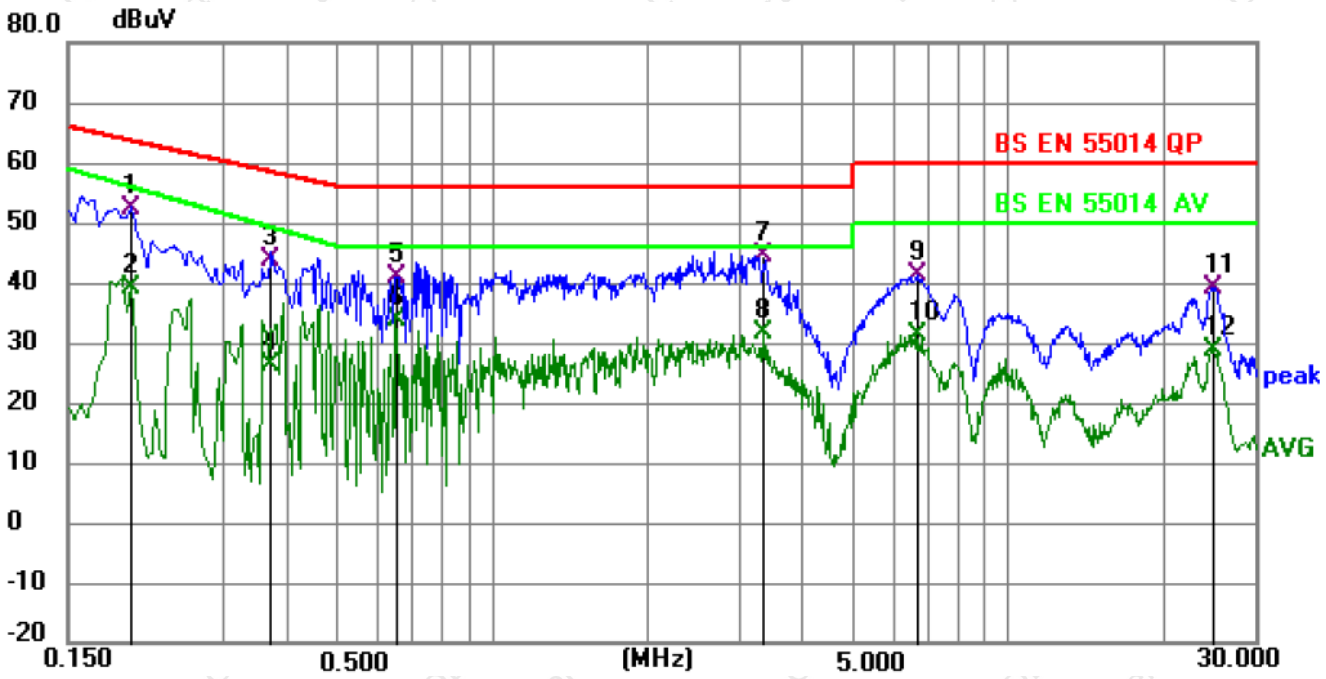
Conducted Emission Test Data			
Temperature:	24.5℃	Relative Humidity:	54%
Pressure:	1009hPa	Phase:	Line
Test Voltage:	AC 230V/50Hz	Test Mode:	Mode 1



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1860	45.92	9.81	55.73	64.21	-8.48	QP	P	
2	0.1860	32.03	9.81	41.84	56.68	-14.84	AVG	P	
3	0.2580	38.72	9.33	48.05	61.50	-13.45	QP	P	
4	0.2580	27.83	9.33	37.16	53.14	-15.98	AVG	P	
5	0.5280	28.89	9.30	38.19	56.00	-17.81	QP	P	
6	0.5280	11.11	9.30	20.41	46.00	-25.59	AVG	P	
7	0.8160	28.64	9.38	38.02	56.00	-17.98	QP	P	
8	0.8160	14.14	9.38	23.52	46.00	-22.48	AVG	P	
9	7.9080	28.58	10.04	38.62	60.00	-21.38	QP	P	
10	7.9080	18.56	10.04	28.60	50.00	-21.40	AVG	P	
11	21.9525	21.92	10.77	32.69	60.00	-27.31	QP	P	
12	21.9525	10.78	10.77	21.55	50.00	-28.45	AVG	P	

Remark:Correct Factor = Cable lose + LISN insertion loss;
Level = Reading + Correct factor;Margin = Level – Limit;

Conducted Emission Test Data			
Temperature:	24.5℃	Relative Humidity:	54%
Pressure:	1009hPa	Phase:	Neutral
Test Voltage:	AC 230V/50Hz	Test Mode:	Mode 1

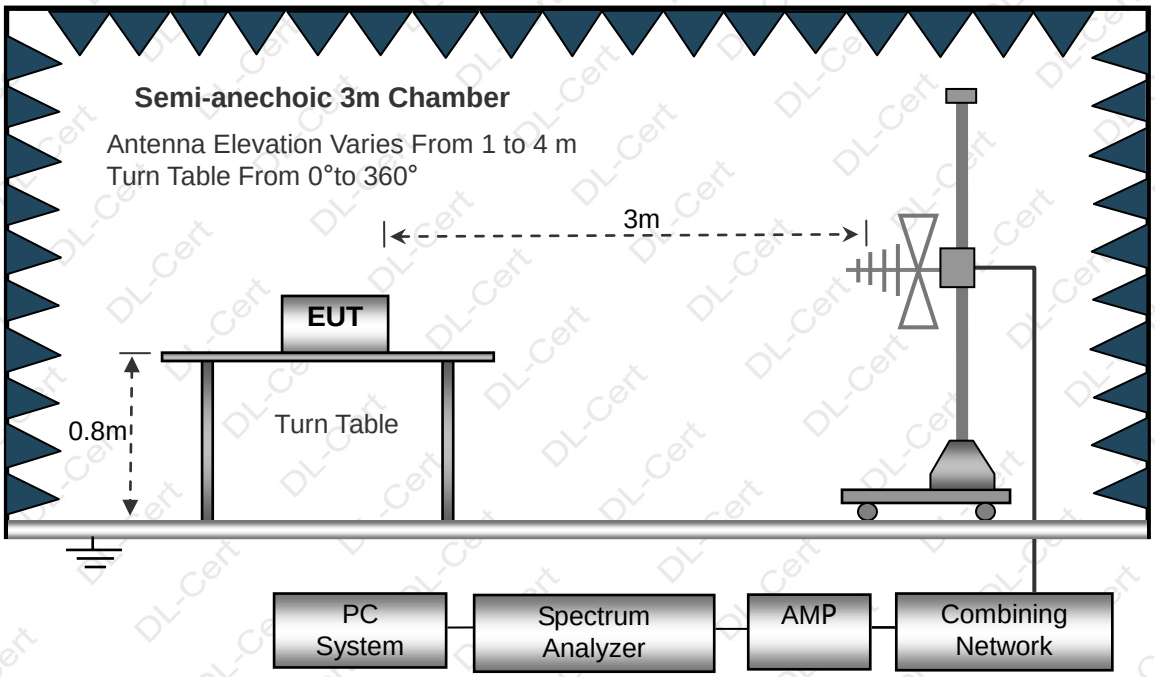


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1995	43.36	8.90	52.26	63.63	-11.37	QP	P	
2	0.1995	30.24	8.90	39.14	55.92	-16.78	AVG	P	
3	0.3704	34.64	9.23	43.87	58.49	-14.62	QP	P	
4	0.3704	17.02	9.23	26.25	49.24	-22.99	AVG	P	
5	0.6540	31.71	9.28	40.99	56.00	-15.01	QP	P	
6	0.6540	24.56	9.28	33.84	46.00	-12.16	AVG	P	
7	3.3405	34.35	10.00	44.35	56.00	-11.65	QP	P	
8	3.3405	21.61	10.00	31.61	46.00	-14.39	AVG	P	
9	6.6615	30.97	10.12	41.09	60.00	-18.91	QP	P	
10	6.6615	20.97	10.12	31.09	50.00	-18.91	AVG	P	
11	24.9090	27.80	11.35	39.15	60.00	-20.85	QP	P	
12	24.9090	17.42	11.35	28.77	50.00	-21.23	AVG	P	

Remark:Correct Factor = Cable lose + LISN insertion loss;
Level = Reading + Correct factor;Margin = Level – Limit;

6. RADIATION EMISSION TEST

6.1 Block Diagram of Test Setup



6.2 Test Standard and Limit

BS EN IEC 55014-1

Frequency MHz	Distance (Meters)	Field Strengths Limits dB(μV)/m
30~230	3	40.0
230～1000	3	47.0

Remark:

(1) The smaller limit shall apply at the cross point between two frequency bands.

(2) Distance refers to the distance in meters between the measuring instrument, antenna and the closed point of any part of the device or system.

6.3 EUT Configuration on Test

The BS EN 55014-1 regulations test method must be used to find the maximum emission during radiated emission test.

The configuration of EUT is the same as used in conducted emission test.

Please refer to Section 2.2.

6.4 Operating Condition of EUT

Same as conducted emission test, which is listed in Section 2.2 except the test set up replaced as Section 4.1.

6.5 Test Procedure

1) The radiated emissions test was conducted in a semi-anechoic chamber.

2) 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.

3) Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT.

4) The frequencies of maximum emission were determined in the final radiated emissions measurement. 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.

5) The bandwidth setting on the field strength meter (R&S Test Receiver ESCI) is set at 120KHz.

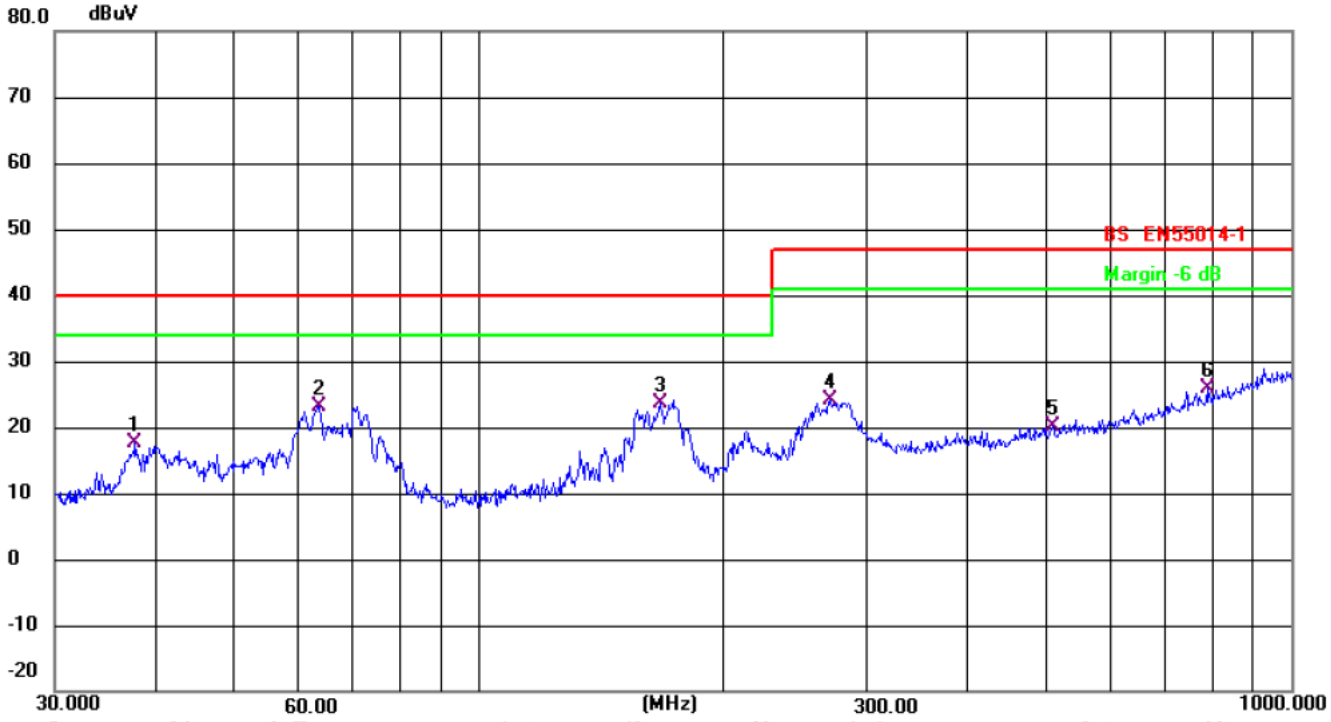
6) The frequency range from 30MHz to 1000MHz is checked.

6.6 Test Result

PASS

Please refer to the following page.

Radiation Emission Test Data			
Temperature:	24.5℃	Relative Humidity:	54%
Pressure:	1009hPa	Polarization:	Horizontal
Test Voltage:	AC 230V/50Hz	Test Mode:	Mode 1



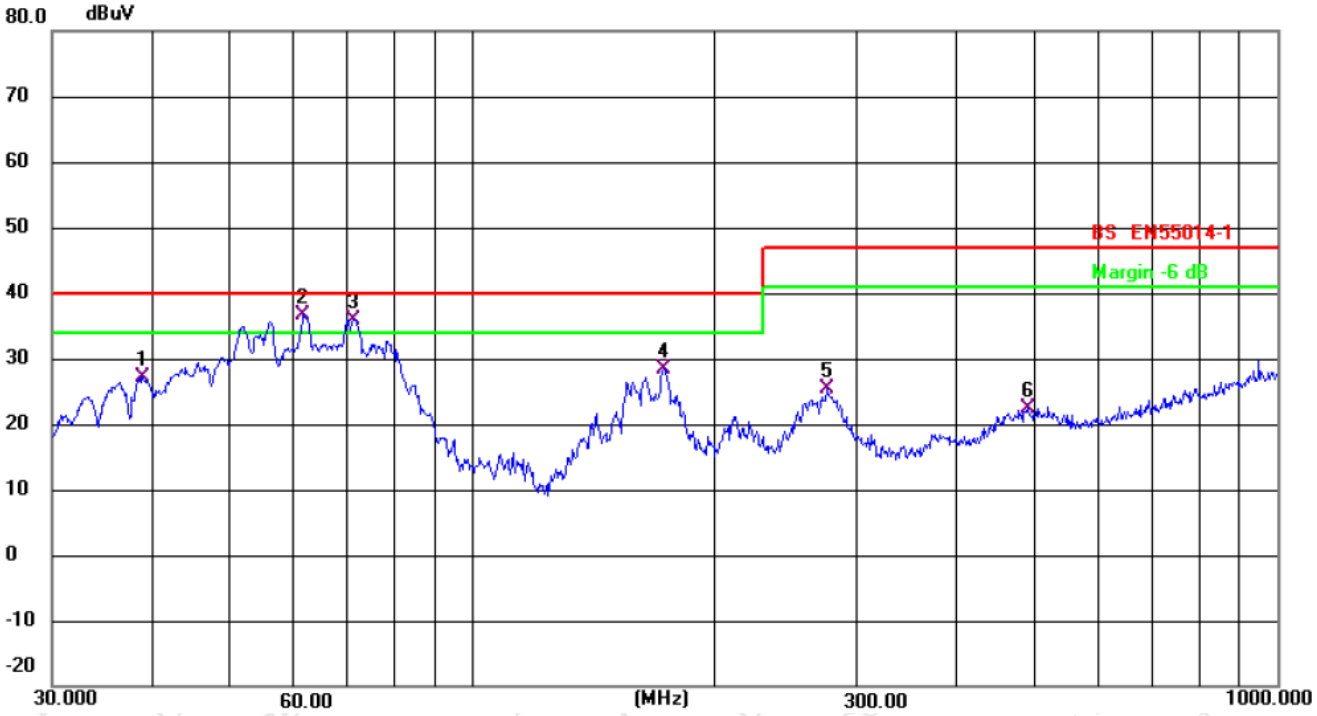
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV	dB	dB	Detector
1		37.6798	31.98	-14.34	17.64	40.00	-22.36	QP
2		63.5356	36.82	-13.66	23.16	40.00	-16.84	QP
3	*	167.2368	40.47	-16.73	23.74	40.00	-16.26	QP
4		270.3748	36.21	-12.19	24.02	47.00	-22.98	QP
5		508.2582	27.65	-7.42	20.23	47.00	-26.77	QP
6		787.8513	28.29	-2.43	25.86	47.00	-21.14	QP

Remark:

Correct Factor=Cable loss+Antenna factor-Preamplifier

Measurement Level = Reading Level + Correct Factor; Margin = Measurement Level- Limit;

Radiation Emission Test Data			
Temperature:	24.5℃	Relative Humidity:	54%
Pressure:	1009hPa	Polarization:	Vertical
Test Voltage:	AC 230V/50Hz	Test Mode:	Mode 1



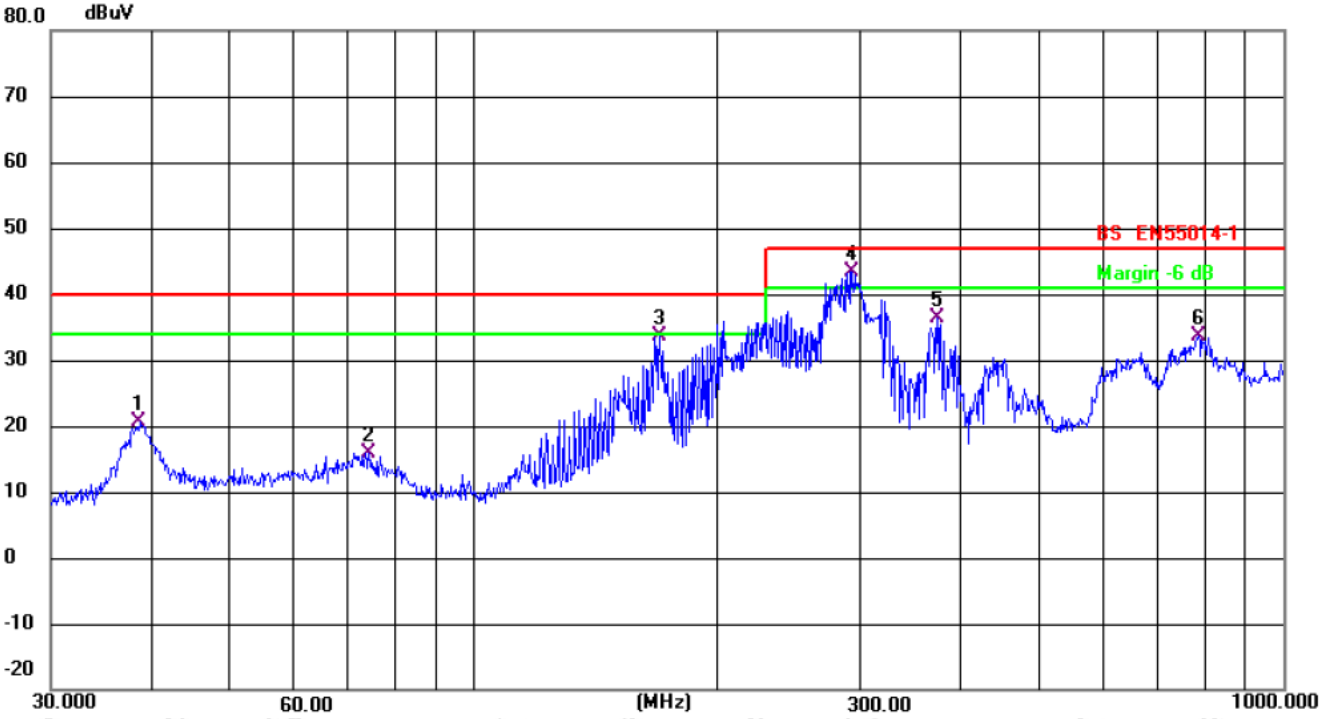
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV	dB	dB	Detector
1		38.8878	41.32	-14.08	27.24	40.00	-12.76	QP
2	*	61.5618	49.76	-13.11	36.65	40.00	-3.35	QP
3	!	71.0803	51.58	-15.62	35.96	40.00	-4.04	QP
4		172.5988	44.74	-16.39	28.35	40.00	-11.65	QP
5		275.1570	37.50	-12.07	25.43	47.00	-21.57	QP
6		489.0269	30.11	-7.80	22.31	47.00	-24.69	QP

Remark:

Correct Factor=Cable loss+Antenna factor-Preamplifier

Measurement Level = Reading Level + Correct Factor; Margin = Measurement Level- Limit;

Radiation Emission Test Data			
Temperature:	24.5℃	Relative Humidity:	54%
Pressure:	1009hPa	Polarization:	Horizontal
Test Voltage:	DC 18V	Test Mode:	Mode 2



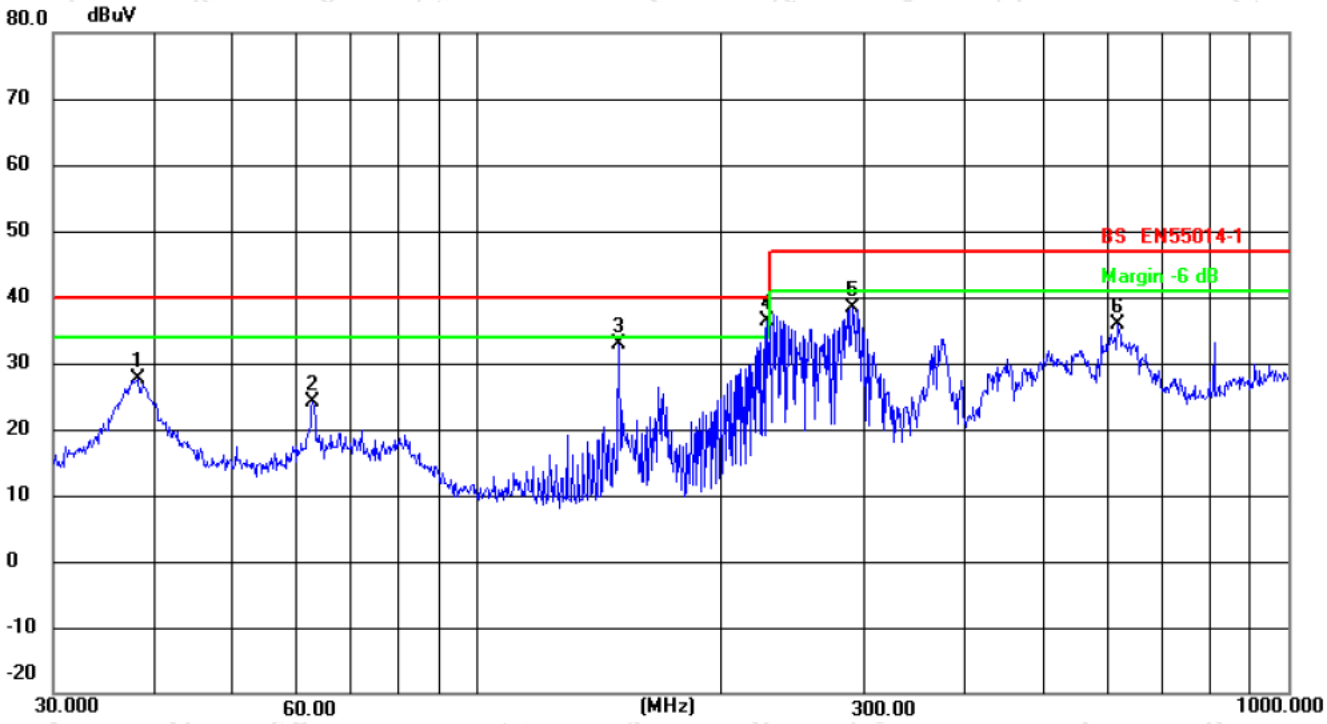
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV	dB	dB	Detector
1		38.6160	34.72	-14.13	20.59	40.00	-19.41	QP
2		74.1351	32.15	-16.28	15.87	40.00	-24.13	QP
3		169.5990	50.26	-16.58	33.68	40.00	-6.32	QP
4	*	293.0842	55.00	-11.60	43.40	47.00	-3.60	QP
5		373.3112	46.57	-10.22	36.35	47.00	-10.65	QP
6		785.0934	36.07	-2.48	33.59	47.00	-13.41	QP

Remark:

Correct Factor=Cable loss+Antenna factor-Preamplifier

Measurement Level = Reading Level + Correct Factor; Margin = Measurement Level- Limit;

Radiation Emission Test Data			
Temperature:	24.5℃	Relative Humidity:	54%
Pressure:	1009hPa	Polarization:	Vertical
Test Voltage:	DC 18V	Test Mode:	Mode 2



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV	dB	dB	Detector
1		38.0783	41.84	-14.25	27.59	40.00	-12.41	QP
2		62.6507	37.52	-13.42	24.10	40.00	-15.90	QP
3		149.4857	50.71	-17.82	32.89	40.00	-7.11	QP
4	*	227.6906	49.99	-13.63	36.36	40.00	-3.64	QP
5		290.0172	50.05	-11.68	38.37	47.00	-8.63	QP
6		616.3718	41.67	-5.74	35.93	47.00	-11.07	QP

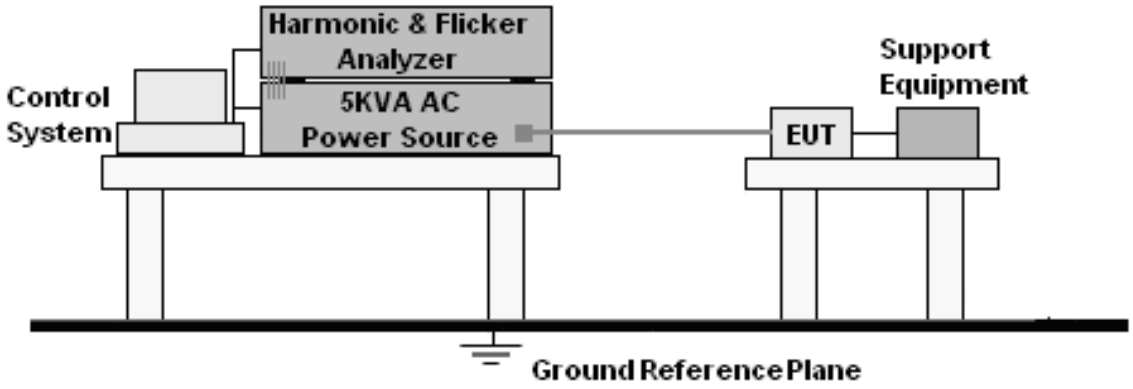
Remark:

Correct Factor=Cable loss+Antenna factor-Preamplifier

Measurement Level = Reading Level + Correct Factor; Margin = Measurement Level- Limit;

7. HARMONIC CURRENT EMISSION TEST

7.1 Block Diagram of Test Setup



7.2 Test Standard

BS IEC 61000-3-2

7.3 Operating Condition of EUT

Setup the EUT as shown in Section 8.1.

Turn on the power of all equipment.

Let the EUT work in test mode and test it.

7.4 Test Procedure

The power cord of the EUT is connected to the output of the test system. Turn on the power of the EUT and use the test system to test the harmonic current level.

7.5 Test Results

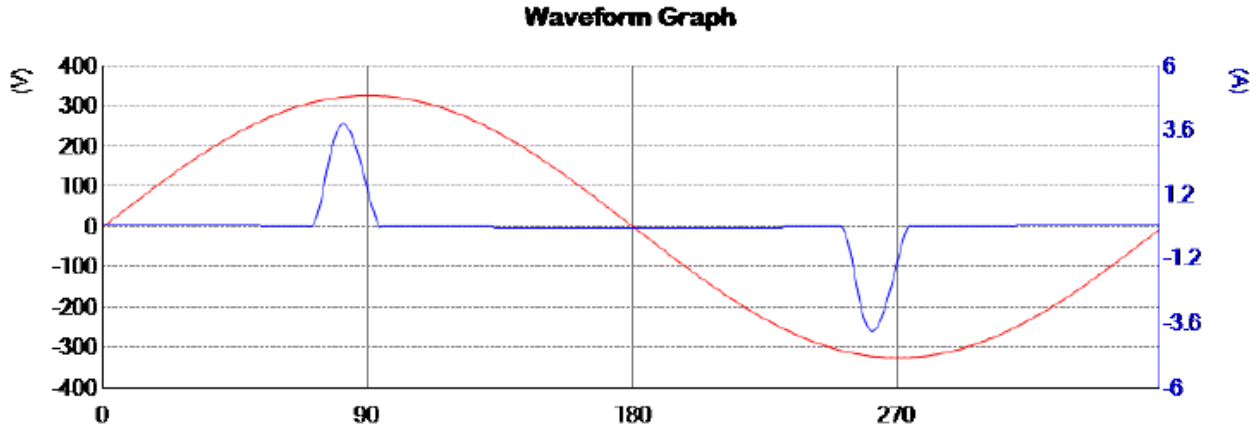
PASS

Please refer to the following page.

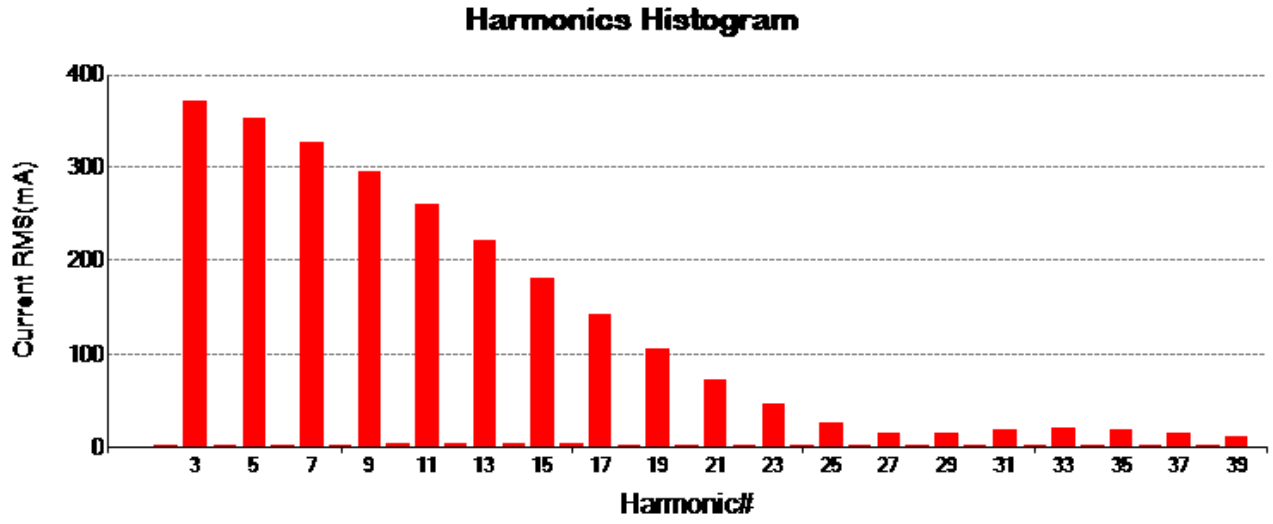
EUT: GRABO High Flow **Operator:**
Test category: BS IEC 61000-3-2:2019+A1:2021 Class B **Model/Type: GHF-V1**
Measurement standard: IEC 61000-4-7 Ed2:1:2009 **Serial number:**
Test date:2024-05-22 **Start time: 16:34:46** **End time: 16:37:25**
Test duration (sec):150
Describe:

Test Result: Pass **Source qualification(Power Off Load): Idle - Pass**

Current & voltage waveforms



Harmonics and Class B



EUT: GRABO High Flow **Operator:**

Test category: BS IEC 61000-3-2:2019+A1:2021 Class B **Model/Type: GHF-V1**

Measurement standard: IEC 61000-4-7 Ed2:1:2009 **Serial number:**

Test date:2024-05-22 **Start time: 16:34:46** **End time: 16:37:25**

Test duration (sec):150

Describe:

Test Result: Pass **Source qualification(Power Off Load): Idle - Pass**

THC(mA): 804.500 **I - THD(%): 90.1** **POHC(mA):100.100** **POHC Limit(mA):377.030**

Parameter values during test:

V_RMS (Volts): 230.0 **Frequency(Hz): 50.0**
I_RMS(A): 0.9 **Crest Factor: 4.104**
Power (Watts): 87.0 **Power Factor: 0.422**

Harm#	Harms(filtered) (mA)	Limit (mA)	Harms(avg) (mA)	100%Limit	Harms(max) (mA)	150%Limit	Status
I_Fund	385.700						
2	1.700	1620.000	2.400	0.148	5.300	0.218	Pass
3	370.900	3450.000	369.800	10.719	371.100	7.171	Pass
4	2.100	645.000	2.700	0.419	5.000	0.517	Pass
5	353.100	1710.000	351.900	20.579	353.500	13.782	Pass
6	2.500	450.000	3.000	0.667	4.800	0.711	Pass
7	327.800	1155.000	326.500	28.268	328.500	18.961	Pass
8	2.800	345.000	3.200	0.928	4.400	0.850	Pass
9	295.900	600.000	294.700	49.117	297.200	33.022	Pass
10	3.000	276.000	3.400	1.232	4.300	1.039	Pass
11	259.600	495.000	258.400	52.202	261.600	35.232	Pass
12	3.200	229.950	3.400	1.479	4.300	1.247	Pass
13	220.400	315.000	219.300	69.619	222.900	47.175	Pass
14	3.200	197.100	3.400	1.725	4.100	1.387	Pass
15	180.500	225.000	179.400	79.733	183.400	54.341	Pass
16	3.000	172.500	3.200	1.855	3.700	1.430	Pass
17	141.700	198.600	140.600	70.796	144.700	48.573	Pass
18	2.800	153.300	3.000	1.957	3.700	1.609	Pass
19	105.100	177.600	104.300	58.727	108.600	40.766	Pass
20	2.300	138.000	2.600	1.884	3.400	1.643	Pass
21	73.000	160.650	72.400	45.067	76.200	31.622	Pass
22	1.900	125.400	2.200	1.754	3.000	1.595	Pass
23	46.000	146.700	45.600	31.084	48.700	22.131	Pass
24	1.400	115.050	1.800	1.565	2.600	1.507	Pass
25	25.700	135.000	25.500	18.889	27.500	13.580	Pass
26	1.000	106.200	1.300	1.224	2.100	1.318	Pass
27	14.700	124.950	14.900	11.925	15.800	8.430	Pass
28	0.700	98.550	0.900	0.913	1.700	1.150	Pass
29	15.200	116.400	15.200	13.058	16.900	9.679	Pass
30	0.300	91.950	0.700	0.761	1.400	1.015	Pass
31	18.700	108.900	18.500	16.988	19.700	12.060	Pass
32	0.300	86.250	0.500	0.580	1.400	1.082	Pass
33	20.100	102.300	19.700	19.257	20.500	13.359	Pass
34	0.300	81.150	0.500	0.616	1.200	0.986	Pass
35	18.700	96.450	18.200	18.870	18.800	12.995	Pass
36	0.500	76.650	0.600	0.783	0.800	0.696	Pass
37	15.600	91.200	15.000	16.447	15.600	11.404	Pass
38	0.500	72.600	0.600	0.826	0.800	0.735	Pass
39	11.100	86.550	10.600	12.247	11.500	8.858	Pass
40	0.500	69.000	0.500	0.725	0.700	0.676	Pass

Note: All harmonics are below the minimum limits and are ignored.

8. VOLTAGE FLUCTUATIONS & FLICKER TEST

8.1 Block Diagram of Test Setup

Same as Section 8.1.

8.2 Test Standard

BS EN 61000-3-3

8.3 Operating Condition of EUT

Same as Section 8.3. The power cord of the EUT is connected to the output of the test system. Turn on the power of the EUT and use the test system to test the harmonic current level.

Flicker Test Limit

Test items	Limits
Pst	1.0
dc	3.3%
Tmax	4.0%
dt	Not exceed 3.3% for 500ms

8.4 Test Procedure

The power cord of the EUT is connected to the output of the test system. Turn on the power of the EUT and use the test system to test the harmonic current level.

8.5 Test Results

Flicker Test Data			
Temperature:	24.5 ℃	Relative Humidity:	54%
Test Voltage:	AC 230V/50Hz	Test Mode:	Mode 1

Voltage Fluctuation	Limit	Value
Relative Voltage Change Characteristic Tmax (dc > 3%)	500 ms	0 ms
Maximum Relative Voltage Change dmax	4%	0.00
	6%	/
	7%	/
Relative Steady-state Voltage Change dc	3.3%	0.00

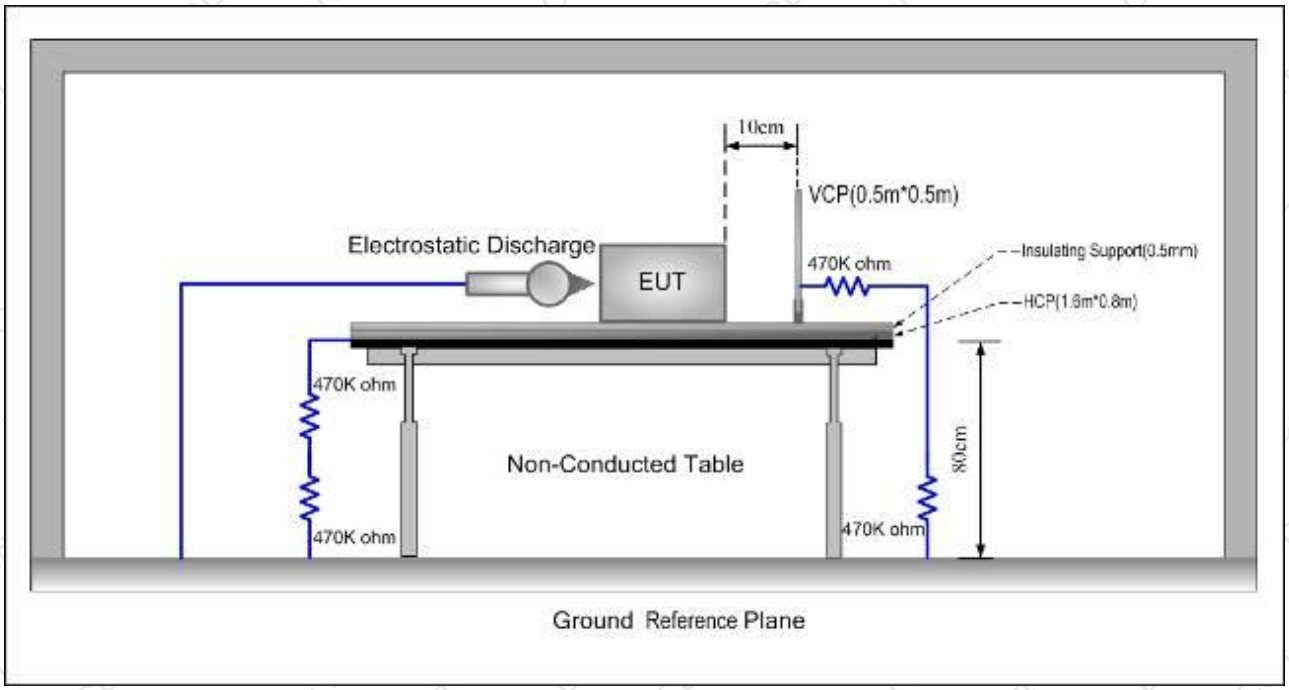
Flicker	Limit	Value
Short-term Flicker Indicator Pst	1.0	0.065
Long-term Flicker Indicator Plt	0.65	/

9. IMMUNITY TEST OF GENERAL THE PERFORMANCE CRITERIA

Product Standard	BS 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 resonably 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.

10.ELECTROSTATIC DISCHARGE IMMUNITY TEST

10.1 Block Diagram of Test Setup



10.2 Test Standard

BS EN IEC 55014-2, BS EN 61000-4-2

10.3 Severity Levels and Performance Criterion

Severity Level: 3 / Air Discharge: ±8KV

Level: 2 / Contact Discharge: ±4KV

Performance criterion: B

10.4 Test Procedure

a. Electrostatic discharges were applied only to those points and surfaces of the Product that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

c. The time interval between two successive single discharges was at least 1 second.

d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the Product.

e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the Product as fast as possible (without causing mechanical damage) to touch the Product. After each discharge, the ESD generator was removed from the Product and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

g. At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the Product. The ESD generator was positioned vertically at a distance of 0.1 meters from the Product with the discharge electrode touching the HCP.

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the Product were completely illuminated. The VCP (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the Product.

10.5 Test Results

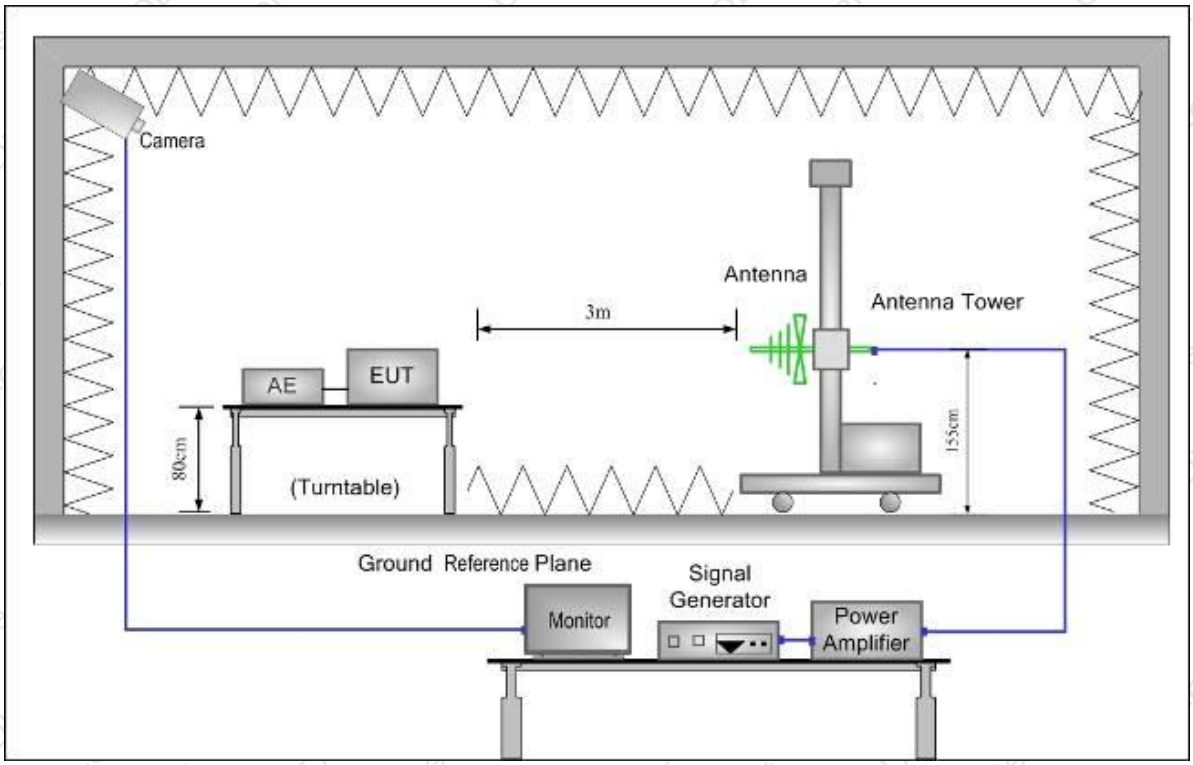
PASS

Please refer to the following page.

Electrostatic Discharge Test Data					
Temperature:	25.1℃		Humidity:	55%	
Power Supply:	AC 230V/50Hz DC 18V		Test Mode:	Mode1/2	
Discharge Method	Discharge Position	Voltage (±kV)	Min. No. of Discharge per polarity (Each Point)	Required Level	Result
Contact Discharge	Conductive Surfaces	4	10	B	Pass
	Indirect Discharge HCP	4	10	B	Pass
	Indirect Discharge VCP	4	10	B	Pass
Air Discharge	Slots, Apertures, and Insulating Surfaces	8	10	B	Pass
Note: N/A					

11 RF FIELD STRENGTH SUSCEPTIBILITY TEST

11.1 Block Diagram of Test Setup



11.2 Test Standard

BS EN IEC 55014-2, BS EN IEC 61000-4-3

11.3 Severity Levels and Performance Criterion

Severity Level 2, 3V / m

Performance criterion: A

11.4 Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. EUT is set 3 meter away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarization of the antenna are set on test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually.

All the scanning conditions are as follows:

Condition of Test	Remarks
Fielded Strength	3 V/m (Severity Level 2)
Radiated Signal	Modulated
Scanning Frequency	80 – 1000 MHz
Dwell time of radiated	0.0015 decade/s
Waiting Time	1 Sec.

11.5 Test Results

PASS

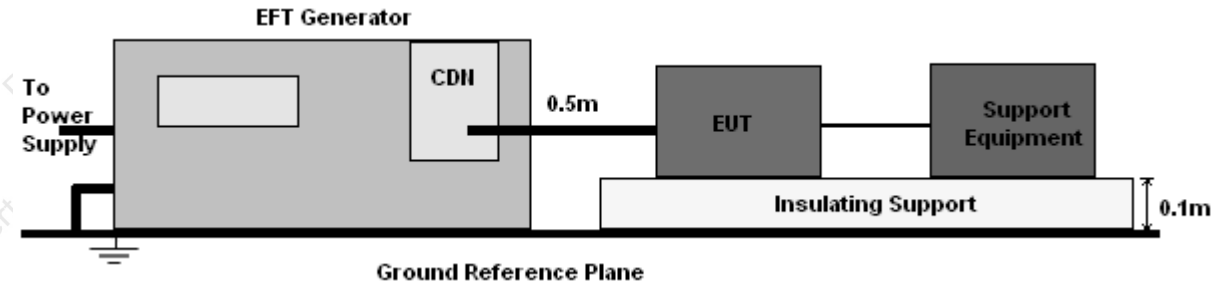
Please refer to the following page.

R/S Test Data				
Temperature:	25.1℃	Humidity:	55%	
Power Supply:	AC 230V/50Hz DC 18V	Test Mode:	Mode1/2	
Criterion:	A	Steps	1 %	
Frequency (MHz)	Position	Field Strength (V/m)	Required Level	Result
80 – 1000	Front, Right, Back, Left	3	A	Pass
Note: N/A				

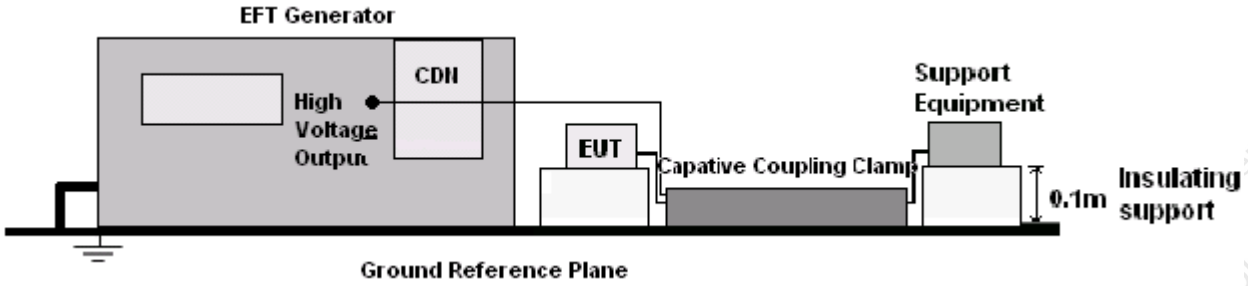
12 ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST

12.1 Block Diagram of EUT Test Setup

For input a.c. / d.c. power port:



For signal lines and control lines:



12.2 Test Standard

BS EN IEC 55014-2, BS EN 61000-4-4

12.3 Severity Levels and Performance Criterion

Severity Level 2 at 1KV, Pulse Rise time & Duration: 5 nS / 50 nS

Performance criterion: B

12.4 Test Procedure

EUT shall be placed 0.8m high above the ground reference plane which is a min.1m*1m metallic sheet with 0.65mm minimum thickness. This reference ground plane shall project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane beneath the EUT, shall be more than 0.5m

For input and output AC power ports:

The EUT is connected to the power mains by using a coupling device which couples the EFT interference signal to AC power lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 minutes.

12.5 Test Results

PASS

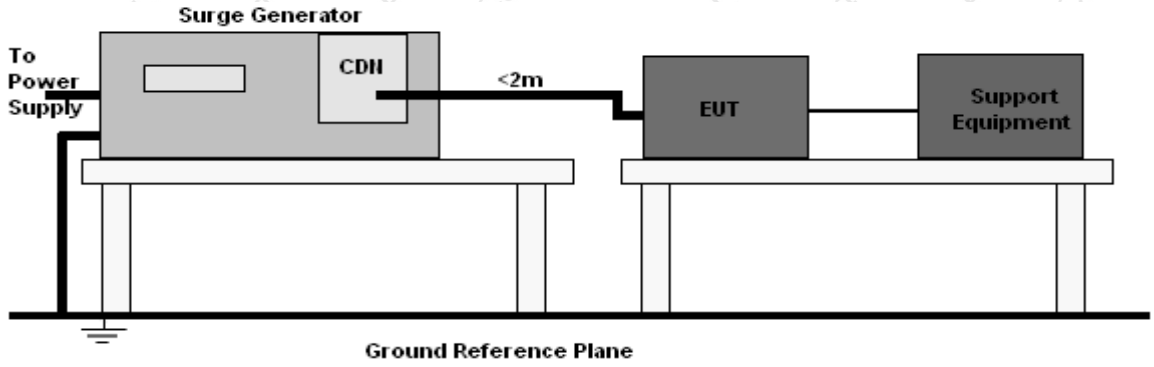
Please refer to the following page.

EFT Test Data			
Temperature:	24.5℃	Humidity:	53%
Power Supply:	AC 230V/50Hz	Test Mode:	Mode 1

Coupling Line	Test Voltage (kV)	Performance Criterion	Result
L	±0.5, 1	B	PASS
N	±0.5, 1	B	PASS
L-N	±0.5, 1	B	PASS

13 SURGE TEST

13.1 Block Diagram of EUT Test Setup



13.2 Test Standard

BS EN IEC 55014-2, BS EN61000-4-5

13.3 Severity Levels and Performance Criterion

Severity Level: Line to Line, Level 2 at 1KV;

Severity Level: Line to Earth, Level 3 at 2KV.

Performance criterion: B

13.4 Test Procedure

1) Set up the EUT and test generator as shown on section 11.1

2) For line-to-line coupling mode, provide a 1KV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points.

3) At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.

4) Different phase angles are done individually.

5) Repeat procedure 2) to 4) except the open-circuit test voltage change from 1KV to 2KV for line to earth coupling mode test.

6) Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

13.5 Test Result

PASS

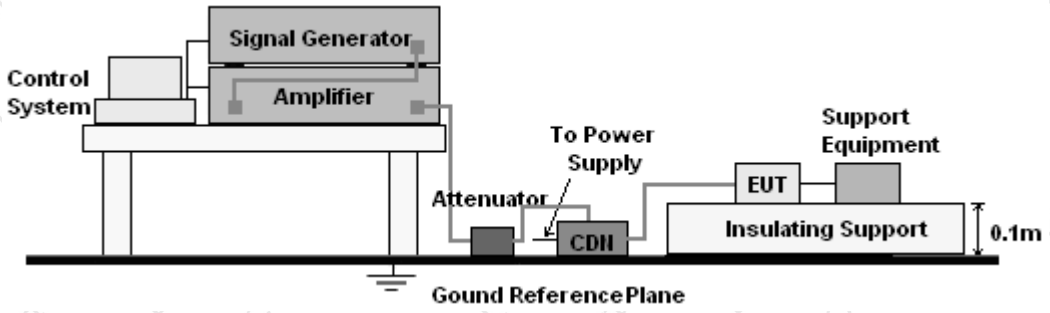
Please refer to the following page.

Surge Test Data						
Temperature:	24.5℃		Humidity:	53%		
Power Supply:	AC 230V/50Hz		Test Mode:	Mode 1		
Location	Polarity	Phase Angle	No of Pulse	Pulse Voltage (KV)	Performance Criterion	Result
L-N	+	90	5	0.5,1	B	Pass
L-N	-	270	5	0.5,1	B	Pass
Note: N/A						

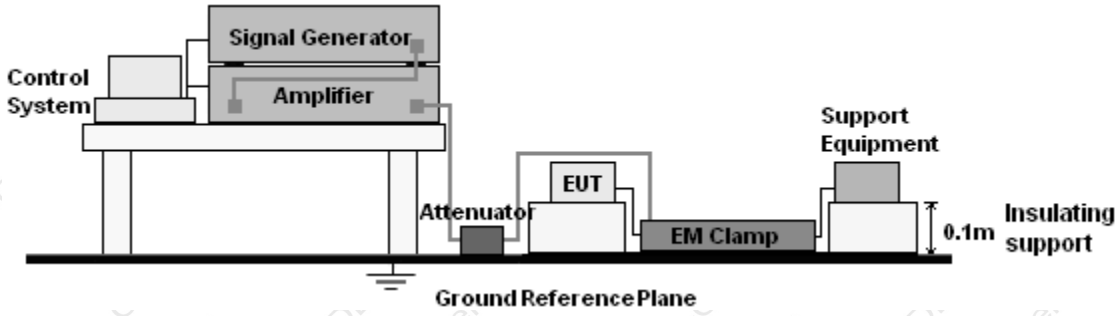
14 INJECTED CURRENTS SUSCEPTIBILITY TEST

14.1 Block Diagram of EUT Test Setup

For input a.c. / d.c. power port:



For signal lines and control lines:



14.2 Test Standard

BS EN IEC 55014-2, BS EN61000-4-6

14.3 Severity Levels and Performance Criterion

Severity Level 2: 3V(rms), 150KHz ～ 80MHz

Performance criterion: A

14.4 Test Procedure

1) Set up the EUT, CDN and test generator as shown on section 12.1

2) Let EUT work in test mode and measure.

3) The EUT and supporting equipments are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane at above 0.1-0.3m 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).

4) The disturbance signal described below is injected to EUT through CDN.

5) The EUT operates within its operational mode(s) under intended climatic conditions after power on.

6) The frequency range is swept from 150KHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1KHz sine wave

7) The rate of sweep shall not exceed 1.5×10^{-3} decades/s. Where the frequency is swept

incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.

8) Recording the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

14.5 Test Result

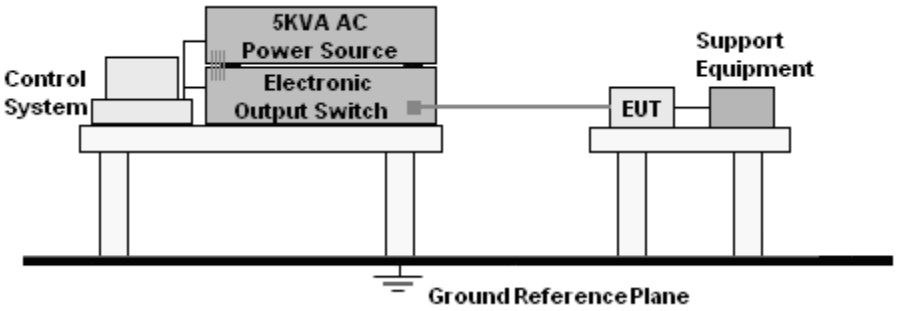
PASS

Please refer to the following page.

CS Test Data						
Temperature:		24.5℃		Humidity:	53%	
Power Supply:		AC 230V/50Hz		Test Mode:	Mode 1	
Frequency Range(MHz)	Injected Position	Strength	Modulation Signal	Freq. Step	Performance Criterion	Result
0.15～80	AC Line	3V(rms), Unmodulated	AM 80%, 1kHz sine wave	1%	A	Pass
0.15～80	DC Line, Signal Line	3V(rms), Unmodulated	AM 80%, 1kHz sine wave	1%	/	/
Note: N/A						

15 VOLTAGE DIPS AND INTERRUPTIONS TEST

15.1 Block Diagram of EUT Test Setup



15.2 Test Standard

BS EN IEC 55014-2, BS EN IEC 61000-4-11

15.3 Severity Levels and Performance Criterion

Input and Output AC Power Ports.

☑ Voltage Dips.

☑ Voltage Interruptions.

Environmental Phenomena	Test Specification	Units	Performance Criterion
Voltage Dips	100 0.5	% Reduction period	C
	60 10	% Reduction period	C
	30 25	% Reduction period	C

15.4 Test Procedure

1) Set up the EUT and test generator as shown on section 14.1

2) The interruption is introduced at selected phase angles with specified duration. There is a 3mins minimum interval between each test event.

3) After each test a full functional check is performed before the next test.

4) Repeat procedures 2 & 3 for voltage dips, only the level and duration is changed.

5) Record any degradation of performance.

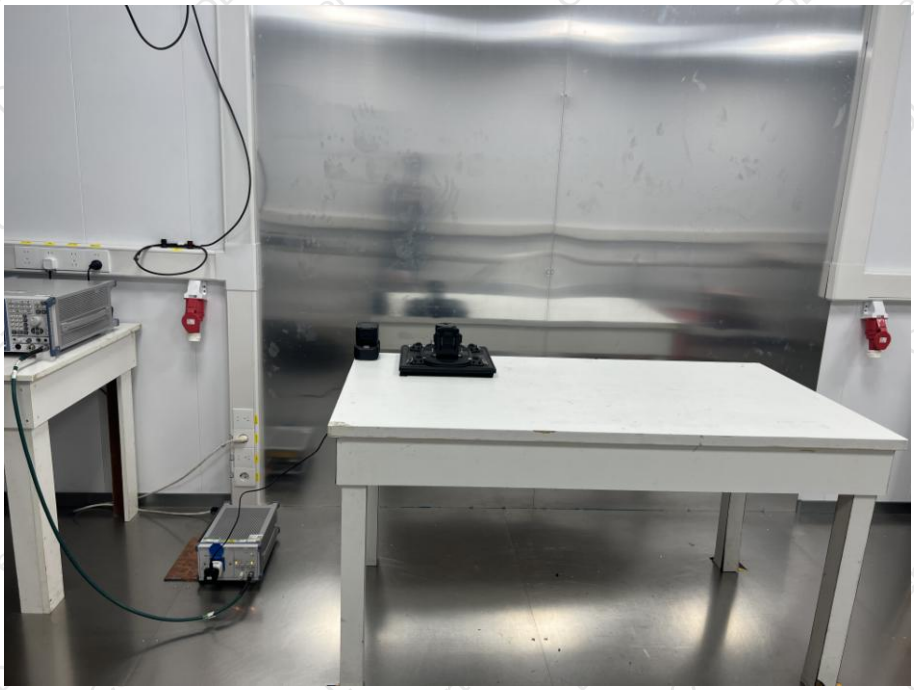
15.5 Test Result

PASS

Please refer to the following page.

DIPS Test Data				
Temperature:	24.5℃	Humidity:	53%	
Power Supply:	AC 230V/50Hz	Test Mode:	Mode 1	
Environmental Phenomena	Test Specification	Units	Performance Criterion	Result
Voltage Dips	100 0.5	% Reduction period	C	Pass
	60 10	% Reduction period	C	Pass
	30 25	% Reduction period	C	Pass

16 SETUP PHOTOGRAPHS




LAPLACE INSTRUMENTS LTD
MACHINE
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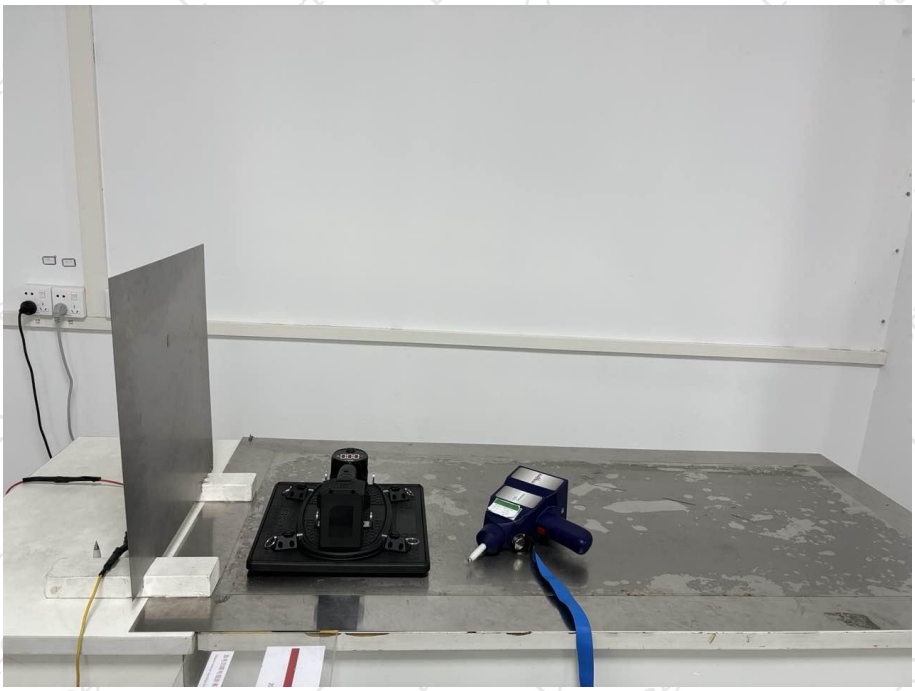
0.62

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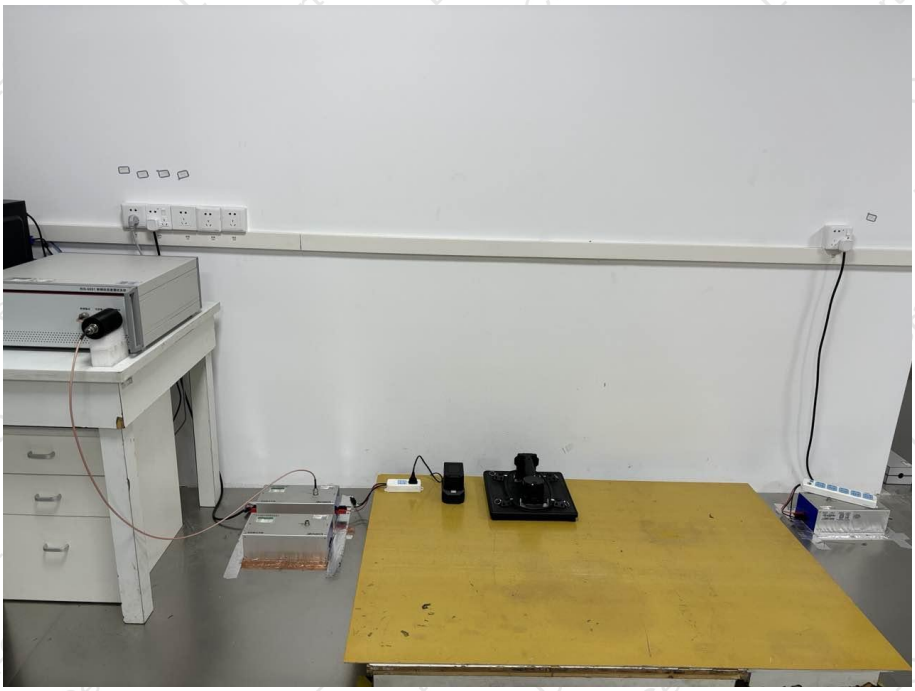
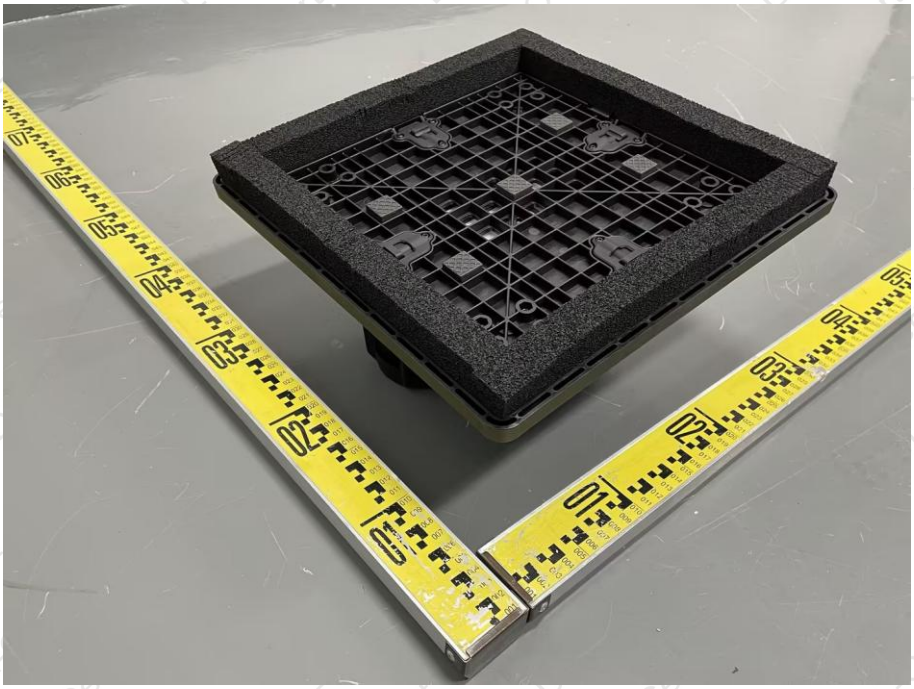


17 EUT PHOTOGRAPHS


GRABO

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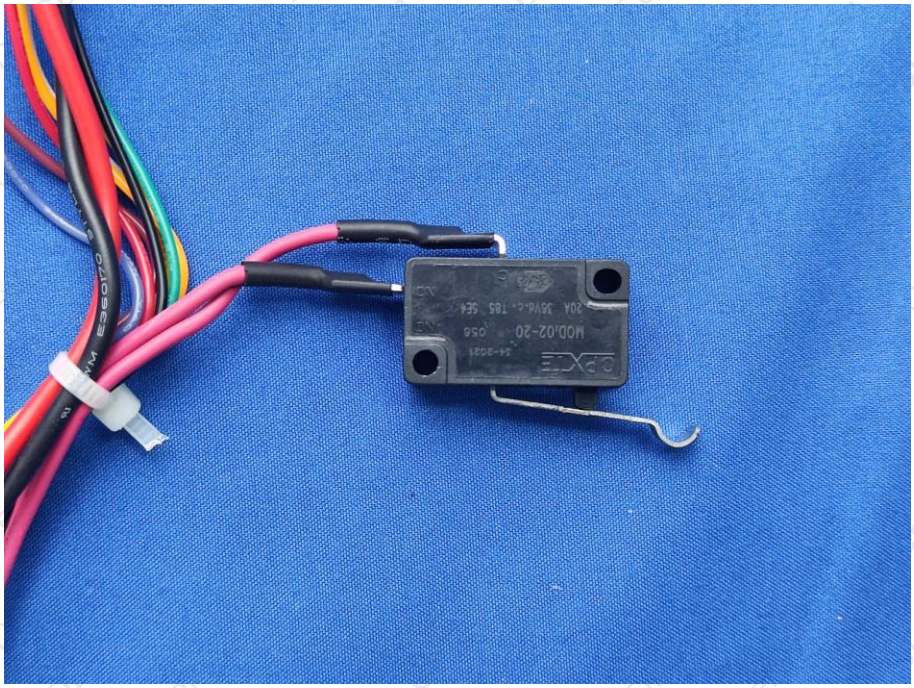

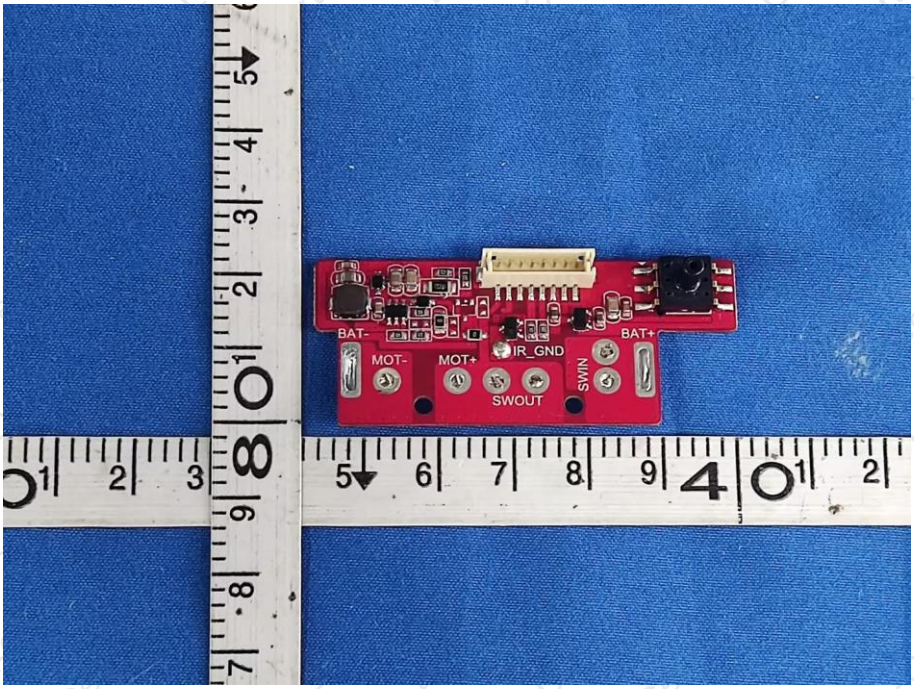
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MOT-
MOT+
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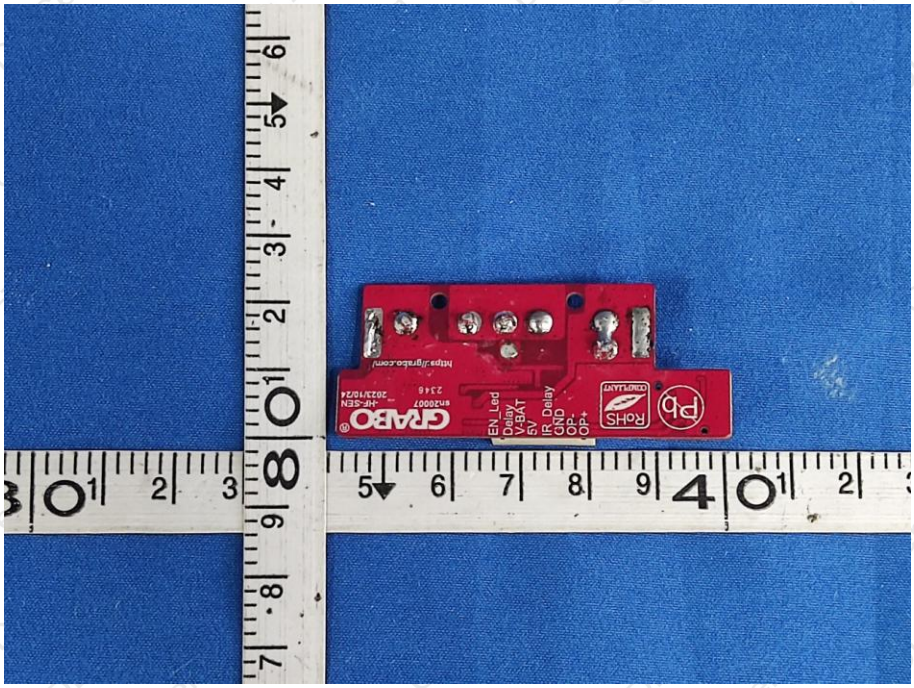
SWOUT
SWMS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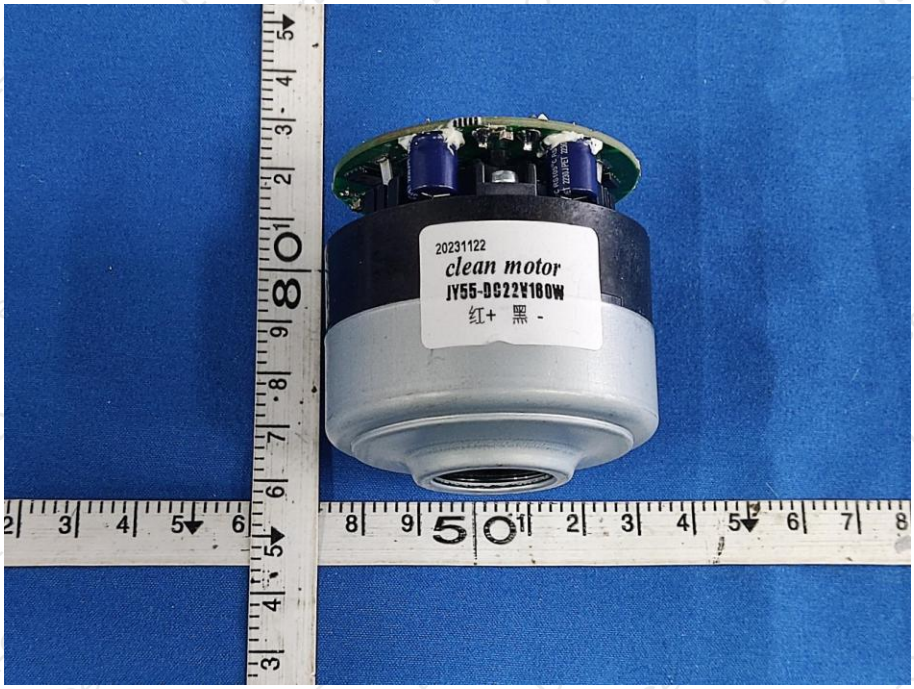
V_BAT
IR
Delay
GND
OP-
OP+


20231122
clean motor
JY55-DC22V180W
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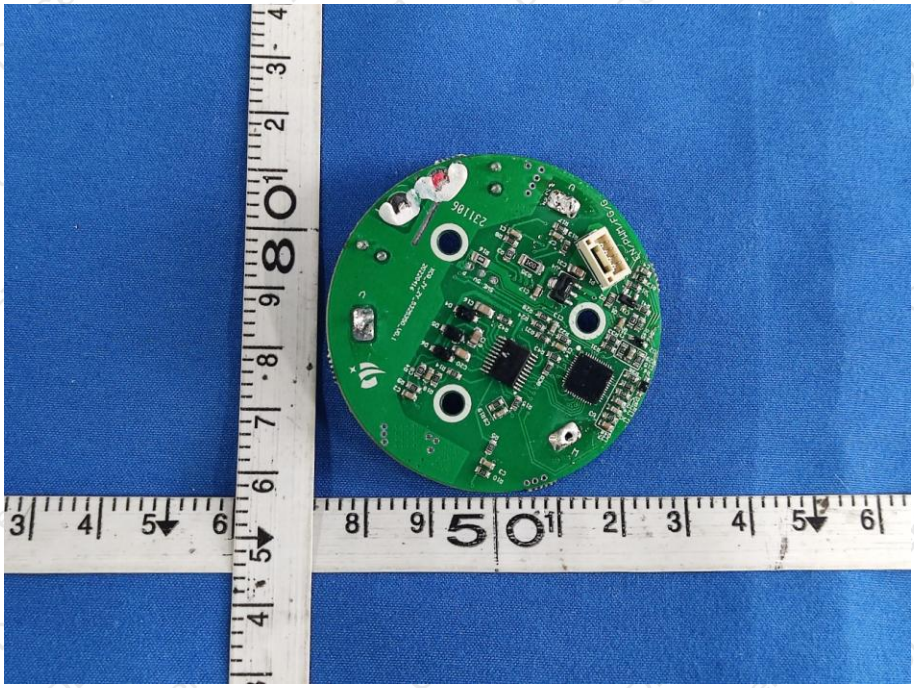

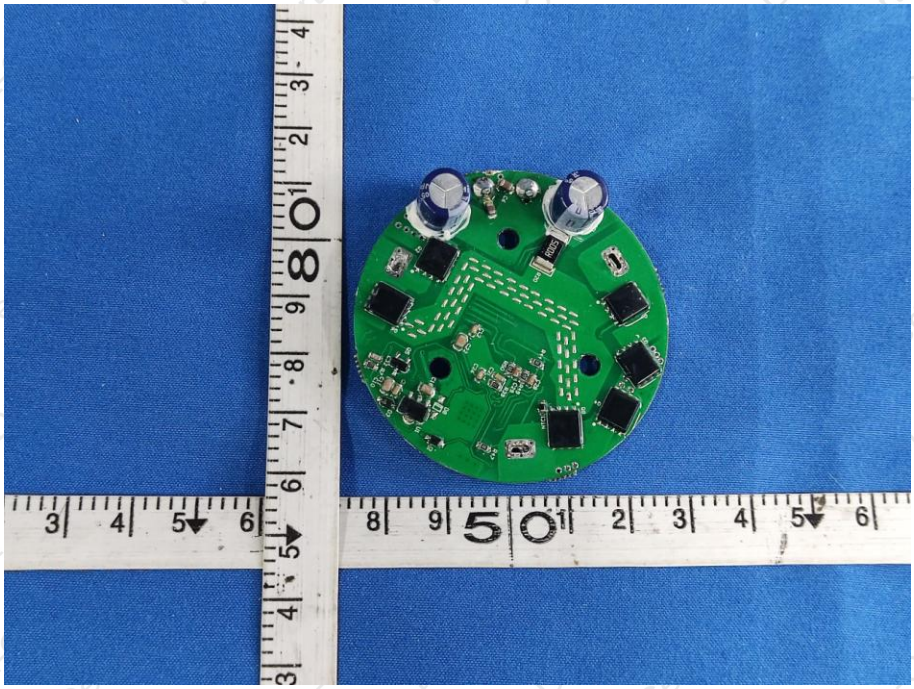

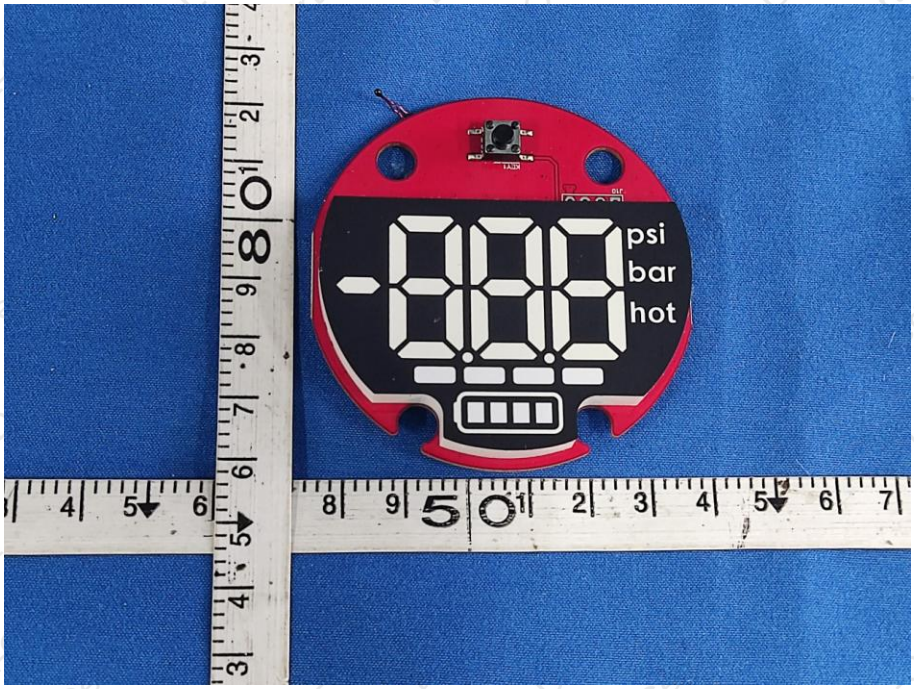
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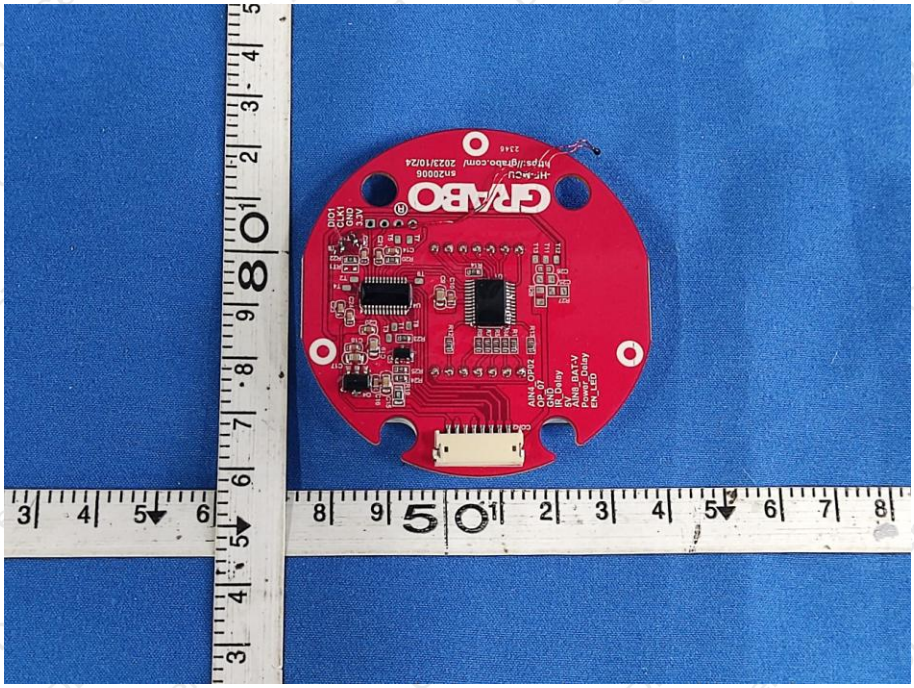
bar
hot

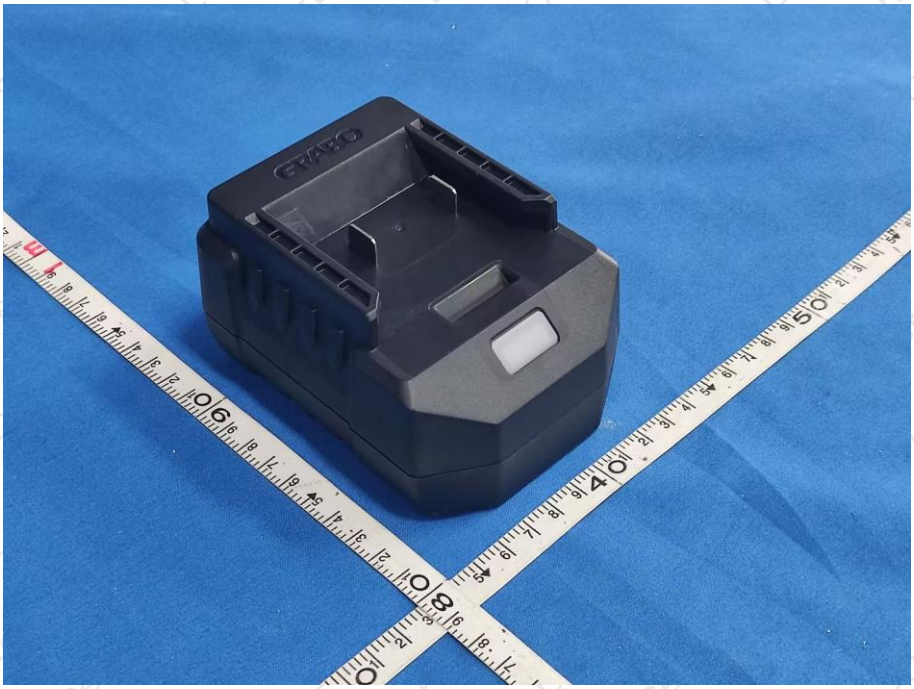

GRABO


GRABO


GRABO
LITHIUM ION
18V
5.0 AH


GRABO
MODEL
LITHIUM ION
5.0 AH
18V


GRABO


GRABO

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